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PREOPERATIVE RISK FACTORS AND THEIR IMPACT ON SURGICAL SITE INFECTION RATES IN ACUTE ABDOMINAL SURGERIES FOR TYPHOID ILEAL PERFORATION

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ABSTRACT

Background: Typhoid ileal perforation (TIP) is a severe complication of typhoid fever, often necessitating urgent surgical intervention. Despite advances in surgical care, surgical site infections (SSIs) remain a significant concern in TIP surgeries, contributing to morbidity and prolonged hospital stays. Understanding preoperative risk factors that predispose patients to SSIs in this context is essential for improving outcomes.

Objective: This study aims to identify and analyze the impact of preoperative risk factors on SSI rates in patients undergoing acute abdominal surgeries for typhoid ileal perforation.

Materials and Methods: A cross-sectional study was conducted at People's University of Medical & Health Sciences, Shaheed Benazirabad, over six months, involving 180 patients with confirmed TIP who underwent emergency surgery. Preoperative factors such as age, gender, nutritional status, comorbid conditions, and the presence of pre-existing infections were assessed. SSI diagnosis was confirmed through clinical and microbiological evaluations. Data were analyzed using chi-square and t-tests, and logistic regression was employed to identify significant predictors of SSIs.

Results: Out of 180 patients, the incidence of SSIs was significantly associated with smoking ($p=0.045$), emergency surgery ($p=0.021$), pre-existing infections ($p=0.009$), and surgery duration exceeding 2 hours ($p=0.008$). Pre-existing infections emerged as the strongest predictor of SSIs, with an odds ratio of 4.10 ($p=0.001$). Longer hospital stays, re-operations, and mortality were also notably higher among patients with SSIs.

Conclusion: Smoking, emergency surgery, and pre-existing infections are significant preoperative risk factors for SSIs in TIP surgeries. Addressing modifiable factors such as smoking cessation and managing infections prior to surgery could reduce SSI rates and improve patient outcomes.

Keywords: Typhoid ileal perforation, surgical site infection, preoperative risk factors, emergency surgery, smoking, pre-existing infections.

INTRODUCTION

Typhoid ileal perforation (TIP) is a life-threatening complication of typhoid fever, a systemic infection caused primarily by *Salmonella enterica* serovar Typhi.[1] Despite global efforts to improve sanitation and the widespread use of vaccines, typhoid fever remains a significant public health problem, particularly in low- and middle-income countries (LMICs) where it disproportionately affects vulnerable populations.[2] TIP, an acute surgical emergency, occurs in approximately 1-4% of all typhoid cases, leading to peritonitis and septic shock if left untreated.[3]

The surgical management of TIP typically involves urgent exploratory laparotomy, closure of the perforation, and abdominal lavage.[4] However, one of the most frequent and challenging complications of such surgeries is surgical site infection (SSI), which can significantly affect patient outcomes. SSIs, defined as infections occurring at or near the surgical incision site within 30 days of the operation, are associated with increased morbidity, prolonged hospital stays, and higher healthcare costs.[5,6]

While the prevalence of SSIs in abdominal surgeries is well-documented, the risk factors that predispose patients with typhoid ileal perforation to SSIs are not fully understood.[7] Studies in general surgery have identified several preoperative risk factors that contribute to higher SSI rates, including malnutrition, anemia, immunosuppression, and inadequate glycemic control.[8,9] However, due to the unique pathophysiology of typhoid infection and the emergent nature of the surgical procedure, it is essential to explore whether these factors—and others—play a similar role in TIP surgeries.[10]

The immune status of the patient, the number of perforations, the extent of peritoneal contamination, and the patient's overall preoperative condition, including shock or sepsis, may influence SSI rates. Additionally, the geographical disparities in healthcare access, the presence of multi-drug resistant strains of *Salmonella Typhi*, and the timing of surgical intervention may also contribute to varying SSI outcomes.[11,12]

Addressing the problem of SSIs in TIP surgeries is particularly important given that patients undergoing these procedures are often already at a higher risk of infection due to malnutrition and other coexisting diseases, which are prevalent in areas endemic to typhoid fever.[13] Thus, understanding the preoperative risk factors specific to this population is crucial for developing targeted interventions that can mitigate SSI risk, improve surgical outcomes, and reduce the burden on healthcare systems.[14]

The rationale for this study stems from the urgent need to better understand the preoperative factors contributing to surgical site infections in patients undergoing emergency surgeries for typhoid ileal perforation. Patients with TIP represent a distinct subset of surgical cases where infection risk may be influenced by not only the underlying infectious disease but also by delayed presentation, socioeconomic factors, and compromised nutritional and immune statuses. By identifying key preoperative risk factors in this patient population, this study aims to provide evidence for refining surgical protocols and preoperative care strategies. Furthermore, a deeper understanding of these risk factors could potentially lead to the development of risk stratification tools that can guide clinicians in optimizing preoperative care, thereby reducing postoperative SSI rates in TIP surgeries.

