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Efficacy of Ivabradine, Metoprolol Alone vs Ivabradine Plus Metoprolol (Combination) for Heart Rate Reduction and Heart Rate Variability During Computed Tomography Coronary Angiography: A Randomized Controlled Trial

Farhan Tuyyab, Rehana Khadim, Shaheer Farhan, Abdul Hameed Siddiqui, Fahad Munir, Tahir Iqbal, Sohail Aziz, Tariq Hussain Khattak, Imtiaz Ahmed Khan, Faheem Hassan
Armed Forces Institute of Cardiology/National University of Medical Sciences (NUMS) Rawalpindi Pakistan

ABSTRACT

Objective: To establish the efficacy of Ivabradine, Metoprolol alone vs Ivabradine plus Metoprolol for the heart rate reduction in patients undergoing computed tomography coronary angiography.

Study Design: Randomized controlled trial.

Place and Duration of Study: Armed Forces Institute of Cardiology & National Institute of Heart Disease, Rawalpindi, from Oct 2017 to Jan 2018.

Material and Methods: Patients undergoing first CTCA angiography meeting inclusion criteria with heart rates more than 80 beats/min were included. Patients were randomized into three groups using computer generated random tables. Arm A was administered Ivabradibe plus placebo, Arm B was administered Metoprolol plus placebo while Arm C was administered Ivabradine plus Metoprolol one hour before the scan. All the groups had scans under strictly similar conditions. Heart rate before and during scan along with heart rate variability were recorded.

Results: A total of 165 patients were included in the study, 55 patients in each group. Mean age of patients was 53.5 ± 0.5 years. One hundred and seven (64.8%) were males while patients 58 (35.2%) were females. Risk factor profile was almost similar in all the groups. Heart rate reduction in Arm A was 18.3 ± 3.8, in Arm B was 12.6 ± 5.8 and in Arm C was 24 ± 3.0 (p=0.02). Heart rate variability in Arm A was 3.2, in Arm B was 4.0 and in Arm C was 1.8 (p=0.001). Arm C had significantly lower heart rate and significantly less heart rate variability followed by Arm A then Arm B.

Conclusion: Ivabradine is an established safe and effective heart rate reducing agent in patients undergoing CTCA, particularly in those patients, who cannot tolerate beta-blockers or calcium-channel blockers due to their side effects.

Keywords: Computed tomography coronary angiography, Heart rate, Heart rate variability, Ivabradine, Metoprolol.

INTRODUCTION

Stable heart rate is the foremost prerequisite for the achievement of excellent image quality and the diagnostic accuracy with computed tomography coronary angiography (CTCA). Therefore, to reduce the coronary artery motion artifacts and enhance the image quality, an heart rate of 60-65 beats per minutes is essential, while an increase in heart rate is related with nearly linear deterioration of image quality and diagnostic accuracy.1 β-Blockers and calcium channel blockers are the basic drugs which are utilize for the heart rate reduction, but their negative inotropic and dromotropic effects restrict their utilization in patients with hypotension, asthma, and peripheral vascular disease as some patients cannot bear the side effects.2 The pacemaker current channel (If) is a hyperpolarization activated cyclic nucleotide gated channel, and Ivabradine is the first sinoatrial node If current inhibitor which is unusual from the conventional heart rate reducing agents. Ivabradine decreases the heart rate without influencing the cardiac contractility, ventricular repolarization, blood pressure, or
atrioventricular conduction. Ivabradine is undoubtedly a promising attractive substitute for inappropriate sinus tachycardia, stable angina, heart failure, and other cardiovascular diseases and it has beneficial implications for future clinical utilization.

Many studies have shown that Ivabradine plays an significant part in the heart rate reduction in CTCA, specially with regard to the quantification of the efficacy of pre-treatment with Ivabradine before CTCA.

There is no contemporary data documenting the comparison of effect of Ivabradine and Metoprolol (in combination and alone) on heart rate reduction and heart rate variability in patients undergoing CT Angiography in AFIC & NIHD, Rawalpindi. Therefore we examined whether there was a significant difference between two drugs via randomized control trial.

MATERIAL AND METHODS

It was an allocation concealed triple blind (Patient-Investigator-Statistician) randomized control trial. Study was conducted at Cardiac Scan Department AFIC & NIHD, Rawalpindi. All the patients of both genders, with heart rates more than 80 beats/min while at rest and age between 25 to 65 years, undergoing first CTCA scan for the probable diagnosis of coronary artery disease were enrolled in the study. Data was collected using history & procedure details Performa. Patients with the previous history of CABG, PTCA/Stenting, with contraindications to beta blockers, patients with arrhythmia, allergy to iodinated contrast, already using beta blockers, anxiolytics, sedative and hypnotics, known cases of ischemic heart disease (IHD) and those patients who already had a CTCA scans were excluded. Patients who underwent scans in emergency were also excluded.

Patients were recruited into three groups using randomization technique. Randomization was done through computer generated random tables using list of the patients undergoing CTCA. Sample size was calculated using Harvard Sample size Calculator. Sample size was 165 patients (55 study participants in each group).

Arm A was administered tablet Ivabradine 5mg (tab Ivatab by Nabiqasim Industries®) plus a placebo, Arm B was administered tablet metoprolol 100mg ½ tablet (tab Mepressor by Novartis®) plus a placebo and Arm C was administered tablet Mepressor 100 mg ½ tablet plus tablet Ivabradine 5mg one hour before the scan. All the patients were recruited after the written informed consent and confidentiality of the data was maintained.

The variables for this study included heart rate of the patients before the test and heart rate during the test and heart rate variability during the test. Heart rates were recorded by doctor for one complete minute just before the test while patients were still in the waiting room and during the test on the scanning table just after the Calcium scoring. All scans were performed on Somatom Definition DSCT scanner from Siemens using same scan protocols and nonionic iodinated contrast agent Iopromide (Ultravist-370 7 by Bayer schering pharma).

Patients were blinded to the medications; similarly doctor taking the history and recording the heart rate was also blinded to the identity of patient groups. Data of the sample study was of quantitative nature and sample size was enough to make distribution normal. To exclude other factors contributing to heart rate changes consenting doctor, paramedic administering the medication and doctors recording the heart rate were the same for all patients and similarly technicians carrying out the scans, rate auditory instructions and doctors supervising the scan were also the same. All the Patients waited for at least one hour (range 1-3 hours) in the waiting area of cardiac scan department. All the scans were carried out by appointment and done in the morning time before noon and as outdoor procedures. Heart rate variability (HRV) was defined as the standard deviation of the mean heart rate during CT coronary angiography.
Data entry and analysis was done by using SPSS (version 21.0). Chi-square test was used to the qualitative variables while ANOVA (Analysis of variance) was used for quantitative variables between three groups. A p-value<0.05 was taken as significant.

RESULTS

Total 165 patients were enrolled in the study. Table-I illustrates patient baseline characteristics.

Table-I: Patient baseline characteristics.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Total Patients (n=165)</th>
<th>Arm A (Ivabradine + Placebo) (n=55)</th>
<th>Arm B (Metoprolol + Placebo) (n=55)</th>
<th>Arm C (Ivabradine + Metoprolol) (n=55)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age Mean ± SD</td>
<td>53.5 ± 0.5 years</td>
<td>49.3 ± 2.8 years</td>
<td>51.7 ± 10.3 years</td>
<td>52.9 ± 6.6 years</td>
<td>0.671</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>107 (64.8%)</td>
<td>21 (19.6%)</td>
<td>35 (59.0%)</td>
<td>35 (59.0%)</td>
<td>0.025</td>
</tr>
<tr>
<td>Female</td>
<td>58 (35.2%)</td>
<td>24 (41.4%)</td>
<td>34 (58.6%)</td>
<td>20 (18.0%)</td>
<td></td>
</tr>
</tbody>
</table>

Table-II: Association of Risk factor profile of three groups.

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Arm A n (%)</th>
<th>Arm B n (%)</th>
<th>Arm C n (%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>22 (60.0%)</td>
<td>47 (85.5%)</td>
<td>36 (65.5%)</td>
<td>0.006</td>
</tr>
<tr>
<td>Diabetes Mellitus</td>
<td>11 (20.0%)</td>
<td>8 (14.5%)</td>
<td>27 (49.1%)</td>
<td>0.001</td>
</tr>
<tr>
<td>Smoking History</td>
<td>20 (36.4%)</td>
<td>11 (20.0%)</td>
<td>46 (83.6%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Hyperlipidemia</td>
<td>13 (23.6%)</td>
<td>5 (9.1%)</td>
<td>19 (34.5%)</td>
<td>0.042</td>
</tr>
<tr>
<td>Family History of IHD</td>
<td>12 (22.8%)</td>
<td>11 (20.0%)</td>
<td>9 (16.4%)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Table-III: Reduction in heart rate and heart rate variability by medication groups.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Arm A</th>
<th>Arm B</th>
<th>Arm C</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart Rate Variability (mean)</td>
<td>3.2</td>
<td>4.0</td>
<td>1.8</td>
<td>0.002</td>
</tr>
<tr>
<td>Reduction in Heart Rate (Mean ± SD)</td>
<td>18.3 ± 3.8 Beats/min</td>
<td>12.6 ± 5.5 Beats/min</td>
<td>24.4 ± 3.0 Beats/min</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Table-II shows risk factor profile of the three groups. Hypertension was most prevalent among risk factors 105 (63.6%) followed by smoking history 77 (46.6%) and diabetes mellitus 46 (27.8%). Table-III shows that the use of two drugs (i.e. Ivabradine and metoprolol) in combination significantly lowered the heart rate variability 1.8 and significantly lowered the heart rate as well with reduction of 24.4 ± 3.0 beats/min.

DISCUSSION

Ivabradide is a potential choice for patients undergoing CTCA, particularly for the patients who cannot tolerate beta blockers due to the side effects. Ivabradine had no marked effect on either systolic or diastolic blood pressure. The patient groups comprized of a well-defined patient population referred for their first diagnostic CTCA angiogram with the diagnosis of probable coronary artery disease. Risk factor profile was similar to reported earlier. Peak effect of both metoprolol and Ivabradine was achieved after an hour. All the treatment groups showed significant drop in the heart rate but the magnitude of was higher in Ivabradine alone group and was much bigger and statistically significant in case of Arm C. Ivabradine is an established safe and effective heart rate-reducing agent. Ivabradine is a particular heart rate lowering agent that acts via selective and specific inhibition of the cardiac pacemaker If current, which controls the spontaneous diastolic depolarization in the sinus node and regulates the heart rate. Its effects on the heart are particular to the sinus node, with no effect on intra atrial,
atrioventricular, or intraventricular conduction times, myocardial contractility, or ventricular repolarization.\textsuperscript{12-15} Ma et al.\textsuperscript{16} reported that ivabradine enhance myocardial performance, left ventricular function and ventricular remodeling and even survival in rodent heart failure, including ventricular fibrillation, myocardial infarction, stable angina, and hypertension-induced cardiomyopathy\textsuperscript{16}. Its side effects are uncommon and mainly limited to the dose related visual disturbances\textsuperscript{10}. Hence, ivabradine is appropriate for large variety of patients, including those individuals for whom other heart rate lowering drugs might be contraindicated\textsuperscript{11,13}. Beta-blockers are contraindicated in many conditions, despite the common use of beta-blockers before CTA studies, it is quite common to have patients with heart rate continuously above the target range of 65 beats per minutes even though the use of oral as well as intravenous beta-blockers\textsuperscript{13-15}. In this way, CTA with oral ivabradine premedication is a practicable, safer, and better effective way to reduce the heart rate to generate images of diagnostically acceptable quality in nearly all coronary segments in comparison to beta-blockers.

CONCLUSION

Ivabradine is an established safe and effective heart rate reducing agent in patients undergoing CTA, particularly in those patients, who cannot tolerate beta-blockers or calcium-blockers due to their side effects.

ACKNOWLEDGEMENT

We would like to thank the whole CT Angio department for their valuable co-operation in the whole trial.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

REFERENCES

HYPERLIPIDEMIA PATTERNS IN NEWLY DIAGNOSED YOUNG DIABETIC SOLDIERS: A DESCRIPTIVE CROSS-SECTIONAL STUDY


Armed Forces Institute of Cardiology/National University of Medical Sciences (NUMS) Rawalpindi Pakistan, *Military Hospital/ National University of Medical Sciences (NUMS) Rawalpindi Pakistan, **Combined Military Hospital Multan Pakistan

ABSTRACT

Objective: To report the patterns of hyperlipidemia in newly diagnosed young diabetic soldiers.

Study Design: A descriptive cross-sectional study.

Place and Duration of Study: Combined Military Hospital Multan, from Jan to Sep 2017.

Material and Methods: All newly diagnosed hospitalized type-II diabetic male soldiers, were included in the study after having their informed consent. All the data was collected protectively through consecutive sampling. Data collection tool was developed regarding patient demographics, co-morbid, previous medical history and laboratory findings.

Results: A Total of 55 patients were recruited for the study. The mean age of the patients was 41.1 ± 5.5 years and the range was 25 years to 50 years. All patients were males. Eight (14.5%) patients had diabetic nephropathy while diabetic retinopathy was present in 7 patients (12.7%). Family history was positive in 22 (40%) soldiers. Six (10.9%) patients were hypertensive while thirty nine patients (70.1%) were having type-II diabetes and 16 (29.1%) had type-I diabetes mellitus. About 46 (83.6%) patients had trace proteinuria, out of which 3 patients had +1 proteinuria and 4 patients had +2 proteinuria. Mean LDL was 1.1 ± 4.1 mmol/L. Mean cholesterol was 4.5 ± 0.9 mmol/L while mean triglycerides was 2.4 ± 1.7 mmol/L and mean HDL 0.9 ± 2.0 mmol/L.

Conclusion: The study has clearly demonstrated statistically that high triglyceride levels are more prevalent than high LDL cholesterol levels in this patient group. Keeping the fact in view that hypertriglyceridaemia is a serious risk factor for the development of coronary artery disease it is therefore of paramount importance that this abnormality should be sought out at the outset of diabetes mellitus and addressed accordingly.

Keywords: Hyperlipidemia, Diabetic Nephropathy, Diabetic Retinopathy.

INTRODUCTION

Diabetes mellitus is one of the leading causes of chronic morbidity and mortality. Diabetes mellitus prevalence is increasing many folds in South Asian population. Many factors like high body mass index, high susceptibility to environmental insulin, high degree of genetic predisposition and high level of insulin resistance are involved in this metabolic disorder. It is characterized by absolute deficiency in insulin secretion and insulin action associated with hyperglycemia, metabolism of protein, carbohydrate and lipids are disturbed. Different research studies show that body composition components like lipid profile and body fat are responsible for the increased prevalence of this disease. In diabetes mellitus the lipid abnormalities are more prevalent because major key enzymes and lipid metabolism pathways are affected due to deficiency of insulin production and secretion. Dyslipidemia is one of the major risk factors for cardiovascular disease in hyperglycemic patients. High triglycerides, low High Density Lipoprotein cholesterol, and increased Low Density Lipoprotein cholesterol are the characteristic feature of diabetic dyslipidemia. Type-II diabetes affects an estimated 21 million people in the United States. About 70-80% of diabetic patients will die of cardiovascular disease. The prevalence of hypercholesterolemia is not increased in patients with diabetes mellitus but mortality from coronary heart disease increases. American Diabetes Association
guidelines recommend maintaining serum levels of TG below 150 mg/dl, LDL cholesterol below 100 mg/dl and HDL cholesterol of more than 40 mg/dl in males and 50 mg/dl in females.

The lifestyle changes of the modern era have complicated the situation further. One has to keep in mind that the metabolic derangements so produced are to a significant extent preventable and reversible. In the whole world about 382 million people are the victim of hyperglycemia. The regions of high prevalence are North America and Caribbean about 11%. According to International Diabetes Federation estimates in 2013, 35 countries out of 219 countries have about 12% prevalence of diabetes. 10-19% of Asian population is currently affected due to diabetes. In Pakistan 7.1 million people suffer due to diabetes. The data from Pakistan showed a prevalence rate of 18-46% while 46-75% Pakistani patients with diabetes had metabolic syndrome.

One very important scenario is the triad of hyperlipidemia, type-II diabetes and coronary artery disease whereby the severity of coronary artery disease is more pronounced. This study was conducted to analyse and document the frequency of hypertriglyceridaemia and hyperlipidemia in a cohort of young male soldiers of productive age group with newly diagnosed type-II diabetes mellitus.

MATERIAL AND METHODS

This study was conducted at CMH, Multan from January to September 2017. All newly diagnosed hospitalized type-II diabetic male soldiers were included in the study after having their informed consent. These patients were from Armed Forces who clustered in a few months’ time.

Data Analysis

All the data was collected protectively through consecutive sampling. Data collection tool was developed regarding patient demographics, co-morbidities, previous medical history and laboratory findings. Fasting samples were collected and analyzed for LDL cholesterol, total cholesterol and triglyceride levels. The fasting period was at least 9 hours and the maximum 12 hours. Exclusion criteria were patients on lipid lowering drugs as well as those patients who already were on dietary restriction. Patients who were obese were not included in the study. Also excluded were patients on who were alcoholic, on diuretics and beta blockers. High triglyceride levels were considered as readings above 1.7 mmol/L and high LDL cholesterol levels were considered readings above 2.59 mmol/L. Data was entered and analyzed in SPSS version 23.

RESULTS

A Total of 55 patients were recruited for the study. The mean age of the patients was 41.1 ± 5.5 years and the range was 25 years to 50 years. All patients were males. Eight (14.5%) patients had diabetic nephropathy while diabetic retinopathy was present in 7 patients (12.7%). Macrovascular complications were seen in 2 (3.6%) patients. Family history was positive in 22 (40%) soldiers. Six (10.9%) patients were hypertensive while thirty nine patients (70.1%) were having type-II diabetes and 16 (29.1%) had type-I diabetes mellitus. About 46 (83.6%) patients had trace proteinuria, out of which 3 patients had +1 proteinuria and 4 patients had +2 proteinuria.

Mean LDL was 1.1 ± 4.1 mmol/L. Mean cholesterol was 4.5 ± 0.9 mmol/L while mean triglycerides was 2.4 ± 1.7 mmol/L and mean HDL 0.9 ± 2.0 mmol/L. Mean HBA1c was found to be 8.4 ± 1.1 as shown in table.

DISCUSSION

The risk of cardiovascular heart diseases in hyperglycemic patients is two to four times more as compare to normal. Lipid abnormalities (increased level of LDL, VLDL and triglycerides; and low levels of HDL) are an important cause of atherogenesis and known as atherogenic dyslipidemia. Lipid abnormalities may be the result of unbalanced metabolic state of diabetes and improved control of hyperglycemia does moderate diabetes-associated dyslipidemia. Fifty five patients were recruited for this study. Majority (78.5%) of the hyperglycemic patients
were aged above 40 years. The age of diabetic patients was observed to be above 40 years confirmed by earlier literature, previous studies reported that age plays a major role in the risk of developing type-II diabetes especially after 40 years. The results showed in the present study that in hyperglycemic patients the lipid level are higher and the similar results were shown by Agrawal et al 2014 and Huang et al 2014.

In our study prevalence of dyslipidemia was 29.7% in hyperglycemic patients. Two different studies conducted in India showed the prevalence of dyslipidemia in hyperglycemic patients was 89.0% and 92.4% (Udawat et al., 2001, Jayarama et al., 2012)\(^1\). In this study high prevalence of dyslipidemia could be credited to urbanization in the population from villages. Modernized life style associated with increasing urbanization, characterized by less physical activity and change of diet plan causes obesity leads to development of diabetes type-II.

The most common pattern of dyslipidemia was combined dyslipidemia with high LDL and low HDL this pattern of combined dyslipidemia was also studied in another study conducted in Southern India by Jayarama\(^4\). It was found that the prevalence of dyslipidemia in type-II diabetes mellitus as a whole was 86.75% with 29.7% single parameter of dyslipidemia, hypertriglycerides was found in about 56.46% and low HDL was found in about 72.92%\(^5\). The most prevalent lipid abnormality in our study was high LDL 24.3%

<table>
<thead>
<tr>
<th>Variables</th>
<th>n (%)</th>
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<tbody>
<tr>
<td>Age</td>
<td>(Mean ± SD) 41.15 ± 5.5 years (Range) 25-50 years</td>
</tr>
<tr>
<td>Diabetic nephropathy</td>
<td>8 (14.5%)</td>
</tr>
<tr>
<td>Diabetic retinopathy</td>
<td>7 (12.7%)</td>
</tr>
<tr>
<td>Macrovascular Complications</td>
<td>2 (3.6%)</td>
</tr>
<tr>
<td>Hyperglycemic Hyperosmolar Non-ketotic Coma history</td>
<td>1 (1.8%)</td>
</tr>
<tr>
<td>Family History</td>
<td>22 (40.0%)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>6 (10.9%)</td>
</tr>
<tr>
<td>Diabetes Type</td>
<td>16 (29.1%)</td>
</tr>
<tr>
<td>Type I</td>
<td></td>
</tr>
<tr>
<td>Type II</td>
<td>39 (70.9%)</td>
</tr>
<tr>
<td>Proteinuria</td>
<td></td>
</tr>
<tr>
<td>Trace</td>
<td>46 (83.6%)</td>
</tr>
<tr>
<td>+1</td>
<td>3 (5.5%)</td>
</tr>
<tr>
<td>+2</td>
<td>4 (7.5%)</td>
</tr>
<tr>
<td>Hyperlipidemia</td>
<td>(Mean ± SD) 4.5 ± 0.9 mmol/L</td>
</tr>
<tr>
<td>Hypertriglyceridemia</td>
<td>(Mean ± SD) 2.4 ± 1.7mmol/L</td>
</tr>
<tr>
<td>LDL</td>
<td>(Mean ± SD) 1.1 ± 4.1mmol/L</td>
</tr>
<tr>
<td>HDL</td>
<td>(Mean ± SD) 0.9 ± 2.0mmol/L</td>
</tr>
<tr>
<td>Urea</td>
<td>(Mean ± SD) 3.0 ± 24.0mmol/L</td>
</tr>
<tr>
<td>Creatinine</td>
<td>(Mean ± SD) 96.7 ± 67.4μmol/L</td>
</tr>
<tr>
<td>HbA1C</td>
<td>(Mean ± SD) 8.4 ± 1.1mmol/L</td>
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<tr>
<td>ALT</td>
<td>(Mean ± SD) 49.8 ± 4.8 units/L</td>
</tr>
<tr>
<td>BSF</td>
<td>(Mean ± SD) 198.5 ± 63.8mg/dL</td>
</tr>
<tr>
<td>BSR</td>
<td>(Mean ± SD) 311.7 ± 97.5mg/dL</td>
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followed by low HDL 27.6% whereas in another study conducted in Kuwait isolated dyslipidemia is the second most common pattern with increased LDL-cholesterol, observed in 21% of the patients\textsuperscript{4}. Kandula et al conducted a study in Hyderabad (India) showing that prevalence of dyslipidemia was 86%, while high total cholesterol was 41%, LDL was 64%, triglycerides was 47% and low HDL was 71\%\textsuperscript{14}. This prevalence of dyslipidemia was relevant to our study. A study conducted in Nishtar Hospital Multan showed that 21% patients with diabetes had raised serum cholesterol and 34.2% had raised serum triglyceride level\textsuperscript{13,16}, while in another study conducted in 2011, 14% diabetic patients had raised cholesterol level while 31% patients had raised TG level\textsuperscript{17,18}. In our study high cholesterol level was found in 29.7% patients and high serum TG found in 49.0% hyperglycemic patients. Different values of serum cholesterol may be due to different dietary habits of people in different cities of the country.

According to different previous studies diabetes mellitus has been one of the most prevailing diseases. Its complications may cause death directly and indirectly\textsuperscript{19,20}. According to a study of 100 patients, 31% hyperglycemic patients had vision problem, 81% were hypertensive, 40% had neuropathy and 26% had nephropathy\textsuperscript{21}. But in our study most prevalent complication associated with hypertension, nephropathy and retinopathy was about 6%, 8% and 7% respectively. The complications can be reduced by management of diabetes. Further research would be done to determine the management of dyslipidemia and other complications. Adequate knowledge about the different factors controlling diabetes and its complications are important. Improper diet, treatment and life style may be the leading cause of dyslipidemia and other complications.

CONCLUSION

The study has clearly demonstrated that high triglyceride levels are more prevalent than high LDL cholesterol levels in our patient group. Keeping the fact in view that hypertriglyceridaemia is a serious risk factor for the development of coronary artery disease it is therefore of paramount importance that this abnormality should be sought out at the onset of diabetes mellitus and addressed accordingly.

CONFLICT OF INTEREST

This study has no conflict of interest to be declare by any author.

REFERENCES

A RETROSPECTIVE DESCRIPTIVE STUDY ANALYSIS OF FREQUENCY OF TOTALY OCCLUDED CORONARY ARTERIES IN PATIENTS OF STABLE IHD UNDERGOING ROUTINE CORONARY ANGIOGRAPHY

Muhammad Nadir Khan, Shoaib Akbar, Abeer Ashfaq
Army Cardiac Center, Lahore Pakistan

ABSTRACT

Objective: To assess the current burden/frequency of chronic coronary total occlusions in patients with stable ischemic heart disease undergoing angiography at Army cardiac centre Lahore.

Study Design: Descriptive cross sectional study.

Place and Duration of Study: Army cardiac centre Lahore from Jan 2016 to Dec 2016.

Material and Methods: This is a retrospective descriptive study analysis of the record of 2441 patients who came to Army Cardiac Centre Lahore (ACC) for coronary angiography during the year of 2016. Patient’s data with completely (100%) occluded arteries (CTO) was analysed for age, gender, specific coronary artery occluded and co-morbidities like diabetes. The data was obtained from ACC registry and then tabulated.

Results: Out of 2441 patients 1753 were found to have stable IHD. Out of these 463 patients were found to have completely occluded arteries. Most common occluded artery was found to be proximal RCA followed by proximal LAD. About 84.7% patients with chronic coronary occlusion were males and 30.4% had diabetes.

Conclusion: Analysis of data revealed that 26.4% of patients with stable ischemic heart disease undergoing coronary angiography had completely occluded coronary arteries which indicate a significant burden, especially considering the morbidities, mortality and therapeutic challenges associated with CTO.

Keywords: Chronic occluded coronary arteries, Coronary angiography, Chronic total occlusion, Interventional cardiology, Ischemic heart disease, Percutaneous intervention, RCA occlusion.

INTRODUCTION

Ischemic heart disease is the leading cause of mortality worldwide, claiming more than 8 million lives in 2015 according to the world health organization statistics. The recent advances in the emergency care, catheter based percutaneous interventions and improved post-op care has led to a decrease in the proportion of fatal myocardial infarctions as compared to the non-fatal incidents. Ischemic heart disease is also associated with significant morbidities in patients causing significant impairment to life. One of the challenging problems faced by interventional cardiologists is the chronic totally occluded coronary arteries (CTO). It has been recognized by some as the final frontier of interventional cardiology because it leads to different therapeutic challenges as compared to the non-total occlusions. It also causes increased incidence of significant morbidities including angina\(^1\) and left ventricular pump failure\(^2\). As a result of the new technological advances, the success rate of successful PCI is around 75%-80%. However due to the therapeutic challenges CTO is one of the commonest reasons for failure to do PCI ultimately leading to an increase in the need of coronary artery bypass grafting procedures\(^3\). It is hence a topic of significant scientific research in modern interventional cardiology. The purpose of this study was to assess the burden of CTO to determine the magnitude of this problem.

Operational Definitions

CTO:

- 100% luminal stenosis with no antegrade flow, known or assumed to be >12 week duration on the basis of previous angiogram or lesions with significant bridging collaterals.
Totally occluded coronary arteries of unknown duration with Rentrop 2-3 retrograde filling.

**MATERIAL AND METHODS**

This descriptive cross-sectional study was conducted at the Army Cardiac Center Lahore to assess the frequency of CTO lesion in patients undergoing routine coronary angiography. We included 2441 patients who underwent coronary angiography routine and had stable ischemic heart disease for a period of 1 year between 1st January to 31st December 2016. The patients’ clinical characteristics were tabulated retrospectively from a 1 year data obtained from Army Cardiac Center Lahore registry. The data included in the study includes patients’ characteristics like age, gender, total, number of vessels involved, distribution of CTO lesions among specific branches of coronary arteries, the sub-segment of those branches involved (proximal or distal), patients with more than one CTO lesions and comorbidities like diabetes mellitus. Patients with previous coronary artery bypass graft (CABG) procedure or patients with non-ST segment elevation myocardial infarction (NSTEMI) and ST segment elevation myocardial infarction (STEMI) were indentified and excluded from the sample. The patients with previous CABG and those with acute coronary syndrome (NSTEMI=STEMI) were excluded and 1753 patients were indentified as those with stable ischemic heart disease undergoing coronary angiography.

**RESULTS**

Out of 1753 stable IHD patients, 463 (26.4%) had coronary CTO. A total of 606 occluded vessels were identified with some patients having more than one CTO lesions. A total of 1290 patients had non-total occlusions of coronary arteries.

The most commonly involved vessel was the right coronary artery with 38.3% of the total lesions. Left anterior descending was the second most common location of CTO (36.8%) with middle LAD being the most common site in LAD. A total of 24.6% lesions were located in LCX. This study is unique in that it also measures the relative prevalence of CTO lesions in different coronary arteries as shown in fig-1. A more detailed analysis is given in the table.

**Table: Frequency (%) of vessels causing CTO (n=606).**

<table>
<thead>
<tr>
<th>Vessels</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Right coronary Artery (RCA)</strong></td>
<td></td>
</tr>
<tr>
<td>Proximal RCA</td>
<td>111 (18.3%)</td>
</tr>
<tr>
<td>Middle RCA</td>
<td>77 (12.7%)</td>
</tr>
<tr>
<td>Distal RCA</td>
<td>27 (4.4%)</td>
</tr>
<tr>
<td>PLV/PDA</td>
<td>17 (2.8%)</td>
</tr>
<tr>
<td>RCA Total</td>
<td>232 (38.2%)</td>
</tr>
<tr>
<td><strong>Left Anterior Descending (LAD)</strong></td>
<td></td>
</tr>
<tr>
<td>Proximal LAD</td>
<td>88 (14.5%)</td>
</tr>
<tr>
<td>Mid LAD</td>
<td>111 (18.3%)</td>
</tr>
<tr>
<td>Distal LAD</td>
<td>9 (1.4%)</td>
</tr>
<tr>
<td>Diagonal</td>
<td>16 (2.6%)</td>
</tr>
<tr>
<td>LAD Total</td>
<td>224 (36.8%)</td>
</tr>
<tr>
<td><strong>Left Circumflex (LCX)</strong></td>
<td></td>
</tr>
<tr>
<td>Proximal LCX</td>
<td>67 (11%)</td>
</tr>
<tr>
<td>Distal LCX</td>
<td>36 (5.9%)</td>
</tr>
<tr>
<td>OM-Branches</td>
<td>47 (7.7%)</td>
</tr>
<tr>
<td>LCX Total</td>
<td>150 (24.7%)</td>
</tr>
</tbody>
</table>

S11
CTO was identified more commonly in males with 392 out of 462 (84.7%). The range of age was 30-93 years. About 30.4% patients were reported to be diabetics as shown in fig 2 & 3.

**DISCUSSION**

The recent advances in diagnostic and therapeutic procedure in the field of interventional cardiology have lowered the morbidity and mortality associated with cardiac disease and have led to an overall improved functional status of patients with coronary artery disease. Newer PCI techniques and stents have led to a decrease in in-hospital major cardiac adverse events including in-hospital death, Q wave MI and transient ischemic attacks.

CTO lesions are uncharted territory in the field of interventional cardiology because of the therapeutic challenges associated with it. CTO PCI is a complex procedure and has a high operator dependency. It has a long learning curve. The procedural time for CTO PCI is longer than a non CTO PCI leading to prolonged occupation of the catheter lab, increased fluoro time and a higher contrast dosage requirements compared to the non CTO PCI. And this leads to significant occupation of financial and human resources. The equipment for CTO PCI is costly due to the use of multiple guide wires and different types of micro catheters from those used in non CTO stenting e.g. stingray balloon, caravel micro catheter, corsair micro catheter. Due to these issues many patients with CTO lesion go untreated and are ultimately referred for coronary artery bypass surgery. Although costly, but this new equipment e.g sting-ray balloon, caravel super-cross microcatheter etc, for CTO PCI has made the procedure more feasible and successful thereby reducing the need for coronary artery bypass graft surgery.

Coronary CTO lesions in patients with ischemic systolic failure are associated with a higher mortality and a worse prognosis than those with non CTO lesions. There is also an increased incidence of ventricular arrhythmias in patients who have ischemic cardiomyopathy with CTO lesions than those with non total occlusions.

![Figure-1: CTO Frequency in stable IHD.](image1)

which increases the risk of sudden cardiac death.

However successful CTO recanalization has to be beneficial for the patient as it is associated with a reduced all cause mortality and improved long term survival compared to those with failed CTO PCI or those with untreated CTO lesions.

![Figure-2: Gender distribution in CTO.](image2)

![Figure-3: Diabetes Mellitus in CTO patients.](image3)

It improves the overall cardiac function by restoring the appropriate myocardial supply...
thereby increasing the LV ejection fraction and decreasing the end systolic volume in IHD patients, specially when there is ischemia of the area supplied by the CTO vessel. The amount of collaterals of the CTO vessel also impact the overall survival specially in a non CTO related STEMI patient.

CTO PCI is beneficial as it lowers the risk for coronary artery bypass graft surgery. Studies show that patients with total occlusion who are diabetic are at an increased risk of being adversely affected by it as compared to the nondiabetics due to a worse vascular status, hence PCI in diabetics yields better results and a reductions in adverse cardiac effects.

Successful recanalization of CTO vessels leads to improved quality of life with reduction in symptoms of myocardial ischemia and pump failure due to restoration of myocardial perfusion. According to a meta analysis carried out, different studies showed a reduction in anginal symptoms after successful recanalization.

Recent studies show that the current rate of CTO PCI performed ranges between 3-10% among the total PCI done for stable IHD. Studies also show that the rate of successful PCI done for CTO lesions is around 75-80%. The current observation of 26.4% prevalence of CTO lesions indicates the magnitude of this problem and a huge potential for improvement.

CONCLUSION

CTO lesions having a high frequency of 26.4% in stable IHD patients undergoing coronary angiography indicate the significant burden of this pathology. The difficulties approaching it therapeutically due to multiple factors like operator dependency & longer occupation of catheter lab often leads to failure to do PCI in CTO lesions. But the high burden of CTO lesions, the increased morbidities and mortality associated with it and with the recent studies showing positive response to successful recanalization warrants further research on this topic along with development of newer therapeutic modalities and allocation of time and resources to treat it.

CONFLICT OF INTEREST

This study has no conflict of interest to be declare by any author.

REFERENCES

TRANSCATHETER CLOSURE OF LARGE PERSISTENT DUCTUS ARTERIOSUS WITH THE MUSCULAR VENTRICULAR SEPTAL DEFECT DEVICE

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ABSTRACT

Objective: To assess the efficacy of Ventricular Septal Defect device for occlusion of large Patent Ductus Arteriosus with high pulmonary artery pressure.

Study Design: Descriptive cross-sectional study.

Place and Duration of Study: Armed Forces Institute of Cardiology Rawalpindi from May 2014 to Dec 2017.

Material and Methods: It was a descriptive cross-sectional study included seventy patients. Patients more than 2 months of age were included. Patients with large PDAs and systemic or near systemic pulmonary artery pressure underwent transcatheter closure using the VSD (SHSMA). Patients had weight less than 3kg were excluded. All patients were followed by echocardiogram 2 weeks and 6 months following the procedure.

Results: The mean echocardiographic and angiographic PDA diameter was 8.5 mm (1.8) (range 5-14 mm) and the mean VSD diameter was 11.4 (1.8) mm (range 9-16 mm). Successful device delivery and complete closure occurred in 55 patients (96.5% occlusion rate). Mean systolic pulmonary artery pressure was 65 mm Hg before procedure and 39 mm Hg immediately after the procedure. Fluoroscopy time was 9 min (range 5-25 min). Two devices embolized.

Conclusions: VSD device is very effective for closure of large PDAs along with high pulmonary artery pressure.

Keywords: Ventricular Septal Defect, Patent Ductus Arteriosus.

INTRODUCTION

Transcatheter closure of persistent patent ductus arteriosus (PDA) using various types of devices is a well established procedure. Somehow all patients with PDA are not suitable for this type of treatment, as these devices are not always appropriate for large pulmonary hypertensive ducts (PH-PDA). In the presence of high pulmonary artery pressure such devices are prone to embolisation into the aorta. The muscular ventricular septal defect device has recently been used successfully for transcatheter closure of muscular ventricular septal defects. This device is suitable for use with PH-PDA as its double disk tends to hold the device, minimising embolisation into the aorta. In this study we report the successful use of the muscular VSD device for treating PH-PDA.

The Memo Part VSD Occluder (LEPU Medical Technology, Beijing, China) has been described in detail in multiple studies. This VSD device is a self centering and repositionable device constructed of 0.004 inch (0.1 mm) Nitinol wires, tightly woven into two flat round discs with a 7mm connecting waist. The left disc is 4 mm larger than the waist and the right disc is 3 mm larger than the waist. Prostheses are currently available in various sizes.

MATERIAL AND METHODS

It was a descriptive cross-sectional study conducted at Armed Forces Institute of Cardiology from May 2014 to Dec 2017 included seventy patients. Patients more than 2 months of age and patients with large PDAs and systemic or near systemic pulmonary artery pressure underwent transcatheter closure using the VSD (SHSMA) were included. Patients had weight less than 3kg were excluded. All patients were followed by echocardiogram 2 weeks and 6 months following the procedure. Informed parental consent for the procedures was obtained.
from each patient. Data analysis was done on SPSS version-22. Descriptive statistics was applied to measure mean ± SD and frequency & percentages.

The technique of transcatheter closure of PDA using the VSD has been described in various studies. After percutaneous puncture of the femoral artery and vein, a complete haemodynamic evaluation was performed with pressure and saturation measurements taken in all cardiac chambers. A descending aortogram in anteroposterior and lateral projections was performed with a 5 or 6 French pigtail catheter to define the size and anatomy of the PDA (fig-1a). A 5 French JR catheter was advanced percutaneously from the venous side through the PDA into the descending aorta. Using an exchange 260 cm, 0.035 inch guide wire, the JR catheter was exchanged for various sizes of delivery sheaths advanced directly through the femoral vein and positioned in the proximal descending aorta.

An appropriately sized occluder was screwed to the delivery cable, pulled into the loader, and introduced into the guiding sheath. Under fluoroscopic guidance, the occluder was advanced into the descending aorta, where the left disk was deployed and pulled gently against the orifice of the duct (fig-1b).

Correct position was confirmed by injection of contrast medium through the aortic catheter into the descending aorta. Using gentle tension on the delivery cable, the sheath was pulled back to deploy the rest of the device. With the device still attached to the delivery cable, cross sectional colour Doppler echocardiography, pulmonary arteriography (fig-2) and descending aortography (hand injection of contrast medium) were done to confirm proper device position and exclude left pulmonary or aortic obstruction. Once optimal position was confirmed, VSD device was released by counter clockwise rotation of the delivery cable. A repeat aortogram (fig-3) and a complete haemodynamic evaluation were performed to check for residual shunts and change of pressures. Prophylactic antibiotics were not routinely given during the procedure. All patients were sent home 24 hours after the procedure on no drug treatment. Endocarditis prophylaxis was discontinued at the 12 month follow up visit if the duct was completely closed.

A chest x-ray and colour Doppler echocardiographic studies were performed on all patients at 24 hours, one month, and serially at 3-6 month intervals.

RESULTS

Seventy patients with clinical and echocardiographic findings of a large PDA and pulmonary hypertension underwent transcatheter closure with the VSD device. Their median age was 8 years (range 2 months to 20 years) and their median body weight was 30 kg.
(4 Kg to 65 kg). Ten patients had symptoms of heart failure and failure to thrive. On Doppler echocardiography there was evidence of bidirectional shunting through the PDA with left atrial and left ventricular enlargement.

According to Krichenko's PDA classification, Forty five patients had type A, 20 had type C, and five had type E. The length of the duct varied between 7-9 mm. The mean duct diameter (pulmonary end) was 9.8 (1.7) mm (range 7-13 mm). The mean VSD diameter was 12mm. The pulmonary to systemic flow ratio (Qp/Qs) varied between 2-3. All patients had systemic or near systemic systolic pulmonary artery pressure (mean 102 (11) mm Hg; mean systolic aortic pressure 109 (10) mm Hg). Device delivery was successful and associated with complete closure in all patients (100% closure rate). There was a significant fall ($p<0.05$) in mean systolic pulmonary artery pressure after the placement of the VSD device (to 50(5) mm Hg). Fluoroscopy time was 8.6 (4.1) minutes (range 4-16 minutes). One patient developed device embolization which was retrieved successfully and closed with 2 mm higher size6,7.

There was fall in the mean systolic pulmonary artery pressure at the six months follow echocardiogram. No complications were observed in the early post procedural period or during the one year follow up. All patients had complete closure with no evidence of device recanalisation, migration, wire fracture, thromboembolism, or endocarditis. No obstruction of the left pulmonary artery or the aorta was noted.

Transcatheter echocardiogram one year after implantation of the VSD device, showed complete closure and good position of the device with no evidence of aortic or pulmonary artery obstruction.

**DISCUSSION**

PDA closure using the SHSMA VSD device has significantly improved the results of trans catheter closure of moderate to large sized ducts. Its major advantages over previous devices are the smaller delivery sheaths (7-9 French), easy to reposition the device before release, and a significantly lower rate of complications and residual shunts8-10. However, the duct occluder devices are not designed to maintain a stable position under high pressure. Therefore in the presence of high pulmonary artery pressure there is a real possibility of systemic embolization. Even with VSD device we had one case of device embolization but it was retrieved and a bigger device was deployed successfully13,14.

This study shows the biggest number of patients treated with this modality with excellent results showing that trans catheter closure of large PH-PDAs is practicable, effective, and safe. Complete occlusion was obtained in all patients, with a significant fall in the pulmonary artery pressure and no complications during the follow up.
procedure or at the one year follow up. The device is muscular VSD device and its retention disk system ensures secure positioning in the pulmonary orifice of the duct and prevents device embolization into the systemic circulation in the presence of high pulmonary artery pressure. In addition, because of its construction from tightly woven Nitinol wire, this VSD device exerts an exaggerated stenting effect on the duct wall, giving it greater stability than the PDA device. Finally, this occluding device is available in various sizes, which makes it suitable for transcatheter closure of very large ducts.

Our major estimation of device size was based on echocardiographic estimation of PDA in short axis medially angulated view. The selected device size was 2-3 mm larger than the echo estimated size. This method reduced the chances of device embolization and better positioning across the aorta and pulmonary artery.

Pulmonary artery pressures were measured in all patients before and after the device closure. The cases with severe pulmonary hypertension having bidirectional shunting and right ventricular dilatation on echocardiography were not subjected to device closure. These cases were supposed to have elevated pulmonary vascular resistance not amenable to device closure.

CONCLUSION

The SHSMA VSD device was found safe for the closure of large ducts having adequate ampulla. With the use of this device we can minimize the chances of embolization with efficient closure and no residual shunt across PDA.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

REFERENCES

DIFFERENCES IN ANGIOGRAPHIC CHARACTERISTICS OF YOUNG AND THE ELDERLY PATIENTS UNDERGOING PRIMARY PERCUTANEOUS CORONARY INTERVENTION IN AFIC

Hafiz Muhammad Shafique, Mubarra Nasir, Farhan Tuyyab, Muhammd Asad, Rehana Khadim, Hassan Shabeer, Mir Waqas Baloch

Armed Forces Institute of Cardiology/National University of Medical Sciences (NUMS) Rawalpindi Pakistan

ABSTRACT

Objective: To assess the differences of angiographic features of young and old with STEMI.

Study Design: Descriptive cross sectional study.

Place and Duration of Study: This study was conducted at Department of Cardiology, AFIC & NIHD Rawalpindi from Jan to Aug 2017.

Material and Methods: A total of 602 patients with STEMI who underwent Primary PCI from Jan 2017 to Aug 2017, were included in this study. Two groups were formulated on the basis of age group. Group-A were younger age group with 40 years of age or less. Group-B included patients older than 40 years. They were compared with respect to risk factors and angiographic characteristics.

Results: A total of 602 patients with STEMI under gone primary PCI. Fifty three patients were in group-A while 549 patients were in group-B. Males were predominant in this cohort with 83% and 87% in group-A and B respectively. Family history of premature CAD was predominate in group-A, i.e. About 12 (22.6%) as compared to group-B i.e. 54 (9.9%). The most common infarct related artery was LAD in group-A. Single vessel disease was common in group-A 34 (64.15%) while triple vessel disease was common in group-B 195 (35.6%). There was no mortality in younger group while mortality rate in group was 16 (2.9%).

Conclusion: Single vessel coronary artery disease and anterior wall STEMI was common in younger group. Family history of premature CAD, smoking and dyslipidemia were the associated risk factors in young patients with STEMI.

Keywords: ST segment elevation myocardial infarction, Primary percutaneous coronary intervention.

INTRODUCTION

Myocardial infarction (MI) is one of the major causes of morbidity and mortality in Pakistan2. It is a disease that is usually found to be prevalent in the elderly, but now a days the incidence is seen to be increasing in the younger population i.e. in patients of age less than 40 years2. The recent internationally conducted studies have demonstrated the incidence rates of MI in young ranging between 2% and 10%, based on the local statistics and relevant risk factors3-5. Pakistan has a distinct racial cohort with increasing incidence of ischemic heart disease and morbidity associated with it. There is limited established data till date on the frequency and clinical presentation of ischemic cardiac events in young population. Analysis of the clinical characteristics and overall frequency of ST segment elevation MI, can help elaborating the major determinants of risk in this particular age group and how it is distinct from those who present at an older age. The inferences derived from such analysis can lead to formulation of screening and prevention strategies in our population. Therefore, the objective of the current study was to evaluate the frequency and overall clinical as well as angiographic characteristics of young patients presenting with myocardial infarction. It has been observed, that in western countries, a large number of young patients developing ST elevation MI are cocaine and amphetamine addicts and eventually they were found to have normal coronary angiograms6-9. In our country, such causes are found to be rare. Despite the before cited difference, there is
increased frequency of younger patients presenting with ST segment elevation MI in our region10. In the presence of distinct predictors of risk in both the societies, a difference in the angiographic and clinical profile is expected.

MATERIAL AND METHODS

This descriptive cross sectional study was conducted at the Department of Cardiology, AFIC/NIHD, Rawalpindi. We included consecutive 602 patients with ST segment elevation Myocardial infarction undergoing PPCI, presented in emergency department from Jan to Aug 2017. All patients (20-90 years) of both genders presented were included in the study. The inclusion criteria was first episode of acute ST segment elevation MI diagnosed on the basis of history of chest pain lasting >30 minutes associated with an ST-elevation of ≥1 mm in ≥2 contiguous leads or new left bundle branch block plus time from symptom-onset to presentation ≤24 hours. Their coronary angiograms followed by Primary PCI were performed in Catheterization Laboratory of AFIC/NIHD between Jan 2017 and Aug 2017 with standard protocol. The patients with a past history of stenting were not included in the study. The recruited patients were segregated in two groups on the grounds of their respective ages. Group-A comprised of patients who were of age 40 or younger, whereas group-B comprised of patients who were more than 40 years of age. Their coronary angiograms were obtained and analyzed. The extent and severity of coronary artery disease was categorized as minor irregularities of the vessel, insignificant disease i.e. stenosis ≤ 50% and significant disease i.e. stenosis > 50%. Significant disease also included totally occluded vessels. In addition, the disease severity was also described on the basis of the number of diseased vessels, number and type of lesions as defined by the AHA. If more than 50% reduction of vessel diameter was observed in comparison to a normal vessel, the vessel was declared to be diseased. The comparison of the two groups was done on the basis of their gender, presence of co-morbidities such as diabetes and hypertension, obesity, dyslipidemia, family history of ischemic heart disease, smoking, and angiographic characteristic of coronary artery disease. Myocardial infarction was defined according to the third universal definition of myocardial infarction11.

The relevant data were collected on a structured proforma. Procedural data was

Table-I: Clinical Characteristics of study population.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>GROUP-A Stemi in younger ≤40 years (n=53) (8.8%)</th>
<th>GROUP-B Stemi in older &gt;40 years (n=549) (92.2%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>34.46 ± 4.4</td>
<td>63.17 ± 8.65</td>
<td>0.473</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>44 (83.0%)</td>
<td>477 (87.0%)</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>9 (17.0%)</td>
<td>72 (13.0%)</td>
<td></td>
</tr>
<tr>
<td>CO MORBIDS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypertension</td>
<td>8 (15.09%)</td>
<td>148 (26.95%)</td>
<td>0.05</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>4 (6.6%)</td>
<td>93 (17%)</td>
<td>0.07</td>
</tr>
<tr>
<td>Smoking</td>
<td>28 (52.8%)</td>
<td>193 (35.15%)</td>
<td>0.01</td>
</tr>
<tr>
<td>Family history of CAD</td>
<td>12 (22.6%)</td>
<td>54 (9.9%)</td>
<td>0.004</td>
</tr>
<tr>
<td>BMI</td>
<td>29.7 ± 6.1</td>
<td>29.1 ± 5.8</td>
<td>0.6</td>
</tr>
<tr>
<td>HTN+DM</td>
<td>1 (3.5%)</td>
<td>53 (9.6%)</td>
<td>0.05</td>
</tr>
<tr>
<td>Dyslipidemia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low HDL levels</td>
<td>31 (58.49%)</td>
<td>236 (42.98%)</td>
<td>0.03</td>
</tr>
<tr>
<td>High Cholesterol</td>
<td>20 (37.77%)</td>
<td>289 (52.64%)</td>
<td></td>
</tr>
</tbody>
</table>
assessed from the database at the time of the PPCI, and hospital outcomes was be assessed from chart reviews in the previous records. Risk factors were obtained from reviews of medical records and telephone contact.

**Data Analysis**

Statistical analysis was performed using statistical software SPSS version 23. Mean and standard deviation was calculated for continuous variable while Categorical variables were expressed as frequencies and percentages. Statistical analysis were performed with chi square tests for dichotomous data and independent t-tests for continuous data. For all statistical analyses a p-value <0.05 was considered significant. Data analysis was performed using SPSS-23. Associations were calculated applying chi-square test.

**RESULTS**

Clinical characteristics of the patients are given in table-I. A total of 602 patients were included in our study (table-I). Mean ± SD age of the patients was 34.46 ± 4.4 years in younger group and 63.17 ± 8.65 in older group. Fifty three patients were in younger age group while 549 patients were more than 40 years of age. About 44 (83%) vs. 477 (87%) were male and 9 (17%) vs 72 (13%) were female in the younger and older age group respectively. In group-A, 8 (15.09%) patients were hypertensive and 4 (6.6%) were diabetic, while only 1 (3.5%) was both diabetic and hypertensive. In group-B, 174 (31%) patients were hypertensive and 93 (17%) were diabetic while 53 (9.6%) were both hypertensive and diabetic. Rate of Smoking and dyslipidemia 28 (52.8%) vs 193 (35.15%), and 29 (54.71%) vs 340 (52.8%) was lower in group-B.

**Table-II: Comparison of angiographic characteristics of the two groups.**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>GROUP-A</th>
<th>GROUP-B</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infarct Related artery</td>
<td>Stemi in younger ≤40 years (n=53) (8.8%)</td>
<td>Stemi in older &gt;40 years (n=549) (92.2%)</td>
<td></td>
</tr>
<tr>
<td>LMS</td>
<td>0(0%)</td>
<td>8 (1.4%)</td>
<td>0.005</td>
</tr>
<tr>
<td>LAD</td>
<td>36 (67.92%)</td>
<td>307 (55.7%)</td>
<td></td>
</tr>
<tr>
<td>RCA</td>
<td>13 (24.5%)</td>
<td>197 (35.8%)</td>
<td></td>
</tr>
<tr>
<td>LCX</td>
<td>4 (7.5%)</td>
<td>36 (6.5%)</td>
<td></td>
</tr>
<tr>
<td>Recanalized</td>
<td>2 (3.7%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of vessels involved</td>
<td>No vessel involved</td>
<td>2 (3.7%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>SV CAD</td>
<td>34 (64.15%)</td>
<td>160 (29%)</td>
<td></td>
</tr>
<tr>
<td>DVCAD</td>
<td>14 (26.41%)</td>
<td>194 (35.3%)</td>
<td></td>
</tr>
<tr>
<td>TV CAD</td>
<td>5 (9.43%)</td>
<td>195 (35.6%)</td>
<td></td>
</tr>
<tr>
<td>Target lesion Length (mm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LAD</td>
<td>30 ± 6.5</td>
<td>33 ± 9.5</td>
<td>0.08</td>
</tr>
<tr>
<td>RCA</td>
<td>28 ± 10</td>
<td>33 ± 8.5</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One</td>
<td>2 (3.7%)</td>
<td>0 (0%)</td>
<td></td>
</tr>
<tr>
<td>Two</td>
<td>30 (56.6%)</td>
<td>60 (11%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Three</td>
<td>10 (18.86%)</td>
<td>211 (38.43%)</td>
<td></td>
</tr>
<tr>
<td>Four or more</td>
<td>6 (11.3%)</td>
<td>157 (28.59%)</td>
<td></td>
</tr>
<tr>
<td>Thrombus aspiration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Access site</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radial</td>
<td>53 (100%)</td>
<td>545 (99.4%)</td>
<td>0.75</td>
</tr>
<tr>
<td>Femoral</td>
<td>0 (0%)</td>
<td>4 (0.6%)</td>
<td></td>
</tr>
<tr>
<td>Types of stent</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DES</td>
<td>51 (96.22%)</td>
<td>449 (81.7%)</td>
<td></td>
</tr>
<tr>
<td>BMS</td>
<td>0</td>
<td>88 (16.02%)</td>
<td></td>
</tr>
</tbody>
</table>
(61.93%) were high in both group-A and group-B respectively and both are statistically significant (p-value 0.01 and 0.03 for smoking and dyslipidemia). Family history of premature CAD was prominent in group-A 12 (22.6%) as compared to group-B 54 (9.9%). Table-II shows the angiographic characteristics: the most common infarct related artery was LAD although the preponderance was high in Younger age group as compared to older age group 36 (67.92%) vs 307 (55.7%) respectively. Single vessel disease was common in group A 34 (64.15%) while triple vessel disease was common in group-B 195 (35.6%). Significant lesion was defined as when it causes >50% stenosis of vessel. One lesion disease was predominant in group-A (56.6%) while two or more lesion disease was common in group-B patients (table-II). Target lesion length was long in group-B as compared to group-A (33 ± -8.5 vs 30 ± -6.5 mm). Use of thrombuster due to high thrombus burden was statistically in significant in both groups. Radial or ulnar access was used in all patients of group-A and 99.4% patients of group-B. Similarly DES was used in all patients with younger age while in group-B 449 (81.7%) and 88 (16.02%) patients were implanted DES and BMS respectively. Twelve patients needed temporary pace maker due to complete heart block in group-B. There was no mortality during stay in hospital and follow up up to 30 days in younger group while mortality rate in group was 16 (2.9%).

DISCUSSION

Myocardial infarction occurred with acute onset and if it happened in younger age it leads to trauma to the family and increased morbidity. STEMI is one of the leading causes of cardiac mortalities, it is important to look into the clinical characteristics and risk factors involved in STEMI among young adults. In western world, myocardial infarction in young with normal coronary angiogram is highly prevalent. However, in our study, the younger patients with STEMI were having many characteristics similar to older patients in quite many respects. In our study 8.8% of the patients were 40 years or younger. This is a slightly high percentage of patients compared to previously published data. Hosseini et al studied patients with acute STEMI aged ≤40 years. Of the total admissions for myocardial infarction, only 5.4% of the patients were ≤40 years. This may be explained by the reason that the mean age for first MI among south Asians is lower when compared to individuals in other countries. We studied both the groups with respect to the gender distribution, presence of hypertension, diabetes mellitus, smoking, BMI, Family history of premature CAD, lipid profile and angiographic characteristics. The higher proportion of males in the younger MI group (83%) in our study is not surprising as the coronary artery disease is usually occur 7 to 10 years earlier in men than women. Seventeen percent of the patients in younger MI group and 13% in older MI group were females. This is in consistency with previous studies which showed the prevalence of 3–25% female sex in young patients. There were very few studies in the past which have compared the gender distribution among young. In this study, smoking and premature CAD in family (52.8% and 22.6% respectively) was the most important medical history factor in younger group. This is closely in line with recent studies of young STEMI patients from the Indian subcontinent. The frequency of diabetes and hypertension were found to be lower in the younger STEMI group compared to the older group (15.09% vs 26.95% and 6.6% vs 17% respectively) and it is not statistically significant (p-value 0.05 for hypertension and 0.07 for diabetes mellitus). This is a known fact that incidence of both diabetes mellitus and hypertension increases with age and is in relevance with the previous studies.

Premature CAD is strongly associated with dyslipidemia especially when in combined with smoking. In our study, few patients in younger group had a history of dyslipidemia. However, at the time of presentation, 58.49% of patients in younger group and 42.98% in older group had low HDL levels (p-value 0.03). Screening of
dyslipidemia and then early intervention can prevent acute cardiac events among individual aged <40 years with other risk factors. Young age group in our study had higher frequency of single vessel disease (64.15%) when compared with their older counterparts (29%). The present finding of single vessel disease in young patients versus multivessel disease in the older patients is in accordance with the previous studies. Similarly the number of lesions per patient in older age group were more as compared to younger age. Young patients with acute STEMI had a predominance of acute anterior STEMI due to occluded left anterior descending artery (67.92%). These findings are similar to previous study. Use of thrombuster for thrombus aspiration in younger and older groups were 3.5% and 5.1% respectively and was statistically in significant. We used radial site for PPCI in majority of patients (table-II). Similarly DES was implanted in all younger group patients and in 81.9% of older group. There was no documented mortality in younger patients where as in older age group it was 2.9%.

CONCLUSION

Anterior wall STEMI was common in younger group. Family history of premature coronary artery disease, smoking and dyslipidemia were the main risk factors in young patients with STEMI. Early intervention to treat dyslipidemia in high risk younger population along with smoking cessation can decreased the disease burden in this age.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author

REFERENCES


Primary Percutaneous Coronary Intervention

S22

Pak Armed Forces Med J 2018; 68 (Suppl-1): S18-S22
PROCEDURAL OUTCOMES OF CHRONIC TOTAL OCCLUSIN-PERCUTANEOUS CORONARY INTERVENTION, AN UPDATED ANALYSIS OF AFIC/NIHD CTO-PCI REGISTRY

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Armed Forces Institute of Cardiology/National University of Medical Sciences (NUMS) Rawalpindi Pakistan

ABSTRACT

Objective: To evaluate the procedural outcomes of patients having chronic total occlusion undergoing percutaneous coronary intervention at our clinical setup.

Study Design: Descriptive cross sectional study.

Place and Duration of Study: This study was conducted at Armed Forces Institute of Cardiology & National Institute of Heart Diseases, Rawalpindi from Jul 2014 to Jun 2017.

Material and Methods: A total of 536 patients who underwent for percutaneous coronary intervention- chronic total occlusion were included in our study. Patients with chronic total occlusion lesion ≥3 months were included in our study. All the patients underwent percutaneous coronary intervention of chronic total occlusion Vessel were selected by non probability sampling technique. Patient’s clinical, demographic data and data regarding procedural outcome was recorded. Finally data was analyzed using descriptive statistics.

Results: Out of 536 patients 468 (87%) were male while 68 (12%) were female. Mean age was 55.5 ± 11.6 Years from 36 to 81 Years. Two hundred and one (37.5%) patients were diabetic, 181(33.7%) were hypertensive and 224 (41.7%) were smokers. Mean LVEF% was 48.7 ± 7.1 (Mean ± SD). Most common vessel involved was RCA 248 (46.2%) followed by LAD 188 (35.0%). Only drug eluting stents (DES) were implanted in successful cases with average no of stents used per patient were 1.43 ± 0.7. Common reasons for failure of procedure was inability of balloon/microcatheter to cross the lesion, inability to cross through retrograde collaterals but the most common reason was the failure of wire to cross the CTO lesion. The overall procedural success was achieved in 73.1% patients. No deaths were reported during the procedures.

Conclusion: The recanalization of CTO lesion was successfully done in 73% cases using PCI. Most common reason for unsuccessful revascularization was failure of guide wire to cross the lesion. With increasing experience and better equipment recanalization of CTO coronary lesions is a safe and effective treatment option for patients with persistent Angina even on optimal medical treatment.

Keywords: Chronic total occlusion (CTO), Percutaneous coronary intervention (PCI), Drug eluting stents (DES)

INTRODUCTION

Chronic total occlusions (CTO) of coronary arteries are present in 15-30% of patients undergoing coronary angiography1,2. Various studies have suggested that presence of CTO is associated with high mortality3,4. CTOs are complex lesion with low procedural success rates and even after, successful PCI, chances of restenosis are 1.5 to 4 times greater than non-occluded coronary artery lesion5,6. Various prediction risk scores have been devised to predict success of the procedure7. Presence of CTO vessel is also one of the major reason for referral to CABG surgery1. Successful revascularization of CTO can provide significant improvement in symptoms, left ventricular function, reduction in arrythmias, and better tolerance of an acute coronary syndrome6. By contrast, failure of CTO revascularization has been found to be associated with an increased risk of mortality and angina pectoris when compared with successful revascularization in meta-analysis6,8. Despite significant volume of CTO on coronary angiography, due to technical difficulties and failure of procedural success, only
3.8-4.8% CTO PCI as compared to total PCI volumes are reported in National cardiovascular data registry USA⁹. Very limited centers in Pakistan perform complex coronary intervention especially PCI of CTO vessels and to the best of our knowledge no local studies with such large no of patients are available to show procedural outcomes of CTO PCI in Pakistan. In this study we planned to analyze Armed Forces Institute of Cardiology / National Institute of heart diseases PCI data for CTO cases. This institute is a high volume center and among leading and very few institute in Pakistan with much experience in successful recanalization of CTO-PCI. The analysis will also include the average equipment/hardware used for CTO-PCI thus encouraging other centers to treat CTO and to reduce overwhelming burden on limited cardiac surgical centers.

**MATERIAL AND METHODS**

This was an observational study, carried out at AFIC/NIHD Rawalpindi from July 2014 to June 2017. All patients who underwent CTO PCIs which include 536 patients at AFIC/NIHD cardiac catheterization laboratory were included in the study. A chronic total occlusion (CTO) was defined as the complete obstruction of a coronary artery, exhibiting TIMI 0 or TIMI 1 flow, with an occlusion duration of >3 months. Procedural success was defined as TIMI 3 grade flow achieved without any MACE. Most common indication for CTO PCI was persistent angina despite optimal medical treatment. All patients underwent the CTO PCI as per protocol after getting the written informed consent.

**Data Analysis**

Categorical variables are presented as frequencies and continuous variables are presented as means with standard deviation. Comparisons were done with Pearson chi-square test for parametric data and with Mann-Whitney-Wilcoxon test for nonparametric data (SPSS Version 21). A p-value of <0.05 was considered statistically significant. The data is also breakdown on basis of years and a comparison is done for procedural success.

**RESULTS**

The registry data showed that total numbers of PCI done in AFIC/NIHD are 11399 out of which 536 (4.7%) was CTO cases. Demographic characteristics of our patient’s registry showing highest amount of intervention done for male patients as most patients entitled at our center are male as shown in Table-I. Smoking was commonest risk factor for presence of CTO followed by diabetes mellitus. The mean left ventricular ejection fraction was 48.7 ± 7.1%. Most common vessel involved was RCA 248 (46.2%) followed by LAD 188 (35.0%), LCX (18.8%), while...
only 0.98% patients had double CTO vessels. Procedural success rate for 4 years was 73.1%. Almost all patients underwent Antegrade wire escalation with retrograde approach accounting only for 4.85%. Most common access site for CTO PCI used was Radial (51%), followed by femoral approach (47%) and DUAL Injections were used in 35% of the cases. All the patients with successful recanalization were implanted with drug eluting stents. No deaths were reported during the procedures. Table-II shows that procedural success rate for 4 years is 73.1% with highest success rate achieved in 2014 and highest number of cases done in 2015. Almost all patients underwent Antegrade wire escalation with retrograde approach accounting only for 2.98%. The access site of PCI was also shown in table-III. Although recommended approach to access CTO is dual injection (double stick) but at our setup routine CTO access site is radial or femoral to reduce the patient cost. Table-III shows that RCA followed by LAD are common sites for CTO in our registry. The average equipment use for recanalizing CTO was shown in table-III.

