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PREVALENCE OF SURGICAL SITE INFECTION IN DIABETIC PATIENTS UNDERGOING IN LAPAROTOMY

Muhammad Tahir Latif[*1], Dr Maham Qazi[2], Hafiz Muhammad Aamir Farooq[3], Zobia Khadam[4], Mughees Ul Rehman[5], Abdul Basit[6], Anmol Arif[7], Muhammad Nauman Saleem[8]

[*1]*MS Allied Health Sciences Superior University Lahore*
[2]*Assistant Professor General Surgery Azra Naheed Medical college Faculty Allied Health sciences*
[3]*Department of Operation Theater Technology, Al-Shifa Institute of Health Sciences, Narowal*
[4]*Department of Microbiology,Al-Shifa Institute of Health Sciences, Narowal*
[7]*Department of Allied Health Sciences Rashid Latif Khan University Lahore*
[8]*Master of Sciences in Diagnostic Ultrasound, University Institute of Radiological Sciences and Medical Imaging Technologies (UIRSMIT) Faculty of Allied Health Sciences (FAHS), The University of Lahore, Lahore, Pakistan*

[*1]tahirlatif962@gmail.com, [2]mhmqazi@gmail.com, [3]aamirfarooq596@gmail.com, [4]1663zobia.khadam@gmail.com,[5]Mugheesr13@gmail.com, [6]**ab580092@gmail.com,** [7]anmol.arif@rlku.edu.pk, [8]naumansaleem72@gmail.com

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Corresponding Author: *

Abstract

Background: *Surgical site infections (SSIs) stand as significant postoperative complications that affect diabetic patients particularly hard because of their impaired wound healing along with immune dysfunction. Very little information about SSI occurrence exists for patients who need laparotomy procedures.*

Aim: *To determine the prevalence of SSIs in diabetic patients undergoing laparotomy and assess associated risk factors.*

Methodology: *A prospective cohort study took place during four months at Arif Memorial Teaching Hospital in Lahore. The research study evaluated 120 diabetic patients who met the criteria of no additional health conditions. A SPSS 23 data analysis platform processed information from patient demoraphics as well as glycemic control measurements and surgical outcomes and wound care data.*

Results: *The research showed SSIs affected 43.3% of patients indicating that 53.3% presented pus at the suture point and 45% developed pus along the wound. The study showed that diabetic patients demonstrated poor glycemic control since 47.5% of participants had elevated HbA1c levels while 34.2% experienced poor control. Midline incisions occurred most frequently among patients at 58.3% while 13.3% of patients received inadequate wound treatments. The implementation of universal antibiotic prophylaxis did not prevent the high SSI prevalence which health providers maintained through improper postoperative procedures.*

Conclusion*: Surgical site infections remain high in diabetic patients after laparotomy because of unstable blood glucose levels combined with insufficient wound care practices.*

INTRODUCTION

SSIs represent a major surgical complication that affects diabetic patients after they undergo major operations including laparotomy[1]. The combination of diabetes mellitus and chronic hyperglycemia alongside reduced immune response and microvascular complications make patients more susceptible to infections according to existing medical research[2][3]. The standard surgical procedure known as laparotomy poses a natural infection risk that becomes more severe when treating diabetic patients[4].

SSIs among diabetic patients show wide global variations because of diverse healthcare systems together with different surgical methods and infection prevention procedures. According to recent epidemiological studies[5].The risk of surgical site infections (SSIs) develops more frequently in diabetic patients who undergo laparotomy compared to patients who do not have diabetes[6]. Research studies have delivered detailed information about this matter[7]. The systematic review and meta-analysis discovered that diabetic patients experience SSI at a rate of 26.3%[8]. The research evaluated ten studies containing patient data from 78,500 participants to demonstrate that diabetics face substantially elevated SSIs risks compared to patients without diabetes[9]. The research on elective laparotomies showed that surgical site infections developed in 14.29% of patients and incisional SSIs made up 12.25% of the total cases[10]. The infection risk remains high during surgical procedures which include diabetic patients as part of the patient population. SSIs occur more frequently among diabetic patients by 1.84 times when compared to people without diabetes especially during vascular surgical procedures[11]. The likelihood of developing surgical site infections rises for diabetic patients because their diabetes causes impaired immune response and delayed wound healing processes[12]. The successful control of blood glucose amounts stands essential for surgical periods both before and after the procedure. The reduction of SSIs becomes possible when patients keep their HbA1c hemoglobin levels below 7%.[13].Minimal invasive surgical techniques are expected to reduce SSI rates because they minimize tissue damage particularly beneficial for diabetic patients [14].

