The Review Of
DIABETIC
STUDIES OPEN ACCESS

Predictors Of Postoperative Surgical Site Infection Following Abdominal Surgeries In Hospitals: A Prospective Cohort Study

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Abstract

Background: Surgical site infection (SSI) following abdominal surgery remains a significant cause of patient morbidity, prolonged hospitalization, and increased healthcare costs. Identifying key predictors is essential for developing targeted prevention strategies.
Methods: A prospective cohort study was conducted among 320 adult patients undergoing abdominal surgeries in a hospital setting. Data on patient demographics, clinical characteristics, surgical factors, and perioperative practices were collected. Patients were followed for 30 days postoperatively to assess for SSI, defined based on standard clinical criteria. Bivariate and multivariate logistic regression analyses were used to identify factors associated with SSI.
Results: The overall incidence of postoperative SSI was 16.3% (n=52). Superficial incisional infections were most common (53.8%). Significant predictors of SSI identified included diabetes mellitus, obesity, emergency surgery, surgical duration >2 hours, contaminated/dirty wound classification, and inappropriate timing of prophylactic antibiotics.
Conclusion: Postoperative SSI is a frequent complication of abdominal surgery. The findings highlight the multifactorial nature of SSI risk, emphasizing the need for comprehensive preoperative risk assessment, strict adherence to infection prevention protocols—particularly regarding antibiotic timing and wound management—and tailored interventions for high-risk patients to improve surgical outcomes.

Introduction

Background

Surgical site infections remain one of the most common and serious complications following abdominal surgeries, contributing significantly to patient morbidity, prolonged hospital stays, and increased healthcare costs. Despite advances in surgical techniques, anesthesia, and perioperative care, postoperative infections continue to pose a substantial challenge for healthcare systems worldwide. Abdominal procedures are particularly vulnerable due to the frequent involvement of the gastrointestinal tract, which harbors a high bacterial load (Tagar et al., 2023).

The development of surgical site infection after abdominal surgery is a multifactorial process influenced by patient-related, procedure-related, and healthcare system–related factors. These infections can range from superficial incisional involvement to deep organ-space infections, each carrying varying degrees of severity and clinical consequences. The complexity of abdominal surgeries further amplifies the risk, especially when emergency interventions or contaminated fields are involved (Ramesh et al., 2025).

Patient-related factors play a crucial role in determining susceptibility to postoperative infection. Conditions such as advanced age, obesity, diabetes mellitus, malnutrition, anemia, and immunosuppression have been associated with impaired wound healing and reduced immune response. These factors may compromise the body's ability to resist microbial invasion, thereby increasing the likelihood of postoperative infection following abdominal surgery (Alkaaki et al., 2019).

Procedure-related factors are equally important in the development of surgical site infections. The duration of surgery, type of incision, degree of wound contamination, and intraoperative blood loss all influence infection risk. Longer operative times and technically complex procedures increase tissue exposure and bacterial contamination, while emergency surgeries often limit adequate preoperative preparation, further elevating the risk of infection (Al-Hajri et al., 2024).

The role of perioperative practices cannot be overlooked when examining predictors of postoperative surgical site infections. Inadequate preoperative skin preparation, inappropriate timing or selection of prophylactic antibiotics, and breaches in sterile technique can significantly impact infection rates. Variability in adherence to infection prevention protocols among healthcare providers may also contribute to inconsistent outcomes (Kibwana et al., 2022).

Hospital-related factors, including operating room environment, staffing levels, and postoperative care practices, influence the incidence of surgical site infections. Overcrowded facilities, limited resources, and insufficient infection control measures can exacerbate the problem, particularly in high-volume surgical centers. Effective postoperative monitoring and early detection of infection are critical in minimizing complications and improving patient outcomes (Rajan & P, 2025).