**DISCUSSION**

Revascularization of CTO coronary vessels remains a challenge irrespective of the modality chosen\(^9\text{-}^{11}\). CTO PCI is done in most patients for treating symptoms, usually angina and dyspnea\(^11,^{12}\). In the SYNTAX trial, percutaneous coronary intervention (PCI) of CTO lesions was successful in 49% percent of patients, while the surgical success rate was only marginally better at 68\%\(^{13}\). Currently, PCI success rates of greater than 80\% are being reported in specialist Japanese, American and European Centers. DECISION CTO and EURO-CTO TRIALS are new addition to controversies surrounding the challenging revascularization of CTO PCI\(^{14,15}\). It has generated lot of debate among the experts around the world, some favoring to keep patients on optimal medical treatment as it has been shown to be non-inferior to revascularization in DECISION CTO TRIAL. While some experts like Emmanuel S. Brilakis, believe that this trial will not change the contemporary practice as this trial has its own flaws in recruitment and hard end points. Our center is veteran hospital and amongst the highest PCI volume centre in the country with huge experience in complex PCI cases. In our CTO registry data majority of the patients were males as AFIC is the biggest a referral Centre in the Armed Forces with major volume of male entitled patients. Smoking was the commonest risk factor for presence of CTO followed by Diabetes Mellitus\(^5,^{14,15}\). This result is in consistence with the study done by Brilaki et al.

### Table-III: Complete total occlusion approach, complete total occlusion access site, culprit artery and equipment used.

<table>
<thead>
<tr>
<th>Approach</th>
<th>Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antegrade Approach</td>
<td>510 (95.1%)</td>
</tr>
<tr>
<td>Retrograde Approach</td>
<td>26 (4.85%)</td>
</tr>
<tr>
<td>Radial</td>
<td>275 (51.3%)</td>
</tr>
<tr>
<td>Femoral</td>
<td>254 (47.3%)</td>
</tr>
<tr>
<td>Ulnar</td>
<td>7 (1.3%)</td>
</tr>
<tr>
<td>Dual Injection (Radial + Femoral)</td>
<td>188 (35.0%)</td>
</tr>
<tr>
<td>AD</td>
<td>188 (35.0%)</td>
</tr>
<tr>
<td>LCX</td>
<td>101 (18.8%)</td>
</tr>
<tr>
<td>RCA</td>
<td>248 (46.2%)</td>
</tr>
<tr>
<td>Double CTO</td>
<td>5 (0.93%)</td>
</tr>
<tr>
<td>Wires (Mean ± SD)</td>
<td>2.13 ± 0.92</td>
</tr>
<tr>
<td>Balloons (Mean ± SD)</td>
<td>2.74 ± 1.10</td>
</tr>
<tr>
<td>Stents (Mean ± SD)</td>
<td>1.43 ± 0.71</td>
</tr>
<tr>
<td>Contrast (Mean ± SD)</td>
<td>192 ± 47.3 ml</td>
</tr>
</tbody>
</table>
which showed smoking and diabetes to be a significant risk factor for CTO. In our study average procedural success rate was 73.18% which is comparable to the success rate reported in international studies like Stone et al, Suero et al, and TOAST-GISE14,16,17. Highest success rate was achieved in 2014 (76.66%) and highest number of cases done in 2015 (190). In a previous study registry data from Feb 2012 to Dec 2013 (AFIC/NIHD) reported success rate was 98%, but the no of patients were very low (n=50) as compared to our data. Reasons for relatively low success rate in 2017 (65.6%) are multi-factorial including increasing complexity of cases, new less experienced operators attempting CTOs. Experienced operators at our Centre have a steady success rate of more than 80%. The volume of CTO PCI has remained steady over the last few years. So this trend in our result is not against the fore mentioned studies which showed significant success in CTO PCI over the years. In our study most common vessel involved was RCA 248 (46.2%) followed by LAD 188 (35.0%), LCX (18.8%), while only 0.98% patients had double CTO vessels. The findings are consistent with Canadian Multicenter CTO Registry showed that 47% of solitary CTOs occur in the right coronary artery, 20% in the LAD, and 16% in the left circumflex. Similar distributions of CTOs have been reported by other investigators18-21. Majority of the CTO cases were attempted through Antegrade approach with wire escalation strategy. While only 4.85% cases were attempted through retrograde approach after failure of antegrade technique. The most common access for CTO PCI was radial (51%) followed by femoral (47%). Dual injections were used in only 35% of the cases. Reason for less use of dual injections and common Antegrade approach is operator experience, and high cost of equipment in retrograde approach. Most common wire used was Run-through followed by pilot 50 and Fielder XT. Average no of wires used per patient were 2.13 ± 0.92. Average no of balloons and stents used per patient were 2.74 ± 1.10 and 1.47 ± 0.71 stents. All the patients with successful revascularization were implanted drug eluting stents which is in keeping with the evidence that DES implantation in CTO PCI is associated with better outcomes22-24. Common reasons for failure of procedure was inability of balloon/micro catheter to cross the lesion due to severe calcification or tortuosity of the vessel, inability to cross through retrograde collaterals but the most common reason was the failure of wire to cross the CTO lesion. There were no intra-procedural or in hospital deaths reported.

CONCLUSION

CTO prevalence in angiography was found very high as compared to CTO PCI. Fear of failure, lack of CTO experience and higher cost of CTO PCI inventory in a developing country can be attributed to this lower rate of CTO PCI in Pakistan. Descriptive statistics of CTO in Pakistan is in accordance to international studies. With higher retrograde PCI and more use of Dual injection can improve CTO PCI success.

LIMITATION OF STUDY

Our study results cannot be generalized as it does not show randomized data. Cost is the primary factor in all PCI in Pakistan, the success rate and volume cannot be compared to international studies. The lack of large data for retrograde PCI which is a very important procedure to open complex CTO also limits the findings of our study.

CONFLICT OF INTEREST

This study has no conflict of interest to be declare by any author.

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ELECTROCARDIOGRAPHIC CHANGES IN ACUTE PULMONARY EMBOLISM WITH RIGHT HEART STRAIN AND IT’S ASSOCIATION WITH ADVERSE CLINICAL EVENTS

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ABSTRACT

Objective: To determine the frequency of electrocardiographic changes in right heart strain RHS due to acute pulmonary embolism PE and its effect on mortality.

Study Design: Prospective cross-sectional study.

Place and Duration of Study: AFIC/NIHD Rawalpindi, from Dec 2015 to Jan 2018.

Material and Methods: 70 patients with acute pulmonary embolism were enrolled in this study. The primary outcome was right heart strain (RHS) on echocardiogram. The secondary outcome was mortality.

Results: Mean age was 50.16 ± 18.754 and male were 51 (72.9%). Thirty eight (54.28%) had right heart strain RHS on echocardiography. Mortality was 14 (20%). Provocating factors were identified in 34 (48.6%). Major contributing factors were high altitude in 11 (15.7%) and postoperative and malignancy cases in 7 (10%) each. ECG changes with significant association with RHS included: Tachycardia in 13 (34%) (p-value 0.013), S wave in lead I in 12 (31.57%) (p-value 0.039), T wave inversion TWI in lead VI and lead V2 in 10 (26.31%) and TWI in lead V1 to V3 in 8 (21.05%) (p-value 0.03). ECG changes with significant association with mortality included- Tachycardia ≥100 bpm/min 7 (50%) (p-value 0.012), SIQ3T3 in 5 (35.71%) (p-value 0.022), S wave in lead I in 8 (57.14%) (p-value 0.001), TWI in leads V1 through V2 in 5 (35.71%) (p-value 0.054) and TWI in leads V1 through V3 in 5 (35.71%) (p-value 0.013).

Conclusions: ECG can identify patients with RHS in acute PE and this in turn helps in identifying patients vulnerable to adverse clinical events.

Keywords: Pulmonary embolism, Right heart strain, Thrombolysis.

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INTRODUCTION

Acute pulmonary embolism (PE) is a serious complication of venous thromboembolism (VTE) with an annual incidence of 100 ± 200 per 100,000 persons1. Depending upon the thrombotic burden it can have In-hospital mortality as high as 59%2. Four year adverse event rate of 50%3 and a 5 year mortality rate of up to 32%4 speaks of the high long term morbidity and mortality despite treatment5.

PE can be classified as massive, sub-massive, or non-massive based on the hemodynamic.

Status and right ventricular (RV) function of the patient. Massive PE is characterized by systemic hypotension or cardiogenic shock, submassive PE is characterized by RV dysfunction without hypotension, and non-massive PE has neither systemic hypotension nor RV dysfunction6.

In-hospital mortality varies with severity as high as 25-50% with massive PE, 3-15% with submassive and 5% or less with non-massive PE7. Sub-massive PE can have mortality approaching massive PE with attendant difficult risk assessment8.

While there is a consensus that in patients with massive PE should receive either systemic thrombolysis, catheter directed interventions, or surgery9. The management of patients with submassive PE remains controversial, the risk-benefit...
ratio of thrombolytic or invasive therapies versus bleeding is unclear.

Patients with PE are risk stratified so as to estimate the probability of circulatory shock and 30-day all-cause mortality. Patients with low risk PE might be considered for immediate treatment at home. Fibrinolytic therapy is recommended for patients with PE and RV failure as they may have hemodynamic collapse. Risk stratification includes clinical scoring systems, biomarkers (troponins I and T, brain natriuretic peptides), RV strain on echocardiography and right heart strain (RHS) based on mortality.

The purpose of this study is to ascertain the frequency of electrocardiographic changes with RHS and its association with mortality, so as to recommend ECG as a risk marker of RHS and identifying patients in need of thrombolytic therapy in centers where echocardiographic facility is unavailable.

**MATERIAL AND METHODS**

This is a prospective cross-sectional study carried out at AFIC/NIHD Rawalpindi from December 2015 to January 2018. Institutional ethical review board approval was obtained. Verbal consent was obtained from patients. Data collection tool was developed to measure demographics, response to treatment and outcome. Doppler ultrasound of lower limbs was carried out for DVT. Diagnosis of Pulmonary Embolism was based on CTPA showing filling defect.

12-lead electrocardiogram was obtained on arrival at ER and was used as the primary predictor. The ECG was assessed for heart rate (HR), rhythm, S wave in lead I, SIQIIITIII pattern, Q wave /T wave inversion in lead III, incomplete or complete right bundle branch block (RBBB), ST-segment elevations/depressions, and T-wave inversions (TWI).

Primary outcome was right heart strain on echocardiography. Echocardiography was carried out within 24 hours. RHS was based on RV dilatation, hypokinesis, Mc Connel Sign, Peak pulmonary artery pressure and Trans annular peak systolic excursion TAPSE. TAPSE was determined by the longitudinal motion of annulus at peak systole with the M-mode cursor at the lateral tricuspid annulus.

Secondary outcome was death as the only adverse clinical event, assessed during the period of hospitalization.

Statistical analysis was carried out on IBM SPSS version 23. Categorical data was presented as percentages and frequency whereas descriptive statistics were expressed as mean and standard deviation for quantitative analyses. Chi square test was applied to analyze the data. A $p$-value of $\leq$0.05 was considered statistically significant.

**RESULTS**

Between December 2015 and January 2018, 70 patients with pulmonary embolism were enrolled. Table-I shows basic characteristics of the enrolled patients. Mean age was $50.16 \pm 18.75$. Male were 51 (72.9%). An Emergency deptt ECG was available for review in all 70 (100%) patients. CTPA confirmed acute PE in 70 (100%). Doppler study was carried out in all patients and revealed DVT in 29 (42%). Echocardiography was carried out in all patients and revealed Right heart strain RHS in 38 (54.28%). Mortality was 14 (20%). Provoking factors were identified in 34 (48.6%). Major contributing factors were high altitude in 11 (15.7%) and postoperative and malignancy cases in 7 (10%) each.

ECG changes with significant association with RHS included; Tachycadia in 13 (34%) ($p$-value 0.013), Swave in lead I in 12 (31.57%)
(p-value 0.039), T wave inversion TWI in lead VI and lead V2 in 10 (26.31%) and TWI in lead VI to V3 in 8 (21.05%) (p-value 0.03).

ECG changes with significant association with mortality included-Tachycardia ≥100 bpm in 7 (50%) (p-value 0.012), SIQ3T3 in 5 (35.71%) (p-value 0.022), S wave in lead I in 8 (57.14%) (p-value 0.001), TWI in leads V1 through V2 in 5 (35.71%) (p-value 0.054) and TWI in leads V1 through V3 in 5 (35.71%) (p-value 0.013).

**DISCUSSION**

In a patient with symptoms suggestive of pulmonary embolism ECG is usually the first investigation to be carried out. Its role is primarily to exclude other conditions like acute myocardial infarction. However with certain findings it provides clue to the possibility of pulmonary embolism. Recently its role has been enhanced as a tool for detection of right heart strain. This is particularly important from the fact that echocardiography is not available in all the centers.

The right ventricular (RV) strain and severe pulmonary hypertension after PE is corroborated by certain ECG findings. Daniel et al in 2001 developed a scoring system that predicted increased pulmonary arterial pressure. It was based on scores as in parenthesis: sinus tachycardia (2); incomplete right bundle branch block (2); complete right bundle branch block (3); T-wave inversion, graded by magnitude (V1 [0 to 2], V2 [1 to 3], V3 [1 to 3], V1 through V4 all inverted 2 mm [4]); SIQ3T3 complex components (S wave in lead I [0], Q wave in lead III [1], inverted T wave in lead III [1], and the entire

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>n (%) or ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age (years)</td>
<td>50.16 ± 18.754</td>
</tr>
<tr>
<td>Male</td>
<td>51(72.9%)</td>
</tr>
</tbody>
</table>

**Table-I: Baseline characteristics of enrolled patients no (70).**

**Table-II: Provocating factors.**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>No (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provoked</td>
<td>34 (48.6%)</td>
</tr>
<tr>
<td>High altitude</td>
<td>11 (15.7%)</td>
</tr>
<tr>
<td>Fracture</td>
<td>7 (10%)</td>
</tr>
<tr>
<td>Postoperative</td>
<td>7 (10%)</td>
</tr>
<tr>
<td>Bedridden</td>
<td>5 (7.1%)</td>
</tr>
<tr>
<td>Long travel</td>
<td>1 (1.4%)</td>
</tr>
<tr>
<td>Steroid intake</td>
<td>1 (1.4%)</td>
</tr>
</tbody>
</table>

...
S1Q3T3 complex [2]). The maximum score was 21 points. At a cutoff point of \( \geq 10 \) points, it was 97.7% specific and 23.5% sensitive for the detection of PE with severe pulmonary hypertension, and 52% of patients had fatal PE\(^6\). A systematic review and meta-analysis of 3,007 patients by Shopp et al found six ECG findings (heart rate, S1Q3T3, crBBB, inverted T waves in V1–V4, ST elevation in aVR, and atrial fibrillation) which predict hemodynamic collapse

points) makes RHS unlikely, which further limits further tests\(^3\). TWI in leads V1 through V3 has the strongest association with RHS\(^2\).

In our study ECG changes with significant association with RHS included as shown in table-II; Tachycardia in 13 (34%) (\( p \)-value 0.013), S-wave in lead I in 12 (31.57%) (\( p \)-value 0.039), T wave inversion TWI in lead VI and lead V2 in 10 (26.31%) and TWI in lead VI to V3 in 8 (21.05%) (\( p \)-value 0.03). Mortality was significantly

and death within 30 days after acute PE\(^2\). In another study by Hariharan et al in 2015, 3 ECG characteristics were independently associated with RHS. This was the basis of a ten point score as in parenthesis: TWI in leads V1 through V3 (5 points), S wave in lead I (2 points), and sinus tachycardia (3 points). 85% of acute PE patients could be effectively stratified using this score. A TwiST ECG score \( \leq 2 \) points excludes RHS with 85% sensitivity, and a score of \( \geq 5 \) points has 93% specificity for RHS in acute PE. A Twist score \( \leq 2 \) associated with ECG changes that included-Tachycardia \( \geq 100 \) bpm in 7 (50%) (\( p \)-value 0.012), S1Q3T3 in 5 (35.71%) (\( p \)-value 0.022), S wave in lead I in 8 (57.14%) (\( p \)-value 0.001), TWI in leads V1 through V2 in 5 (35.71%) (\( p \)-value 0.054) and TWI in leads V1 through V3 in 5 (35.71%) (\( p \)-value 0.013) as shown in table-III. Our findings are corroborated by a systematic review and meta-analysis by Qaddoura et al, in which ECG signs that were good predictors of a negative outcome for in-hospital mortality

### Table-II: ECG changes in Pulmonary embolism with and without RHS.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>RHS present 38 (54.28%)</th>
<th>RHS absent 32 (45.72%)</th>
<th>( p )-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sinus tachycardia</td>
<td>13 (34%)</td>
<td>3 (9.3%)</td>
<td>0.013</td>
</tr>
<tr>
<td>S wave lead 1</td>
<td>12 (31.57%)</td>
<td>3 (9.3%)</td>
<td>0.039</td>
</tr>
<tr>
<td>Q wave lead III</td>
<td>7 (18.42%)</td>
<td>4 (12.5%)</td>
<td>NS</td>
</tr>
<tr>
<td>T wave lead III</td>
<td>11 (28.94%)</td>
<td>7 (21.87%)</td>
<td>NS</td>
</tr>
<tr>
<td>S1QIIIITIII pattern</td>
<td>7 (18.42%)</td>
<td>3 (9.3%)</td>
<td>NS</td>
</tr>
<tr>
<td>TWI V1-V2</td>
<td>10 (26.31%)</td>
<td>2 (6.25%)</td>
<td>0.031</td>
</tr>
<tr>
<td>TWI V1-V3</td>
<td>8 (21.05%)</td>
<td>1 (3.12%)</td>
<td>0.033</td>
</tr>
<tr>
<td>Partial RBBB</td>
<td>4 (10.52%)</td>
<td>1 (3.12%)</td>
<td>NS</td>
</tr>
<tr>
<td>Complete RBBB</td>
<td>4 (10.52%)</td>
<td>1 (3.12%)</td>
<td>NS</td>
</tr>
<tr>
<td>Non sinus rhythm</td>
<td>3 (8.5%)</td>
<td>0 (0%)</td>
<td>NS</td>
</tr>
</tbody>
</table>

ECG, Electrocardiogram; RHS, Right heart strain; TWI, T wave inversion; RBBB, Right bundle branch block.

### Table-III: ECG changes in acute PE and association with mortality.

<table>
<thead>
<tr>
<th>ECG Characteristics</th>
<th>Death14 (%)</th>
<th>Alive 56 (%)</th>
<th>( p )-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tachycardia ( \geq 100 ) bpm</td>
<td>7 (50%)</td>
<td>9 (16.07%)</td>
<td>0.012</td>
</tr>
<tr>
<td>S1Q3T3</td>
<td>5 (35.71%)</td>
<td>5 (8.92%)</td>
<td>0.022</td>
</tr>
<tr>
<td>S wave in lead I</td>
<td>8 (57.14%)</td>
<td>7 (12.5%)</td>
<td>0.001</td>
</tr>
<tr>
<td>TWI in leads V1 through V2</td>
<td>5 (35.71%)</td>
<td>7 (12.5%)</td>
<td>0.054</td>
</tr>
<tr>
<td>TWI in leads V1 through V3</td>
<td>5 (35.71%)</td>
<td>4 (7.14%)</td>
<td>0.013</td>
</tr>
<tr>
<td>Complete RBBB</td>
<td>2 (14.2%)</td>
<td>3 (5.35%)</td>
<td>0.260</td>
</tr>
<tr>
<td>Incomplete RBBB</td>
<td>2 (14.2%)</td>
<td>3 (5.35%)</td>
<td>0.260</td>
</tr>
</tbody>
</table>

ECG: Electrocardiogram, PE: Pulmonary embolism
included S1Q3T3 (OR: 3.38, 95% CI: 2.46-4.66, p<0.001), complete right bundle branch block (OR: 3.90, 95% CI: 2.46-6.20, p<0.001), T-wave inversion (OR: 1.62, 95% CI: 1.19-2.21, p=0.002), right axis deviation (OR: 3.24, 95% CI: 1.86-5.64, p<0.001), and atrial fibrillation (OR: 1.96, 95% CI: 1.45-2.67, p<0.001)\textsuperscript{18}.

Our study has provided simple ECG findings that suggest RHS and help in risk stratifying significant number of patient with pulmonary embolism who are at risk of adverse clinical event. This is important for centers without echocardiography facility.

**CONCLUSION**

ECG is a simple easily available investigation which not only rules out other conditions like acute myocardial infarction but also helps in risk stratifying patients with PE, which makes it a useful investigative tool in centers without echocardiography facility. This can help in decision making in intermediate risk patients for consideration of thrombolytic therapy as well as for decision making for home treatment.

**ACKNOWLEDGEMENT**

We thank Dr Farrah Pervaiz and her team of Research and development department at AFIC/NIHD Rawalpindi for help in Data collection and data analysis.

**CONFLICT OF INTEREST**

This study has no conflict of interest to be declare by any author. The authors certify that they have no affiliation with or involvement in any organization or entity with any financial interest in the subject matter or materials discussed in the manuscript.

**REFERENCES**

EFFECTS OF PROPOFOL INFUSION VERSUS SEVOFLURANE ON HEMODYNAMIC RESPONSE DURING CARDIOPULMONARY BYPASS IN PATIENTS UNDERGOING CORONARY ARTERY BYPASS GRAFT SURGERY

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Armed Forces Institute of Cardiology/National University of Medical Sciences (NUMS) Rawalpindi Pakistan

ABSTRACT

Objective: The aim of this study was to compare hemodynamic effects of propofol with that of sevoflurane during cardiopulmonary bypass time in patients undergoing coronary artery bypass surgery to avoid high lactate level which is an indicator of poor prognosis.

Study Design: Randomized control trial.

Place and Duration of Study: Armed Forces Institute of Cardiology/National Institute of Heart Diseases, from Jan 2017 to Aug 2017.

Material and Methods: Hemodynamic of 120 patients during CPB were studied after either propofol or Sevoflurane was applied with initiation of a Standard cardiopulmonary bypass technique, applying cross clamp, administering cardioplegia and allow time to develop stable perfusion pressure. Base line lactate level from initial arterial blood gases was recorded, total time which is an indicator of poor prognosis during cardiopulmonary bypass time in patients undergoing coronary artery bypass surgery.

Method: This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

INTRODUCTION

Propofol (2,6 Di-isopropylphenol) is one of the most widely and frequently used intravenous anesthetic1,2. It has high lipid solubility. The kinetics of Propofol allows rapid induction of anesthesia, adequate maintenance, and rapid return of consciousness2. Sevoflurane is fluorinated methyl isopropyl ether, a newer halogenated volatile anesthetic, has some chemical advantages, lower blood gas solubility resulting in a faster onset and rapid emergence, pleasant to inhale, offers good hemodynamic stability. Moreover, there appears to be an opinion among cardiac anesthesiologists that sevoflurane is superior to Isoflurane3,4. It has vasodilator effect on systemic vascular resistance during CPB5 due to its direct relaxant action on vascular smooth muscle, reduction in sympathetic output and ineffective ness of other stimuli on the vascular smooth6. There are still many controversies on the impact of sevoflurane versus propofol on cardiovascular stability. Some author have not found any differences between sevoflurane and propofol7.

It is an established fact that tissue hypoperfusion is associated with lactic acidosis secondary to anaerobic metabolism, hence measurement of blood lactate levels can be used as a marker to assess the adequacy of tissue perfusion8, which is at risk during CPB and in the immediate postoperative period. lactate level is affected by many potential factors such as pump flow rate that affect Oxygen delivery, the duration of CPB, degree of hypothermia, rewarming, the hematocrit value and intra-
operative hemodynamic effects of maintenance anesthetics might contribute to high lactate level\(^9,10\).

High lactate level after cardiac surgery is common, it is regarded as predictors of major complications, patients may require prolonged inotropic and ventilatory support\(^11,12\) and is associated with morbidity and mortality\(^13\), some studies regard CPB lactate level one of the factors that could significantly affect ICU free survival days\(^14\) but the implications of raised levels remain multifactorial and controversial. According to what previously mentioned and to Barolia et al study published in May 2017 coronary heart disease (CAD) is one of the top leading cause of death in Pakistan\(^15\) and the conventional CABG surgery with CPB is still the gold standard treatment method for treatment of CAD and CPB has been considered a useful model for studying the isolated effect of drugs on the systemic vasculature as cardiac effects are excluded during aortic cross clamp\(^18\), this study was conducted with objective to correlate hemodynamics effects of Propofol and sevoflurane that may affect perfusion pressure and hence blood lactate level and allow intervention in a suitable time to reduce patient complication.

**MATERIAL AND METHODS**

One hundred and twenty consecutive patients were included (88 male and 32 female), under-went elective CABG surgery at Armed Forces Institute of Cardiology/National Institute of Cardiology (AFIC/NIHD), from January to August 2017, after approval from ethical committee of the institute. All patients had a standard anesthesia technique as per our cardiac anesthesia unit protocol, were induced with tit rated dose of fentanyl (5-15\(\mu g/kg\)), midazolam (0.05-1 mg/kg), propofol (1-1.5mg/ kg), atracurium (0.5 mg/Kg) and maintained with inhalation of Isoflurane (1-2\%) and incremental doses of fentanyl and Atracurium till initiation of CPB. Patients selected randomly using card drawing system and divided into two groups ‘A’ and ‘B’, in group-A Propofol infusion with HUAXI medical infusion pump was applied for maintenance of anesthesia during standard CPB technique, in a dose range of 75 to 125\(\mu g/kg/min\)^17. In group-B inspired concentration of sevoflurane was kept between 1 to 2\% using Dragger vaporizer connected to CPB oxygenator gas supply system with constant gas flow of 3 liters/min.

During CPB, the following conditions were continuously monitored and maintained; a mild hypothermia of 32\(^\circ\)C using hemotherm stocker\(^\text{And}\) monitored by nasal probe, perfusion pressure of 60–70 mmHg using invasive blood pressure monitoring, through pre-determined non pulsatile flow rate according to body surface area and cardiac index at 2.4 L/min/m\(^2\) with titrating and recording Noradrenaline dose and/or increasing perfusion flow to maintain stable hemodynamics if needed. Hemoglobin was monitored by frequent arterial blood gases (ABGs) and maintained between 8 and 9 gm%, base line lactate level was recorded from initial ABG using blood gas analyzer ABL800 and after heart isolation by applying cross clamp, intermittent antegrade or retrograde cold blood cardioplegia was used, final blood lactate level was recorded from last ABG after established rewarming. Total bypass time, cross clamp time, were recorded for all patients.

**Data Analysis**

Descriptive statistics were performed for frequency and percentage. Pearson Chi Square test was applied for comparison of categorical variables and independent t-test was applied for continuous variables.

**RESULTS**

The patients in this study were in the age group of 40–65 years, 88 were males and 32 were females. There were no significant differences between groups in the mean age or weight as shown in table-I & II. The results are given as Mean ± SD. A p-value<0.05 values is significant with equal variances assumed.
DISCUSSION

Hemodynamic stability is important requirement of modern anesthesia generally and maintenance of appropriate hemodynamic goals is essential to improve outcomes after cardiac surgery and determine prognosis. As it is well-known that circulatory insufficiency due to CPB and hemodynamic in stability caused by anesthesia synergistically may lead to high lactate which is considered as a prognostic factor intraoperatively. Anesthesia is considered as one of the factors that may determine lactate level and hemodynamic stability, our study confirms the lack of significant change in mean lactate levels (p-value was 0.9) in patients whose anesthesia was maintained by Propofol, and those whose anesthesia maintained by sevoflurane during CPB period and have shown insignificant differences in parameters that may determine lactate production between the study groups; in regards of CPB duration (p-value was 0.3).

Ranucci et al and Shinde et al18,19 indicated that the relation between CPB time and spike lactate level was not linear and the cut off value for CPB time was 96 minutes. Our mean CPB time in Propofol group was 108.74 ± 4.708 minutes and 114.52 ± 4.25 minutes in sevoflurane group and both results were not confirming these studies. Temperature was maintained at moderate hypothermia (32°C) in both groups as it helps an easier management of temperature after completion of CPB20. Hemodilution and using catecholamines have a well-known effect on lactate level, in our study total Noradrenaline dose that given to maintain the MAP was insignificant between the two groups (p-value 0.3) and hemoglobin maintained between 8-9 g/dl to maintain oxygen delivery because many Previous studies has indicated that increase lactate level is considered as an indicator of inadequate perfusion and tissue oxygen delivery together with CPB effect and its related factors21-23.

Table-I: Demography of Patients of both groups.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Group-I Mean ± SD</th>
<th>Group-II Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Age (years)</td>
<td>51.90 ±10.47</td>
<td>55.31 ± 8.838</td>
</tr>
<tr>
<td>Mean Weight (kgs)</td>
<td>68.09±13.864</td>
<td>71.16 ± 16.15</td>
</tr>
<tr>
<td>No. of Male Patients</td>
<td>41</td>
<td>47</td>
</tr>
<tr>
<td>No. of Female Patients</td>
<td>19</td>
<td>13</td>
</tr>
</tbody>
</table>

Table-II: Hemodynamic parameters of both groups.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Group-I Mean ± SD</th>
<th>Group-II Mean ± SD</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-cross clamp lactate level</td>
<td>1.78 ± 127</td>
<td>1.935 ± 0.134</td>
<td>0.418</td>
</tr>
<tr>
<td>Post- rewarming lactate (mmol /L)</td>
<td>4.734 ± 2218</td>
<td>4.761 ± 0.2157</td>
<td>0.93</td>
</tr>
<tr>
<td>Total Noradrenaline dose (μg/kg)</td>
<td>0.00833</td>
<td>0.00616</td>
<td>0.31</td>
</tr>
<tr>
<td>MAP during CPB mmHg</td>
<td>63.1 ± 2.6</td>
<td>69.5 ± 5.3</td>
<td>0.04</td>
</tr>
<tr>
<td>Flow rate L/min = (CI×BSA)</td>
<td>5.089 ± 0.87</td>
<td>4.683 ± 0.066</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Cross clamp time (min)</td>
<td>108.74 ± 4.708</td>
<td>114.52 ± 4.250</td>
<td>0.36</td>
</tr>
</tbody>
</table>

was maintained by Propofol, and those whose anesthesia maintained by sevoflurane during CPB period and have shown insignificant differences in parameters that may determine lactate production between the study groups; in regards of CPB duration (p-value was 0.3). Knowing the body surface area (BSA) of the patient, the required pump flow is as follows; pump flow rate=BSA × cardiac index (CI) cardiac index of a 70 kg adult with normal metabolism at 37°C is 2.2-2.4 L/m²/min. For each 1°C decrease in temperature, the required cardiac output reduces by 7%, and the pump flow can be reduced by an equivalent factor24,25.

A main potential intervention that may alter organ perfusion and tissue oxygen delivery during CPB is manipulation of perfusion pressure and flow rates26,27. Flow rates in our
Effects of Propofol Infusion Versus Sevoflurane

study were significantly higher in propofol group, (p-value <0.001) which may off set the vasodilatory effects of Propofol and the fact that fall in systemic vascular resistance may decrease organ perfusion.

CONCLUSION
To conclude, patients who were undergoing CABG under CPB, choice of Propofol infusion or Sevoflurane has no significant effect in lactate level during CPB period but MAP decreased more in Propofol group which may influence the decision of which anesthetic to use in special cases. Large randomized trials are indicated to support this study.

CONFLICT OF INTEREST
This study has no conflict of interest to be declare by any author.

REFERENCES
A COMPARISON OF CONTRAST INDUCED NEPHROPATHY BETWEEN NORMAL AND HIGH RISK POPULATION UNDERGOING CORONARY ANGIOGRAPHY

Mir Waqas Baloch, Rehana Khadim, Samra Rehmat, Mohammad Asad, Sohail Aziz, Tahir Iqbal, Imran Fazal, Tariq Hussain Khattak, Azhar Ali Chaudary, Hasnain Iqbal

Armed Forces Institute of Cardiology/National University of Medical Sciences (NUMS) Rawalpindi Pakistan

ABSTRACT

Objective: To determine the frequency of contrast induced nephropathy in patients undergoing coronary angiography and compare frequency of contrast induced nephropathy in low and high risk patients.

Study Design: A comparative cross-sectional study.

Place and Duration of study: Cardiac cath department, Armed forces institute of cardiology and National institute of heart diseases, Rawalpindi from Jul 2017 to Dec 2017.

Material and Methods: Patients undergoing elective percutaneous coronary angiography with co-morbidities (diabetes mellitus and hypertension) were included. Diabetics who are on oral hypoglycemic agents i.e. metformin were stopped 48 hours prior to the procedure. Patients were enrolled into two groups; one with normal baseline creatinine level and the second group with abnormal baseline i.e. creatinine >1.5, diabetes and hypertension which was pre-hydrated. All patients were administered intravenous fluid (normal saline) before the procedure.

Results: Total 115 patients were included according to the inclusion criteria of the study. Mean age was 45.11 ± 7.09 years while there were 60 (52.2%) male and 55 (47.8%) female patients in the study. Frequency of contrast induced nephropathy in patients undergoing coronary angiography was 11 (9.3%), whereas frequency of contrast induced nephropathy in low and high risk patients was 8 (72.7%) and 3 (27.3%) respectively which was statistically not significant (p-value 0.980).

Conclusion: The study showed that occurrence of contrast induced nephropathy in patients undergoing coronary angiography was not statistically significant but more studies should be done in order to contribute in the existing research through validation of risk factors (predictors) for contrast induced nephropathy in diabetic and hypertensive patients.

Keywords: Contrast Induced Nephropathy, Coronary angiography, High risk patients, low risk patients.

INTRODUCTION

The use of radio contrast media has increased greatly from the past decades for diagnostic radiography and interventional procedures and it is estimated that approximately 60 million people in the world are administered radio contrast medium each year1. Contrast induced nephropathy (CIN) has gained increased attention in the clinical setting, particularly during cardiac intervention but also in many other radiological procedures in which iodinated contrast media are used2. There is at present good clinical evidence from well-controlled randomized studies that CIN is a common cause of acute renal dysfunction3. After radiographic contrast procedures 12 to 14 percent of patients suffer from acute renal insufficiency during hospitalization4. CIN is the third primary cause of hospital-acquired acute renal failure5,6.

Contrast induced nephropathy is the acute deterioration of renal function after parenteral administration of radiocontrast media in the absence of other causes. Contrast Induced Nephropathy is generally defined as an increase in serum creatinine concentration of >0.5 mg/dl or 25% above baseline within 48 hours after contrast administration5,7. Although the exact mechanisms of CIN have yet to be fully elucidated, several causes have been described. Increased adenosine, endothelia, and free radical–induced vasoconstriction and reduced...
nitric oxide and prostaglandin-induced vasodilatation have been observed\(^5\). Contrast agents also have direct toxic effect on renal tubular cells causing vacuolization and altered mitochondrial function\(^2,6\). According to minnesota registry of interventional cardiac procedures, RCIN was found in 22 percent of patients with serum creatinine >2 mg/ dl and in 30 percent of patients with serum creatinine >3 mg/ dl\(^1\). CIN in patients undergoing percutaneous coronary intervention has been reported to have 30 percent mortality rate with risk factors such as dehydration, diabetes mellitus, nephrotoxic drugs and quantity of contrast dye used\(^3\). The incidence of CIN in the general population has been calculated to be less than 3 percent\(^4\). In high-risk patients, i.e., patients with preexisting renal dysfunction, diabetes mellitus, congestive heart failure, and older age; the incidence has been calculated to vary extensively from 12 to 50 percent\(^4\). The occurrence of CIN in diabetic patients ranges from 5.2 to 35.7 percent in recent studies\(^7\). The chances of progressive deterioration can rise to 42 percent in patients with abnormal baseline renal function\(^2\). Eleven (7.10%) out of 155 patients undergoing coronary angiography experienced contrast induced nephropathy\(^7\). CIN has been associated with increased morbidity, extended length of hospital stay\(^8\) and increased costs\(^8\).

This study aims to investigate the occurrence of CIN in patients undergoing coronary angiography as there is inevitable clinical need for it. As suggested by literature CIN is more common in patients with diabetes mellitus and hypertension which is why the present study would verify the extent of CIN in diabetic and hypertensive patients undergoing coronary angiography. Moreover, there is a lack of research regarding this complication, hence local data would be available. Thus, the study would contribute in the existing research through validation of risk factors (predictors) for CIN in diabetic and hypertensive patients undergoing coronary angiography and help undertake preventive measures.

**MATERIALS AND METHOD**

Permission was sought from hospital ethical committee. A descriptive cross sectional study conducted in Armed forces institute of cardiology and National institute of heart disease, Rawalpindi with duration of study was 6 month from Jul 2017 to Dec 2017. Non probability consecutive sampling techniques was used as a sampling technique. Contrast induced nephropathy was taken as greater than 25% increase of serum creatinine or an absolute increase in serum creatinine of 0.5mg/ dl after using iodine contrast agent in 48 hours without another clear cause for kidney injury. High risk patients included any one of following parameters; diabetes mellitus documented H/o diabetes mellitus >2 years, hypertension documented H/o hypertension >2 years and baseline-creatinine level >1.5-2.0. Low risk patients included any one of the following parameters; Diabetes mellitus not documented of diabetes mellitus, hypertension not documented of hypertension and baseline-creatinine level <1.5. Patients undergoing Elective PCI, gender (both male & female) with ages between 20-80 years and Low risk and high risk patients were considered as inclusion criteria of the study whereas patients with chronic kidney disease-V, baseline creatinine >2, prior history of coronary artery by-pass graft surgery, cardiogenic shock, left ventricular ejection fraction less than 30 percent and History of exposure to contrast with in previous 6 months, were considered as exclusion criteria of the study. Particulars of all the patients who meet the inclusion and exclusion criteria was recorded in the Performa. Patients undergoing elective percutaneous coronary angiography with co-morbid (diabetes mellitus and hypertension) were included. Diabetics who are on oral hypoglycemic agents i.e. metformin was stopped 48 hours prior to the procedure. Patients were enrolled into two groups; one with normal baseline creatinine level and the other with abnormal baseline i.e. creatinine >1.5, diabetes and hypertension which was prehydrated. All patients were administered
intravenous fluid (normal saline) before the procedure. Intravenous hydration consisted of 1ml normal saline per kilogram of body weight per hour which was started 12 hours before contrast agent injection and continued for 12 hours after the injection. Renal function tests after the procedure was done. Followed by 24 hours and 48 hours interval to observe any late changes in renal functions. Both high and low risk groups were hydrated and limited amount of dye was used i.e. 40-60 cc. Statistical analysis was performed using SPSS version 23. Mean and standard deviation was calculated for quantitative variable like age. Frequency and percentage was calculated for qualitative variable which was statistically not significant (p-value 0.980), as shown in table-II.

**DISCUSSION**

Contrast-induced nephropathy (CIN), also known as contrast-induced acute kidney injury, is an iatrogenic renal injury that follows intravascular administration of radio-opaque contrast media (CM) in susceptible individuals⁹. CIN was first described during the 1950s in case reports of fatal acute renal failure that had occurred following intravenous pyelography in patients with renal disease arising from multiple myeloma. Despite technological advances, CIN remains responsible for a third of all hospital-acquired acute kidney injury (AKI) and affects between 1% and 2% of the general population and up to 50% of high-risk subgroups following coronary angiography (CA) or percutaneous coronary intervention (PCI)⁶,⁸. The serum creatinine levels begin to rise within 24-48 hours, peak at 2-3 days and return to the baseline values within 2 weeks. The most commonly used definition of CIN in the literature is either a relative increase in serum creatinine of 25% or an absolute increase of 0.5 mg/dL from a baseline value within 48 to 72 hours after contrast exposure¹⁰. The proliferation of imaging methods and interventional procedures involving administration of intravascular CM in both non-cardiac modalities (e.g. vascular CT angiography and interventional vascular angiography)¹¹ and in established (e.g. CA and PCI) and emerging

<table>
<thead>
<tr>
<th>Table-I: Descriptive statistics of Age (years) of patients.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Mean ± SD)</td>
</tr>
<tr>
<td>Gender</td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Female</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table-II: Comparison of high and low risk patients with Contrast-Induced Nephropathy.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contrast Induced Nephropathy</td>
</tr>
<tr>
<td>--------------------------------</td>
</tr>
<tr>
<td>High risk</td>
</tr>
<tr>
<td>Low risk</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

*A p-value<0.05 was taken as significance.

like gender, contrast induced nephropathy, low and high-risk patients. Low and high risk was compared for contrast induced nephropathy by applying chi-square test. A p-value <0.05 was taken as significant.

**RESULTS**

Total 115 patients were included according to the inclusion criteria of the study. Mean age of the patients was 45.11 ± 7.09 years while there were 60 (52.2%) male and 55 (47.8%) female patients as shown in table-I. Frequency of contrast induced nephropathy in patients undergoing coronary angiography was 11 (9.3%), followed by high and low risk patients in undergoing coronary angiography was 84 (73.0%) and 31 (27.0%) respectively. Frequency of contrast induced nephropathy in low and high risk patients was 8 (72.7%) and 3 (27.3%) respectively.
Contrast Induced Nephropathy in Coronary Angiography

nephropathy in diabetic and hypertensive patients undergoing coronary angiography which will help to undertake preventive measures.

CONFLICT OF INTEREST

This study has no conflict of interest to be declare by any author.

REFERENCES

PREVALENCE AND ASSOCIATED RISK FACTORS OF RENAL COMPLICATIONS IN CONGENITAL CARDIAC DISEASE PATIENTS

Hafsa Khalil, Iftikhar Ahmed, Kamal Saleem, Umair Younas, Rawail Iftikhar, Adeela Khan
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ABSTRACT

Objective: To investigate the risk factors associated with renal complications and comparison of peritoneal dialysis survival and non-survival patients after open heart surgery.

Study Design: Descriptive cross-sectional study.

Place and Duration of Study: Pediatric cardiac anesthesia Department of Armed Forced Institute of Cardiology & National Institute of Heart Diseases from Jul 2017 to Jan 2018.

Material and Methods: Retrospective data was collected from hospital based registry. Demographics, clinical characteristics, complications and outcome of patients were recorded. Data analysis of 199 patients was done on SPSS version 22.

Results: Total of 199 patients were enrolled in the study, mean age was 4.9 ± 5 years (p=0.01), 117 (59.1%) were male and 82 (40.9%) were female patients. Out of total, 24 (12%) patients had kidney disease (KD) and underwent peritoneal dialysis (PD). Sixteen children (66.7%) died after PD while 08 children (33.3%) survived after PD. 09 (37.5%) had pulmonary edema (p=0.001), 05 (20.8%) had pulmonary hypertension (p=0.005), 09 (37.5%) had high inotropic duration (p=0.004) and 13(54.2%) patients had low cardiac output (p=0.001).

Conclusion: It was concluded that patients with renal impairment who underwent peritoneal dialysis had poor outcomes as they had longer hospital stay and high mortality rate. Risk factors associated with renal complications included pulmonary edema, high inotropic support, low cardiac output and pulmonary hypertension. Longitudinal follow-up studies with robust methodology are needed to fill significant knowledge gaps. There are currently no clear guidelines for clinicians in terms of renal assessment in the long term follow up after cardiac surgery in childhood.

Keywords: Acute kidney injury, Kidney Disease, Peritoneal Dialysis.

INTRODUCTION

With advances in care, children undergoing complex cardiac repairs are surviving more frequently, resulting in a markedly increasing number of adults with congenital heart disease1,2. It is important to think about the impact that these intensive interventions have on organ systems, including the kidney. The kidney is at high risk of long-term negative impact, given the pathophysiologica changes that occur in the context of congenital heart disease, surgical intervention and cardiopulmonary bypass, post-operative critical care and recurrent exposure to potential renal insults3. Patients with congenital heart disease use substantial healthcare resources, and not just during the time of cardiac repair, but also as surviving adults with congenital heart disease4. Kidney disease (KD) also causes significant personal and economical health care burden and is associated with worse long term outcome, quality of life and well being in the general population5. Hence KD in patients with congenital heart disease has potential for synergistic negative impact. Although there are a significant gaps in the knowledge related to the renal outcomes of children with congenital heart disease and children who have had cardiac surgery, current evidence demonstrates KD as an increasingly prevalent and important problem in these patients6. RF was defined as a creatinine level of more than 1.2 mg/dL or oliguria (<0.5 mL/kg/hour) for more than 4 hours despite aggressive diuretic therapy and optimization of

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Email: hafsa.khalil100@gmail.com
the inotropic support, or a combination of both. Infants and children who undergo surgical repair of complex congenital heart diseases are more prone to develop renal dysfunction. The development of renal failure (RF) is a frequently reported complication after cardiopulmonary bypass surgery in infants and children. Studies have reported a high mortality rate ranging from 30-79%. Fluid restrictions, diuretics, and inotropic agents have been the initial therapeutic strategies for mild renal dysfunction and low cardiac output syndrome. The more severe cases require a slow and continuous removal of the fluid by hemofiltration or peritoneal dialysis (PD). Compared with hemofiltration, PD in pediatric patients is associated with advantages in the establishment of vascular access, avoidance of systemic anticoagulation, and decreased associated risks of ischemic and embolic complications. The feasibility and efficacy of PD, optimal timing of application, complications, prognosis, and predictive risk factors of the mortality in children undergoing PD after open heart surgery are currently under discussion. We reviewed our experience with PD in treating children with RF after surgical repair of congenital heart disease. The aims of this study were:

- To determine the differences in clinical and laboratory variables between survivors and non-survivors receiving PD.
- To investigate the risk factors associated with prolonged peritoneal dialysis (PD) and the mortality of pediatric patients with renal failure after open heart surgery.

Given the potential to mitigate KD development and progression in many different populations, with universally accepted interventions, clinicians, researchers, and policy makers should be interested in this problem from both an economical and patient-centered outcome point of view.

**MATERIAL AND METHODS**

This was a descriptive cross-sectional study, conducted at paed’s cardiac anaesthesia department, from the medical records of 199 children that underwent open heart surgery at Pediatric surgery and anesthesia department of Armed Forcide Institute of Cardiology & National Institute of Heart Diseases were reviewed retrospectively. Among them, 24 (12%) received PD. Study duration was from July 2017 to Jan 2018. The age, height, weight, diagnosis of the congenital heart disease, surgical procedure performed, cardiopulmonary bypass time, and aorta clamping duration were recorded. Serum sodium & potassium levels, serum creatinine levels, and daily urinary output were recorded before PD.

The indications for PD included: (1) hypervolemia with severe edema; (2) anuria or oliguria for more than 4 hours despite aggressive diuretic and inotropic support; (3) hyperkalemia (>5.5 mmol/L); (4) metabolic acidosis (serum pH <7.3, HCO3 < 18 mmol/L) persistent after failing to be corrected by at least two boluses of an intravenous sodium bicarbonate infusion and adjustment of the fluid status with an inotropic support; (5) low cardiac output with renal insufficiency. The PD catheter was connected to a closed system for peritoneal drainage. The dialysate solutions used were standard commercial preparations (DiaNel PD-2; Baxter International Inc., Deerfield, IL, USA); heparin (500 U/L of dialysate) and potassium chloride were added. The dextrose concentration varied from 1.5−4.5%, and the choice of dextrose concentration depended on the presence of serum hyperglycemia. PD was started with a dwell volume from 10 mL to 20 mL/kg with a dwell time of 1-2 hours. The recovery of the urine output was defined as a urine output >1 mL/kg/hour, and the recovery of serum creatinine was defined as a decline in serum creatinine to preoperative levels. Indications for stopping PD included a return to a sufficient urine output, maintaining a negative fluid balance, and normalization of the serum electrolytes and acid-base status. Serum creatinine at the day of surgery was extracted. For the patients who did not have laboratory
measurements on the day of surgery, measurements obtained within 3 days before procedure were taken as the baseline value. Renal function was estimated as glomerular filtration rate (GFR) by using the simplified modification of diet in renal disease equation (estimated glomerular filtration rate [eGFR] [ml/min/1.73 m^2] = 186.3 [serum creatinine] ^-1.154 [age] ^0.203 [0.742 if female])^5. Estimated GFR values _200 ml/min/1.73 m^2 were set equal to 200 ml/min/1.73 m^2, according to Coresh et al^14.

Data Analysis

Normality was assessed using the Shapiro-Wilk test. In normally distributed parameters, values are expressed as mean ± standard error and comparison between groups was performed using independent t-test. In non-normally distributed data, values are expressed as median and interquartile range and comparison of values was performed using the Mann-Whitney U test. The comparison of categorical values was assessed using the chi-squared test and for continuous variables, association was found by using independent sample t-test. The differences were evaluated using Microsoft Excel 2016 and SPSS version 22.

RESULTS

Total of 199 patients were enrolled in our study, out of which 24 (12%) patients had kidney disease (KD) and undergone peritoneal dialysis (PD). We divided the patients who underwent

<table>
<thead>
<tr>
<th>Variables</th>
<th>Patients had Peritoneal Dialysis (PD) n</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Survived</td>
<td>Non-survived</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>03</td>
<td>12</td>
</tr>
<tr>
<td>Female</td>
<td>02</td>
<td>04</td>
</tr>
<tr>
<td>Disease</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VSD (ventricular septal defect)</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>PDA (patent ductus arteriosus)</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>PS (pulmonary stenosis)</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>TGA (transposition of the great arteries)</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>TOF (tetralogy of fallot)</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>ASD (Atrial septal defect)</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>DORV (double outlet right ventricle)</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>IAA (Interrupted aortic arch)</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Tricuspid atresia</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>PAVSD Repair</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>CAVSD</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Type of surgery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open</td>
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<td>5</td>
</tr>
<tr>
<td>Close</td>
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<td>1</td>
</tr>
<tr>
<td>Inotropic support</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mild</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Moderate</td>
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<td>4</td>
</tr>
<tr>
<td>high</td>
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<tr>
<td>Inotrope duration:</td>
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<tr>
<td>&gt;72 hrs</td>
<td>1</td>
<td>7</td>
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<tr>
<td>&lt;72 hrs</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>Low cardiac output</td>
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<tr>
<td>Pulmonary hypertension</td>
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<td>4</td>
</tr>
<tr>
<td>Cardiac failure</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>Re-ventilated</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Pulmonary edema</td>
<td>1</td>
<td>8</td>
</tr>
</tbody>
</table>
PD into two groups depending on the outcome: group-I, sixteen children (66.7%) died after PD; group-II, 08 children (33.3%) survived after PD but there was not any significant difference found between the two groups except cardiac failure \((p<0.001)\) and re-ventilated \((p=0.033)\) as both groups were having the PD patients. Their outcome is mentioned in table.

In our study population mean age was \(4.9 \pm 5\) years \((p=0.01)\), 117 (59.1%) were male and 82 (40.9%) were female. When we compared the patients had renal complications 24(12%) with other 175 (88%) no renal complication group, significant difference was found as shown in figure. About 16(66.7%) patients expired \((p<0.001)\), 09 (37.5%) had pulmonary edema \((p<0.001)\), 05 (20.8%) patients had pulmonary hypertension \((p=0.005)\), 09 (37.5%) had high inotropic duration \((p=0.004)\), 13 (54.2%) patients had low cardiac output \((p=0.001)\). PD patients had longer ICU stay \((8.6 \pm 6\) days, \(p=0.007)\).

**DISCUSSION**

Pathophysiology in congenital heart disease can lead to long-term changes in kidney structure and function children with congenital heart disease have a number of risk factors for potential development of CKD later in life, including pathophysiological changes related to a structurally abnormal heart and circulation. These may include polycythemia, cyanosis and chronic hypoxia, changes in renal blood flow and intra glomerular hemodynamics, and derangements in neurohormonal activation. Several drugs used frequently in the setting of congenital heart disease have known nephrotoxicity\(^15\). In our study out of 199 patients, only 24 (12%) patients had renal dysfunction. A recent retrospective study of 206 hospitalized neonates with congenital heart disease demonstrated a significant decrease in renal function (estimated creatinine clearance) 42% of patients had AKI (with 70 % of these being classified as renal failure by modified pRIFLE criteria)\(^16\). In children, there is some retrospective data demonstrating AKI as a risk factor for CKD; Mammen et al, evaluated 126 critically ill children with AKI and demonstrated that at 1-3 years of follow-up, 10 % of children developed CKD (defined as estimated glomerular filtration rate (eGFR) <60 mL/ min/1.73 m\(^2\) or persistent albuminuria)\(^16,17\). Forty-seven percent of children with a history of AKI were considered at risk of CKD (defined as eGFR of 60-90 mL/min/1.73 m\(^2\), hyperfiltration (eGFR >150 mL/min/1.73 m\(^2\)), or hypertension)\(^17\). There are large, multicenter research studies currently underway, with primary aims of determining the risk of developing future KD. Long term follow up studies are also needed to predict the associated risk factors involved in developing kidney disease (KD) in congenital heart disease patients. A number of older, small studies have suggested

![Figure: Comparison of patients who had renal complications and who do not had.](image)
that renal dysfunction exists in adults with congenital heart disease. Apera et al. demonstrated decreased GFR (by inulin clearance) in 5 out of 10 adults with tetralogy of fallot, a mean of 20 years post ballock-taussig shunt; mean GFR in these adults was 80 mls/min/1.73m². In a renowned study, Flanagan et al. demonstrated a cohort of young adults (n=83) had proteinuria in one-third of cyanotic congenital heart disease patients. Risk of proteinuria was significantly higher than in an acyanotic control group with surgically corrected cyanotic congenital heart disease (Tetralogy of Fallot or transposition of the great vessels)²⁸,¹⁹ while in our study no significant difference was found between cyanotic and acyanotic groups. Reasons for differences between these groups were not explored in detail, particularly in relation to their early childhood course, prior surgical procedures, or concomitant medication use; however as expected, many patients with cyanotic congenital heart disease had more complex heart disease. Chronic glomerular injury as a prominent feature of cyanotic congenital heart disease has similarly been suggested by additional data demonstrating both an elevated albumin/creatinine ratio and an elevated protein/creatinine ratio in 38% (n=26) of long-standing cyanotic congenital heart disease. In a small study of 43 children with cyanotic and acyanotic congenital heart disease, Agras et al., found a significant increase in the fractional excretion of sodium and N-acetyl-B-D-glucosaminidase (used as a marker of proximal tubular damage) in children with cyanotic congenital heart disease. These markers of proximal tubular dysfunction and injury were also elevated in non-cyanotic congenital heart disease relative to controls, although to a lesser extent than in cyanotic congenital heart disease. A more recent study of 58 children with congenital heart disease (with healthy matched controls) confirmed similar findings²² of note, in both of these studies, the majority of children in this study were in lower risk congenital heart surgery classes (by Risk Adjustment for Congenital Heart Surgery-1), the duration of follow-up was not specified, and it was not clear if urine evaluations occurred before or after cardiac repair. Recent data from a large, well designed study confirms the presence of CKD in patients with congenital heart disease. When compared to the general population, the prevalence of significant renal impairment in another study was 18-fold higher in non-cyanotic and 35-fold higher in cyanotic congenital heart disease patients. A study importantly demonstrated that it is not just those patients with cyanotic congenital heart disease that are at increased risk of CKD but also non-cyanotic, and changes occur fairly early in adulthood with a mean age at assessment of 36 ± 14 years. KD contributes significantly to increase the risk of cardiovascular events and mortality in the general population which was 66.7% (p<0.001), there is not yet a clear understanding of the impact of KD in patients with congenital heart disease. A study demonstrates the young adults with congenital heart disease who have decreased GFR have lower survival than those with normal GFR. This is not simply because they have lower heart function; there is a clear additional effect of renal impairment over that of functional class and systemic ventricular function. A population-based study in congenital heart disease patients surviving to >65 years demonstrated that one of the most powerful predictors of mortality was KD; the mortality risk associated with KD was larger than that associated with cancer, heart failure, myocardial infarction, or diabetes. Children with pulmonary hypertension were at high risk of developing KD as it is demonstrated in other studies that endothelial dysfunction is present in KD, which is associated with pulmonary hypertension, left ventricle hypertrophy, and increased cardiovascular disease events such as myocardial infarction. We found it to be significant factor (p=0.005). The extent of vascular change is associated with the number of risk factors, their intensity, and exposure duration. Thus, KD associated
Renal Complications in Congenital Cardiac Disease


cardiovascular disease pathogenesis in children appears to begin early in life with exposure to the atherogenic milieu of CKD, speaking to the potential importance of early KD detection and identifying risk factors of child KD development.

Given the large negative impact of KD on health outcomes in the general population and the child’s potentially long life time to accumulate risk, KD development in children with congenital heart disease could place them at high risk for future cardiovascular disease. In addition, the presence of congenital heart disease concomitantly places patients at risk of exposure to factors that cause AKI, including cardiopulmonary bypass and nephrotoxins. The risk of KD is higher with cyanotic congenital heart disease but it is also present with non cyanotic congenital heart disease. Many questions still need to be answered, yet this population represents one in whom long-term primary and secondary prevention strategies to reduce KD occurrence and KD progression could be instituted to significantly change outcomes. There should be an opportunity to mitigate KD progression and negative renal outcomes by instituting universally accepted interventions including stringent blood pressure control and its treatment. Ongoing generation, synthesis, and translation of evidence in this area are critically important, as the population of adult survivors of congenital heart disease expands. Patients with congenital heart disease should be recognized as a population at risk of developing KD. Although limited, the current epidemiological evidence suggests that renal dysfunction occur in patients with congenital heart disease with higher frequency than the general population and are detectable early in follow-up (i.e. during childhood). Despite a relatively young age, the best evidence suggests that approximately 30 to 50% of adult patients with congenital heart disease have significantly impaired renal function.

CONCLUSION

It was concluded that patients with renal impairment who underwent peritoneal dialysis had poor outcomes as they had longer hospital stay and high mortality rate. Risk factors associated with renal complications included pulmonary edema, high inotropic support, low cardiac output and pulmonary hypertension. Long-term studies with robust methodology are needed to fill significant gaps. There are currently no clear guidelines for clinicians in terms of renal assessment in the long term follow up after cardiac surgery in childhood.

ACKNOWLEDGEMENT

We are thankful to our research team members of Paeds Cardiac Surgery / Anaesthesia department including KPO Saquib Shahzad and KPO Hussain for their cooperation in data collection and data entry to make this study feasible.

CONFLICT OF INTEREST

This study has no conflict of interest to be declare by any author.

REFERENCES

Renal Complications in Congenital Cardiac Disease


SHORT TERM OUTCOMES OF LEFT MAIN CORONARY ARTERY STENTING
Muhammad Nadir Khan, Tahira Muqaddas, Tahir Iqbal
Army Cardiac Center, Lahore Pakistan

ABSTRACT

Objective: To determine the short term outcomes of left main coronary artery stenting and whether stenting of unprotected left main coronary artery (ULMCA) stenosis in carefully selected patients with normal left ventricular (LV) systolic function is safe and thus may provide an alternative treatment to coronary artery bypass graft (CABG).

Study Design: Descriptive study.

Place and Duration of Study: Army Cardiac Center Lahore from Jan 2016 to Jun 2017.

Patients and Methods: A total of 50 patients with ULMCA stenosis who were treated with stent angioplasty by using drug eluting stents were evaluated. Patients were followed closely with monthly telephone interviews and follow-up angiography was done at 3 months. The occurrence of major in hospital complications like death, fatal and non fatal myocardial infarction (MI), acute or subacute stent thrombosis and urgent CABG in these patients were recorded. Along with this occurrence of angiographic restenosis and target vessel revascularization rates were recorded after 3 months of angiographic followup.

Results: The procedural success rate was 100%. Major events like acute or subacute stent thrombosis, death, fatal or nonfatal MI, urgent CABG didn’t occur in any patient. Three months follow-up angiography was performed in 20 of 50 patients. Other patients (without angiographic follow-up) remained asymptomatic. All of 20/50 patients had patent stents of left main coronary artery and hence target vessel revascularization rate was zero in these patients.

Conclusion: Stenting of ULMCA stenosis may be a safe and effective alternative to CABG in carefully selected patients.

Keywords: Coronary artery bypass graft, Left main coronary artery, Percutaneous coronary intervention.

INTRODUCTION

The prevalence of left main coronary artery disease in patients with coronary artery atherosclerosis varies from 5% to 7%1. Mortality of such patients with ULMCA disease at 3 years who were treated medically was 60%. Coronary artery bypass graft (CABG) remains the standard treatment of choice in patients with unprotected left main coronary artery (ULMCA) disease. However, stenting of unprotected LMCA stenosis has been attempted in selected patients with prohibitive surgical risk, usually as a result of noncardiac related comorbidities. A few cases of stenting of such unprotected LMCA stenotic lesions have also been reported in bailout situations. Initially, rates of restenosis following PCI with balloon angioplasty were 30-40% and 20-25% with bare-metal stent2. Sirolimus-Eluting Stents have demonstrated persistent neointimal hyperplasia inhibition for up to 2 years, while many other studies have shown restenosis rates to less than 10%. The advent of aggressive antiplatelets protocols and drug-eluting stents has led to renewed interest in the applicability of PCI as modality for LMCA stenosis. It has been shown in various studies that with the advent of newer drug eluting stents, better intravascular imaging modalities like intravascular ultrasound, fractional flow reserve (FFR), optical coherence tomography (OCT) and careful selection of patients, use of percutaneous coronary intervention (PCI) in this setting is increasing with results showing non inferiority of PCI as compared to CABG3. The objective of the current study was to determine short term outcomes of LMCA stenting by using drug eluting stents in
terms of major in hospital complications like death, fatal or non fatal myocardial infarction, acute or sub acute stent thrombosis, urgent CABG angiographic evidence of restosis and target vessel revascularization in carefully selected patients with normal left ventricular (LV) systolic function as an alternative treatment to CABG.

**PATIENTS AND METHODS**

A descriptive study was conducted at Army Cardiac Center Lahore from Jan 2016 to Jun 2017, 50 patients with significant unprotected LMCA stenosis who either declined CABG or were at high risk case for CABG due to non cardiac comorbidities were treated with stent implantation as shown in table. Forty six out of 50 Stent implantation was performed electively and in bailout situations in the other four patients. The inclusion criteria were 1) clinical symptoms or objective evidence of myocardial ischemia during stress test in form of ETT or pharmacological thallium scan and 2) coronary angiographic evidence of ≥50% diameter stenosis of the LMCA. The criteria for exclusion were 1) contraindication for dual antiplatelets and 2) reduced LV function (ejection fraction ≤40%).

Predilation before stent implantation was performed with conventional angioplasty balloons. The stents were then deployed by inflating the stent delivery balloon at nominal pressure. The stented segment was post dilated with high pressure balloon inflation to achieve angiographic optimization. The balloon inflation time were brief (<30 s) and multiple (≥3) to avoid prolonged ischemia and its-related complications. Angiographic success of stenting was defined as residual stenosis <30% by visual analysis in the presence of Thrombolysis in Myocardial Infarction (TIMI) 3 flow grade as shown in the Table:

<table>
<thead>
<tr>
<th>Patient, angiographic and procedural characteristics.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
</tr>
<tr>
<td>40-50</td>
</tr>
<tr>
<td>51-60</td>
</tr>
<tr>
<td>61-70</td>
</tr>
<tr>
<td>&gt;70</td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Female</td>
</tr>
<tr>
<td>Lesion confined to shaft</td>
</tr>
<tr>
<td>Lesion involving distal bifurcation</td>
</tr>
<tr>
<td>Size of stent</td>
</tr>
<tr>
<td>&lt;3.0 mm</td>
</tr>
<tr>
<td>3.0-3.5 mm</td>
</tr>
<tr>
<td>&gt;3.5-4.0 mm</td>
</tr>
<tr>
<td>&gt;4.0 mm</td>
</tr>
<tr>
<td>Type of stent</td>
</tr>
<tr>
<td>Xience xpedition</td>
</tr>
<tr>
<td>Xience v</td>
</tr>
<tr>
<td>Xlimus</td>
</tr>
<tr>
<td>Firebird</td>
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<td>Excel</td>
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<tr>
<td>Ultimaster</td>
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<tr>
<td>Biomatrix</td>
</tr>
<tr>
<td>Partner</td>
</tr>
</tbody>
</table>
The size of stent was 3.0-3.5 mm in 80% of the lesions. The lesions at the ostium or shaft without involvement of the distal bifurcation comprised 12% of the lesions as in fig-2.

During the procedure, all patients received a 10,000-U bolus of heparin with a repeat bolus of 5,000 U every 30 min to maintain an activated clotting time >250 s. Patients were preloaded with 300 mg clopidogrel and 300 mg aspirin and were advised life-long aspirin together with 75 mg clopidogrel/day for at least 3 months. Glycoprotein IIb/IIIa inhibitors was given after the operator’s discretion. All patients were kept in the coronary care unit for 24 h post stenting. Post stenting, all patients were given dual antiplatelets with the intent of keeping dual antiplatelets for 1 year and continuing aspirin for rest of the life.

Major in-hospital complications including acute or subacute stent thrombosis, fatal or non fatal myocardial infarction, emergency CABG or death didn’t occur in any patient.

Clinical follow-up was obtained by monthly telephonic interviews. All patients were requested to visit outpatient clinics at 1 and 3 months and to have followup angiograms at 3 months if symptomatic. Angiographic restenosis was defined as luminal diameter stenosis ≥30% at follow-up. Angiographic follow-up data were obtained for 20 of the 50 eligible patients who underwent LMCA stenting. Other patients who refused angiographic follow-up were asymptomatic. Follow-up angiography for the remaining patients is scheduled to be performed 3 months after the intervention. Angiographic restenosis did not occur in any of 20 patients who were angiographically followed up.

