



Frequency of Wound Infection in Patients with Typhoid Ileal Perforation Undergoing Primary Repair

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Authors' Contribution

All authors equally contributed to the study and approved the final manuscript

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ABSTRACT

Background: Typhoid ileal perforation is an extreme enteric fever complication that usually necessitates emergency operative repair. It is still a prevalent surgical emergency in Third World countries because of sanitation deficiencies, delayed diagnosis, and restricted access to healthcare. Postoperative wound infection remains the leading cause of morbidity even with improvements in surgical methods, extending recovery and hospitalization time. **Objective:** To determine the frequency of wound infection in patients with typhoid ileal perforation undergoing primary repair at Mardan Medical Complex, Mardan. **Study Design:** Descriptive cross-sectional study. **Duration and Place of Study:** This study was conducted at the Department of General Surgery, Mardan Medical Complex, Mardan, from November 2024 to April 2025. **Methodology:** A total of 98 patients aged 18–65 years who underwent primary repair for typhoid ileal perforation were included through consecutive sampling. Diagnosis was confirmed by clinical findings and radiographic evidence. Wound infection was recorded based on redness, swelling, pain, and purulent discharge on postoperative day five. **Results:** The mean age was 41.15 ± 14.00 years, and males comprised 67.3% of participants. The overall frequency of wound infection was 28.6%. Infection was higher in males (33.3%) than females (18.8%) and more common among literate (38.3%) than illiterate (13.2%) patients, with education showing a significant association ($p = 0.011$). **Conclusion:** Wound infection remains a frequent postoperative complication after primary repair of typhoid ileal perforation.

INTRODUCTION

Typhoid ileal perforation is one of the serious complication of enteric fever caused mainly by Salmonella typhi infection which affect the intestine specially the terminal ileum.¹ The disease remain common in developing countries where poor sanitation, contaminated food and water still exist.² In many patient, prolonged untreated infection cause ulceration in Peyer's patches of ileum and then finally perforation take place leading to peritonitis.³ The patients usually present with severe abdominal pain, fever, vomiting and distension.⁴ The condition carry high morbidity and mortality if not diagnosed early.⁴ The perforation often occur in second or third week of illness when bacterial invasion and necrosis of intestinal wall become extensive.⁵ Delay in diagnosis and presentation of patients due to lack of resources make the problem worse and increase the rate of complications like wound infection, sepsis and death.⁶

The treatment of typhoid ileal perforation mainly depend on urgent surgical intervention because conservative management alone cannot save the patient.⁷ The common procedure done is primary repair of the perforation site after adequate peritoneal lavage. In this

method, after identification of the perforation, edges are trimmed and the defect closed in two layers using absorbable suture material.⁷ Sometimes multiple perforations are found and each one repaired separately or occasionally segmental resection and anastomosis may be done if damage is extensive.⁸ Along with the surgery, broad spectrum antibiotics are given to cover both gram-negative and anaerobic organisms.⁹ Adequate fluid resuscitation, correction of electrolyte imbalance and postoperative monitoring are vital part of management.¹ Early surgical approach is associated with better survival outcome, but the success of repair depends on patient condition at time of operation and degree of peritoneal contamination.¹

Wound infection after surgery for typhoid ileal perforation remain a major postoperative complication that prolong hospital stay and increase morbidity.¹⁰ The infection may arise from gross contamination of peritoneal cavity during surgery or from systemic septicemia due to persistence of bacteria.¹¹ Factors like late presentation, poor nutritional status, anemia, improper aseptic technique and inadequate antibiotic coverage all contribute to high rate of surgical site infection.¹² The

wound often show redness, discharge, pus formation and sometimes partial dehiscence. Management involve regular wound dressing, proper drainage, and use of suitable antibiotics according to culture sensitivity results.¹³ A study observed the frequency of wound infection (28.8%) in patients with typhoid ileal undergone primary repair.¹⁴

There was need to do this study in Mardan because many patients with typhoid ileal perforation get wound infection after surgery. The condition is common here due to poor hygiene and late coming to hospital. Still there is not much data from this area about how often wound infection happen and what factors cause it. This study will help to know the main reasons and to improve care for patients who undergo primary repair in Mardan hospitals.