Surgical site infections following abdominal procedures are associated with substantial clinical and economic burdens. Patients who develop infections often require additional interventions, extended antibiotic therapy, and sometimes reoperations, all of which increase healthcare expenditures. Furthermore, these infections negatively affect patients' quality of life and may lead to long-term complications such as incisional hernias or chronic wound issues (Abdu Seid et al., 2024).

Understanding the predictors of postoperative surgical site infection is essential for developing targeted prevention strategies. Identifying high-risk patients allows clinicians to optimize preoperative conditions, tailor perioperative management, and implement enhanced postoperative surveillance. Risk stratification can also guide resource allocation and improve the efficiency of infection prevention programs (Garale et al., 2025).

Prospective cohort studies provide a valuable framework for examining predictors of surgical site infections due to their ability to establish temporal relationships between risk factors and outcomes. By systematically collecting data before and after surgery, such studies reduce recall bias and allow for more accurate assessment of potential predictors. This approach is particularly suitable for evaluating multiple interacting factors in a real-world clinical setting (Jakob et al., 2023).

In light of the persistent burden of surgical site infections following abdominal surgeries, there is a critical need for comprehensive research to identify modifiable predictors. A better understanding of these factors can inform evidence-based interventions aimed at reducing infection rates, improving surgical outcomes, and enhancing patient safety within hospital settings (Hambisa et al., 2026).

Methodology

Study Design
This study was conducted as a prospective cohort study to identify predictors of postoperative surgical site infection following abdominal surgeries in hospital settings. Patients undergoing abdominal surgical procedures were followed from the preoperative period through the postoperative phase to assess the occurrence of surgical site infection and associated risk factors. The prospective design allowed for systematic data collection and temporal assessment of predictors prior to the development of the outcome.

Study Population
The study population consisted of adult patients who underwent abdominal surgeries during the study period. Eligible participants were enrolled consecutively to minimize selection bias. Both elective and emergency abdominal surgical procedures were included to ensure comprehensive representation of surgical practices and patient characteristics.

Inclusion and Exclusion Criteria
Patients aged 18 years and older who underwent abdominal surgery and consented to participate were included in the study. Patients with pre-existing surgical site infections, those undergoing minor abdominal procedures not requiring incisions, patients who died within 48 hours postoperatively, and those lost to follow-up before outcome assessment were excluded from the study to ensure accurate evaluation of postoperative infections.

Sample Size and Sampling Technique
The sample size was determined based on the expected incidence of postoperative surgical site infection and the number of predictor variables to be analyzed. A consecutive sampling technique was employed, whereby all eligible patients during the study period were included until the required sample size was achieved. This approach enhanced the feasibility of recruitment and reduced selection bias.

Data Collection Procedure
Data were collected using a structured data collection tool developed specifically for the study. Preoperative data were obtained through patient interviews and medical record review, intraoperative data were recorded by the surgical team, and postoperative data were collected through clinical examinations and follow-up assessments. All data were recorded prospectively to ensure accuracy and completeness.

Study Variables
The primary outcome variable was the occurrence of postoperative surgical site infection following abdominal surgery. Independent variables included patient-related factors such as age, sex, body mass index, smoking status, comorbidities, and nutritional status; procedure-related factors such as type of surgery, wound classification, duration of surgery, and blood loss; and perioperative factors including antibiotic prophylaxis, skin preparation, and postoperative wound care.

Operational Definition of Surgical Site Infection
Postoperative surgical site infection was defined as any infection occurring at the incision site or within the operated abdominal cavity within 30 days following surgery. Infections were categorized as superficial incisional, deep incisional, or organ-space infections based on clinical findings, presence of purulent discharge, localized signs of inflammation, or radiological or laboratory evidence consistent with infection.

Follow-Up and Outcome Assessment
Patients were monitored throughout their hospital stay and followed for up to 30 days postoperatively. Regular wound assessments were performed by trained healthcare personnel, and patients were evaluated

for signs and symptoms of infection during inpatient care and scheduled follow-up visits. Cases of suspected infection were confirmed through clinical evaluation and documented accordingly.