RESULTS

This study showed that LMCA stenting is safe and alternative treatment in carefully selected patients with normal left ventricular function. The procedure was successful in all patients, and there were no episodes of acute or subacute stent thrombosis. Angiographic restenosis did not occur in any of the 20 patients who were followed up angiographically and hence there was zero target vessel revascularization rates. There were no incidences of sudden death, fatal or non fatal myocardial infarction and urgent CABG during the follow-up period.

DISCUSSION

Balloon angioplasty of unprotected LMCA stenosis has been generally associated with poor long-term prognosis. Coronary artery bypass surgery is considered the gold standard treatment of unprotected left main coronary artery (ULMCA) disease. Compared with balloon angioplasty, low restenosis rates after stenting of LMCA disease may be attributed to larger post-stent arterial lumen dimensions and to the resistant effect of stent against pathologic arterial remodeling and acute recoil.
An additional benefit of PCI over CABG is seen in the duration of hospital stay. Patients undergoing PCI require a shorter hospital stay than the patients undergoing CABG, an issue of growing importance in a resourcescarce era (PCI 3.4 6 4.5 days vs. CABG 9.5 6 8.0 days)\(^4\).

The SYNTAX (synergy between percutaneous intervention with taxus and cardiac surgery) provides the largest data regarding early and late outcomes of PCI of LMS (left main stem) stenosis.

The primary end point of death, stroke, myocardial infarction and repeat revascularization favored CABG over PCI. Whereas, the secondary end point of death, stroke and MI was not different between those who undergo PCI or CABG. Primary end point favoring CABG was driven primarily by increased rate of repeat revascularization in PCI group (13.7% with CABG vs 25.9% with PCI), though the rate of stroke was also significantly lower in PCI group (3.7% with CABG vs 2.4% with PCI)\(^5\).

Calculating SYNTAX score is a class I indication for left main stem disease or multi vessel coronary artery disease as per recent AHA/ ACC PCI guidelines.

Patients with low (0-22) and intermediate syntax score (23-32) can be treated with PCI or CABG with equal results. Those with high syntax score (>32) do better with CABG.

SYNTAX score II\(^6\) (SSII) provides 4-year mortality after coronary artery bypass grafting (CABG) and percutaneous coronary intervention (PCI) in order to facilitate decision-making between these two modalities. SSII has robust prognostic accuracy, both in CABG and in PCI patient groups and was more accurate as compared to syntax score I in stratifying patients for late mortality.

The recent EXCEL trial\(^7\) (evaluation of Xience Prime or Xience V-eluting stent vs. CABG for effectiveness of LM revascularization) evaluated the safety and efficacy of PCI with Xience Prime or Xience V everolimus eluting stents (EES) vs. CABG in patients with ULMCA disease with a low or intermediate SYNTAX score (<33). This trial concluded that PCI with everolimus-eluting stents was noninferior to CABG in terms of the rate of composite end point of death, stroke, or myocardial infarction at 3 years.

Intracoronary Stenting and Angiographic Results: Drug-eluting Stents for Unprotected LM Lesions’ (ISAR-LM2)\(^8\) evaluated the efficacy and safety of everolimus EES vs zotarolimus eluting stent (ZES) and provided comparable clinical and angiographic outcomes at 1-year follow-up.

In the ERACI IV\(^9\) study, patients treated with second generation DES were compared to the first generation DES in patients with multiple vessel disease and unprotected left main stenosis. Those treated with second generation DES had lower incidence of MACCE.

Bio resorbable vascular scaffolds (BVS) in ostial left main stem lesions has the advantage of avoiding permanent metal struts protruding into the aorta\(^10\).

As per Pil et al\(^11\), the observed 3-year rates of target-vessel failure were not significantly different for the different types of second generation DES [16.7% for the CoCr-EES (cobalt-chromium everolimus-eluting stent), 13.2% for the BP-BES (biodegradable polymer-biolumin eluting stent), 18.7% for the PtCr-EES (platinum chromium everolimus-eluting stent), and 14.7% for the Re-ZES (resolute zotarolimus-eluting stent); \(p=0.15\)].

As per european society of cardiology guidelines 2014, PCI of LMS disease with low syntax score is a class Ib indication and in case of intermediate score PCI is class IIa indication.

The current study indicates that stenting of LMCA stenosis improves procedural success and clinical outcomes in part because of the low sub-acute stent thrombosis rate using optimal stent implantation techniques. Most of the procedures in this study were elective and balloon inflations were intentionally kept short. These facts may
explain the high procedural success rate in our cases. Major in-hospital complications did not occur in any of our patients. This finding suggests that antiplatelet therapy alone might be an effective post-stent antithrombotic regimen even in the LMCA stenting.

**CONCLUSION**

Stenting of unprotected LMCA stenosis may be a safe and effective alternative to CABG in carefully selected patients.

**CONFLICT OF INTEREST**

This study has no conflict of interest to be declared by any author.

**REFERENCES**

FREQUENCY OF ANGIOGRAPHICALLY SIGNIFICANT CORONARY ARTERY DISEASE IN PATIENTS UNDERGOING VALVE REPLACEMENT SURGERY WITH OR WITHOUT RISK FACTORS FOR ATHEROSCLEROSIS


Armed Forces Institute of Cardiology/National University of Medical Sciences (NUMS) Rawalpindi Pakistan

ABSTRACT

Objective: To determine the frequency of angiographically significant coronary artery disease in patients undergoing valve replacement surgery with or without risk factors for atherosclerosis. Study Design: A single center, descriptive cross-sectional study. Place and Duration of Study: Adult Cardiology department of AFIC & NIHD from 1st Jan 2017 to 30th Jun 2017. Material and Methods: All consecutive patients who underwent coronary angiography before valve replacement /repair surgery were included in the study. Excluded Patients were those who had previous valve surgery, known CAD, post CABG and Post PCI patients, associated risk factors like diabetes, hypertension, dyslipidemia, family history of coronary artery disease, smoking and BMI of the patients were recorded. All the information was entered in an annexed pro-forma. All the collected data was entered and analyzed using the SPSS-23. Results: A total of 136 patients underwent coronary angiography before valve replacement/repair surgery during study period and were recruited. Mean Age of the patients was 48.23 ± 5.2 years with minimum age 31 years and maximum 67 years. There were 80 (58.8%) male patients while 56 (41.2%) female patients. Smoking was found to be the most prevalent risk factor 98 (72.1%) followed by family history 67 (49.3%), hypertension 65 (48.0%), Obesity (BMI≥ 30) 63 (46.3%), diabetes mellitus 42 (30.9%) and dyslipidemia 35 (25.7%). Out of total patients, 63 (46.3%) patients had significant CAD. 33 (24.3%) had AVR, 89 (65.4%) patients had MVR while 14 (10.3%) patient had DVR. Conclusion: Our study shows that significant proportion of patients above 40 years of age have asymptomatic underlying CAD (46%), this frequency of angiographically significant CAD in our patient population signifies pre valve replacement screening by coronary angiogram so that coronary bypass grafting can be offered to those patients concomitantly with valve replacement. Keywords: Angiography, Atherosclerosis, Coronary artery disease.

INTRODUCTION

Coronary artery disease is the leading cause of death in Asian population 4.9%, compared to 7.0% of the total population and this prevalence is expected to increase globally1. Valvular heart disease is a growing problem particularly in developing countries like Pakistan but interestingly with a different spectrum of valvular disease than west, as we all know that most of valvular lesions are degenerative in western population while in developing countries the commonest etiology for valvular lesions is rheumatic valvular disease2. Among those patients with valvular heart disease many have concomitant coronary artery disease (CAD) as well, but considering our spectrum of valvular disease there are only limited data regarding optimal strategies for diagnosis and treatment of CAD in such patients3. The prevalence of CAD in patients undergoing valve replacement / repair is 30% in developed countries4. It is important to devise a screening strategy for coronary artery disease in patients with rheumatic valvular disease undergoing valve replacement surgery in our population subgroup considering more and more number of patients from that subgroup are presenting nowadays to tertiary care centers with CAD.
However, the data regarding that subgroup of patients with concomitant CAD is limited. Marchant et al studied 100 patients with rheumatic valvular disease undergoing valve replacements and reported the prevalence of significant coronary artery disease (>50% stenosis) 14% in that subgroup of population\(^5\), however, it is important to consider that coronary angiograms were only performed in patients with clinical evidence of ischemia (Angina, ECG changes suggestive of ischemia) or who were >50 years of age as incidence of CAD rises significantly after 50 years of age in general population studies. In another study by Bozbas et al, of 346 patients with rheumatic valvular disease who underwent surgery, 218 (63%) who were found eligible for coronary angiogram as per guidelines, 18.8% of them had significant coronary artery disease\(^6\). However, it was reported that out of them only seven patients were <50 years of age with the youngest being a 40 year old male with history of angina pectoris. They concluded that in patients less than 40 years of age if there was no history of angina or any coronary risk factors then coronary angiography can be omitted in such patients. Comparing patients with mitral stenosis CAD was found to be more common in patients with AS\(^9\). Among those patients with AS and history of angina the prevalence of coronary artery disease was reported from 40 to 80% in different studies\(^7,8\). Coronary artery disease often coexist with hemodynamically compromised aortic stenosis\(^8\).

In another study of > 40 years of age patients with rheumatic heart disease, planned for valve replacement/repair and underwent coronary angiography. 46 (12.2%) patients out of total 376 were found to have significant CAD. Among those patients 13.5% had mitral valve disease, while 15.3% patients had aortic valve disease and 9% of them had combined mitral as well aortic valve disease\(^10\). In another study, Significant CAD was found in 7% of cases, and its prevalence was 3% in mitral, 10% in aortic, and 6% in combined mitral and aortic valve disease\(^11\). Patients with CAD are older than patients without significant CAD. In addition to that risk factors like smoking, hypertension, diabetes mellitus and dyslipidemia were more prevalent among patients with significant CAD\(^12\). A significant reduction in mortality is seen in such patients with aortic stenosis who had CAD and underwent concomitant valve replacement and CABG. Therefore, it is desirable to identify CAD in patients presenting for valve surgery\(^13,14\).

American College of Cardiology (ACC)/American Heart Association (AHA) recommendations for patients with planned valve replacement surgery is to undergo coronary angiography before surgery if they have history of angina or any objective evidence of coronary ischemia, impaired LV systolic function, risk factors for coronary artery disease including men >40 years age or postmenopausal women\(^15\). The purpose of this study is to determine the frequency of significant CAD in patients undergoing valve replacement surgery in our population considering our spectrum of valvular disease is different than western population so as to determine the need for concomitant CABG surgery or not.

**MATERIAL AND METHODS**

A descriptive cross-sectional study was carried out at department of Cardiology at Armed Forces Institute of Cardiology & National Institute of Heart Disease, Rawalpindi from 1\(^{st}\) January 2017 to 30\(^{th}\) June 2017 through consecutive non probability sampling. All patients of either gender who underwent coronary angiography before valve replacement surgery were included in the study. Excluded Patients were those who had prior valve surgery, known CAD patients, post CABG patients and Post PCI patients. All patients were assessed for eligibility and enrolled in study according to inclusion criteria after informed consent. Permission from the institutional ethical review board was taken before the commencement of study. Risk factors like diabetes, hypertension, dyslipidemia, family history of coronary artery disease, smoking and BMI of the patients were
recorded. All the patients planned for Valvular heart surgery meeting the inclusion criteria underwent coronary angiography before surgery and their significant findings were noted. All the information was entered in a annexed pro-forma. All the collected data was entered and analyzed using the SPSS version 23.

**RESULTS**

Continuous variable such as age was reported as mean ± standard deviation while categorical variables such as gender, diabetes, hypertension, family history of premature coronary artery disease, obesity, dyslipidemia, smoking and type of valve surgery were reported using frequency and percentages. Frequency of angiographically significant CAD was also recorded as percentage. Confounding factors and interactions were addressed using stratified analysis for variables such as age, gender, family history of premature coronary artery disease, obesity, smoking and diabetes.

Total 136 patients were recruited in the study. Mean Age of the patients was 48.23 ± 5.2 years with minimum age 31 years and maximum 67 years. There were 80 (58.8%) male patients while 56 (41.2%) female patients. Out of total patients, 63 (46.3%) patients had significant CAD. 33 (24.3%) had AVR, 89 (65.4%) patients had MVR while 14 (10.3%) patient had DVR as shown in table-I. Smoking was found to be the most prevalent risk factor 98 (72.1%) followed by family history 67 (49.3%), hypertension 65 (48.0%), Obesity (BMI ≥ 30) 63 (46.3%), diabetes mellitus 42 (30.9%) and dyslipidemia 35 (25.7%).

Table-I: Showing baseline and risk factors profile.

<table>
<thead>
<tr>
<th>Variables</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (mean ± SD) 48.23.98 ± 5.2 years (Range) 31-67 years</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>80 (58.8%)</td>
</tr>
<tr>
<td>Female</td>
<td>56 (41.2%)</td>
</tr>
<tr>
<td>Family History of CAD</td>
<td>67 (49.3%)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>65 (48.0%)</td>
</tr>
<tr>
<td>Obesity(BMI≥30)</td>
<td>63 (46.3%)</td>
</tr>
<tr>
<td>Smoking History</td>
<td>98 (72.1%)</td>
</tr>
<tr>
<td>Diabetes Mellitus</td>
<td>42 (30.9%)</td>
</tr>
<tr>
<td>Dyslipidemia</td>
<td>35 (25.7%)</td>
</tr>
<tr>
<td>Type of Valve Surgery</td>
<td></td>
</tr>
<tr>
<td>AVR</td>
<td>33 (24.3%)</td>
</tr>
<tr>
<td>MVR</td>
<td>89 (65.4%)</td>
</tr>
<tr>
<td>DVR</td>
<td>14 (10.3%)</td>
</tr>
<tr>
<td>Significant CAD</td>
<td>63 (46.3%)</td>
</tr>
</tbody>
</table>

Table-II: Distribution of type of valve surgery with respect to age groups.

<table>
<thead>
<tr>
<th>Type of Valve Surgery</th>
<th>Age Group &lt;40 years</th>
<th>Age Group ≥ 40 years</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>AVR</td>
<td>33 (24.3%)</td>
<td>33 (24.3%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>MVR</td>
<td>52 (38.2%)</td>
<td>37 (27.2%)</td>
<td></td>
</tr>
<tr>
<td>DVR</td>
<td>14 (10.3%)</td>
<td>14 (10.3%)</td>
<td></td>
</tr>
</tbody>
</table>

Chi-square test was applied to find out the association between Type of Valve Surgery and age groups. Association was found to be statistically significant with p-value<0.001 as shown in table-II.
DISCUSSION

Assessment of significant CAD is of utmost importance in patients undergoing for valve replacement surgeries beforehand who fulfill AHA criteria for prescreening by coronary angiogram in order to know if there is any need for concomitant coronary artery bypass grafting. In our study we found that the frequency of CAD was 58.8% among study population Males were more at risk of CAD, compared to females. People with smoking history, diabetes mellitus, hypertension, Dyslipidemia and symptoms of angina also had increased risk of CAD in study population and this was similar to various studies across the globe. In Sonmez et al study, out of 760 patients (357 males, 403 females; mean age 54.4 ± 18.1 years) planned for valve replacement surgeries and underwent coronary angiography between 1995 and 2000 were enrolled retrospectively. Significant CAD was reported in 46.3% of patient, the commonest valve lesion was aortic stenosis. Among them CAD was not seen commonly in patients <40 years of age. The highest correlation found was between CAD and smoking, family history of CAD, followed by hypertension, obesity, DM and hyperlipidemia. Li et al studied consecutive 651 patients aged >40 who were scheduled for valve surgery underwent diagnostic coronary angiography. Seventy-one male patients and 17 females were detected as with CAD. The atheromatous lesion mostly involved the left descending branch (38.12%), and 38 patients (53.52%) showed lesions in 2 or more branches. The prevalence rates of diabetes mellitus and hypertension in the CAD group were 32.39% and 29.58% respectively, both significantly higher than those in the non-CAD.

In Jose et al study out of 376 patients who underwent diagnostic angiograms before valve replacement surgery the prevalence of coronary artery disease in subgroup of patients with rheumatic heart disease was reported around 12.2%. In another study by altar etal, of 1075 patients (658 females, 61.2%; mean age: 53.2 ± 9.9 years) the prevalence of CAD was found 11.1%.

Ayazetal showed in his retrospective study that, out of 144 patients, 99 (68.8%) found to have <50% coronary stenosis and remaining 45 (31.3%) had >50% stenosis. Among them 32.9% of patients were found to have significant CAD who underwent MVR, whereas 31.9% underwent AVR while 25% of patients with dual valve replacement were found to have coronary artery disease. A prospective study of 387 patients with coronary evaluation for risk factors with valvular heart disease, revealed that 36.6% of the study population had angina. Whereas, in our study only 6.5% of the subjects with CAD had reported angina in the study population.

CONCLUSION

Our study shows that significant proportion of patients above 40 years of age have asymptomatic underlying CAD (46%). This being of therapeutic as well as of prognostic importance, the frequency of angiographically significant CAD in our patient population signifies pre valve replacement screening by coronary angiogram so that coronary bypass grafting can be offered to those patients concomitantly with valve replacement.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

REFERENCES

THROMBOLYTIC THERAPY IN PROSTHETIC VALVE THROMBOSIS; EFFICACY AND OUTCOME

Tariq Hussain Khattak, Tahir Naqqash, Muhammad Azmat Khan*, Javeria Kamran, Aysha Saddiqa, Rehana Javaid, Hafsa Khalil

Armed Forces Institute of Cardiology/National University of Medical Sciences (NUMS) Rawalpindi Pakistan, *Combined Military Hospital/National University of Medical Sciences (NUMS) Rawalpindi Pakistan

ABSTRACT

Objective: To determine the efficacy of thrombolytic therapy and its complications in PVT.

Study Design: Prospective cross-sectional study.

Place and Duration of Study: Study was conducted at AFIC/NIHD Rawalpindi from first Jan 2016 to Dec 2017.

Material and Methods: A total of 51 patients admitted with Prosthetic valve thrombosis PVT were enrolled in this study, through non-consecutive sampling technique. The primary outcome was complete response to thrombolytic therapy. The secondary outcome was a composite of death, Central nervous system CNS embolism, non CNS systemic embolism or major bleeding.

Results: Mean age was 40.88 (±11.72). Twenty (43.13%) were male while 29 (56.86%) were female. Mitral PV was involved in 40 (78.4%) and aortic in 11 (21.6%). About 21 (41.2%) were in NYHA-I class and 29 (58.8%) in NYHA-III/IV class. All had bileaflet valve with involvement of one leaflet in 36 (70.6%) and both leaflet in 15 (29.4%). International normalized ratio INR was sub therapeutic in 37 (72.5%). Complete response was observed in 24 (47.05%) while secondary outcome was seen in 15 (29.41%) with death in 13 (25.49%) and CNS embolism in 2 (3.92%). There was no case of non-CNS embolism or major bleeding. Complete responses varied with the severity of patient and was 14 (66.66%) in NYHA-I/II and 10 (28.57%) in NYHA-III/IV, with p-value 0.044.

Conclusion: This study reveals the burden of prosthetic valve thrombosis in a developing country. It also reveals a high mortality and a suboptimal response to thrombolytic therapy. This study also underscores the advanced stage in which patients present.

Keywords: Fibrinolysis, Prosthesis, Thrombosis, Valves.

INTRODUCTION

Prosthetic valve PV implantation is at risk of prosthetic valve thrombosis PVT, a serious complication with a high morbidity and mortality. Its incidence varies from 0.3 to 1.3 per 100 patient years in developed countries to 6.1% in developing countries. Mechanical prosthetic heart valve MHV obstruction may be caused by thrombus formation, pannus ingrowth, or a combination of both. Urgent diagnosis, evaluation, and therapy are indicated because rapid deterioration can occur if there is thrombus causing malfunction of leaflet opening. Initial evaluation includes Transthoracic echocardiography TTE followed by Transesophageal echocardiography TEE in cases with suboptimal findings. TEE has a greater diagnostic accuracy over TTE. Fluoroscopy provides accurate assessment of opening angle and mobility of MHVs. Bioprosthetic heart valves BHVs being radiolucent are not assessed with fluoroscopy. Multidetector computed tomography is of value when TTE and TEE are inconclusive. It not only provides an accurate evaluation of the prosthetic valve structure and functional status, but is also helpful in identifying masses amenable to thrombolysis.

Current guide lines recommend fibrinolytic therapy if the thrombus is less than 14 days old, the patient has NYHA class I-II symptoms and thrombus is small I size (<0.8 cm2).
Thrombolytic Therapy in Prosthetic Valve Thrombosis

Operational Definition

Complete response was defined as complete normalization of valve function in the absence of death, major bleeding, or embolic stroke. Complete normalization of valve function was defined as normal leaflet motion on fluoroscopy and normalization of trans-valvular pressure gradients on Doppler echocardiography. Partial response was defined as >50% improvement in trans-valvular gradients from baseline but with incomplete normalization of leaflet motion on fluoroscopy. Fibrinolytic therapy failure was defined as reduction in transvalvular gradient by less than 50%, persistent leaflet motion abnormality on fluoroscopy or if death occurred. Early valve thrombosis was defined as valve thrombosis occurring within 12 months of surgery.

Statistical analysis was carried out on IBM SPSS version 23. Categorical data was presented as percentages and frequency whereas descriptive statistics were expressed as mean and standard deviation for quantitative analyses. Chi square test was applied to analyze the data. A p-value of ≤0.05 was considered statistically significant.

RESULTS

From January 2016 to December 2017, 51 patients with PVT were enrolled. All had diagnosis confirmed on fluoroscopy and underwent Echocardiography. Baseline characteristics are shown in table-I: Mean age was 40.88 (± 11.72). 22 (43.13%) were male while 29 (56.86%) were female. Mitral PV was involved in 40 (78.4%) and aortic in 11 (21.6%). 21 (41.2%) were in NYHA-I/II class and 29 (58.8%) in NYHA-III/IV class. All had bileaflet valve with involvement of one leaflet in 36 (70.6%) and both leaflet in 15 (29.4%). International normalized ratio INR was subtherapeutic in 37 (72.5%). Metallic valve was involved in 98%. Late valve thrombosis was observed in 84.3%.

Efficacy of Streptokinase

Complete response was observed in 24 (47.05%) while secondary outcome was seen in...
15 (29.41%) with death in 13 (25.49%) and CNS embolism in 2 (3.92%). There was no case of non-CNS embolism or major bleeding. Complete responses varied with the severity of patient and was seen in 14 (66.66%) of NYHA -I/II and in 10 patients with PVT over two years. The study evaluated efficacy of standard infusion of streptokinase in prosthetic valve thrombosis. Our main findings include an overall complete response in 24 (47.05%) while secondary outcome

<table>
<thead>
<tr>
<th>Table-I: Baseline Characteristics.</th>
<th>No (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age mean</td>
<td>40.88 (± 11.72)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>22 (43.13%)</td>
</tr>
<tr>
<td>Female</td>
<td>29 (56.86%)</td>
</tr>
<tr>
<td>Valve involved</td>
<td></td>
</tr>
<tr>
<td>Mitral</td>
<td>40 (78.4%)</td>
</tr>
<tr>
<td>Aortic</td>
<td>11 (21.6%)</td>
</tr>
<tr>
<td>Valve type</td>
<td></td>
</tr>
<tr>
<td>Metallic</td>
<td>50 (98%)</td>
</tr>
<tr>
<td>Bioprosthetic</td>
<td>1 (2%)</td>
</tr>
<tr>
<td>Post surgery</td>
<td></td>
</tr>
<tr>
<td>Early</td>
<td>8 (15.7%)</td>
</tr>
<tr>
<td>Late</td>
<td>43 (84.3%)</td>
</tr>
<tr>
<td>Severity</td>
<td></td>
</tr>
<tr>
<td>NYHA I/II</td>
<td>21 (41.2%)</td>
</tr>
<tr>
<td>NYHA III/IV</td>
<td>29 (58.8%)</td>
</tr>
<tr>
<td>Number of leaflet involved</td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>36 (70.6%)</td>
</tr>
<tr>
<td>Double</td>
<td>15 (29.4%)</td>
</tr>
<tr>
<td>INR</td>
<td></td>
</tr>
<tr>
<td>Therapeutic</td>
<td>14 (27.5%)</td>
</tr>
<tr>
<td>Subtherapeutic</td>
<td>37 (72.5%)</td>
</tr>
<tr>
<td>Response</td>
<td></td>
</tr>
<tr>
<td>Complete</td>
<td>24 (47.05%)</td>
</tr>
<tr>
<td>Partial</td>
<td>13 (25.49%)</td>
</tr>
<tr>
<td>Failed</td>
<td>14 (27.45%)</td>
</tr>
<tr>
<td>Secondary outcome</td>
<td></td>
</tr>
<tr>
<td>Death</td>
<td>15 (29.41%)</td>
</tr>
<tr>
<td>CNS/non-CNS embolism</td>
<td>2 (3.92%)</td>
</tr>
</tbody>
</table>

(28.57%) of NYHA-III/IV, with p-value 0.044 as shown in table-II.

**DISCUSSION**

Prosthetic valve thrombosis PVT is a serious complication of PV, and has a high mortality. Early diagnosis is paramount in guiding management. Our study represents single center study in a developing country enrolling 51
Thrombolytic Therapy in Prosthetic Valve Thrombosis


statements suggest at least 80% success rate with fibrinolytic therapy. Complete hemodynamic success was achieved in 76.3% of the 93 obstructed valves in an international multi-center registry (PRO-TEE study), in which thrombolytic agents used were streptokinase (54.7%), urokinase (17%), and t-PA (28.9%). Thrombolytic success was similar among different valves and lytic agents. Relatively low complete response observed in our study is due to a high number of cases in advanced NYHA class III/IV and in circulatory shock at presentation. In our study only streptokinase was used. Alternative streptokinase administration technique and alternative fibrinolytic agents: In a randomized controlled trial by Karthikeyan et al compared an accelerated infusion with the conventional infusion of streptokinase in 120 patients. Complete clinical response occurred in 38 (64.4%) of 59 patients with the accelerated infusion compared with 32 (53.3%) of 60 with the conventional infusion (hazard ratio 1.6, 95% confidence interval 0.9 to 2.5, p 0.055). There was no significant difference in the occurrence of the composite secondary outcome (hazard ratio 1.4, 95% confidence interval 0.5 to 3.5, p 0.50) or major bleeding (hazard ratio 2.2, 95% confidence interval 0.6 to 7.7, p 0.24) with the accelerated infusion. The success rate with fibrinolytic therapy was low overall (59%) and very low in patients in New York Heart Association functional class III/IV (24%). In another study by Özkan et al, ultrasound infusion (25 hours) of low-dose (25 mg) t-PA, was used in all patients a with PVT, with an overall success rate of 90% (95% CI 0.85-0.95) with low complications and mortality. In another study in elderly patients prolonged and low dose infusions of thrombolitics showed an initial and cumulative success rates of 40.7% and 85.2%, respectively. Wei et al studied a non-thrombolytic regimen based on clopidogrel plus warfarin with initial 5 days of LMWH resulted in recovery of normal valve function in 73% of patients with PVT and stable hemodynamics, after an average of 36.4 ± 23.1 days’ observation.
Surgery versus thrombolytic therapy: In a meta-analysis and a systematic review by Castilho et al, surgery was compared with thrombolysis. There was a highly significant difference in mortality between the two groups: surgery, 18.1% (CI, 14.6-22.1%) and thrombolysis, 6.6% (CI, 4.8-9.9%) (p<0.001). In a literature survey by Huang et al, results revealed 30-day mortality in the group treated with surgery at 15% (98 deaths in 662 patients) vs. 8% (61 deaths in 756 patients) in the thrombolysis pooled. The rates of recurrence and complications, however, were higher in patients treated with thrombolysis.

CONCLUSION

PVT is a serious complication of prosthetic heart valves with high mortality and morbidity both due to disease and treatment. It is recommended that urgent surgery be carried out once failed fibrinolytic therapy is observed after 24 hours. Management requires a well-coordinated heart team approach not only to rapidly diagnose the condition but also to define the optimal treatment for the patient.

LIMITATION OF STUDY

Our study is limited due to lesser use of TEE, which is important not only in evaluation of valve function but also in quantification of thrombus size.

ACKNOWLEDGEMENT

We thank Dr Farrah Pervaiz and her team of Research and development department at AFIC/NIHD Rawalpindi for help in Data collection and data analysis.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

REFERENCES


INCIDENCE AND RISK FACTORS OF DELERIUM AFTER CARDIAC SURGERY

Amna, Saira Mahboob, Safdar Ali Khan, Urooj Alam, Quratalain Amjad
Armed Forces Institute of Cardiology /National University of Medical Sciences (NUMS) Rawalpindi Pakistan

ABSTRACT

Objective: To determine the incidence and associated risk factors for post-operative delirium after cardiac surgery.

Study Design: Descriptive cross-sectional study.

Place and Duration of Study: Adult cardiac anesthesia department of Armed Forces Institute of Cardiology, Rawalpindi, from Mar to Apr 2015.

Material and Methods: A total of 176 patients who had undergone cardiac surgery were studied in our descriptive-cross sectional study lasting 02 months at Armed Forces Institute of Cardiology, Rawalpindi. Age more than 18 years, elective cardiac surgery, and post cardiac surgery stay in ICU more than 24 hours. Post-operative CVA or intracranial bleed, Pre-operative cognitive impairment.

Results: Out of 176 patients, 20 (11.4%) developed post-operative delirium. Mean mechanical ventilation time in patients who developed delirium was 10.8 hours ± 6.13 and was 6.47 ± 4.75 hours in patients who did not developed delirium (p= 0.000). The 14 (70%) patients who developed delirium were found to be hyperglycemic in our study versus 59 (37.8%) patients who had neither delirium nor hyperglycemia (p=0.006). ICU stay was prolonged in patients with delirium was 3.52 days ± 5.12 as compared to patients who did not developed delirium 2.45 ± 3.21 days (p=0.002).

Conclusion: Our study revealed that advanced age, prolonged mechanical ventilation and hyperglycemia are significant risk factors of delirium in post cardiac surgery patients.

Keywords: Post operative delirium, Cardiac surgery

INTRODUCTION

Delirium is defined as a disturbance of consciousness, a change in cognition or the development of a perceptual disturbance; with acute onset and fluctuating course with an evidence from the history, physical examination, or laboratory findings that the disturbance is caused by a medical condition, substance intoxication or medication side effect. Post operative delirium is one of the common problems after cardiac surgery. Post op delirium is associated with morbidity, mortality and longer hospital stay. It can be very disturbing and distressing for patients and their families and nursing staff. Patients who have undergone cardiac surgery, delirium may increase post-operative complications like respiratory insufficiency, sternum instability and need for re-opening of sternum, self extubation, exit of catheters and asynchrony between patient and ventilator. The incidence of post-operative delirium varies from (10-46%) in general surgical population and reaches (50-67%) in patients after cardiac surgery. There is wide variation because of methodology differences between studies and study population. The purpose of our study was to study the frequency and risk factors of delirium in patients undergoing cardiac surgery for earlier detection and reduction in the complications associated with this seemingly benign disorder.

MATERIAL AND METHODS

After approval by the ethical committee of our institute; 176 patients who had undergone open heart surgery were studied in our comparative cross sectional study lasting 02 months (March- April 2015). Before surgery, pre-anesthesia assessment was done by cardiac anesthetist as per institute protocol. The
assessment forms were scrutinized for the presence of risk factors for delirium as well as history of any alcohol or drug use pre-operatively. None of the patients suffered from pre-operative dementia or cognitive impairment. Preoperative evaluation, premedication, anesthesia and surgery were performed according to institutional protocols; no adjustments were made for study participants. After the surgery patients were immediately transported to the ICU. All the patients were assessed for risk stratification and diagnosis of post-operative delirium by the investigators.

Patients of age more than 18 years with planned open heart surgery, post cardiac surgery stay in ICU more than 24 hours were included in the study.

Patients with pre-operative and post-operative CVA or intracranial bleed, pre-operative cognitive impairment were excluded from study. Post-operative clinical and cognitive assessment was carried out using confusion assessment method (CAM). The patient was deemed to be in post-operative delirium if CAM score was positive. Risk factors of delirium were recorded and statistically analyzed.

**Operational Definitions**

According to the diagnostic and statistical manual of mental disorders fourth edition, the key characteristics are a change in mental status with reduced awareness of environment and a disturbance in attention; along with perceptual symptoms (hallucinations) or cognitive symptoms (including disorientation or temporary memory dysfunction). (CAM ICU) confusion assessment method was used to diagnose delirium.

**RESULTS**

The study included total 176 patients out of which 20 (12%) developed delirium. The demographic profile of our study population is tabulated as table-I. One hundred and forty one (80.1%) were male and 35 (19.9%) were female. Out of 176 patients, 20 (11.4%) developed post-operative delirium. Risk factor association was calculated by using chi-square test. The 17 out of the 20 (85%) of patients who developed delirium were aged more than 50 years, while 87 out of 156 (49.4%) non delirium patients were aged more than 50 years ($p=0.012$). Mean mechanical ventilation time in patients who developed delirium was 10.8 hours ± 6.135 and was 6.47 ± 4.75 hours in patients who did not develop delirium ($p=0.000$). The 14 (70%) patients who developed delirium were found to be hyper-glycemic in our study versus 59 (37.8%) patients who had neither delirium nor hyper-glycemia ($p=0.006$). ICU stay was prolonged in patients with delirium was 3.52 days ± 5.12 as compared to patients who do not delirium 2.45 ± 3.21 days ($p=0.022$). Mean Cardiopulmonary bypass time in

<table>
<thead>
<tr>
<th>Table-I: Demographics of study population.</th>
<th>n=176</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>141</td>
<td>80.1</td>
</tr>
<tr>
<td>Female</td>
<td>35</td>
<td>19.9</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;50 years</td>
<td>71</td>
<td>40.9</td>
</tr>
<tr>
<td>&gt;50 years</td>
<td>104</td>
<td>59.1</td>
</tr>
<tr>
<td><strong>Surgery type</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CABG surgery</td>
<td>125</td>
<td>71.0</td>
</tr>
<tr>
<td>Valvular surgery</td>
<td>50</td>
<td>28.4</td>
</tr>
<tr>
<td>Myxoma excision</td>
<td>1</td>
<td>0.5</td>
</tr>
</tbody>
</table>

(80.1%) were male and 35 (19.9%) were female. Out of 176 patients, 20 (11.4%) developed post-operative delirium. Risk factor association was calculated by using chi-square test. The 17 out of the 20 (85%) of patients who developed delirium were aged more than 50 years, while 87 out of 156 (49.4%) non delirium patients were aged more than 50 years ($p=0.012$). Mean mechanical ventilation time in patients who developed delirium was 10.8 hours ± 6.135 and was 6.47 ± 4.75 hours in patients who did not develop delirium ($p=0.000$). The 14 (70%) patients who developed delirium were found to be hyper-glycemic in our study versus 59 (37.8%) patients who had neither delirium nor hyper-glycemia ($p=0.006$). ICU stay was prolonged in patients with delirium was 3.52 days ± 5.12 as compared to patients who do not delirium 2.45 ± 3.21 days ($p=0.022$). Mean Cardiopulmonary bypass time in
patients with delirium was 125.85 min ± 47.298 and in patients who do not developed delirium was 110.93 minutes ± 103.756 (p=0.903). In our study, 15 (75%) patients who had delirium were males, whereas, in delirium free group 126 (80.7%) were males (p= 0.774). The incidence of carotid artery disease in delirium group was 15%, whereas, in non-delirium patients it was 10.6% in non-delirious patients (p=0.586). All patients in both delirium and non-delirium groups suffered from pre-operative com-morbidities including hypertension, diabetes mellitus (p=0.579). In the delirium group, 3 (15%) had peri-operative IABP insertion whereas 100 (63.3%) patients who did not develop delirium had IABP insertion, (p=0.216). The postoperative ionotropes were used in 18 (90%) of patients who developed delirium, whereas ionotropes were used in 130 (83.3%) patients in non-delirium group (p= 0.443). The results have been tabulated in table-II.

**DISCUSSION**

Delirium is defined as an acute cognitive impairment and neglect which fluctuates in level of consciousness or altered level of consciousness with unorganized thinking. The patients may express hypoactive, hyperactive or mixed psychosocial behaviors. Delirium has been hypothesized to occur as a result of the inflammatory response associated with the stress of surgery. Postoperative chemokines have been found to be more elevated in patients who became delirious than in matched controls. This difference was non-significant by forth postoperative day. The mechanism for delirium might include initial leucocytes migration into the central nervous system (CNS) and potentially a breakdown of the blood–brain barrier. There are several tests for diagnosing and grading of delirium. These include the confusion assessment method (CAM), The Delirium Rating Scale Revised-98, and the delirium symptom...
was used by us in our study for the diagnosis of delirium. In our study, the 176 patients were studies during their admission to the surgical intensive care unit postoperatively after various cardiac surgeries of these 20 patients (11.4%) developed post-operative delirium. The incidence of post-operative delirium in cardiac surgery was 23% and 31% in studies conducted by Reissmuller and Norkiene respectively\textsuperscript{16,17}. The incidence of post-operative delirium in our population was found to be higher in patients who had undergone CABG surgery as compared to valvular surgeries (12% vs 10% of cases).

In Kazmierski study of 563 patients, the incidence of post-operative delirium according to DSM-IV was 16.3%. Advanced age, pre-operative cognitive impairment, ongoing major depression, anemia, atrial fibrillation, prolonged intubation and post-operative hypoxia were independent risk factors for delirium\textsuperscript{18}. Advanced age and prolonged intubation and mechanical ventilation as risk factors are in line with our study. However, none of our patients had pre-operative cognitive impairment or major depression. Reissmuller studied 107 patients who had undergone cardiac surgeries. The incidence of post-operative delirium was 23.4%. The risk factors were age over 60 years, longer mechanical ventilation and longer cardiopulmonary bypass time\textsuperscript{16}. In our study, advanced age and prolonged mechanical ventilation were found to be significant risk factors for delirium. However, we have taken more than 50 years as advanced age, whereas Reissmuller took more than 60 years as advanced age.

Koster review of risk factors for delirium revealed 27 risk factors; 12 predisposing and 15 precipitating factors for delirium after cardiac surgery\textsuperscript{6}. The most established risk factors were: a trial fibrillation, cognitive impairment, depression, history of stroke, older age and peripheral vascular disease. Our study also established older age as significant risk factor. Whereas, history of stroke, peripheral vascular disease was not found to be associated with delirium. In our study, prolonged mechanical ventilation 10.8 ± 6.13 hours in patients with delirium and 6.47 ± 4.75 hours in non-delirium patients was found to a highly significant risk factor for delirium (p<0.001) but bias may be present in this regard due to the fact that institutional trend towards intubating and mechanically ventilating a patients who has altered sensorium with risk of respiratory compromise. In addition, delays maybe present in extubating a delirious patient. Additionally, none of our patient had pre-operative obvious cognitive impairment nor does an institutional protocol exist for detailed cognitive impairment assessment during pre-anesthesia assessment. Additionally, 176 patients were included in our study. More reliable results would be expected if the study were to be done on a larger sample size.

RECOMMENDATIONS

Pre-operative identification of patients at high risk of developing post-operative delirium can help in earlier detection of delirium. Post-operatively, daily scoring of patient with CAM-ICU by care giver, which is a simple and quick method that can be helpful in earlier diagnosis and treatment of delirium, thus preventing complication and sequelae of delirium.

CONCLUSION

Our study has revealed significant risk factors of delirium i.e. advanced age, prolonged mechanical ventilation and hyperglycemia in post cardiac surgery patients. Thus prevention, early detection and timely management of the modifiable risk factors may be helpful in reducing the length of ICU stay, morbidity and mortality.

CONFLICT OF INTEREST

This study has no conflict of interest to be declare by any author.

REFERENCES

Delerium After Cardiac Surgery


EFFICACY OF TISSUE PLASMINOGEN ACTIVATOR, HEPARIN AND STREPTOKINASE IN PATIENTS WITH SUB MASSIVE PULMONARY EMBOLISM IN A TERTIARY CARE CARDIAC HOSPITAL


Military Hospital /National University of Medical Sciences (NUMS) Rawalpindi Pakistan, *Armed Forces Institute of Cardiology/National University of Medical Sciences (NUMS) Rawalpindi Pakistan, **Ayub Teaching Hospital, Abbotabad Pakistan

ABSTRACT

Objective: To determine the clinical characteristics and outcomes of 25 cases of pulmonary embolism in relation to use of thrombolytic and anticoagulants.

Study Design: Case series study.

Place and Duration of Study: Adult cardiology department of Armed Forces Institute of Cardiology & National Institute of Heart Diseases from Oct 2017 to Jan 2018.

Material and Methods: Total 25 patients with pulmonary embolism were included in the study using consecutive sampling technique. Clinical characteristics and outcomes of the patients were noted and analyzed. SPSS-23 was used for data analysis.

Results: Twenty five cases of acute pulmonary embolism were included in our study and were admitted to the coronary care unit of hospital during the study period. Mean age of patients was 42 ± 18.32 years with minimum age 20 years and maximum age 83 years. There were 19 (76.0%) male patients while 6 (24.0%) female patients. Most common NYHA class with which patients presented was, class-II 10 (40%) followed by class-III 8 (32%). The most common CT pulmonary angiogram finding of the patients was bilateral segmental embolism 17 (68.0%). Out of 25 patients, 12 (48.0%) patients received streptokinase and four (16%) received tissue plasminogen activator. Four patients were found to have deep venous thrombosis. Mortality was 20%.

Conclusion: Acute pulmonary embolism is a relatively common medical emergency and accurate diagnosis in early period can help institute appropriate thrombolytic therapy to maximally benefit the patients.

Keywords: CT pulmonary angiogram, Deep venous thrombosis, NYHA class, Pulmonary embolism

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INTRODUCTION

Pulmonary embolism (PE) is a relatively common cardiovascular emergency occurring in 60 to 112 of every 100,000 individuals1. About 430,000 people each year in Europe are affected by pulmonary emboli. In the United States between 300,000 and 600,000 cases occur each year, which results in between 50,000 and 200,000 deaths2. Rates are similar in males and females. They become more common as people get older. It is the third most common cause of cardiovascular mortality and is responsible for 100,000 to 180,000 deaths annually1. The prevalence of pulmonary embolism among hospitalized patients in the United States, according to data collected between 1979 and 1999, was 0.4% though only 40–53 per 100 000 persons were diagnosed with pulmonary embolism per year3. By occluding the pulmonary arterial bed it may lead to acute life-threatening but potentially reversible right ventricular failure4. Pulmonary embolism is a difficult diagnosis that may be missed because of non-specific clinical presentation. However, early diagnosis is fundamental, since immediate treatment is highly effective. PE should be part of differential diagnosis in patients who present with new or worsening dyspnoea, chest pain or hypotension. Based on physician’s level of suspicion, the diagnostic workup may include a clinical decision rule, biomarkers (e.g., d-dimers) and/or imaging modalities such as computed tomographic pulmonary angiography (CTPA) or
a ventilation perfusion scan. Additional evaluations may be performed with Troponins, B-type natriuretic peptide (BNP) and/or echocardiography. PE is commonly classified as massive (high-risk), submassive (intermediate-risk) and low risk to help determine the required treatment. Massive PE is defined as suspected or confirmed PE in the presence of shock, sustained hypotension, pulselessness or persistent profound bradycardia. Sub-massive PE is defined as suspected or confirmed PE with right ventricular dysfunction in the absence of shock\textsuperscript{5}. Epidemiology, predisposing factors, natural history, and the pathophysiology of pulmonary embolism have been described more extensively worldwide\textsuperscript{4,6,8}. Depending on the clinical presentation, initial therapy is primarily aimed either at life-saving restoration of flow through occluded pulmonary arteries (PA) or at the prevention of potentially fatal early recurrences. Both initial treatment and the long-term anticoagulation that is required for secondary prevention must be justified in each patient by the results of an appropriately validated diagnostic strategy\textsuperscript{6,7,9}. Pulmonary embolism and deep venous thrombosis are two clinical presentations of venous thromboembolism (VTE) and share the same predisposing factors. In most cases pulmonary embolism is a consequence of DVT. Among patients with proximal DVT, about 50% have an associated, usually clinically asymptomatic pulmonary embolism at lung scan\textsuperscript{5,7,8}. In about 70% of patients with Pulmonary embolism, DVT can be found in the lower limbs if sensitive diagnostic methods are used\textsuperscript{10}. The risk of death related to the initial acute episode or to recurrent PE is greater in patients who present with pulmonary embolism than in those who present with DVT. According to prospective cohort studies, the acute case fatality rate for Pulmonary embolism ranges from 7 to 11\textsuperscript{11}. Although Pulmonary embolism can occur in patients without any identifiable predisposing factors, one or more of these factors are usually identified (secondary pulmonary embolism)\textsuperscript{12-14}. The proportion of patients with idiopathic or unprovoked pulmonary embolism was about 20% in the International cooperative pulmonary embolism registry (ICOPER)\textsuperscript{15}. Patient-related predisposing factors include age, history of previous VTE, active cancer, neurological disease with extremity paresis, medical disorders causing prolonged bed rest, such as heart or acute respiratory failure, and congenital or acquired thrombophilia, hormone replacement therapy and oral contraceptive therapy\textsuperscript{16-18}. An association between idiopathic pulmonary embolism and cardiovascular events, including myocardial infarction and stroke, has recently been reported\textsuperscript{12,17}. Reports of a high risk of pulmonary embolism among obese people, smokers and patients affected by systemic hypertension or metabolic syndrome have renewed interest in the link between arterial thromboembolism and VTE\textsuperscript{9,10}.

**MATERIAL AND METHODS**

A Case series study was carried out at Armed forces Institute of Cardiology (AFIC/NIHD) Rawalpindi from Oct 2017 to Jan 2017. A total of 25 patients of pulmonary embolism were included in the study, using consecutive sampling technique. Data collection tool was used to collect the different variables. Data was entered analyzed using SPSS Version 23.

**RESULTS**

Twenty five cases of acute pulmonary embolism were included in the study who were admitted in the coronary care unit (CCU) during study period. Mean age of patients was 42 ± 18.3 years with minimum age 20 years and maximum 83 years. There were 19 (76.0\%) male patients while 6 (24.0\%) female patients. Most common NYHA class with which patients presented was, class-II 10 (40\%) followed by class-III 8 (32\%). The most common CT pulmonary angiogram finding of the patients was bilateral segmental embolism in 17 (68.0\%) as shown in table-I. Out of 25 patients, 12 (48.0\%) patients received streptokinase. Four patients were found to have deep venous thrombosis. Mortality was 20.0\%
(n=5). Chi-square test was applied to find out the association between mortality and different variables. Results showed that only NYHA class findings was statistically significant (p-value<0.05) with mortality as shown in table-II.

**DISCUSSION**

Massive PE was previously defined by anatomical criteria: >50% obstruction of pulmonary vasculature or occlusion of 2 or more lobar arteries. It is now more commonly defined by hemodynamic instability, which is a function of both PE size and underlying cardiopulmonary status. Massive acute pulmonary embolism is now defined as sustained hypotension (systolic blood pressure <90 mmHg for at least 15 min or requiring inotropic support not due to a cause other than PE such as arrhythmia, hypovolemia, sepsis or LV dysfunction, pulselessness, or persistent profound bradycardia (heart rate <40 bpm with sign and symptoms of shock)\(^{10}\). Acute

| Table-I: Frequencies (%) of characteristics of patients with pulmonary embolism. |
|----------------------------------------|-----------------|
| Variables                               | Frequency (%) (n=25) |
| Age (Mean ± SD )                        | 44 (± 18.52)     |
| Outcome                                |                 |
| Dead                                   | 5 (23%)          |
| Alive                                  | 20 (76%)         |
| Gender                                 |                 |
| Male                                    | 19 (76%)         |
| Female                                  | 6 (24%)          |
| NYHA                                    |                 |
| I                                       | 2 (10%)          |
| II                                      | 10 (50%)         |
| III                                     | 4 (20%)          |
| IV                                      | 4 (20%)          |
| dDimers                                 |                 |
| <200                                    | 2 (8%)           |
| >200<400                                | 13 (52%)         |
| >400<800                                | 9 (36%)          |
| >1200                                   | 1 (4%)           |
| Treatment                               |                 |
| SK                                      | 12 (48%)         |
| Heparin                                 | 9 (36%)          |
| tPA                                     | 4 (16%)          |
| Echo                                    |                 |
| Dilated RA/RV                           | 20 (80%)         |
| Normal                                  | 5 (20%)          |
| DVT                                     |                 |
| Yes                                     | 4 (16%)          |
| No                                      | 21 (84%)         |
| CTPA                                    |                 |
| Bil segmental embolism                  | 16 (64%)         |
| Saddle Embolus                          | 1 (4%)           |
| Bil massive                             | 2 (8%)           |
| Lobar embolism                          | 6 (24%)          |
pulmonary embolism leads to an abrupt rise in pulmonary vascular resistance. Right ventricular contractile function is compromised and right ventricular failure ensues. This vicious cycle of cardiogenic shock is augmented by concomitant hypoxia, which inevitably leads to cardiovascular collapse. The interval from the onset of symptoms to death is relatively short. In patients with massive pulmonary embolism, 50% died within 30 minutes, 70% died within 1 hour, and more than 85% died within 6 hours of the onset of symptoms. Therefore, the window for obtaining a definitive diagnosis is small. In an optimal setting, the diagnosis of pulmonary embolism can be made on the basis of the history and physical examination along with selective tests, such as electrocardiography (ECG) to rule out myocardial infarction, chest radiography to rule out pneumothorax, and an arterial blood gas analysis to strengthen the diagnosis. When the diagnosis of massive pulmonary embolism is made, medical or surgical treatment must be initiated immediately. If the patient is in remote area, the decision to perform embolectomy may be made primarily on clinical impression. Thrombolysis is also an established therapy for massive pulmonary embolism. Definitions of submassive PE vary in literature and intermediate risk PE is sometimes used in preference to ‘submassive’. It is defined as acute PE without systemic hypotension (SBP >90 mmHg but with RV dysfunction or myocardial necrosis). In PEITHO trial intermediate risk PE was defined as presence of RV dysfunction or a positive Troponin. In MOPPET trial moderate PE was defined as the presence of signs and symptoms of pulmonary embolism.  

Table-II: Association between outcome and independent variables.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Outcome</th>
<th>X² Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td>p=0.811</td>
</tr>
<tr>
<td></td>
<td>Alive(n=20)(%)</td>
<td>Dead (n=5)(%)</td>
</tr>
<tr>
<td>Male</td>
<td>15 (75%)</td>
<td>4 (80%)</td>
</tr>
<tr>
<td>Femal</td>
<td>5 (25%)</td>
<td>1 (20%)</td>
</tr>
<tr>
<td>dDimer</td>
<td></td>
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</tr>
<tr>
<td>&lt;200</td>
<td>1 (5%)</td>
<td>1 (20%)</td>
</tr>
<tr>
<td>&gt;200 - &lt;400</td>
<td>10 (50%)</td>
<td>4 (80%)</td>
</tr>
<tr>
<td>&gt;400 - &lt;800</td>
<td>8 (40%)</td>
<td>0</td>
</tr>
<tr>
<td>1200</td>
<td>1 (5%)</td>
<td>0</td>
</tr>
<tr>
<td>NYHA</td>
<td></td>
<td>p=0.05</td>
</tr>
<tr>
<td>I</td>
<td>2 (10%)</td>
<td>0</td>
</tr>
<tr>
<td>II</td>
<td>10 (50%)</td>
<td>0</td>
</tr>
<tr>
<td>III</td>
<td>4 (20%)</td>
<td>4 (80%)</td>
</tr>
<tr>
<td>IV</td>
<td>4 (20%)</td>
<td>1 (20%)</td>
</tr>
<tr>
<td>DVT</td>
<td></td>
<td>p=0.57</td>
</tr>
<tr>
<td>Yes</td>
<td>4 (16%)</td>
<td>1 (20%)</td>
</tr>
<tr>
<td>No</td>
<td>16 (84%)</td>
<td>4 (80%)</td>
</tr>
<tr>
<td>Echo</td>
<td></td>
<td>p=0.75</td>
</tr>
<tr>
<td>Dilated RA/RV</td>
<td>15 (75%)</td>
<td>5 (100%)</td>
</tr>
<tr>
<td>Normal</td>
<td>5 (25%)</td>
<td>0</td>
</tr>
<tr>
<td>Treatment</td>
<td></td>
<td>p=0.162</td>
</tr>
<tr>
<td>SK</td>
<td>8 (40%)</td>
<td>4 (80%)</td>
</tr>
<tr>
<td>Heparin</td>
<td>9 (45%)</td>
<td>0</td>
</tr>
<tr>
<td>tPA</td>
<td>3 (15%)</td>
<td>1 (20%)</td>
</tr>
</tbody>
</table>
PE plus computed tomographic pulmonary angiographic involvement of >70% involvement of thrombus in >2 lobar or left or right main pulmonary arteries or by a high probability ventilation/perfusion scan showing ventilation/perfusion mismatch in >2 lobes\textsuperscript{12,18}. Sub-massive PE accounts for 20% of all PEs with in-hospital mortality of 2-5%. There is evidence from registries data that the short term mortality rate directly attributable to sub-massive PE treated with heparin anticoagulation is probably <3%. It accounts for most deaths from PE, leads to long term morbidity especially chronic pulmonary hypertension and worst functional outcome. Cho JH et al, found that haemodynamically stable patients with PE, 37% have RV dysfunction on echo and also found higher short term mortality in this group (Odds ratio 2.29; 13.7 vs 6.5 without RV dysfunction)\textsuperscript{15}. RV dysfunction and elevated troponins are also predictors of poor outcome in sub-massive PE\textsuperscript{18}. As such a smaller PE in a patient with poor cardiopulmonary reserve could produce similar outcomes to a larger PE in a patient without prior cardiopulmonary disease\textsuperscript{17}.

The use of thrombolytic agents for the treatment of sub-massive PE is somewhat debateable the limited documented benefit (e.g. improved hemodynamics, potential for less chronic pulmonary hypertension) must be weighed against the increased risk of life-threatening hemorrhage and the availability of other therapies (e.g. catheter-directed thrombolysis or clot retrieval)\textsuperscript{25}. The present study was conducted to document efficacy of thrombolytic and anticoagulant agents in sub-massive PE. We used Streptokinase and tissue plasminogen activator and heparin and studied their use in terms of efficacy, resolution of symptoms, improvement in haemodynamic profile and echocardiographic parameters. This is an ongoing study and presently data of initial twenty five patients is being analyzed and presented. Streptokinase was used in 12 patients in a dose of 250,000 initial bolus followed by 100,000 units/hour for next 24 hour. Out of these twelve patients, 8 survived and four succumbed to their illness. Tissue plasminogen activator (tPA) was used in four patients in a dose of 100 mg over 2 hours preceded by 10 mg bolus. Out of these four patients, three made an uneventful recovery and one patient died. In the remaining nine patients only heparin was use in a dose of 18 units /Kg/hour preceded by intravenous bolus of 5000 units. Tissue plasminogen activator was used preferentially in young soldiers who developed venous thromboembolism (VTE) at high altitude and later confirmed on CT pulmonary angiogram. The patient who died after tPA administration was because of massive haemoptysis which is in line with higher bleeding risk after thrombolysis\textsuperscript{1,15,27}. Patients who were given heparin only did reasonably well as no patient died in this group. This was well demonstrated in earlier studies like MAPPET-3 trial which compared heparin with alteplase in sub-massive pulmonary embolism and showed no difference for in-hospital mortality (3.4% versus 2.2%; \(p=0.71\))\textsuperscript{27}. However, in PEITHO trial which compared Heparin with Tenecteplase, substantial reduction in combined end point of early mortality or haemodynamic collapse was seen but at the cost of significant increase in major haemorrhage (including intracranial haemorrhage)\textsuperscript{17}.

**CONCLUSION**

Cardiologists may be asked to manage patients with massive and sub-massive PE because cardiovascular medical specialists are trained to treat hemodynamic derangements with a variety of interventional and pharmacological approaches. A rapid and accurate assessment of risk and a decisive treatment plan should be established. Fortunately, fibrinolysis, catheter intervention, and possible col-laboration with cardiac surgeons for desperately sick patients are tools that will assist cardiovascular specialists in maximizing the likelihood of prompt and complete recovery in these seriously ill patients.

**CONFLICT OF INTEREST**

This study has no conflict of interest to be declared by any author.
REFERENCES

IMMEDIATE THERAPEUTIC OUTCOMES OF TRANS CATHETER PULMONARY BALLOON VALVULOPLASTY FOR CRITICAL PULMONARY STENOSIS


Armed Forces Institute of Cardiology/National University of Medical Sciences (NUMS) Rawalpindi Pakistan

ABSTRACT

Objective: To share a single centre experience of percutaneous balloon valvuloplasty for critical pulmonary valve stenosis.

Study Design: A retrospective cross sectional study.

Place and Duration of study: This study was conducted at AFIC/NIHD Rawalpindi, from Aug 2010 to Dec 2015.

Materials and Methods: In this study a retrospective analysis of all consecutive infants who underwent BVP for critical PVS was carried out to assess its immediate efficacy and safety.

Results: A total of 28 infants diagnosed with critical PVS were enrolled. Male to female ratio was 1.5:1. Pulmonary valve (PV) annulus mean diameter was 12 ± 4.2. Mean age of pulmonary BVP was 6 ± 8 years and average balloon to PV annulus ratio was 1.35. Immediate success was achieved in 100% by significant reduction of trans-pulmonary valve peak pressure gradient (p<0.001). One death occurred 5 days after the procedure, 21.4% had complications and none of our patient needed re-intervention in the immediate post procedure period or before discharge.

Conclusion: Percutaneous BVP was found very effective and safe intervention for critical narrowing of pulmonary valve in order to gain time for further intervention needed in a high risk age group for surgery. Balloon pulmonary valvuloplasty is equally successful in neonates as well as in adult subjects and is the treatment of choice for relief of pulmonary valve stenosis. Surgery should be reserved for unsuccessful BVP. Life-long follow-up to identify the significance of residual pulmonary insufficiency is indicated.

Keywords: Critical pulmonary valve stenosis, Percutaneous balloon valvuloplasty, Patent ductus arteriosus

INTRODUCTION

PVS has a reported incidence of 0.6 to 0.8 per 1000 live births, and occurs in 50% of all patients with congenital heart disease in association with other CHD’s1,2. Critical pulmonary stenosis with an intact ventricular septum is relatively uncommon but demands urgent intervention because of high risk of mortality. It is defined as very severe pulmonary valve narrowing with some flow across the valve resulting in duct dependant pulmonary circulation and cyanosis or RV dysfunction with supra systemic RV pressures3-6. Cyanosis is because of right to left shunting at atrial level secondary to decrease RV compliance because of RV hypoplasia or hypertrophy. BPV is a preferred therapeutic alternative to surgical valvotomy in patients with isolated congenital pulmonary valve stenosis3-6. It results in immediate reduction of the valvular obstruction, it is safe and provides equivalent or better sustained gradient relief when compared to surgical valvotomy4,5,12. Since the first description of balloon pulmonary valvuloplasty in 1982 by Kan8, several have applied this technique with great success in all age groups9-11. Recommended use of a balloon/annulus ratio of 1.2 to 1.5, should give better results10. In neonates gradational BVP and balloon annulus ratio not greater than 1.3 can significantly reduce incidence of PR in long term12-17. Success rates of balloon pulmonary valvuloplasty in infants with critical PS have been reported to be 55% to 94%18-20. Five to ten percent might need surgery to relieve any residual valvular or sub valvular stenosis and 25-30% will need a percutaneous re-intervention in the longterm17,21,22. Previous surgery and pulmonary valve dysplasia are not contra-
indications for balloon valvuloplasty\textsuperscript{10,23}. Complication can be higher in infants and neonates but are rare in children and adults\textsuperscript{24-26} and also relatively less as compared to other treatment options like PDA stenting\textsuperscript{25-27}, surgical valvotomy and systemic to PA shunt. Neonatal mortality is approx 3\% and morbidity is on average 10\%\textsuperscript{25,26}. Venous injury, myocardial dissection and necrotising enterocolitis (NEC) are leading causes of mortality. RVOT perforation, cardiac tamponade, PV and TV regurgitation, stroke, seizures, endocarditis, septic shock and abrupt closure of ductus are some important complications during BPVP\textsuperscript{26}. The aim of this study was to assess the immediate results of percutaneous balloon valvuloplasty in all age groups diagnosed with critical pulmonary valve stenosis in a tertiary-care setting.

**MATERIAL AND METHODS**

A retrospective cross sectional analysis of all consecutive patients from neonatal to adult age group who underwent percutaneous balloon valvuloplasty for critical pulmonary valve stenosis from Aug 2010 to Dec 2015 at AFIC/NIHD was done. We identified 28 patients who fulfilled the following criteria for critical pulmonary valve stenosis: Severe narrowing of pulmonary valve with some antegrade flow across it resulting in duct dependant pulmonary circulation, cyanosis and RV dysfunction or hypoplastic RV or supra systemic RV pressures as well as those who have undergone percutaneous balloon valvuloplasty within 8 weeks of age. Patients with predominantly subvalvular, supravalvular or branch PS, pulmonary atresia, severe tricuspid annulus hypoplasia (<−4 Z score), coronary circulation dependent on the right ventricle, post surgery critical pulmonary stenosis, patients with any other CHD that needed treatment in the neonatal period and patients with large ASD or VSD (but not PFO or small VSD) were excluded from the study.

Clinical records of the selected patients were retrospectively analysed in pre-intervention, intervention, and immediate post intervention period. In the pre-intervention period age, sex, height, weight, symptoms, oxygen saturation in room air and TTE assessment by an experienced cardiologist for existence and direction of shunt across atrial septal defect/patent foramen ovale, PDA patency and dependancy, tricuspid annulus diameter, right ventricle size, morphology and contraction, pulmonary valve morphology and flow, largest pulmonary annulus diameter measured in systole, maximum peak instantaneous systolic PG across the PV quantified by the modified Bernoulli equation, presence or absence of sub valvular, supra valvular and branch PA’s stenosis or any associated cardiac lesions was done. All patients had a well developed right ventricle with a tricuspid annulus size ranging from 9-25 mm (mean ± SD, 11.6 ± 1.8). Patients with severe desaturation were maintained on oral Prostaglandin E2 1 to 2 hrly before, during, and shortly after intervention by a dose of 25 microgram/kg/dose to maintain arterial duct patency. During intervention we recorded age, pre and post percutaneous balloon valvuloplasty pulmonary variables such as trans valvular peak pulmonary gradient, right ventricle pressure, procedural details such as diameter of the largest balloon and ratio of the largest balloon/diameter of the pulmonary annulus, and complications during cardiac catheterisation. Patients were analysed 24 hr after the procedure and on discharge from hospital for oxygen dependance, maximum peak instantaneous systolic PG across the PV, degree of PR, RVF reversal of shunt across PFO and need for percutaneous or surgical intervention.

Procedures were performed under general anaesthesia according to the previously described technique\textsuperscript{4,5}. Venous and arterial accesses were placed by cannulation of the femoral vessels. After cannulation of the femoral vein, right cardiac catheterisation was performed. Pressure gradients were measured, followed by right ventricular angiography in lateral projection to measure the diameter of the pulmonary valve
annulus in systole. The valvuloplasty balloon was centred on the annulus valve and inflated until complete resolution of the waist. Finally, pressure measurements were obtained, and a final angiography was performed. Safety of the procedure was assessed by mortality and major complications; success of the procedure was determined by the reduction in pulmonary trans-valvular peak gradient after percutaneous balloon valvuloplasty for values ≤50% of pre-ballooning gradient and by the need for percutaneous re-intervention or surgical intervention before hospital discharge.

**Data Analysis**

Continuous variables were expressed as ranges and Mean ± Standard deviation. Qualitative variables were expressed as percentages. A paired Student t test was used for the comparison of different variables before versus immediately after BVP. All statistical analyses were performed using SPSS (v 20.0; IBM SPSS Software for Predictive Analytics; SPSS, Chicago, IL, United States of America). A p-value <0.05 was considered statistically significant.

**RESULTS**

Over the span of 6 years and 5 months from Aug 2010 to Dec 2015, 28pt’s underwent pulmonary BVP for critical PVS at our institute. sixteen patients (57.1%) were below 1 year of age. Age of the patients ranged from 1 day to 30 years with a mean age of 6 ± 8 years. There were 17 males (60.7%) and 11 females (39.2%). Weight of the patients ranged from 2.5 to 55 kg with a mean of 17 ± 16 kg. Height of the patients ranged from 51 to 165 cm with a mean of 93 ± 41cm. Calculated body surface area (BSA) ranged from 0.18 to 1.6. The PV annulus measured from the left lateral angiogram had a mean of 12 ± 4.2 (fig-1). The balloon sizes used had a mean of 14 ± 5.7mm with balloon/annulus ratio ranging from 1.2 to 1.5. Progressive dilatation or gradational BVP of the critical stenosed pulmonary valve was done in 5 pt’s (17.8%) of neonatal age group by using low profile coronary angioplasty balloons over coronary wires deployed across the pulmonary valve and was also done in one 30 years old by using 12 x 40 mm balloon for pre-dilatation (fig-2 & 3) to facilitate passage of catheters and guide wires for definitive BVP. The peak to peak trans valvular PG measured during the procedure dropped significantly from a mean of 98 ± 38 mm Hg before performing the BPV to a mean of 29 ± 14 mmHg after the procedure (p-value<0.001). The immediate
success rate defined as the drop in the trans valvular peak to peak PG to more than or equal to 50% of the baseline measurement was achieved in 93% of the cases. Procedural time ranged from 28-180 min with a mean of 62 ± 42 min's and mean fluoroscopy time was 20 ± 18 min's. There was a highly significant drop in trans valvular pulmonary gradient on trans thoracic echocardiogram from a mean of 116.3 ± 41mmHg to a mean of 30.6 ± 15.4 mm Hg 24 hrs after BPV (p-value<0.001), this drop in the PG was maintained at discharge.