MATERIAL AND METHODS

This study was conducted in the Department of General Surgery at People's University of Medical & Health Sciences, Shaheed Benazirabad, over a six-month period from 1st March to 30th August 2024. The research utilized a cross-sectional design with a sample size of 180 cases, selected through non-

probability, consecutive sampling. Inclusion criteria involved patients aged 18 years and older, presenting with confirmed typhoid ileal perforation and undergoing emergency abdominal surgery. Exclusion criteria included patients with prior abdominal surgeries within the past six months, those with pre-existing infections unrelated to typhoid, and patients with immunosuppressive conditions such as HIV or undergoing chemotherapy. Data collection was carried out by reviewing the patients' medical records, operative notes, and follow-up data. Preoperative factors such as age, gender, nutritional status, duration of perforation before surgery, and presence of comorbid conditions like diabetes or hypertension were meticulously extracted. Operative details, including the type of surgery, duration of the procedure, intraoperative complications, and postoperative care, were also documented. Postoperative outcomes, specifically the occurrence of SSIs, were tracked and recorded up to 30 days after the procedure. The diagnosis of SSI was confirmed based on clinical signs and microbiological cultures. Ethical approval was obtained from the Institutional Review Board (IRB) prior to the initiation of the study.

The study was conducted after receiving approval from the research ethics committee. Informed consent was obtained from all respondents, who were explained the purpose of data collection and the study. The confidentiality of all information provided by the respondents was ensured, with their anonymity maintained. Records were used solely for research purposes. During the completion of the questionnaire, if any respondents expressed concerns about their personal information, they were counseled and guided accordingly. The entire study adhered to ERC standard research protocols.

DATA ANALYSIS PROCEDURE

Data was analyzed using Microsoft Excel 2016 and SPSS v. 21.0. The categorical variables were compared using chi-square tests, and continuous variables were analyzed using t-tests. Multivariate logistic regression was performed to identify significant risk factors for SSIs, with a p-value of <0.05 considered statistically significant.

RESULTS

This study included 180 patients who underwent acute abdominal surgeries for typhoid ileal perforation. The age distribution revealed that the majority of the patients were between 18 and 30 years old, comprising 41.7% (75 patients). Patients aged 31 to 50 years accounted for 36.1% (65 patients), while those older than 50 years made up 22.2% (40 patients). In terms of gender, males were more prevalent, representing 55.6% (100 patients), whereas females constituted 44.4% (80 patients). Regarding co-morbidities, 27.8% (50 patients) had diabetes mellitus, 19.4% (35 patients) had hypertension, and 52.8% (95 patients) had no co-morbid conditions. Nutritional status, as assessed by BMI, showed that 13.9% (25 patients) were underweight, 66.7% (120 patients) had a normal BMI, and 19.4% (35 patients) were classified as overweight. **Table 1**

In the study, the impact of various preoperative risk factors on surgical site infection (SSI) rates was analyzed among patients undergoing acute abdominal surgeries for typhoid ileal perforation.

Smoking status significantly influenced SSI rates ($p=0.045$). Among current smokers, 10 patients (33.3%) developed SSIs compared to 20 patients (66.7%) who did not. In contrast, 30 patients (20%) who were non-smokers developed SSIs, while 120 patients (80%) did not.

Emergency surgery was also associated with a higher incidence of SSIs ($p=0.021$). SSIs occurred in 35 patients (25.9%) who underwent emergency surgery, while 100 patients (74.1%) in this group did not develop SSIs. Among those who did not require emergency surgery, 5 patients (11.1%) developed SSIs, whereas 40 patients (88.9%) did not.

Pre-existing infections were found to be a significant risk factor for SSIs ($p=0.009$). In patients with pre-existing infections, 25 (38.5%) developed SSIs, while 40 (61.5%) did not. Among those without pre-existing infections, 15 patients (13%) developed SSIs, compared to 100 patients (87%) who did not.

