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Original Research Article

Comparative Analysis of Primary Closure Versus Ileostomy in the Surgical Management of Typhoid Intestinal Perforation

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Abstract: *Typhoid fever remains a significant public health concern in low and middle-income countries, particularly in overcrowded and resource-limited settings. In Pakistan, the emergence of multidrug-resistant Salmonella Typhi strains has increased the severity and complications associated with the disease. Intestinal perforation is a common and life-threatening complication requiring urgent surgical intervention. Literature presents conflicting evidence regarding the superiority of primary repair versus ileostomy in the management of typhoid perforation. This study was designed to compare early outcomes of these two surgical approaches.* ***Objective:*** *To evaluate and compare the short-term outcomes of primary repair versus ileostomy formation in patients undergoing surgery for typhoid-related intestinal perforation.* ***Methods:*** *This randomized controlled trial was conducted in the Department of Surgery at Nishtar Medical University/Hospital, Multan, over six months, following ethical approval. A total of 40 patients who met the inclusion and exclusion criteria were enrolled and randomized into two groups. Group A underwent primary repair of the perforation, while Group B received ileostomy formation. Patients were followed postoperatively for 7–10 days, and outcomes, including wound infection, mortality, and duration of hospital stay, were recorded.* ***Results:*** *Wound infection occurred in 11 (55%) patients in the primary repair group and in 4 (20%) patients in the ileostomy group (p = 0.022). Mortality was noted in 3 (15%) patients in the primary repair group compared to 1 (5%) patient in the ileostomy group (p = 0.292). The mean hospital stay was significantly longer in the primary repair group (7.15 ± 2.18 days) compared to the ileostomy group (5.70 ± 1.34 days) (p = 0.017).* ***Conclusion:*** *In the short-term postoperative period, ileostomy formation was associated with significantly lower wound infection rates and shorter hospital stay compared to primary repair in patients with typhoid intestinal perforation. These findings support the use of ileostomy as a preferred initial surgical approach in such cases.*

Keywords: Typhoid Perforation, Ileostomy, Primary Repair, Surgical Outcomes, Wound Infection, Mortality.

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Introduction

Typhoid fever, caused by Salmonella Typhi, continues to pose a major health burden in developing countries, particularly in regions with inadequate sanitation and poor access to clean water (1,2). It is estimated that globally, more than 9–11 million cases of typhoid fever occur annually, resulting in approximately 110,000–161,000 deaths, with South Asia bearing the highest disease burden (3,4). In Pakistan, typhoid remains endemic, and the emergence of multidrug-resistant (MDR) and extensively drug-resistant (XDR) strains of S. Typhi has further complicated treatment protocols and increased disease severity (5,6).

The clinical presentation of typhoid fever can range from nonspecific systemic symptoms—such as fever, malaise, and abdominal discomfort—to severe complications, with intestinal perforation being one of the most serious (7). Ileal perforation, typically occurring in the second or third week of illness, results from necrosis of Peyer's patches due to bacterial invasion and subsequent inflammation (8). This complication leads to diffuse fecal peritonitis and carries a high risk of morbidity and mortality, especially in resource-constrained settings (9,10).

Despite advancements in surgical techniques and perioperative care, the mortality rate for typhoid-related intestinal perforation remains high, ranging from 10% to 39% in various reports (11,12). Prompt surgical intervention is critical, but there remains no clear consensus on the optimal surgical approach. Common procedures include primary closure of the perforation, segmental bowel resection with anastomosis, and loop ileostomy formation (13,14).

Several studies have attempted to compare primary repair and ileostomy, but their findings remain inconsistent. Some report higher wound infection and leak rates with primary repair, while others note increased morbidity associated with ileostomy due to stoma-related complications and patient inconvenience (15,16). Factors influencing outcomes include delay in presentation, nutritional status, number and size of perforations, degree of peritoneal contamination, and intraoperative findings (17,18).

Given the high incidence of typhoid perforation and the ongoing debate over optimal surgical management, particularly in the context of developing countries, there is a pressing need for evidence-based recommendations. This study aims to compare early outcomes—specifically wound infection, mortality, and length of hospital stay—between primary closure and ileostomy in patients with typhoid ileal perforation.