Although incidence of PR significantly increased immediately after the BPV in some of patients (<30%), severity of PR correlated with the increase in balloon/annulus ratio. Regarding complication during BPV, one (3.5%) patient had VT responding to medical treatment, 4 (14.2%) had non fatal cardiac arrest responding to CPR and 2 patients had suboptimal results (<50% reduction in trans valvular peak PG. The intra-procedure mortality rate was zero but one patient died later due to sepsis and DIC needing mechanical ventilation.

DISCUSSION

Congenital isolated pulmonary valve stenosis is one of the first congenital cardiac defect for which balloon valvuloplasty has become the treatment of choice and preferred therapeutic alternative3-6 in all age groups regardless of valve morphology29. Since 1984 when Tynan et al29 described the results of percutaneous balloon valvuloplasty in neonates with critical pulmonary valve stenosis many have shown its efficacy and success as first-line treatment for critical PS 3,5,6,12,14-17,28. In the present study successful immediate outcome of BPV was reported in 93% of the cases. These results are in close agreement with Loureiro et al3, Alsawah7 as well as Luo and and his colleagues30 who have studied BPV in neonates with CPS with immediate success rates of 91.7%, 94.4% and 100% respectively. The significant immediate reduction of pulmonary trans valvular PG, RVSP and the PG across the RVOT in the current study was consistent with data published by Karagoz et al31, Saad et al32, zevei et al33 and Loureiro et al3. Achieving an immediate gradient reduction by using oversized balloons (20 to 40% larger than the annulus) was consistent with results achieved by Benjamin zevei et al33. Hundred percent success was achieved by gradational BVP of the critical stenosed pulmonary valve in 5 pts (17.8%) of neonatal age group in contrast to 75% reported by Janusz et al34 Pre dilatation was necessary in 29.1% cases reported by Alsawah et al7 and also described by Li and colleagues35. Contrary to other studies data published by Saad et al32 who reported immediate post procedure PR in 64% and Werynski et al36 in 39.5% of children with critical PS, in our patients significant PR (moderate to severe) was observed in less than <30% of cases in the immediate post procedure period and at discharge which is in agreement with the recent findings of Loureiro et al3 who found moderate PR in 25% and severe in 4.2% post BVP. None of our patients required any additional percutaneous or surgical intervention during or after BVP before discharge contrary to 2.7% requiring PDA stent implantation during the BVP procedure reported by Alsawah et al and also in some by Mortera and assistants37, Schneider and colleagues38.

Following successful BPV some of our patients were still oxygen or oral PGE2 dependent, to maintain adequate arterial oxygen saturation. This has been reported before by many authors6,7,39,40 and thought to be secondary to reactive infundibular stenosis as well as impaired RV compliance resulting in right to left shunt across PFO. These patients were treated with propranolol while on oxygen and oral PGE2 with gradual reduction of PGE2 or propranolol only in mild cases. Our experience in that situation was consistent with that of Alsawah et al7, Buheitel and coworkers41, Freund and colleagues42. In our study major complications were observed in 21.4% of patients and only one pt died of complications (3.5%) in the post BVP period,which are almost similar results to what has been reported by Loureiro et al (14 and 31%)
CONCLUSION

BVP for critical PS was found relatively safe and effective procedure which can be successfully used as primary procedure for critical PS at all ages and a high success rate with low mortality and morbidity can be achieved by careful and sensible attention to various procedural details. Miniaturatization of balloon/catheter systems and refinement of technique can further reduced the complication rate.

LIMITATION OF STUDY

Our study limitations are primarily related to its retrospective nature, sample size and reporting only the immediate post procedure or pre discharge results which limited evaluation of right ventricular function and dimensions after percutaneous balloon valvuloplasty over a longer period of time and also neither the consequences of pulmonary valve regurgitation on the right ventricle. In addition this is a single center data. Multi center studies with longer follow-up periods are needed to analyze the important predictors of successful BPV in patients with critical PS.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

REFERENCES


DYSPNEA IN PREGNANCY-INCIDENCE AND COMMON CAUSES

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ABSTRACT

Objective: To determine incidence of dyspnea in pregnant patients and major underlying causes in these patients and relation of grade of dyspnea and disease with mortality.

Study Design: Prospective cohort study.

Place and Duration of Study: Obstetrics and Gynaecology ward of Armed Forces Institute of Cardiology/ National Institute of Heart Disease (AFIC/NIHD) and Obstetrics and Gynaecology department of Military Hospital Rawalpindi, from Jan 2017 to Jun 2017.

Material and Methods: All patients complaining of dyspnea NYHA II-IV were enrolled from second trimester onwards (>13 weeks). Those undergoing miscarriage, termination of pregnancy and already diagnosed cardiac, pulmonary, thyroid or blood disorders were excluded. Thorough physical examination and laboratory tests to exclude common causes of dyspnea like blood Complete Picture, thyroid function tests, x-ray chest and Echocardiography were done. Patients were followed every month till delivery.

Results: Over all incidence of dyspnea was 40% amongst all obstetric patients. In 35% patients no cause was found and 5% had an underlying cause for dyspnea. Mean age 28.5 ± 5 years, Parity 2 ± 1.4, Period of gestation (POG) at diagnosis was 29.5 ± 3.3 weeks, POG at delivery was 36 weeks ± 1.5 weeks, frequency of NYHA class 2,3,4 was 68%, 28% and 4% respectively. Most common cause of dyspnea was anemia 1050 (87.5%), Cardiac disease 87 (7.2%), pulmonary disease 35 (2.9%) thyroid disease 8 (0.66%) and others 20 (1.66%). Mortality ratio was 220/100,000 live births. Out of mortalities 8% were due to cardiac disease compared to 0.3% due to anemia. All the mortalities were in patients who presented with grade 3 and 4 dyspnea.

Conclusion: Dyspnea should not be ignored as a normal symptom due to pregnancy changes. It could be the sole manifestation of underlying life threatening disease. Some diseases with a high prevalence like anemia can be identified and treated easily during antenatal period. Early recognition and evaluation can save many precious lives.

Keywords: Cardiac disease, Dyspnea, Pregnancy.

INTRODUCTION

Dyspnea during pregnancy is quite common, occurring by most estimates in approximately 60% of women with exertion and less than 20% at rest1. This symptom is so common that it usually is referred to as physiologic dyspnea. Dyspnea during pregnancy can be a result of the pregnancy itself however, other causes of dyspnea should be kept in mind including hematologic, cardiac, and pulmonary etiologies2. The exact mechanism of dyspnea during pregnancy is not yet known, however, it may be due to increased metabolic needs or mechanical causes during pregnancy. Cardiopulmonary signs and symptoms of normal pregnancy may simulate heart disease. These include easy fatigability, palpitations and dyspnea. It has been reported that 0.2-0.4% of all pregnancies are complicated by cardiovascular disease3, and although death is rare, cardiovascular disease is the biggest indirect cause of maternal death worldwide, with an attributable rate of two deaths per 100,000 in the UK and a similar rate in other countries4. Cardiac assessment of the pregnant patient can be difficult as common symptoms of pregnancy, such as breathlessness and fatigue, can mimic cardiac symptoms. Other symptoms mimicking cardiac disease are orthopnea, chest pain, tachycardia and syncope.

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Signs and symptoms which are abnormal in pregnancy include extreme breathlessness, marked edema, a fourth heart sound, diastolic murmurs, jugular venous pressure of >2 cm and a persistent tachycardia of >100 beats per minute. So any one of these should prompt further evaluation.

Possible explanations for pregnancy-associated benign dyspnea include changes in chest wall conformation, diaphragm positioning, or altered respiratory center sensitivity.

Anemia affects almost two-thirds of pregnant women in developing countries and contributes to maternal morbidity and mortality and to low birthweight babies. The prevalence of anemia among pregnant women living in urban areas is similar, ranging from 29% to 50% among pregnant women attending antenatal clinics in a large private, tertiary hospital in Karachi. Anemia has a variety of contributing factors including nutritional, genetic, frequent pregnancies, multiparity, abortions and infectious disease, however, iron deficiency is the cause in 75% of cases. The major causes of iron deficiency include insufficient intake of iron-rich foods and poor bioavailability of consumed iron in relation to the need during pregnancy. Prevalence of iron deficiency anemia among women in developing countries was calculated from 40% to 88%. The prevalence of hyperthyroidism in pregnancy is about 0.2% to 2.5%. The most common cause is Graves' disease. Production of thyroid hormones and iodine requirement both increases by approximately 50% during pregnancy as part of physiology. American Thyroid Association recommends >2.5 and >3.0 µIU/ml as cutoff range for diagnosis of hypothyroidism during the first and later part of pregnancy, respectively. Chest infections including pneumonia, tuberculosis are common amongst pregnant patients also due to high prevalence in this area. Amniotic fluid embolism is a rare (1 case per 8000-80,000 births) but potentially catastrophic complication, with a mortality rate of 10-80%. Pulmonary edema may rarely occur in association with 3% of preeclampsia cases. Asthma is one of the most common coexisting medical conditions affecting reproductive-aged woman. Pregnant patients are at risk of developing ARDS from obstetric complications and from nonobstetric conditions. Obstetric complications, such as amniotic fluid embolism, chorioamnionitis, trophoblastic embolism, and placental abruption, can produce acute lung injury. There is also anxiety related dyspnea that occurs in a background of emotionally stress which is known as psychogenic dyspnea.

This study was conducted to determine the incidence of dyspnea amongst pregnant patients which are a vulnerable group, as some signs and symptoms could be ignored considering them due to pregnancy. Life threatening underlying causes which could endanger the life of mother and fetus will remain undiagnosed if their importance in not understood.

**MATERIAL AND METHODS**

This was a prospective cohort study conducted at obstetrics and gynecology ward of Armed Forces Institute of Cardiology/National Institute of Heart Disease (AFIC-NIH) and obstetrics and gynecology department of Military Hospital Rawalpindi from Jan to Jun 2017. All the pregnant patients presenting with New York Heart Association Classification class >II dyspnea were included by consecutive non probability sampling technique after informed consent and Institutional Review Board approval, from
second trimester (13 weeks) onwards with a live fetus. Those undergoing miscarriage, termination of pregnancy and already diagnosed cardiac, pulmonary, thyroid and blood disorders or past history of cardiac surgery were excluded. Thorough history, physical examination and laboratory tests to exclude common causes of dyspnoea like blood Complete Picture, Thyroid function tests, x-ray chest, ECG and echocardiography were done. For each participant Echocardiography parameters including ejection fraction volume (EF), valvular function, pulmonary pressure and ventricular function were investigated to exclude structural cardiac disease and electrocardiogram was done to exclude rhythm disorders. Blood complete picture was done to grade Patients into severe anemia (hemoglobin concentration less than 7.0 g/dL), moderate (7.0-9.9 g/dL) and mild anemia (10.0 to 11.0 g/dL). Reference ranges for diagnosing thyroid disorders were first trimester, 0.1–2.5 mIU/Second trimester, 0.2–3.0 mIU/Land third trimester, 0.3–3.0 mIU/L. X-ray chest was done with abdominal shielding only if clinically indicated.

Data Analysis

Patients were followed every month till delivery or at development of deterioration of NYHA class or fetal or maternal complications. Demographic data including age, parity, Post-delivery data including period of gestation of diagnosis was 29.5 ± 3.3 weeks, POG at delivery was 36 weeks ± 1.5 weeks, frequency of NYHA class 2,3,4 was 68%, 28% and 4% respectively. As shown in fig-2 most common cause of dyspnea was Anemia 1050 (87.5%), Cardiac disease 87 (7.2%), Pulmonary disease 35 (2.9%) Thyroid disease 8 (0.66%) and others 20 (1.66%) as shown in fig-2. Iron deficiency anemia was the cause in 998 (95%), 32 (3%) had thalassemia, 10 (1%) megaloblastic anemia and 10 (1%) had mixed picture. The etiology of maternal cardiac lesions was 96 (57%) acquired, 40 (23%), congenital 25 (15%), arrhythmias and 9 (5%) had cardiomyopathy. Of pulmonary diseases 28 (80%) were asthmatic, 4 (11.6%) infections including

<table>
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<th>Underlying Disease</th>
<th>Anaemia</th>
<th>Cardiac Disease</th>
<th>Hyperthyroidism</th>
<th>Pulmonary Disease</th>
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<td>1050</td>
<td>87</td>
<td>8</td>
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Figure-2: Major causes of dyspnea.
tuberculosis and pneumonia, 2 (5.7%) had pulmonary edema and 1 (2.8%) developed acute lung injury secondary to obstetric complications. Less common other causes of dyspnea were sepsis 18 (90%), amniotic fluid embolism 1 (5%) and ruptured gall bladder in 1 (5%) patient.

Mode of delivery was 37% LSCS, 52% vaginal delivery, 9.6% instrumental vaginal delivery and 1.4% assisted breech delivery. Mortality ratio was 220/100,000 live births. Out of mortalities 8% were due to cardiac disease compared to 0.3% due to anemia. All the mortalities were in patients who presented with grade 3 and 4 dyspnea.

**DISCUSSION**

Dyspnea or breathing discomfort may be a benign symptom of the pregnancy and can exist in the absence of cardiac and pulmonary conditions. Although common during pregnancy dyspnea is almost always limited to the awareness of breathing, rather than the uncomfortable awareness of the necessity for breathing. As in this study 35% patients had physiological dyspnea which is similar to another study by Sahasrabudhe TR\(^2\). It is important to consider the cause of dyspnea, however, because it can herald more severe conditions such as pulmonary edema, pulmonary embolism, pneumothorax, pneumonia, or worsening asthma. The pregnant patient also can suffer cardiac disease, or may have hematologic problems which can produce significant anemia and lead to dyspnea. Ultimately, however, any organic condition which can cause dyspnea in the non-pregnant patient could affect the pregnant patient.

In the study by Ruest et al, it was shown that dyspnea is a common finding even in normal pregnancies, while many cardiac and pulmonary diseases manifest with this symptom\(^3\). Weinberger et al stated that dyspnea in a pregnant woman brings up the question whether the patient has certain degrees of an underlying cardiac or pulmonary disease or if is an isolated symptom induced by pregnancy\(^4\). In total, 60-70% of pregnant women experience dyspnea during pregnancy\(^5\), which is most common during the first and second trimesters as compared to this study in which dyspnea was in 35% patients only, as grade 1 dyspnea was excluded. In a study 85% of patients with dyspnea were due to asthma, pneumonia, cardiac ischemia, pulmonary disease, heart failure, obstructive airway disease and psychological problems\(^6\) as compared to this study where anaemia was the leading cause of dyspnea in 87.5% cases. Regarding the great importance of cardiac diseases and their related morbidity and mortality, mainly during pregnancy and due to unknown nature of many such diseases, the European Cardiac Society Guideline on cardiac disease in pregnancy recommended precise evaluation in pregnant women with dyspnea\(^7,8\).

In this study population majority were anemic and a major contributor towards symptoms of breathing difficulty in another study 90.5% patients were anemic\(^8\). In Pakistan the prevalence of anemia among pregnant women living in urban areas was reported from 29% to 50%. Some studies have shown that the frequency of Iron deficiency anemia varies in the pregnant women of Karachi (64%), Lahore (73%) and Multan (76%)\(^9,10\). Grades of anemia in these patients were 75.0% mild anemia (hemoglobin from 9.0 to 10.9 g/dL) and 14.8% moderate anemia (hemoglobin from 7.0 to 8.9 g/dL). Only 0.7% were severely anemic (hemoglobin <7.0 g/dL). Pulmonary disease was responsible for dyspnea in 2.9% of patients which is similar to other studies\(^11\). The prevalence of hyperthyroidism in pregnancy is about 0.2% to 2.5%\(^12\) as compared to this study which shows incidence of 0.66%. Other less common causes of dyspnea were responsible for 1.66% cases\(^13\). Out of mortalities 8% were due to cardiac disease compared to 0.3% due to anemia. Global Mortality ratio is 210/100,000 births. In developed world MMR is 14/100,000 and according to demographic survey of Pakistan mortality ratio is 176/100,000\(^14\). In this study Mortality ratio was 220/100,000 live births which
is high showing that dyspnea is a symptom not to be ignored. Out of mortalities 8% were due to cardiac disease compared to 0.3% due to anemia. Cardiac disease being the leading indirect cause of maternal mortality as shown by other studies.\(^{24}\)

Contribution of this study is highlighting the importance of dyspnea as an important symptom in pregnant patients which merits further investigations. Anemia is a public health problem in our country as shown by high incidence in this study but underlying cardiac disease is a major contributor towards maternal mortality and antenatal period is an excellent opportunity to identify and treat these causes for a better maternal and neonatal outcome.

Limitation was that study population was subjectively graded and investigated for limited causes.

**CONCLUSION**

Dyspnea should not be ignored as a normal symptom due to pregnancy changes. It could be the sole manifestation of underlying life threatening disease. Some diseases with a high prevalence like anemia can be identified and treated easily during antenatal period. Early recognition and evaluation can save many precious lives.

**CONFLICT OF INTEREST**

This study has no conflict of interest to declare by any author.

**REFERENCES**

MEDIASTINAL BLEEDING AND BLOOD TRANSFUSIONS IN PATIENTS UNDERGOING CORONARY ARTERY BYPASS SURGERY PERFORMED WITH OR WITHOUT CRDIOPULMONARY BYPASS

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ABSTRACT

**Objective:** To determine the rate of postoperative bleeding and blood transfusions in patient undergoing coronary artery bypass surgery for coronary artery disease during OPCAB or conventional CABG.

**Study Design:** Comparative cross-sectional study.

**Place and Duration of Study:** Adult Cardiac Surgery Departments of Armed Forces Institute of Cardiology & National Institute of Heart Disease (AFIC/NIHD) Rawalpindi, Pakistan from 1 July 2017 to 31 Dec 2017.

**Material and Methods:** Two hundred patients undergoing coronary artery bypass surgeries performed with (Conventional CABG) or without cardiopulmonary bypass.

(Off pump CABG /OPCAB) were enrolled in the study and were divided into two equal groups. All procedures were elective. Careful monitoring was carried out on hourly basis. The rate of postoperative chest drainage and number of blood transfusions received were measured in both groups.

**Results:** As compared to the OPCAB group, the patients in CPB group required ionotropic support for a longer duration (29.6 ± 6.51 vs 60.9 ± 71.2, p-value <0.02). Similarly, the rate of chest drainage was significantly higher in conventional CABG Vs OPCAB (45% vs 30% p<0.026). Requirement of blood transfusion (RCC) was significantly higher in conventional CPB vs OPCAB group (1.6 ± 1.6 vs 1.0 ± 1.2, p-value 0.04). Mechanical ventilation time was almost same in both groups with a median value of 6 hours.

**Conclusions:** Our study concluded that the main advantages of OPCAB technique are that there is less amount of postoperative chest drainage and it makes it possible to decrease the number of blood transfusions after surgery.

**Keywords:** Blood transfusion, Coronary artery bypass grafting, Cardiopulmonary bypass, Off-pump coronary artery bypass, On-pump coronary artery grafting, Red cell concentrate.

INTRODUCTION

Ischemic heart disease is one of the leading causes of death in the world. Coronary artery bypass grafting (CABG) remains the standard treatment option in patients with extensive coronary artery disease. The majority of cardiac procedures are carried out using the cardiopulmonary bypass (CPB), but those performed without, in the recent years, have relatively less rate of complications, as these avoid systemic inflammatory response syndrome (SIRS) produced by the use of extracorporeal circuit. This systemic inflammation can involve many organs and is usually self-limiting.

There is an ongoing debate regarding the clinical outcomes after on-pump versus off-pump coronary artery bypass (ONCAB versus OPCAB) surgery and postoperative bleeding remains a major concern.

The aim of this retrospective study is to compare the effect of CPB, either used or not, on the rates of postoperative bleeding and packed red cell transfusions after coronary surgery, as these are closely related with increased hospital mortality and morbidity, patients survival, blood transfusion reactions, wound infections and sepsis.
MATERIAL AND METHODS

Patients

All patients below the age of 70 years who underwent elective isolated CABG surgery using a median sternotomy approach at a tertiary care cardiac facility, between July 2017 and December 2017 were acquired from the adult cardiac surgery database. The decision to perform the operation, either on-pump or off pump was made by the operating surgeon. Patients with age of more than 70 years, redo surgeries, cases who were intended to be operated off-pump but were later converted to on-pump after initiation of coronary grafting, those having difficult coronary anatomy ending up in endarterectomy or venous patch plasty and patients with lateral thoracotomy incisional approaches were excluded. The study was approved by the hospital’s institutional ethical review board.

This study included 200 patients, 100 patients underwent coronary surgery with CPB (group-1) and 100 cases were subjected to OPCAB grafting (group-2). All patients included in the study were subjected to full history, local and general physical examination, routine laboratory investigations, imaging studies before surgery that included Chest x-rays, 2D-Echoes, Carotid Doppler.

The primary endpoints of interest were packed red blood cell transfusions, re-operation rate for bleeding or cardiac tamponade, and 12 h and total postoperative chest tube drainage. Pre-operative parameters which were analyzed included age, gender, Body Mass Index (BMI) and co-morbid conditions, whereas operative characteristics included cardiopulmonary bypass time and cross clamp time.

Pre-operative Considerations

In both groups, patients were using dual antiplatelet therapy in the form of Aspirin and Clopidogrel pre-operatively, which was stopped 3 days and 5 days before operation respectively. No patient received oral or parenteral anticoagulants before surgery.

Anesthesia and Anticoagulation Management

Patients in both groups, undergoing OPCAB or conventional CPB surgery, received the same anaesthetic regimen. In CABG group, before initiation of CPB, a bolus dose of 300-400 IU/kg of heparin was given to achieve a kaolin activated clotting time (ACT) of at least 480 seconds. Additional heparin was infused on CPB if required. After termination of CPB, 3-4 mg/kg protamine was given to fully reverse the anticoagulant effect of heparin. In the OPCAB group, 150 IU/kg of heparin was administered before division of the internal mammary artery to maintain an ACT of 250-350 seconds. On completion of anastomoses in patients undergoing OPCAB, 0.75 mg/kg protamine was given to partially reverse the heparin. Anti-fibrinolytics in the form of alpha aminocaproic acid were injected at the surgeon’s discretion.

Operative and Perfusion Procedure

OPCAB surgery was performed through a median sternotomy approach. Stabilization of the target coronary artery was achieved by using either a compression device or suction apparatus. Operative blood was aspirated into a blood salvaging system to be concentrated, washed, and transfused if enough was collected. A perfusionist remained on standby for emergency institution of CPB if required. While, surgery in CPB group was performed through a full sternotomy incision using a membrane oxygenator and a roller pump. The circuit was primed with 2200 mL of Hartman solution or 1700 mL Hartman and 500 mL 4% albumin solution with 10,000 units of heparin. An addition of 10 g of mannitol was made while priming the circuit of CPB in patients who had a preoperative creatinine of >0.15 mmol/L. Institution of CPB was achieved by cannulating the ascending aorta and right atrium. After cross-clamping, antegrade or retrograde blood cardioplegia was infused for myocardial protection of the arrested heart. Minimum systemic temperatures ranged from 28°C to 34°C. Perfusionist preference determined whether all or part of the cardiotomy blood was
returned to the CPB circuit or collected in a cell-saving device for subsequent processing. After weaning from CPB, the residual blood in the extracorporeal circuit was salvaged and processed either through a cell-saving device or simply bagged before patient reinfusion. At least two chest drains were inserted in the pericardium and pleura if internal mammary arteries were harvested. These drains were connected to a low suction system (-20 cm H2O) after closure of the chest. Total chest drainage was recorded as the volume of blood in the collection receptacle from closure of the chest until removal of the chest drains.

**Postoperative Care**

Treatment of patients undergoing on-pump or off-pump coronary surgeries followed a standardized care from operation to discharge irrespective of the type of procedure performed.

**Transfusion Protocol**

For patients in both groups, the decision to transfuse homologous packed RBCs was based on the patient’s clinical assessment like pulse, blood pressure, urine output and/or a haematocrit (Hct) level (<20%). Postoperatively, blood transfusions were given when hemoglobin level fell to <10 g/dL.

**Table-I: Clinical characteristics and demographics (CPB vs OPCAB).**

<table>
<thead>
<tr>
<th>Variables</th>
<th>CPB n=100</th>
<th>OPCAB n=100</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGE (Mean ± SD)</td>
<td>57.5 ± 8.9</td>
<td>59.1 ± 7.2</td>
</tr>
<tr>
<td>Gender n(%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>85 (84.2%)</td>
<td>76 (76%)</td>
</tr>
<tr>
<td>Female</td>
<td>16 (15.8%)</td>
<td>24 (24%)</td>
</tr>
<tr>
<td>BMI (Mean ± SD)</td>
<td>27.0 ± 4.1</td>
<td>29.2 ± 5.4</td>
</tr>
<tr>
<td>NYHA Class</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>28 (28 %)</td>
<td>23 (23%)</td>
</tr>
<tr>
<td>II</td>
<td>29 (29%)</td>
<td>34 (34%)</td>
</tr>
<tr>
<td>III</td>
<td>43 (43 %)</td>
<td>43 (43%)</td>
</tr>
<tr>
<td>IV</td>
<td>NIL</td>
<td>NIL</td>
</tr>
<tr>
<td>Hypertension</td>
<td>54 (54 %)</td>
<td>52 (52%)</td>
</tr>
<tr>
<td>Diabetics</td>
<td>46 (46 %)</td>
<td>44 (44%)</td>
</tr>
<tr>
<td>Smoking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ex-Smokers</td>
<td>21 (21 %)</td>
<td>25 (25%)</td>
</tr>
<tr>
<td>Current Smokers</td>
<td>11 (11%)</td>
<td>7 (7%)</td>
</tr>
</tbody>
</table>

**Table-II: Angiographic data (CPB vs OPCAB).**

<table>
<thead>
<tr>
<th>Variable</th>
<th>CPB n=100</th>
<th>OPCAB n=100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extent of Coronary artery disease</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single vessel</td>
<td>2 (2%)</td>
<td>5 (5%)</td>
</tr>
<tr>
<td>Double vessel</td>
<td>14 (14%)</td>
<td>20 (20%)</td>
</tr>
<tr>
<td>Triple vessel</td>
<td>84 (84%)</td>
<td>75 (75%)</td>
</tr>
<tr>
<td>Left Main stem disease &gt;70%</td>
<td>17 (17%)</td>
<td>15 (15%)</td>
</tr>
</tbody>
</table>

**Reoperation Protocol**

Re-exploration was performed if bleeding exceeded 400 mL/0.5 h, >300 mL/h, or >200 mL/h for 2 hours despite correction of any coagulopathies. Re-operations were also indicated if there were clinical signs of cardiac tamponade such as tachycardia, increasing central venous pressures, or decreasing urine output, usually associated with a sudden reduction in chest tube drainage.
Data Collection and Statistical Analysis

Statistical analyses were performed using SPSS version 23 with two tailed tests performed and a p-value<0.05 was considered significant. Data are summarized as the mean ± SD for continuous variables and as frequency and percentages for categorical variables. The two groups (CPB or CABG vs OPCAB) were compared using the Chi-square or Fisher exact test for categorical data and unpaired t tests.

Table-III: Intra operative data (CPB vs OPCAB).

<table>
<thead>
<tr>
<th>Variable</th>
<th>CPB n=100</th>
<th>OPCAB n=100</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ionotropic support (in Hrs)</td>
<td>60.9 ± 71.2</td>
<td>29.6 ± 65.1</td>
<td>0.02</td>
</tr>
<tr>
<td>Chest Drain N (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 800 ml</td>
<td>51 (51%)</td>
<td>70 (70%)</td>
<td>0.02</td>
</tr>
<tr>
<td>More than 800 ml</td>
<td>49 (49%)</td>
<td>30 (30%)</td>
<td></td>
</tr>
<tr>
<td>Blood Transfusion (RCC) Requirement (Mean ± SD)</td>
<td>1.6 ± 1.6</td>
<td>1.0 ± 1.2</td>
<td>0.04</td>
</tr>
<tr>
<td>Ventilation Time (in hrs)</td>
<td>12.9 ± 25.2 (6)</td>
<td>10.6 ± 23.4 (6)</td>
<td>0.07</td>
</tr>
</tbody>
</table>

Table-IV: Post-operative complication (CPB vs OPCAB).

<table>
<thead>
<tr>
<th>Variable</th>
<th>CPB n=100</th>
<th>OPCAB n=100</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Re-exploration for bleeding N (%)</td>
<td>12 (12%)</td>
<td>2 (2%)</td>
<td>0.02</td>
</tr>
<tr>
<td>ICU Stay Time (in hrs)</td>
<td>67.6 ± 74.0</td>
<td>51.0 ± 78.5</td>
<td>0.04</td>
</tr>
<tr>
<td>Mortality N (%)</td>
<td>6 (5.9%)</td>
<td>5 (5%)</td>
<td>0.93</td>
</tr>
</tbody>
</table>

RESULTS

Of the total 200 patients, 100 cases were included in each CABG or CPB group. Patients in both groups were similar in terms of demographic features, pre-operative characteristics, re-do operations and incidence of co-morbid conditions. In OPCAB group, there were 76 males (76%) and 24 females (24%) with a mean age of 59.1 ± 7.2 years, whereas, in CPB group, there were 85 males (85%) and 16 females (16%), with a mean age of 57.5 ± 8.9 years. Fifty two patients (52%) had hypertension in OPCAB group, while 54 (54%) patients were hypertensive in the CPB group. In OPCAB group, 44 patients (44%) were known to be diabetic and the number was 46 (46%) in CPB group. 7 (7%) were smokers in OPCAB patients and there were 11 (11%) smokers in group-2. In OPCAB group, 23 patients (23%) had NYHA class I, 34 patients (34%) had NYHA class II, and 43 (43%) patients were having NYHA class III symptoms. While in CABG group, 28 patients (28%) had NYHA class I, 29 patients (29%) had NYHA class II, and 43 (43%) cases were in NYHA class III (table-I).

The patients in CPB group had tendency to have multi-vessel disease than those in OPCAB (off pump) group. In CPB group, there were 85 patients (85%) who had triple vessel disease vs 75 (75%) patients in OPCAB group, 20 patients (20%) had double vessel disease in OPCAB vs 14 patients (14%) in CPB; however, there were only 5 patients (5%) who had single vessel disease in OPCAB vs 2 patients (2%) in CPB group. In addition, the left main disease was almost same
among the off pump group 15 (15%) and 17(17%) patients in group-1. Results are shown in table-II.

As compared to the OPCAB group, the patients in the CPB group required ionotropic support for a longer duration (29.6 ± 65.1 vs 60.9 ± 71.2, p-value<0.02). Similarly, the rate of postoperative chest drainage was significantly higher in CPB Vs OPCAB (49% vs 30% p<0.026). Requirement of blood transfusion product (RCC) was significantly higher in CPB group as compared to OPCAB patients (1.6 ± 1.6 vs 1.0 ± 1.2, p-value 0.04). Mechanical ventilation time was almost same in both groups with median value of 6 hours. Results are shown in table-III & figure.

![Figure: Comparison of OPCAB and coronary surgeries with CPB.](image)

<table>
<thead>
<tr>
<th></th>
<th>OPCAB</th>
<th>CPB</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEAN RCC USAGE</td>
<td>1</td>
<td>1.6</td>
</tr>
<tr>
<td>VENTILATION TIME (Hours)</td>
<td>5.5</td>
<td>6</td>
</tr>
<tr>
<td>IONOTROPIC DURATION (Hours)</td>
<td>29.6</td>
<td>60.9</td>
</tr>
<tr>
<td>RE-EXPLORATION FOR BLEEDING</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>DEATH</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

DISCUSSION

Off-pump surgery has evolved into the most frequently adopted alternative technique to conventional on-pump coronary artery bypass grafting (CABG) in the treatment of patients with advanced coronary artery disease (CAD) over the last two decades. It has even become the procedure of choice for some surgeons, who believe that off-pump CABG is associated with lower occurrence of perioperative complications due to avoidance of cardiopulmonary bypass (CPB) and reduced or lack of manipulation of the ascending aorta. A rise in the number of off-pump CABG procedures in the late nineties and the earlier half of the first decade of the new millennium set off a never-ending debate regarding the benefits and drawbacks intrinsic to the two techniques of coronary artery grafting. Several randomized controlled trials (RCTs) have been conducted to compare the outcomes of off-pump as regards to on-pump CABG procedures\textsuperscript{10,11}.

Most trials demonstrated no difference in immediate outcomes between the two CABG techniques. Nevertheless, the two major RCTs, the Randomized On/ Off Bypass (ROOBY) trial and the Danish On-pump versus Off-pump Randomization Study (DOORS) revealed a significantly higher rate of the primary composite outcome including all-cause mortality, repeat revascularization (RR), or nonfatal myocardial infarction (MI) at 1 year and an inferior graft patency at 6 months following surgery in patients, who underwent off-pump CABG, respectively\textsuperscript{12}.

In contrast, other important RCTs such as the CABG Off- or On-Pump Revascularization Study
(CORONARY) and the Surgical Management of Arterial Revascularization Therapies (SMART) trial identified no differences in mortality, stroke, MI, RR and quality of life between off-pump and on-pump CABG at a follow-up of 1 year\(^\text{13}\). The latter study also showed similar angiographic patency rates. The efficacy of these RCTs to detect and assess differences in clinically important outcome measures between the two operative techniques has been questionable\(^\text{14}\).

In the present study, there was a reduction in the requirement of blood transfusions in the OPCAB group, as compared to the CPB group. Previous studies have revealed that CPB was associated with increased demand for blood transfusions but did not investigate the contribution of intraoperative hemodilution\(^\text{15}\). Other studies have speculated that their observed increased blood transfusion rate for on-pump compared to off-pump patients was caused by an increased postoperative bleeding\(^\text{16}\).

Our study reported a higher postoperative ICU stay and re-exploration rate in the conventional CABG group as compared to OPCAB group. The evidence in the literature seems to support these findings that Off-pump coronary artery bypass has been associated with a significant reduction in the risk of death, stroke, acute renal failure, mortality or morbidity, and postoperative length of hospital stay compared with on-pump coronary artery bypass surgery\(^\text{17-20}\).

**CONCLUSION**

Our study concluded that the main advantages of OPCAB technique are that there is less amount of postoperative chest drainage and it makes it possible to reduce the number of blood transfusions after surgery.

**LIMITATION OF STUDY**

This retrospective review failed to show intraoperative hematocrit (Hct) as a marker of hemodilution that provides a more complete understanding of the mechanism of the need for blood transfusions after cardiac surgery. Addressing intraoperative hemodilution is a very important issue in minimizing CPB associated morbidities.

**CONFLICT OF INTEREST**

This study has no conflict of interest to be declare by any author.

**REFERENCES**

15. Ayman El, Naggar AE, Rania M, Hosein Y, Mohamed Y. Off pump vs on pump coronary artery bypass grafting;


ARRHYTHMIAS AMONG YOUNG MALE SOLDIERS UP TO 40 YEARS OF AGE WITH STRUCTURALLY NORMAL HEART


Armed Forces Institute of Cardiology/National University of Medical Sciences (NUMS) Rawalpindi Pakistan

ABSTRACT

Objective: To classify different types of arrhythmias and to study their frequency and presentations among young male soldiers up to 40 years of age who have structurally normal heart.

Study Design: Descriptive cross-sectional study.

Place and Duration of Study: Inpatient and Outpatient departments of Armed Forces Institute of Cardiology/National Institute of Heart Diseases (AFIC/NIHD), Rawalpindi, from Jan 2016 to December 2017.

Materials and Methods: It was a descriptive cross sectional study conducted at inpatient and outpatient departments of AFIC/NIHD, Rawalpindi from Jan 2016 to Dec 2017. Male soldiers between 18 to 40 years of age; with no known structured heart disease and presenting with cardiac arrhythmias, not secondary to electrolytes imbalances, hormonal disorders or drugs intake were included in the study through consecutive sampling from hospital record papers. Ethical and institutional approval was taken from IERB committee. Arrhythmias and types were defined as per standard ECG criteria and Holter monitoring. Types of arrhythmias were noted through recorded ECGs and holter reports. Data was entered and analyzed using SPSS version 23.

Results: A total of 286 patients were recruited in the study. Mean age of the patients was 34.5 ± 7.6 years. The most common arrhythmia type was found to be supraventricular tachycardia (SVT) 126 (44%), followed by premature ventricular contractions (PVCs) 80 (28%), early repolarization 34 (11.9%), Atrial Fibrillation (AF) 25 (8.7%), first degree heart block 15 (5.2%), Inappropriate sinus tachycardia (IST) 6 (2.1%). Among SVT common arrhythmias were Atrial Tachycardia (AT) 50 (17.5%) and atrioventricular nodal re-entry tachycardia (AVNRT) 38 (13.2%). Among the recorded symptoms, a palpitation was the most common symptom. No symptoms were recorded for first degree heart block and early repolarization.

Conclusion: Common arrhythmias in young male soldiers having structurally normal hearts were PVCs and SVTs. Among SVTs, AT and AVNRT were commonly observed arrhythmias. Dizziness was the common complaint in PVCs. Palpitations was the most commonly observed symptom.

Keywords: Arrhythmias, Atrioventricular nodal re-entry tachycardia, Atrial tachycardia, Atrial fibrillation, First degree heart block, Supra ventricular tachycardia

INTRODUCTION

Cardiac arrhythmias can be benign and can lead to potentially disabling medical conditions or even sudden cardiac death. Varied causes can lead to arrhythmias in structurally normal or abnormal hearts, including electrolytes abnormalities, channelopathies, hormonal disorders and ischemic cardiac events. Common presenting symptoms are dizziness, palpitations, and syncope but in contrast to these ubiquitous complaints, sudden cardiac death remains an important public health concern. Statistics from the center for disease control and prevention have estimated sudden cardiac death rates at more than 600,000 per year in USA. Atrial fibrillation is the most common arrhythmia and accounts for the majority of arrhythmia-related hospitalizations. Atrioventricular nodal reentrant tachycardia (AVNRT) is the most common of paroxysmal supraventricular tachycardia (PSVT) in adults. Idiopathic ventricular tachycardia (VT) account for 10% of all VT diagnoses. There are community based studies reporting prevalence of different types and common presentations of arrhythmias but, to best

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Email:khan_kharotee@gmail.com
of our knowledge and search, no study has been done on soldiers. Purpose of this novel study, is to classify different types of arrhythmias, their presentations and frequencies among soldiers up to 40 years of age who have structurally normal heart.

**MATERIAL AND METHODS**

It was a descriptive cross sectional study conducted at inpatient and outpatient departments of Armed Forces institute of cardiology and National institute of heart diseases, Rawalpindi from Jan 2016 to Dec 2017. Male soldiers between 18 to 40 years of age; with no known coronary artery disease and presenting with cardiac arrhythmias, not secondary to electrolytes imbalances, hormonal disorders or drugs intake were included in the study through consecutive sampling from hospital record papers. Ethical and institutional approval was taken from IERB committee. Arrhythmias and types were defined as per standard ECG criteria and Holter monitoring. Types of arrhythmias were noted through recorded ECGs and Holter reports. Palpitations are defined as an unpleasant awareness of forceful or rapid heartbeats. Dizziness and syncope are defined as the sudden transient loss of consciousness with associated loss of postural tone and spontaneous recovery without neurological deficit.

**RESULTS**

A total of 286 patients were recruited in the study. Mean age of the patients was 34.5 ± 7.6 years. The most common arrhythmia was found to be Supra ventricular tachycardia (SVT) 126 (44%), followed by premature ventricular contractions (PVCs) 80 (28%), early repolarization 34 (11.9%), Atrial fibrillation (AF) 25 (8.7%), first degree heart block 15 (5.2%), inappropriate sinus tachycardia (IST) 6 (2.1%). Among SVTs common arrhythmias were atrial tachycardia (AT) 50 (17.5%) and atrioventricular nodal re-entry tachycardia (AVNRT) 38 (13.2%), while Atrioventricular re-entry tachycardia (AVRT) and atrial flutter (AFL) were less common found in 30 (10.4%) and 8 (2.8%) cases, respectively, as shown in table-I. Among SVTs, AT presented with palpitations (72%) and pre-syncope (18%), while AVNRT, AVRT and AFL commonly presented with palpitations and dizziness (65%}

<table>
<thead>
<tr>
<th>Presenting complaint</th>
<th>AVNRT</th>
<th>AVRT</th>
<th>AT</th>
<th>AFL</th>
<th>AF</th>
<th>PVCs</th>
<th>IST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dizziness</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Palpitation</td>
<td>65%</td>
<td>50%</td>
<td>72%</td>
<td>70%</td>
<td>80%</td>
<td>10%</td>
<td>77%</td>
</tr>
<tr>
<td>Blackouts</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Dyspnea</td>
<td>7%</td>
<td>-</td>
<td>-</td>
<td>5%</td>
<td>-</td>
<td>-</td>
<td>5%</td>
</tr>
<tr>
<td>Pre-Syncope</td>
<td>-</td>
<td>-</td>
<td>18%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>16%</td>
</tr>
<tr>
<td>Syncope</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Table-I: Showing types of arrhythmias.

Table-II: Common presentations of arrhythmias.
and 15%), (50% and 10%) and (70% and 20%), respectively. Among PVCs, common presenting complaints were dizziness (30%) and palpitations (10%). Pre-syncpe was common in AT and IST, as shown in table-II.

DISCUSSION

There has been significant progress in the understanding of the electrophysiological mechanisms and remodeling processes\textsuperscript{12}. In present study SVT were the most common arrhythmias in patients with structurally normal hearts present in 44% cases. Among the SVTs most common arrhythmia was noted to be AT (17.5%) followed by AVNRT (13.2%) and AVRT (10.4%). Reported frequency of SVTs in studies conducted by Budhwar et al\textsuperscript{13} and Irfan et al\textsuperscript{14} is 34% and 38%, respectively. Other common arrhythmias in our study were PVCs present in 28% cases and early repolarization, in 11.9% cases. But in study reported by Abass et al, PVCs were found in 1% and early repolarization in 6% studied male population under 40 years of age with normal hearts\textsuperscript{15}, while reported frequencies by Liesemer et al\textsuperscript{16} were 1.5% and 1.1% for PVCs and early repolarization among male cadets, respectively. In our study, AF was found in 8.7%. Reported incidence of AF was 4.4% among military crew in study by Hunter et al\textsuperscript{17}. First degree heart block and IST were relatively less frequent, found in 5.2% and 2.1% subjects, respectively.

This study has given an account of common clinical presentations for observed arrhythmias. Studies have showed no specific complaint or combination of complaints was likely to predict a disturbance in rhythm\textsuperscript{18}. Only 40% subjects having PVCs had symptoms, and dizziness was the common complaint (30%). In AT 90% subjects had symptoms where palpitations was the common complaint. Among other arrhythmias, 95% of AFL, 87% of AVNRT and 80% of AF cases were symptomatic. Palpitations was the most common of the symptoms, with variable proportions, related with all types of studied arrhythmias. For first degree heart block and early repolarization no symptoms were noted. In study by Irfan et al, most frequently observed symptom was palpitations, but the mentioned proportions of each symptom was different than our study\textsuperscript{14}. Nevertheless, it should be kept in mind that the group of subjects analyzed in this study can only be described as selective, since all subjects were young soldiers (less than 40 years of age), it must be assumed that the prevalence revealed by this study is lower than would be the case in an age-matched comparison group from the general population. Furthermore, the major limiting factor was the frequency of symptoms itself, which may be complicated by the fact that the same arrhythmia may occur with different symptoms over a course of time.

CONCLUSION

Common arrhythmias in young male soldiers having structurally normal hearts were PVCs and SVTs. Among SVTs, AT and AVNRT were commonly observed arrhythmias. Palpitations was the most commonly observed symptom. Significant arrhythmias were detected in both symptomatic and asymptomatic patients, but it is difficult to attribute a symptom to an arrhythmia. Large population study is needed to demonstrate a close temporal relationship between symptoms and types of rhythm disorder.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

REFERENCES

KNOWLEDGE OF FOOD SERVICE STAFF REGARDING FOOD SAFETY AND FOOD HYGIENE IN AFIC & NIHD
Maryam Zahid, Hafsa Khalil, Samina Nazir, Sabat Baber, Safdar Abbass
Armed Forces Institute of Cardiology/National University of Medical Sciences (NUMS) Rawalpindi Pakistan

ABSTRACT

Objective: To determine the knowledge of food service staff regarding food hygiene and food safety. To determine the association between demographic profile and knowledge of food service staff.

Study Design: Descriptive cross sectional study.

Place and Duration of Study: Armed Forces Institute of Cardiology & National Institute of Heart Diseases Rawalpindi, from Dec 2017 to Jan 2018.

Material and Methods: A convenient sampling technique was employed to select 45 food service staff members. Food service staff members consisting of cooks, waiters, food delivery boys and cleaner participated in the study. Data collection was done using structured questionnaires. The questionnaire dealing with food safety knowledge comprised 29 close-ended questions. The data were analyzed using the statistical package for social sciences version 22.

Results: Among 45 food service staff members who participated in the research, 19 (42%) were cooks, 13 (30%) were waiters, 9 (21%) were food delivery boys and 4 (9%) were cleaners. Twenty three (51%) food service employees were in group of 21-30 years and 6 (13%) of them were above 50 years of age. Majority of food-handlers in this study knew the importance of general sanitary practices such as regular hand washing at the work place (98% correct answers), wearing of gloves (100% correct answers), cleaning of workplace (93% correct answers) and detergent use (93%). Education and work activity were significantly associated with food hygiene knowledge, with p-value 0.001 and 0.021, respectively.

Conclusion: In general, the institutional food-handlers have good knowledge of food safety but this does need to be translated into strict hygienic practices during processing and handling food products.

Keywords: Food hygiene, Food safety, Food service staff.

INTRODUCTION

Food safety is defined as the conditions and measures that are necessary during production, processing, storage, distribution and preparation of food to ensure that it is safe, sound and fit for human consumption. When food is cooked on a large scale, it may be handled by many individuals and thus increasing the chances of contamination of the final food. Unintended contamination of food during large scale cooking leads to food-borne disease outbreaks. The Centre for Disease Control and prevention (CDC) has identified five risk factors related to the human factor and preparation methods that contribute to the high prevalence of foodborne illnesses. The five risk factors are improper holding temperatures, inadequate cooking, contaminated equipment, food from unsafe source and poor personal hygiene. Food, if not handled hygienically, could be a mode for transmission of hazards and the contaminated food can pose a health threat, a problem that is serious in developing countries due to difficulties in securing optimal hygienic food handling practices.

In order to minimize foodborne outbreaks, education must be an integral component of all interventions. Therefore, to plan a successful food safety intervention, obtaining information pertaining to food safety knowledge is of utmost importance. Additionally, making prudent decisions to uproot the problems as early as possible lessens the risk of major foodborne...
outbreaks. Several studies have posed strong emphasis for educational programs as a way to improve knowledge and control foodborne diseases\(^7,^8\) pointed out that food handlers need training and education as a result of their low level of knowledge on microbiological food hazards, temperature control of refrigerators, cross contamination, and personal hygiene\(^9\).

### MATERIAL AND METHODS

A convenient sampling technique was employed to select 45 food service staff members.

<table>
<thead>
<tr>
<th>Questions</th>
<th>Response</th>
<th>Work activity</th>
<th>Education Status</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Filtered water is necessary for preparing food.</td>
<td>Yes 9 10 7 4</td>
<td>No 10 3 2 0</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>Using gloves while handling food reduces the risk of food contamination.</td>
<td>Yes 19 13 9 4</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Proper cleaning and sanitization of utensils increase the risk of food contamination.</td>
<td>Yes 17 11 3 3</td>
<td>No 2 2 6 1</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Clean and sanitize work surfaces after each task is important</td>
<td>Yes 19 10 9 4</td>
<td>No 0 3 0 0</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>AIDS can be transmitted by food.</td>
<td>Yes 19 11 3 1</td>
<td>No 9 2 4 3</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Bloody diarrhea can be transmitted by food.</td>
<td>Yes 19 12 5 3</td>
<td>No 0 1 3 1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Microbes are on the skin, in the nose and mouth of healthy food handlers.</td>
<td>Yes 19 13 5 4</td>
<td>No 0 0 4 0</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Clean is the same as sanitized.</td>
<td>Yes 7 11 2 2</td>
<td>No 11 1 5 2</td>
<td>0.023</td>
</tr>
<tr>
<td>0</td>
<td>The correct temperature for storing perishable foods is 5 °C.</td>
<td>Yes 4 10 6 2</td>
<td>No 8 2 0 0</td>
<td>0.018</td>
</tr>
<tr>
<td>5</td>
<td>During infectious disease of the skin, it is necessary to take leave from work.</td>
<td>Yes 19 13 9 4</td>
<td>No</td>
<td>5 9 13 16 2</td>
</tr>
<tr>
<td>7</td>
<td>The ideal place to store raw meat in the refrigerator is on the bottom shelf.</td>
<td>Yes 3 11 3 2</td>
<td>No 16 2 6 2</td>
<td>0.001</td>
</tr>
<tr>
<td>9</td>
<td>Wash raw products before using it is important</td>
<td>Yes 19 13 9 4</td>
<td>No</td>
<td>5 9 13 16 2</td>
</tr>
</tbody>
</table>
was collected from December 2017 to January 2018. Face-to-face interviews were conducted using structured questionnaires in the kitchen of Armed Forces Institute of Cardiology and National Institute of Heart Disease. Demograph the questionnaire dealing with food safety knowledge comprised 29 close-ended questions with three possible answers; “true”, “false”, and “do not know”. These questions specifically dealt with respondents’ knowledge of personal hygiene, cross contamination, food-borne diseases, microorganisms, temperature control and hygienic practices. A scale ranging between 0 and 29 (representing the total number of questions on food safety knowledge) was used to evaluate the overall knowledge of respondents.

Data Analysis

Figure-1A: Relationship between length of employment and knowledge regarding correct temperature for storing perishable foods.

The statistical analysis was carried out using SPSS software version 22 (IBM corporation, USA). Mean ± SD and n (%) was calculated for descriptive variables and chi-square test was applied for comparing various categorical groups. A p-value of <0.05 was taken significant.

RESULTS

Among 45 food service staff members who participated in the research 19 (42%) were cooks, 13 (30%) were waiters, 9 (21%) were food delivery boys and 4 (9%) were cleaners. All the food service members were male. Twenty three (51%) food service employees were in group of 21-30 years and 6 (13%) of them were above 50 years of age. Thirty four (76%) members were permanently posted in AFIC & NIHD whereas 11 (24%) were temporary employees. Seven (16%) food service employees were serving the hospital for more than 20 years, whereas most of the employees, 24 (53%) had less than 5 years of food service experience. Sixteen (36%) of the members completed 10 years of education and 2 (4.4%) completed 12 years of education, whereas 5 (11%) employees did not receive any proper education.

Fourty four (98%) of the food service employees knew the importance of hand washing and use of hair restraint. All the employees knew that using gloves while handling food reduces the risk of food contamination. Forty four (98%) members were aware that cross contamination occurs when microorganisms from a contaminated food are transferred by the food handler’s hands or kitchen utensils to another food. All employees said its necessary to take leave from work during infectious disease of the skin. Thirteen (30%) didn’t know the correct temperature for storing perishable food, whereas 22 (49%) knew the right answer. Twenty five (56%) said hot, ready to eat food should be kept at a temperature of 65°C, whereas 6 (13%) didn’t knew the answer. Nineteen (42%) employees knew the difference between cleaning and sanitizing. Twenty five (56%) employees said that
AIDS can be transmitted by food and 38 (84%) said typhoid fever can be transmitted by food. All employees, 45 (100%) knew that washing of raw products before use is important.

Table shows the strong Relationship between work activity and education level with food safety knowledge with the $p$-value $<0.05$. In fig-1a health status of workers before employment had $p$-value of 0.009 as shown in fig-1c.

**DISCUSSION**

Food safety is extremely important to health since it protects against foodborne illnesses. In this study, food safety knowledge of food service workers was carried out to examine the relationship of length of employment and knowledge regarding correct temperature for storing perishable foods was shown and it had $p$-value of 0.039. While in fig-1b relationship between length of employment and knowledge regarding contamination of raw vegetables and under-cooked beef was highly significant. Relationship between length of employment and knowledge of food service regarding evaluation health status of workers before employment had $p$-value 0.009.

The largest group 23 (51%) in the study was between the age of 21-30 years of age. This is similar from other studies where the majority of the participants were also a bit younger aged between 25 to 30°.
In our study, the food-handlers were knowledgeable about hygiene practices, cleaning and sanitation procedures. Majority of food handlers in this study knew the importance of general sanitary practices such as regular hand washing at the workplace, wearing of gloves, cleaning of workplace and detergent use. Similarly in Ghana majority of food-handlers knew the importance of general sanitary practices.

Education and work activity were significantly associated to food hygiene knowledge, with p-value 0.01 and 0.042, respectively specifically regarding proper cleaning and sanitization of utensils. Similar findings were reported in food hygiene knowledge, attitude and practices of food handlers in the Military Hospitals study by Sharif et al (2013) where they reported that practice scores were significantly (p<0.05) affected by the level of education and by the type of work for separating raw from cooked foods.

Eighty two percent remember that hepatitis A is a foodborne pathogen. On the other, 84 and 87% of respondents agreed that typhoid fever and bloody diarrhea respectively can be transmitted by food. The majority (56%) of respondents agreed that HIV/AIDS is transmitted by food, which is an indication that public education on HIV/AIDS is not sufficient. These results support recently published work where majority of the respondents did not know if Salmonella, hepatitis A and B viruses, and Staphylococcus caused foodborne diseases. Over hundred percent (100%) of respondents agreed that taking leave from work in periods of infectious skin disease was necessary. Additionally, 91% knew that microorganisms can be found on the skin and in the mouth and nose of healthy looking individuals. They also recognize that the health status of food-handlers should be assessed prior to employment.

On the other hand, food-handlers were less familiar with time and temperature abuse and its effect on food safety. Kajagar reported that improper handling of food, including the abuse of time temperature, account for most food-borne disease outbreak. In this study, respondents had insufficient knowledge on time temperature controls. This result is supported by others whose report show that knowledge of critical temperatures were insufficient amongst food handlers. Similar findings on the lack of adequate knowledge on temperature controls by food handlers have also been reported from different countries.

CONCLUSION

In general, the institutional food handlers have good knowledge in food safety but this does not translate into strict hygienic practices during processing and handling food product.

RECOMMENDATIONS

Gaungoo and Jeewen in their study for effectiveness of training among food handlers (“A review on the Mauritian Framework”) recommended that it should be mandatory for food handlers to undergo a refresher food safety training course prior to renewal of their Food Handler Certificate after its expiry after three years. Therefore, there is a need for continuous training of food handlers on food hygiene and food safety; this might assist in improve knowledge and maintaining the standard of hygiene practices in food service units.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

REFERENCES


AWAWARENESS OF HEALTH CARE WORKERS REGARDING ALCOHOL HAND RUB USAGE AT TERTIARY CARE HOSPITALS

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ABSTRACT

Objective: To assess the knowledge, attitude and practices of hand hygiene by using alcohol hand rubs amongst healthcare workers.

Study Design: Descriptive cross sectional study.

Place and Duration of Study: Military Hospitals of Rawalpindi from Jul 2016 to Dec 2016.

Material and Methods: Data was collected using a pre-structured questionnaire from 350 healthcare workers using convenience sampling.

Results: Statistical analysis showed that 210 (59%) healthcare workers had adequate knowledge about proper Alcohol hand rub usage, 202 (56%) showed positive attitude while good practices were found in 189 (53%) respondents. Strong statistical association exists between socio-demographic characteristics and knowledge and attitude of healthcare workers.

Conclusion: The study identified factors responsible for gaps such as: Lack of awareness, work overload, negligence, shortage of time, non-availability of Hand Hygiene facilities, overcrowding of patients and lack of encouragement by seniors in Alcohol Hand Rub usage amongst healthcare workers in tertiary care hospitals. Identified issues can play a pivotal role in determining critical steps required for action to bring about improvement in hand hygiene practices to reduce hospital acquired illnesses and deaths.

Keywords: Alcohol hand rub, Hand Hygiene, Hospital acquired infections.

INTRODUCTION

Adoption of hand aseptic techniques to attain hand hygiene (HH) dates back to 19th century which was studied by Semmelweis1. Association of HH practices and health care associated infections is also a known fact. Multiple studies over the period of time have supported the fact that improved HH practices play an important role in reducing overall length of hospital stays, as well as morbidity and mortality rates2.

Healthcare associated infections (HCAI) undoubtedly portray a grave problem for patient safety and their prevention automatically becomes the first priority of hospitals and institutions. Their prevention also remains a major concern worldwide that no hospital, institution or country can claim to have fully attained. In Europe alone, hospital wide prevalence rates of patients affected by healthcare associated infections ranged from 4.6% to 9.3%3.

Prevalence of nosocomial infections is highly dependent on hand hygiene practices of healthcare workers; however, most of these infections can be prevented by simple adoption of WHO recommended “My Five Moments of Hand Hygiene” Strategy3.

Both, World Health Organization (WHO) and Centre of Disease Control (CDC) recommend guidelines for hand washing with soap and water when visibly dirty but in all other scenarios, alcohol hand rubs are the gold standard for hand hygiene4. Introducing alcohol hand rubs with multifaceted interventions has

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been reported to increase the compliance rates of healthcare workers\textsuperscript{5}.

Alcohol hand rubs have proven to have better microbiological efficacy, require lesser time to attain preferred effects and a better skin tolerance\textsuperscript{6}.

Despite strong recommendations from WHO as well as CDC to use alcohol hand rub as first line for attainment of hand hygiene in clinical practice, Pakistan is still miles away in attaining the desired goal. In Pakistan, alcohol hand rubs are generally more in practice in Armed Forces Institutes; whereas they are not as prevalent and their availability is also scarce in public sector hospitals.

Hence, the rationale of this study was to assess the knowledge, attitude and practices of healthcare workers in those settings where alcohol hand rubs are available.

**MATERIAL AND METHODS**

This descriptive cross sectional study was conducted at Military Hospital of Rawalpindi from July 2016 to December 2016 with a view to assess knowledge, attitude and practices of hand hygiene by using alcohol hand rubs amongst healthcare workers. A total of 355 permanently employed Health Care Workers working/involved in patient care in Tertiary Care Hospitals were included in this study. Health care workers who were on medical cover, on leave, involved in administrative duties and who did not give the consent for filling out the questionnaire were excluded. Convenience sampling technique was used. The demographic profile of HCW was studied that included age, gender, hospital, profession, education, years of experience and department (ITC, surgical unit etc). A modified, pre-designed and pre-tested questionnaire was used for data collection\textsuperscript{7}. Data was collected after obtaining ethical clearance from AFIC IERB and AFPGMI IRB. Formal permission was obtained from respective hospitals. All HCWs participated voluntarily in the study after giving verbal informed consent. Participants were guaranteed confidentiality of the information they gave and also had the right to refuse or quit participation at any time during their involvement in the study. The questionnaire was pre-tested on 20 healthcare workers for their understanding of the questionnaire.

**Data Analysis**

Data recording, storage, assessment and analysis was done by using SPSS software version 21. Continuous variable data was presented in mean and standard deviation. Categorical variable data is presented in frequencies and percentages. Chi-square test is used to find association between knowledge,
awareness, practices and socio-demographic variables. A *p*-value < 0.05 is taken as significant and *p*-values of different variables are reported.

**RESULTS**

Demographic data includes age, gender, hospital, education, profession, years of experience and departments. Majority of HCWs had 7 to 15 year of experience followed by 23 (6%) with >16 years of experience. 153 (43%) respondents belonged to CMH, 51 (14%) to MH, 126 (35%) to AFIC and 25 (7%) to other hospitals. 96 (27%) of HCWs were MBBS, 141 (39%) BSc and 118 (33%) had intermediate level education. Out of 355 respondents 65 (18%) were from ICU, 88 (24%) from medicine, 79 (22%) from surgery, 76 (21%) from other departments.

230 (64%) lie between 18 to 26 age bracket whereas 78 (22%) between 26 to 37 and 47 (13%) was >37 years old. Proportion of female to male HCW was 295 (83%) and 60 (16%) respectively. Female HCWs were by far in majority. The difference in proportion is due to the fact that males belonged mostly to paramedical staff whereas doctors and nurses were mostly females. Most of the respondents had 1 to 6 years of experience 285 (80%) followed by 47 (13%) who (13%) from pediatrics and 76 (21%) from other departments. Majority of respondents 195 (54%) belonged to nurses followed by 95 (26%) of doctors followed by 65 (18%) of paramedical staff.

Mean age of HCWs was 26.56 (± 7.52) years, ranging between 18 to 47 years. Mean years of experience was 4.79 (± 5.4), ranging between 1 to 25 years.

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**Table I: Association between demographic characteristics and knowledge of respondents.**

<table>
<thead>
<tr>
<th>Demographic Characteristics</th>
<th>Knowledge n (%)</th>
<th>x² Results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Adequate</td>
<td>Inadequate</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>43 (20)</td>
<td>17 (11)</td>
</tr>
<tr>
<td>Female</td>
<td>167 (79)</td>
<td>128 (88)</td>
</tr>
<tr>
<td><strong>Profession</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Doctor</td>
<td>54 (25)</td>
<td>41 (28)</td>
</tr>
<tr>
<td>Nurse</td>
<td>101 (48)</td>
<td>94 (64)</td>
</tr>
<tr>
<td>Paramedical Staff</td>
<td>55 (26)</td>
<td>10 (6)</td>
</tr>
</tbody>
</table>

**Table II: Association between demographic characteristics and attitude of respondents.**

<table>
<thead>
<tr>
<th>Demographic Characteristics</th>
<th>Attitude n (%)</th>
<th>x² Results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Adequate</td>
<td>Inadequate</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>26 (12)</td>
<td>34 (22)</td>
</tr>
<tr>
<td>Female</td>
<td>176 (87)</td>
<td>119 (77)</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MBBS</td>
<td>40 (19)</td>
<td>56 (36)</td>
</tr>
<tr>
<td>BSc</td>
<td>86 (42)</td>
<td>55 (35)</td>
</tr>
<tr>
<td>Intermediate</td>
<td>76 (37)</td>
<td>42 (27)</td>
</tr>
<tr>
<td><strong>Profession</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Doctor</td>
<td>42 (20)</td>
<td>53 (34)</td>
</tr>
<tr>
<td>Nurse</td>
<td>121 (59)</td>
<td>74 (48)</td>
</tr>
<tr>
<td>Paramedical Staff</td>
<td>39 (19)</td>
<td>26 (17)</td>
</tr>
</tbody>
</table>

*No statistically significant association is seen between demographic characteristics and practices.*
Regarding mode of spread of nosocomial infections, 144 (40%) responded correctly by answering that it is transmitted by hands whereas 211 (59.4%) thought that common utensils and patients poor hygiene was responsible for its spread.

As regards effectiveness of alcohol hand rubs, 351 (98%) had the correct knowledge that alcohol hand rubs reduced transmission of infections, 324 (94%) were aware of WHO's recommendations for routine use of alcohol hand rub, 218 (61%) said AHR was less rapid than soap and water, 264 (74%) stated that AHR caused skin dryness and 271 (76%) knew that AHR was more effective mode of attaining hand hygiene. About 203 (57%) HCWs had the knowledge about the appropriate time that should be given for AHR to kill the germs and have effective level of reduction of microbes on hands.

Hurdles reported by HCWs during HH practices by use of AHR usage are mentionbes as shown in figure.

About 337 (94%) HCWs correctly reported that alcohol hand rubs should be used before touching a patient, only 130 (36%) practiced hand hygiene after exposure to the body fluids whereas 312 (87%) correctly performed hand hygiene immediately before an aseptic technique. Three hundred and twenty seven (92%) performed hand hygiene after exiting patients environment.

As regards attitude of HCWs showing positive association with increased likelihood of colonization of hands with harmful germs, 272 (76%) had positive attitude of not wearing jewelry, 322 (90%) had the attitude to avoid damaged skin, 315 (88%) with attitude to avoid use of artificial nails and 102 (28%) had the attitude of regular use of hand cream to avoid colonization of hands with germs due to damaged skin.

Table-I shows significant association between gender, profession and knowledge whereas Table-II shows significant association between gender, education, profession and attitude.

