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Post-Operative Wound Infection after Elective Abdominal Surgery in Diabetic Patients with Good Glycemic Control Versus Patients with no Diabetes; A Comparative Study

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ABSTRACT

Objective: To compare the frequency of post-operative wound infection after elective abdominal surgery in controlled diabetes mellitus patients versus patients without diabetes of same age.

Study design: Quasi-experimental study.

Place and duration of study: Combined Military Hospital Rawalpindi, Pakistan from Apr to Dec 2022.

Methodology: The quasi experimental study was conducted on 60 patients [30 with well controlled diabetes (group-A) and 30 without diabetes (group-B)]. The patients aged between 18 to 65 years of either gender, scheduled to have elective abdominal surgery were included in the study. Patients in both the groups were followed up four weeks after surgery to see the presence of post-operative wound infection.

Results: Out of the 60 patients (30 with well controlled diabetes and 30 without diabetes) included in the study the mean age of patients was 34.43±8.49 years. Male patients were 40(66.70%) while remaining 20(33.30%) patients were females. There was no statistically significant difference between the two groups in terms of baseline characteristics except for baseline HbA1C% levels (p< 0.001). Frequency of post-operative wound infection was significantly higher in group-A [15(50.00%)] as compared to group-B [5(16.67%)], p=0.006.

Conclusion: The frequency of developing post operative surgical site infection in patients with diabetes having good glycemic control is higher as compared to non-diabetic patients. Post-operative wound infection is a common complication after surgery. Presence of diabetes, even if well controlled increases the chances of developing post-operative wound infection.

Keywords: Abdominal Surgery in Diabetes, Post Operative Infection, Wound Infection in Diabetes.

How to Cite This Article: *Shahzad M, Saeed B, Qayyum H, Farooq W, Ahmed S, Cheema BA. Post-Operative Wound Infection After Elective Abdominal Surgery In Patients With Diabetewith Good Glycemic Control Versus Patients With No Diabetes;A Comparative Study. Pak Armed Forces Med J 2024; 74(6): 1573-1577. DOI: https://doi.org/10.51253/pafmj.v74i6.9999*

INTRODUCTION

Abdominal surgeries encompass a wide variety of operations ranging from as simple as appendectomy (removal of an appendix surgically, which is inflamed) to as drastic as exploratory laparotomy. Abdominal surgeries are performed primarily by two different approaches i.e., open and laparoscopic. Abdominal surgeries especially those performed laparoscopically are amongst the most common procedures that are performed by general surgeons and is continuously evolving with the advancing research in the field of surgery.[1] Some of the major benefits that laparoscopic surgery, in comparison to the open approach, offers include early patient recovery, lower intensity of surgery related pain, lesser frequency of complications and better outcome of the patients.[2, 3]

Despite the vast extent of advancements in terms of operative techniques, surgical approaches and tools that are used for performing surgery, there is still a significant number of patients that still develop a myriad of complications one of which is infection of the surgical wound which is commonly encountered.[4,5] Diabetes mellitus is a multi-system, endocrine disorder that affects almost every system and organ of the body including skin, brain, heart, nerves, kidneys, etc. and has been found associated with higher frequency of developing infection of the surgical wound, especially in patients who undergo abdominal surgery.[6, 7]

Patients with diabetes have increased propensity of infection due to production of various mediators which have pro-inflammatory and antioxidant properties which result in creation of an immune deficient environment mediated by state of hyperglycemia. This promotes the growth of infectious pathogens that ultimately lead to development of infection.[8] It has been observed that patients with diabetes having poor glycemic control have higher chances of developing infections of the surgical

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Received: 01 Mar 2023; revision received: 20 May 2023; accepted: 22 May 2023

wound as compared to those patients with diabetes who have good glycemic control and those who do not have diabetes.[9]

Association of control of diabetes with developing post-surgical wound infection has been studied widely and there is still a discrepancy that whether or not there is a significant influence of diabetes on the frequency of developing surgical wound infection.[10] Some of the studies suggest that having diabetes, even if well controlled results in higher frequency of developing post-operative wound infection as compared to the age matched patients who do not have diabetes while other studies suggest that although there is higher frequency of post-operative infections in the patients with diabetes as compared to non-diabetics but the association between the two is not statistically significant. For this purpose, this study was conducted to compare the frequency of post-operative wound infection after elective abdominal surgery in patients who have well controlled diabetes versus non-diabetic patients.