This study aims to compare the outcomes of primary repair versus ileostomy formation in typhoid intestinal perforation, particularly in critically ill patients presenting late with diffuse peritonitis and heavy fecal contamination. Existing literature suggests that ileostomy may reduce postoperative wound infection, mortality, and hospital stay. However, conflicting evidence persists, especially in locally conducted studies. Therefore, this research seeks to objectively evaluate the efficacy and associated risks of both surgical approaches.

The objective of this study was to compare the short-term outcomes of primary repair versus ileostomy stoma formation in patients presenting with typhoid intestinal perforation. The focus was on assessing postoperative wound infection, mortality, and duration of hospital stay within one week of surgery. The null hypothesis proposed no significant difference between the two surgical approaches. Conversely, the alternate hypothesis suggested that outcomes differ significantly between primary repair and ileostomy. This study aimed to provide evidence-based

guidance on optimal surgical management, particularly for late-presenting and critically ill patients.

Methodology

This randomized controlled trial was conducted in the Department of Surgery, Nishtar Medical University and Hospital, Multan, over six months, from January to June, following approval from the institutional ethics review committee. The study population comprised patients presenting with clinical features of typhoid intestinal perforation. A total of 40 eligible patients were enrolled using non-probability consecutive sampling. The required sample size of 40 (20 per arm) was calculated at 90% power and a 5% significance level, using postoperative wound infection rates from previous literature (86.96% in primary repair versus 43.47% following ileostomy).

Patients aged 12 to 70 years of either gender presenting with a clinical diagnosis of typhoid ileal perforation confirmed intraoperatively were included. Patients classified as ASA class III or IV, those with major organ dysfunction including hepatic, renal, or cardiac failure, or those requiring intensive mechanical ventilatory support were excluded.

After obtaining informed written consent, eligible participants were randomized to two treatment groups using a computer-generated randomization list. Group A underwent primary perforation repair, and Group B underwent ileostomy formation. Allocation concealment was maintained using sealed, opaque envelopes that were opened in the operating room.

All patients received standard preoperative resuscitation, including intravenous fluids, electrolyte correction, and nasogastric decompression. An exploratory laparotomy was performed through a midline incision. The number, size, and anatomical position of perforations were documented. After performing either primary repair or ileostomy as per allocation, the peritoneal cavity was irrigated with warm saline. Appropriate tube drains were placed, and wounds were closed in layers.

Postoperatively, patients received broad-spectrum antibiotics according to institutional protocol: intravenous ciprofloxacin (400 mg twice daily) and ceftriaxone (2 g twice daily) for seven days. Subsequently, oral ciprofloxacin (500 mg twice daily) was continued for 21 days. Routine postoperative monitoring included vital signs, pain control, wound inspection, assessment of bowel function, and drain monitoring.

Primary outcomes included postoperative wound infection, duration of hospital stay, and mortality. Wound infection was defined clinically as erythema, tenderness, purulent discharge, or wound disruption requiring dressing or antibiotic escalation. These outcomes were assessed by blinded surgical staff between postoperative days 7 and 10. Mortality occurring within 30 days of surgery was recorded as procedure-related.

Data were entered and analyzed using SPSS version 23. Quantitative variables such as age, operative time, and duration of hospital stay were described using mean ± standard deviation (SD). Qualitative variables such as gender, wound infection, and mortality were summarized as frequencies and percentages.

Normality of continuous data was assessed using the Shapiro-Wilk test. For normally distributed variables, group differences were evaluated using the independent sample t-test. Categorical comparisons between study arms were performed using the chi-square test or Fisher's exact test where appropriate. A p-value less than 0.05 was considered statistically significant. Intention-to-treat principles were followed during analysis.

Results

A total of 40 patients with typhoid ileal perforation were included in the study. The overall mean age was 35.58 ± 15.97 years (range: 20–70 years). Patients in the primary repair group had a mean age of 31.40 ± 13.30 years, while those in the ileostomy group had a mean age of 39.75 ± 17.60 years ($p = 0.099$), indicating no significant age difference between groups. Among all patients, 25 (62.5%) were male, and 15 (37.5%) were female, with a male-to-female Ratio of 1.67:1. The gender distribution between the two groups was statistically insignificant ($p = 0.744$).

The mean operative time was 86.87 ± 15.54 minutes (range: 62–114 minutes). In the primary repair group, it was slightly higher (90.05 ± 17.99 minutes) compared to the ileostomy group (83.70 ± 12.28 minutes), but the difference was not significant ($p = 0.200$).