Postoperative care for patients who have diabetes mellitus necessitates extra attention because surgical site infections pose a major challenge that requires proper management. SSIs get classified as surgical site infections when they develop around a surgical cut or within that same area during the thirty-day postoperative period or throughout the year when an implant exists [15]. SSIs that affect diabetic individuals continue to be a significant concern because their occurrence increases both medical expenses and death risk and patient hospitalization duration and health complications[16].]. Healthcare facilities in every part of the world incur major expenses from these infections that extend hospital stays and increase mortality rates while leading to frequent readmissions and generating enormous healthcare costs [17]. The Centers for Disease Control and Prevention (CDC) together with the World Health Organization (WHO) identify SSIs as preventable medical complications while these infections maintain their position as one of the most common healthcare-associated infections (HAIs)[18].The management progress in perioperative care and infection control procedures and antibiotic prophylaxis has not successfully reduced the SSIs impact on this vulnerable population[19]. Determining the incidence rates and risk factors of surgical site infections among diabetic patients who undergo laparotomy operations is necessary to create specific prevention methods and enhance surgical results[20].

The purpose of this research is to study the SSIs frequency rates among diabetic patients who have laparotomy along with the evaluation of risk elements and possible prevention strategies. Current data analysis and trend observations form the basis of this study to deliver essential information for better perioperative care and reduced postoperative complications among diabetic surgical patients.

Methodology

The research follows a prospective cohort design which took place at Arif Memorial Teaching Hospital in Lahore for four months..A total of 120 patients were included in study [2]. Patient selection follows a non-convenient sampling method.The research study selects diabetic patients without other

illnesses who need emergency and elective laparotomy procedures. Patients of both sexes who consent to the study are included in the research. The study excludes diabetic patients who have hypertension or cardiac diseases or any other comorbidities with a higher than ASA score of 3. Immunosuppressant users together with cancer patients and bedridden patients and patients who decline consent participation are excluded from this study.The study followed every ethical requirement as established by the Ethical Committee of Superior University. Every participant gave written consent to maintain study confidentiality and anonymity. Structured questionnaires alongside data collection sheets served as the methods for data collection. Researchers examined complete medical documents at Arif Memorial Teaching Hospital to collect necessary patient data. Collected data was anylzed by using SPSS version 23. The analysis used descriptive statistics to determine categorical variable frequencies and percentages especially regarding SSIs prevalence. The research compared perioperative results between diabetic patients and the general laparotomy patient population through assessments of bleeding complications and surgical site infections and surgical success rates.

RESULTS

In this research we examined 120 diabetic patients who received laparotomy surgery to establish the frequency of surgical site infections (SSIs) along with their linked risk elements. The research included adults aged between 27 to 60 years who had a mean participant age of 40.7 years. The research subjects included 120 patients of which male participants formed the majority at 73.3% and female participants made up 26.7% of the study's demographic. Type II diabetes cases dominated over Type I diabetes cases as the two diabetes types were studied. Type II diabetes cases made up 67.5% of the population while Type I diabetes cases made up 32.5%.

Table 1: Gender and Diabetes Type Frequency

Variable	Frequency	Percentage (%)
Gender		
Male	88	73.3
Female	32	26.7
Diabetes Type		
Type I	39	32.5
Type II	81	67.5

Glycemic duration and Surgical Site Infection Risk

Among the infection parameters, deep wound infections were observed in 3 patients with DM for less than a year, 23 patients with DM for 1 to 5 years, and 26 patients with DM for 6 to 10 years. The statistical analysis yielded a p-value of 0.010, indicating a significant association between DM duration and deep wound infections. Similarly, pus at the suture point was noted in 4 patients with DM for less than a year, 27 patients in the 1 to 5-year group, and 33 patients in the 6 to 10-year group. The highly significant p-value of 0.001 suggests that longer DM duration is strongly linked to this type of infection.

Pus formation along the wound also showed a significant correlation with DM duration, with 3, 25, and 26 cases reported in the respective DM duration groups. The p-value of 0.007 confirms the statistical significance of this relationship. However, when examining bruising or erythema, the distribution was 10, 25, and 33 cases, respectively, across the three groups, but the p-value of 0.144 indicates no statistically significant association. Similarly, clear discharge along the wound was observed in 13, 37, and 37 cases, but with a p-value of 0.482, this parameter showed no significant correlation with the duration of DM

Table 2: Glycemic Control and Its Impact on SSIs

Infection Parameter	Duration of DM (in years)			p value (Pearson Chi-Square)
	Less then 1 year	1 to 5 year	6 to 10 years	
Deep wound infection	3	23	26	0.010
Pus at the suture point	4	27	33	0.001
Pus along the wound	3	25	26	0.007
Bruising or erythema	10	25	33	0.144
Clear discharge along wound	13	37	37	0.482

Prevalence of Surgical Site Infections comparing with HBA1C Level

Among the infection parameters, deep wound infections were observed in 7 patients with controlled blood sugar, 21 patients with high blood sugar, and 24 patients with poorly controlled blood sugar. The statistical analysis yielded a p-value of 0.049, indicating a significant association between glycemic control and deep wound infections. Similarly, pus at the suture point was noted in 11 patients with controlled blood sugar, 24 patients in the high group, and 29 patients in the poorly controlled group. The highly significant p-value of 0.019 suggests that poor glycemic control is strongly linked to this type of infection.

