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Research Paper

Typhoid Intestinal Perforation in North-Central Nigeria: A 5-Year Review of The Determinants of Morbidity and Mortality

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ABSTRACT

Background: *Typhoid Intestinal Perforation (TIP) is the most lethal complication of enteric fever, with a disproportionately high incidence and mortality in low- and middle-income countries. Late presentation and delays in surgical intervention are significant contributors to poor outcomes. This study aimed to audit the 5-year surgical experience with TIP at a tertiary hospital in North-Central Nigeria.*

Methods: *A retrospective analysis of 74 patients who were managed for TIP at Benue State University Teaching Hospital, Makurdi, from January 2019 to December 2024 was conducted. Data on demographics, clinical presentation, operative findings, post-operative complications, and mortality were retrieved and analysed using IBM SPSS version 26. Descriptive statistics, Chi-square, and T-tests were employed, with a p-value of <0.05 considered significant.*

Results: *The mean age of patients was 18.2 ± 9.5 years, with a male predominance (62.2%). The mean duration of fever before presentation was 16.1 ± 4.9 days, and the mean in-hospital delay to surgery was 41.0 ± 23.0 hours. Pre-operative acute kidney injury (AKI) was present in 33.8% of patients. The overall post-operative mortality rate was 18.5%. Significant predictors of mortality included a longer duration of fever (18.0 vs. 14.8 days, $p=0.026$) and the presence of pre-operative AKI ($p=0.01$). A clinically important, though not statistically significant, longer in-hospital delay was observed in non-survivors (51.2 vs. 39.0 hours, $p=0.101$). Post-operative morbidity was substantial, featuring a 58.6% surgical site infection rate and a 23.8% re-operation rate.*

Conclusion: *TIP continues to be a disease of dire consequences in our environment, characterised by high morbidity and a persistent mortality rate driven by a triad of pre-hospital delay, pre-operative organ failure, and in-hospital delays. A paradigm shift towards aggressive public health education and hospital-based quality improvement to streamline emergency surgical care is urgently needed to improve outcomes.*

Keywords: *Typhoid Intestinal Perforation; Mortality; Morbidity; Nigeria; Acute Kidney Injury.*

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I. INTRODUCTION

Typhoid fever, caused by *Salmonella typhi* and *Salmonella Paratyphi*, remains a major global health concern endemic in low-socioeconomic settings. It is transmitted via the faecal-oral route and presents with a spectrum of clinical manifestations, from acute diarrhoea to severe systemic complications (1,2,5,6). Annually, it is estimated to cause over 33 million cases and more than 500,000 deaths worldwide (3-5).

The most fatal complication of typhoid fever is Typhoid Intestinal Perforation (TIP), accounting for 40-50% of all typhoid-associated mortality (1,3,4,7,8). It results from full-thickness ischaemic injury of the intestinal wall adjacent to inflamed Peyer's patches in the terminal ileum (1,2,4,5). Its global incidence varies dramatically, from approximately 0.83% in high-income nations to up to 39% in low- and middle-income countries (LMICs) (1,3-6). In West Africa, it is a leading cause of surgical acute abdomen, with reported

incidences between 15% and 33% (4,8,9,10). Surveillance data from the Severe Typhoid in Africa Program (SETA) found TIP accounted for 35% of non-traumatic intestinal perforations in several African countries (8). Similar high burdens are reported elsewhere, including 50% in rural Niger and 45% in India (8,11,12). This geographical variation is attributed to differences in water quality, sanitation, and hygiene, which drive faecal-oral transmission (4-6,8,13).

TIP is a surgical emergency requiring exploratory laparotomy for diagnosis and definitive management. Patients often present late with complications, including fluid and electrolyte deficits, acute kidney injury, and sepsis (1,2). In sub-Saharan Africa and other LMICs, outcomes are worsened by delays in both patient presentation and subsequent surgical intervention, leading to higher peri-operative morbidity and mortality (1,8-12). The emergence of multidrug-resistant strains of *Salmonella typhi* further complicates treatment (14).