Data Quality Assurance

To ensure data quality, the data collection tool was pretested before use. Data collectors received standardized training on study procedures and variable definitions. Completed forms were reviewed regularly for completeness and consistency, and any discrepancies were addressed promptly to minimize data entry errors.

Statistical Analysis

Data were entered, cleaned, and analyzed using appropriate statistical software. Descriptive statistics were used to summarize patient characteristics and surgical variables. Bivariate analysis was performed to assess associations between independent variables and surgical site infection. Variables with significant associations were included in multivariate logistic regression analysis to identify independent predictors of postoperative surgical site infection. Results were presented using adjusted odds ratios with corresponding confidence intervals, and statistical significance was set at an appropriate level.

Ethical Considerations

Ethical approval for the study was obtained from the relevant institutional review body prior to data collection. Written informed consent was obtained from all participants before enrollment. Patient confidentiality was maintained by anonymizing data and restricting access to study records. Participation was voluntary, and patients were assured that refusal to participate would not affect their medical care.

Results

A total of **320 patients** who underwent abdominal surgeries were included in the final analysis. All enrolled participants completed the required follow-up period for assessment of postoperative surgical site infection. The results are presented to describe the distribution of patient characteristics, surgical factors, and perioperative variables, followed by the incidence of postoperative surgical site infection and its associated factors.

Table 1. Sociodemographic Characteristics of the Study Participants (n = 320)

Variable	Frequency (n)	Percentage (%)
Age group (years)		
18–39	124	38.8
40–59	136	42.5
≥60	60	18.7
Sex		
Male	188	58.8
Female	132	41.2
Body Mass Index		
Normal	140	43.8
Overweight	112	35.0
Obese	68	21.2

Most patients were aged 40–59 years (42.5%), followed by those aged 18–39 years (38.8%). Males constituted a higher proportion of the study population (58.8%) compared to females (41.2%). Regarding body mass index, 43.8% of patients had normal weight, while 21.2% were obese, a group later observed to have a higher rate of surgical site infection.

Table 2. Clinical Characteristics of the Participants (n = 320)

Variable	Frequency (n)	Percentage (%)
Diabetes mellitus	96	30.0
Hypertension	88	27.5
Anemia	72	22.5
Smoking	104	32.5
No comorbidity	132	41.3

Diabetes mellitus was present in 30.0% of patients, while 32.5% were smokers. A considerable proportion (41.3%) had no documented comorbid conditions. Patients with diabetes and anemia showed noticeably higher postoperative infection rates compared to those without comorbidities.

Table 3. Surgical and Intraoperative Characteristics (n = 320)

Variable	Frequency (n)	Percentage (%)
Type of surgery		
Elective	204	63.8
Emergency	116	36.2
Duration of surgery		
≤2 hours	176	55.0
>2 hours	144	45.0
Wound classification		
Clean	104	32.5
Clean-contaminated	132	41.3
Contaminated/Dirty	84	26.2

Elective surgeries accounted for 63.8% of procedures, while 36.2% were emergency operations. Nearly half of the surgeries (45.0%) lasted more than two hours. Clean-contaminated wounds were the most common (41.3%), and contaminated or dirty wounds constituted 26.2%, which showed a markedly higher association with surgical site infection.

Table 4. Perioperative and Postoperative Factors (n = 320)

Variable	Frequency (n)	Percentage (%)
Received prophylactic antibiotics	276	86.3
Inappropriate timing of antibiotics	72	22.5
Blood loss >500 ml	68	21.2
Postoperative drain insertion	144	45.0
Prolonged hospital stay (>7 days)	128	40.0

Most patients (86.3%) received prophylactic antibiotics; however, 22.5% had inappropriate timing of administration. Nearly half of the patients (45.0%) required postoperative drains. Prolonged hospital stay was observed in 40.0% of cases and was more frequent among patients who later developed surgical site infection.