DISCUSSION

The study was conducted in multiple departments of military hospitals to assess knowledge, attitude and practices of HCWs regarding use of alcohol hand rub for attaining hand hygiene. Health care workers’ hands are the most usual type of vehicle for transmission of health care associated infections. Pathogenic micro-organisms have the ability to survive for 2-60 minutes on health care workers’ hands. So, in order to provide optimal care health care, workers should follow recommended guidelines to get their hands rid of micro-organisms.

A systematic review comprising 96 studies was published which reported that overall compliance rate was 32% in doctors; much lower than 48% in nurses. Also, they practiced HH 21% of times before touching the patient and 47% after coming in contact with the patient, whereas in our study 46% of doctors and 58% of nurses showed compliance with HH practices.

A similar study conducted in Spain showed compliance rate of 56% in acute wards and yet another study conducted in ICU of a tertiary care hospital in India reported the compliance rate of 43%. It did not differ much between physicians and nurses being 41% and 40% respectively.

A study conducted in Iran also showed shockingly low compliance of HH practices. Overall compliance was 6.4% (teaching hospital: 7.4%, public hospital: 6.2%, private hospital: 1.4%). Nurses (8.4%) had the highest rates of compliance.

A multi-centered study conducted in multiple departments in Pakistan concluded that out of 3243 respondents, 87% had knowledge about hand washing techniques but only 69% practiced hand hygiene procedures adequately. Out of those who performed HH, 58% performed HH for more than 20 seconds as per WHO guidelines. Majority preferred soap and water over alcohol hand rubs. In our study 67% preferred alcohol hand rub usage and 73% reported to be performing HH for over 20 seconds. However, 76% of the HCWs agreed that
hand rubs were more effective for hand hygiene and 67% reported to be using alcohol hand rub as preferred means of acquiring hand hygiene in comparison to 32% which used soap and water. In our study 98% of HCWs had the knowledge that AHR usage reduces the transfer of infections from one person to another, 61% had the correct knowledge that AHR is faster acting HH product and 76% knew that hand rubs are more effective than hand washing. The difference in the study was attributed to non-availability of AHR at the patient care points, poor quality of AHR, skin irritation and allergies.

An observational study conducted in Istanbul in Pediatric ICU on the compliance of HH for the five World Health Organization (WHO) indications revealed HCWs were more likely to use soap and water (63.6%) compared to waterless alcohol based hand hygiene (36.3%). Adherence to hand hygiene practice and use of alcohol-based disinfectant was found to be very low because of the unpleasant irritation effects on the hands and lack of knowledge concerning its benefits14.

In our study, we observed that rate of HH practices vary with different healthcare departments which is supported by a study conducted in Kuwait by Batool Al-Wazzan et al. which concluded that compliance varied in departments i.e. 17% in emergency, 55% in medical wards, 43% in ICU, 40% in Surgical wards15.

A study conducted in Saudi Arabia, notified the hurdles faced in attaining HH by AHR usage as: less encouragement by seniors, inaccessibility to HH products, lack of knowledge, forgetfulness, more work load and irritating effect of AHR on hands which are the similar hurdles mentioned in a study conducted by Al-Tawfiq and Pittet for improving HH compliance in healthcare setting16. Similar hurdles were also reported in our study.

The limitation of our study is that to quantify the practices was not possible and mixed method should have been used to overcome this hurdle. There is also the issue of generalizability as external factors vary from place to place.

**CONCLUSION**

This study shows that HCWs display adequate knowledge and attitude but there is a gap between practices which is attributed to multiple hurdles. A WHO recommended multi-faceted, multi-dimensional approach involving individual and organization is required to bring about improvement in HH practices3. This study should be followed by an observational study involving multiple conductors to confirm the reported facts by HCWs.

**CONFLICT OF INTEREST**

This study has no conflict of interest to declare by any author.

**REFERENCES**

FREQUENCY AND PREDICTORS OF STENT THROMBOSIS IN PRIMARY PCI PATIENTS AT AFIC

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ABSTRACT

Objective: To determine the frequency and predictors of early stent thrombosis in primary Primary Percutaneous Intervention patients.

Study Design: Cross sectional study.

Place and Duration of Study: Department of Cardiology AFIC/NIHD Rawalpindi, from Jan 2016 to Dec 2016.

Material and Methods: Non probability consecutive sampling technique was used to enroll 960 patients with ST segment elevation myocardial infarction and underwent Primary percutaneous coronary intervention in the prescribed duration satisfying inclusion/exclusion criteria. Data regarding type of myocardial infarction, risk factor like diabetes mellitus (DM), hypertension, smoking and family history was recorded followed by analysis using SPSS version 21.

Results: Total 960 patients included with ST-segment elevation myocardial infarction undergoing primary percutaneous coronary intervention, 883 (92%) were male and 77 (8%) were female, with male female ratio of 11.4: 1. Mean age of presentation was 54.99 ± 7.84 years in males and 55.14 ± 8.99 years in females respectively. Stents were implanted in 937 (97.6%) out of 960 patients, including 738 (76.9%) who received drug-eluting stents and 95 (9.89%) who received only bare metal stents, 81 (8.43%) patients received both BMS and DES and POBA was done in 23 (2.3%) patients. Definite stent thrombosis occurred in 16 (1.7%), and 3 (0.32%) patients receiving DES and BMS respectively. Probable stent thrombosis occurred in 3 (0.32%) patients receiving DES and 1 (0.1%) patient receiving BMS. Total frequency of early stent thrombosis is 2.35%. Early stent thrombosis was associated with higher in hospital mortality (p=0.03)

Conclusion: Early stent thrombosis has multifactorial causes in primary PCI patents, and is associated with diabetes mellitus, late presentation to hospital, length of stent, high thrombus burden and small stent diameter.

Keywords: Stent thrombosis, St Segment elevation myocardial infarction, Primary Percutaneous Coronary Intervention.

INTRODUCTION

Primary percutaneous coronary intervention (PCI) is the treatment of choice in patients with ST segment elevation myocardial infarction (STEMI). These patients are at increased risk of acute and sub-acute risk of stent thrombosis when compared with stable coronary disease. Stent thrombosis is a serious and dreadful complication of PCI which can lead to death and myocardial infarction. Early ST following primary PCI is almost 3 to 4 times higher when compared with elective PCI Swedish Registry revealed the rate of ST in STEMI cohort about 2.5 times greater than the non-STEMI cohort. Hence, STEMI cohort remains a unique group that poses a higher risk of early ST and worse outcomes There are multifocal etiologies of early stent thrombosis (ST) and are associated with clinical features of patient, lesion-related, procedural, and post-procedural factors, including type of stent and thrombus burden. Platelet aggregation adhesion and activation play pivotal role in the beginning of intra-coronary thrombosis that leads to acute coronary syndromes (ACS) and ischemic complications after coronary artery interventions, including recurrent myocardial. The present study was undertaken to identify the frequency of early stent thrombosis in PCI patients and associated clinical and angiographic risk factors. Infarction (MI) and stent thrombosis (ST). Indeed, the most

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Email: shafique176@gmail.com

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feared complication related to coronary stent placement is ST. Stent thrombosis can occur after implantation of either a bare metal stent (BMS) or a drug-eluting stent (DES). The reported incidence of early stent thrombosis ranges from 0.5-2.0%\cite{10,11}. The risk of early ST is similar between BMS and DES, but very late ST might occur more frequently in patients receiving first-generation DES. Stent thrombosis is associated with high risk of MI and death although the frequency of event is low\cite{9}.

**PATIENTS AND METHODS**

This descriptive cross sectional study was conducted at the Department of Cardiology, AFIC/NIHD, Rawalpindi. We used WHO calculator for sample size and included consecutive 960 patients with ST segment elevation Myocardial infarction presented in emergency department for one year from Jan 2016 to Dec 2016. All patients with ST segment elevation MI (25-80 years) of both gender presented in emergency were included in the study. Patients with Patients with Chronic Kidney disease (CKD), previous history of early stent thrombosis (EST) and cardiogenic shock were excluded from study. Acute STEMI was diagnosed on the basis of history of chest pain lasting >30 minutes associated with an ST-elevation of ≥1 mm in ≥2 contiguous leads or new left bundle branch block plus time from symptom onset to presentation ≤24 hours.

The main objective of the study was to analyze predictors of early ST in STEMI patients treated with primary PCI. Early ST was defined as ST within 30 days of coronary stent deployment. Diagnosis of ST was made according to the definition proposed by the Academic Research Consortium\cite{28}. Only patients with early (0-30 days post stent deployment) ST were analyzed. Definite ST was defined as symptoms suggestive of an ACS along with angiographic or pathologic confirmation of ST. Probable ST was defined as unexplained death within 30 days or target vessel myocardial infarction without angiographic confirmation of ST. Patients were further subdivided into acute (<24 hrs of stent deployment) and subacute ST (>24 hours of stent deployment). Patients were followed up at 30 days post discharge. Stroke was defined as a focal neurologic deficit resulting from a cerebrovascular cause, lasting >24 hr, that was not due to an obvious identifiable cause.

After confirmation of STEMI and brief history was taken to rule out any contraindication to dual antiplatelet treatment. After obtaining informed consent all patients were loaded with 300 mg of aspirin, 600 mg of clopidogrel and 40-80 mg of atorvastatin and transferred to the catheterization laboratory as early as possible. Procedure was performed either through radial or femoral route although the vast majority of interventions were performed via the radial route. I/V 70 to 100 U/kg heparin was administered to maintain the activated clotting time (ACT) between 200 and 250s. Glycoprotein IIb/IIIa inhibitors were given in the form of two I/V boluses during the procedure and as an intravenous infusion post procedurally to all patients in the absence of contraindications. Infarct related artery (IRA) was engaged with an appropriate sized guiding catheter and the culprit lesion was crossed with non-hydrophilic soft 0.014” guide wire. After lesion crossing, the TIMI flow and thrombus burden were assessed. If TIMI flow was grade III and thrombus burden was low, the lesion was stented directly. Conversely, when there was large thrombus burden, aspiration thrombectomy was performed and balloon dilatation was done if the lesion was too tight to allow the passage of the stent or when it was difficult to assess the size of the distal vessel. Non-infarct related artery was imaged at the end with a diagnostic catheter to rule out any critical lesions with compromised blood flow. As per the hospital protocol, bare metal stents (BMS) and drug-eluting stents (DES) were used. In case of multi-vessel disease, PCI was limited to Infarct Related Artery (IRA) unless patients had significant stenosis with less than TIMI III flow in a non-IRA. Coronary flow of the infarct related artery was assessed visually by the operator and...
classified according to the TIMI grading system on a scale of 0–3 both before and after the PCI. Procedural success was defined as achievement of vessel patency to a residual stenosis <30% with TIMI 3 flow. Hemodynamically stable patients discharged on the third day. At the time of discharge, all the patients were continued on dual antiplatelet, statin, beta-blocker and ACE inhibitor if not contraindicated. Patient’s record were follow up for month on electronic system. Those who didn’t follow up were telephonically contacted and asked for complications.

Data Analysis

The relevant data were collected on a structured proforma. Procedural data was assessed from the database at the time of the PPCI, and hospital outcomes was be assessed from chart reviews in the previous records. Follow-up events were obtained from reviews of medical records and telephone contact. Statistical analysis was performed using statistical software SPSS 23. Mean and standard deviation was calculated for quantitative variable age. Other list of variables included : age in years, sex, diabetes, hypertension, hyperlipidemia, smoker, previous PCI, previous myocardial infarction, or coronary artery bypass graft (CABG) surgery; multivessel disease; access site (femoral vs. radial); drug-eluting stents; Target lesion Length (mm), Reference Diameter of artery (mm), thrombus burden (low, moderate, high). Statistical analysis was done with Chi-square test for categorical variable and Independent Kruskal Wallis test was used for dependant categorical and independent numerical variables. The statistically significant p-value in all these tests was assumed at a value <0.05. From the list of variables, diabetes mellitus, late presentation to hospital, length of stent, high thrombus burden and Small stent diameter at PPCI were found to be significant.

RESULTS

Total 960 patients included with ST-segment elevation myocardial infarction undergoing primary percutaneous coronary intervention, 883 (92%) were male and 77 (8%) were female, with male female ratio of 11.4: 1. Mean age of presentation was 54.99 ± 7.84 years in males and 55.14 ± 8.99 years in females respectively. Stents were implanted in 937 (97.6%) out of 960 patients, including 738 (76.9%) who received drug-eluting stents and 95 (9.89%) who received only bare metal stents, 81 (8.43%) patients received both BMS and DES and POBA was done in 23 (2.3%) patients as shown in table-I. Definite stent thrombosis occurred in 16 (1.7%) and 3 (0.32%) patients receiving DES and BMS respectively. Probable stent thrombosis occurred in 3 (0.32%) patients receiving DES and 1 (0.1%) patient receiving BMS as shown in table-I. Total frequency of early stent thrombosis was 2.35% as shown in table-II. Early stent thrombosis is associated with higher in hospital mortality. Frequency of acute stent thrombosis was 1% and 1.35% of subacute thrombosis. Stent thrombosis

Table-I: Stent Thrombosis in different types of stents.

<table>
<thead>
<tr>
<th>Types of Stent</th>
<th>DES</th>
<th>BMS</th>
<th>POBA</th>
<th>DES + BMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definite stent thrombosis</td>
<td>19 (1.97%)</td>
<td>16 (1.7%)</td>
<td>3 (0.32%)</td>
<td>0</td>
</tr>
<tr>
<td>Probable stent thrombosis</td>
<td>4 (0.41%)</td>
<td>3 (0.31%)</td>
<td>1 (0.1%)</td>
<td>0</td>
</tr>
<tr>
<td>No stent thrombosis</td>
<td>937 (97.6%)</td>
<td>738 (76.9%)</td>
<td>95 (9.89%)</td>
<td>23 (2.3%)</td>
</tr>
<tr>
<td>Total</td>
<td>960</td>
<td>757</td>
<td>99</td>
<td>23</td>
</tr>
</tbody>
</table>

Table-II : Frequency of stent thrombosis.

<table>
<thead>
<tr>
<th>Early stent thrombosis</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute stent thrombosis</td>
<td>10</td>
<td>1.00</td>
</tr>
<tr>
<td>Subacute stent thrombosis</td>
<td>13</td>
<td>1.35</td>
</tr>
<tr>
<td>No stent thrombosis</td>
<td>937</td>
<td>96.50</td>
</tr>
<tr>
<td>Total</td>
<td>960</td>
<td>100.00</td>
</tr>
</tbody>
</table>
in PPCI patient in our study was increased in frequency in age between 58 to 75 years but it is not statistically significant.

Early Stent thrombosis developed in 13 (8.2%) of diabetic patients which is statistically significant \((p=0.0001\), There were no significant association of early stent thrombosis in patients with hypertension, smoking, previous history of PCI, CABG and MI as shown in table-III. Family history of ischemic heart disease. Drop in systolic blood pressure \((100.5 \pm 15.7)\) at presentation and long duration of symptoms \((7.8 \pm 2.6 \text{ hours})\) is a risk factor for stent thrombosis as shown in table-III. About 48.8% of patients with stent thrombosis vs 14.3% of non-stent thrombosis have high thrombus burden which is statistically significant. Anterior, inferior and lateral myocardial infarction was seen in stent thrombosis vs non stent thrombosis group as 47.8% vs 5.8%, 39.1% vs 38.8%, 8.6% vs 8.3% respectively. Radial approach was used in 30 (90.9%) patients of stent thrombosis group and 891 (92.8%) of non stent thrombosis group and femoral approach was used in 3 (9%) and 35 (3.65%) patients of both groups respectively. Left anterior descending (LAD) was the commonest infarct related artery accounting for culprit artery followed by right coronary artery (RCA) and left circumflex artery (LCX) as shown in table-IV.

Patients with early ST had higher in-hospital mortality, 21.7 versus 6%, \((p \ 0.03)\) and 30-day mortality 13.04 versus 5%, \((p \ 0.05)\). Furthermore, the rate of cardiogenic shock \((p \ 50.004)\) and cerebrovascular accident \((p \ 0.006)\) was higher in the early ST group.

### Table-III: Comparison of risk factors between two groups.

<table>
<thead>
<tr>
<th></th>
<th>Stent thrombosis</th>
<th>No stent thrombosis</th>
<th>(p)-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Definite ST (n=19)</td>
<td>Probable ST (n=4)</td>
<td>(n=937)</td>
</tr>
<tr>
<td>Diabetes / (Non diabetic)</td>
<td>11(8)</td>
<td>2 (2)</td>
<td>145 (792)</td>
</tr>
<tr>
<td>Hyperlipidemia/ (normal lipid profile)</td>
<td>2 (17)</td>
<td>1 (3)</td>
<td>123 (814)</td>
</tr>
<tr>
<td>Hypertensive / (Normotensive)</td>
<td>3 (16)</td>
<td>1 (3)</td>
<td>239 (698)</td>
</tr>
<tr>
<td>Smoker/ (Nonsmoker)</td>
<td>6 (13)</td>
<td>2 (2)</td>
<td>255 (682)</td>
</tr>
<tr>
<td>Previous PCI / (No PCI)</td>
<td>2 (17)</td>
<td>0 (4)</td>
<td>43 (894)</td>
</tr>
<tr>
<td>Previous CABG / (No previous CABG)</td>
<td>2 (17)</td>
<td>0 (4)</td>
<td>28 (909)</td>
</tr>
<tr>
<td>Previous MI / (No previous MI)</td>
<td>0 (28)</td>
<td>1 (3)</td>
<td>23 (914)</td>
</tr>
<tr>
<td>Family history of IHD / (No family history of IHD)</td>
<td>1 (18)</td>
<td>0 (4)</td>
<td>121 (816)</td>
</tr>
<tr>
<td>Systolic Blood pressure</td>
<td>100.5 ± 15.7</td>
<td>110 ± 19.8</td>
<td>0.013 (by Independent samples Kruskal Wallis test)</td>
</tr>
<tr>
<td>Duration of symptoms</td>
<td>7.8 ± 2.6</td>
<td>5.1 ± 2.8</td>
<td>0.001 (by Independent samples Kruskal Wallis test)</td>
</tr>
</tbody>
</table>
DISCUSSION

In this study, we studied the frequency, predictors and outcomes of early Stent thrombosis in patients with STEMI who were managed with primary PCI. Males were predominant in this cohort, their preponderance was around 91%, 8.3% were female while in EUROMAX trial 76% were female and 24% were male. Stent thrombosis in our study is frequently encountered in 58 to 75 years of age group of patients (table-III).

The frequency of early ST was 2.35% in our study. Definite stent thrombosis and probable stent thrombosis occurred in 19 and 4 patients, respectively. Acute stent thrombosis and subacute stent thrombosis occurred in 10 (1%) and 13(1.35%) cases within 24 hours and within 15 days of stent deployment respectively. In our study DES and BMS had no significant difference for early stent thrombosis and the results were consistent with the ACUITY trial. The baseline characteristics of the patients are shown in table. Diabetic patients were found to have increased stent thrombosis which is statistically significant.

**Table-IV: Procedural characteristics of two groups and their short term outcome.**

<table>
<thead>
<tr>
<th></th>
<th>Stent thrombosis group (n=23)</th>
<th>No stent thrombosis group (n=937)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRA</td>
<td></td>
<td></td>
<td>0.68</td>
</tr>
<tr>
<td>LAD</td>
<td>11</td>
<td>47.8%</td>
<td>495</td>
</tr>
<tr>
<td>RCA</td>
<td>9</td>
<td>39.1%</td>
<td>364</td>
</tr>
<tr>
<td>LCx</td>
<td>2</td>
<td>8.6%</td>
<td>78</td>
</tr>
<tr>
<td>Target lesion Length</td>
<td>28 ± 6.25</td>
<td>23 ± 5.8</td>
<td></td>
</tr>
<tr>
<td>Reference Diameter</td>
<td>2.75 ± 0.5</td>
<td>3 ± 0.5</td>
<td></td>
</tr>
<tr>
<td>artery (mm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial TIMI flow in</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>the IRA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>16</td>
<td>69.5%</td>
<td>487</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>8.6%</td>
<td>27</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>4.34%</td>
<td>131</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>17.39%</td>
<td>292</td>
</tr>
<tr>
<td>Thrombus Burden</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>7</td>
<td>21.2%</td>
<td>569</td>
</tr>
<tr>
<td>Moderate</td>
<td>10</td>
<td>30.3%</td>
<td>253</td>
</tr>
<tr>
<td>High</td>
<td>16</td>
<td>48.8%</td>
<td>138</td>
</tr>
<tr>
<td>Acces site</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>radial</td>
<td>30</td>
<td>90.9%</td>
<td>891</td>
</tr>
<tr>
<td>femoral</td>
<td>3</td>
<td>9.09%</td>
<td>35</td>
</tr>
<tr>
<td>Outcome</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In-hospital mortality</td>
<td>5 (21.7%)</td>
<td>56 (6%)</td>
<td></td>
</tr>
<tr>
<td>30-day mortality</td>
<td>3 (13.04%)</td>
<td>47 (5%)</td>
<td></td>
</tr>
<tr>
<td>Cardiogenic shock</td>
<td>8 (34%)</td>
<td>112 (12%)</td>
<td></td>
</tr>
<tr>
<td>Stroke</td>
<td>1 (4.3%)</td>
<td>9 (0.96%)</td>
<td></td>
</tr>
</tbody>
</table>

EUROMAX trial 76% were female and 24% were male. Stent thrombosis in our study is frequently encountered in 58 to 75 years of age group of patients (table-III).
relatively smaller stent diameter were significant risk factor for early stent thrombosis in our study. These result are similar to results from the multicenter Spanish registry ESTROFA (Estudio Espanol sobre TR Ombosis de stents F Armacoactivos)\(^\text{12}\).

Theoretically, STEMI patients have high coronary thrombus burden, hemodynamic changes, and coronary inflammation which can lead to the highest risk of early ST in patients of ACS. However, it is noted that the incidence of early ST in the primary PCI patients was similar to the non-STEMI group\(^\text{16,17}\). However, acute and subacute stent thrombosis risk raised to 3 to 4 times in patients undergoing PCI for ACS when compared to patients with stable ischemic heart disease undergoing PCI\(^\text{18,19}\). Data from various randomized trials has revealed diversity in the incidence of early ST. The rate of early stent thrombosis has ranged from roughly 0.6% in the EUROMAX registry\(^\text{20}\), 1% in the MATRIX\(^\text{14}\) trial, 1.4% in the ACUITY\(^\text{17}\) trial, 2% in the HORIZONSAMI\(^\text{21}\) to as high as 3.4% in the bivalirudin arm of the HEAT-PPCI study\(^\text{15}\). In contrast, the incidence of early ST in our primary PCI study was 2.35%, which is on the upper end of previously published data.

It is found that early ST was associated with significantly higher in hospital mortality, when compared with previously published studies\(^\text{23,24}\). Mortality was more common in patients with subacute stent thrombosis as it was associated with other systemic illnesses such as shock or metabolic acidosis and at the same time acute ST was rapidly diagnosed and treated. This was initially observed by by Ioannis Iakovou et al\(^\text{25}\). Incidence of cardiogenic shock and stroke in patients with early ST was higher (table-II(b)). Higher events of stroke could be secondary to hypotension related hypoperfusion and a increased risk of mural thrombus in ST patients.

Our study has some limitations; The small number of patients with early ST can lead to type II error and because of relatively small number of events we were unable to perform a multiple logistic regression and therefore incapable to execute a propensity score match. Secondly, we analyzed data by using clopidogrel as the preferred antiplatelet agent, and novel antiplatelet agents were not available in our setup. It is difficult to comment if the use of novel antiplatelet agents has reduced the incidence of ST, specifically in light of results of MATRIX and HEAT-PPCI trials where significant patients were on novel antiplatelet agents.

**CONCLUSION**

Early ST remains a rare but an important complication following primary PCI. Diabetes mellitus, increased total ischemic time, length of stent, high thrombus burden and Small stent diameter are associated with early ST.

**CONFLICT OF INTEREST**

This study has no conflict of interest to declare by any author.

**REFERENCES**


CARDIAC SURGERY ASSOCIATED ACUTE KIDNEY INJURY IN RELATION TO CARDIOPULMONARY BYPASS TIME AND AORTIC CROSS CLAMP TIME

Amna, Etizaz Haider Kazmi*, Rashad Siddiqi, Karam Iqbal, Iftikhar Ahmad Zaidi, Rehana Javaid

Armed Forces Institute of Cardiology/National University of Medical Sciences (NUMS) Rawalpindi Pakistan, *Bahria Hospital Islamabad Pakistan

ABSTRACT

Objective: To identify the frequency of cardiac surgery associated acute kidney injury and its association with cardio pulmonary bypass time and aortic cross clamp time.

Study Design: Descriptive cross sectional study.

Place and Duration of Study: Six months duration in Adult cardiac anesthesia department of Armed Forces Institute of Cardiology, Rawalpindi.

Material and Methods: A total of 340 patients undergoing cardiac surgery were evaluated for CSA AKI as per the Akin Kidney Injury Network (AKIN) criteria over a period of 6 months for 5 postoperative days (POD). The chi-square test was used find the relationship of different durations of CPB and aortic cross clamp time with CSA-AKI.

Results: A total of 340 patients (269 male, 71 female; mean age of 54.19 ± 11.73 years, and baseline mean serum creatinine 0.97 ± 0.23 mg%) patients undergone mostly coronary artery bypass grafting, and valvular heart disease correction was evaluated. Nearly 69.7% suffered CSA-AKI. The incidence of acute kidney injury was significantly increased by increase in cardiopulmonary bypass time and aortic cross clamp time with p-values <0.01 and <0.01 respectively.

Conclusion: CSA-AKI is common complication, mostly of AKIN Class-I and increases with increasing CPB and cross clamp time. The AKIN can be identified earlier and can be prevented by decreasing cardiopulmonary bypass time and aortic cross clamp time.

Keywords: Aortic cross clamp time, Cardiac surgery associated acute kidney injury, Cardio pulmonary bypass time.

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INTRODUCTION

Cardiac surgery associated acute kidney injury (CSA-AKI) is one of the common and serious postoperative complication after cardiac surgery that employs cardiopulmonary bypass (CPB). Clinically relevant kidney injury occurs in about 30% of cardiac surgery patients and 1% to 2% require dialysis. Even modest kidney injury is independently associated with markedly increased morbidity and mortality. Cardiac surgery associated kidney injury is caused by a variety mechanisms, including exogenous and endogenous toxins, metabolic abnormalities, ischemia and reperfusion injury, neuro-hormonal activation, inflammation, and oxidative stress. Several risk factors have been identified for postoperative kidney injury such as diabetes mellitus, preexisting kidney disease, and left ventricular dysfunction, cardiopulmonary bypass time (CPB), Intra aortic balloon pump, preoperative anemia, peri-operative red blood cell transfusions, and postoperative exploration. Some of these risk factors such as cardiopulmonary bypass time, and aortic cross clamp time are modifiable. Development of AKI is associated with the use of cardiopulmonary bypass and the, with combined surgical procedures (valve replacement and coronary artery bypass) and prolonged cardiopulmonary bypass times increasing the incidence of AKI in adults. Cardiac surgery associated acute kidney injury increases with increasing CPB time and cross clamp time. The development of AKI in adults undergoing cardiac surgery, is associated with prolonged ICU stay and an increased risk of
death\textsuperscript{11,12}. Our purpose of study was to identify the incidence of cardiac surgery associated acute kidney injury and its association with cardiopulmonary bypass time and cross clamp time and this will help in detecting the potential risk of kidney injury in our setup.

**MATERIAL AND METHODS**

After approval by the ethical committee of our institute; consecutive patients undergoing cardiac surgery were studied in our descriptive-cross sectional study lasting 06 months after approval of abstract/synopsis. Preoperative evaluation, premedication, anesthesia and surgery was performed according to institutional protocols; no adjustments were made for study participants. Demographic data and preoperative serum creatinine cardiopulmonary bypass time and aortic cross clamp time were noted. After the surgery patients were immediately transported to the ICU. Serum creatinine was recorded daily in post operative period for five days. CSA-AKI was determined using acute kidney injury network (AKIN) Criteria. All the patients were assessed for risk stratification and diagnosis of post-operative acute kidney injury by the investigators.

**Data Analysis**

Data was analyzed using statistical package for social science (SPSS) version 20. CSA-AKI incidence and severity was determined using AKIN criteria and expressed in absolute number and percentages. The serum creatinine levels was noted and analyzed in positive and negative cases. Cardiopulmonary bypass time and aortic cross clamp time was recorded and stratified further based on different durations of CPB time and cross clamp time i-e <70, 70-140, >140 minutes and <50, 50-80, >80minutes. The data was analyzed by descriptive statistics (number, percentage, mean and standard deviation) and Chi square was used for analysis of variance. A \( p \)-value<0.05 was taken as significant.

**Operational Definition**

Acute Kidney Injury Network was formed in September 2004. It described Acute kidney injury in terms of three stages using serum creatinine and urine output criteria\textsuperscript{13} (table-I).

**RESULTS**

Two hundred and sixty nine (79.1%) were male and 71 (20.9%) were female. Also mean ± standard deviation (SD) for age and weight were evaluated and found to be of 54.19 ± 11.73 years and 73.71 ± 29.42 kg respectively. The mean ± SD of mean ± SD of mean ± SD

<table>
<thead>
<tr>
<th>Table-I: Serum creatinine criteria.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stage</strong></td>
</tr>
<tr>
<td>-----------</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
</tbody>
</table>

the ICU. Serum creatinine was recorded daily in post operative period for five days. CSA-AKI was determined using acute kidney injury network (AKIN) Criteria. All the patients were assessed for risk stratification and diagnosis of post-operative acute kidney injury by the investigators.
Cardiac Surgery Associated Acute Kidney Injury


injury according to acute kidney injury network criteria.

Increasing Cardiopulmonary bypass time and aortic cross clamp time was also found to be significantly increasing ICU stay \( p \)-value <0.01 and <0.01 respectively, mortality with \( p \)-value of 0.02 and 0.42, and acute kidney injury \( p \)-value <0.01 and 0.01 respectively. Acute kidney injury was significantly associated with increase in mortality and ICU stay with \( p \)-value <0.01.

**DISCUSSION**

In our observational study, it was tried to evaluate the incidence of CSA-AKI with an intention to get more insight so that more appropriate risk stratification can be done. In the present study, 69.7% of the patients were found to develop acute kidney injury by definition of CSA-AKI which is relatively higher as compared to the findings of other studies and reviews. This is probably because we used AKIN criteria used in our study which categorizes even 0.3 mg\% absolute rise of serum creatinine as Class-I acute kidney injury (AKI). The AKIN criteria have shown to diagnose significantly more patients as having AKI as compared to risk, injury, failure, loss of kidney function, and end stage renal failure. The predominant surgery performed in the present study was Coronary bypass grafting (CABG) surgeries (81.2%) as compared to valve replacement surgeries in which is also an independent risk factor for postoperative acute renal failure. Patients with CSA-AKI progressing to renal failure requiring HD varies from 1% to 3%. In our study 2.35% patients required renal replacement therapy. The CPB and cross clamp time has got deleterious effect on kidney leading to acute kidney injury, they are among modifiable risk factors and attention should be paid to reduce CPB time and aortic cross clamp time. Elena Mancini and colleagues found that time on CPB was significantly increased CSA-AKI numbers (\( p \)-value <0.01) was found with increasing trend of CPB durations. The cross clamp time has also shown similar and significant impact on CSA-AKI (\( p \)-value <0.01).

Off-pump or beating heart surgery was developed to avoid post operative complications like kidney injury and pulmonary complications. Kidney injury requiring renal replacement is less common in cardiac surgery without CPB. A meta-analysis of 22 randomized trials was evaluated to compare off-pump and on-pump cardiac surgery with respect to kidney injury off pump patients got benefit. Coronary a very

### Table II: The predominant cardiac diseases requiring surgeries.

<table>
<thead>
<tr>
<th>Disease</th>
<th>Frequency</th>
<th>Percentage</th>
<th>Valid percentage</th>
<th>Cumulative percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coronary artery disease</td>
<td>276</td>
<td>81.2</td>
<td>81.2</td>
<td>81.2</td>
</tr>
<tr>
<td>Mitral valve disease</td>
<td>21</td>
<td>6.2</td>
<td>6.2</td>
<td>87.4</td>
</tr>
<tr>
<td>Aortic valve disease</td>
<td>22</td>
<td>6.5</td>
<td>6.5</td>
<td>93.8</td>
</tr>
<tr>
<td>Double valvedisease</td>
<td>19</td>
<td>5.6</td>
<td>5.6</td>
<td>99.4</td>
</tr>
<tr>
<td>Coronary plus valve disease</td>
<td>2</td>
<td>0.6</td>
<td>0.6</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>340</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

### Table III: The association of acute kidney injury with cardiopulmonary bypass time.

<table>
<thead>
<tr>
<th>cpbtime</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 70 mins</td>
<td>33</td>
<td>25</td>
<td>7</td>
<td>1</td>
<td>66</td>
</tr>
<tr>
<td>70 -140 mins</td>
<td>59</td>
<td>123</td>
<td>21</td>
<td>1</td>
<td>204</td>
</tr>
<tr>
<td>&gt;140 mins</td>
<td>11</td>
<td>31</td>
<td>22</td>
<td>6</td>
<td>70</td>
</tr>
<tr>
<td>Total</td>
<td>103</td>
<td>179</td>
<td>50</td>
<td>8</td>
<td>340</td>
</tr>
</tbody>
</table>

requireing dialysis. In our study significantly increased CSA-AKI numbers (\( p \)-value <0.01) was found with increasing trend of CPB durations. The cross clamp time has also shown similar and significant impact on CSA-AKI (\( p \)-value <0.01).
large randomized controlled trial also compare off-pump and on pump CABG surgery\textsuperscript{23} to find long term effect on kidneys. Our study is a single centre prospective study and patients without cardiopulmonary bypass have not been identified.

**CONCLUSION**

CSA-AKI is very common complication, mostly of AKIN Class-I and increases with increasing CPB and cross clamp time. The AKIN can be identified earlier and can be prevented by decreasing cardiopulmonary bypass time and aortic cross clamp time.

**CONFLICT OF INTEREST**

This study has no conflict of interest to declare by any author.

**REFERENCES**

PATTERNS OF LAD INVOLVEMENT IN INDIVIDUALS TILL 40 YEARS OF AGE PRESENTING AS ACUTE ANTERIOR WALL ST-ELEVATED MYOCARDIAL INFARCTION AND UNDERGOING PRIMARY PERCUTANEOUS CORONARY INTERVENTION

Armed Forces Institute of Cardiology/National University of Medical Sciences (NUMS) Rawalpindi Pakistan

ABSTRACT

Objective: To study the patterns of left anterior descending artery (LAD) involvement in individuals till 40 years of age presenting as acute anterior wall ST elevation myocardial Infarction (AW-STEMI) undergoing primary percutaneous coronary intervention.

Study Design: Descriptive cross-sectional study.

Place and Duration of study: Armed Forces institute of cardiology and National institute of heart diseases from, Jan 2014 to Oct 2017

Material and Methods: Using non probability consecutive sampling technique 223 patients were included in study according to inclusion and exclusion criteria.

Results: Out of 223 patients 205 (91.9%) were male and 18 (8%) were female. Common site for CAD lesion was mid LAD, present in 136 (61.2%) cases followed by proximal, ostial and distal LAD in 66 (29.3%) patients, 11 (5.1%) and 9(4.4%) cases, respectively. Smoking was the most common risk factor for coronary artery disease (CAD) present in 76 (34.5%) cases, hypertesion was the second common prevailing risk factor present in 54 (24.2%) patients. Other less common risk factors were family history of CAD, Diabetes Mellitus present in 43 (19.2%) and 32 (14.3%) cases, respectively. Pulmonary edema was the most common complication seen with ostial and proximal LAD lesions in 1 (9%) and 3 (4.5%) cases, respectively. Other complications were cardiogenic shock, arrhythmias and in hospital deaths.

Conclusion: Most common site for coronary artery disease in young with Ant Wall -STEMI is the mid LAD followed by proximal lesions. Larger studies are needed to study the risk factors, firmly establish the association of coronary lesion site and rate of complications in young patients presenting with acute myocardial infarction and further compare it with older age group population.

Keywords: Anterior wall myocardial infarction, LAD, Primary Percutaneous Coronary Intervention, STEMI, Young.

INTRODUCTION

Coronary artery disease (CAD) is the leading cause of morbidity and mortality, both in developing as well as developed countries. About 17.7 million people died from Cardiovascular Diseases (CVDs) in 2015, representing 31% of all global deaths. By 2030 global projected annual mortality due to CVDs is estimated to rise to 23.3 million. Prevalence of CAD in young is relatively uncommon. Reported incidence of myocardial infarction (MI) in young adults varies between 2% and 10%, according to different studies. Consequences of MI in young, particularly, can be overwhelming due the fact that they provide the workforce and positive impact in every field of life and MI can have potential devastating effects on patient’s mental health and socioeconomic integrity. Moreover there are differences in risk factors and angiographic characteristics of coronary artery lesions in young comparing old patients. Present study was planned to provide an insight into common patterns for left anterior descending artery (LAD) involvement and related complications in individuals till 40 years.
age presenting as acute Anterior Wall ST Elevation MI (AW-STEMI) who underwent primary Percutaneous coronary Intervention (PCI) to LAD at our clinical setup.

**MATERIAL AND METHODS**

This descriptive cross sectional study was carried out at Armed Forces Institute of Cardiology and National Institute of Heart Disease (AFIC and NIHD) Rawalpindi from Jan 2014 to Oct 2017. Study was approved by the institutional review board. Informed consent of patients was taken.

Patients included till 40 years of age of both gender who presented to emergency reception (ER) with typical chest pain of cardiac origin of less than 12 hours duration, Electrocardiograph (ECG) showing ST elevation of at least 0.2 mV in more than one precordial leads and underwent primary PCI to LAD. Patients who had previous history of CAD or PCI and the patients presenting after 12 hours of onset of chest pain were excluded. The demographic data was noted down. Risk factors for CADs were recorded through relevant history and laboratory investigations. Data for patterns of LAD involvement is known through angiographic recordings. Patients were closely monitored in intensive coronary care unit for 48 hours following primary PCI for possible complications.

**Data Analysis**

Data analysis was done using statistical package for the social sciences (SPSS) ver 20. Data was presented in frequencies and proportions.

**RESULTS**

Total number of patients included in our study were 223, out of which 205 (91.9%) were male and 18 (8%) were female. Most common site for CAD lesion was mid LAD, present in 137 (61.2%) cases while proximal, ostial and distal

<table>
<thead>
<tr>
<th>Risk Factors</th>
<th>n=223</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoking History</td>
<td>77</td>
<td>34.5</td>
</tr>
<tr>
<td>Hypertension</td>
<td>54</td>
<td>24.2</td>
</tr>
<tr>
<td>Family History</td>
<td>43</td>
<td>19.2</td>
</tr>
<tr>
<td>Diabetes Mellitus</td>
<td>32</td>
<td>14.3</td>
</tr>
<tr>
<td>No risk factors</td>
<td>17</td>
<td>7.6</td>
</tr>
</tbody>
</table>

**Table-II:** Patterns of LAD involvement in anterior wall myocardial infarction.

<table>
<thead>
<tr>
<th>Site of Lesion</th>
<th>n=223</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osteal</td>
<td>11</td>
<td>5.1</td>
</tr>
<tr>
<td>Proximal</td>
<td>66</td>
<td>29.3</td>
</tr>
<tr>
<td>Mid</td>
<td>137</td>
<td>61.2</td>
</tr>
<tr>
<td>Distal</td>
<td>9</td>
<td>4.4</td>
</tr>
</tbody>
</table>

**Table-III:** Complications in STEMI patients with site of lesion.

<table>
<thead>
<tr>
<th>Complications</th>
<th>Ostal (n=11)</th>
<th>Proximal (n=66)</th>
<th>Mid (n=137)</th>
<th>Distal (n=9)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulmonary Edema</td>
<td>1 (9.0%)</td>
<td>3 (4.5%)</td>
<td>4 (2.9%)</td>
<td>-</td>
</tr>
<tr>
<td>Cardiogenic Shock</td>
<td>2 (18.1%)</td>
<td>-</td>
<td>1 (0.7%)</td>
<td>-</td>
</tr>
<tr>
<td>Arrhythmias</td>
<td>-</td>
<td>1 (1.5%)</td>
<td>-</td>
<td>1 (11.1%)</td>
</tr>
<tr>
<td>Stroke</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Mortality</td>
<td>2 (18.1%)</td>
<td>2 (3.0%)</td>
<td>4 (2.9%)</td>
<td>-</td>
</tr>
</tbody>
</table>

less than 12 hours duration, Electrocardiograph (ECG) showing ST elevation of at least 0.2 mV in more than one precordial leads and underwent primary PCI to LAD. Patients who had previous history of CAD or PCI and the patients presenting after 12 hours of onset of chest pain were excluded. The demographic data was noted down. Risk factors for CADs were recorded through relevant history and laboratory LAD were involved in 66 (29.3%), 11 (5.1%) and 9 (4.4%) cases respectively as shown in table-I. Among the risk factors for CADs, smoking was the most common one present in 77 (34.5%) cases, while hypertension was the second common prevailing risk factor present in 54 (24.2%) subjects. Other less prevailing risk factors were family history of CAD present in 43 (19.2%) and diabetes mellitus in 32 (14.3%) cases. In 17 (7.6%)
patients no risk factors were known for CAD as shown in table-II. Pulmonary edema was the most common complication associated with ostial and proximal LAD lesions present in 1 (9%) and 3(4.5%) cases, respectively. Cardiogenic shock was mainly seen with ostial LAD occlusions. Mortality was 18.1% in ostial LAD disease as shown in table-III.

**DISCUSSION**

Taking into account that the early onset of ischemic heart disease is not so rare, the evaluation of its risk profile, clinical features and prognosis may have a relevant clinical impact for risk factors modification and for the improvement of primary and secondary prevention. In our study 91.9% patients were male same as studies reported by Incalcaterra et al8 and Hosseini et al9 While reported proportions were 84% and 86% in studies reported by Saghir et al10 and Maroszyńska-Dmoch et al11, respectively. Mid LAD was the most common site for coronary artery lesion involved in 61.2% cases. Proximal LAD coronary artery lesion was present in 29.3% cases. Ostal and Distal LAD coronary artery lesions were relatively rare, present in 5.1% and 4.4% cases respectively. These results are consistent with findings of TIMI study Group which showed that mid LAD was the most common site of involvement in young patients with Anterior Myocardial Infarction12. In our study complications were most commonly found with ostal and Proximal LAD disease. Recorded complications were cardigenic shock, pulmonary edema, and Arrhythmias. Overall mortality was 3.0%. These findings were also consistent with the findings of TIMI study group. No local studies were found on the subject even after careful online search to compare our results and the only study available was very old publication of TIMI study group. Identifying and addressing risk factors for CAD in young population is of utmost importance for primordial and primary prevention of CAD. In this study risk factor profile was comparable to national and international studies with smoking being the most common, followed by HTN and Diabetes Mellitus respectively10,13.

**CONCLUSION**

Most common site for coronary artery disease in young with Ant Wall -STEMI was found to be the mid LAD followed by proximal lesions.

Larger studies are needed to study the risk factors, firmly establish the association of coronary lesion site and rate of complications in young patients presenting with acute myocardial infarction and further compare it with older age group population.

**LIMITATION OF STUDY**

This was just an observational study and not a randomized trial for documentation of patterns of LAD involvement in AW-STEMI undergoing PPCI in young patients. Larger studies are needed to assess the risk factor profiles, establish association of site of lesion with complications in young individuals undergoing PPCI for AW-STEMI.

**CONFLICT OF INTEREST**

This study has no conflict of interest to declare by any author

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Acute Anterior Wall ST-Elevated Myocardial Infarction


COMPARISON OF DIFFERENT TYPES OF RESPONSES TO TILT-TABLE TESTING IN PATIENTS OF BOTH GENDERS WITH UNEXPLAINED SYNCPE


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ABSTRACT

Objective: To compare the frequency of various types of responses in both genders undergoing tilt table test with unexplained syncope.

Study Design: A comparative cross-sectional study.

Place and Duration of Study: Department of EP studies, Armed Forces Institute of Cardiology and National Institute of Heart Diseases, Rawalpindi, from Aug 2017 to Jan 2018.

Material and Methods: Patients were recruited through non-probability consecutive sampling. Patients of all age groups of both genders who had syncope as per operational definition were included in our study. Patients who were excluded from the study were, newly diagnosed or previously established history of arrhythmias, coronary artery disease, cardiomyopathies and structural heart disease e.g. HOCM, aortic stenosis, mitral stenosis. Patients who had history of epilepsy on medical record and history of anemia on medical record were also excluded from the study. Base line demographic information of patients (age, gender, duration of complain) and types of responses were recorded on especially designed proforma.

Results: Total 294 patients were recruited for the study. Mean age of the patients was 46.7 ± 8.1 years, with minimum age 12 years and maximum age 85 years. Male patients were found to be 244 (82.4%) while female patients were 50 (16.9%). Mean duration of complaints was 1.5 ± 1.7 months. Our study showed that the most common type of response in male and females were mixed type (88.1%) and (84%) respectively, with the p-value of 0.022. while, cardioinhibitory type response was (2.8%) but found in male gender only. Next most common type was vasodepressor type response common in females with 6% and 2.4% respectively. Subsequently, less frequent type of response was showed with classic type of orthostatic hypotension (2%) while type initial orthostatic hypotension was not recoreded in the study. Females were more frequent than males in Progressive orthostatic hypotension with (5%) and (0.4%) in males. POTS response was not present in either gender.

Conclusion: As our study showed, among type of responses, mixed type of response has a significantly high positive rate being more common in male gender, while vasodepressive type and progressive orthostatic hypotension type being more common in female gender. Tilt-table testing plays a major role during the evaluation of syncope patients, helps to differentiate syncope subtypes and could be useful in guiding treatment. however, the need for using another protocol with a similar diagnostic accuracy in gender specificity is necessary.

Keywords: Tilt-table testing, Syncope, Arrhythmia, Cardiomyopathy.

INTRODUCTION

Syncope is a clinical syndrome defined as a relatively brief and self-limited transient loss of consciousness (TLOC) caused by a period of inadequate cerebral nutrient flow. Most often the trigger is an abrupt drop of systemic blood pressure1. True syncope must be distinguished from other common non-syncope conditions in which real TLOC may have occurred such as seizures or concussions, or in which TLOC may seem to have occurred such as with accidental falls or psychogenic pseudosyncope1.
The tilt table test (TTT) was initially described by Kenny et al., in 1986 as a tool to diagnose syncope of unknown origin. Since then various protocols have been developed. The cornerstone of the test is an orthostatic challenge which is done with the upright tilt. Apart from its main use in the syncope workup, use of the test was described in the evaluation of the presence of autonomic neuropathy in a variety of conditions.

The main idea behind the test is that reflex syncope is due to the abnormal cardiac autonomic reflexes, which lead to inappropriate vasodilatation (vaso-depressive reflex syncope), inappropriate bradycardia (cardioinhibitory reflex syncope) or a mixed response. A prolonged upright position is a known trigger of reflex syncope, where, after an initial normal adaptation to standing, inappropriate vasodilatation or bradycardia appears, leading to symptoms. This is different from the orthostatic hypotension, where the initial response to standing is abnormal. These are benign conditions without any associated increase in mortality and are characterized by vasodilatation or vagally driven bradycardia or asystole, which causes profound systemic hypotension and consequent dizziness, presyncope, and finally, syncope. Older people are at a high risk for syncope due to the physiological changes of aging and the presence of more comorbid conditions and, thereby, more medications, which may predispose them to hypotension. However, a definite relationship between age and type of syncope has yet to be fully documented, particularly in the elderly, whose clinical conditions need further clarification. No such study has been done before in our local population. Results of international studies cannot be generalized on our population due to different genetic makeup and confounding variables. Therefore we planned to determine the frequency of different types of responses in patients with syncope undergoing tilt table test in our local population. Results of our study would help to generate local evidence for further research in this subject.

Syncope

Defined as a sudden transient loss of consciousness with associated loss of postural tone and spontaneous recovery without neurologic deficit and without requiring electrical or chemical cardioversion.

Types of Responses to Tilt-Table Testing

- **Mixed type:** The heart rate falls at the time of syncope, but it does not fall to under 40 beats per minute (bpm), or reaches <40 beats per minute for less than 10 seconds, with or without asystole <3sec. The blood pressure falls before the heart rate falls.

- **Cardio-inhibitory type:** Defined as any one of the following: a) Cardioinhibition without asystole occurs when the heart rate falls to a ventricular rate below 40 bpm for longer than 10 seconds but asystole of shorter than 3 seconds. The blood pressure drops prior to the fall of the heart rate. b) Cardioinhibition with asystole is defined as when the heart rate falls to a ventricular rate below 40 bpm for longer than 10 seconds but with occurrence of asystole for more than 3 seconds. The heart rate fall coincides with or precedes the blood pressure fall.

- **Vasodepressor type:** BP falls to systolic value of <60mmHg. The heart rate does not fall by more than 10% from its peak value at the time of syncope.

- **Initial orthostatic hypotension:** Decrease in BP >40mmHg at standing with spontaneous and fast normalization, so that hypotension and symptoms last <30secs.

- **Classic orthostatic hypotension:** Decrease in systolic BP ≥20mmHg and diastolic BP ≥10mmHg during the first 03 minutes after standing.

- **Progressive orthostatic hypotension:** Slow and progressive systolic BP decline after the 3rd minute of standing.

- **Postural orthostatic tachycardia syndrome (POTS):** Increase in heart rate >30 beats per minute or heart rate >120 beats per minute.
after standing, accompanied by symptoms (e.g. fatigue, dyspnea, light headedness).

MATERIAL AND METHODS

A descriptive cross sectional study was carried out at the department of EP studies, Armed Forces Institute of Cardiology and National Institute of Heart Diseases, Rawalpindi, from Aug 2017 to Jan 2018. Patients were recruited through non-probability consecutive sampling. Patients of all age groups of both genders who had syncope as per operational definition were included in our study. Patients who were excluded from the study were, newly diagnosed or previously established history of arrhythmias, coronary artery disease, cardiomyopathies and structural heart disease e.g. HOCM, aortic stenosis, mitral stenosis. Patients who had history of epilepsy on medical record and history of anemia on medical record were also excluded from the study. Base line demographic information of patients (age, gender, duration of complain) and types of responses were recorded on especially designed proforma. The tilt table test was performed using an electrically controlled tilt table with a foot board for weight bearing, using a Task Force® hemodynamic monitor 3040i. The blood pressure, heart rate, and rhythm was continuously monitored and recorded according to a 2-stage tilt protocol with nitroglycerin (TNG) provocation. The tilt table test was conducted after an initial observation with the patient in the supine position for 10 minutes. The test consisted of 2 consecutive stages. In stage-I, the patient was tilted at 70 degrees for 20 minutes without medication and with control of the heart rate and 3-lead electrocardiography. The blood pressure was continuously and non-invasively monitored during the test. If syncope (or limiting symptoms) developed, the test would be halted and the patient was returned into the supine position. Otherwise, the patient would be taken into stage-II, where 500 micrograms of sublingual TNG was administered and tilting was continued for another 20 minutes. If syncope (or limiting symptoms) occurred during the active phase, the tilt table was rapidly reversed to return the patient to the supine position, and the study was terminated. Data was entered and analyzed with IBM-SPSS version-22.

Table: Comparison of type of responses to tilt-table testing in both genders.

<table>
<thead>
<tr>
<th>Type of responses to tilt-table testing</th>
<th>Male patients n(%)</th>
<th>Female patients n(%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixed Type</td>
<td>215 (88.0%)</td>
<td>42 (84.0%)</td>
<td>0.022</td>
</tr>
<tr>
<td>Cardioinhibitory type with asystole</td>
<td>1 (0.4%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Without Asystole</td>
<td>6 (2.4%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vasodepressor Type</td>
<td>6 (2.4%)</td>
<td>3 (6.0%)</td>
<td>0.001</td>
</tr>
<tr>
<td>Initial orthostatic hypotension</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classic orthostatic hypotension</td>
<td>5 (1.7%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Progressive orthostatic hypotension</td>
<td>1 (0.4%)</td>
<td>5 (10.0%)</td>
<td>1.899</td>
</tr>
<tr>
<td>Postural orthostatic tachycardia syndrome (POTS)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

RESULTS

Total 294 patients were recruited for the study. Mean age of the patients was 46.7 ± 8.1 years with minimum age 12 years and maximum age 85 years. Male patients were found to be 244 (82.4%) while female patients were 50 (16.9%). Mean duration of complaints was 1.5 ± 1.7 months as shown in table-I. Our study showed that the most common type of response in male and females were mixed type (88.1%) and (84%) respectively, with the p-value of 0.022. while,
cardio inhibitory type response was (2.8%) but found in male gender only. Next most common type was vasodepressor type response common in females than males with 6% and 2.4% respectively. Subsequently, less frequent type of response was showed with classic type of orthostatic hypotension (2%) while type Initial orthostatic hypotension was not recorded in the study. Females were more frequent than males in Progressive orthostatic hypotension with (5%) and (0.4%) in males. POTS response was not present in either gender.

DISCUSSION

Tilt-testing enables the reproduction of reflex syncope. Positive responses in patients with neurally mediated syncope are 61-69% and specificity is high (92-94%)5. The most commonly used protocol includes tilting to 70, a passive unmedicated phase of 20 minutes, application of 300-400 μg sublingual nitroglycerine at the 20th minute and an additional 20 minutes of standing12. The most common indication for TTT is to confirm a diagnosis of reflex syncope in patients in whom this diagnosis has been suspected but not confirmed by the initial evaluation. This includes cases with a single unexplained syncope in a high-risk setting or those with multiple recurrent episodes when a cardiovascular cause has been reasonably excluded13. TTT is also recommended when it is of clinical value to demonstrate susceptibility to reflex syncope to the patient. Other indications for tilt-testing are discrimination between reflex syncope and orthostatic hypotension or falls, between TLOC with jerking movements and epilepsy, and in patients with frequent episodes of TLOC and suspicion of psychiatric problems14. Performing tilt-testing according to ESC guidelines could have a high diagnostic yield (higher than most of the other tests). Occurrence and recurrence of TLOC could have a major impact on a patient’s wellbeing and social adaptation15. Most of the tests initially performed on these patients (mostly in general practices and not in dedicated syncope units) do not yield any positive results. It is still widespread practice to refer such cases to a neurologist who will perform different tests to exclude epilepsy, which can be additionally frustrating for the patient. Generally, these tests have a much lower diagnostic yield compared to tilt-testing. In such a situation the ability to apply a simple and non-invasive test (like TTT) which could confirm the diagnosis of the most common syncope type reflex syncope is of great value. The type of response to tilt-testing could guide patient management16. Patients with vasodepressor and mixed syncope and those with orthostatic hypotension most of all need reassurance regarding the benign nature of the condition. Education plays a key role in this setting and includes avoidance of triggering factors, increase in fluid intake, physical counter pressure maneuvers and tilt-training10,17. The proper management for patients with cardioinhibitory syncope with asystole has been the subject of much debate5,8. Several randomized controlled trials4,6,10 based on tilt-testing response have given conflicting results. The International study on syncope of uncertain etiology-2 trial10 showed a striking reduction in the recurrence of syncope with pacing in patients with documented asystole during spontaneous syncope (implantable loop recorder monitoring). International study on syncope of uncertain etiology-2 was a non-randomized trial, but recently its results were confirmed by the randomized International study on syncope of uncertain etiology-3 trial10.

In a study by Noormand et al17 has showed that frequency of mixed type syncope was 36.7%, cardioinhibitory 35.3% and 27.4% was vasodepressive in patients underwent tilt table test7. Our study showed that the most common type of response in male and females were mixed type (88.1%) and (84%) respectively, with the p-value of 0.022. while, cardioinhibitory type response was (2.8%) but found in male gender only. Next most common type was vasodepressor type response common in females than males with 6% and 2.4% respectively. Subsequently, less frequent type of response was showed with classic type of orthostatic hypotension (2%)
while type Initial orthostatic hypotension was not recorded in the study. Females were more frequent than males in Progressive orthostatic hypotension with (5%) and (0.4%) in males. POTS response was not present in either gender.

At present, the issue regarding the appropriateness of pacing patients with TTT-induced asystole during syncope is not fully resolved. The decision to implant a pacemaker (an invasive procedure) should be taken in the clinical context of a benign (in terms of mortality) condition that usually affects young individuals and often children.

CONCLUSION

As our study showed, among type of responses, mixed type of response has a significantly high positive rate being more common in male gender, while vasodepressive type and progressive orthostatic hypotension type being more common in female gender. Tilt-table testing plays a major role during the evaluation of syncope patients, helps to differentiate syncope subtypes and could be useful in guiding treatment. However, the need for using another protocol with a similar diagnostic accuracy in gender specificity is necessary.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

REFERENCES

GAIT SPEED A CLINICAL MAKER OF FRAILTY AS A PREDICTOR OF CARDIAC SURGERY-RELATED COMPLICATIONS AND IN HOSPITAL MORBIDITY IN PATIENTS UNDERGOING CARDIAC SURGERY

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ABSTRACT

Objective: To use gait speed as a frailty marker to predict the adverse outcomes after cardiac surgery and in hospital morbidity of elderly patients undergoing the cardiac surgery.

Study Design: Comparative cross-sectional study.

Place and Duration of study: Department of Cardiac Surgery Armed forces Institute of Cardiology and National Institute of Heart Disease, from Oct 2017 to Feb 2018.

Materials and Methods: This study was conducted on 100 adult patients undergoing the cardiac surgery at AFIC/NHID, over 5 months from Oct 2017 to Feb 2018. Patients included if they were 55 years or older; undergoing coronary artery bypass graft (CABG) surgery, aortic valve surgery, mitral valve surgery, or CABG combined with aortic or mitral valve surgery. The primary predictor was slow gait speed, 5-meter walk in 6 seconds or longer. The primary end point was a composite of post-operative complications and in hospital morbidity.

Results: Comparative cross-sectional study consisted of hundred patients out of which 81 (81%) were male and (19) 19% were female patients. Ninety two (92%) with a mean age of 62.5 ± 5.3 years. The post-operative complications like prolonged ventilation with p-value (p<0.001), deep sternal wound infection (p=0.41), Pulmonary complications (p=0.002) and prolonged post-operative length of stay (p<0.001) were more in patient with slow and slowest walking speed and differences were highly significant. There was no significant different in stroke (p=0.771), reoperation (p=0.342) and readmission (p=0.451) with slow and slowest gait speed.

Conclusion: Gait speed is most economical and independent predictor of adverse outcomes and morbidity after cardiac surgery. Gait speed as a frailty marker may help to identify, screen and subset the adult population at high risk of adverse outcomes of cardiac surgery that could benefit from further assessment.

Keywords: Cardiac surgery, Coronary artery bypass graft, Gait speed test.

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INTRODUCTION

Walk is a basic and necessary component of functional mobility so a person can move around and complete their everyday tasks. Slowness of movement with aging is a complete biological phenomena that involves integrity of physiological system like nervous system, skeletal system, muscular system, respiratory system and the circulatory system. In medicine, frailty is used to define as older adults with impaired resistance to stressors due to a decline in physiologic reserve. In older adults, the prevalence of frailty is 10%. Slow walking speed is a reliable and valid source to measure frailty and found to be associated with adverse outcomes of cardiovascular disease. Gait speed test measured as the time required to walk a short distance (usually 5m) at a comfortable pace and one of the most commonly used tests to screen for frailty and identify high-risk adults that need further evaluation. Gait speed test is found most promising especially in cardiac surgery, where an aging and heterogeneity of older adults make clinical decision making very challenging and also inherent stress to surgery. Prediction of morbidity is particularly relevant to the older adults because they have less resiliency to complications and complications are a noteworthy driver of increase hospital billing, adverse outcomes can affect the quality of life, and prolongs the stay in hospital. Numerous

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cross-sectional and randomized studies have shown adverse outcomes of cardiac surgery are fairly large, older adults undergoing cardiac surgery has already presented with many comorbid illnesses which make them frail so they present with adverse outcome after surgery that make effect their hospital stay longer with adverse outcomes of post-operative complications. The frailty assessment before cardiac surgery (Frailty ABCs) study measured gait speed in 131 patients undergoing cardiac surgery and found that slow gait speed (<0.83 m/s) was associated with an odds ratio (OR) of 3.05 (95% CI, 1.23-7.54) for in-hospital mortality or major morbidity. As walking speed is a clinical marker of frailty and gait speed is very simple and can help to identify, screen and subset the adult population at high risk of adverse outcomes of cardiac surgery: The purpose of this study was to use gait speed as a frailty marker to predict the adverse outcomes after cardiac surgery and morbidity of elderly patients undergoing the cardiac surgery.

MATERIAL AND METHODS

A comparative cross-sectional study was conducted on hundred patients undergoing the cardiac surgery at AFIC/NIHD, over 5 months from Oct 2017 to Feb 2018. Eligible patients were approached. Based on this 5-m gait speed test, walking speed more than or equal to 6 sec is considered as slow and less than 6 sec as normal. Timed measured by a stopwatch over a short distance (5 meter). Patients were permitted to use any mobility aid. Measured straight walk on a level indoor surface without turns (excluding walking on treadmill). Test begins on the word “go”; start the timer with the first footfall on the 0-m line; and stop the timer with the first footfall on the 5-m line. To take average, this test was repeated 3 times, for accurate measurement. Although speed is typically measured in m/s, it was elected to report it in seconds (taken to walk 5 m) to facilitate subsequent bedside application and interpretation of this test in clinical practice without any calculations.

Outcome variables

The primary end point was in-hospital morbidity and post-operative complications increasing the length of stay. These complications were stroke (central neurologic deficit persisting >72 h), prolonged ventilation (>24 h), deep
sternal wound infection (requirement for operative intervention and antibiotic therapy, with positive culture), pulmonary complications (pleural effusions and atelectasis), readmission, need for reoperation (for any reason) and prolonged post-operative length of hospital stay (>10 days after surgery).

**Statistical Analysis**

The statistical analysis was carried out using SPSS 23 (Statistical package for social sciences) software. Statistical test applied was chi-square and descriptive statistics was applied to calculate mean, standard deviation and frequencies.

**RESULTS**

This comparative cross sectional study consisted of 100 patients with a mean age of 62.5 ± 5.3 years; 81 (81%) were male and 19 (19%) were female patients. No patients were lost to follow-up. Out of these patients, Body mass index (calculated as weight in kilograms divided by height in meters squared), thirty eight (38%) were overweight, twenty three (23%) were underweight and thirty two (32%) were obese patients. Among comorbid conditions, hypertension was most common condition in fifty six (56%) patients and the frequency of other comorbidities like diabetes was in thirty four (34%) patients, dyslipidemia 3 (3%) and twenty seven (27%) were active smokers. The mean and standard deviation of LVEF in percentage 53.9 ± 10.1. Prior to surgery eighty (80%) patients reported dyspnea at NYHA class-II, sixteen (16%) were at NYHA class- I, 4 (4%) were at NYHA class-III. The surgery performed was isolated CABG in ninety two (92%) Patients, four (4%) had AV replacement, two (2%) had MV replacement only and two (2%) AV replacement+CABG. Among Post-operative complications 52 patient went on prolonged ventilation, there was a significant association (p=0.000) that slowest walker had prolonged ventilation (n=50) than slow walkers (n=2). eleven patients had deep sternal wound infection are slowest walkers (p=0.41), twenty patients had pulmonary complications were slowest walker (p=0.002). There was no significant association between stroke and slow gait speed or slowest gait speed (p=0.771), reoperation (p=0.342) and readmission (p=0.451). There was a significant association between prolonged post-operative length of stay (>10 days). Among 39 patients with prolonged stay n=33 with slowest gait speed, n=1 with slow gait speed and n= 5 was with normal gait speed (p<0.001) as shown in table.

**DISCUSSION**

The finding of this study was to use gait speed as a frailty marker to predict the adverse outcomes after cardiac surgery and in hospital morbidity of elderly patients undergoing the cardiac surgery. The 5-m gait speed test was successfully implemented at 109 centers in more than 15000 patients during a 3-year time frame. Slow gait speed was independently predictive of operative mortality and, to a lesser extent of major morbidity and adverse outcomes of cardiac surgery. This result was observed across a spectrum of the most commonly performed
cardiac surgical procedures used to treat ischemic and valvular heart disease. Overall, for each 0.1-m/s decrease in gait speed (e.g., taking 6 seconds as opposed to 7 seconds to walk the 5-m course at a comfortable pace), there was an 11% relative increase in operative mortality after adjusting for STS-PROM12,13. Afilalo et al, reported that an impaired gait speed (a simple measure of frailty) can be used to identify elderly patients at high risk of major in-hospital events after cardiac surgery. They defined the primary predictor slow gait speed as the time taken to walk 5 m in more than 6 s, consistent with our findings patients that participants presented with slow walking speed had adverse outcomes and increased length of stay after cardiac surgery13. Patients undergoing cardiac surgery had twice incidence of stroke and renal failure post-operatively14,15 but in this study there was no significant association between stroke and slow gait speed or slowest gait speed (p=0.771), reoperation (p=0.342) and readmission (p=0.451). Although it is clear that frailty portends adverse outcomes, its subjective nature has inhibited the application of this knowledge. This study supports the use of the 5-m gait speed test as an objective measure of frailty and should help overcome this barrier. Gait speed can play an influential role in defining the appropriate treatment plan for the older patient. In addition to signaling for further evaluation and support at the slow end of gait speed, it can be reassuring at the high end of gait speed despite a patient’s advanced chronological age. Prediction of operative risk, particularly in the complex clinical case of a patient with multiple chronic conditions, can help the care team and patient arrive at the most informed decision aligned with values and goals for both survival and quality of life. This shared decision may on occasion be for a less-invasive option, such as percutaneous intervention, medical management, or comfort care. When cardiac surgery is the treatment of choice, this real-world study reaffirms that older adults have the potential for excellent outcomes with low overall rates of mortality and major morbidity. To further improve outcomes, comparative effectiveness studies are needed to determine whether the risks of cardiac surgery are modulated by patient frailty, as are randomized clinical trials to determine whether the benefits of cardiac surgery are maximized by concomitant interventions, such as exercise training, nutritional supplementation, multidimensional programs, home-based services, and drug therapies16,17,18,20,21.