Globally, mortality rates from TIP range widely from 5% to 62% (6,13). Contemporary series from well-resourced settings report mortality below 3%, contrasting sharply with rates in LMICs (18). In Africa, reported mortality rates include 23.1% in Tanzania (5). Nigerian studies show a progressive decline from 58% five decades ago (16) to 28% two decades ago (17), and more recently to approximately 18-19% (18,19). This persistently high mortality in developing regions is attributed to multiple factors, including late diagnosis, the emergence of multidrug-resistant and virulent bacterial strains (4, 6, 8, 14), delays in surgical intervention, and the development of postoperative complications (5, 6, 9, 19).

This study aimed to conduct a comprehensive 5-year audit of Typhoid Intestinal Perforation (TIP) at Benue State University Teaching Hospital (BSUTH), Makurdi.

The specific objectives are:

1. To determine the incidence and epidemiological profile of surgically managed TIP at BSUTH over the 5 years (2019-2024).
2. To describe the clinical presentation and the spectrum of perioperative complications encountered.
3. To determine the overall mortality rate and identify the significant predictors of mortality in patients with TIP at our institution.

II. METHODOLOGY

This was a 5-year retrospective study of patients who were managed for typhoid perforation at BSUTH, Makurdi, from January 2019 to December 2024.

BSUTH is a four-hundred-and-eighty (480) bed tertiary health facility located in Makurdi, the capital city of Benue state. Benue state is a state in the North-Central of Nigeria, with an estimated population of 6,141,300 persons as of 2024, out of which an estimated 461,500 persons live in Makurdi (22). The hospital also receives referrals from neighbouring states (Cross-River, Taraba, Kogi, and Nassarawa).

The case notes and patient folders of all patients managed for TIP over the study period were retrieved from the medical records. Relevant information on these patients was obtained from the medical records and recorded in the research proforma.

This data was eventually analysed using IBM SPSS version 26 and presented in frequency tables and charts. Descriptive statistics of normally distributed numeric variables were carried out using their mean and standard deviations (Mean ± SD). The categorical variables were analysed using the chi-square test, while a Student's T-test was used to determine the significance of associations between numerical variables. The level of statistical significance was determined at p-values of <0.05.

ETHICAL CONSIDERATION

Approval to begin this study was obtained from the Health Research and Ethical Committee of BSUTH before the commencement of the study. Confidentiality was ensured by not writing the names of patients on the proforma.

III. RESULTS

1. Patient Demographics and Clinical Profile

A total of 74 patients with a pre-operative diagnosis of peritonitis secondary to Typhoid Intestinal Perforation (TIP) over the study interval were studied. The cohort had a mean age of 18.22 ± 9.45 years, with a male

predominance (62.2%). A slightly higher proportion, 41(55.4%), presented in the rainy season, while 33(44.6%) presented in the dry season. The mean duration of fever before presentation was 16.12 ± 4.90 days. The mean interval from hospital presentation to surgery was 41.01 ± 23.01 hours. A significant proportion of patients, 25(33.8%) had pre-operative acute kidney injury (AKI); 9 (12.2%) of these required pre-operative dialysis. In addition, the relationship between pre-op AKI and pre-op mortality was statistically significant with p=0.001.

