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Association of Hyperuricemia and Albuminuria with Presence of Cardiovascular Complications Among Patients of Type-II Diabetes Mellitus

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ABSTRACT

Objective: To look for association of hyperuricemia, albuminuria and other biochemical markers with presence of cardiovascular complications among patients of type-II Diabetes Mellitus.
Study Design: Comparative cross-sectional study.
Place and Duration of Study: Department of Medicine, PNS Shifa Hospital, Karachi, Pakistan from Jan 2021 to Jun 2021
Methodology: The sample population for this study comprised of patients suffering from type-II diabetes mellitus reporting for routine follow-up visit at medicine department of our hospital. patients were divided into two groups according to presence or absence of cardiovascular complication diagnosed by treating team. Association of uric acid levels, C-reactive protein, LDL-cholesterol and albuminuria was established with presence of cardiovascular complications among the study participants.
Results: Out of 208 patients of type-II diabetes mellitus included in the study, 130(63.3%) were male while 78(36.7%) were female. Mean age of the patients was 45.64±7.764 years. Mean duration of type-II Diabetes Mellitus in the study participants was 4.64±5.67 years. Out of 208 patients, 138(66.3%) patients had no cardiovascular complications while 70(33.7%) patients had any one or more cardiovascular complications. Statistical analysis revealed that hyperuricemia, raised LDL cholesterol levels and albuminuria had statistically significant association with presence of cardiovascular complications (p-value<0.05).
Conclusion: Cardiovascular complications were seen in considerable number of patients managed with type-II diabetes mellitus at our hospital. Presence of albuminuria, raised serum LDL cholesterol levels and hyperuricemia emerged as risk factors for these complications among patients of type-II Diabetes mellitus.

Keywords: Cardiovascular; Microalbuminuria; Type II DM; Uric acid.

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INTRODUCTION

Prevalence of Type-II diabetes mellitus had been on a rise in last two decades in almost all parts of the world including both developed and developing countries.[1,2] Main problem treating teams face during the management of these patients is presence of multi-system complications which demand multidisciplinary approach at various stages of management.[3] There have been various laboratory and clinical methods designed to check the presence of poor glycemic control and systemic complications among patients suffering from this chronic condition.[4]

Patients suffering from diabetes may develop complications related to cardiac and vascular system. These patients have risk increased to manifold for developing these complications as compared to population not suffering from diabetes mellitus.[5] Only key for better management is identify high risk cases early on and manage the glycemic control and other metabolic parameters strictly in order to prevent these complications or treat at a very early level.[6]

Association of derangement in various metabolic parameters with presence of cardiovascular abnormalities in patients of type-II DM has been studied in various parts of the world. Gaita *et al*., in 2019 published a cross sectional study regrading relationship of hyperuricemia with Cardio-metabolic risk factors among patients of DM. It was concluded that in patients suffering from DM uric acid levels were associated with various cardiovascular complications including stroke.[7] Raja *et al*., in 2022 studied the role of albuminuria as biomarker of diabetes related complications including cardiovascular compilations. It was revealed that various metabolic pathways associated this metabolic marker with cardiovascular complications in patients of diabetes mellitus.[8] Ethiopian study published in

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2019 came up with the findings that hyperuricemia was common among patients of DM and was associated with different types of cardiovascular complications as well .[9]

Cardiovascular diseases are otherwise quite prevalent in our part of the world. If they are a consequence of metabolic disorder like DM or coexist with such chronic condition. It becomes very difficult for the treating team to provide holistic care to the patients. A recent local study concluded that huge number of patients suffering from type-II DM have risk factors for cardio-vascular complications in Pakistani population.[10] It could be interesting and handy to look for relationship of various biochemical markers other than glycaemic control with cardiovascular complications in patients suffering from DM. This study was therefore designed with the rationale to look for association of hyperuricemia, albuminuria and other biochemical markers with presence of cardiovascular complications among patients of type-II Diabetes Mellitus.