CONCLUSION

This study adds to the growing body of literature that has shown that slow gait speed is prevalent in patients with cardiovascular disease and predictive of adverse outcomes16. To our knowledge, this study test the value of gait speed as frailty marker in patients undergoing cardiac surgery. As gait speed is most economical, and independent predictor of adverse outcomes and morbidity after cardiac surgery. It may be useful to identify, screen and subset the elderly population at high risk of adverse outcomes of cardiac surgery that could benefit from further assessment. Additional research is needed to examine the effect of gait speed on long-term hazards and patient-centered outcomes, and to develop targeted interventions that can offset the negative impact of frailty.

LIMITATION OF STUDY

There are a number of limitations in this study. The primary end point was measured in-hospital as opposed to long term, and events occurring after discharge or transfer were not captured. This is particularly relevant for deep sternal wound infections that typically occur weeks after surgery, once patients have been discharged. This study conducted at single center with relatively small sample size and male patient were more than female patient so we suggest that multicenter study required with large sample size representing gender equality around Pakistan for more examination.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.
REFERENCES


COMPARISON OF GABAPENTIN AND LORAZEPAM AS PREMEDICATION TO ATTENUATE THE PRESSOR RESPONSE TO INTUBATION IN CARDIAC PATIENTS UNDERGOING CORONARY ARTERY BYPASS GRAFT SURGERY; A RANDOMIZED CONTROLLED TRIAL

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ABSTRACT

Objective: To determine the efficacy of Gabapentin and Lorazepam as premedication to reduce the pressor response to intubation in cardiac patients undergoing CABG surgery.

Study Design: Randomized control trial.

Place and Duration of Study: Adult cardiac anesthesia department of Armed Forces Institute of Cardiology, Rawalpindi, from Nov 2017 to Feb 2018.

Material and Methods: This double blinded randomized clinical trial was carried out on 110 patients scheduled for elective CABG under general anesthesia with endotracheal intubation. Patients were divided into two equal groups, where group A patients received 300mg of Gabapentin (Gabix) R in one dosage and group B received 2mg of Lorazepam (Ativan) R in one dosage, 4 hours before shifting to OT. Patient’s hemodynamic parameters including heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial pressure (MAP) were recorded before induction of anaesthesia (baseline) and at 1, 5 and 10 minutes after tracheal intubation.

Results: There was no significant difference in the baseline hemodynamic parameters of the patients in two groups, the inter-group comparison showed significantly higher HR, SBP, DBP and MAP at 1, 5 and 10 minutes after tracheal intubation in group B (lorazepam) patients ($p<0.05$).

Conclusion: Premedication with 300 mg of oral Gabapentin four hour before surgery better attenuates the hemodynamic response to laryngoscopy & intubation in comparison to 2mg of oral Lorazepam.

Keywords: CABG, Endotracheal intubation, Premedication.
suggested to control these hemodynamic responses and prevent hemodynamic instabilities.\textsuperscript{7,8}

Gabapentin, a structural analogue of gamma-aminobutyric acid, has revealed to have multi-modal effects which make it a potentially useful drug for premedication in adults, providing postoperative analgesia and preoperative anxiolysis while preventing chronic postsurgical pain, postoperative nausea and vomiting and delirium.\textsuperscript{9} In addition, the drug has also been reported to successfully attenuate the cardiovascular responses to tracheal intubation. This beneficial effect of Gabapentin is probably due to inhibition of membrane voltage gated calcium channels, an action similar to calcium channel blockers. Two recent randomized controlled trials have shown that oral Gabapentin premedication attenuated the hemodynamic changes following tracheal intubation.\textsuperscript{10,11} On the other hand, benzodiazepines used as sedative and anxiolytic medications, are routinely administered to mechanically ventilated (MV) patients in ICU but have been associated with prolonged mechanical ventilation and ICU length of stay (LOS).

As there is no contemporary data documenting the comparison of the effects of Gabapentin and Lorazepam on reduction of presser response in cardiac surgical patients, we conducted this study to evaluate the effects of premedication dose of oral Gabapentin (Gabix) 300 mg and premedication dose of oral Lorazepam (Ativan) 2 mg in patients undergoing coronary artery bypass grafting (CABG) surgery.

**MATERIAL AND METHODS**

This study was double blind randomized control trial conducted at Armed Forces Institute of Cardiology/NIHD from between November 2017 and February 2018. After approval of the hospital ethics committee, consecutive 110 patients scheduled for elective CABG, were randomly allocated in two groups A and B using computer generated random number tables. After taking informed consent from the patient and a day before surgery, when the patients were listed up for surgery, the in-charge nurse of the pre-operative ward was informed by the investigator to allocate the patient in either of the two groups. Neither the patient nor the anaesthetist planned to be conducting the surgery next day, did not know what premedication the patient had received. Patients in group A (n=55) received 300 mg of Gabapentin, 4 hours before shifting to OT with a sip of water, and patients in group B (n=55) received 2 mg of Lorazepam, 4 hours before shifting to OT with a sip of water. All patients were induced with standard intravenous induction drugs including propofol 1 mg/kg, fentanyl 3 ug/kg, midazolam 2 mg and sevoflurane 4%. An anesthesiology resident who was blinded to the study recorded baseline parameters of patients including heart rate (HR), systolic blood pressure (SBP), and diastolic blood pressure (DBP), mean arterial pressure (MAP) immediately before intubation (baseline), and at

<table>
<thead>
<tr>
<th>Variable</th>
<th>Gebapentin (N=55)</th>
<th>Lorazepam (N=55)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Mean ± SD)</td>
<td>59.1 ± 8.3</td>
<td>62.3 ± 7.9</td>
<td>0.03</td>
</tr>
<tr>
<td>BMI (Mean ± SD)</td>
<td>24.3 ± 2.0</td>
<td>24.3 ± 1.6</td>
<td>0.83</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>42 (76.3%)</td>
<td>33 (60.0%)</td>
<td>0.10</td>
</tr>
<tr>
<td>Female</td>
<td>13 (23.6%)</td>
<td>22 (40.0%)</td>
<td></td>
</tr>
<tr>
<td>Hypertension</td>
<td>46 (83.6%)</td>
<td>51 (92.7%)</td>
<td>0.11</td>
</tr>
<tr>
<td>Diabetes</td>
<td>33 (60.0%)</td>
<td>35 (63.6%)</td>
<td>0.84</td>
</tr>
<tr>
<td>Smokers</td>
<td>20 (36.3%)</td>
<td>14 (25.4%)</td>
<td>0.30</td>
</tr>
</tbody>
</table>
1, 5 and 10 minutes after tracheal intubation. Patients of both genders and age between 25 to 65 years, undergoing elective CABG surgery were included in the study. Patients with emergency CABG, uncontrolled hypertension, patients with missed dose of beta blockers and with severe renal dysfunction with serum creatinine level >2 micromole/L and/or Creatinine clearance <40 ml/min. were excluded from our study.

RESULTS

The results were available for all 110 patients. There was no significant difference between the demographics including age, gender, body mass index (BMI) and co-morbid like hypertension and diabetes in the patients of two groups, except the Gabapentin group had more smokers than the Lorazepam group (table-I).

The baseline hemodynamic variables including SBP, DBP, MAP, and HR were all similar in the two groups (p>0.05). Although, there were similar trend in the hemodynamic response to tracheal intubation in both groups, i.e. a rise in SBP and DBP at 1 and 5 minutes interval, post-intubation and returning towards baseline at 10 minutes, these hemodynamic changes were significantly pronounced in patients of group B (receiving Lorazepam) as shown in tables-II & III.

DISCUSSION

Hemodynamic response to tracheal intubation remains a sore point for the practicing anaesthesiologists all across the world. A lot of work has been done in patients undergoing cardiac as well as non-cardiac surgeries using different drugs and comparing their effects on patients.

In our study it was found that the changes in hemodynamic variables (i.e. the rise in HR, SBP, MAP and DBP) were present in both groups, but the measures of these indicators were significantly lower in Gabapentin group at all time points. Review of recent literature had

Table-II: Comparing mean arterial pressure and Heart rate between the Gabapentin and Lorazepam groups at different time points of intubation.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Gebapentin (n=55)</th>
<th>Lorazepam (n=55)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAP baseline</td>
<td>111.7 ± 15.3</td>
<td>109.4 ± 10.8</td>
<td>0.38</td>
</tr>
<tr>
<td>MAP after 1minute of intubation</td>
<td>100.0 ± 16.7</td>
<td>114.6 ± 10.1</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>MAP after 5 minute of intubation</td>
<td>89.5 ± 14.8</td>
<td>103.3 ± 10.3</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>MAP after 10 minute of intubation</td>
<td>84.9 ± 12.0</td>
<td>93.5 ± 10.0</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>HR baseline</td>
<td>83.6 ± 11.7</td>
<td>74.2 ± 11.2</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>HR after 1minute of intubation</td>
<td>78.6 ± 14.7</td>
<td>82.6 ± 13.1</td>
<td>0.132</td>
</tr>
<tr>
<td>HR after 5 minute of intubation</td>
<td>71.6 ± 12.1</td>
<td>74.2 ± 9.4</td>
<td>0.182</td>
</tr>
<tr>
<td>HR after 10 minute of intubation</td>
<td>68.8 ± 9.5</td>
<td>66.8 ± 9.9</td>
<td>0.298</td>
</tr>
</tbody>
</table>

Table-III: Comparing systolic and diastolic blood pressure between the Gabapentin and Lorazepam groups at different time points of intubation.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Gebapentin (n=55)</th>
<th>Lorazepam (n=55)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systolic BP baseline</td>
<td>159.2 ± 18.6</td>
<td>156.7 ± 15.8</td>
<td>0.43</td>
</tr>
<tr>
<td>Systolic BP after 1 minute of intubation</td>
<td>138.5 ± 23.4</td>
<td>161.0 ± 15.5</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Systolic BP after 5 minute of intubation</td>
<td>120.7 ± 19.8</td>
<td>144.8 ± 15.6</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Systolic BP after 10 minute of intubation</td>
<td>113.7 ± 14.5</td>
<td>128.6 ± 14.8</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Diastolic BP baseline</td>
<td>89.1 ± 14.0</td>
<td>86.1 ± 10.3</td>
<td>0.20</td>
</tr>
<tr>
<td>Diastolic BP after 1minute of intubation</td>
<td>81.8 ± 14.9</td>
<td>91.6 ± 9.7</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Diastolic BP after 5 minute of intubation</td>
<td>73.8 ± 13.6</td>
<td>83.3 ± 9.9</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Diastolic BP after 10 minute of intubation</td>
<td>70.1 ± 12.9</td>
<td>88.8 ± 96.0</td>
<td>0.158</td>
</tr>
</tbody>
</table>
similar results and is comparable with our study. The hemodynamic presser response during laryngoscopy and intubation occurs frequently\textsuperscript{14}. Shribman et al reported that laryngoscopy increases the blood pressure and catecholamine levels, while intubation significantly increases heart rate which could lead to dangerous sequelae\textsuperscript{13,14}. Though various agents have been used to prevent these pressure responses, but still the search for ideal agent continues\textsuperscript{15-18}. Our study shows that the presser response to intubation does occur after premedication with Gabapentin, but the severity is much less as compared to the patients receiving Lorazepam.

Our study concurs with the study conducted by Rastogi et al who found that 150 mg of pregabalin successfully attenuated the hemodynamic response to airway instrumentation\textsuperscript{19}. However, unlike other studies our study did not note any significant difference in the heart rate between the two groups following intubation. The probable reason could be the dose and type of different premedication and induction agents used in other studies.

Our study also confers to the study done by Chaudhary et al who did a comparative study between pregabalin and clonidine. They observed that pregabalin was equally efficacious in stabilizing the hemodynamics during laryngoscopy. However, pregabalin premedication was associated with higher mean heart rate values after intubation as compared to the clonidine group\textsuperscript{20-24}.

In another comparative study, Raichurkar et al concluded that 200μg clonidine and 150mg pregabalin given 90 minutes before surgery and noted that pregabalin was better in attenuating hypertensive response to airway instrumentation while heart rate was better attenuated by clonidine premedication\textsuperscript{25}.

The present study is comparable with other similar studies that has obtained some powerful evidence indicating that the use of oral gabapentin, even hours before tracheal intubation can be successful for attenuation of the hemodynamic response to laryngoscopy and intubation\textsuperscript{26-28}. The mechanism of hemodynamic response attenuation following preoperative gabapentin administration is already unknown. One of the anticipated mechanisms is inhibition of membrane voltage-gated calcium channels that is similarly identified following use of calcium channels blockers. In fact the non strychnine site of NMDA receptor and two subunits of voltage-sensitive calcium channels have been indicated as the binding sites of gabapentin, thus can mediate hemodynamic indices stability by gabapentin\textsuperscript{29-31}. In another study, decreasing the synthesis of some neurotransmitters such as glutamate has been suggested as the mechanism of hemodynamic stability following gabapentin administration\textsuperscript{29}. Besides, it has been shown that the change in arterial pressure usually occurs the following laryngoscopy while the maximum increase in heart rate can occur during endotracheal intubation\textsuperscript{31}. On the other hand, gabapentin mechanism of action in attenuating heart rate and blood pressure response to tracheal intubation might be different\textsuperscript{32}, and more studies in this field are needed.

**CONCLUSION**

We conclude that premedication with 300 mg of oral gabapentin four hours before surgery better attenuates hemodynamic response to laryngoscopy & intubation along with acceptable levels of sedation in comparison of 2mg of lorazepam.

**ACKNOWLEDGEMENT**

We thank research and development department AFIC/NIHD staff specially Shahzaib Arshad and Nazma Latif for helping in data collection and entry.

**CONFLICT OF INTEREST**

This study has no conflict of interest to be declare by any author.

**REFERENCES**


BALLOON ATRIAL SEPTOSTOMY: IS BEDSIDE PROCEDURE SAFE AND EFFECTIVE UNDER TRANSTHORACIC ECHOCARDIOGRAPHIC GUIDANCE?


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ABSTRACT

Objective: To evaluate the safety and efficacy of balloon atrial septostomy under transthoracic Echocardiographic guidance in ward setting in patients with transposition of great arteries.

Study Design: Comparative cross-sectional study.

Place and Duration of Study: Armed Forces Institute of Cardiology Rawalpindi from Jan 2012 to Dec 2014.

Material and Method: It was a comparative cross-sectional study of all consecutive young infants with transposition of the great arteries that underwent balloon atrial septostomy for restrictive inter-atrial communication and cyanosis from January 2012 to December 2014. In group 1, balloon atrial septostomy was performed under local anesthesia in ward setting successfully. The cases who were shifted to catheterization lab for completion of procedure assigned as group 2 (procedure started in ward but couldn’t be completed).

Results: A total of 49 patients with transposition of the great arteries underwent balloon atrial septostomy during study period, 77.6% (n=38) of these were male and 22.4% (n=11) were female. A total of 44.8% (n=22) patients presented in 1st week with significant \( p \)-value <0.05. Balloon atrial septostomy was successfully performed in ward in 42 cases (group 1), while seven cases (group 2) were shifted to cath lab for completion of procedure. There was significant improvement in Oxygen saturation post-procedure with \( p \)-value of <0.05 in both groups and there was positive correlation between post-procedural Patent foramen ovale size and post-procedural oxygen saturation. Independent t-test was applied to compare both groups and there was no significant statistical difference between two groups.

Conclusion: Balloon atrial septostomy was found to be safely performed in ward setting under transthoracic guidance, provided expertise of technique are available. However facilities of catheterization lab should also be available for backup.

Keywords: Balloon atrial septostomy, Transposition of great vessels.

INTRODUCTION

Congenital heart diseases occur in approximately 6 in 1,000 live births and transposition of the great arteries (TGA) is the most commonly diagnosed cyanotic congenital heart disease presenting in the neonatal period\(^1,2\). In TGA, the aorta and pulmonary arteries do not arise from their respective ventricles, resulting in ventriculo-arterial discordance and thus parallel pulmonary and systemic circulation. In the patients with un-repaired TGA, delivery of oxygen to tissues, including the brain, is dependent on mixing between the systemic and pulmonary circulations. An adequate inter-atrial communication along with prostaglandin infusion to keep patent ductus arteriosus open, are the two very important components of initial stabilization of young infants with unrepaired TGA\(^3\).

Balloon atrial septostomy (BAS) was introduced by Rashkind and Miller in 1966 and is an effective palliative procedure in children with transposition of the great arteries and poor inter-circulatory mixing\(^4\). The non-restrictive atrial communication improves systemic oxygen saturations and helps in preoperative stabilization prior to definitive arterial switch operation (ASO)\(^5,7\). BAS can be performed in catheterization lab as conventional manner or can be done in...
intensive care/ward settings under transthoracic echocardiography guidance. In fluoroscopic guided cardiac catheterization, there is exposure to radiation and involves shifting of young infants to cath lab which may increases the risks of destabilization and hypothermia. Moreover as a bedside procedure it is cost effective too. We are reporting our three years’ experience of BAS in young infants done in ward setting under transthoracic guidance in department of paediatric cardiology.

**MATERIAL AND METHODS**

It was a comparative cross-sectional study of all consecutive young infants with transposition of the great arteries that underwent BAS for restrictive inter-atrial communication, from January 2012 to December 2014 Armed Forces Institute of Cardiology Rawalpindi. Balloon septostomy was performed under local anesthesia in ward setting successfully, allotted as group 1. Those who failed in ward were taken to catheterization lab and assigned as group 2. A detailed proforma was filled for each patient. Detailed maternal, patient history and examination including gender, gestational age, birth weight, postnatal age of admission, oxygen saturation levels before and after procedure, presenting complaints and complications were recorded. Baseline investigations including complete blood count, infective markers and biochemistry were also recorded. Pre-procedural echocardiographic findings were also recorded. Informed consent was taken before procedure. Neonates were kept warm throughout the procedure by warmers. Femoral vein was preferred mode of access in both groups. After establishing venous line (confirmed by transthoracic echo by visualizing wire in IVC or by injecting saline in IVC), 1.8 ml septostomy balloon advanced from IVC to right atrium across the PFO to left atrium. The standard subcostal view was mainly used to delineate the inter-atrial septum and to guide the balloon catheter. In all cases, 6F short sheaths were used. After confirming position in left atrium, balloon inflated and pulled back to right atrium with quick yet precise force to create an adequate inter-atrial communication. Procedure repeated till desired results achieved. In group 2, we could not cross the PFO with echo guidance and thus shifted to cath lab and procedure was completed under fluoroscopy guidance.
Post procedural care included intravenous fluids, two doses of antibiotics and keeping baby dry and warm. Post-procedural echo was done for size of PFO and for ventricular functions and pericardial effusion. Post procedural saturations were recorded. Data was analyzed in SPSS 16.

**Data Analysis**

Descriptive statistics including means, standard deviations and percentages for variables like degree of hypoxia, complications and outcome were calculated. A p-values calculated for quantitative analysis. Group 1 and 2 were compared by independent t-test.

**RESULTS**

A total of 49 patients with TGA underwent BAS during study period, 77.6% (n=38) of these were male and 22.4% (n=11) were female (fig-I).

A total of 44.8% (n=22) patients presented in 1st week with significant p-value<0.05 and 37% patients were severely cyanosed with oxygen saturation <50%. In 83.7% (n=41) cases via right femoral vein, 14.3% (n=7) via left femoral vein and in 2% (n=1) cases umbilical vein was utilized as mentioned in fig 2.

Balloon atrial septostomy was successfully performed in ward in 42 (86%) cases (group 1), while seven (14%) cases (group 2) were shifted to cath lab for completion of procedure as shown in table-I. In group 2, mean fluoroscopy time was 2.2 ± 1.4 minutes. One patient had respiratory arrest which was managed with positive pressure ventilation and another one developed minimal pericardial effusion in group 1 which was managed conservatively and dissolved itself over next two days as mentioned in table-II. There was significant improvement in Oxygen saturation post- procedure with p-value of <0.05 in both groups. There was positive correlation (r=+0.613, p-value 0.00) between post-procedural PFO size and post-procedural oxygen saturation.

Independent t-test was applied to compare both groups and there was no significant statistical difference between two group.

**DISCUSSION**

TGA is the most common cyanotic congenital heart disease in neonatal period and mostly presents in first week of life. In developing country like ours, presentation of these cases can be delayed due to lack of adequate health facilities and early recognition. In our study population only 44.8% presented during first week of life. TGA is more common in males as reported by many studies, and in accordance 77.6% of our study population was male. To maintain adequate oxygen saturations, it’s mandatory to

| Table-I: Parameters of both groups are compared as follows |
|---------------------------------|---------------|---------------|
| Parameter | Group 1 (mean ± SD) | Group 2 (mean ± SD) |
| Weight (kilogram) | 3.05 ± 0.32 | 3.2 ± 0.39 |
| Length (cm) | 52.4 ± 2.5 | 52 ± 3.3 |
| Mean age of presentation (days) | 15.2 ± 17.65 | 21.28 ± 31.3 |
| Pre-procedural saturation % | 56.2 ± 8.59 | 51 ± 6 |
| Post-procedural saturation % | 79.19 ± 3.9 | 77 ± 3.69 |
| Pre-procedural PFO (mm) | 1.96 ± 0.26 | 1.81 ± 0.36 |
| Post-procedural PFO (mm) | 4.7 ± 0.54 | 4.7 ± 0.68 |
| Time of Procedure (minutes) | 42.93 ± 14.17 | 58.57 ± 21.54 |

| Table-II: Comparison of safety parameter between two groups |
|---------------------------------|---------------|---------------|
| Safety Parameter | No. of patients Group 1 | No. of patients Group 2 |
| Respiratory arrest | 1 | 0 |
| Pericardial effusion | 1 | 0 |
| Cross over rate | 7 | 0 |
have some form of free mixing between systemic and pulmonary circulation. It can be either achieved at atrial level or by having unrestricted large VSD or PDA. In neonates with small restrictive interatrial communications, even presence of VSD/PDA may not allow adequate mixing of blood, thus necessitating creation of ASD with the help of balloon atrial septostomy. Rashkind and Miller, in 1966 gave description of the BAS and thus open door for interventional cardiology12,13. BAS is of established value in the management of many congenital heart diseases in the neonatal period and most important of all is TGA. BAS can be performed in cath lab under fluoroscopic monitoring, ITC or in paediatric wards under echocardiographic control at bedside14. In ward, it is easy to maintain body temperature of young infant and also avoids potential destabilization while shifting the baby to cath lab and moreover we can prevent child from undue exposure of radiations.

We offered BAS in ward setting to 49 patients and were completely done in ward in 85.7% of the patient. However, in only 14.2% septostomy balloon could not be advanced to left atrium under echo guidance and procedure was completed under fluoroscopy guidance. In almost all patients (98%) percutaneous femoral vein was used to access central line which carry lowest post-op complications as discussed in another study by Porter et al15 There was significant improvement in Oxygen saturation post-procedure with p-value of <0.05 in both groups. The diameter of the foramen ovale was the most important factor influencing arterial oxygenation16,17. We found no statistical difference when both groups were compared. In many centers, with trained specialists, it is performed at bedside and considered safe and cost-effective18.

CONCLUSION

Bedside BAS was found and effective procedure and also helped in prevention risk of radiation exposure without a change in efficacy. However facilities of catheterization lab should be available as a standby.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

REFERENCES

FREQUENCY AND OUTCOME OF ACUTE LEFT VENTRICULAR FAILURE IN PATIENTS UNDERGOING PRIMARY PERCUTANEOUS CORONARY INTERVENTION FOR ST-SEGMENT ELEVATION ANTERIOR WALL MYOCARDIAL INFARCTION

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ABSTRACT

Objective: To determine the frequency and outcomes of acute left ventricular failure in patients undergoing primary PCI for ST segment elevation anterior wall myocardial infarction.

Study Design: Descriptive cross-sectional study.

Place and Duration of Study: Adult cardiology department, Armed Forces Institute of Cardiology & National Institute of Heart Diseases Rawalpindi, Pakistan from January 2017 to June 2017.

Material and Methods: One hundred and twenty patients of both genders between 20 to 90 years of age meeting the inclusion criteria were recruited in the study. ECG was done for every patient for diagnosis of acute anterior wall myocardial infarction. Blood test including cardiac biomarkers was sent. Patients with acute anterior wall MI, their outcomes like acute left ventricular failure, pre or post primary PCI outcomes and in-hospital mortality were documented for every patient.

Results: Out of 120 patients who underwent primary PCI for acute anterior wall MI, 101 (84.4%) patients were males while 19 (15.6%) patients were female patients. Mean age of the patients was 54.6 ± 7.5 years. Forty (33.3%) patients had single vessel coronary artery disease, 48 (40%) had double vessels coronary disease and 32 (26.7%) patients were with triple vessels coronary artery disease. Forty five (37.5%) patients had peri-procedural acute LVF. One hundred and ten (91.7%) patients improved and were discharged from hospital. In-hospital mortality was 8.3%.

Conclusion: It is concluded from our study that primary PCI is first choice and best reperfusion strategy because it improves acute LVF and its outcome in patient with acute anterior wall MI and hence reduce morbidity and mortality.

Keywords: Anterior wall MI, Primary PCI, Acute LVF

INTRODUCTION

Acute left ventricular failure is a serious condition. It affects 38 million patients worldwide. The development of heart failure has a negative effect on the outcome of Acute MI patient. It is accordingly considered as “a warning sign for death” among them¹. Its prevalence is 10-40% in acute MI patients². The most common mechanical complication of acute myocardial infarction is acute left ventricular failure³. The factors like recurrent myocardial ischemia, size of infarct, remodeling of the ventricles, stunning myocardium, mechanical complications, and hibernation of myocardium influence the left ventricular systolic dysfunction after acute myocardial infarction⁴,⁵. The presence of acute LVF after acute myocardial infarction increases the mortality by at least 3 to 4 times. It is the common complication after acute ST segment elevation MI mostly associated with acute anterior wall myocardial infarction⁶. Previous myocardial infarction, advanced age, female gender, anterior wall myocardial infarction and diabetes mellitus are risk factors which play a major role in the development of cardiogenic shock⁷. Aging of the population and longevity in the lives of cardiac patients by modern therapeutic intervention has resulted in an increase in prevalence of left heart failure⁸,⁹. The mortality rate in patients with left heart failure has remained unacceptably high despite
improvements in therapy\textsuperscript{10}, early detection of susceptible persons and intervention would benefit from preventive measures\textsuperscript{11}. In Hospital mortality is 5\% to 8\% with acute LVF. Primary PCI is first choice reperfusion strategy because it improves outcome in patient with acute ST elevation MI especially acute anterior wall MI in term of morbidity and mortality\textsuperscript{12,13}. Coronary artery disease is the leading cause of heart failure in patients with reduced LV ejection fraction which is more associated with anterior wall\textsuperscript{14,15}. This study was carried out to determine the frequency and outcomes of acute left ventricular failure in the patients and to see whether early diagnosis of heart failure and treating it by identifying risk factors can prevent recurrent attacks and frequent hospital admissions.

**MATERIAL AND METHODS**

This descriptive cross-sectional study was carried out at Armed Forces Institute of Cardiology & National Institute of Heart Diseases after approval from hospital ethical committee from Jan to Jun 2017. All the patients with acute anterior wall myocardial infarction undergoing Primary PCI were included in the study. Patients with COPD, valvular heart disease, LRTI, old myocardial infarction, acute ST elevation, MI thrombolysed with streptokinase prior to PCI and patients with prior CCF were excluded from the study. Informed written consent was taken from the family of the patients for participation in the study, after informing the purpose of study. History of co-morbid and chest pain was taken and clinical examination was performed. The diagnosis of acute ST-segment elevation anterior wall MI was based on the presence of chest pain lasting 20 minutes or longer combined with typical electrocardiographic changes (ST-segment elevation ≥2 mV in ≥2 contiguous precordial anterior leads, presumed new complete left bundle branch block). Patients with at least one of the following criteria were labeled with acute left ventricular failure; a) KILLIP Class ≥2 on admission, b) KILLIP Class ≥2 at any time of hospitalization.

<table>
<thead>
<tr>
<th>Table: Clinical characteristics of the patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variables</td>
</tr>
<tr>
<td>Age</td>
</tr>
<tr>
<td>Gender</td>
</tr>
<tr>
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<tr>
<td>Female</td>
</tr>
<tr>
<td>Risk Factors</td>
</tr>
<tr>
<td>Diabetes Mellitus</td>
</tr>
<tr>
<td>Hypertension</td>
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<tr>
<td>Smoking History</td>
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<tr>
<td>Hyperlipemia</td>
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<tr>
<td>Coronary Artery Disease</td>
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<tr>
<td>Single Vessel CAD</td>
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<td>Double Vessel CAD</td>
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<tr>
<td>Triple Vessel CAD</td>
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<tr>
<td>KILLIP Class</td>
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<td>KILLIP Class-I</td>
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<td>KILLIP Class-II</td>
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<td>KILLIP Class-III</td>
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<td>KILLIP Class-IV</td>
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<tr>
<td>Peri- Procedural Acute LVF</td>
</tr>
<tr>
<td>Mortality</td>
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</tbody>
</table>
Acute Left Ventricular Failure

Data Analysis

All the data was analyzed on SPSS-21. Mean ± Standard Deviation was calculated for quantitative variables e.g. Age. Frequency and percentages was calculated for qualitative variables e.g. gender, risk factors, severity of disease, left ventricular failure and outcomes.

RESULTS

Out of 120 patients who underwent primary PCI for acute anterior wall MI. One hundred and one (84.4%) patients were males while 19 (15.6%) patients were female patients. Mean age of the patients was 54.6 ± 7.5 years. 40 (33.3%) patients had single vessel coronary artery disease, 48 (40%) had double vessels coronary disease and 32 (26.7%) patients were with triple vessels coronary artery disease. 45 (37.5%) patients had peri-procedural acute LVF. 110 (91.7%) patients improved and were discharged from hospital. In-hospital mortality was 8.3% as shown in table.

DISCUSSION

Acute myocardial infarction is the major killer in the modern world. Approximately 450,000 people in USA dies from coronary artery disease per year. The survival rate in hospitalized patients in U.S is approximately 95%. There are two types of acute MI, acute Non ST segment elevation MI and acute ST segment elevation MI. Acute LVF is the common complication of Acute MI, mainly associated with STEMI of the STEMI, anterior wall MI is the mainly complicated by acute LVF which may lead to death if not promptly diagnosed and managed. Primary PCI is first choice reperfusion strategy because it improves outcome in patient with acute ST elevation MI in term of morbidity and mortality. It reduces morbidity and mortality in patients with acute LVF at presentation or post procedure as compared to streptokinase. A study conducted in Germany on 312 patients undergoing primary PCI, 16.9% developed peri-procedural acute left ventricular failure. All-cause in-hospital mortality was 10% patients, out of which 87% was associated with acute LVF. Cardiovascular risk factors play a major role in the occurrence of MI and its complication like LVF. In our study hypertension, smoking and diabetes were major risk factor for MI. Out of 120 patients who underwent primary PCI for acute anterior wall MI, 16 (13.3%) were of 20-45 years age group and 104 (86.7%) were of 46-90 years age group, 101 (84.4%) were male and 19 (15.6%) were female. Forty (33.3%) patients had single vessel coronary artery disease, 48 (40%) had double vessels coronary disease and 32 (26.7%) patients were with triple vessels coronary artery disease. Seventy five (62.5%) were in KILLIP class-I of heart failure. Thirty six patients (30.0%) developed KILLIP class-II left ventricular failure, 6 (5%) were with KILLIP class-III and 3 (2.5%) were with KILLIP class-IV. Fourty five (37.5%) patients had peri-procedural acute LVF. One hundred and ten (91.7%) patients improved and were discharged from hospital. In-hospital mortality was 8.3% which is in accordance with developed countries of the world.

CONCLUSION

It is concluded from our study that primary PCI is first choice and best reperfusion strategy because it improves acute LVF and outcome in patient with acute Anterior wall MI and hence reduce morbidity and mortality.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

REFERENCES

ROLE OF DUKE TREADMILL SCORE IN ASSESSING THE SEVERITY OF CORONARY ARTERY DISEASE IN PATIENTS PRESENTING WITH ANGINA

Muhammad Asad, Rehana Khadim, Tahir Iqbal, Hafiz Muhammad Shafique, Mir Waqas Baloch, Samra Rehmat, Hasnain Iqbal, Sibtain Iqbal, Mohsin Hayat

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ABSTRACT

Objective: To evaluate the role of duke treadmill score in assessing the severity of coronary artery disease in patients presenting with angina.

Study Design: A descriptive cross-sectional study.

Place and Duration of Study: Adult Cardiology department of AFIC and NIHD Rawalpindi, from Sep 2017 to Dec 2017.

Material and Methods: Patients of both genders above the age of 30 years who presented first time with angina were included in the study. Patients excluded from the study were those who had previous myocardial infarction, patients with severe valve disease (severe stenosis and/or regurgitation of heart valves), patients with prosthetic valve, heart failure (ejection fraction <50), acute coronary syndrome (unstable angina pectoris), hematological disorders, previous revascularization procedures (whether percutaneous transluminal coronary angioplasty or coronary artery bypass grafting [CABG]), congenital heart disease, patients taking digoxin therapy and having chronic kidney disease.

Results: There were 100 patients included in the study. The mean age of the patients was 46.04 ± 6.74 years, with minimum age 31 years and maximum age 55 years. About 68 (68.0%) patients were males and 32 were females (32.0%). The main risk factors for CAD among study participants were diabetes mellitus 55 (55.0%) hypertension 24 (24.0%) and smoking 13 (13.0%). Association between Duke Treadmill Score and SYNTAX score was found out by using ANOVA (Analysis of variance) and it showed statistically significant result between two variables with p= 0.04. Association between Duke Treadmill score and coronary arteries involvement was found by using chi-square test, the result of which was statistically significant with p=0.001.

Conclusion: It is concluded from our study that Duke treadmill score is a significant prognostic tool for coronary artery disease. There is significant association between DTS and SYNTAX score. DTS also had a significant association with extensive and significant CAD.

Keywords: Coronary Artery Disease, Duke treadmill score (DTS), SYNTAX score.

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INTRODUCTION

Cardiovascular disease is considered to be one of the leading cause of death among human race. Ischemic heart disease (IHD) is one of the common manifestation of this disease. Stable angina is one of the presenting features of IHD. Worldwide 50% of all deaths have been attributed to coronary artery disease. Instable angina, blood and oxygen supply to the myocardial tissue is diminished because of obstructive atherosclerosis and ischemia occurs when the demand increases, such as during exercise. The diagnosis of coronary heart disease (CHD) as the cause of chest pain requires the use of a careful clinical history as well as additional investigations. Coronary angiography is the gold standard test for identifying the presence and extent of atherosclerotic coronary artery disease (CAD). Exercise stress testing is a widely used and inexpensive method for initial evaluation of patients with suspected CAD. Exercise tolerance test has been used to assess patients who present with chest pain and intermediate pre-test probability of ischemic heart disease. The limited sensitivity and specificity of standard exercise ECG testing for...
Detection of coronary artery disease has stimulated increased use and development of noninvasive stress imaging technologies. However, the added diagnostic accuracy of stress imaging tests is associated with substantially higher cost. An alternative to the use of more expensive tests is the more efficient use of available low-cost data. Diagnostic and prognostic predictive accuracy increases when multiple pieces of information from the patient’s clinical history and the treadmill test are integrated.

Duke Treadmill Score (DTS) is a composite index that is based on the results from the exercise test, including ST-segment depression, chest pain and exercise duration, and provides more accurate prognostic information for the evaluation of patients with clinically-suspected ischemic heart disease. SYNTAX score (SS) is an angiographic scoring system that is widely used to evaluate the severity and complexity of CAD. It is used in the estimation of long-term outcomes of CAD and in the selection of the treatment modality. Its efficacy has been demonstrated in various studies. Some studies have suggested that DTS score helps in assessing the severity of the disease. Therefore in this article we investigated the role of DTS in prediction of severity (SYNTAX score) of CAD.

MATERIAL AND METHODS

This descriptive cross sectional study was conducted at Cardiology Department of AFIC & NIHD Rawalpindi, from September 2017 till December 2017. Patients were recruited through non-probability purposive sampling. Patients of both genders above the age of 30 years who presented first time with angina were included in the study. Patients excluded from the study were those who had previous myocardial infarction, patients with severe valve disease (severe stenosis and/or regurgitation of one or more heart valves), patients with prosthetic valve disease, heart failure (ejection fraction <50), acute coronary syndrome (unstable angina pectoris), hematological disorders, Revascularization procedures (whether percutaneous transluminal coronary angioplasty or coronary artery bypass grafting [CABG]), congenital heart disease, patients taking digoxin therapy and chronic kidney disease were excluded from the study. Permission of study was sought from hospital ethical committee. Patients without a history of prior CAD, admitted to the outpatient clinic with chest pain (typical angina, atypical angina, non-angina chest pain) were included. Pre test probabilities (PTP) of all patients were calculated. Patients with low (<15%) and high (>85%) probability were excluded from the study. Only the patients with intermediate PTP (15–85%) performed exercise stress testing, and DTS was calculated in each subject. Patients with 1 mm or more horizontal or down-sloping ST depression (80 ms after the J point) due to effort were considered to have a positive stress test and underwent coronary angiography (CAG). These patients composed the study population.

All the patients underwent symptom-limited exercise testing according to the standard Bruce protocol test with standard ECG, blood pressure and heart rate measurements performed at pre-specified time points as per relevant guidelines and were exercised to the endpoints described in the original duke treadmill score (DTS) study by Mark et al. Resting heart rate, blood pressure and 12-lead ECGs were recorded in the supine and upright positions before exercise. The target heart rate was determined according to the formula 0.85x (220-age). During each minute of exercise, heart rate, blood pressure and ECG were recorded. Exercise testing was discontinued if exertional hypotension, malignant ventricular arrhythmias or limiting chest pain was reported. An abnormal exercise ST response was defined as 1 mm or more of horizontal or down sloping ST depression (J point ± 80 ms).

The equation for calculating the Duke treadmill score is as follows:

\[ \text{DTS} = \text{exercise time} - (5 \times \text{ST deviation}) - (4 \times \text{exercise angina}) \]

Exercise angina was assessed as one of three levels:
Duke Treadmill Score in Patients Presenting With Angina

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- 0 = none,
- 1 = non-limiting and
- 2 = exercise-limiting.

The DTS was grouped into low-risk (with a score of ≥+5), moderate-risk (with scores ranging from -10 to +4), and high-risk (with a score of ≤-11) categories.

Coronary angiography was performed by the Judkins technique, using the standard Seldinger technique through a percutaneous femoral or radial artery puncture. Each angiogram was analyzed independently by experienced interventional cardiologist who was blinded to the patient clinical data. Those patients whose angiogram was normal were excluded from the study. Coronary lesion was considered hemodynamically significant when stenosis of coronary artery was ≥ 70% and stenosis of the left main stem was ≥ 50%. Each coronary lesion producing 50% diameter stenosis in vessels 1.5 mm was scored separately and added together to provide the overall Syntax Score, which was calculated prospectively using the Syntax Score algorithm.

**Table-I: Characteristics of angiographic findings in various DTS groups.**

<table>
<thead>
<tr>
<th>Significant stenosis</th>
<th>All patients n=100</th>
<th>Low risk ≥+5 n=20</th>
<th>Moderate risk -10 to +4 n=58</th>
<th>High risk ≤-11 n=22</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAD</td>
<td>91</td>
<td>18</td>
<td>53</td>
<td>20</td>
<td>0.98</td>
</tr>
<tr>
<td>RCA</td>
<td>65</td>
<td>10</td>
<td>36</td>
<td>19</td>
<td>0.03</td>
</tr>
<tr>
<td>LCX</td>
<td>65</td>
<td>8</td>
<td>38</td>
<td>19</td>
<td>0.007</td>
</tr>
<tr>
<td>LMS</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0.03</td>
</tr>
</tbody>
</table>

**Table-II: Association between Duke Treadmill Score and SYNTAX score.**

<table>
<thead>
<tr>
<th>SYNTAX Score (Mean ± SD)</th>
<th>DTS ≥ +5</th>
<th>DTS -10 to +4</th>
<th>DTS ≤ -11</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>19 ± 21.68</td>
<td>42 ± 23.57</td>
<td>39 ± 23.6</td>
<td>0.04</td>
</tr>
</tbody>
</table>

The mean St changes seen in exercise tolerance test was 1.61mm + 0.61. The mean syntax score of all the patients under study was 23.1 ± 8.65 with minimum score of 7 and maximum 46. There were 22 patients in Low risk group, 58 patients in intermediate and 20 patients in high risk group. The frequency of various angiographic findings in DTS groups is given in table-I. Association between Duke treadmill score and SYNTAX score was found out by using ANOVA (Analysis of variance) which showed statistically significant result between two variables, with p=0.04 as shown in table-II. Association between Duke treadmill score and coronary arteries involvement was found out by using chi-square test was used to assess the significance of associations between variables. Level of significance (p-value) ≤0.05 was considered significant.

**RESULTS**

There were 100 patients included in the study. The mean age of the patients was 46.04 ± 6.74 years with minimum age 31 years and maximum age 55 years. About 68 (68.0%) patients were males and 32 were females (32.0%). The main risk factors for CAD among study participants were diabetes mellitus 55 (55%) then 24 hypertension (24%) and smoking 13 (13.0%). Patients who had one risk factor were 54 (54.0%), those who had two risk factors were 25 (25.0%), those who had no risk factors were 8 (8.0%) and those who had three risk factors were 13 (13.0%).

**Data Analysis**

Data was entered and analyzed in SPSS version 23. The mean and standard deviation was calculated for quantitative variables. The frequency and percentage was calculated for qualitative variable. Student’s t-test was used to compare DTS risk groups, coronary artery lesions subtypes, and mean ST changes. Chi square test was used to assess the significance of associations between variables. Level of significance (p-value) ≤0.05 was considered significant.
test. The result was statistically significant with $p=0.001$ as shown in table-III.

**DISCUSSION**

Exercise testing is the most widely performed test for prognostic assessment of ischemic heart disease in patients who are able to with stand exercise and who have no substantial abnormalities in the resting electrocardiogram. It is assumed that the patients with suspicion of ischemic heart disease and a low risk exercise test result have a favorable prognosis$^{16,17}$.

Demographic presentation of the present study revealed that males were more than females although no significant difference was observed, in age groups and mean age, between males and females ($p>0.05$). This finding is consistent with results of Saeed et al study in Iraq$^18$ and Assiri$^19$.

The SYNTAX score, which is used in the evaluation of angiographic severity of coronary lesions, has already been shown to predict mortality in addition to its role in the decision-making process of intervention procedure (percutaneous coronary intervention [PCI] or CABG). DTS is a risk stratification index that was developed by Mark et al$^7$ and Shaw et al$^{13}$. DTS is widely used in the prediction of CAD. DTS includes non-invasive clinical information, while SYNTAX score (SS) exhibits information about the severity and complexity of coronary lesions.

The SYNTAX score presents information about prognosis. Moreover, DTS is also known to provide information about prognosis. While DTS is expected to be low and SS to be high in patients with severe CAD, the number of studies demonstrating a comprehensive evaluation of both these two risk stratification methods is limited$^{20}$.

Acar et al$^{21}$ found the average DTS value to be $-2.5 \pm 7$ while it was $-4.17 \pm 7.28$ in our study. Our study population had lower DTS values. The difference in the number of patients may also be the reason for this inequality. In the present study the no of vessels involved was more in intermediate group and high risk DTS score group patients as compared to low group. This picture is close to the results of other study in USA; Kwok et al study$^{22}$, in regard to three vessels involvement. The sex in the present study did not significantly affect the outcome of DTS ($p=0.79$). This finding is inconsistent with that found in other study carried out by Jang et al study in South Korea$^{23}$ and an earlier study conducted by Shaw et al in USA$^{13}$ that found significant association between sex and DTS, the inconsistency with these studies might be attributed to the small number of females compared to males in our study. The present study revealed a significant association between high risk DTS and the extent CAD ($p<0.001$). This

<table>
<thead>
<tr>
<th>Coronary Arteries Involvement</th>
<th>DTS $\geq +5$</th>
<th>DTS $-10$ to $+4$</th>
<th>DTS $\leq -11$</th>
<th>$p$-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAD</td>
<td>3 (15.8%)</td>
<td>7 (16.7%)</td>
<td>4 (10.3%)</td>
<td></td>
</tr>
<tr>
<td>LAD, LCX</td>
<td>4 (21.1%)</td>
<td>6 (14.3%)</td>
<td>7 (17.9)</td>
<td></td>
</tr>
<tr>
<td>LAD, LCX, RCA</td>
<td>3 (15.8%)</td>
<td>13 (31.1%)</td>
<td>15 (38.5%)</td>
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</tr>
<tr>
<td>LAD, RCA</td>
<td>5 (26.3%)</td>
<td>6 (14.3%)</td>
<td>6 (15.4%)</td>
<td></td>
</tr>
<tr>
<td>LAD, RCA, LCX</td>
<td>-</td>
<td>3 (7.1%)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>LAD, LCX, RCA</td>
<td>1 (5.3%)</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>LCX, RCA</td>
<td>-</td>
<td>-</td>
<td>3 (7.7%)</td>
<td>0.001</td>
</tr>
<tr>
<td>LMS, LAD, LCX, RCA</td>
<td>-</td>
<td>1 (2.4%)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>LMS, LCX, LAD</td>
<td>-</td>
<td>1 (2.4%)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>RCA</td>
<td>-</td>
<td>2 (4.8%)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>RCA, LAD</td>
<td>-</td>
<td>1 (2.4%)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>RCA, LCX</td>
<td>2 (10.5%)</td>
<td>-</td>
<td>2 (5.1%)</td>
<td></td>
</tr>
</tbody>
</table>
finding is consistent with results of Acar et al who concluded that there is strong correlation between high risk DTS and coronary lesion complexity. Shaw et al also found a significant association between high risk DTS with extensive and significant CAD. They regarded CAD severity as the number of diseased arteries rather than the degree of stenosis of coronary arteries. In a study done on stable angina patients by Banerjee et al comparing DTS with single-photon emission computed tomography myocardial perfusion imaging (SPECT-MPI) showed that exercise treadmill test using DTS score was satisfactorily correlated with SPECT-MPI scanning in low DTS subsets of patients. They inferred that the patients with low DTS score do not need an MPI study and should undergo CAG for further evaluation. In another similar study it was suggested that patients with low DTS score can be referred to CAG without SPECT-MPI and patients with high DTS can be followed on medical management. At the present time, physicians usually ignore DTS results while making a decision about CAG. DTS can provide information about the potential outcomes of coronary angiography such as requirement of CABG and PCI and therefore we believe that it should be used more often in clinical practice. Our results also support the evidence that DTS can be used more often in clinical cardiology practice instead of CT coronary angiography to avoid radiation exposure, especially in patients with high DTS.

CONCLUSION

It is concluded from our study that Duke treadmill score is a significant prognostic tool for coronary artery disease. There is significant association between DTS and SYNTAX score. DTS also had a significant association with extensive and significant CAD so it might play a role in diagnosis as well as guiding management strategy.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

REFERENCES


TRANSCATHETER MANAGEMENT OF CORONARY ARTERIOVENOUS FISTULA - SEVEN YEAR EXPERIENCE

Mehboob Sultan, Khurram Akhtar, Maad Ullah, Nadeem Sadiq, Amjad Mehmoond, Kamal Saleem, Syed Asif Akbar Shah, Aziz Ahmed

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ABSTRACT

Objective: To measure efficacy and immediate complications of percutaneous device closure of coronary artery fistula (CAF).

Study Design: Retrospective study.

Place and Duration of Study: Armed Forces Institute of Cardiology and National Institute of Heart Diseases, (AFIC/NIHD) Rawalpindi, from Jan 2011 to Dec 2017.

Material and Methods: Consecutive eight patients, who underwent attempted CAF device closure were included in the study. Device closure was attempted in isolated CAF (Coronary artery fistula) with significant shunt and with body weight of at least 10 kgs.

Results: Total 8 cases of attempted CAF device closure were included with mean age of 13 years and male to female ratio of 1:1. In 7 cases (87.5%), CAF were successfully occluded. There was no mortality, thrombosis, residual leak or peripheral vascular injuries in the study population. We used three ductal occluders and four septal device occluders to achieve complete closure of CAFs in seven cases.

Conclusion: Transcatheter occlusion of CAF by various occluder devices is an effective therapeutic option with high success rate. Complication rate is low in the hands of skilled operators.

Keywords: Coronary fistula, Device closure, Occluder device.

INTRODUCTION

Isolated Coronary artery fistula (CAF) are one of least common cases encountered in pediatric catheterization laboratory and defined as an abnormal linking between one or more coronary arteries and an adjacent cardiac chamber or vascular structure. First described by Krause in 1865, CAF is a rare anomaly found in approximately 0.2% of patients undergoing diagnostic coronary angiography and accounts for about 0.2%-0.4% of all congenital cardiac defects but is most common paediatric coronary anomalies. The true incidence of CAFs cannot be accurately estimated as the small fistulas are usually asymptomatic and may not come to medical attention.

CAFs are divided into two types, either a coronary-cameral fistula ending in any of the cardiac chambers or a coronary arteriovenous fistula ending in either a systemic or pulmonary vein. CAF arise most commonly from the RCA (>50%), the rest arising from the left coronary artery or both coronary arteries. The vast majority terminate in the right side of the heart (>90%), primarily the right ventricle, right atrium, pulmonary trunk, coronary sinus and, rarely, in the left atrium or left ventricle. The natural history of coronary artery fistula is vastly unpredictable as some patients report no symptoms throughout life. In the absence of symptoms, a continuous murmur may be the only positive clinical sign. The symptoms are mainly dependent on the severity of the shunt, with small shunts being asymptomatic and such patients can be monitored periodically to make sure the condition is not progressing. Reported pediatric fistula-related complications include congestive heart failure, myocardial infarction, bacterial endocarditis, rupture and death. The aim of this audit was to share our experience...
regarding device closure of CAFs in last seven years at AFIC/NIHD, with especial emphasis on immediate complications and problems encountered during these procedures.

**MATERIAL AND METHODS**

This retrospective study analyzed the CAF device closure done from January 2011 to December 2017 by reviewing the clinical records including catheterization data, echocardiography reports and follow up record. Total 08 patients with attempted percutaneous CAF device closure were included in the study. Device closure was attempted in isolated CAF with significant shunt and with body weight of at least 10 kgs. All patients were underwent detailed pre procedural assessment including history & physical examination, 12 Lead ECG, chest x-ray, blood complete picture and echocardiography (fig-1).

After taking informed consent, patients were taken to the catheterization lab. Both femoral vein and artery entered with short sheaths. Aortogram was performed with pigtail to delineate the anatomy of fistula, exit point, narrowest diameter, coronary arteries and their branches. In seven cases, fistula crossed from aorta and snared from venous side to make an Arterio-venous loop. As shown in fig-2 & 3, in one case (LCA to LV fistula) after Trans-septal puncture wire crossed from LV to fistula to Aorta and snared from arterial side. Appropriate delivery sheath advanced from venous side across the fistula, at least beyond narrowest point. In one case, wire retaining technique was used. The appropriate device was advanced through the delivery sheath and the larger disk was deployed beyond narrowest point of interest and then sheath and the retention disk were pulled back as a single unit. The rest of the device was then peeled off by pulling back the delivery sheath. Post procedural aortogram was performed to confirm device position and to evaluate residual leak and device was released only if correct positioning was ascertained. Post procedural care included two doses of antibiotics, vital signs monitoring, examination & echo-cardiography after 4 hours and discharge echocardiography in next morning. Data was entered in SPSS 23 and descriptive analysis done; Student’s t or chi-square tests were used as appropriate.
RESULTS

There were 8 cases (4 male & 4 female) of CAF underwent attempted device closure from 2011 to 2017. The details of all patients are shown in table 1. Mean age was 12.9 ± 12 years and mean weight was 34.5 ± 22 kgs and mean height was 128 ± 36 cms. Among eight cases, 5 (62.5%) were done under general anaesthesia. Both femoral vein and artery were entered with short sheaths.

The procedure was successful in seven while in one case, fistula anatomy was considered not suitable for device closure due to more than one narrow tortuous exit points. There was no residual flow after device closure. In three cases, PDA occluder was used whereas in another three VSD septal occluder was used to completely occlude the flow. In one patient (41-year old male), CAF was occluded with 12 mm ASD device. During early follow-up there were no complications or evidence of coronary arterial insufficiency.

DISCUSSION

CAF's are rare but very important clinical entity and represent abnormal connection between one or more coronary arteries and an adjacent cardiac chamber or vascular structure. In our study, the most common site of origin was RCA to RA as documented in literature. The treatments options include surgical, transcatheter or hybrid approach. The goal of treatment for symptomatic patients is to completely stop the flow across the fistulous track without compromising the coronary arteries flow. Although CAF complications are more common in older children over time, there is still no consensus in terms of treatment indications in children with asymptomatic fistula. Surgery was the only choice to treat CAF, prior to the availability of occlusive devices. Cheung DL et al reported surgical results of 41 patients with no operative mortality and more than 96% of the patients were asymptomatic at a mean follow-up duration of 09 years.

The first successful percutaneous transcatheter coil embolization was performed in 1983, has therefore become the procedure of choice in many centers in order to avoid surgical risk. Depending upon morphology, variety of devices are being reported for trans-catheter occlusion of CAFs including coils, ductal occlusion devices, septal occlusion devices, vascular plugs, detachable balloons etc. Factors to consider in deciding between surgery and device occlusion include the size of the fistula, its location and drainage pattern and the associated cardiac lesions. Transcatheter treatment is proving to be an important mode of treatment in CAFs cases as acceptable immediate results and by avoiding surgical risks. A recent study from Switzerland, shared their experience of six
patients with CAFs, treated by catheter interventions with 83% immediate success and good results at seven years follow-up. One of their patient had significant residual flow and required surgery.

We did not use coils in our patients, rather all seven cases were closed with devices (3 ductal, 3 VSD occluders & one ASD device Occluder), largely because of anatomy of fistula and operators preferences. One out of eight procedures was unsuccessful as anatomy of RCA to RV fistula was not favorable for device closure. There were more than one narrow and tortuous exit points to inlet area of RV and guide wire could not be negotiated across the fistula. In our small cohort, there were no immediate complications and patient remained asymptomatic in early follow-up period. Complications after CAF occlusion are rare but may include transient T-wave inversions, transient arrhythmias, coil or device migration/embolization, coronary artery trauma or rupture, or total occlusion of a coronary artery. In view of possibility of coronary complications, long-term follow up is mandatory. Low-dose aspirin therapy (3 to 5 mg/kg per day) is recommended until coronary normalization occurs. Warfarin may be added if the dilatation is severe (>10 mm), particularly when coronary flow is sluggish. We used aspirin or warfarin for about one year in almost all the cases followed by recatheter study.

CONCLUSION

Transcatheter closure of the CAF was found safe and effective percutaneous intervention with high success rate and good safety profile in hands of skilled operators.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

REFERENCES

SINGLE CENTER EXPERIENCE ON USE OF RECOMBINANT FACTOR SEVEN FOR BLEEDING AFTER CONGENITAL HEART SURGERY

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ABSTRACT

Objective: The objective of our study is to review the use of recombinant factor seven to control bleeding in non-hemophilic patients undergoing cardiac surgery for congenital heart disease.

Study Design: Retrospective case series.

Place and Duration of Study: Peds cardiac anesthesia department of Armed Forces Institute of Cardiology, Rawalpindi, from Jan 2017 to Jan 2018.

Material and Methods: Data was collected from ICU daily monitoring and treatment charts. Patients who received rFVIIa to limit post surgical bleeding were sorted out. Gender, Age, weight, disease, date of surgery, dose of factor seven, thrombotic evidence and mortality of patients who were given factor seven to control bleeding were recorded.

Results: Total 19 patients received factor seven from Jan 2017 to Jan 2018. Mean age at surgery was 6.99 years. Nine patients (47.4%) underwent total correction for Tetralogy of fellot, three patients (15.8%) had surgical patch closure for ventricle septal defect and two patients (10.5%) had arterial switch operation for transposition of great arteries. Fourteen patients (73.7%) survived to hospital discharge. Nine patients (47.4%) received 40 mcg/kg or less of rFVIIa while the remaining ten patients received up to 80 mcg/kg total dose of rFVIIa post operatively. None of the patients was found to have evidence of thrombosis.

Conclusion: Post operative bleeding was found very common in children who received factor VIIa for control of bleeding. Further prospective study over large number of patients should be done and rFVIIa should be compared with tranexamic acid transfusion and desmopressin.

Keywords: congenital, non-haemophilic factor, Tetralogy.

INTRODUCTION

Severe post operative bleeding is one of the major causes of morbidity in pediatric patients with congenital heart disease undergoing open heart surgeries. Bleeding requiring exploration occurs in 1% of pediatric cardiac surgery patients, and transfusion may exceed 100 ml per Kg1. Several factors are responsible for coagulation disturbances and bleeding following cardiopulmonary bypass in patients with congenital heart disease. This includes dilution during priming of pump, platelet disorder and dysfunction, premature haemostatic system in neonates, fibrinolysis, residual heparin and disseminated intravascular coagulation (DIC)2. Abnormal homeostasis and bleeding disorder is well known in children with cyanotic heart disease. These children in hypo-coagulable state related to impaired fibrinogen function3. In 1999 Recombinant factor seven was approved for treatment of bleeding in patients with hemophilia and inhibitors of factor VIII or IX4. Activated factor VIIa plays important role in homeostasis mechanism by forming complex with tissue factor, this complex then activates factor X which induces thrombin formation5. It has been increasing because of usage of off-label in controlling excessive bleeding following trauma, surgery and extracorporeal membrane oxygenation (ECMO) support6. In cardiac surgery patients factor seven has been found to reduce transfusion requirements and chest drain output7.

The use of recombinant factor seven has less widely been reported in pediatric patients than adults. In children different non hemophilic
conditions has been described that may benefit from rFVIIa to control bleeding associated with cardiac surgery, neurosurgery, DIC, liver failure and transplantation. rFVIIa has also got some adverse effects like, the potential to cause limb ischemia, as well as pathologic thrombosis and related major neurological events. The main objective of this study is to review the use of rFVIIa for the treatment of bleeding in non-hemophiliac pediatric patients undergoing cardiac surgery for congenital heart disease in our setup and to recommend its use in future.

The objective of our study was to review the use of recombinant factor seven to control bleeding in non hemophilic patients undergoing cardiac surgery for congenital heart disease.

**MATERIAL AND METHODS**

A retrospective cases series conducted at Pediatric cardiac surgery operation theatre and intensive care unit Armed Forces Institute of Cardiology (AFIC) from January 2017 to January 2018. After approval from ethical committee, we reviewed retrospectively medical record of patients undergoing congenital heart surgeries requiring cardiopulmonary bypass from Jan, 2017 to Jan 2018 in pediatric cardiac surgery ICU. Data was collected from ICU daily monitoring and treatment charts. Patients who received rFVIIa to limit post surgical bleeding were sorted out. Gender, Age, weight, disease, date of surgery, dose of factor seven, thrombotic evidence and mortality of patients who were given factor seven to control bleeding were recorded. Total 19 patients were found to receive rFVIIa. Conduct and management of cardio pulmonary bypass (CPB), surgical procedure was according to institutional guidelines and surgeon practice.

**Data Analysis**

The data was analyzed by descriptive statistics (frequency, percentage, mean and standard deviation) and chi square test was used for analysis of variance. In our study p-value of less than 0.05 was considered as statistically significant. The statistical analysis was done by using SPSS version 21.

**RESULTS**

For the 19 patients in our study, the demographics, congenital heart defects, dose of factor seven used, thrombotic evidence and mortality was analyzed. Mean age at surgery was 6.99 years with standard deviation of 6.16 (range: 2 months–20 years) as shown in table. Nine patients (47.4%) underwent total correction for Tetrollogy of fellot, three patients (15.8%) had surgical patch closure for ventricle septal defect and two patients (10.5%) had arterial switch operation for transposition of great arteries.

For the 19 patients in our study, the demographics, congenital heart defects, dose of factor seven used, thrombotic evidence and mortality was analyzed. Mean age at surgery was 6.99 years with standard deviation of 6.16 (range: 2 months–20 years) as shown in table. Nine patients (47.4%) underwent total correction for Tetrollogy of fellot, three patients (15.8%) had surgical patch closure for ventricle septal defect and two patients (10.5%) had arterial switch operation for transposition of great arteries. Fourteen patients 73.7% survived to hospital discharge and five (26.3%) died. Nine patients (47.4%) received 40mcg/kg or less of rFVIIa while the remaining ten patients received up to 80 mcg/kg total dose of rFVIIa postoperatively. None of the patients was found to have evidence of thrombosis. A p-value was found insignificant when two doses of factor seven were compared as related to mortality. A p-value was also found to be insignificant when effect of type of congenital heart defect was studied on mortality.

### Table: Clinical variables of study participants.

<table>
<thead>
<tr>
<th>S. No</th>
<th>Variables</th>
<th>Variable value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Age (mean ± SD) years</td>
<td>6.99 ± 6.16</td>
</tr>
<tr>
<td>2.</td>
<td>Procedure type.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Total correction for tetrollogy of fellot.</td>
<td>9 (47.4%)</td>
</tr>
<tr>
<td></td>
<td>• Surgical patch closure for ventricle septal defect.</td>
<td>3 (15.8%)</td>
</tr>
<tr>
<td></td>
<td>• Arterial switch operation for transposition of great arteries</td>
<td>2 (10.5%)</td>
</tr>
<tr>
<td>3.</td>
<td>rFVIIa dose &lt;40 mcg/kg</td>
<td>9 (47.4%)</td>
</tr>
</tbody>
</table>
DISCUSSION

Post operative bleeding requiring massive transfusion and re-exploration is one of the major problems in patients undergoing cardiac surgery. Re-exploration and multiple transfusions are associated with increase in mortality and end organ injury. Blood products are most commonly used for management of bleeding. Antifibrinolytic agents like tranexamic acid, has been used in our setup in cardiac surgery to reduce blood loss and need for transfusions. Factor concentrates and pharmacologic agents such as Desmopressin have been studied for control of bleeding in hemophilia patients with inhibitors. In these patients the standard bolus dosage varies from 90 to 120 mcg/kg and repeated every two to three hours until cessation of bleeding and rFVIIa has been used as off label in controlling surgical bleeding. Its first off-label use was reported in 2001 as rescue treatment of uncontrolled postoperative bleeding. Since then there have been increasing number of cases that report off label use of rFVIIa in various clinical situations where bleeding was difficult to control such as cardiac surgery, massive trauma and obstetrical uncontrolled bleeding. The congenital cardiac anesthesia society task force recommends rFVII for refractory post CPB bleeding. In our center use of rFVIIa occurred just few years back. It is not being frequently used in our centre to control bleeding because of limited supply and resources. The half life of rFVIIa is 2.9 hours; therefore the frequency of rFVIIa dose is every two to three hours. In our institute rFVIIa is given at dose of 20-40 mcg/kg and repeated after one hour as required. The dose of rFVIIa in non hemophilia patients to control bleeding has not been determined; low doses have been studied and found effective. Friederich et al found that 20 mcg/kg was effective to control bleeding. Karsies et al. noted that 30-50 mcg/kg per dose every two to three hours was effective. In our study 47.4% of the patients received 40 mcg/kg or less and remaining received up to 80 mcg/kg. The use of rFVIIa is associated with thrombotic events. Chuansumrit et al. studied the use of rFVIIa pediatric patients for control of hemorrhage and noted adverse events. He found the total number of doses given was directly related to thrombo-embolic events. In our study no patient had thrombosis. Our study was a retrospective with small number of patients. In future we plan to conduct study which would be prospective control trial.

CONCLUSION

Post operative bleeding was found common and challenging problem in cardiac surgery. Further prospective study over large number of patients should be done and rFVIIa should be compared with tranexamic acid transfusion and desmopressin.

CONFLICT OF INTEREST

This study has no conflict of interest to be declare by any author.