Postoperative outcomes showed a significantly higher rate of wound infection in the primary repair group (55.0%) than in the ileostomy group (20.0%) ($p = 0.022$). Mortality was observed in four patients (10.0%)—three (15.0%) in the primary repair group and one (5.0%) in the ileostomy group, showing no statistically significant difference ($p = 0.292$). The mean hospital stay was significantly shorter in the ileostomy group (5.70 ± 1.34 days) compared to the primary repair group (7.15 ± 2.18 days) ($p = 0.017$).

These findings suggest that ileostomy was associated with fewer postoperative wound infections and a shorter hospital stay, though differences in mortality were not statistically significant.

Table 1. Baseline Demographic and Clinical Characteristics of Patients (n = 40)

Variable	Primary Repair (n=20)	Ileostomy (n=20)	Total (n=40)	p-value
Age (years)	31.40 ± 13.30	39.75 ± 17.60	35.58 ± 15.97	0.099
Gender				
Male	13 (65.0%)	12 (60.0%)	25 (62.5%)	0.744
Female	7 (35.0%)	8 (40.0%)	15 (37.5%)	
Operative Time (minutes)	90.05 ± 17.99	83.70 ± 12.28	86.87 ± 15.54	0.200

Table 2. Comparison of Postoperative Outcomes Between Study Groups

Outcome Variables	Primary Repair (n=20)	Ileostomy (n=20)	Total (n=40)	p-value
Wound Infection	11 (55.0%)	4 (20.0%)	15 (37.5%)	0.022
Mortality	3 (15.0%)	1 (5.0%)	4 (10.0%)	0.292
Hospital Stay (days)	7.15 ± 2.18	5.70 ± 1.34	6.43 ± 1.93	0.017

Discussion

Typhoid fever remains a major public health concern in low- and middle-income countries, particularly in regions with inadequate sanitation and unsafe drinking water. The burden is further aggravated by the emergence of multidrug-resistant Salmonella Typhi strains, which delay treatment and increase complications such as intestinal perforation—a life-threatening emergency requiring prompt surgical management(19,20).

In this study, the mean age of patients was 35.58 ± 15.97 years, with a male predominance (62.5%), findings comparable to those of Neelma et al. and Mittal et al., who reported similar demographic profiles and male-to-female ratios ranging from 3:1 to 6.5:1(21–23). This gender difference may be attributed to greater exposure among males to contaminated food

and water in many developing societies. Our results showed significantly lower wound infection rates in the ileostomy group (20%) compared to the primary repair group (55%) ($p = 0.022$), aligning with findings by Farooq et al. and Ahmad et al., who reported higher postoperative infection rates after primary closure (24,25). Conversely, Mishra et al. and Qureshi et al. observed higher infection rates in ileostomy cases (26,27), reflecting differences in case selection, intraoperative conditions, and postoperative care.

Mortality was higher in the primary repair group (15%) than in the ileostomy group (5%), though the difference was statistically insignificant ($p = 0.292$). This trend mirrors the results of Farooq et al., who found nearly twice the mortality with primary repair (24). However, other studies noted no significant difference in mortality, suggesting that early diagnosis, effective resuscitation, and surgical timing are crucial prognostic factors (28,29).

The mean hospital stay was shorter in the ileostomy group (5.70 ± 1.34 days) than in the primary repair group (7.15 ± 2.18 days) ($p = 0.017$). Similar observations were made by Nsar et al. and Nema et al. (30,31), while Mittal et al. reported longer stays in ileostomy patients due to stoma care and delayed reversal (23).

Overall, the heterogeneity of outcomes in the literature underscores the need for individualized surgical decision-making. Factors such as the timing of presentation, hemodynamic stability, degree of peritoneal contamination, and the number or size of perforations must guide the choice between primary repair and ileostomy (32). Our findings suggest that in patients with late presentation, diffuse peritonitis, or poor general condition, ileostomy offers a safer short-term outcome with fewer postoperative complications.

Conclusion

This study concludes that ileostomy provides better short-term outcomes than primary repair in patients with typhoid intestinal perforation. It resulted in significantly lower wound infection rates and shorter hospital stays. Although mortality did not differ significantly, it was lower in the ileostomy group. Ileostomy may be a safer option, especially in critically ill patients. These findings support its consideration in surgical decision-making.

Declarations

Data Availability statement
All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate
Approved by the department concerned. (IRBEC-6246/d-24)

Consent for publication
Approved

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The authors declared no conflict of interest.

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All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the study's integrity.

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