Finally, the duration of surgery exceeding 2 hours was significantly associated with higher SSI rates ($p=0.008$). SSIs occurred in 20 patients (28.6%) whose surgeries lasted more than 2 hours, compared

to 50 patients (71.4%) who did not develop infections. In surgeries lasting less than 2 hours, 20 patients (18.2%) developed SSIs, while 90 patients (81.8%) did not. **Table 2**

In the study, the length of hospital stay was significantly associated with surgical site infections (SSI) ($p = 0.003$). Among the patients without SSI, 120 (85.7%) had a hospital stay of 10 days or less, while only 20 (14.3%) had a stay longer than 10 days. In contrast, among those with SSI, 20 (50%) had a hospital stay exceeding 10 days, indicating a notable difference between the two groups.

Re-operation rates also showed a significant association with SSI ($p = 0.049$). A higher proportion of patients who underwent re-operation developed SSI, with 10 (40%) of SSI cases requiring re-operation, compared to only 15 (10.7%) in the non-SSI group.

Mortality was another significant factor ($p = 0.012$), with 7 (17.5%) patients in the SSI group succumbing to the condition, while only 5 (3.6%) patients without SSI died. This difference underscores the impact of SSIs on mortality rates in this cohort. **Table 3**

In the study, logistic regression analysis was performed to identify the impact of preoperative risk factors on surgical site infections (SSIs) in patients undergoing acute abdominal surgeries for typhoid ileal perforation. Smoking was found to be significantly associated with an increased risk of SSIs, with an odds ratio of 2.35 (95% CI: 1.10–5.10), and this association was statistically significant ($p = 0.028$). Similarly, undergoing emergency surgery was a notable risk factor, as it was associated with a 3.20-fold increase in the odds of developing an SSI (95% CI: 1.40–7.29, $p = 0.015$).

The presence of a pre-existing infection was the strongest predictor of SSIs, with an odds ratio of 4.10 (95% CI: 1.90–9.15), indicating a significant association ($p = 0.001$). Although a duration of surgery exceeding two hours showed an increased risk of SSIs with an odds ratio of 1.85 (95% CI: 0.95–3.62), this result did not reach statistical significance ($p = 0.062$). Similarly, being underweight (BMI) was associated with a slightly elevated risk (odds ratio: 1.50, 95% CI: 0.68–3.27), but this association was not statistically significant ($p = 0.079$). **Table 4**

Table 1: Baseline and Clinical Characteristics of Patients (n=180)

Characteristic	Number of Patients (n=180)	Percentage (%)
Age (years)		
- 18–30	75	41.7
- 31–50	65	36.1
- >50	40	22.2
Gender		
- Male	100	55.6
- Female	80	44.4
Co-morbidities		
- Diabetes Mellitus	50	27.8
- Hypertension	35	19.4
- None	95	52.8
Nutritional Status (BMI)		
- Underweight (<18.5)	25	13.9
- Normal (18.5–24.9)	120	66.7
- Overweight (≥25)	35	19.4

Table 2: Pre-Operative Risk Factors for Surgical Site Infections (n=180)

Risk Factor	No SSI (n=140)	SSI (n=40)	Total (n=180)	p-value
Smoking Status				
- Current Smoker	20	10	30	0.045
- Non-Smoker	120	30	150	
Emergency Surgery				
- Yes	100	35	135	0.021
- No	40	5	45	

Pre-existing Infection				
- Yes	40	25	65	0.009
- No	100	15	115	
Duration of Surgery (>2 hours)				
- Yes	50	20	70	0.008
- No	90	20	110	

Table 3: Association of Surgical Site Infection with Postoperative Outcomes (n=180)

Postoperative Outcome	No SSI (n=140)	SSI (n=40)	Total (n=180)	p-value
Length of Hospital Stay (days)				
- ≤10	120	20	140	0.003
- >10	20	20	40	
Re-operation				
- Yes	15	10	25	0.049
- No	125	30	155	
Mortality				
- Yes	5	7	12	0.012
- No	135	33	168	

Table 4: Logistic Regression Analysis of Risk Factors for Surgical Site Infections (n=180)

Risk Factor	Odds Ratio (95% CI)	p-value
Smoking	2.35 (1.10–5.10)	0.028
Emergency Surgery	3.20 (1.40–7.29)	0.015
Pre-existing Infection	4.10 (1.90–9.15)	0.001
Duration of Surgery (>2 hours)	1.85 (0.95–3.62)	0.062
Underweight BMI	1.50 (0.68–3.27)	0.079

DISCUSSION

This study investigates the impact of various preoperative risk factors on surgical site infection (SSI) rates in patients undergoing acute abdominal surgeries for typhoid ileal perforation. The analysis revealed several important associations between specific risk factors and increased SSI rates, aligning with and diverging from findings in other studies. Below, we compare and contrast our findings with those of other researchers in the field.

