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Surgical Site Infections Following Orthopaedic Trauma Surgery at Orthopedic Department BKMC

1: DR ABDUS SAMAD KHAN
MBBS FCPS ORTHOPAEDIC DEPARTMENT BKMC MMC

2. MUHAMMAD HAROON
Principle Medical Officer (PMO), Naseerullah Khan Baber Memorial Hospital (NKBMH), Kohat Road, Peshawar, KPK, Peshawar.

3: DR AIMON ZIA
MBBS FCPS ORTHOPAEDIC DEPARTMENT BKMC MMC

4: DR ANWER ALI
MBBS FCPS ORTHOPAEDIC DEPARTMENT BKMC MMC

5: DR KHALID KHAN
MBBS FCPS ORTHOPAEDIC DEPARTMENT BKMC MMC

6: DR MUHAMMAD BILAL
MBBS FCPS ORTHOPAEDIC DEPARTMENT BKMC MMC

7: PROF DR HAZIQ DAD KHAN
MBBS FCPS ORTHOPAEDIC DEPARTMENT BKMC MMC
8: DR SAAD ALI
MBBS FCPS-II EMO MMC-BKMC

9: DR IRSA HIDAYAT
MBBS FCPS CLINICAL HEMATOLOGY AND BONE MARROW TRANSPLANT SPECILAIST DHQ MARDAN

10: DR AMMAD ALI
MBBS D-ERM,D-AESTHETIC, RESEARCH SCHOLAR

11: DR MUHAMMAD ISRAR
MBBS, M-PHIL, BIOCHEM DEPARTMENT MMC-BKMC

Corresponding author

Name: **DR AIMON ZIA**
Designation: MBBS FCPS
Email: AIMONZ@GMAIL.COM

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Abstract

Objective: To evaluate the impact of age, diabetes, hypertension, and surgical site infection (SSI) on postoperative complications in surgical patients.

Method: A retrospective analysis of surgical patients was conducted, assessing age, diabetes, hypertension, and SSI as potential risk factors for postoperative complications. Data were analyzed using statistical tests to determine significance levels.

Result: The study found that SSI was significantly associated with surgical complications ($p<0.001$), whereas age, diabetes, and hypertension did not show statistically significant associations. Younger patients (20-39 years) had a higher complication rate (24%) compared to older patients (>40 years, 12.3%), though this was not significant ($p=0.101$).

Conclusion: Surgical site infection is a critical determinant of postoperative complications, emphasizing the need for stringent infection control measures. While age, diabetes, and hypertension did not show significant associations, targeted interventions for infection prevention remain crucial. Future research should explore antimicrobial strategies and optimized perioperative care to reduce SSI-related complications.

Keywords: Surgical site infection, postoperative complications, diabetes, hypertension, antimicrobial strategies, perioperative management.**Introduction:** Surgical site infections (SSIs) are a significant concern in orthopedic surgery, contributing to prolonged hospital stays, increased healthcare costs, and higher morbidity and mortality rates. They occur when pathogenic microorganisms infect the site of a surgical incision, leading to complications that may impair recovery and function. Several risk factors have been identified, including poor nutritional status, diabetes, smoking, and the presence of fractures, particularly high-grade fractures such as those classified by the Cauchoix system. Understanding these risk factors is crucial for improving clinical outcomes and preventing infections. This study aims to identify the predictive factors associated with SSIs in orthopedic surgeries and assess their impact on long-term mortality and morbidity in patients undergoing fracture management at Bacha Khan Medical Complex, Mardan[1-2].

Fractures, especially complex ones, present an increased risk for SSIs due to the higher likelihood of contamination during surgery and the challenges in achieving adequate soft tissue coverage. In particular, fractures classified under the Cauchoix grading system, such as the higher-grade fractures (Cauchoix 3), are more prone to complications like infection due to their severity and the complexity of surgical interventions required. Previous studies have shown that high-grade fractures, along with other clinical factors such as maximum lactate levels, minimum hemoglobin levels, and impaired arterial oxygenation, are strongly correlated with

increased rates of SSIs. These factors highlight the need for a targeted approach in managing patients at risk of SSIs, which could lead to improved outcomes in orthopedic trauma care[3-4].

The role of microbiological factors, including the predominance of gram-positive cocci, especially Staphylococcus aureus, has also been well-documented in the development of SSIs. Polymicrobial infections, characterized by the presence of multiple bacterial species, have been reported to complicate the clinical management of SSIs and are associated with more severe outcomes. The use of external fixators, often employed in the stabilization of fractures, has been implicated in increasing the risk of infection, especially when the devices are exposed to the environment or when there is inadequate post-operative care. Empirical antibiotic therapy is commonly initiated to prevent infection, but its effectiveness in preventing SSIs remains an area of ongoing research. Studies have suggested that the use of prophylactic antibiotics can reduce infection rates, although this depends on the choice of antibiotics and their timely administration[5-6].

The prediction of SSIs based on clinical and laboratory parameters is a critical area of research. In this study, the predictive model for SSIs includes various clinical markers such as hemoglobin levels, lactate levels, serum creatinine, and blood glucose levels. The area under the receiver operating characteristic curve (AUC) and the negative predictive value (NPV) of the model will provide valuable insights into the clinical utility of these parameters[7-8]. Such predictive models have been shown to improve clinical decision-making and allow healthcare providers to implement preventive measures more effectively. The model's ability to accurately predict patients at high risk for SSIs could also lead to better resource allocation, reducing unnecessary interventions for patients with a low risk of infection[9-10].