Pus formation along the wound also showed a correlation with glycemic control, with 6, 25, and 23 cases reported in the respective groups. However, the p-value of 0.088 suggests this association is not statistically significant. When examining bruising or erythema, the distribution was 11, 31, and 26 cases, respectively, but the p-value of 0.527 indicates no significant association. Similarly, clear discharge along the wound was observed in 19, 40, and 28 cases, but with a p-value of 0.267, this parameter showed no significant correlation with glycemic control.

Table 3: Prevalence and Severity of SSIs

Infection Parameter	HbA1c			p. value (Pearson Chi-Square)
	Control (5-5.4)	High (5.7-6.4)	Poorly Controlled (<6.5)	
Deep wound infection	7	21	24	0.049
Pus at the suture point	11	24	29	0.019
Pus along the wound	6	25	23	0.088
Bruising or erythema	11	31	26	0.527
Clear discharge along wound	19	40	28	0.267

Surgical Factors and Infection Risk

Among the two types of incisions used midline incisions were chosen more frequently compared to paramedian incisions. A significant difference in SSIs rates existed between patients with midline incisions when compared to patients with other incision types

($p < 0.05$). The combination of extensive tissue exposure with increased bacterial contamination and elevated tension forces from midline incisions probably explains this difference.

Table 4: Incision Type and SSI Risk in diabetic patients

		Frequency	Percentage (%)
Incision Type	Midline	70	58.3
	Paramedian	50	41.7

Discussion

This study found that diabetic patients undergoing laparotomy experienced a major incidence of surgical site infections (SSIs). The study showed deep wound infection occurred in 43.3% of 120 subjects and 53.3% of participants presented pus at the suture point and 45% of subjects had pus throughout the wound. The observed SSI prevalence exceeds previous research findings reported by Emily et al. (2015) who documented a systemic review result of 26.3%. The primary cause identified for elevated infection rates was suboptimal glycemic control because 81.7% of participants showed high or poorly controlled HbA1c levels. Patients with uncontrolled diabetes faced increased risk of wound complications that included erythema and bruising along with clear discharge because their hyperglycemic status damages wound healing and immune functions.

The study showed that midline incisions were used by 58.3% of patients but these surgical cuts result in elevated infection risks when compared to other minimal intervention approaches. All patients received antibiotic prophylaxis but received different wound care treatment as reported by 13.3% of participants. Patient hospitalization time duration affected postoperative outcomes because prolonged stays increased the number of wound complications. The study findings demonstrate that diabetic patients are most affected by SSIs based on their glycemic control and surgical approaches and postoperative treatment methods. The obtained data demonstrates that clinical care protocols need significant improvement especially for glycemic control and wound treatment to reduce risks and enhance postoperative results.

Deep wound infections developed in 43.3% of diabetic patients who underwent laparotomy according to this research. The prevalence rate exceeds findings presented in other studies within the literature. The systematic review conducted by Emily et al. (2015) demonstrated that diabetes acts as an independent risk factor for surgical site infections (SSIs) based on an overall odds ratio (OR) of 1.53 yet the pooled prevalence of SSIs in diabetic patients amounted to 26.3%[3]. The research by Huda et al. (2022) on elective laparotomy patients in India revealed a 14.29% incidence of SSI[10]. The research differences can be explained by variations in patient characteristics as well as their degree of glycemic control and surgical treatment methods.

The research findings indicate that pus manifestation was observed at both the suture site and wound length in 53.3% and 45% of participants respectively. Postoperative wound complications are reported to be extensive within your research participant group. The research may show elevated infection rates because diabetic patients participated as study subjects since people with diabetes face poor wound healing and increased susceptibility to infections.

The medical community repeatedly establishes diabetes mellitus as a major predictor of SSIs because hyperglycemia causes immune system breakdown and delays wound healing. This research's outcome confirms this particular understanding completely. The research established that participants with suboptimal glucose management made up 81.7% of the sample group while 47.5% had elevated HbA1c values and additional 34.2% presented poor HbA1c levels. The SSI prevalence rates increase significantly at these blood glucose levels. The findings from ShumailaArshad et al. (2024) match the results of your study by showing that HbA1c control under 7% decreases SSI risk as noted in their meta-analysis[14].