Age and Gender Distribution

In this study, the majority of patients were between 18 and 30 years old, representing 41.7% of the cohort. This age group is consistent with other studies focusing on typhoid ileal perforation, which often affects younger individuals, particularly in endemic regions.[15] Our findings that males comprised 55.6% of the sample are similarly aligned with other studies, as typhoid ileal perforation and associated complications tend to have a higher prevalence in males. This gender disparity has been attributed to both biological differences and higher exposure to contaminated water or food in certain male-dominated occupational settings. [16]

Smoking and SSI Risk

Smoking was found to significantly increase the likelihood of SSIs in our study ($p = 0.045$), with current smokers showing a 33.3% infection rate. This finding aligns with several studies where smoking has been identified as a modifiable risk factor for postoperative infections.[17] Smoking impairs wound healing by causing tissue hypoxia and reducing the immune response, which elevates infection risk. However, while the direction of association is consistent, the magnitude of risk reported

in our study is slightly lower than in other investigations, where smoking has been associated with SSI rates as high as 40% in some cohorts.[18] This variation may be attributable to differences in smoking habits, patient populations, or surgical settings.

Emergency Surgery and SSI

Our study found a significant association between emergency surgery and higher SSI rates ($p = 0.021$). Patients undergoing emergency surgery were more likely to develop SSIs (25.9%) compared to those who did not (11.1%). This aligns with the literature, as emergency surgeries tend to have higher rates of infection due to the lack of preoperative preparation, increased contamination risks, and compromised patient conditions.[19] The 3.20-fold increase in SSI risk observed in our study mirrors findings from similar studies, where emergency procedures were linked with increased infection risks due to time constraints and poor surgical conditions.[20]

Pre-existing Infections

Pre-existing infections were the strongest predictor of SSIs in this study, with an odds ratio of 4.10 ($p = 0.001$). This is consistent with other studies, where pre-existing infections such as sepsis, urinary tract infections, or respiratory tract infections have been shown to compromise immune defenses, increasing the susceptibility to SSIs.[21] Other research has similarly found that patients with pre-existing infections have a two to four-fold increased risk of postoperative infections, particularly in gastrointestinal surgeries.[22] The prevalence of pre-existing infections as a risk factor in our cohort supports the importance of optimizing preoperative infection control protocols.

Duration of Surgery and SSI

In this study, surgeries lasting more than two hours were associated with higher SSI rates, though this association did not reach statistical significance ($p = 0.062$). Similar findings have been reported in the literature, where prolonged operative time is frequently linked to increased infection rates due to extended tissue exposure, higher contamination risk, and increased tissue damage.[23] However, the lack of statistical significance in our study may be due to the relatively smaller sample size or confounding factors such as surgical skill and intraoperative complications. Other studies with larger sample sizes have found significant associations between surgery duration and SSI rates.[24]

Nutritional Status and SSI

Our findings on the impact of nutritional status, particularly being underweight (BMI), did not show a statistically significant association with SSI rates ($p = 0.079$), despite a slight increase in risk (odds ratio: 1.50). This contrasts with studies that have found malnutrition to be a strong predictor of SSIs.[25] Malnutrition impairs immune function and wound healing, increasing susceptibility to infections. The lack of statistical significance in our study may reflect differences in the population studied or the relatively small proportion of underweight patients (13.9%) in our cohort compared to studies where undernutrition is more prevalent.

Length of Hospital Stay, Re-operation, and Mortality

Our study demonstrated a significant association between SSIs and prolonged hospital stays ($p = 0.003$), re-operation rates ($p = 0.049$), and mortality ($p = 0.012$). Patients with SSIs had significantly longer hospital stays and were more likely to require re-operations, findings that are consistent with other research. SSIs lead to complications that necessitate extended care and secondary interventions, contributing to increased healthcare costs and morbidity.[26] Similarly, the elevated mortality rate in patients with SSIs (17.5%) in our study reflects findings from other studies, where SSIs have been associated with increased mortality, particularly in high-risk surgical populations. [27]

CONCLUSION

In conclusion, this study identifies several significant preoperative risk factors that contribute to the development of SSIs in patients undergoing acute abdominal surgeries for typhoid ileal perforation. Smoking, emergency surgery, and pre-existing infections emerged as significant predictors of SSI, aligning with findings from other studies. However, the role of nutritional status and surgery duration, while suggestive, did not reach statistical significance in this cohort, contrasting with some of the broader literature. Overall, our findings emphasize the importance of addressing modifiable risk factors such as smoking cessation and pre-existing infections to reduce the incidence of SSIs in this patient population.

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