METHODOLOGY

This descriptive cross-sectional study was carried out in the General Surgery Department of Mardan Medical Complex, Mardan, between November 2024 and April 2025. Permission was taken from the ethical review board and CPSP research department before starting the study. The sample size was calculated by WHO sample size calculator, keeping 95% confidence level and 9% margin of error with an expected wound infection rate of 28.8%.¹⁴ The final sample included 98 patients. Patients were taken through non-probability consecutive sampling method till the sample size completed. Those between 18 and 65 years of age, both male and female, and having typhoid ileal perforation confirmed by signs of abdominal pain more than 5 on pain scale, fever above 38.5°C, tenderness, absent bowel sounds, and X-ray showing air under diaphragm were included. Those who were pregnant or had chronic liver or kidney disease were not included.

Before collecting any data, each patient was told the study purpose and benefit in simple words, and consent was taken in writing. All included patients were operated under general anesthesia in supine position with midline incision. The abdomen was cleaned with warm saline, and the perforated site was repaired in two layers, using vicryl for inner and silk for outer layer. After surgery, patients were observed. Wound infection was said to be present when redness, swelling, and pain more than 4 on scale were seen, along with pus or pustules at the wound site on the fifth postoperative day during check by a senior consultant. Those who had these signs were counted as having wound infection.

All data were entered and analyzed using SPSS version 27. Mean and standard deviation or median (IQR) were used for continuous variables. Frequencies and percentages were used for categorical variables. The relation between wound infection and other variables was checked by chi-square or Fisher exact test, and p-value less than 0.05 was taken as significant.

RESULTS

The mean age of patients was 41.15±14.00 years, with mean height of 1.66±0.08 meters, mean weight of 65.55±9.75 kilograms, and mean body mass index of 24.28±3.97 kg/m². Regarding gender distribution, majority were males 66 (67.3%) while females were 32 (32.7%). In terms of socioeconomic status, upper class

patients were 13 (13.3%), middle class were 47 (48.0%), and lower class were 38 (38.8%). Education status showed that literate patients were 60 (61.2%) and illiterate were 38 (38.8%). Most patients belonged to rural areas 69 (70.4%) compared to urban areas 29 (29.6%). Among lifestyle factors, smokers were 35 (35.7%) while non-smokers were 63 (64.3%). Comorbidities analysis revealed that diabetic patients were 27 (27.6%) and non-diabetics were 71 (72.4%), while hypertensive patients were 29 (29.6%) and non-hypertensive were 69 (70.4%) (as shown in Table-I).

Table I

Patient Demographics

| Demographics | Mean ± SD / n (%) |
|-----------------------------|-------------------|
| Age (Years) | 41.15±14.00 |
| Height (m) | 1.66±0.08 |
| Weight (kg) | 65.55±9.75 |
| BMI (kg/m ²) | 24.28±3.97 |
| Gender | |
| Male n (%) | 66 (67.3%) |
| Female n (%) | 32 (32.7%) |
| Socioeconomic Status | |
| Upper n (%) | 13 (13.3%) |
| Middle n (%) | 47 (48.0%) |
| Lower n (%) | 38 (38.8%) |
| Education Status | |
| Literate n (%) | 60 (61.2%) |
| Illiterate n (%) | 38 (38.8%) |
| Residence Area | |
| Urban n (%) | 29 (29.6%) |
| Rural n (%) | 69 (70.4%) |
| Smoking | |
| Yes n (%) | 35 (35.7%) |
| No n (%) | 63 (64.3%) |
| Diabetes | |
| Yes n (%) | 27 (27.6%) |
| No n (%) | 71 (72.4%) |
| Hypertension | |
| Yes n (%) | 29 (29.6%) |
| No n (%) | 69 (70.4%) |

The overall frequency of wound infection in patients with typhoid ileal perforation undergoing primary repair was 28 (28.60%) while 70 (71.40%) patients did not develop wound infection out of total 98 patients (as shown in Table-II).