Results from Farhanul Huda et al. revealed that decreased serum protein levels which indicate malnutrition lead to a substantial rise in surgical site infection rates. The results of this research did not measure nutritional status directly but poor wound care practices observed in 13.3% of patients may have indirectly raised infection risks due to improper

postoperative care practices. The observed prevalence of clear wound discharge and erythema in Type II diabetes patients compared to Type I patients matches established literature explanations about insulin resistance and inferior blood sugar management in Type II diabetic patients[21].

Postoperative results strongly depend on how well patients maintain their blood sugar levels according to this research. The research data about SSIs and wound complications among patients with uncontrolled HbA1c levels matches similar results presented in research by Emily et al. along with the INCan study. Research findings confirmed that patients with blood glucose above 150 mg/dL or HbA1c higher than 7% displayed a statistically significant higher risk of SSIs. The INCan study discovered an OR of 3.05 for SSI development in patients with high glucose levels which matches your findings on infection rates among patients with poor glycemic control.

Among the patient population this study examined midline incisions were used by 58.3% of patients yet research indicates these incisions lead to higher infection risks than laparoscopic methods. ShumailaArshad et al. showed in their review that minimally invasive surgical approaches prove most advantageous for diabetic patients through their reduced tissue damage. Your results demonstrated total antibiotic prophylaxis use at 100% which is excellent although studies indicate that surgical cut and operation duration directly affect SSI rates.

Huda et al. discovered that patients who spent extended time in hospital developed more SSI compared to your study results which demonstrated higher wound complication rates in patients who needed longer hospital stays such as 5 days. Hospital exposure duration must decrease as a method to lower infection risks.The postoperative care practices regarding wound discharge at 72.5% and erythema or bruising at 56.7% demonstrate the importance of intense patient monitoring. The São Paulo cohort study identified post-discharge follow-up as the primary time period when SSIs would be detected suggesting that extended monitoring helps prevent surgical site complications[22]. The research highlights the significance of proper wound care because patients showed good practices in 49.2% of cases but poor wound care occurred in 13.3% of patients. The elimination of these identified gaps represents a reasonable approach to decrease SSIs among comparable populations.

The research design follows the same methodology used in various published studies which allows for effective data assessment. The research limitation stems from its selective participant group consisting only of diabetic patients with no additional health conditions. The retrospective University of Sarajevo analysis studied extensive patient populations which revealed how hypertension and anemia worked together with SSIs. Future investigations should delve into these combined effects to establish complete risk factor knowledge.The research demonstrates a strong requirement for specific prevention programs to minimize SSIs among diabetic patients who undergo a laparotomy procedure. Healthcare providers should implement rigorous blood sugar control before and during surgery to minimize diabetic infections that result from poor diabetes management. The optimization of HbA1c levels before surgery must be performed along with strict postoperative blood glucose monitoring. The successful treatment of wounds requires healthcare providers to maintain sterile dressing procedures and educate patients about preventing infections to achieve better results. Minimally invasive surgical approaches should become standard practice because they decrease both tissue damage and hospital time while resulting in fewer SSI occurrences among diabetic patients. The outcome of early wound complication detection through extended postoperative patient monitoring both reduces patient morbidity and healthcare expenses in outpatient settings.

CONCLUSION

SSIs occur frequently among diabetic patients having laparotomy surgery and inadequate blood sugar control shows clear connections to wound complications. The study results confirm reported research which places diabetes as a main contributor to SSIs. Systemic antibiotic prophylaxis use remained universal yet insufficient wound care together with inadequate diabetes control led to observed infection rates. The observed data demonstrates that diabetic

patients require extensive multi-specialty methods to enhance their surgical achievement rates.

RECOMMENDATION

The research faces limitations because it worked with a small patient group at only one medical location which reduces the ability to generalize the results for wider healthcare populations. The SSI prevalence estimates might be reduced because the study excluded patients who had additional health problems including hypertension and cardiac conditions. Long-term assessment of patient outcomes and post-discharge infection recurrence becomes restricted because the study depended on observational data while lacking extended longitudinal tracking. Insufficient examination of surgical procedures during operations hinders the evaluation of intraoperative elements for their influence on surgical site infection risks.

LIMITATIONS

The need exists for bigger multi-site research studies to uncover universal results while evaluating different healthcare settings. A study which includes patients affected by multiple health conditions can better identify combined risk elements. Further research needs to evaluate how advanced surgical techniques particularly laparoscopic procedures affect the reduction of SSIs in diabetic patients. Additional research needs to evaluate the effectiveness of strategies designed to enhance perioperative glycemic control by monitoring blood glucose in real-time along with individualized management techniques. Post-discharge surveillance programs need expansion to detect and treat SSIs rapidly which will reduce their lasting effects on patient health outcomes.

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