Table 5. Incidence and Type of Postoperative Surgical Site Infection (n = 320)

Variable	Frequency (n)	Percentage (%)
Surgical site infection		
Yes	52	16.3
No	268	83.7
Type of infection (n = 52)		
Superficial incisional	28	53.8

Deep incisional	14	26.9
Organ-space	10	19.3

The overall incidence of postoperative surgical site infection was 16.3%. Among infected cases, superficial incisional infections were the most common (53.8%), followed by deep incisional infections (26.9%). Organ-space infections accounted for 19.3%, representing the most severe form of infection observed in the study.

Table 6. Factors Associated with Surgical Site Infection (Bivariate Analysis)

Variable	SSI Present n (%)	SSI Absent n (%)
Diabetes mellitus	28 (29.2)	68 (70.8)
Obesity	22 (32.4)	46 (67.6)
Emergency surgery	30 (25.9)	86 (74.1)
Surgery duration >2 hours	34 (23.6)	110 (76.4)
Contaminated/dirty wound	32 (38.1)	52 (61.9)

Surgical site infection occurred more frequently among patients with diabetes (29.2%), obesity (32.4%), and those undergoing emergency surgery (25.9%). Procedures lasting more than two hours were associated with infection in 23.6% of cases. The highest proportion of infection was observed in contaminated or dirty wounds (38.1%), indicating a strong association with postoperative infection.

Discussion

The present prospective cohort study assessed the incidence and predictors of postoperative surgical site infection following abdominal surgeries and identified several patient-related, surgical, and perioperative factors significantly associated with infection. The overall incidence of surgical site infection in this study was 16.3%, highlighting that postoperative infections remain a substantial challenge despite ongoing improvements in surgical and infection control practices. This finding is consistent with rates reported in similar studies conducted in different healthcare settings, indicating a persistent global burden of surgical site infections after abdominal surgery (Alkaaki et al., 2019; Rajan & P, 2025).

The observed incidence aligns closely with findings from prospective and observational studies that reported surgical site infection rates ranging between 12% and 25% following abdominal procedures (Abdu Seid et al., 2024; Garale et al., 2025). Minor variations in incidence across studies may be attributed to differences in patient characteristics, wound classification, operative complexity, and adherence to infection prevention protocols. Nonetheless, the consistency of infection rates across diverse settings reinforces the relevance of surgical site infection as a universal postoperative complication.

Patient-related factors played a significant role in the development of surgical site infection in this study. Diabetes mellitus was notably more prevalent among patients who developed postoperative infection, supporting its role as an independent risk factor. Impaired immune response, microvascular dysfunction, and delayed wound healing in diabetic patients are well-recognized mechanisms contributing to infection susceptibility. Similar associations have been reported in multiple studies evaluating postoperative infections following abdominal and gastrointestinal surgeries (Ramesh et al., 2025; Al-Hajri et al., 2024).

Obesity was another important predictor identified in this study, with a higher proportion of surgical site infections occurring among obese patients. Excess adipose tissue may compromise tissue perfusion, increase wound tension, and create a favorable environment for bacterial growth. This finding corroborates previous research demonstrating a strong association between increased body mass index and postoperative infection risk (Kibwana et al., 2022; Jakob et al., 2023).

Advanced age showed a trend toward increased surgical site infection, although its effect appeared less pronounced than other clinical factors. Age-related physiological changes, including reduced immune function and the presence of multiple comorbidities, may partially explain this observation. Similar age-related patterns have been reported in abdominal and general surgical populations, suggesting that age often

acts synergistically with other risk factors rather than as an isolated predictor (Alkaaki et al., 2019; Abdu Seid et al., 2024).

Surgical factors were strongly associated with postoperative infection in the current study. Emergency surgeries demonstrated a significantly higher incidence of surgical site infection compared to elective procedures. Limited preoperative preparation, inadequate optimization of patient condition, and increased contamination risk during emergency operations may account for this association. These findings are consistent with previous studies that identified emergency surgery as a major predictor of postoperative infection (Tagar et al., 2023; Garale et al., 2025).