REFERENCES

IN-HOSPITAL OUTCOMES OF PATIENTS WITH OR WITHOUT RECIPROCAL ELECTROCARDIOGRAPHIC CHANGES PRESENTING WITH ACUTE INFERIOR WALL MYOCARDIAL INFARCTION

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ABSTRACT

Objective: To determine the in-hospital outcome in patients with and without reciprocal electrocardiographic changes presenting with acute inferior wall myocardial infarction.

Study Design: Descriptive cohort study.

Place and Duration of Study: Cardiology department of AFIC & NIHD, Rawalpindi from Jan 2017 to Dec 2017.

Material and Methods: Patients of both genders, who had acute inferior wall myocardial infarction were included in the study. While Patients with previous myocardial infarction, CABG assessed by history, left ventricular hypertrophy assessed by electrocardiography by Sokolow criteria were excluded from the study.

Results: Two hundred and fifty patients were recruited in our study who presented with inferior wall infarction through consecutive sampling. Age of patients ranged from 35 to 85 years with mean age of 58.92 ± 9.7 years and 219 (87.6%) patients were males while 31 (12.4%) patients were females. Out of 250 patients 161 (64.4%) of patients were with reciprocal changes and 89 (35.6%) were without reciprocal changes and 12(7.2%) patients had cardiogenic shock while 17 (6.8%) patients had ventricular arrhythmias and 44 (17.4%) patients were with atrioventricular block. Mortality rate was 10 (6.6%).

Conclusion: It is concluded from our study that reciprocal ST depression in acute inferior wall myocardial infarction reflects ischemia in territory distant from the site of infarction and is associated with a high risk of fatal arrhythmias and late morbidity.

Keywords: Reciprocal echocardiography changes, Inferior wall MI, Cardiogenic shock, Atrioventricular shock

INTRODUCTION

Inferior wall myocardial infarction accounts for nearly 40-50% of all acute myocardial infarction.1,2,16 The presence of ST segment depression (reciprocal changes) in precordial leads during acute inferior wall myocardial infarction is associated with greater myocardial necrosis hence left ventricular dysfunction and more frequent left coronary artery disease. Thus identifying a subset of high risk group with poor outcome.3,4 When ST segment elevation occurs in two continuous leads and ST segment depression occur in other leads, ST elevation is considered primary changes and ST depression considered as reciprocal changes. This reciprocal change may also represent remote ischemia in a distant territory in patient with multi-vessel coronary disease or may represent simply a benign electrical phenomenon5,6. Various forms of ST depression in STEMI 17 have different implications. In patients with inferior myocardial infarction, ST segment depression in lead aVL is a reciprocal change and is usually present in nearly all patients,18 while ST depression in leads V1-V3 most likely does not represent ischemia at different region rather reciprocal changes.19 Interestingly, among patients with inferior STEMI, ST segment depression in leads V4-V6 is usually associated with left anterior descending coronary stenosis or three vessel disease representing ischemic changes at distant zones.20 There is huge ever growing burden of coronary artery disease in Pakistan and most of the patient often seek care in emergency department with myocardial infarction demanding strenuous workup. This study would help emergency department staff to identify high risk patient
(those with reciprocal changes) who benefit more from invasive approach like percutaneous coronary intervention at priority bases and hence there would be reduction in mortality and complications in this high risk group.

MATERIAL AND METHODS

It was a descriptive cohort study, conducted at cardiology department of AFIC/NIHD, Rawalpindi from Jan 2017 to Dec 2017. Patients were recruited through non-probability consecutive sampling. Patients of both genders, who had acute inferior wall myocardial infarction were included in the study. While Patients with previous myocardial infarction, by-pass surgery assessed by history, left ventricular hypertrophy assessed by electrocardiography by Sokolow criteria were excluded from the study. Patients who had ST elevation in anterior or anterolateral leads in addition to ST-segment elevation in inferior leads on electrocardiography, with serum creatinine more than 1.5mg/dl, with right ventricular infarction assessed by echocardiography by SDEW, those with reciprocal changes were taken as group-I and those with reciprocal changes were taken as group-II. The diagnosis of acute inferior myocardial infarction was then confirmed during coronary angiography by identifying the causative lesion (the thrombotically occluded infarct-related vessel) that was then revascularized during the primary percutaneous coronary intervention or was given injection streptokinase if patient was unwilling for PPCI or lesion was not crossed. Electrocardiographic monitoring for initial 24 hours using three chest leads to record Atro-ventricular blocks and Ventricular arrhythmias was carried out. Patients underwent echocardiography to record remote regional wall motion abnormality. Patients were observed during period of hospitalization for mortality.

Data Analysis

Data was analyzed by SPSS Version-21. Mean and SD were used for continuous variables while frequency (%) for categorical variables and chi-square test was applied to compare the groups.

RESULTS

Two hundred and fifty patients recruited in our study, who presented with inferior wall infarction. Age of patients ranged from 35 to 85 years with mean age of 58.92 ± 9.7 years. 219 (87.6%) patients were males while 31(12.4%) patients were females. Out of 250 patients 161 (64.4%) of patients were with reciprocal changes and 89 (35.6%) were without reciprocal changes, shown in table-I and table-II (56.8%) of patients were with remote regional wall motion abnormalities and 108 (43.2%) patients were, without remote regional wall motion abnormality. Out of 161 (64.4%) patients with reciprocal changes 123 (76.4%) were with remote regional wall motion abnormality and 38(23.6%) were without remote regional wall motion abnormality. Out of 89 (35.6%) patients without reciprocal changes 19 (21.3%) were with remote regional wall motion

| Table-I: Distribution of Reciprocal Echocardiographical changes between two groups. |
| Groups | N (%) |
| Group-I Without Reciprocal Changes | 89 (35.6%) |
| Group-II With Reciprocal Changes | 161 (64.4%) |

| Table-II: Distribution and comparison of remote regional wall motion abnormality in study groups. |
| Groups | Remote Regional Wall Motion Abnormality (n=142) | p-value |
| Group-I Without Reciprocal Changes | 19 (21.3%) | 0.0001 |
| Group II With Reciprocal Changes | 123 (76.4%) |
abnormality and 70 (78.7%) were without remote regional wall motion abnormality as shown in table-II. Complications were found to be cardiogenic shock, ventricular arrhythmias and atrio-ventricular block. Twelve (7.2%) were with cardiogenic shock. In patients with reciprocal changes 9 (5.3%) suffered with cardiogenic shock. In patients without reciprocal changes 3 (3.4%) suffered with cardiogenic shock. Seventeen (6.8%) had episode of ventricular arrhythmias. Patients with reciprocal changes 16 (9.9%) had ventricular arrhythmias. Patients without reciprocal changes 1 (1.1%) had between two groups. Statistically significant association was found between presence of remote regional wall motion abnormality and reciprocal changes. Presence of cardiogenic shock was statistically insignificant in between two groups: p-value=0.32. In case of ventricular arrhythmias difference was statistically significant between two groups (p=0.007). Presence of Atrioventricular block was statistically significant in between two groups, p-value=0.0001. Mortality was not statistically significant between two groups, shown in table-III (a) & table-III (b).

**Table-III (a): Distribution and comparison of complications among study groups.**

<table>
<thead>
<tr>
<th>Complications</th>
<th>Group-I with reciprocal changes</th>
<th>Group-II without reciprocal changes</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiogenic Shock</td>
<td>3 (3.4%)</td>
<td>9 (5.4%)</td>
<td>0.32</td>
</tr>
<tr>
<td>Ventricular Arrhythmias</td>
<td>1 (1.1%)</td>
<td>16 (9.9%)</td>
<td>0.007</td>
</tr>
<tr>
<td>Atrioventricular Block</td>
<td>3 (3.4%)</td>
<td>41 (25.5%)</td>
<td>0.0001</td>
</tr>
<tr>
<td>Mortality</td>
<td>1 (1.12%)</td>
<td>5 (3.1%)</td>
<td>0.30</td>
</tr>
</tbody>
</table>

**Table-III (b): Clinical characteristics of study population.**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Group-I Without Reciprocal Changes (n=89)</th>
<th>Group II With Reciprocal Changes (n=161)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes Mellitus</td>
<td>11 (12.3%)</td>
<td>34 (21.1%)</td>
<td>0.08</td>
</tr>
<tr>
<td>Hypertension</td>
<td>31 (34.8%)</td>
<td>55 (34.1%)</td>
<td>0.51</td>
</tr>
<tr>
<td>Smokers</td>
<td>27 (30.3%)</td>
<td>50 (31.0%)</td>
<td>0.67</td>
</tr>
<tr>
<td>Family history of IHD</td>
<td>7 (7.8%)</td>
<td>19 (11.8%)</td>
<td>0.22</td>
</tr>
<tr>
<td>Systolic Blood pressure</td>
<td>132.4 ± 31.0 mm Hg</td>
<td>129.2 ± 27.8 mm Hg</td>
<td>0.39</td>
</tr>
<tr>
<td>Diastolic Blood pressure</td>
<td>79.8 ± 16.6</td>
<td>77.3 ± 15.0</td>
<td>0.38</td>
</tr>
<tr>
<td>Door to balloon time</td>
<td>54.56 ± 30.4 min</td>
<td>59.1 ± 32.6 min</td>
<td>0.08</td>
</tr>
</tbody>
</table>

ventricular arrhythmias. Forty four (17.4%) patients developed atrioventricular block. In patients with reciprocal changes 41 (25.5%) had atrioventricular block. In patients without reciprocal changes 3 (3.4%) were with atrioventricular block. Out of 250 patients 10 (6.6%) died. In patients with reciprocal changes 1 (1.12%) died while 5 (3.1%) died patients without reciprocal changes.

Chi-square test was used to determine the significance level of difference in patients with reciprocal changes and without reciprocal changes. Demographic variables were similar.

**DISCUSSION**

Acute myocardial infarction is common not only in developed countries but is also a raising epidemic in developing countries. It is still one of major killer of mankind. Pakistanis are part of an ethnic group which suffers from the highest prevalence rates of coronary artery disease. According to the most careful estimates based on sound scientific studies nearly one hundred thousand individuals suffered an acute myocardial infarction in Pakistan in calendar year 2002. Inferior wall myocardial infarction occurred in 64.4% in this study while a study
conducted by Abbase AH it was 62.5% of patients. In another study conducted by GP parate et al it was 80%8. It is generally agreed that presence of precordial ST depression identifies a sub group of patients with inferior wall myocardial infarction with lower ejection fraction reflecting larger infarction and more severe remote regional wall motion abnormalities11. In this study Remote regional wall motion abnormalities were present in 76.4% of patients with reciprocal changes and 21.3% of patients without reciprocal changes12. In a study conducted by Abbase AH Remote regional wall motion abnormality was present in 80% of patients with reciprocal changes and 15% of patients without reciprocal changes8. In study done by Shah et al found abnormal regional wall motion abnormality in patients with ST depression was 50% vs 15% in patients without ST depression13. The two leading explanations for anterior ST depression that are believed to explain the larger infarction with more Remote regional wall motion abnormalities and more complicated courses observed in these patients are anterior ischemia due to concomitant LAD disease or more extensive infero-posterior infarction which produces ST elevation manifested as anterior ST depression on surface electrocardiography14. Some studies mentioned that complications in patients with reciprocal changes occurred in 72% compared with 31% in patients without ST depression. In study by Abbase AH complications occurred were 44.4% of patients with Reciprocal changes and 7% of patients without Reciprocal changes8. In present study complications occurred in 42.9% of patients with reciprocal changes and 7% of patients without Reciprocal changes. Also in our study we mentioned complications in terms of cardiogenic shock, ventricular arrhythmias, atrioventricular block, which was not done in previous studies11,14. Cardiogenic shock occurred in 8.6% of patients with Reciprocal changes and 3.4% of patients without reciprocal changes. There was significant difference of occurrence of cardiogenic shock in patients with and without reciprocal changes. Ventricular arrhythmias occurred in 9.9% of patients with Reciprocal Changes and 1.1% of patients without reciprocal changes10. There was no statistically significant difference of occurrence of ventricular arrhythmias in patients with and without reciprocal changes. atrioventricular block occurred in 25.5% of patients with reciprocal changes and 3.4% of patients without reciprocal changes. There was significant difference of occurrence of atrioventricular block in patients with and without reciprocal changes. Mortality rates among patients with inferior myocardial infarction is generally 2-9%9 but it differs according to ST depression. Some studies compared the mortality in patients without ST depression versus with precordial ST depression without stating maximum ST depression was 4%, 4% vs 31%, and 28%,7,11,12. In a study done by Abbase AH mortality was 13.3% in patients with Reciprocal changes and 4% in patients without Reciprocal Changes8. In this study mortality in patients with Reciprocal changes was 3.4% and in patients without reciprocal changes was 4.1% the difference between groups was not significant. ST depression in precordial leads reflects more than single vessel disease and this occurs more in patients with ST depression and thus explain the lower ejection fraction, Remote regional wall motion abnormality and higher incidence of complications and mortality5,9. It is thought that in patients with ST depression and single vessel disease a branch of the right coronary artery often supplies the apex that it did in patients without anterior ST depression. So ST depression is either a reflect of larger infarction due to multivessel disease or greater amount of myocardium supplied by infarct related artery11. It is recognized from work of Shroeder et al and others5,13 that extent of ST segment elevation plus depression defines territory at risk and its overall resolution is prognostically relevant.

LIMITATION OF STUDY

The sample size in both group is not large enough to implement on the general population
and it is recommended to conduct prospective study with large sample size.

CONCLUSION

It was concluded from our study that Reciprocal ST depression in acute inferior wall myocardial infarction reflects ischemia in territory distant from the site of infarction and is associated with a high risk of fatal arrhythmias and late morbidity.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

REFERENCES

EVALUATION OF ROLE OF SERUM URIC ACID AS AN INDICATOR OF PROGNOSIS IN PATIENTS PRESENTING WITH ACUTE ST-SEGMENT ELEVATED MYOCARDIAL INFARCTION

Muhammad Asad, Tahir Iqbal, Waheed Ur Rehman*, Hafiz Muhammad Shafique, Mir Waqas baloch, Sadaf Shabbir Kiani, Rehana Khadim, Tahir Naqash, Aatika Kamran

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ABSTRACT

Objective: To evaluate the role of serum uric acid as an indicator of prognosis in patients presenting with Acute ST segment elevated myocardial infarction.

Study Design: Descriptive cross sectional study.

Place and Duration of Study: Adult Cardiology Department, Armed Forces Institute of Cardiology & National Institute of Heart Diseases Rawalpindi Pakistan, from Sep 2017 to Jan 2018.

Material and Methods: Patients were recruited through non-probability purposive sampling. Patients of both gender between 25 to 70 years of age with acute ST elevation myocardial infarction, were included in the study. Patients who were excluded from the study were those who had NSTEMI, Old myocardial infarctions in any territory, pacemaker implantation, liver disease, kidney disease (creatinine >1.5 mg/dl), patients having gout, hypothyroidism, malignancy, valvular heart disease, alcoholics, on diuretics, ACE inhibitors, ARB’s or drugs that increase uric acid levels.

Results: Total 200 patients were included in the study according to the inclusion criteria of the study. Mean age was 49.7 ± 7.96 years which ranges from 35 to 71 years. There were 151 (75.5%) male and 49 (24.5%) female patients. Male to female ratio was 3.08. Patients were divided into two groups according to their serum uric acid level. Regarding the types of myocardial infarction, anterior MI was most common among high uric acid patients but location of MI was not statistically significant with p-value=0.6. Out of 200 patients who presented with STEMI, 156 (78.0%) underwent primary PCI, 2 (1.0%) were thrombolysed and 42 (21.0%) patients were late for thrombolysis. 31 (15.5%) patients in PPCI group had high uric acid levels (p-value=0.001) as compared to 35 (17.5%) patients (p-value=0.001) in late for thrombolysis group.

Conclusion: In conclusion, it is suggested that uric acid level on admission is not only closely related but also a predictor of cardiovascular mortality in patients presenting with STEMI during the in-hospital period.

Keywords: Acute ST elevated myocardial infarction, NSTEMI, Serum uric acid.

INTRODUCTION

One of the most common causes of death worldwide is attributed to acute myocardial infarction (AMI) and patients with AMI are shown to have a high rate of mortality during the first month following an event, especially during in-hospital stay1. In myocardial infarction there is formation of thrombus in coronary artery which leads to the occlusion of blood flow in it. If the occlusion persists for more than 20 minutes then this results in irreversible damage to the heart muscles and cell death would occur2. Cardiac myocytes produce a compound called Adenosine and the role of this compound is to cause vasodilation of arteries. Some conditions like hypoxia and tissue ischemia cause an increase in the levels of this compound3. This adenosine when produced is broken down by a structure called Endothelium. As a result of degradation adenosine is converted to uric acid (UA) rapidly; so this results in the increase in concentration of UA which leads to the decrease in the intracellular PH. As a consequence there is rapid UA efflux to the vascular lumen4. Under stressful condition like in ischemia, activity of enzymes

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involved in the synthesis of Xanthine oxidase activity and uric acid is increased, therefore elevated serum uric acid may act as a marker of underlying tissue ischaemia. In myocardial infarction (MI) there is release of some proteins and enzymes known as cardiac markers (CPK, MB/ Troponin T & I and myoglobin) into the blood stream and the area which is the most necrotic releases the largest amount. It has been demonstrated that there exists a temporal relationship of these cardiac biomarkers with MI however they do not correlate with myocardial function.

Epidemiological studies have recently shown that serum uric acid may be a risk factor for cardiovascular diseases and a negative prognostic marker for mortality in subjects with pre-existing heart failure. Elevated serum uric acid is highly predictive of mortality in patients with heart failure or coronary artery disease and of cardiovascular events in patients. It has been still not clear that how does uric acid produce pathological effects on our bodily functions including cardiovascular systems and studies are still ongoing, but it has been revealed that hyperuricemia is associated with deleterious effects on endothelial dysfunction, oxidative metabolism, platelet adhesiveness, haemorrhology and aggregation.

There is ample proof that increased levels of uric acid is a bad prognostic factor in those patients who have mild to severe heart failure and the development of hyperuricemia is linked almost always with the worsening of renal failure in these patients. Akpek M and his colleagues studied association of serum uric acid levels on coronary flow in patients undergoing primary PCI. They showed that among patients with STEMI plasma uric acid level on admission was an independent and powerful predictor of poor coronary blood flow after primary PCI and also in hospital major adverse cardiac events (MACE). A Japan based study (Japanese Acute Coronary Syndrome Study) showed a close collaboration between serum uric acid concentration and Killip’s classification in patients of acute myocardial infarction and those types of patients who have high uric acid concentration develop large number of short term adverse effects. Long term mortality is closely associated with serum uric acid level, Killip’s class, age and peak creatinine phosphokinase level and they have been related as significant predictors of long-term mortality. Patients with angiographically confirmed coronary artery disease with serum uric acid levels in the upper quartile are five times more likely to die than those in the lowest quartile. 1 mg/dl increase in serum acid levels was associated with a 26% increase in mortality. Another study done by Chen et al in STEMI patients showed a relationship between serum UA and adverse events. Kroll et al showed that in patients with higher on admission serum UA short term and long term mortality was increased. Akpek et al. reported that hyperuricemia is associated with endothelial dysfunction and microvascular disease in patients with STEMI and they concluded that free radicals may be responsible for the no-reflow phenomenon during reperfusion therapy. Furthermore, hyperuricemia may decrease nitric oxide production in vascular endothelium, which plays an important role in the regulation of coronary blood flow.

This study is being done to evaluate the role of serum uric acid in predicting cardiovascular events in patients presenting with acute ST elevation myocardial infarction, showing its association with Killip’s class of heart failure and assessing the relationship of raised serum uric acid levels with in hospital mortality.

MATERIAL AND METHODS

This study was descriptive cross-sectional study conducted at AFIC/NIHD Rawalpindi from September 2017 to January 2018. Patients were recruited through non-probability purposive sampling. Patients of both gender between 25 to 70 years of age with acute ST elevation myocardial infarction, were included in the study. Patients who were excluded from the study were those who had NSTEMI, Old
myocardial infarctions in any territory, pacemaker implantation, liver disease, kidney disease (creatinine > 1.5 mg/dl), patients having gout, hypothyroidism, malignancy, valvular heart disease, alcoholics, on diuretics, ACE inhibitors, ARB's or drugs that increase uric acid levels. Permission was sought from hospital ethical committee. Patients presenting with acute ST elevation myocardial infarction were selected based on inclusion criteria. A detailed cardiovascular history and examination with special reference to KILLIP class was done. Risk factors like diabetes mellitus, hypertension, hyperlipidemia and smoking were taken into account. Hypertension was interpreted as blood pressure ≥140/90 or taking anti-hypertensive medications. Patients having fasting blood glucose level higher than 126 mg/dl or having a random blood glucose test level of 200 mg/dl or higher as well as those taking medications for hyperglycemia were defined as having diabetes. Blood sample for uric acid was drawn 24 hours after admission. Normal levels of uric acid were defined 2.5 - 6 mg/dl in women and 3.1 - 7 mg/dl in men according to our reference laboratory. The study population was divided into normal and hyperuricemic groups according to baseline levels. Hyperuricemia was defined as serum uric acid levels as >6 mg/dl in women and >7 mg/dl in men. The patients underwent coronary angiography and revascularization according to current guidelines. Coronary angiography was done through radial or femoral route using Judkin’s technique and on Philips machines in catheterization laboratory. Data was analyzed in SPSS version 23.

**RESULTS**

Total 200 patients were included in the study according to the inclusion criteria of the study. Mean age was 49.7 ± 7.96 years which ranges from 25 to 80 years. The study population was divided into normal and hyperuricemic groups according to baseline levels. Hyperuricemia was defined as serum uric acid levels as >6 mg/dl in women and >7 mg/dl in men. The patients underwent coronary angiography and revascularization according to current guidelines. Coronary angiography was done through radial or femoral route using Judkin’s technique and on Philips machines in catheterization laboratory. Data was analyzed in SPSS version 23.

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from 35 to 71 years. There were 151 (75.5%) male and 49 (24.5%) female patients. Male to female ratio was 3.08. Patients were divided into two groups according to their serum uric acid level. Table-I shows the demographic, risk factors and location of MI of patients according to their serum uric acid level. Regarding the types of myocardial infarction, anterior MI was most common among high uric acid patients but location of MI was not statistically significant with p-value =0.6.

Out of 200 patients who presented with STEMI, 156 (78.0%) underwent primary PCI, 2 (1.0%) were thrombolysed and 42 (21.0%) patients were late for thrombolysis. 31 (15.5%) patients in PPCI group had high uric acid levels (p-value=0.001) as compared to 35 (17.5%) patients (p-value=0.001) in late for thrombolysis group.

Taking risk factors of STEMI into account smoking and hypertension were more common in normal UA group but diabetes was more commonly found in high UA group (p=0.05). Figure shows the KILLIP class differences in two groups.

Out of 200 patients most of the patients were in KILLIP class 1 and hyperuricemia occurred more commonly with higher KILLIP class (p-value=0.001) as shown in table-II. Death occurred in 28 (14.0%) patients in whom 16 (8.0%) were found hyperuricemic and this was significant with p-value=0.006. Ventricular tachycardia occurred in 8 (4.0%) patients, 5 (2.5%) of them had high uric acid levels (p-value=0.55) as shown below.

**DISCUSSION**

Uric acid (UA) has long been known to be a cardiovascular risk factor. Clinical and epidemiological studies have shown that there is an association between high levels of UA and the severity of coronary artery disease. Increased serum UA levels were independently and significantly associated with cardiovascular mortality over a long-term period. These findings suggest a relationship between high serum UA levels and coronary artery disease, although the underlying mechanisms remain unclear12.

Our study showed that mean age of patients in high and normal uric acid groups was not significant. Furthermore there was no statistical significance between male and female patients in both groups. Regarding risk factors diabetes mellitus was significantly associated with the rise of uric acid post myocardial infarction but other risk factors of hypertension and smoking were not. A study by Safi et al also showed a significant association between hyperuricemia and type 2 diabetes mellitus13.
The aim in the management of acute myocardial infarction is early restoration of myocardial blood flow because early reperfusion decreases mortality rates. In patients who had myocardial infarction those who were having higher UA concentration were in high Killip’s class. A failing heart due to AMI may cause tissue hypo perfusion and hypoxia, which results as a trigger factor for xanthine oxidase activation and oxidative stress production. Xanthine oxidase and oxidative stress as reflected by UA may form a vicious cycle that promotes severe heart failure. Therefore, UA may not only be a bystander marker but also a causative marker of mortality in patients who have AMI. In view of this fact improvement of coronary reperfusion alone may be less effective in decreasing heart failure and reducing mortality rate in patients who have acute myocardial infarction and high UA level and are in a high Killip’s class. Supporting this fact some studies have shown that in patients with MI, high serum UA level can increase the mortality rate. Our study also supported the above findings with higher no of death in hyperuricemic patients.

A study done by Kaya et al showed that raised levels of UA are significantly related to lower thrombolysis in myocardial infarction (TIMI) flows in infarct- related artery and adverse events and in-hospital mortality are higher in patients with STEMI who had undergone primary percutaneous coronary intervention (PCI). Our study also showed that no of patients who had underwent primary pci had lower rates of high uric acid levels 31 (45.5%) vs 125 (94.6%) p-value 0.001 compared to those who were late for thrombolysis 35 (51.4%) vs 7 (0.5%) p-value 0.001 as per the guidelines. In this study we also found out that frequency of ventricular tachycardia was not statistically significant among the two groups (p-value 0.5).

According to a study by Siniša Car1 and et al A total of 621 patients (age 27-90 years, 64.7% men, 77.5% AMI with ST elevation, SUA 63-993 μmol/L) were included. Higher SUA on admission was independently associated with higher in-hospital mortality (p 0.043) and higher thirty-day mortality (p 0.018). Higher serum uric acid determined on admission is associated with higher in-hospital mortality and poorer long-term survival after AMI. Nadkar and Jain concluded that SUA levels were higher in patients with acute MI and were correlated with killip’s class. In a recent systematic review, it was shown that increased risk of incident heart failure can be associated with hyperuricemia and also cardiovascular mortality, composite of death or cardiac events and risk of all other mortality cause. In this regard, for every 1 mg/dl increase in serum uric acid, the odds of development of heart failure increased by 19% and the risk of total mortality and the combined endpoint in patients with heart failure increased by 4%. Our study showed that death occurred in 16 out of 68 patients having raised uric acid which was statistically significant (p-value 0.06) which correlates with the above studies.

CONCLUSION

In conclusion, it is suggested that uric acid level on admission is not only closely related but also a predictor of cardiovascular mortality in patients presenting with STEMI during the in-hospital period. Heart failure is also linked to hyperuricemia. The majority of deaths in St elevation myocardial infarction occur during hospital admission. Uric Acid being a readily available laboratory test can be used as a biomarker for risk stratification. STEMI patients having hyperuricemia should be monitored closely for cardiovascular events during the in-hospital period.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

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Acute ST-Segment Elevated Myocardial Infarction

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FREQUENCY AND PATTERN OF LEFT MAIN STEM DISEASE IN PATIENTS REPORTING AT AFIC & NIHD, RAWALPINDI

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ABSTRACT

Objective: To determine the frequency and pattern of left main stem disease in patients reporting at AFIC & NIHD, Rawalpindi

Study Design: A single center, descriptive cross-sectional study.

Place and Duration of Study: Adult Cardiology department of AFIC & NIHD from 1st Jul 2017 to 31st Dec 2017.

Material and Methods: Patients were recruited through consecutive non-probability sampling. All the Patients of either gender who underwent for coronary angiography were included in the study. Patients excluded were either known case of coronary artery disease or Post CABG or Post PCI patients. All patients were assessed for eligibility and enrolled in study according to inclusion & exclusion criteria after informed consent. History of diabetes, hypertension, dyslipidemia, obesity, and smoking were recorded. Coronary angiographic findings of patients were noted. Data was entered and analyzed in SPSS version-21.

Results: A total of 6136 patients underwent coronary angiography during study period out of which there were 538 (8.7%) patients with LMS disease. Mean Age of the patients was 51.98 ± 2.2 years with minimum age 27 years and maximum 75 years. There were 487 (90.5%) male patients while 51 (9.5%) female patients. Hypertension was found to be the most prevalent risk factor 280 (52.0%) followed by Obesity (BMI ≥ 30), smoking history, diabetes mellitus and dyslipidemia. About 282 (52.4%) patients had TVCAD. Forty three (8.0%) had bifurcation LMS disease, 15 (2.8%) patients had shaft LMS disease while one patient had ostial LMS disease.

Conclusion: The frequency of Left main coronary artery is quite high in our patient population (8.9%), which leads to increase morbidity and mortality in these patients.

Keywords: Coronary angiography, Coronary artery disease, Left main stem disease.

INTRODUCTION

Coronary artery disease (CAD) is the leading cause of death in the world1. CAD burden is on rise in developing countries despite of recent advancements in diagnostic and therapeutic approaches owing to life style changes because of rapid urbanization2. Every 5th middle aged person in Pakistan is having CAD3. A good number of those patients present with left main stem disease defined as >50% luminal diameter narrowing of left main stem which carries 50% mortality at 3 years with medical management and requires early intervention4,5. When left main stem disease is present, it is associated with multivessel CAD in about 70% of the patients6-8. LMS disease with concomitant TVCAD carries a high risk of death and adverse outcomes. Isolated left main coronary artery stenosis is not uncommon9. Most common site for left main stenosis is distal left main bifurcation followed by ostial left main while shaft of left main has least incidence of left main stenosis in western population10. Significant LMS disease (>50% narrowing) is reported in approximately 5% of patients who underwent coronary angiography, while total occlusion of LMS is quite uncommon almost incompatible with life and is very rarely seen in general routine day-to-day practice. Review by DE Ward11 showed that 6 patients (0.04%) out of 11,900 patients undergoing angiography had complete left main occlusion12. Significant LMS disease occurs in upto 7% of patients who under went coronary angiography9,10. But these are international
studies\textsuperscript{11,12} and local burden of left main stem disease is not known and data regarding this subject is scanty.

**MATERIAL AND METHODS**

It was descriptive cross sectional study, conducted at Department of Cardiology AFIC & NIHD, Rawalpindi from 1st July 2017 to 31\textsuperscript{st} December 2017. All consecutive patients undergoing coronary angiography during this study period were included in the study. Patients excluded were either known case of CAD or Post CABG or Post PCI patients. All patients were assessed for eligibility and enrolled in study according to inclusion / exclusion criteria after informed consent. Permission from the institutional ethical committee was taken before the commencement of study. History of diabetes, hypertension, dyslipidemia, obesity, and smoking were recorded. Angiographic findings of patients with pattern of disease was noted. Data was entered and analyzed in SPSS version-21. Continuous variables such as age, height, weight and BMI were reported as mean \pm standard deviation while categorical variables such as gender, diabetes, hypertension, dyslipidemia and smoking were reported as frequency and percentages. Frequency of LMS disease and type of disease like one involving ostium, shaft or bifurcation were presented as percentages. Confounding factors and interactions were addressed by stratification for variables such as age, gender, smoking and diabetes. Chi Square test was used for association of variables.

**RESULTS**

A total of 6136 patients underwent coronary angiography during study period out of which there were 538 (8.7\%) patients with LMS disease. Mean Age of the patients was 51.98 \pm 2.2 years with minimum age 27 years and maximum 75 years.
years. There were 487 (90.5%) male patients while 51 (9.5%) female patients. Hypertension was found to be the most prevalent risk factor 280 (52.0%) followed by Obesity (BMI ≥ 30), smoking history, diabetes mellitus and dyslipidemia. About 282 (52.4%) patients had TVCAD. 43 (8.0%) had bifurcation LMS disease, 15 (2.8%) patients had shaft LMS disease while one patient had ostial LMS disease as shown in table-I.

Association between TVCAD and LMS disease was found to be statistically significant with $p$-value=0.02 as shown in table-II.

**DISCUSSION**

Coronary artery disease is the most important cause of mortality in the developed countries and is one of the leading causes of disease burden in developing countries. CAD is the epidemic of this era worldwide, LMS disease remains an independent risk factor for increased mortality and morbidity during all stages of management of coronary artery disease. LMS disease is often silent with unpredictable presentation and as such poses a certain diagnostic and management challenge. Significant (defined as a greater than 50 percent angiographic narrowing) LMS disease is found in 8.9% of our study patient population which is higher as compared to 4% to 6% of all patients who underwent coronary angiography, most likely because of late presentation to tertiary care in our study population. It is associated with multivessel coronary artery disease in around 70% of cases. Identification of significant left main disease is not always easy. Coronary Angiography may sometimes under or overestimate the degree of left main narrowing. This is particularly true for ostial or distal bifurcation, or in the presence of dense calcium or eccentric disease which requires other modalities for objective assessment of disease severity. On the other hand Left main stem disease is a relatively infrequent cause of symptomatic coronary artery disease, so patient most of the time come to medical attention very late in our part of the world. There are limited number of cath labs available in very few centers and most patient are taken to those cath labs quite late with advanced disease when they are having class III and Class IV angina, so the chance of picking the LMS disease earlier is further reduced. Coronary anomalies and coronary heart disease together contribute about 24% to Sudden cardiac death. However about 40% of sudden deaths can be unwitnessed. There is another 3 to 5% of cases which remain unexplained. During our study, we came across 538 (8.9%) cases of significant left main disease. The possible cause we presume of higher rate as compare to the international data is that, our patient’s presentation is very late to the cath lab and during this delay there disease gets worse. The average age was 51.98 ± 0.2 years in our study population and people get coronary involvement very early so there has to be an early screening for CAD here. There were 487 (90.5%) male while 51 (9.5%) female patients. The possible reason can be increased prevalence of coronary artery disease in male population, secondly there is a trend of females presenting very late to tertiary care as compared to males in developing countries like pakistan likely because of societal taboos. Diabetics were 207 (38.5%) out of 538 patients with left main stem disease. Non diabetics were 331. Although diabetes is a major risk factor but mortality is only 2 to 4% higher in diabetics. The possible cause of getting the low figure in them can be the same custom of late presentation and in the age group they came to us we lost a significant number of cases. Patients who were hypertensive with left main disease were 280 (52.0%). This is interesting as hypertension is a late presentation as compare to diabetics. About 7.9% patients who were having significant Left Main CAD were in class I angina, whereas class II angina patients with significant disease were 73%, and 14.28% were in class III and 4.7% were in CLASS IV angina. Again, if we look at the cohorts more patients were found in the class of angina where angiography might not have been done routinely and by the time they reach the catheterization laboratory we have lost most of them.
CONCLUSION

There is a high frequency of left main disease in our population with comparatively younger patients presenting with significant LMS disease which is an independent risk factor for high mortality and morbidity so there is a need for devising some measures to recognize those patients earlier for avoiding any catastrophe on patient and family.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

REFERENCES

EFFECT OF GENDER ON OPERATIVE AND EARLY RESULTS OF CORONARY ARTERY BYPASS GRAFTING

Iftikhar Paras, Ghulam Hussain, Mirza Ahmad Raza Baig, Sehrish Khalid, Sara Zaheer*, Khaliq Mahmood
Chaudhary Parvaiz Elahi Institute of Cardiology Multan Pakistan, *Civil Hospital Multan Pakistan

ABSTRACT

Objective: To evaluate the effect of gender on early morbidity and mortality after coronary artery bypass grafting. Study Design: Retrospective comparative study. Place and Duration of Study: Cardiac surgery unit of Chaudhary Parvaiz Elahi Institute of Cardiology Multan Pakistan, from Jun 2013 to Dec 2015. Material and Methods: Two thousand and one (2001) patients were included in this study, out of which 1445 were men and 556 women. SPSS V20 was used for data analysis. Independent sample t-test was used to compare quantitative variables, while qualitative variables were compared using Chi-square or Fisher’s exact test. A p-value <0.05 was considered as statistically significant. Results: Out of two thousand and one patients 1445 (72.30%) were men and 556 (27.70%) were women. Women were more obese, hypertensive and diabetics as compared to men. Pre-op ejection fraction was high in female group (p-value 0.003). Cardiopulmonary bypass time and cross clamp time was significantly high in male gender (p-value <0.001 and <0.001 respectively). The need of inotropic and circulatory support on weaning from bypass and in ICU stay was high in female gender (p-value <0.001 and <0.001 respectively). Mechanical ventilation support time and hospital stay time was significantly high in women population (p-value 0.01 and <0.001 respectively). Incidence of renal complications was significantly high in female gender, 30 (2.7%) in female versus 12 (0.8%) in male population (p-value 0.001). In-hospital mortality was 17 (3.1%) in female and 11 (0.8%) in male group with highly significant p-value of <0.001. There was no significant effect of hypertension and diabetes on operative outcomes of female gender.
Conclusion: Female gender is associated with higher incidence of mortality and morbidity after coronary artery bypass grafting.
Keywords: Coronary artery bypass grafting, Female gender, Morbidity.

INTRODUCTION

In the recent years, there has been a tremendous increase in the number of coronary artery bypass graft (CABG) surgery as it is considered an effective method for patients suffering from severe coronary artery disease for both male and female gender. But women are reported to have higher incidence of peri-operative mortality and morbidity after coronary artery bypass grafting. According to European system for cardiac risk evaluation female gender is an independent risk factor for CABG surgery. According to some researches difference in variables in men and women is responsible for this variation as women who referred to CABG are older than men, smaller coronary arteries, more advanced disease, less utilization of internal thoracic artery graft, and higher rate co-morbid conditions e.g. diabetes mellitus, higher rates of Pulmonary Hypertension and heart failure.

Despite huge number of researches on this issue it is still unclear whether it is gender or the co-morbid conditions that are responsible for poor outcome in female patients as compared to males. But almost all authors are agreeing that female patients have poor outcome after surgery. On the other hand, some researchers have found similar post-operative outcomes in female gender as compared to males. The purpose of this study is to see the difference in pre-operative risk
factors and post-operative outcomes in patients undergoing CABG surgery at a tertiary care cardiac center.

**PATIENTS AND METHODS**

It was a retrospective comparative study conducted in the cardiac surgery unit of Ch. Pervaiz Elahi Institute of Cardiology Multan, Pakistan. The demographic, echocardiographic, angiographic and per-operative data of patients operated from January 2013 to September 2015 was retrieved from the cardiac surgery database of the hospital. All patients undergoing coronary artery bypass grafting (CABG) were selected for the study. Patients undergoing concomitant surgery along with CABG were excluded from the study. Total number of 2001 patients was included in this study. The patients were divided into two groups depending upon the gender of patients. Sample size for this study was calculated by using the incidence of Peri-operative MI. In the study of Yazdanian et al, there were 1.9% males who developed peri-operative MI during surgery while none of the females developed peri-operative MI\textsuperscript{14}. Using the results of this study the calculated sample size

<table>
<thead>
<tr>
<th>Table-I: Comparison of pre-operative characteristics.</th>
<th>Male Gender</th>
<th>Female Gender</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>1445 (72.30)</td>
<td>556 (27.70)</td>
<td></td>
</tr>
<tr>
<td>Age (Y)</td>
<td>55.86 ± 9.7</td>
<td>55.63 ± 9.44</td>
<td>0.62</td>
</tr>
<tr>
<td>Body Mass Index</td>
<td>26.25 ± 4.48</td>
<td>27.34 ± 5.19</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Hypertension (%)</td>
<td>592 (41.0)</td>
<td>348 (62.5)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Diabetic History (%)</td>
<td>452 (31.3)</td>
<td>293 (52.7)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Smoking History (%)</td>
<td>631 (43.7)</td>
<td>21 (3.8)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Family History (%)</td>
<td>300 (20.8)</td>
<td>144 (25.9)</td>
<td>0.013</td>
</tr>
<tr>
<td>Pre-op EF</td>
<td>51.28 ± 10.21</td>
<td>52.78 ± 9.54</td>
<td>0.003</td>
</tr>
<tr>
<td>Pre-op Creatinine Levels</td>
<td>1.02 ± 0.33</td>
<td>0.91 ± 0.25</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Parsonnet Score</td>
<td>3.88 ± 3.93</td>
<td>5.98 ± 3.4</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Severity of the Disease (%)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>SVD</td>
<td>69 (4.8)</td>
</tr>
<tr>
<td>DVD</td>
<td>256 (17.7)</td>
</tr>
<tr>
<td>TVD</td>
<td>803 (55.6)</td>
</tr>
<tr>
<td>LMS</td>
<td>317 (21.9)</td>
</tr>
</tbody>
</table>

| Angina Class CCS (%) |  |
|---|---|---|
| Class I | 183 (12.7) | 62 (11.2) | 0.463 |
| Class II | 25 (8.7) | 40 (7.2) |
| Class III | 1071 (74.1) | 431 (77.5) |
| Class IV | 66 (4.6) | 23 (4.1) |

| LV Function Grades (%) |  |
|---|---|---|
| Grade I | 953 (66.0) | 402 (72.3) | 0.013 |
| Grade II | 306 (21.2) | 104 (18.7) |
| Grade III | 186 (12.9) | 50 (9.0) |

| Priority Status (%) |  |
|---|---|---|
| Elective | 1371 (94.9) | 537 (96.6) | 0.16 |
| Urgent | 63 (4.4) | 19 (3.4) |
| Emergency | 9 (0.6) | 0 (0.0) |
| Salvage | 2 (0.1) | 0 (0.0) |

\(\text{EF}=\text{Ejection Fraction}, \text{CCS}=\text{Canadian Cardiovascular society.}\)
was 420 individuals in each group. In our study, there were 1445 men and 556 women.

In all patients anesthesia were induced and maintained by low doses of midazolam (2-3 mg), fentanyl (10-15mg/kg), propofol (100-150 mg/kg min) and isoflurane (0.8-2.0%). In all patients standard cardiopulmonary bypass was established through median sternotomy using straight tip aortic cannula and a cavo-atrial venous cannula. Moderate hypothermia (28-32°C) was used in all patients. After clamping the aorta, cardiac arrest was achieved and maintained by using cold blood cardioplegia delivered through the aortic root at the aortic root pressures of 50-70 mmHg. Internal thoracic and sephanoous vein grafts were used as conduits in all patients. In ICU, frequency of major complications e.g. myocardial infarction, respiratory complications, renal failure and neurologic complications, ventilation time, inotropic support and hospital mortality were noted. Myocardial infarction was defined as a fivefold increase in CK-MB levels from the borderline value post-operatively. Increase in post-operative creatinine more than 1mg/dl from the pre-op value was recognized as renal failure. Pulmonary complications were defined as pleural effusion requiring drainage, pneumonia, prolonged ventilation more than 48 hours and development of ARDS. Any death that occurred during or after surgery within the hospital was categorized as In-hospital mortality. Emergency surgery was defined as need of surgery on next routinely available operative day, if operative time was given on routine OPD visit is was defined as elective surgery, if surgery was

Table-II: Comparison of operative and early post-operative variables.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Male Gender</th>
<th>Female Gender</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bypass Time</td>
<td>108 ± 30.85</td>
<td>102 ± 30.21</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Clamp Time</td>
<td>62.75 ± 20.33</td>
<td>57.45 ± 19.91</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Number of Grafts</td>
<td>2.83 ± 0.68</td>
<td>2.80 ± 0.72</td>
<td>0.45</td>
</tr>
<tr>
<td>Post-op CKMB* Levels (IU)</td>
<td>57.23 ± 68.34</td>
<td>63.20+62.58</td>
<td>0.07</td>
</tr>
<tr>
<td>Peri-op MI** (%)</td>
<td>52 (3.6)</td>
<td>40 (7.2)</td>
<td>0.001</td>
</tr>
<tr>
<td>Duration of Support (hours)</td>
<td>11.35 ± 18.17</td>
<td>13.56 ± 20.65</td>
<td>0.02</td>
</tr>
<tr>
<td>Ventilation time (hours)</td>
<td>7.66 ± 19.18</td>
<td>10.38 ± 27.76</td>
<td>0.01</td>
</tr>
<tr>
<td>ICU Stay (hours)</td>
<td>41.26 ± 42.93</td>
<td>46.06 ± 70.08</td>
<td>0.07</td>
</tr>
<tr>
<td>Hospital stay (days)</td>
<td>7.02 ± 2.72</td>
<td>7.61 ± 3.29</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Inotropic Support (%)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>880 (60.9)</td>
<td>323 (58.1)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Moderate</td>
<td>339 (23.5)</td>
<td>137 (24.6)</td>
<td></td>
</tr>
<tr>
<td>High Dose</td>
<td>38 (2.6)</td>
<td>48 (8.6)</td>
<td></td>
</tr>
<tr>
<td>Nil</td>
<td>188 (13.0)</td>
<td>48 (8.6)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Neurologic complications (%)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Brain death</td>
<td>3 (0.2)</td>
<td>1(0.2)</td>
<td>0.07</td>
</tr>
<tr>
<td>Permanent Local Paralysis</td>
<td>1 (0.1)</td>
<td>5 (0.9)</td>
<td></td>
</tr>
<tr>
<td>Acute Confusional State</td>
<td>12 (0.8)</td>
<td>6 (1.1)</td>
<td></td>
</tr>
<tr>
<td>TIA</td>
<td>2 (0.1)</td>
<td>1 (0.2)</td>
<td></td>
</tr>
<tr>
<td>Renal Complications (%)</td>
<td>12 (0.80)</td>
<td>15 (2.7)</td>
<td>0.001</td>
</tr>
<tr>
<td>Pulmonary Complications (%)</td>
<td>60 (4.2)</td>
<td>30 (5.4)</td>
<td>(0.23)</td>
</tr>
<tr>
<td>IABP*** (%)</td>
<td>47 (3.3)</td>
<td>43 (7.7)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Operative Mortality (%)</td>
<td>11 (0.8)</td>
<td>17 (3.1)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

*CKMB=Creatinine Kinase Myocardial Band, **MI=Myocardial Infarction, ***IABP=Intra-aortic Balloon Pump.
performed on immediate available list it as defined as urgent surgery.

SPSS V20 was used for data analysis. Independent sample t-test was used to compare quantitative variables, while qualitative variables were compared using Chi-square or Fisher’s exact test. Quantitative variables were presented as mean and standard deviation while qualitative variables were presented as frequency and percentage. A p-value<0.05 was considered as statistically significant.

RESULTS

Out of two thousand and one (2001) patients, there were 1445 (72.30%) males and 556 (27.70%) females. There was no significant difference between baseline characteristics between the groups except females were more obese as compared to males. Mean body mass index in female group was 27.34 ± 5.19 versus 26.25 ± 4.48 in male group (p-value <0.001). Regarding risk factors there were more females having history of hypertension and diabetes. The incidence of hypertension was 592 (41.0%) versus 348 (62.5%) and 452 (31.3%) versus 293 (52.7%) in male and female group and this difference was statistically significant (p-value <0.001 and <0.001 respectively). Pre-op ejection fractions were also higher in female group (0.003). There were more patients in LV Grade II and III in male group (p-value 0.013). Numbers of grafts applied were same in both groups (table-I).

Cardiopulmonary bypass time and cross clamp time was significantly high in male gender. Post-op Creatinine Kinase Myocardial Band (CK-MB) levels were high in female group but this difference was not significant. Duration of ventilation support and inotropic support was significantly high in female group with highly significant p-values 0.01 and 0.02 respectively. Similarly hospital stay time was also high in female group. There were more patients in female group who required high inotropic support

Table-III: Comparison of post-operative characteristics and complications between diabetics and non-diabetics in female gender.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Diabetic</th>
<th>Non-Diabetics</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-op CKMB Levels (IU)</td>
<td>59.54 ± 56.54</td>
<td>67.28 ± 68.6</td>
<td>0.16</td>
</tr>
<tr>
<td>Peri-op MI (%)</td>
<td>12 (4.1)</td>
<td>28 (10.6)</td>
<td>0.003</td>
</tr>
<tr>
<td>Duration of Support (hours)</td>
<td>12.21 ± 20.85</td>
<td>15.08 ± 20.36</td>
<td>0.11</td>
</tr>
<tr>
<td>Ventilation time (hours)</td>
<td>10.71 ± 34.03</td>
<td>10.00 ± 18.42</td>
<td>0.76</td>
</tr>
<tr>
<td>ICU Stay (hours)</td>
<td>44.52 ± 42.59</td>
<td>47.72 ± 91.62</td>
<td>0.60</td>
</tr>
<tr>
<td>Hospital stay (days)</td>
<td>7.58 ± 2.55</td>
<td>7.64 ± 3.94</td>
<td>0.85</td>
</tr>
<tr>
<td>Inotropic Support (%)</td>
<td></td>
<td></td>
<td>0.61</td>
</tr>
<tr>
<td>Mild</td>
<td>172 (58.7)</td>
<td>151 (57.4)</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>76 (25.9)</td>
<td>61 (23.2)</td>
<td></td>
</tr>
<tr>
<td>High Dose</td>
<td>22 (7.5)</td>
<td>26 (9.9)</td>
<td></td>
</tr>
<tr>
<td>Nil</td>
<td>23 (7.8)</td>
<td>25 (9.5)</td>
<td></td>
</tr>
<tr>
<td>Neurologic complications (%)</td>
<td></td>
<td></td>
<td>0.62</td>
</tr>
<tr>
<td>Brain death</td>
<td>0 (0.00)</td>
<td>1 (0.0)</td>
<td></td>
</tr>
<tr>
<td>Permanent Local Paralysis</td>
<td>3 (1.0)</td>
<td>2 (0.8)</td>
<td></td>
</tr>
<tr>
<td>Acute Confusional State</td>
<td>4 (1.4)</td>
<td>2 (0.8)</td>
<td></td>
</tr>
<tr>
<td>TIA</td>
<td>1 (0.3)</td>
<td>0 (0.0)</td>
<td></td>
</tr>
<tr>
<td>Renal Complications (%)</td>
<td>6 (2.0)</td>
<td>9 (3.4)</td>
<td>0.32</td>
</tr>
<tr>
<td>Pulmonary Complications (%)</td>
<td>15 (5.1)</td>
<td>15 (5.7)</td>
<td>0.76</td>
</tr>
<tr>
<td>IABP (%)</td>
<td>17 (5.8)</td>
<td>26 (9.9)</td>
<td>0.07</td>
</tr>
<tr>
<td>Operative Mortality (%)</td>
<td>8 (2.7)</td>
<td>9 (3.4)</td>
<td>0.64</td>
</tr>
</tbody>
</table>
post-operatively, there were 48 (8.6%) patients in female group who required high inotropic support as compared to 38 (2.6%) patients in male group (p-value <0.001). incidence of neurologic complications and renal complications was also high in female group. The need of inotropic support on weaning from cardiopulmonary bypass time was also higher in female group (p-value <0.001). Similarly operative mortality was also higher in female group. There were 17 (3.1%) mortalities in female gender versus only 11 (0.8%) mortalities in male group with p-value <0.001 (table-II). So we found that female gender was associated with higher incidence of morbidity and mortality in patients undergoing coronary artery bypass graft surgery.

We stratified the patients on the basis of gender and see the effect of major co-morbid pathologies that were significantly high in female population. We analyze the patients on the basis of hypertensive and non-hypertensive and diabetics and non-diabetics. Regarding Diabetics and non-diabetics there was no significant difference in postoperative outcomes and complications except the incidence of peri-operative MI was significantly high in non-diabetic group. Requirement of IABP was also high in non-diabetic group but this difference was not statistically significant (table-III). On comparison of women on the basis of hypertensives and non-hypertensives, no significant effect of co-morbidities on operative outcomes of female gender.

**DISCUSSION**

Coronary artery bypass grafting is associated with the risk of mortality and morbidity but according to several studies the risk of post-operative complications and mortality is more...
in women population\textsuperscript{2,11}. Many studies has concluded that female gender is an independent predictor of mortality after CABG surgery\textsuperscript{12,13}. Some studies have concluded that it is not gender but actually these are comorbid risk factors which are associated with higher mortality in female gender\textsuperscript{14,15}. According to the Australian Society of Cardiac and Thoracic Surgeons cardiac surgery database, women carry a higher risk of 30 day operative mortality as compared to men, operative mortality in female gender was 2.2 vs 1.5 percent in male gender\textsuperscript{16}. In our study, the operative mortality in women was 3.1% versus 0.8% in men. The need and duration of inotropic support and Intra-aortic balloon pump counterpulsation support on weaning from cardio-pulmonary bypass was also high in women population.

In our study the women were younger as compared to men and have larger body surface area 27.34 ± 5.19 versus 26.25 ± 4.48 in male population. But according to many studies the women who undergo CABG were older having small body surface area\textsuperscript{4,16}. The reason for this difference is not known. But we found a higher incidence of diabetes and hypertension in female population as compared to men. In this study hypertension was 22.5% more common in women. Similarly incidence of diabetes was also 21.4% high in women population. There were more men in LV Grade II and III in this study. And more men underwent urgent emergency and salvage surgeries unlike previous studies. Advanced age, smaller body surface area, Low LV grade, urgent surgery and incomplete revascularization were considered as contributing factors of mortality and morbidity in previous studies. But in this study, there were no such factor available. And there was no difference in number of grafts in men and women. We also found a higher incidence of post-operative complications in women population. The incidence of renal complications and neurologic complications was high in women population in this study. And we did not find any significant effect of co-morbidities like diabetes and hypertension on postoperative outcomes and complications in female gender. So we found that female gender is associated with higher incidence of morbidity and mortality after coronary artery bypass graft surgery.

**CONCLUSION**

Female gender is associated with higher incidence of mortality and morbidity after coronary artery bypass grafting.

**CONFLICT OF INTEREST**

This study has no conflict of interest to declare by any author.

**REFERENCES**


PATENCY OF BYPASS GRAFTS ON MSCT ANGIOGRAPHY, AFIC EXPERIENCE

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Muhammad Hamza Jahangeer*, Arslan Mehmood*

Armed Forces Institute of Cardiology/National University of Medical Sciences (NUMS) Rawalpindi Pakistan, *Army Medical Collage/
National University of Medical Sciences (NUMS) Rawalpindi Pakistan

ABSTRACT

Objective: To determine the patency of coronary artery bypass grafts (CABG) in patients presenting with recurrent angina.

Study Design: Descriptive study.

Place and Duration of Study: Cardiac Catheterization Lab AFIC/NIHD, Rawalpindi, from Jan 2011 to Jan 2014 over a time period of about 3 years.

Material and Methods: A total of 955 patients who presented with recurrent angina or atypical chest pain or newly developed ECG changes after prior bypass surgery were included in study. Patients with chest pain at rest, cardiac arrhythmias and history of allergy to contrast, renal failure, hemodynamically unstable patients and pregnant females were not enrolled in study. All 955 patients were selected by non-probability consecutive sampling. Patient’s demographic and multi-slice computer tomography (MSCT) angiography findings were recorded. Finally data was analyzed by using SPSS version 21.

Result: Out of 955 patients 863 (90.4%) were male while remaining 92 (9.6%) were female. Age range was 34-91 years. LIMA was the most frequently implanted graft i.e. 861 (90.16%). RIMA is the least implanted graft. Out of 861 LIMA grafts 788 (91.5%) were patent as visualized by MSCT, 55 (6.4%) were occluded while 18 (2.1%) were atretic. A total of 2001 saphenous venous grafts were implanted out of which 1234 (61.66%) were patent, 682 (34.08%) were occluded while 85 (4.3%) were diseased. In case of RADIAL a total of 33 (91.7%) grafts were patent, 3 (8.3%) were occluded and in case of RIMA 19 (82.6%) grafts were patent and 4 (17.4%) were occluded. Overall 91.30% of arterial grafts were patent. In case of both RADIAL and RIMA no graft was diseased.

Conclusion: SVG were patent in 61.66% of the grafts while arterial grafts had a patency rate of 91.30%. Thus arterial grafts have high patency rate as compared to others.

Keywords: CABG, Graft patency, MSCT angiography.

INTRODUCTION

With the commencement of digital era and industrialization coronary artery disease has become one of the most common causes of hospital admission and mortality. As a result coronary artery bypass graft surgery (CABG) is most often frequently performed surgical procedure in advanced countries1. In USA, around 427000 patients undergo CABG annually2. CABG has emerged as an effective treatment for patients with intractable angina and in patients having stable coronary artery disease3. However its long term results are limited by failure of grafts4. Generally speaking graft occlusion occurs in 10-15% of patients shortly after surgery or during first year and in 25% patients in 5 years5. Venous graft patency is reduced to 50% at 10 years after surgery, and at 15 years about 80% of the venous grafts become occluded while 90% of the arterial grafts remain patent even after 10 years of surgery. LIMA have much improved survival rates6,7.

Recurrent angina after CABG has become an important issue in cardiology, as reflected by increasing number of patients presenting with thoracic discomfort raising a question of bypass graft stenosis. Therefore evaluation of the bypass graft as well as native arteries is indispensable. Coronary interventional angiography is the gold standard technique in the evaluation of bypass
graft patency and stenosis. As it is invasive and complicated technique, therefore both immediate and follow up control of graft patency are not performed. Therefore since the early 1980s, CT and MRI were in use as an alternative to invasive techniques to visualize bypass grafts. However both techniques cannot judge graft stenosis and distal graft anastomosis. Similarly electron beam tomography on the other hand is limited by three dimensional resolutions, cost and its availability. With advancement in technology, both temporal and spatial resolution could be substantially increased by use of Multi-detector row spiral computed tomography (MSCT). MSCT with retrospective ECG gating has partly overcome the limitations of EBCT and MRI and show high accuracy in the detection of graft diseases. Many studies have demonstrated good diagnostic accuracy of MSCT for the detection of significant stenosis in grafts with high diagnostic accuracy (sensitivity 96% to 99%, specificity 95% to 100%) .

In current study we analyze bypass graft patency by using 64 slice MSCT in patients who has undergone CABG and presented with recurrent chest discomfort at Armed Forces Institute of Cardiology, Rawalpindi.

MATERIAL AND METHODS

This descriptive study was performed at Catherization laboratory, Armed Forces Institute of Cardiology, from Jan 2011 to Jan 2014 over a time period of about 3 years. All 955 consecutive patients who were scheduled for invasive coronary angiography (ICA) were included in the study. Patients with chest pain at rest, cardiac arrhythmias and history of allergy to contrast, renal failure, hemodynamically unstable patients and pregnant females were not enrolled in study. All 955 patients were selected by non-probability consecutive sampling.

Written informed consent was taken from all the patients. In all patients 64 slice MSCT angiography was performed within 15 days before ICA. Patients were given metoprolol 100mg orally 3 hours before the procedure to bring heart rate below 65 beats/min. Heart rate, electrocardiogram, and blood pressure were monitored; and additional intravenous metoprolol (10-15mg) was administered if necessary to achieve the target heart rate. Sublingual nitroglycerin 0.5mg was given 1 minute before image acquisition.

Computerized tomography angiography (CTA) images were taken using 64 slice MSCT scanner. During scan 80-120ml of contrast agent usually iopamidol was injected continuously at infusion rate of 4.5 ml/s through anteceubital vein for MSCT images. Contrast was followed by injection of 30-50ml saline chasing bolus. Scanning was initiated in craniocaudal direction. This was done during a single inspiratory breath hold for an acquisition time of 12-15 sec. For an optimal heart phase selection, retrospective ECG gating was used. Retrospective reconstruction of the image data was performed for acquisition of phase images starting from early systole (10% of the R-R interval) and ending at late diastole (90% of the R-R interval) using 10% increments. All images were reconstructed with a display field of view of 25cm, a standard soft tissue filter as suggested by the manufacturer and an effective slice thickness of 0.625mm with an increment of 0.625mm. The best phase was selected for analysis of grafts and native vessels.

After scan images were reformatted and were analyzed by two experts and findings were agreed upon. Only excellent (with no motion or gating artifacts present), good (with minor motion artifacts present) and diagnostic (with substantial motion artifacts present, but luminal assessment of significant stenosis still possible) images were selected for graft evaluation. All the grafts were assessed for the origin, the body, the distal anastomosis and the native recipient coronary arteries after the grafts. Patient’s demographic data and MSCT angiography findings were recorded. Finally data was analyzed by using SPSS version 21. Various descriptive statistics were used to calculate frequencies, percentages and standard deviation. The numerical data such as age were expressed...
as Mean ± Standard deviation while the categorical data were expressed as frequency and percentages.

RESULTS

Out of 955 patients 863 (90.4%) were male while remaining 92 (9.6%) were female. Age range was 34-91 years with mean of 60.72 ± 9.52. Hypertension was most common risk factors followed by smoking, diabetes mellitus and hyperlipidemia. Maximum number of grafts implanted in a patient was 4 while minimum of 1 graft was implanted in a patient. A total of 2001 saphenous venous grafts were implanted out of which 1234 (61.66%) were patent, 682 (34.08%) were occluded while 85 (4.3%) were diseased. In case of RADIAL a total of 33 (91.7%) grafts were patent, 3 (8.3%) were occluded and in case of RIMA 19 (82.6%) grafts were patent and 4 (17.4%) were occluded. Overall 91.30% of arterial grafts were patent. In case of both RADIAL and RIMA no graft was diseased. Frequency and type of graft implanted and MSCT angiography findings are shown in table-I & II.

Table-I: Frequency of grafts implanted.

<table>
<thead>
<tr>
<th>Grafts</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIMA</td>
<td>861 (90.16%)</td>
</tr>
<tr>
<td>SVG to LAD</td>
<td>90 (9.42%)</td>
</tr>
<tr>
<td>SVG to DIAG</td>
<td>389 (40.73%)</td>
</tr>
<tr>
<td>SVG to OM1</td>
<td>732 (76.65%)</td>
</tr>
<tr>
<td>SVG to OM2</td>
<td>75 (7.85%)</td>
</tr>
<tr>
<td>SVG to RCA</td>
<td>715 (75.87%)</td>
</tr>
<tr>
<td>RADIAL</td>
<td>36 (3.77%)</td>
</tr>
<tr>
<td>RIMA</td>
<td>23 (2.41%)</td>
</tr>
</tbody>
</table>

LIMA (Left Internal Mammary Artery), RIMA (Right Internal Mammary Artery), SVG (Saphenous Venous Graft), LAD (Left Anterior Descending), DIAG (Diagonal), RCA (Right Coronary Artery), OM (Obtuse Marginal).

Table-II: MSCT findings.

<table>
<thead>
<tr>
<th></th>
<th>Patent</th>
<th>Occluded</th>
<th>Diseased</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIMA</td>
<td>788 (91.5%)</td>
<td>55 (6.4%)</td>
<td>18 (2.1%)</td>
</tr>
<tr>
<td>SVG to LAD</td>
<td>60 (66.7%)</td>
<td>23 (25.6%)</td>
<td>7 (7.8%)</td>
</tr>
<tr>
<td>SVG to DIAG</td>
<td>243 (62.5%)</td>
<td>132 (33.9%)</td>
<td>14 (3.6%)</td>
</tr>
<tr>
<td>SVG to OM1</td>
<td>438 (59.8%)</td>
<td>251 (34.3%)</td>
<td>43 (5.9%)</td>
</tr>
<tr>
<td>SVG to OM2</td>
<td>54 (72%)</td>
<td>18 (24%)</td>
<td>3 (4%)</td>
</tr>
<tr>
<td>SVG to RCA</td>
<td>439 (61.4%)</td>
<td>253 (35.4%)</td>
<td>23 (3.2%)</td>
</tr>
<tr>
<td>RADIAL</td>
<td>33 (91.7%)</td>
<td>3 (8.3%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>RIMA</td>
<td>19 (82.6%)</td>
<td>4 (17.4%)</td>
<td>0 (0.0%)</td>
</tr>
</tbody>
</table>

DISCUSSION

MSCT is the latest breakthrough in CT technology. It is in use since 1992 in the form of dual spiral scanning, while first 4 slice unit was introduced in 199814. Systems with 8, 10, 16, 32 and 64 detector arrays have become available over the last few years. Compared with previous generations, 64 slice MSCT scanner provides improve temporal and spatial resolution15,16.

Although promising results have been reported for MRI recently. Langerak et al evaluated 56 venous grafts with the help of MRI17. Similarly in another study, patients who presented with recurrent chest pain were assessed by MRI to detect stenosis. A sensitivity and specificity of 94% and 63% were observed for the detection of single vein grafts with stenosis ≥50%; sensitivity and specificity rose to 96 and 92%, respectively, when stenosis ≥70% was considered. Other non-invasive techniques like exercise ECG, stress myocardial imaging and stress echo are also available for the assessment of post CABG patients however they lack the...
anatomical details of the grafts and native vessels.

In present study we assess the patency of arterial and venous graft in patients who presented with recurrent chest pain. In our study the overall patency rate of saphenous venous grafts was 61.66%, however it depends upon the grafted vessel (59.8-72%), similarly patency rate of arterial graft ranges from 82.6%-91.7%. These results are consistent with the results described by Basri et al. He stated a patency rate of 86.3-91.5% for saphenous venous grafts while patency rate for arterial grafts was 95% including 97.3% for the LIMA grafts, 50% for the RA grafts, and 50% for the RIMA grafts. These results are also confirmed by another study in which a patency rate of >90% was stated. Naveed et al conducted a study on 64 post CABG patients to evaluate the patency of bypass grafts. He showed a patency rate of 66% for SVG and 92% for arterial grafts. Various studies have shown that 10–15 year post CABG graft patency is 50–60 % for venous grafts and 85 % for the arterial grafts.

The best quality images are always obtained in patients with low heart rate. However recent study has demonstrated that heart rate is not a crucial determinant of image quality. However temporal resolution varies with patient heart rate. Therefore we gave beta blockers in cases to lower the heart rate.