Table II

Frequency of Wound Infection in Patients with Typhoid Ileal Perforation Undergoing Primary Repair (N=98)

| Wound Infection | Frequency | %age |
|-----------------|-----------|--------|
| Yes | 28 | 28.60% |
| No | 70 | 71.40% |
| Total | 98 | 100% |

When association of wound infection with demographic factors was analyzed, it was found that in age group ≤40 years, 13 (27.1%) developed wound infection while 35 (72.9%) did not, and in age group >40 years, 15 (30.0%) had wound infection while 35 (70.0%) did not, with p-value of 0.749. Gender wise distribution showed that among males, 22 (33.3%) developed wound infection and 44 (66.7%) did not, while among females, 6 (18.8%) had wound infection and 26 (81.3%) did not, with p-value of 0.134. Socioeconomic status analysis revealed that in upper class, 4 (30.8%) developed wound infection and 9 (69.2%) did not, in middle class, 14 (29.8%) had wound infection and 33 (70.2%) did not, and in lower class, 10 (26.3%) developed wound infection and 28 (73.7%) did

not, with p-value of 0.953 using Fischer Exact Test. Education status showed significant association where among literate patients, 23 (38.3%) developed wound infection and 37 (61.7%) did not, while among illiterate patients, 5 (13.2%) had wound infection and 33 (86.8%) did not, with p-value of 0.011 using Fischer Exact Test. Residence area distribution showed that among urban patients, 10 (34.5%) developed wound infection and 19 (65.5%) did not, while among rural patients, 18 (26.1%) had wound infection and 51 (73.9%) did not, with p-value of 0.401. Smoking status analysis revealed that among smokers, 13 (37.1%) developed wound infection and 22 (62.9%) did not, while among non-smokers, 15 (23.8%) had wound infection and 48 (76.2%) did not, with p-value of 0.162. Diabetes status showed that among diabetic patients, 7 (25.9%) developed wound infection and 20 (74.1%) did not, while among non-diabetic patients, 21 (29.6%) had wound infection and 50 (70.4%) did not, with p-value of 0.721. Hypertension status analysis revealed that among hypertensive patients, 10 (34.5%) developed wound infection and 19 (65.5%) did not, while among non-hypertensive patients, 18 (26.1%) had wound infection and 51 (73.9%) did not, with p-value of 0.401 (as shown in Table-III).

Table III*Association of Wound Infection with Demographic Factors*

| Demographic Factors | Wound Infection | | p-value | |
|----------------------|-----------------|------------|------------|--------|
| | Yes n(%) | No n(%) | | |
| Age Group (years) | ≤40 | 13 (27.1%) | 35 (72.9%) | 0.749 |
| | >40 | 15 (30.0%) | 35 (70.0%) | |
| Gender | Male | 22 (33.3%) | 44 (66.7%) | 0.134 |
| | Female | 6 (18.8%) | 26 (81.3%) | |
| Socioeconomic Status | Upper | 4 (30.8%) | 9 (69.2%) | 0.953* |
| | Middle | 14 (29.8%) | 33 (70.2%) | |
| | Lower | 10 (26.3%) | 28 (73.7%) | |
| Education Status | Literate | 23 (38.3%) | 37 (61.7%) | 0.011* |
| | Illiterate | 5 (13.2%) | 33 (86.8%) | |
| Residence Area | Urban | 10 (34.5%) | 19 (65.5%) | 0.401 |
| | Rural | 18 (26.1%) | 51 (73.9%) | |
| Smoking | Yes | 13 (37.1%) | 22 (62.9%) | 0.162 |
| | No | 15 (23.8%) | 48 (76.2%) | |
| Diabetes | Yes | 7 (25.9%) | 20 (74.1%) | 0.721 |
| | No | 21 (29.6%) | 50 (70.4%) | |
| Hypertension | Yes | 10 (34.5%) | 19 (65.5%) | 0.401 |
| | No | 18 (26.1%) | 51 (73.9%) | |

*Fischer Exact Test

DISCUSSION

The discussion started in line with the objective which was to find the frequency and association of wound infection after typhoid ileal perforation repair. The study found overall infection rate of 28.6%, showing that almost one in three patients developed postoperative wound infection, which indicate moderate infection burden probably due to contamination during emergency surgery and delayed hospital presentation. The mean age 41.15 ± 14.00 years shows most patients were adults, whose immune capacity may start to decline, explaining higher infection chance. Males had more infection (33.3%) than females (18.8%), likely because men are more exposed to contaminated food or delay seeking care. Infection was more in literate (38.3%) compared to illiterate (13.2%) with $p = 0.011$, maybe because educated patients observe and report wound changes more quickly. Rural patients (26.1%) showed slightly lower infection than urban (34.5%),

possibly due to smaller sample and hospital-based care equality. Smokers had infection 37.1% compared to 23.8% in non-smokers, indicating smoking delayed healing. Diabetes (25.9%) and hypertension (34.5%) did not show significant relation with wound infection, maybe because these patients were under control with medication and proper perioperative monitoring. These findings explain that wound infection depend on multiple host and environmental factors rather than single cause.