METHODOLOGY

This quasi-experimental study was conducted at General Surgery unit of Combined Military Hospital Rawalpindi, Pakistan from April to December 2022 after obtaining approval from the Ethical Review Board (Reg. # 344). Sample size of 60 (30 patients with diabetes and 30 non-diabetic patients) was calculated using WHO sample size

[11] using following formula:

$$n = \frac{\left\{ z_{1-\alpha/2}\sqrt{2\bar{P}(1-\bar{P})} + z_{1-\beta}\sqrt{P_1(1-P_1)+P_2(1-P_2)} \right\}^2}{\left(P_1 - P_2\right)^2}$$

Inclusion Criteria: Patients who underwent elective abdominal surgery (either laparoscopic or open route) between the age range of 18-65 years who were either male or female were included in the study.

Exclusion Criteria: Patients who had to undergo emergency abdominal surgery, those who had additional comorbidities (hypertension, thyroid disorders, malnutrition, morbid obesity and smoking), coagulation disorders and those who were no fit to undergo abdominal surgery under anesthesia were excluded from the study.

The patients were recruited by consecutive sampling. Thirty patients with controlled diabetes mellitus HbA1C% between 6.5% to 7%[12] were placed in group-A while thirty patients with diabetes having HbA1C% < 5.7%[13] were placed in group-B (Figure).

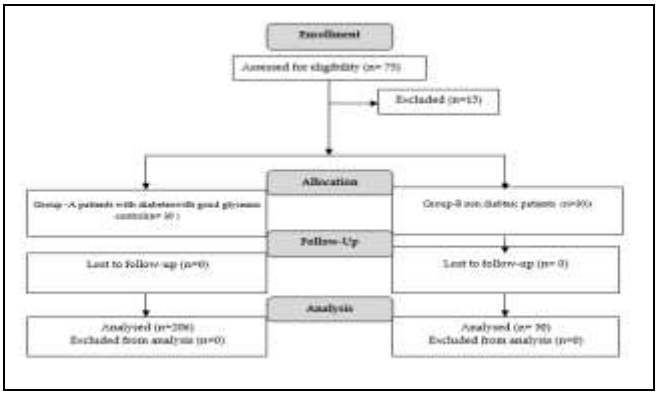

Figure: Patient Flow Diagram

After obtaining a written informed consent, baseline characteristics of all the study participants, including age, gender, body mass index (BMI), HbA1C%, route of surgery (open/laparoscopic) and type of surgery (laparotomy / hernioplasty / appendectomy / cholecystectomy) were documented. HbA1C% sample was collected by following standard protocol in which the phlebotomist from the pathology department of the hospital was called for obtaining a suitable blood sample (3ml of blood) under aseptic conditions. Results were collected in person by the researcher for each study participant. All the study participants were provided with appropriate post operative care with intravenous analgesia (injection paracetamol 1g thrice daily and injection ketorolac 30mg as required) and antibiotics (injection ceftriaxone 1g twice daily for 5 days and injection metronidazole 500mg thrice daily for 5 days). Patients were then called for follow up visit at four weeks after getting discharged to see for presence of surgical wound infection defined as "presence of pus or any discharge at the surgical wound site which is accompanied by pain, fever, raised white blood cell count (> 11000), swelling and erythema"[14]. In case of presence of post-operative wound infection, appropriate treatment was provided to the patients with extended course of antibiotics and/or debridement of the infected wound, depending upon the condition of the post-operative wound and the condition of patient.

Data was analyzed using Statistical Package for Social Sciences (SPSS) 22.00. Normality of data was checked by Shapiro-Wilk test. Quantitative data (age, BMI and HbA1C %) was represented using mean with standard deviation and the median (IQR). Qualitative data (gender, type of surgery, route of surgery and presence of post-operative wound infection) was

represented by using percentage and frequency. Chi square test (for comparison of qualitative variables) and unpaired t-test (for comparison of quantitative variables) were applied and $p \leq 0.05$ was taken as significant.

RESULTS

The study included 60 patients, 30 patients with well-controlled diabetes and 30 non-diabetic patients. The data was first analyzed for baseline characteristics of all the study participants including age, gender, body mass index (BMI), HbA1C%, type of surgery including laparotomy, appendectomy, cholecystectomy and hernioplasty, and route of surgery (open or laparoscopic). Baseline characteristics of all the included patients are tabulated below in Table-I.

Table-I: Demographic characteristics of all study participants (n=60)

Characteristics	Values
Mean Age	34.43±8.49 years
Gender	
Male Female	40(66.70%) 20(33.30%)
Mean BMI	33.40±2.52 kg/m2
HbA1C%	5.98 ± 0.89
Type of surgery	
Laparotomy Hernioplasty Appendectomy Cholecystectomy	5(8.30%) 15(25.00%) 25(41.70%) 15(25.00%)
Route of surgery	
Open Laparoscopic	19(31.70%) 41(68.30%)

The baseline characteristics of patients who were in well controlled diabetes group (group-A) were compared to the patients without diabetes (group-B) to find out the statistical differences between these parameters. It was found that there was no statistically significant difference in terms of age (p=0.674), gender distribution (p=0.204), BMI (p=0.840), type of surgery (p = 0.219) and route of surgery (p=0.781) while in terms of HbA1C%, difference was significant (p< 0.001). This comparison of baseline characteristics between the two groups is tabulated in Table-II:

Composite frequency of post-operative wound infection was 20/60(33.33%). In this study it was found that the frequency of post-operative found infection was higher in patients of group-A (well controlled diabetes) than in group-B (non-diabetics). The comparison of frequency of post-operative wound infection four weeks after surgery between the two groups is given in Table-III.