METHODOLOGY

This comparative cross-sectional study was conducted at Medicine department of PNS Shifa Karachi Pakistan, between January 2021 to June 2022. Non-probability consecutive sampling technique was used to gather the sample for the study. Sample size was calculated by using the WHO sample size calculator by using population prevalence of cardiovascular complications in type II diabetes patients as 32.2%,[11] and keeping margin of error as 10%.

Inclusion Criteria: Patients of both genders between the age of 25 and 65 years managed for type-II diabetes mellitus at PNS Shifa hospital during the study period were included.

Exclusion Criteria: Patients which have hyperglycemic episodes secondary to other diseases or their treatment and were not confirmed cases of type-II DM were excluded. Those who had any cardiovascular condition prior to onset of DM were not included the study. Those patients with history of any comorbid metabolic or nutritional disorders leading to biochemical abnormalities were also not included in the final analysis. Patients who refused to participate or undergo laboratory investigations for the study were also not recruited for this study.

After IREB approval via letter number ERC/2022/MEDICINE/24 study commenced in PNS Shifa and patients of type II diabetes mellitus managed by any mode were recruited after taking consent from them. All study participants were interviewed in detail to look for time line of diagnosis of type-II diabetes mellitus and other complications. All patients underwent detailed examination by consultant cardiologist and medical specialist and cardiovascular complications were diagnosed on the basis of clinical, laboratory and radiological findings.[12] Patients also underwent baseline blood investigations including those which were made part of the study. Ranges for normal serum uric acid,[13] serum LDL-cholesterol,[14] albuminuria,[15] and C-reactive protein,[16] were used as per international standards. A chemical pathologist heading the department in laboratory of our hospital conducted these investigations. All the socio-demographic, clinical and laboratory parameters were noted on a personalized proforma for each patient designed by researchers before the start of study.

All statistical analysis was performed using Statistics Package for Social Sciences version 24.0. Frequency and percentage was calculated for the gender of the patients participating in the study and patients with and without cardiovascular abnormalities. Pearson Chi-square test was used to look for relationship of hyperuricemia, albuminuria and other biochemical parameters with presence of cardiovascular abnormalities in study participants. The *p*-values were considered significant if less than or equal to 0.05.

RESULTS

Out of 208 patients of type-II diabetes mellitus included in the study, 130(63.3%) were male while 78(36.7%) were female. Mean age of the patients was 45.64±7.764 years. Table-I summarized the characteristics of type-II diabetes patients included on the study. Mean duration of type-II Diabetes Mellitus in the study participants was 4.64±5.67 years. Out of 208 patients, 138(66.3%) patients had no cardiovascular complications while 70(33.7%) patients had any one or more cardiovascular complications. Coronary heart disease was the commonest complication 35(16.8%) followed by ischemic cardiomyopathy 27(12.9%). 120(57.6%) patients recruited in the study were having normal BMI while 88(42.4%) were either overweight or obese.

Table-II revealed the results of statistical analysis. It can be seen in the table that hyperuricemia (*p*-value<0.001), raised serum LDL levels (*p*-value-0.011)

and albuminuria (*p*-value<0.001) had statistically significant association with presence of cardiovascular complications in patients of type-II diabetes mellitus included in our study while raised levels of C-reactive protein had no such significant association (*p*-value-0.163) with CVS complications in individuals recruited in the analysis.

Table-I: Characteristics of Study Participants

Study parameters	n(%)
Age (years)	
Mean±SD	45.64±7.764 years
Range (min-max)	25 years-64 years
Gender	
Male	130(63.3%)
Female	78(36.7%)
Duration of Diabetes mellitus	4.64±5.67 years
Body Mass Index	
Normal	120(57.6%)
Obese and over weight	88(42.4%)
Type of treatment	
Oral hypoglycemic	101(48.5%)
Insulin	107(51.5%)
Type of cardiovascular Complications	
Coronary heart disease	35(16.8%)
Ischemic cardiomyopathy	27(12.9%)
Peripheral vascular disease	30(9.6%)
Cerebrovascular disease	25(12.1%)
Others	07(3.3%)