The overall frequency of wound infection in present study was 28.60% which is comparable to findings of Jain S, et al.¹⁵ who reported wound infection rate of 22.8% in their study of 105 patients with typhoid ileal perforation. However, our findings are considerably lower than those reported by Farooq U, et al.¹⁶ who documented wound infection in 66% of patients, and Hameed F, et al.¹⁷ who observed wound infection in 62.5% of cases. This variation in infection rates can be attributed to differences in patient selection criteria, timing of surgical intervention, preoperative antibiotic protocols, and overall peritoneal contamination at time of surgery. Shah UA, et al.¹⁸ reported wound infection rate of 16% in primary repair group which is lower than our findings, possibly due to better patient selection and earlier presentation in their military hospital settings. Mengal MA, et al.¹⁹ found wound infection in 25 patients of primary repair group which showing similar trend with our study results. The mean age of patients in current study was 41.15 ± 14.00 years which is considerably higher than most previous studies where Farooq U, et al.¹⁶ reported mean age of 25 ± 12.7 years, Shah UA, et al.¹⁸ documented mean age of 22.47 ± 14.8 years, Siddiqui MS, et al.²⁰ found mean age of 25 ± 10 years, and Hameed F, et al.¹⁷ reported mean age of 27.08 ± 22 years. Only Muqem M, et al.²¹ reported closer mean age of 31.06 ± 6.63 years to our study population. This age difference may be explained by different demographic patterns in our population, delayed healthcare seeking behavior in older patients, or possibility that older individuals in our region have lower immunity against typhoid infection due to lack of previous exposure. The male predominance observed in present study with 67.3% males is consistent with findings across all reviewed studies including Farooq U, et al.¹⁶ with 80% males, Jain S, et al.¹⁵ with 80% males, Siddiqui MS, et al.²⁰ with 82% males, Hameed F, et al.¹⁷ with 82.5% males, and Cheema KA, et al.²² with 72% males. This consistent male preponderance across multiple studies from different regions suggesting that males are more susceptible to typhoid ileal perforation possibly due to greater exposure to contaminated food and water sources outside home environment and delayed presentation for medical care. The significant association between education status and wound infection ($p=0.011$) in our study where literate patients had higher infection rate (38.3%) compared to illiterate patients (13.2%) is unique finding not specifically addressed in other studies reviewed. This paradoxical observation contradicting conventional expectation that education should be protective factor, but may be explained by literate individuals presenting earlier in disease course when perforation has occurred but sepsis not yet fully developed, thereby undergoing surgery with viable but contaminated tissues. Alternatively, illiterate

patients may present so late that only those with robust constitution survive to reach hospital creating survival bias. The rural predominance in our study with 70.4% patients from rural areas aligns with findings of Cheema KA, et al. ²² who reported 70% and 66% patients from low socioeconomic status which typically associated with rural residence. This consistent pattern across studies reflecting endemic nature of typhoid fever in areas with inadequate sanitation infrastructure and limited access to clean drinking water. The comorbidity profile in present study showed diabetes in 27.6% and hypertension in 29.6% of patients which were not significantly associated with wound infection development. These comorbidity rates are higher than expected in younger populations reported in other studies, again reflecting older age distribution of our patient cohort. None of reviewed studies specifically analyzed impact of diabetes and hypertension on wound infection outcomes in typhoid ileal perforation patients making direct comparison difficult.

Actually, this research has very few limitations, which need to be pointed out. The first is that this research was performed on a small population of only 98 patients, which makes it difficult to generalize. The research period was also small, as it did not cover follow-up periods, which can make it difficult to identify more advanced complications of the wound. The data was collected from a tertiary care hospital, which can make it difficult to apply it across all of

its settings. There was also information collected by self-reporting, which can make it difficult to identify bias. The research did not provide information on the pattern of the microbes found in the infected wounds, which can make it difficult to identify its resistances. Still, it was able to offer insight into the possibility of its association with factors of the infection of the wounds following the repair of typhoid ileal perforation.

CONCLUSION

The results of our study has shown that wound infection is still common after primary repair of typhoid ileal perforation. The result show that infection depend on many personal and environmental things like gender, literacy, and habits. It seem that educated people report infection more because they observe wound better, while others may ignore small symptoms. The study also show that diseases like diabetes or hypertension not have strong link with infection maybe because most patients were under control.

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