Material and methods: The study was conducted at the Orthopaedic Ward of Bacha Khan Medical Complex, Mardan, from January 2024 to june 2024. All patients undergoing surgical procedures for fractures during this period were considered for inclusion. Inclusion criteria included patients aged 20 years or older, admitted with fractures requiring surgical fixation, and those who provided informed consent. Patients were excluded if they had pre-existing infections at the surgical site, incomplete medical records, or were lost to follow-up within 48 months of surgery. Ethical approval was obtained from the institutional review board, ensuring compliance with ethical guidelines.

Data collection involved detailed documentation of patient demographics, clinical parameters, surgical details, and postoperative outcomes. The primary outcome was the development of surgical site infections (SSIs), assessed through clinical and microbiological criteria. Data analysis was performed using SPSS version 25, with descriptive statistics summarized as means and percentages. Logistic regression was used to identify risk factors for SSIs, with results expressed as odds ratios (OR) with 95% confidence intervals (CIs). Receiver operating characteristic (ROC) curves were used to evaluate the predictive model's performance, focusing on the area under the curve (AUC) and negative predictive value (NPV). Statistical significance was set at $p < 0.05$.

Result:

Table: 1 age and surgical site infection wise distribution

distribution		frequency	percentages
age	20-39	50	43.5%
	>40	65	56.5%
Surgical site infection	absent	105	91.3%
	present	10	8.7%

Table 2: different variable wise stratification of surgery complication

variables		Surgery complication		P-value
		Yes	no	
Age group	20-39	12(24%)	38(76%)	0.101
	>40	8(12.3%)	57(87.7%)	
daibetes	absent	18(17.1%)	87(82.9%)	0.820
	present	2(20%)	8(80%)	
Hypertension	absent	7(20%)	28(80%)	0.625
	present	1316.2(%)	67(83.8%)	
Surgical site infection	absent	13(38.2%)	21(61.8%)	<0.001
	present	7(8.6%)	74(91.4%)	

Discussion:

The findings from Table 1 indicate that a higher percentage of surgical patients in our study were aged above 40 years (56.5%) compared to those aged 20-39 years (43.5%). The incidence of surgical site infection (SSI) was relatively low, with 8.7% of the patients experiencing infection post-surgery. This rate is consistent with previously reported SSI rates in similar settings. As highlighted by Calderwood et al. (2023), stringent infection control protocols have significantly reduced the incidence of SSIs in acute-care hospitals. However, certain risk factors, such as advanced age and underlying comorbidities, continue to contribute to postoperative complications.

Table 2 provides an in-depth stratification of surgery complications based on different variables. The age group analysis reveals that 24% of patients aged 20-39 years experienced surgical complications, compared to only 12.3% in the older age group (>40 years), though this difference did not reach statistical significance (p=0.101). This contrasts with findings from Liu et al. (2019), who reported an increased risk of SSIs in elderly patients due to delayed wound healing and compromised immune responses. However, our results suggest that younger patients may have a higher risk of immediate postoperative complications, possibly due to factors such as increased physical activity and wound stress.

The impact of diabetes on surgical complications was minimal, with complication rates of 17.1% in non-diabetic patients and 20% in diabetic patients (p=0.820). These findings align

with prior studies (Li et al., 2020) that suggest diabetes alone may not be a decisive risk factor for surgical complications when glucose levels are well managed perioperatively. Similarly, hypertension did not show a significant impact on surgical complications (p=0.625), which is consistent with previous findings that adequate preoperative blood pressure control mitigates associated risks (Abe et al., 2020).

A significant association was found between surgical site infection and overall surgical complications ($p<0.001$), with 38.2% of patients with SSI experiencing complications compared to only 8.6% in those without SSI. This finding reinforces the critical role of infection control measures in preventing postoperative morbidity. Hofmann et al. (2020) emphasize that improved surgical techniques, timely antibiotic prophylaxis, and optimized wound care can substantially lower the incidence of SSI-related complications. Furthermore, advancements in antimicrobial surface treatments for surgical materials, as discussed by Bai et al. (2020) and Cochis et al. (2019), may offer additional preventive strategies.

In summary, while age, diabetes, and hypertension did not show statistically significant associations with postoperative complications in this cohort, surgical site infection emerged as a crucial factor influencing surgical outcomes. Future research should focus on targeted interventions to minimize SSI risks, including enhanced perioperative management, patient education, and utilization of antimicrobial materials in surgical settings (Bolzoni et al., 2020; Capek et al., 2021). These strategies could help reduce complication rates and improve overall surgical success.

Conclusion: Our study highlights that surgical site infection is a significant predictor of postoperative complications, while age, diabetes, and hypertension did not show statistically significant associations. The findings emphasize the importance of stringent infection control measures to improve surgical outcomes. Incorporating antimicrobial materials and optimizing perioperative care may further reduce complication rates. Future research should explore targeted interventions to enhance patient safety and recovery.

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Authors' contributions:
Study concept and design- **Abdus Samad Khan, Anwer Ali**
Data collection or management- **AIMON Zia, Khalid Khan, Muhammad Bilal, Haziq Dad Khan**
Data analysis-**, Saad Ali, Irsa Hidayat , Muhammad Haroon**
Manuscript writing/editing- **, Ammad Ali, Muhammad Israr**
Final approval of the version to be published:**All Mantion above authors .**

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