Table-II: Association of Various Biochemical Factors with Presence of Cardiovascular Complications Among Study Participants

Factors	No Cardiovascular Complications	Cardiovascular Complications	*p*-value
Uric Acid Levels			
Normal	128(92.7%)	47(67.1%)	<0.001
Deranged	10(7.3%)	23(32.9%)	
Albuminuria			
No	124(89.8%)	44(62.8%)	
Yes	14(10.2%)	26(37.2%)	<0.001
LDL-Cholesterol			
Normal	96(69.5%)	36(51.4%)	
Deranged	42(30.5%)	34(48.6%)	0.011
C-reactive protein			
Normal	105(76.1%)	59(84.2%)	
Raised	33(23.9%)	11(15.8%)	0.163

DISCUSSION

Metabolic derangements like hyperuricemia and albuminuria were found associated with cardiovascular complications in our study participants suffering from type-II DM. Diabetes mellitus is considered as a metabolic disorder with hyperglycemic states leading to various clinical conditions. Situation really becomes complicated when hyperglycemia leads to other metabolic abnormalities and then they further give rise to clinical complications. It becomes a vicious cycle which needs to be broken down for effectively managing the patient. Few biochemical abnormalities like albuminuria and lipid profile derangements are directly linked to hyperglycemia but few chemicals in the body like C-reactive protein, ESR or uric acid may be indirectly affected and may be manifestation of cause or consequence of other clinical complications. We conducted this study with an aim to look for association of hyperuricemia, albuminuria and other biochemical markers with presence of cardiovascular complications among patients of type-II Diabetes Mellitus.

Risk of cardiovascular events in patients with diabetes mellitus having albuminuria was studied by Gerstein *et al*., They came up with the conclusion that any degree of albuminuria had statistically significant association with presence of cardiovascular events in their study participants.[17] Our study supported the results generated by Gerstein *et al*., as albuminuria was also associated with cardiovascular complications in our target population.

Data was published from our neighbouring country China regarding association of uric acid levels with diabetic complications. It was concluded that hyperuricemia was associated with cardiovascular complications in these patients.[18] Our results showed that cardiovascular complications were seen in considerable number of patients managed with type-II diabetes mellitus at our hospital. Presence of albuminuria and hyperuricemia emerged as risk factors for these complications among patients of type-II Diabetes mellitus.

Association of microalbuminuria with left ventricular dysfunction in Nigerian normotensive type-II DM patients was published by Shogade *et al*., in 2018. They revealed that left ventricular dysfunction was found more in patients of DM who were having persistent microalbuminuria.[19] Results of our study were similar as albuminuria was found in considerable number of patients and was associated with presence of cardiovascular abnormalities in patients of type-II DM included in our study.

Hu *et al*., in 2021 published a study looking for association of uric acid levels with different complications occurring in patients of type-II DM. It was concluded that raised levels of serum uric acid were associated with most of diabetic complications

among these patients including cardio-vascular abnormalities.[20] We did not study other complications in patients of type-II DM but raised uric acid levels were found significantly associated with presence of cardiovascular complications in our study participants.

LIMITATIONS OF STUDY

Cardiovascular complications could not be considered as consequence of diabetes or biochemical abnormalities included in the study as data prior to onset of diabetes or biochemical abnormalities was not accessible for these patients. Cohort studies at a larger scale may give better results for association of different variables with presence of biochemical abnormalities among patients suffering from type-II diabetes mellitus.

CONCLUSION

Cardiovascular complications were seen in considerable number of patients managed with type-II diabetes mellitus at our hospital. Presence of albuminuria, raised LDL cholesterol levels and hyperuricemia emerged as risk factors for these complications among patients of type-II Diabetes mellitus.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

MF & SAG: Data acquisition, data analysis, critical review, approval of the final version to be published.

KN & AA: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

MMM & MZA: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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