MSCT can not be called as risk free investigation because of radiation exposure and contrast administration. Compared with ordinary coronary CT, the scan range was extended by 37% which results in high radiation dose. Although 64 slice MSCT has become gold standard for evaluation of post CABG grafts, still development of new generation scanners are still under way. Cardiac freeze frame technique, dual-source CT, flat-panel CT will help to improve further temporal resolution, abolishes the problem of breadth holding further reduces motion artifacts and artifacts related to variations of heart rate during the scan.

CONCLUSION

MSCT in our setup has comparable results to the data available from other cardiology facilities around the world and it has become a standard care for the evaluation of graft disease. Our data showed that 61.66% SVG were patent while arterial grafts were patent in 91.30% of the grafts.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

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Grafts And MSCT Angiography


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EVALUATION OF ETIOLOGY, CLINICO-PATHOLOGICAL PRESENTATION AND OUTCOME OF PERICARDIAL EFFUSION

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ABSTRACT

Objective: To quantify the common causes and clinical presentation of pericardial effusion and its outcome.

Study Design: Descriptive study.

Place and duration of study: Rawalpindi Institute of Cardiology, Rawalpindi for a period of one year.

Material and Methods: A total of 63 cases of pericardial effusion confirmed by clinical complaints and echocardiography were enrolled. Etiology of disease, clinical presentation and management outcome were observed. The patients were consented for participation in the study. Consent was taken from patients. SPSS 17.0 was used to analyze data.

Results: The mean age of patients was 43.9 years with male predominance (61.9%). Leading cause of disease was infectious tuberculous 47 (74.6%), followed by malignant cause 5 (7.9%). Fever 33 (52.3%), shortness of breath 38 (60.3%) and chest pain were main complaints. Conservative management with ATT was given in 38 (60.3%) whereas majority of the patients were managed with pericardiocentesis 53 (84.1%). Majority 59 (93.6%) improved and discharge whereas 3 (4.6%) died and 1 (1.5%) patient suffered recurrence.

Conclusions: The leading cause of pericardial effusion was infectious tuberculous in this study. Breathing difficulty, chest pain, fever and cough were the common presenting complaints. Majority of patients were managed with ATT + pericardiocentesis and they improved and got discharged.

Keywords: Clinical complaints, Etiology, Outcome, Pericardial effusion.

INTRODUCTION

Pericardial effusion presents relatively commonly in clinical practice. It is a significant cause of cardiac malfunction and could lead to tamponade due to accumulation of fluid in cardiac sac. Its effect on heart depends on the size of effusion and fluid volume. Pericardial effusion is attributed to underlying diseases like tuberculosis, malignancy or other viral conditions, however, in many instances the cause is unknown and thus, present as idiopathic pericardial effusion. In the western world malignancy is the major cause of pericardial effusion whereas in the developing and underdeveloped world infectious causes like TB are still common underlying condition.

Thoracic x-ray shows the presence of an enlarged cardiac silhouette with clear lungs and at times is non-specific. Echocardiography is the baseline investigation to determine the presence of pericardial effusion, it is also prioritized due to its distinctive strength to measure the size and volume of fluid. In cases of mild pericardial effusion (<10 mm space in sac) is though very frequent specially in women, it is at times misjudged and can be accurately screened for its nature and intensity by a CT scan or a more in-depth MR imaging.

There are numerous management strategies for pericardial effusion; conservative management, pericardiocentesis and surgical options. The outcome of any treatment lies on the intensity of effusion and any specific co-morbid condition.

Pakistan being a lower middle income developing country has plenty of infectious risk
attributable social and environmental conditions. Pericardial effusion is a frequent presentation but its observation and study has been a neglected affair so far, specially, in the underdeveloped world. There is no or very few pervious data regarding this topic from national and local level settings. Thus, we aimed to determine the etiological background of pericardial effusion and clinical presentation of patients was noted. The status of pericardial effusion on the basis of ECHO and biochemical parameters was also noted. The management strategies and their final outcome in terms of improvement, recurrence and death were also noted.

The patients comprised of adult cases above 15 years of age and both genders. Patients with signs and symptoms of pericardial effusion confirmed on echocardiogram were included. Those below the age of 15 years and having any associated cardiac co-morbidity were excluded from the study.

The study sample was 59 calculated through WHO sample size calculator; based on 95% confidence level, alpha error of 5% and anticipated population with pericardia effusion of 4% (ref), after including a 5% non-response

### Table-I: Demographic characteristics of study patients (n=63).

<table>
<thead>
<tr>
<th>Demographic characteristics</th>
<th>No. of cases</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (years)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 to 20</td>
<td>7</td>
<td>11.1</td>
</tr>
<tr>
<td>21 to 30</td>
<td>13</td>
<td>20.6</td>
</tr>
<tr>
<td>31 to 40</td>
<td>11</td>
<td>17.4</td>
</tr>
<tr>
<td>41 to 50</td>
<td>6</td>
<td>9.5</td>
</tr>
<tr>
<td>51 to 60</td>
<td>13</td>
<td>20.6</td>
</tr>
<tr>
<td>61 or above</td>
<td>13</td>
<td>20.6</td>
</tr>
<tr>
<td><strong>Mean ± SD</strong></td>
<td>43.9 ± 18.8</td>
<td></td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>39</td>
<td>61.9</td>
</tr>
<tr>
<td>Female</td>
<td>24</td>
<td>38.1</td>
</tr>
</tbody>
</table>

### Table-II: Etiology of disease in study patients (n=63).

<table>
<thead>
<tr>
<th>Etiological factors &amp; Co-morbidities</th>
<th>No. of cases</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infectious</td>
<td>47</td>
<td>74.6</td>
</tr>
<tr>
<td>Malignancy</td>
<td>5</td>
<td>7.9</td>
</tr>
<tr>
<td>CRF</td>
<td>4</td>
<td>6.2</td>
</tr>
<tr>
<td>SLE</td>
<td>2</td>
<td>3.1</td>
</tr>
<tr>
<td>Post PCI</td>
<td>1</td>
<td>1.5</td>
</tr>
<tr>
<td>TPM</td>
<td>1</td>
<td>1.5</td>
</tr>
<tr>
<td><strong>Co-morbidities</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypertension/AF</td>
<td>1</td>
<td>1.5</td>
</tr>
<tr>
<td>Hypothyroidism</td>
<td>1</td>
<td>1.5</td>
</tr>
<tr>
<td>VSD</td>
<td>1</td>
<td>1.5</td>
</tr>
</tbody>
</table>

**MATERIAL AND METHODS**

A descriptive study was conducted in the Rawalpindi Institute of Cardiology, Rawalpindi for a period of one year from April 2016 to April 2017. A total of 63 pericardial effusion patients were selected and enrolled. An informed consent was administered to those fulfilling the study inclusion criteria. The etiological background and
rate. Sampling was done through non-probability consecutive sampling. The data was analyzed using SPSS software version 20.0. Descriptive statistics was applied to measure frequency and percentages from categorical variables like etiology, clinical presentation and management outcome and mean and standard deviation from quantitative numerical variables like age of patients and biochemical laboratory parameters like ESR, hemoglobin and TLC levels.

RESULTS

The mean age of stud patients was 43.9 ± 18.8 years with almost equal distribution in all decades of life ranging from 15 years to up to 80 years. Male gender was in majority with (61.9%) proportion (table-I).

In most of the patients the etiology of disease was infectious tuberculous 47 (74.6%), followed by malignant in 5 (7.9%), CRF in 4 (6.2%) and other frequent causes were SLE 2 (3.1%) and co-morbidities like hypertension, hypothyroidism and VSD in 1 (1.5%) patient each (table-II).

The most frequent signs and symptoms in patients were fever 33 (52.3%), shortness of breath 38 (60.3%) and chest pain in 20 (31.7%) patients. The other presenting complaints noted in the study were cough 17 (26.9%) and cardiac tamponade seen in 4 (6.3%) cases (figure).

The size of pericardial effusion was found large in 37 (58.7%) patients, in 9 (14.2%) it was moderate size whereas size was normal in 17 (26.9%) patients. The location of the pericardial effusion was almost circumferential in all study cases. The average ESR was 44.5 ± 12.1 and hemoglobin level was 11.7 ± 2.7 mg/dl. In 19 (30.1%) cases the pericardial fluid was exudative lymphocytic, in 5 (7.9%) cases it was bacterial while in 2 (3.1%) patients it was transudative lymphocytic. Medical ATT + pericardiocentes was given to 38 (60.3%), Antibiotics + pericardiocentesis given to 15 (23.8%) whereas 12 (19.0%) patients were managed with pericardiocentesis alone (table-III).

The majority of the patients 59 (93.6%) improved and were discharged from hospital, however, there were 3 (4.6%) deaths and 1 (1.5%) patient had recurrence of pericardial effusion (table-IV).

DISCUSSION

To date this is one of the earliest observations of pericardial effusion from Pakistan in terms of etiology, clinco-pathological presentation and management outcome. The scientific literature on this topic is not commonly available internationally. A total of 63 patients were analyzed in this trial and the main cause of pericardial effusion was infectious tuberculous (up to 80.0%) and malignant in (8.0%) cases. A study from India on children witnessed a similar trend where tuberculosis was the main cause of
pericardial effusion\(^7\). Similarly, Guven et al from Turkey reported tubercular etiology in 30% of their cases\(^8\). However, most of previous reports from developed world have in contrast finding and the current study clearly shows a deviation from those reports. Studies by Corey et al and Colombo et al witnessed idiopathic and neoplasme nature as the main factors of pericardial effusion in their patients followed by less frequent cause like uremia and TB\(^9,10\). Similarly, Sagristà-Sauleda et al also witnessed neoplasm and idiopathic nature as the most frequent causes of pericardial effusion followed by uremia, TB and other factors\(^11\).

These etiologic findings are in contrast to our study results where the main reasons were infectious TB whereas malignancy and others appeared to be less significant causative agents. The final etiology of pericardial effusion should be based on specific data, in this regard simple clinical complaints may be useful. A previous report observed that hemodynamic compromise, cardiomegaly, pleural effusion, and a large pericardial effusion were significantly found in patients with tuberculous or malignant pericardial disease\(^12\).

Table-III: Findings on investigations and management strategy in the study (n=63).

<table>
<thead>
<tr>
<th>Findings</th>
<th>No. of cases</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Findings on echo</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Size</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large</td>
<td>37</td>
<td>58.7</td>
</tr>
<tr>
<td>Moderate</td>
<td>9</td>
<td>14.2</td>
</tr>
<tr>
<td>Normal</td>
<td>17</td>
<td>26.9</td>
</tr>
<tr>
<td>Location</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circumferential pericardial effusion</td>
<td>61</td>
<td>96.8</td>
</tr>
<tr>
<td>Circumferential effusion with tamponade</td>
<td>2</td>
<td>3.1</td>
</tr>
<tr>
<td>Signs of tamponade</td>
<td>12</td>
<td>19.0</td>
</tr>
<tr>
<td>Lab findings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ESR</td>
<td>44.5 ± 12.1</td>
<td></td>
</tr>
<tr>
<td>Hemoglobin</td>
<td>11.7 ± 2.7</td>
<td></td>
</tr>
<tr>
<td>Pericardial fluid analysis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exudative lymphocytic</td>
<td>19</td>
<td>30.1</td>
</tr>
<tr>
<td>Bacterial</td>
<td>5</td>
<td>7.9</td>
</tr>
<tr>
<td>Transudative lymphocytic</td>
<td>2</td>
<td>3.5</td>
</tr>
<tr>
<td>Management</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medical ATT + Pericardiocentesis</td>
<td>38</td>
<td>60.3%</td>
</tr>
<tr>
<td>Antibiotics + Pericardiocentesis</td>
<td>15</td>
<td>23.8%</td>
</tr>
<tr>
<td>Pericardiocentesis alone</td>
<td>12</td>
<td>19.0%</td>
</tr>
</tbody>
</table>

Table-IV: Outcome of patients (n=63).

<table>
<thead>
<tr>
<th>Outcome</th>
<th>No. of cases</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improved and discharge</td>
<td>59</td>
<td>93.6%</td>
</tr>
<tr>
<td>Death</td>
<td>3</td>
<td>4.6%</td>
</tr>
<tr>
<td>Recurrence</td>
<td>1</td>
<td>1.5%</td>
</tr>
</tbody>
</table>
factors. The causes are viral or non-communicable in developed world and TB in the developing and under developed world. The etiology in current study is not surprising as Pakistan is still one of the few countries where Tuberculosis is epidemic.

In the present study the clinical findings are continuous with previous literature in terms of patients having breathlessness, fever and chest pain, however, cough was also noted as a main complaint. Previous reports also establish these complaints commonly associated with pericardial effusion7,13.

In the current study, most patients had large size of pleural effusion and location was circumferential in almost all. Similarly, the biochemical investigation of hemoglobin was found in normal range, whereas TLC and ESR were found raised indicative of infection. A previous study by Ilan Y found similar findings of hemoglobin and hematocrit in their pericardial effusion patients. It is natural that the disease brings biochemical derangement in majority of patients13.

Medical treatment + pericardiocenteris was given to (60.0%) cases in this study, however, almost one fifth were given antibiotic + pericardiocentesis and one fifth were managed with pericardiocentesis alone. We noted treatment success in (93.6%) study cases, recurrence occurred in 1 (1.5%) case whereas there were 3 (4.6%) deaths which were attributed to underlying medical condition like malignancy and CRF whereas one patient died due to post PCI effusion in the present study.

Bastian reported from his series of cardiac tamponade patients undergoing primary pericardiocentesis, had a success rate of 81% and a recurrence rate of 19%14. A high mortality (8.3%) and complication (16.6%) rates were witnessed by Önen et al after percutaneous catheter drainage in the management of cardiac tamponade15.

In patients with massive idiopathic chronic pericardial effusion, pericardiocentesis is recommended because of the chances of unexpected overt tamponade. Moreover, simple pericardiocentesis alleviates symptoms in majority of patients, however, pericardial effusion could recur in as many as 40%-50% cases16. It has been suggested by many that pericardiocentesis or percutaneous tube drainage could be a useful management for patients with acute tamponade17.

Conservative management in tuberculous infectious pericardial effusion has its own merits for the underlying condition and patients had significant improvement. The prognosis of pericardial effusion depends on underlying etiology, in cases with malignant causes and involvement of lungs and other closely located abdominal parts there is a risk of poor outcome. The cases with tuberculous infectious pericardial effusion the outcome is better with first conservative management and then drainage of effusion. In recurrent cases surgical options like pericardectomy can deal best.

CONCLUSION

As per our findings the leading cause of pericardial effusion was infectious tuberculous in this study. Breathing difficulty, chest pain, fever and cough were the common presenting complaints in our study. Majority of patients were managed with medical ATT + pericardiocentesis. Most of the patients improved and were discharged in recovered state whereas 3 patients died not mainly due to pericardial procedure but underlying malignancy and renal failure. Keeping the lethal nature of pericardial effusion, there is a need to observe these patients and intervene in time so that the risk of mortality can be averted.

ACKNOWLEDGEMENT

We are thankful to the hospital management and patients for their cooperation and provision of data to carry out this study.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.
REFERENCES

Coronary artery bypass surgery is considered as the gold standard treatment of unprotected left main coronary artery (ULMCA) disease. Over the last 2 decades, improvement in stent technology and operators experience explained the increased number of reports on the results of percutaneous coronary interventions (PCIs) for the treatment of left main (LM) coronary artery lesion. The recent data which compared efficacy and safety of PCIs using drug-eluting stent and coronary artery bypass surgery showed comparable results and a lesser need for repeat revascularization for coronary artery bypass surgery.

**Keywords:** Coronary artery bypasses graft, Left main coronary artery, Percutaneous coronary intervention.

**ABSTRACT**

Coronary artery bypass surgery is considered as the gold standard treatment of unprotected left main coronary artery (ULMCA) disease. Over the last 2 decades, improvement in stent technology and operators experience explained the increased number of reports on the results of percutaneous coronary interventions (PCIs) for the treatment of left main (LM) coronary artery lesion. The recent data which compared efficacy and safety of PCIs using drug-eluting stent and coronary artery bypass surgery showed comparable results and a lesser need for repeat revascularization for coronary artery bypass surgery.

**INTRODUCTION**

Patients who undergo coronary angiography, significant unprotected left main coronary artery (ULMCA) disease found to occur occurs in 5-7% of cases and 3 years mortality of the patients with ULMCA disease who were treated medically was 60%1. CABG has been the gold standard therapy for LM disease but with the advent of newer drug-eluting stents (DES), better intravascular imaging modalities and careful patient selection, the use of PCI in this set of patients is expanding.

**Management of LMCA Disease**

**Medical Treatment Versus CABG**

Most studies which were conducted 3 decades ago in small numbers of patients for treatment of LMCA disease showed survival benefit of CABG when compared to medical treatment1.

**CABG**

Taggart et al2 reported a review based on a series of studies, all of which showed an inhospital mortality of between 2 and 3% after CABG for Left main artery stenosis and 5-6% mortality at 5 years as per studies which did not report on long-term outcomes.

**PCI with Stent Implantation**

**Bare-Metal Stents vs DES**

Initially ULM stenting with the use of bare-metal stents produced results similar to those of bypass surgery depending on the patient cohort3. However, high restenosis rates associated with their use, often resulted in sudden cardiac death which resulted in limitation of ULM stenting advancement during that time period.

With the advent of DES in 2002 and its dramatic reduction in rates of restenosis, registry data from multiple centers worldwide showed major adverse cardiovascular event rates similar to those of CABG4.

**Comparison of PCI vs CABG**

According to Ganesh et al5 PCI with DES is a safe and durable alternative to CABG for the revascularization of UPLM stenosis in select patients at long-term follow-up. Several observational, non-randomized registries have shown similar major adverse cardiovascular events (MACCE) between patients treated with DES and CABG in the subset of patients up to 5 years of clinical follow-up.

Randomized controlled trials (RCTs) which compared PCI With CABG for the Treatment of Unprotected Left Main coronary artery disease (CAD) are shown in table-I.
The SYNTAX 7 (synergy between percutaneous intervention with taxus and cardiac surgery) provides the largest data regarding early and late outcomes of PCI of LMS.

The primary end point of death, stroke, MI and repeat revascularization favored CABG. The secondary end point of death, stroke and MI was not different between those who undergo PCI or CABG. Primary end point favoring CABG was driven by increased rate of repeat revascularization in PCI group (26.7% vs 15.5%), though notably rate of stroke was also significantly lower in PCI group (1.5% VS 4.3%).

Calculating SYNTAX score is a class I indication for left main stem disease or multi vessel disease as per recent AHA/ ACC PCI guidelines.

### Table-I: RCTs comparing PCI vs CABG for unprotected left main CAD.

<table>
<thead>
<tr>
<th>Trial name</th>
<th>Event rate for primary end points PCI</th>
<th>Event rate for primary end points CABG</th>
<th>p-value</th>
<th>Event rate for secondary end points PCI</th>
<th>Event rate for secondary end points CABG</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>LE MANS(^a)</td>
<td>54.9 ± 8.3%</td>
<td>49.8 ± 10.3</td>
<td>0.07</td>
<td>51.1%</td>
<td>64.4%</td>
<td>0.28</td>
</tr>
<tr>
<td>SYNTAX</td>
<td>36.9%</td>
<td>31.0%</td>
<td>0.12</td>
<td>31.3% (SS&lt;32)</td>
<td>46.5% (SS&gt;32)</td>
<td>32.1% (SS&lt;32)</td>
</tr>
<tr>
<td>EXCEL</td>
<td>15.4%</td>
<td>14.7%</td>
<td>0.02 for Noninferiority 0.98 for superiority</td>
<td>23.1%</td>
<td>19.1%</td>
<td>0.01 for non-inferiority 0.10 for superiority</td>
</tr>
</tbody>
</table>

Patients with low (0-22) and intermediate score (23-32) can be treated with PCI or CABG with equal results. Those with high score (>32) do better with CABG.

In a subgroup analysis it was found that MACCE rates were significantly higher in the paclitaxel eluting stent (PES) arm compared with the CABG arm in diabetic patients and directionally higher (but non-significant) in non-diabetic patients.

SYNTAX score II\(^a\) (SSII) provides 4-year mortality after coronary artery bypass grafting (CABG) and percutaneous coronary intervention (PCI) in order to facilitate decision-making between these two methods. SSII has robust prognostic accuracy, both in CABG and in PCI patient groups and was more accurate in stratifying patients for late mortality when compared with SS.

The recent EXCEL trial\(^9\) (evaluation of Xience Prime or Xience V-eluting stent vs CABG for effectiveness of LM revascularization) evaluated the safety and efficacy of PCI with Xience Prime or Xience V EES vs. CABG in patients with ULMCA disease with a low or intermediate SYNTAX score (<33). This trial concluded that PCI with everolimus eluting stents was non inferior to CABG with respect to the rate of the composite end point of death, stroke, or myocardial infarction at 3 years.

### Society Guidelines

Recommendations Pertaining to Unprotected Left Main Intervention in the American College of Cardiology Foundation / American Heart Association / Society of Cardiovascular Angiography and Intervention 2011 Guidelines for PCI are given in table-II.

### European Society of Cardiology Guidelines 2014

Recommendations for the type of revascularization in left main stem disease are shown in table-III.

### Procedural Consideration

#### Severity of Obstruction

For lesions of indeterminate severity on coronary angiography, intra vascular ultrasound (IVUS) is used. Significant obstruction of LMS, minimal luminal area (MLA) of <6mm\(^2\) has been shown to be highly sensitive and specific to predict fractional flow reserve (FFR)<0.75. Post
PCI, minimal stent area (MSA) <8 mm² in the proximal LMS, <7 mm² in the LMS bifurcation, <6 mm² in ostial LAD and <5 mm² in ostial LCx is associated with under expanded stent and ISR.10

**Drug-Eluting Stent Choices**

‘Intracoronary Stenting and Angiographic Results: Drug-eluting Stents for Unprotected LM Lesions’ (ISAR-LM2)11 evaluated the safety and efficacy of everolimus EES vs zotarolimus eluting stent (ZES) and provided comparable clinical and angiographic outcomes at 1-year follow-up.

Using the results of the French Left Main Taxus and the LEft MAin Xience registries, EES was compared to PES. After 2-year follow-up, there was a reduction by 53% in target lesion failure with EES.12

NEST13 registry 154 patients with left main coronary disease were treated with everolimus- (44.2%), zotarolimus- (29.9%) and biolimus A9-eluting (25.9%) stents were followed up for 2 years. The MACE rate was 18.8% and no case of MI or definite stent thrombosis was reported.

In the ERACI IV study, patients treated with second generation DES as compared to the first-generation DES in patients with multiple vessel disease and unprotected left main stenosis had lower incidence of MACCE.

Bio resorbable vascular scaffolds (BVS) in ostial LM lesions has the advantage of avoiding permanent metal struts protruding into the aorta.

**Techniques of Left Main PCI**

### Table-II: Recommendations pertaining to left main intervention.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Level of Evidence</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>IIa B</td>
<td></td>
<td>PCI</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) Low SYNTAX score [≤22], ostial or trunk left main CAD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Increased risk of adverse surgical outcomes</td>
</tr>
<tr>
<td>IIa B</td>
<td></td>
<td>PCI</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) UA/NSTEMI with unprotected left main coronary artery is the culprit.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Patient is not a candidate for CABG</td>
</tr>
<tr>
<td>IIa C</td>
<td></td>
<td>PCI</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) STEMI with unprotected left main coronary artery is the culprit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) TIMI flow grade &lt;3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3) PCI can be performed more rapidly and safely than CABG</td>
</tr>
<tr>
<td>IIb B</td>
<td></td>
<td>PCI</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) Low-intermediate SYNTAX score of &lt;33, bifurcation left main CAD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Increased risk of adverse surgical outcomes</td>
</tr>
<tr>
<td>III (HARM) B</td>
<td></td>
<td>PCI shouldn’t be performed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) Unfavorable anatomy for PCI</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Good candidates for CABG</td>
</tr>
</tbody>
</table>

### Table-III: Recommendations for the type of revascularization in left main stem disease.

<table>
<thead>
<tr>
<th>LMS disease with SYNTAX score &gt;22</th>
<th>CABG</th>
<th>PCI</th>
</tr>
</thead>
<tbody>
<tr>
<td>LMS disease with SYNTAX score 23-32</td>
<td>IB</td>
<td>Ia B</td>
</tr>
<tr>
<td>LMS disease with SYNTAX score &gt;32</td>
<td>IB</td>
<td>III B</td>
</tr>
</tbody>
</table>

### Ostial And Mid Vessel Lesions

These lesions can be stented with a single-stent strategy. Szabo technique or the passage of a second coronary guide wire into the aortic root to are techniques for proper ostial stent placement.

### Distal Left Main Lesions

In more than half of all patients, distal left main stem is involved. In case of LMCA lesions involving bifurcation, PCI is complicated by plaque shift. True distal bifurcation lesions may either be treated by a single or two-stent strategy. Certain lesion characteristics like plaque
The diameter of the branches, the angle between them, anatomy of the side branches along with operator experience decide the treatment strategy Final KBPD (kissing balloon post dilatation is mandatory while using 2 stent strategy.

A number of 2-stent techniques like T-stenting, crush stenting, culotte stenting, and simultaneous kissing stenting or Y-stenting ca be used with various levels of complexities and indications.

Recently, dedicated bifurcation stents or self-expandable stents (TRYTON, AXNESS, BiOSS, STENTYS) were used for the treatment of distal LMS stenosis. Early results are encouraging, but definite conclusions are still awaited.

Role of FFR And OCT

A final minimal stent area >9.6mm sq has been associated with a very low rate of revascularization after LMS PCI. FFR help the operator decide to provisionally stent the pinched LCx artery because the degree of angiographic stenosis of LCx is frequently mismatched with functional severity according to FFR. 3D-OCT (optical coherence tomography) can be used in identifying about carina or plaque shift, side branch compromise and “floating struts” at the side branch ostium.

Dual Anti-Platelet Therapy

According to the current guidelines of AHA 2016, long-term aspirin administration and at least 6 months dual anti-platelet therapy (DAT) should be used in patients receiving a DES (Class: I); however, this is not specific for ULMCA stenting. Although the risk-benefit ratio of long-term DAT is not well defined, many clinicians favor prolonged DAT after ULMCA stenting with DES.

CONCLUSION

Stenting of ULMCA stenosis requires careful patient selection after medical-surgical consultation (Heart Team concept) and ethics of information. Patients with less complex LMS disease can be treated by PCI and more complex LMS lesions by CABG. With the results of ongoing trails, current guidelines can be modified.

Financial Disclosure

Authors have no financial interests related to the material in the manuscript.

CONFLICT OF INTEREST

The authors report no relationships that could be construed as a conflict of interest.

REFERENCES

SHORT COMMUNICATION

EFFECT OF RECENTRIFUGATION ON THE LEVELS OF HIGH SENSITIVITY TROPONIN I

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ABSTRACT

Objective: To compare the levels of high sensitivity troponin I in plasma after specimen re-centrifugation in patients presenting with acute coronary syndrome.
Study Design: Cross sectional study.
Place and Duration of study: Department of Pathology, Armed Forces Institute of Cardiology, Rawalpindi, from Sep to Nov 2017.
Material and Methods: Seventy five patients’ plasma samples of high sensitivity troponin I levels, exceeding the value of 0.06ng/ml were analyzed. Blood was collected in K/EDTA evacuated tubes and plasma was separated after an initial centrifugation (2000 g, 10 min; not refrigerated). The samples were recentrifuged after first analysis. High sensitivity troponin I was measured through the chemiluminescence technique on ADVIA CENTAUR XP immunoassay analyzer. Normally distributed continuous variables were presented as Mean ± SD and the others as median. Two-tailed Wilcoxon analysis was applied to determine the difference in high sensitivity troponin I specimens before and after recentrifugation. A p-value <0.05 was considered as statistically significant.
Results: Median value of high sensitivity troponin I was 4.051ng/ml before re-centrifugation and 3.689 ng/ml after recentrifugation. About 2.5th to 97.5th percentile interval was 0.020-47.23 and 0.054-48.7 ng/ml, before and after recentrifugation, respectively. Difference between the two samples were statistically analyzed by using two-tailed Wilcoxon analysis that showed a statistically significant difference (p-value<0.01).
Conclusion: Recentrifugation of specimens is followed by a significant reduction in high sensitivity troponin I levels which may result in misdiagnosis and treatment of the patients.
Keywords: High sensitivity troponin I, Recentrifugation.

INTRODUCTION

Cardiac troponins (cTn) have a major role in the diagnosis of myocardial infarction. Analytical performance of these assays is thus critical in diagnosis of patients with acute coronary syndrome (ACS)\(^1\). International consensus guidelines define acute myocardial infarction (AMI) in terms of rise and fall of cardiac troponins\(^2\). However since the time troponins have been introduced, problem of false positive results arose. Particulate matter such as fibrin strands were thought to be responsible for such results, therefore many researchers suggested the process of recentrifugation of the samples with high results\(^3\).

Various pre-analytical factors such as specimen type, hemolysis, lipemia, icterus, microclots and debris have been reported to affect the results of cardiac troponins\(^1\). Lipids and proteins have been reported to interfere with troponin assay\(^4\). Relative centrifugation force (RCF) has been studied to see its effect on these interferants revealing that low RCF of >300 for 30 min does have an effect on high sensitivity troponin assay. However recentrifugation was recommended for pooled patient based quality controls or samples that have been stored for some time\(^5\).

Researchers further argued that if recentrifugation is carried out for all specimens it may also result in false negative results which increases the chance of missing patients with
ACS\(^6\). High speed centrifugation can cause adherence of troponins to the walls of the test tube resulting in lower values. A study carried out by Canovi et al in 2015 compared the results of conventional troponin in plasma before and after recentrifugation, concluding a significant reduction in the levels of the troponin\(^7\).

However the question for high sensitivity troponin regarding this problem still remains unanswered. This study was planned to see the effect of recentrifugation on high sensitivity troponin assay in plasma samples of patients presenting to the Armed Forces Institute of Cardiology, Rawalpindi with symptoms of acute coronary syndrome.

**MATERIAL AND METHODS**

It was a cross sectional study carried out in the department of Pathology, Armed Forces Institute of Cardiology, Rawalpindi, from Sep to Nov 2017. Seventy five samples of patients that reported to emergency reception of hospital with symptoms of acute coronary syndrome were analyzed. Blood was collected in K/EDTA evacuated tubes. Specimens revealing obvious hemolysis, lipemia, and icterus were excluded. Specimens stored in refrigerator were also excluded from the study considering stability of the specimen also affects results of the assay. High sensitivity troponin I was measured through the chemiluminescence technique on ADVIA CENTAUR XP immunoassay analyzer using Trop I Ultra (SIEMENS ADVIA CENTAUR). Performance of the assay was monitored using two levels of quality control material. Analytical CV of the assay was <10\%. Centrifuges were calibrated by biomedical engineers and verification of calibration was done by laboratory technologists. Samples which had higher troponin levels exceeding the positive cutoff of >0.06 ng/ml were separated and stored at room temperature in plastic tubes and were recentrifuged (2000 g, 10 min) followed by reanalysis of troponin levels.

**Data Analysis**

Troponin I and age were represented as median. Two-tailed Wilcoxon analysis was applied to determine the difference in high sensitivity troponin I specimens before and after recentrifugation. Bland Altman plot was constructed to see the difference between the two samples. Passing- Bablock regression was done to quantify the difference. A \(p\)-value <0.05 was considered statistically significant.

**RESULTS**

A total of 75 patients' serum samples were collected on consecutive days. Normality of data was checked by Shapiro Wilk test that showed
Levels of High Sensitivity Troponin-I


p-value <0.01, showing that the data was non-Gaussian. Median age of the patients was 59 years with IQR of 17 years. Median value of high sensitivity troponin I before and after recentrifugation was 4.051 ng/mL and 3.689 ng/mL, respectively, whereas 2.5th to 97.5th percentile interval was 0.020 ng/mL to 47.230 ng/mL (95% CI, 1.731-9.337) and 0.054 ng/mL to 48.7 ng/mL (95% CI, 1.436-8.291), respectively.

To see whether the difference between the two samples were statistically significant, two tailed Wilcoxon analysis was carried out that showed a p-value<0.01, showing that the samples after recentrifugation had a significantly lower value of high sensitivity troponin I. In order to see the effects of recentrifugation on results near the cut off, we analyzed the data by using non parametric Passing- Bablock regression which showed a median reduction of 0.0174 ng/ml (95% CI,0.061–0.003 ng/ml) after recen-trifugation of troponin I concentration that was statistically significant (p-value<0.01) (fig-1). A Bland Altman plot for the data was constructed to see the difference between the two samples showing mean of 8.4 ng/ml with SD of ± 1.96 ng/ml (fig-2).

**DISCUSSION**

Cardiac troponins have been studied for possible interferences in various studies. This study was carried out to see the effect of recentrifugation that was previously observed by researchers while dealing with high troponin levels. Various pre-analytical, analytical and post-analytical factors have been reported to affect the results of cardiac troponins, but we focused only on recentrifugation.

Effect of recentrifugation on the conventional troponin levels has previously showed a negative bias of 0.01 ng/ml in a previous study, but it did not include high sensitivity troponin I. Limit of detection of this assay was 0.017 ng/mL and the limit of quantification was 2.05 ng/mL. Data was checked for any outliers to further ensure the reliability of the results since the effect of outliers on troponin assay has been reported earlier. Importance of quality control has been emphasized repeatedly for such assays, so it was assessed by using two levels of control materials.

In this study, recentrifugation resulted in reduction in the levels of high sensitivity troponin I to 0.017 ng/mL (95% CI, -0.060 to -0.003) which was statistically significant (p-value <0.01), this finding being consistent with the study mentioned previously. Reason for this negative bias however remains a question. Some researchers think it could either be due to degradation of cardiac troponin or its adherence to the walls of the tube. Whatever the reason may be, recentrifugation may result in

Figure-2: Bland Altman plot showing a difference between the two samples, blue line shows the mean difference showing a mean value of 8.4 ng/ml with SD of ± 1.96 ng/ml.
misdiagnosis and subsequent wrong treatment of the patient. The process of unnecessary recentrifugation may also increase the turnaround time of the assay, thus resulting in delay in management of the patient.

CONCLUSION

Recentrifugation of specimens is followed by a significant reduction in high sensitivity troponin I levels which may result in misdiagnosis and treatment of the patients.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

REFERENCES

ANGIOGRAPHIC STUDY OF CORONARY GRAFTS

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ABSTRACT

In last couple of decades, the number of ‘graft study’ cases in cath labs has increased due to increasing number of post coronary artery bypass surgery cases presenting with angina or ischemia. Coronary angiography in the setting of coronary artery bypass grafting (CABG) is an important diagnostic tool for the evaluation of graft patency in such patients. Angiography in the setting of CABG is more complex and challenging than the conventional angiography, but with increasing experience, the procedure can be made easy, sleek and comfortable both for the patient and for the operator.

Pre-Requisite

Before the graft angiography is performed, it is very important to have the CABG report available. It will assist the operator to know the exact number and anatomical features of grafts. At least the types and number of vein grafts should be available before pursuing with an angiogram. It can substantially decrease radiation exposure, procedural time, contrast use and the risk to the patient. For example, the knowledge about lack of internal mammary artery (IMA) as a bypass graft conduit will eliminate the need for left or right subclavian artery catheterization. Similarly, information about the number of grafts will eliminate the search for unknown number of grafts. Vein grafts to the right coronary arteries have usually right-sided take off from the aorta while left coronary grafts usually have an anterior take off. Sequential vein grafts supplying two coronaries with one vein graft are not uncommon. Therefore, the knowledge about the presence of sequential vein grafts will aid the operator to avoid searching for additional non existing vein graft ostia.

Indications

The indications for performing graft angiography in patients with CABG surgery are similar to those without bypass surgery. Unstable or symptomatic patients who are candidates for coronary intervention, should undergo this procedure. Asymptomatic patients with a large area of ischemia documented on perfusion scans also benefit from angiography. Significant disease in native coronaries or in the grafts documented on CT angiogram is also an indication for graft study. CABG patients with new onset of left ventricular dysfunction, LBBB or congestive heart failure especially in the setting of diabetes mellitus are another group with potential benefit.

Limitations

Higher use of contrast and longer procedural time should be discussed with the patients and their family members. Other limitations of coronary angiography are similar to the patients undergoing native coronary angiography. Patients with risk of bleeding, infection, peripheral vascular disease, renal failure, anemia, coagulopathy, congestive heart failure and significant co-morbid conditions are at higher risk for complications. Informed consent is necessary before the patient undergoes graft angiography.

Sequence

Usually, it is the native coronary angiogram which is performed before the graft study but there are no specific guidelines regarding this sequence. In addition to give the detailed anatomical information, performing native...
coronary angiography first has the advantage of visualizing distal graft insertion site for competitive flow/flash filling that suggests patent graft. This is more helpful when the operator does not have accurate information about the numbers and types of vein grafts before performing angiography.

**Arterial Access**

Although majority of graft studies are performed by the femoral arterial site, but the radial arteries can be used for graft angiography. However, in the presence of left internal mammary artery (LIMA), left arm should be utilized in order to have easy access to the left IMA and vein grafts. For the presence of right IMA, right arm should be selected. As in conventional angiogram, the radial access site is associated with a risk of thrombotic complication. Therefore, intra-arterial injection of 5000 units of heparin is routinely given after the sheath insertion. In addition, the radial artery is prone to develop spasm. Intra-arterial injections of nitroglycerin and/or verapamil after sheath insertion can abate this. Radial artery is small which cannot accumulate large sheath size. Usually a 5 or 6 French sheath is used. Once the sheath is inserted and flushed with saline solution, a diagnostic catheter is advanced over 0.035-inch J wire into the ascending aorta. After the removal of the wire, the catheter is connected to the manifold and double-flushed (aspirating blood followed by flushing with heparin saline) vigorously with the removal of all bubbles. Next, contrast is drawn into the injecting syringe and pressure is monitored during the entire procedure.

**An Over-View of Location of Grafts**

It is better to convince the surgeons to use tiny rings to help in marking the ostia of the vein grafts which can substantially aid the interventionist to localize the ostia during subsequent angiographic studies. The lack of markers increases the contrast use, procedure time and radiation particularly in patients without the knowledge of the types and number of vein grafts. As mentioned earlier, right coronary grafts usually have a right sided take off from the aorta. Therefore, using the standard left anterior oblique (LAO) view, which is used for right coronary artery catheterization, is the view of choice. The catheter tip should be oriented in the same direction as in engaging the right coronary artery with a slightly higher search. However, the left sided grafts usually have an anterior take off. Therefore, a right anterior oblique (RAO) view makes it easier to engage the left-sided vein graft ostia preventing fore shortening of the catheter tip. Using RAO, the catheter tip should be oriented to the right side of the screen. LAD vein graft ostia are usually closest grafts to the aortic valve if IMA is not used as graft conduit. This is followed by diagonal and then the circumflex grafts. Circumflex graft ostia usually have the highest take off from the aorta. There are occasional cases with different take offs making vein graft angiography difficult. In such a situation, the angiography catheter has to be probed across the aorta in different level in order to engage the ostium. A non-selective strong contrast injection or aortogram using a pigtail catheter may be necessary to delineate the unusual take off of missing vein grafts or documenting total occlusion of missing vein grafts. Totally occluded vein grafts usually have a residual knob in the aorta that can be seen during angiography.

Appropriate views are selected to see the graft landing zone and the native coronary arteries distal to the insertion site of the grafts as that portion might be diseased. When the grafts ostia are engaged, the subsequent views depend upon the native vessel, i.e. the caudal views for LCX grafts and cranial views for the LAD grafts. Any additional views to complete the study and to define the anatomy should be taken. It is important to watch for any damping or ventricularization of the aortic pressure. These signify a high grade ostial lesion or catheter touching the vessel wall. It is important to avoid injecting into the vessel wall as it can cause major dissection. Injection into the vein graft with a high grade...
ostial lesion increases the risk of arrhythmias and sudden death\textsuperscript{15}.

**Catheters For Vein Grafts**

Regardless of the right or left coronary artery grafts, most of the vein grafts can successfully be engaged by a commonly used Judkin’s right (JR4) catheter. The JR4 is therefore the most commonly used catheter for graft study including the IMAs. However, many vein grafts have unusual take off requiring different catheters. Many right coronary vein grafts have steep inferior take off making the ostial engagement with JR4 difficult or impossible. In such a scenario, a multipurpose catheter which has a shallow angulation is the best choice. The second major challenge in engaging vein graft ostia, particularly vein grafts supplying the left coronary arteries, is the shape of the aorta\textsuperscript{16}.

A large aorta can make it very difficult for the JR4 catheter to reach the ostial vein grafts. In such a situation, Amplatz right (AR) and left (AL) catheters can be very helpful to reach the vein graft ostia. Amplatz catheters have a larger primary curve and have been used successfully in unusual superior take off of left coronary arteries or vein grafts and in large aorta. Amplatz catheters are available in different sizes (from smaller to larger curve: AR 1, AR2, AL 0.75, AL1, AL2 and AL3)\textsuperscript{17}. Occasionally, a very superior take off of a vein graft requires specially designed bypass graft catheters. Amplatz catheters are also extremely helpful in engaging native right coronary ostium with a high anterior take off\textsuperscript{17}.

**Arterial Graft Angiography**

For left IMA angiography, the major challenge is the advancement of wire and catheter into the subclavian artery. Older age and peripheral vascular disease are the risk factors for tortuous anatomy. Subclavian stenosis is another cause of difficult subclavian catheterization\textsuperscript{17,18}. In most instances, a JR4 catheter can be positioned into the subclavian artery ostium by counter-clockwise rotation and withdraw of the catheter after positioning it in the ascending aorta. Once the catheter is engaged in the subclavian artery ostium, any manipulation of the catheter has to be performed over the J tipped wire with extreme caution in order to avoid injury to the subclavian artery and embolism in the territory of vertebral artery. The later can cause posterior circulation stroke\textsuperscript{18}.

In case the IMA is not engaged, it is reasonable to inflate a blood pressure cuff in the left arm and perform a non-selective angiography of the left IMA. In the majority of cases, IMA opacification is satisfactory by manipulating the catheter 30-degree counter clock wise. However, for unsatisfactory opacification and when further detail of anatomical information of IMA is needed, a JR4 catheter needs to be exchanged to a left IMA catheter (LIMA seeker) using a long exchange J tip wire\textsuperscript{10}. Exchange wire can also be used earlier after subclavian engagement particularly when a JR4 catheter cannot be advanced easily. In the majority of cases using left IMA catheter, excellent engagement and angiography of the left IMA can be performed. Again, it is important to avoid extreme manipulations of any catheters in the subclavian artery to avoid any vascular injury and embolism\textsuperscript{18}. Contrast injection in the IMA can trigger severe pain in the arm. The patient needs to be warned and informed before injecting the contrast. If subclavian ostial engagement cannot be achieved with a JR4 catheter, a J-wire could be utilized and positioned into the subclavian artery followed by the left IMA or JR4 catheter advancement. There are rare instances when subclavian engagement cannot be achieved from femoral arterial route. In such a situation, using the left radial artery gives direct access into the left IMA ostia\textsuperscript{17,19}. The technique for engaging right IMA is similar to the left IMA. However, right IMA angiography and engagement can be more difficult in dilated aortic root and abnormal steep take off of the right innominate artery. Similar to the left IMA, the right arm can be used in difficult cases. Aortogram and left ventriculography are usually performed using a pigtail catheter and power injector for the assessment of the left ventricular function, aortic
valve regurgitation or missing or occluded vein grafts with only a stub visible.

**Special Issues Related To Vein Graft Angiography**
- Higher contrast use with increasing risk of contrast induced nephropathy.
- Increased radiation exposure to the patients and angiographers.
- Longer procedural time.
- Higher risk for thromboembolism and aortic injury during additional catheter manipulations in the aorta.
- Risk of injury to the subclavian artery and aorta during IMA angiography.
- Difficulty in engaging angulated vein grafts take off and subclavian artery in some patients.

**CONFLICT OF INTEREST**

This study has no conflict of interest to declare by any author.

**REFERENCES**

CASE REPORTS

DIPHTHERIA MYOCARDITIS: CASE REPORT

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ABSTRACT

Diphtheria is a communicable disease which is caused by Corynebacterium diphtheria. Global incidence of diphtheria has declined due to worldwide immunization programs, but still cases of diphtheria are reported across the world because of poor vaccine coverage, population growth and low socio-economic status. We report here a case of diphtheria in a 13-years-old girl who presented to us with ventricular tachycardia.

Keywords: Bull neck, Cardiac involvement, Chinese letter appearance, Corynebacterium diphtheria.

INTRODUCTION

Diphtheria is still an important public health problem in developing countries\(^1\). The incidence of diphtheria in the developed nations has declined because of effective immunization program. Factors like inadequate vaccine coverage, low socio-economic status, delayed reporting of such cases and non availability or delayed administration of diphtheria antitoxin lead to resurgence\(^2\). The clinical features of diphtheria are fever, sore throat, pseudo membrane, muffled voice and bull neck. Antitoxin is the mainstay of the treatment.

CASE REPORT

A 13 years old girl was transferred from a hospital to our hospital in Oct 2016, with 3 days history of continuous high grade fever, severe sore throat rendering her unable to eat and drink. She also developed gradual neck swelling along with nausea, headache and malaise from second day of illness followed by hoarseness of voice. Later she developed palpitation and shortness of breath. ECG showed broad complex tachycardia. Then the clinical provisional diagnosis of diphtheria myocarditis was made and she was transferred to our hospital due to unavailability of diphtheria antitoxin. On arrival to our hospital, a detailed history revealed that she was not vaccinated as per expanded program on immunization (EPI). On examination sick looking girl, oriented in time place and person was lying on bed without obvious respiratory distress. She had tachycardia, low grade fever and normal blood pressure. Both her height and body mass index for age were at 50th centile. She was irritable, had marked swelling of neck. Throat was examined in controlled settings which showed marked congestion and a grey white membrane covering tonsils and posterior pharyngeal wall. Cervical lymph nodes were markedly enlarged and tender leading to diffuse swelling of neck conventionally called BULL NECK. Rest of systemic examination was unremarkable. Throat swab containing portion of membrane and blood was sent for culture and sensitivity along with other investigations.

Lab tests revealed elevated WBC count with predominant neutrophils. CRP was raised. CK, CK-MB, AST, LDH were markedly raised, RFT were mildly deranged. ECG showed ventricular tachycardia which was reverted to sinus rhythm with IV lignocaine 50mg after which ECG showed heart rate of 110/min, sickle shaped ST depression in anterior precordial leads and broad QRS complexes. Echocardiography was normal. CXR was normal. Chinese letter appearance was seen on gram staining of throat swab. While on Albert stain club shaped rods containing metachromatic granules were found. Throat swab culture and sensitivity report was awaited.

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Treatment with barrier nursing techniques along with strict bed rest was started. Diphtheria anti toxin 40,000 units were transfused over 1 hour after test dose. IM procaine penicillin G 600,000 units 12 hourly started. All contacts were given prophylactic Erythromycin. Patient’s general look was improved after antitoxin administration and she started taking orally but unfortunately next day patient suddenly again went into pulseless ventricular tachycardia. Immediately biphasic DC shock with 200 joules was given after which she had complete heart block. Temporary pacemaker was passed but myocardium failed to capture. CPR done with full protocol for 45 minutes but patient didn’t survive.

DISCUSSION

Diphtheria is an acute, communicable disease with overall fatality rate as high as 20-30% in toxic forms up to 70% in diphtheritic myocarditis. The ECG changes of myocarditis may be sickle-shaped sagging of the ST segment (specific for diphtheritic myocarditis), arrhythmias and other conduction abnormalities. If complete heart block develops, the prognosis is usually death. Insertion of a pacemaker in severely ill patients can be difficult and risky.

Mainstay of treatment in diphtheria is administration of diphtheria anti toxin. Dose ranges from 20,000 to 120,000 units depending upon clinical state, site and size of membrane. Antibiotics like Penicillin or Erythromycin is given for 14 days.

Availability of antitoxin must be ensured at all times. Timely intervention and treatment of patients and contacts can save life and prevent complications.

CONFLICT OF INTEREST

This study has no conflict of interest to be declare by any author.

REFERENCES
EMERGENCE OF LINEZOLID RESISTANCE IN COAGULASE-NEGATIVE STAPHYLOCOCCUS ISOLATED FROM A POST-SURGICAL CASE OF CORONARY ARTERY BYPASS AT A TERTIARY CARE CARDIAC SETUP IN PAKISTAN

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ABSTRACT

Linezolid is first choice in the treatment of methicillin resistant Staphylococci. Resistance to this antibiotic is quite rare. We report the first case of linezolid resistant coagulase negative Staphylococcus from a tertiary care cardiac setup in Pakistan. The strain was isolated from pus swab of a 62 year old female from post-coronary bypass grafting sites.

Keywords: Coagulase negative Staphylococcus, Linezolid resistance.

INTRODUCTION

Linezolid is the first licensed antibiotic to be used for gram positive bacteria having adequate efficacy for the methicillin resistant Staphylococcal species\(^1\). Oxazolidinones block the initiation complex formation, by binding to the 50S ribosomal subunit, resulting in a bacteriostatic action\(^2\). Staphylococcus causes various infections of skin and soft tissues, of surgical sites, endocarditis and hospital acquired infections\(^3\). The organism develops resistance by mutating and DNA transfer resulting in difficulties in treating infections that contribute to increased morbidity and mortality. The increasing use of broad spectrum antibiotics is resulting in emergence of resistance in coagulase negative staphylococci (CoNS) as well\(^4\). Apart from linezolid resistance in Staphylococcus aureus, its resistance has been documented in various species of CoNS such as Staphylococcus cohnnii, Staphylococcus kloosii, Staphylococcus hominis and Staphylococcus lugdunensis\(^5\). A study that was conducted in Pakistan in the department of Microbiology, University of Health Sciences, Lahore to determine the in-vitro activity of linezolid against clinical isolates of methicillin resistant Staphylococci showed that linezolid was effective against all the strains of methicillin resistant Staphylococcus aureus (MRSA) and methicillin resistant coagulase-negative Staphylococci (MRCoNS) in the range of 1.0–4.0 mg/L and 0.5–4.0 mg/L MICs, respectively\(^6\). Here we report a post-surgical case from the largest tertiary care cardiac setup in Pakistan in which an MRCoNS Staphylococcus haemolyticus showed resistance to linezolid. This further emphasizes on the fact that if linezolid becomes ineffective we shall be left with very limited options for MRSA and MRCoNS.

CASE REPORT

A 62 years old hypertensive and diabetic female patient was admitted in Armed Forces Institute of Cardiology, Pakistan for coronary artery bypass grafting (CABG) surgery for triple vessel coronary artery disease (TVCAD). She underwent CABG on 10th July, 2017 and was put empirically on the antibiotics amikacin and cefazolin parenterally. After four days, her intravenous antibiotics were stopped and she was put on oral linezolid. About ten days later, graft sites showed bleeding and soakage, her right leg wound was stitched and debridement was done for the left leg wound. Patient was then put on injections linezolid and piperacillin-tazobactam. Serial pus swab samples yielded multi-drug resistant strains of Escherichia coli, Klebsiella pneumoniae and Pseudomonas aeruginosa.
Secondary suturing of her left leg wound was done. On 7th July, culture yielded growth of CoNS that was characterized phenotypically as Staphylococcus haemolyticus, based on coagulase and DNase tests and biochemical reactions. The species was confirmed to be Staphylococcus haemolyticus at Armed Forces Institute of Pathology, by VITEK-2® Walkaway automated culture system. The isolate showed susceptibility to teicoplanin, vancomycin and tigecycline mainly. The isolate was resistant to linezolid (MIC≥8 g/mL) so it was stopped and the patient was started on a combination of clindamycin and rifampicin according to susceptibility report. The patient responded well to the above treatment and her surgical site healed.

DISCUSSION

Bacteria as we know seem to develop resistance against the antibiotics rapidly. Recent studies have shown increasing resistance in strains of MRSA and MRCoNS that contributes to morbidity and mortality in the hospital. Linezolid and glycopeptides are the main choice of treatment for such patients. However since cases have been reported around the world that have documented the emerging resistance to linezolid, physicians shall have limited options in future.

In a country like Pakistan with limited resources this is an even bigger issue. The recent prevalence of multidrug resistant Staphylococcus species in Lahore, Quetta, and Rawalpindi was 83%, 86% and 75%, respectively. Studies around the world have shown variable results regarding resistance to linezolid such as the one conducted in Cleveland in which 10.4% MRSA strains were resistant to it. These included strains isolated from patients of cystic fibrosis who had history of prolonged antibiotic therapy. Although a study carried out in Karachi, Pakistan showed 100% susceptibility of MRSA isolates to linezolid.

Cases have been reported in which strains developed linezolid resistance after taking a course of linezolid for MRSA treatment. Similar situation occurred in our patient in whom the culture of pus swab had revealed an MRSA strain that was susceptible to linezolid initially. However after about 10 days linezolid resistant strain of Staphylococcus haemolyticus was isolated from her wound pus swab. This strengthens the view point that prolonged admissions and antibiotic therapy leads to the development of multi-drug resistant strains of bacteria.

The linezolid resistance has become a serious concern worldwide and is based on multi-resistance gene cfr. This gene is located near plasmids in different strains of MRSA. The location of gene near the plasmids helps to spread the resistance against linezolid. We were not able to do sequence analysis of the isolate due to non-availability of the technique readily. However, this case should alert us to follow the infection control guidelines stringently.

CONFLICT OF INTEREST

This study has no conflict of interest to be declare by any author.

REFERENCES

Carotid artery disease is a major cause of ischemic CVA. We report our experience in stenting of the left internal carotid artery (LICA) in patients with bovine arch, in which right brachiocephalic and left carotid share a common trunk from the aortic arch\(^1\).

**Keywords:** Bovine arch, Carotid artery, Stenting.

**INTRODUCTION**

Carotid artery stenting (CAS) is a widely used procedure to treat carotid artery stenosis, especially in patients at high risk for carotid endarterectomy (CEA)\(^2\). Outcomes of the SAPPHIRE trial demonstrated the equivalence of CAS to CEA in patients considered at risk for complications. The bovine arch introduces new challenges to the procedure.

**CASE REPORT**

A 85 years old lady with underlying HTN, DM and IHD came with sudden transient loss of left eye vision. She has history of TIA in form of Rt hemiplegia, which recovered after 12 hours about 4 weeks before admission. She had normal visual acuity at time of examination and rest of the physical examination was also unremarkable. Duplex USG of carotid arteries showed 70 to 80% left carotid bulb stenosis. Echo was normal.

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1. Bovine arch
2. Stenosis of LCCA
3. Distal protection device in LICA
4. Post stenting result

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CT scan of brain showed left MCA infarct. CT angiography neck confirmed the lesion in Left carotid bulb causing 70-80% stenosis but missed to show bovine arch anatomy.

An 8F arterial sheath was inserted via the right femoral artery. The RCCA was directly engaged by the 6 F diagnostic catheter. Right carotid angiography was normal.

Catheter or wire could be crossed into the left common carotid artery. JB 3 diagnostic catheter was used to define the anatomy of the left carotid which showed a bovine arch in figure. The LCA was originating from the Brachiocephalic artery. There was 70% stenosis before the bifurcation of the LCA. We tried to place a 0.035 inch guide wire in the LCA but were not successful. Another 0.035 inch Hydrophilic guidewire was placed in the LCA but it would prolapse into the Aorta once guide catheter was advanced. A 0.014 inch PTCA guidewire was then advanced into the LCA and the guide catheter was advanced over it with the help of a 0.035 inch guidewire but again the PTCA guidewire prolapsed into the Aorta. It was decided to approach the LCA from the right radial artery with a sheathless technique. A 6F radial sheath was placed in the right radial artery. A 0.014 inch PTCA guidewire was advanced through the right radial sheath into the Aorta. The 6F arterial sheath was removed and manual pressure was applied over the right radial artery for temporary haemostasis. A 2.5 x 15 mm Balloon was inflated ahead of the 8F guide catheter and the whole assembly was advanced over the PTCA guidewire until the guide catheter reached the ostium of the LCA. Then a 0.035 inch wire was placed in a 5 French Heart Rail catheter and both were advanced in the 8F guide catheter till the wire and the child catheter reached LCA. The 8F guide catheter was then telescoped over the 5F catheter till it finally reached the LCA. A 7.5 mm Accunet distal protection device was deployed in the straight portion of the LICA distal to the lesion. IV 0.5 mg of atropine was given before stenting and before post dilatation. Direct stenting of the lesion was performed with a 7-10 x 40mm self-expandable Acculink stent. It was post dilated with a 5.0 x 15 mm NC at 12 atm balloon with good end result. The distal protection device was removed. Post procedure view showed no residual stenosis. Pt developed mild transient weakness of right leg on 2nd day which improved within 24 hours.

DISCUSSION

The Bovine arch occurs in 13% of population. Transfemoral approach is still the most common route for carotid angiography3 and stenting LICA stenosis with Bovine arch anatomy can be approached by right arm approach4 and it is still possible to proceed with carotid stenting using our novel sheathless guide advancement technique which is reproducible5. This method of advancing guiding catheter is useful and safer than others for carotid artery stenting.

CONFLICT OF INTEREST

This study has no conflict of interest to be declare by any author.

REFERENCES

DUAL LAD CORONARY ARTERY - A RARE CONGENITAL ANOMALY
Hamza Iqbal, Imtiaz Ahmed Chaudhry, Muhammad Imran Asghar
Army Cardiac Centre Lahore Pakistan

ABSTRACT
Coronary anomalies are one of the most common cardiovascular causes of sudden death in young patients, although the dual LAD remains a benign one. Dual LAD involves two distinct segments of LAD artery - Short and Long - that occupies the anterior interventricular septum. Until now, ten different variants of dual LAD system have been reported in different studies. Keywords: Left Anterior Descending, Computed tomography angiography, Non ST elevation myocardial infarction.

INTRODUCTION
Dual Left Anterior Descending (LAD) coronary artery is a rare congenital anomaly. The reported incidence of dual LAD is approximately 0.64-1.3% in various coronary angiographic studies. Coronary anomalies are one of the most common cardiovascular causes of sudden death in young patients, although the dual LAD remains a benign one.

Dual LAD involves two distinct segments of LAD artery - Short and Long - that occupies the anterior interventricular septum. Until now, ten different variants of dual LAD system have been reported in different studies.

We are reporting type-1 dual LAD system. In this, the main LAD originates from the left main coronary artery which then bifurcates into short and long LAD. Short LAD runs in the anterior interventricular groove, giving rise to septal perforator and ends in the proximal anterior interventricular groove. The long LAD also runs in the anterior interventricular groove, descends on the left ventricular side of it, giving rise to LV diagonals, and then reenters the distal anterior interventricular groove down till apex.

CASE REPORT
Fifty five years old, male, hypertensive patient presented in the emergency department with typical chest pain. Electrocardiograph showed t-wave inversion in anterior chest leads. Trop-T was positive. He was diagnosed as having Non ST elevation myocardial infarction. Transthoracic echocardiography showed fair left ventricular systolic function. No wall motion abnormality was noticed. He underwent coronary angiography that revealed dual LAD system (fig-1 & 2) with critical lesion in LAD and left circumflex coronary artery. Patient was planned for CABG surgery. Conventional CABG was done; LIMA was anastomosed to long LAD, saphenous vein graft to short LAD and obtuse marginal artery. Patient made an uneventful recovery and was discharged on 6th post-operative day.

DISCUSSION
Malformation during the formation of cardiac sinusoids, coronary budding on aortopulmonary trunk and connection between the two systems may lead to development of coronary artery anomalies. Coronary artery anomalies, predominantly in the male population, are uncommon findings during
coronary angiography with incidence rate of 0.64 to 1.3%\textsuperscript{1,2}. Often it causes no signs and symptoms, but can lead to sudden cardiac death. According to the Sudden Death Committee of the American Heart Association, coronary anomalies are responsible for 19% of death in athletes\textsuperscript{5}. Coronary CT angiography remains the primary imaging modality for evaluation of coronary artery anomalies in recent years. The course of LAD is almost constant amongst all other major coronary arteries\textsuperscript{6}. It courses in the anterior interventricular groove down towards the apex and gives off septal perforators to the interventricular septum and diagonal branches to the anterior wall of the left ventricle. Dual LAD was first described and classified by Spindola-Franco et al in 1983\textsuperscript{7}. Four subtypes of dual LAD system were reported. In type 1-3, both short and long LAD originates from the left main coronary artery. Short LAD travels along the proximal part of the anterior interventricular groove but stops well short of the apex (short LAD), long LAD artery joins the anterior interventricular groove distally and reaches the apex after originating elsewhere (long LAD) as shown in fig-3. In type 4 dual LAD, short LAD is formed by the LAD proper, whereas the long LAD originated from the right coronary artery that later enters into the anterior interventricular groove. Type 3 dual LAD system was the least common that was reported by Spindola-Franco et al, with only one of twenty three cases described\textsuperscript{7}. In the dual LAD system, short LAD give rise to septal perforators and the diagonals originates from the LAD proper or long LAD.

In our case, the left main coronary artery originates from the left coronary sinus which divides into left anterior descending artery and left circumflex artery. LAD proper then bifurcates into short and long LAD. Short LAD gave septal perforator branches and terminated higher up in the anterior interventricular groove, while the long LAD gives diagonal branches and enters late in the anterior interventricular groove. The long LAD was epicardial and towards the left ventricular side. These findings were consistent with type 1 of dual LAD system that was described by Spindola-Franco’s classification.

One of the positive attribute suggested of dual LAD system is that in case of significant atherosclerotic disease the binary distribution may limit the extent of ischemic insult to the myocardium\textsuperscript{8}.

It is extremely important for a surgeon to know the exact coronary anatomy especially when considering anomalous origin and course of anomalous LAD and the variants of dual LAD system before proceeding with any intervention. Lack of this knowledge may lead to incomplete revascularization of the anterolateral wall or the interventricular septum. The presence of short LAD can be mistaken for total mid-LAD occlusion. In case if both the LADs are critically diseased, graft to both vessels is important to revascularize anterolateral wall, interventricular septum and apex.
CONFLICT OF INTEREST

This study has no conflict of interest to be declare by any author.

REFERENCES

POLICY OF THE JOURNAL

It is policy of the Pakistan Armed Forces Medical Journal (PAFMJ) to publish articles pertaining to different fields of medical sciences providing sufficient contribution to medical knowledge. The journal is presently being published bimonthly. The articles may include new experimental methods of medical importance; new results obtained experimentally; new interpretation of existing results or data pertaining to clinical problems; or epidemiological work giving substantial scientific information pertaining to medical sciences.

All such articles should aim for development of medical concepts rather than mere recording of facts. Incomplete studies will be discouraged.

AIMS AND OBJECTIVES

a. To publish original, well documented, peer reviewed clinical and basic sciences articles.
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c. To enable physicians to remain informed in multiple areas of medicine, including developments in fields other than their own.
d. To share the experience and knowledge for benefit of patients.
e. To document medical problems pertinent to military medicine like high altitude medicine, heat stroke, disaster management etc.
f. To achieve the highest level of ethical medical journalism and to produce a publication that is timely, credible, and enjoyable to read.

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Chief Editor has full authority over the editorial content of the journal. There is no interference in the evaluation; selection or editing of individual articles either directly or by creating an environment that strongly influences decisions.

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2. Drafting the article or revising it critically for important intellectual content.
3. Final approval of the version to be published.

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c. Each author should have participated sufficiently in the work to take public responsibility for appropriate portions of the content.
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MANUSCRIPT PROCESSING

Upon the initial submission of the manuscript, the author is acknowledged and allocated a reference member for future correspondence. This process takes place within 2 days. The manuscript is categorized according to the type of article into Original, Review, Case Report and so forth. Each type of article has a special format and should comply with the updated PAFMJ Instruction to Authors, which are published in all issues. Normally an article is reviewed by at least two subject experts and the other member of the editorial committee. If the reviewer has not sent
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**PUBLICATION TIMELINES**

Timelines for print and online publications are as under:-

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Each editorial is written by one member of the editorial board as solicited by the editor. The editorial is scientific review on one or two of the current topics pertaining to medical sciences (preference is given to subjects pertaining to Army health problems).

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Manuscript must be accompanied by a certificate signed by author and all coauthors that they have seen and approved the final version of the manuscript and they have not submitted the manuscript to any other journal. All manuscript should be typed in double spacing on A-4 paper (8.25” x 11.70” = 21.0 cms x 29.70 cms) white bond paper with one inch (2.5 cms) margin on both sides. The article submitted should not exceed 2500 words (excluding references and abstract) with maximum 18-25 references and 3–5 figures or tables. If prepared on a word processor/computer, a properly protected, CD should be sent with the manuscript. Each manuscript should include:

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Reference to GHQ letter no. 3543/242/DMS-5(b)-CPPHUJ dated 23 Aug 2017, the processing fee of Rs. 1500/- is to be paid at the time of submission of the article through demand/bank draft payable in the favour of PAFMJ-AMC account. It is further intimated that AMC/ADC officers have to pay Rs. 3500/- and the Civil authors’ will have to pay Rs. 7,000/- as publication charges/fee, if the
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