Table-III: Comparison of Frequency of Post-operative Wound Infection (n=60)

Parameter	Group-A (n = 30)	Group-B (n = 30)	*p*-value
Post-operative wound infection	15(50.00%)	5(16.67%)	0.006

DISCUSSION

In our study there was no statistically significant difference between the two study group in terms of baseline characteristics such as age, gender, body mass index (BMI), type and route of surgery. However, the difference in terms of glycated hemoglobin levels (HbA1C%) was statistically significant. This difference was present because patients with diabetes in group-A still had higher HbA1C% levels overall as compared to patients in group-B which were non-diabetic. It was found that the difference of frequency of post-operative wound infection, between patients who had well controlled diabetes and patients without diabetes, i.e. group-A and B, was statistically significant. In congruence with the results of our study, Sattar *et al.*,[11]

Table-II: Comparison of Baseline Characteristics between Groups (n=60)

Characteristic	Group-A (n = 30)		Group-B (n = 30)		*p*-value
Age	33.96±8.88 years		34.90±8.21 years		0.674
Gender	Male	Female	Male	Female	0.204
	6(28.57%)	15(71.43%)	10(47.62%)	11(52.38%)	
BMI	33.33±2.78 kg/m²		33.46±2.28 kg/m2		0.840
HbA1C%	6.86±0.13		5.11±0.15		< 0.001
Type of surgery	Laparotomy Hernioplasty Appendectomy Cholecystectomy	2(6.67%) 9(30.00%) 9(30.00%) 10(33.33%)	Laparotomy Hernioplasty Appendectomy Cholecystectomy	3(10.00%) 6(20.00%) 16 (53.33%) 5(16.67%)	0.219
Route of surgery	Open Laparoscopic	9(30.00%) 21(70.00%)	Open Laparoscopic	10 (33.33%) 20 (66.67%)	0.781

also reported that the frequency of post-operative wound infection was significantly higher in patients who had diabetes as compared to those who did not have diabetes. Contrary to the observation made in our study, Ismat *et al*.[16] reported that the difference in frequency of post-operative wound infection between patients with diabetes and non-diabetics was not statistically significant. Similar findings were observed in another study conducted with similar aim and it was reported that the difference in frequency of post-operative wound infection between patients with diabetes and non-diabetics was not significant statistically.[17]

Findings of our study suggest that post-operative wound infection is a common surgical morbidity in diabetic patients and having diabetes increases the chances of contracting post-operative wound infection leading to higher frequency of this surgical morbidity in diabetic patients. These finding were in line with the results of studies conducted by Chuang *et al*.,[18] Mangrulkar *et al*.,[19] and Rafiq *et al*.,[20] all of which stated that not only the occurrence of post-operative wound infection is frequent in diabetics but also presence of diabetes increases the chances of getting the surgical wound infected. This may be due to a variety of reasons some of which include less effective immune response against infective pathogens in patients with diabetes which may develop due to state of hyperglycemia which not only results in decreased mobilization and chemotaxis of white blood cells dampening the anti-infective response but also decreases the phagocytosis which results in lower clearance of the infective pathogens.[21] As a result, these patients have higher chances of getting an infection.

Although, in our study, it was found that the patients who have diabetes, irrespective of the status of control of their diabetes have much higher propensity of acquiring infection of the surgical wound as compared to the patients who do not have diabetes. Yet we recommend that further studies should be carried out in this regard to find out the association of having diabetes and increased chances of developing post-operative wound infections.

ACKNOWLEDGEMENT

We are thankful to Head of Surgery Department and Commandant CMH Rawalpindi, for their support and guidance throughout our research which was very helpful to us in completion of our research project. We are also thankful to the whole surgical team as well as the study participants who have helped us thoroughly in addressing this public health problem and conduct this research.

CONCLUSION

In conclusion, presence of diabetes, even if well controlled increases the chances of developing post-operative wound infection. Post-operative wound infection is a common complication after surgery that the surgeons have to deal with on a regular basis. Special care should be extended to the patients with diabetes post-operatively by formulating a separate and more aggressive treatment plan for diabetic patients.

Conflict of Interest: None.

Funding Source: None

Authors' Contribution

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

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

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

SA & BAC: 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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