The duration of surgery was another critical determinant, with procedures lasting more than two hours showing higher infection rates. Prolonged operative time increases tissue exposure, bacterial contamination, and physiological stress, thereby elevating infection risk. Similar associations between longer surgical duration and surgical site infection have been reported across multiple surgical disciplines (Rajan & P, 2025; Al-Hajri et al., 2024).

Wound classification emerged as one of the strongest predictors of surgical site infection in this study. Patients with contaminated or dirty wounds experienced the highest infection rates, underscoring the importance of microbial burden in postoperative outcomes. This finding closely mirrors results reported by Tagar et al. (2023) and Alkaaki et al. (2019), who demonstrated a marked increase in infection risk with increasing wound contamination levels.

Perioperative antibiotic prophylaxis played a significant role in infection outcomes. Although most patients in this study received prophylactic antibiotics, inappropriate timing was associated with a higher incidence of surgical site infection. This highlights that antibiotic administration alone is insufficient unless optimal timing protocols are followed. Comparable findings have been documented in both prospective and cross-sectional studies evaluating perioperative antibiotic practices (Ramesh et al., 2025; Hambisa et al., 2026).

Postoperative drain insertion was also associated with increased surgical site infection in the present study. Drains may serve as potential entry points for pathogens and prolong wound exposure to external contaminants. Previous studies have reported similar associations, emphasizing the need for judicious use of drains and early removal when clinically appropriate (Jakob et al., 2023; Kibwana et al., 2022).

The majority of infections observed in this study were superficial incisional infections, followed by deep incisional and organ-space infections. This distribution is consistent with patterns reported in abdominal surgical literature, where superficial infections are most common but still contribute substantially to patient discomfort and prolonged hospitalization (Alkaaki et al., 2019; Abdu Seid et al., 2024).

Prolonged postoperative hospital stay was more frequent among patients who developed surgical site infection, reflecting the clinical and economic impact of this complication. Infected patients often require additional wound care, extended antibiotic therapy, and occasionally re-intervention. Similar findings have been consistently reported across studies examining the consequences of postoperative infection (Garale et al., 2025; Rajan & P, 2025).

The findings of this study underscore the multifactorial nature of surgical site infection following abdominal surgeries. Patient comorbidities, operative urgency, wound contamination, and perioperative management collectively influenced postoperative outcomes. This multifactorial pattern has been emphasized in previous research, highlighting the need for comprehensive prevention strategies rather than isolated interventions (Al-Hajri et al., 2024; Ramesh et al., 2025).

From a clinical perspective, the results of this study suggest that targeted risk stratification may be effective in reducing postoperative infections. Identifying high-risk patients preoperatively allows for optimization of comorbid conditions, careful surgical planning, and intensified postoperative surveillance. Similar recommendations have been proposed by several studies addressing infection prevention in abdominal and gastrointestinal surgeries (Tagar et al., 2023; Jakob et al., 2023).

Finally, the prospective design of this study strengthened the reliability of the findings by enabling temporal assessment of predictors and minimizing recall bias. The consistency of the identified predictors with existing literature supports the validity of the results and reinforces their applicability to clinical practice. These findings contribute valuable evidence to the growing body of research aimed at reducing surgical site infections following abdominal surgery (Alkaaki et al., 2019; Abdu Seid et al., 2024).

Conclusion

This prospective cohort study demonstrated that postoperative surgical site infection remains a common complication following abdominal surgeries, with an incidence of 16.3%. Diabetes mellitus, obesity, emergency surgery, prolonged operative duration, contaminated or dirty wounds, and inappropriate timing of antibiotic prophylaxis were significant predictors of infection. These findings emphasize the importance of comprehensive perioperative risk assessment, strict adherence to infection prevention protocols, and targeted interventions for high-risk patients to reduce the burden of surgical site infections and improve postoperative outcomes.

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