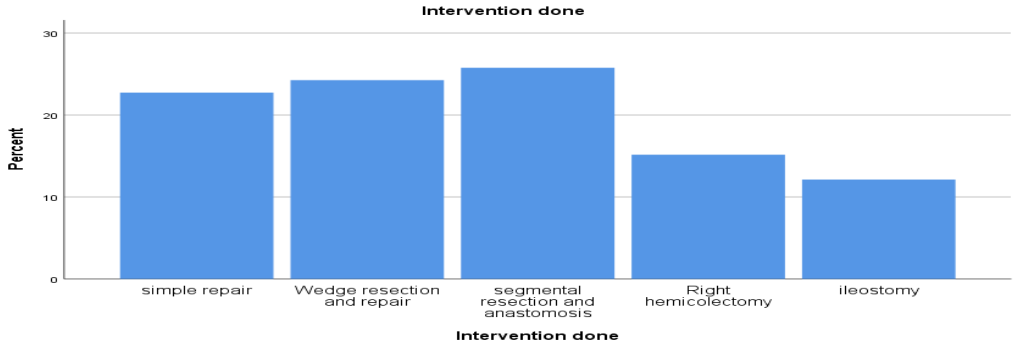
Table 1: Pre-operative morbidity and mortality

	Yes	No	Total
AKI	25 (33.8%)	49 (66.2%)	74(100%)
Dialysis	9(12.2%)	65(87.2%)	74(100%)
Mortality	8(10.8%)	66(89.2%)	74(100%)

2. Operative Findings and Management

The mean number of perforations was 1.89 ± 1.07, occurring at a mean distance of 24.12± 15.3cm from the ICJ. The most common surgical procedures were segmental resection and anastomosis (25.8%), wedge resection and repair (24.2%), and simple repair (22.7%).

Fig 1: Specific surgical interventions done.



3. Post-Operative Outcomes and Morbidity

Post-operative morbidity was high. The surgical site infection (SSI) rate was 58.6%, with 29.4% being organ/space infections (predominantly, intra-abdominal abscess). Other complications included pneumonia (33.3%), post-operative AKI (16.4%), pleural effusion (15.0%), and iatrogenic Entero-Cutaneous Fistula (ECF) (8.2%). The re-operation rate was 23.8% with intra-abdominal abscess, pleural effusion, ECF and burst abdomen being the commonest indications. The mean post-operative hospital stay was 19.89 ± 20.13 days.

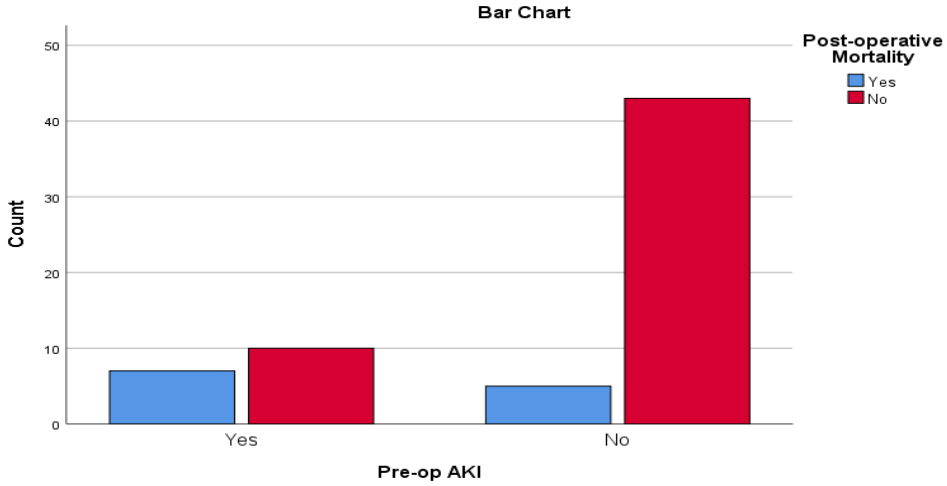
4. Mortality and Associated Factors

The overall post-operative mortality rate was 18.5% (12 out of 65 patients), and 8(66.6%) of these occurred within 48 post-operative hours.

Inferential statistics identified several significant predictors of mortality:

- **Duration of Fever:** Patients who died had a significantly longer duration of fever before presentation compared to survivors (18.00 ± 4.49 days vs. 14.75 ± 4.43 days; p=0.026).
- **Pre-operative AKI:** The presence of pre-operative AKI was a powerful predictor of mortality.

Fig 2: Relationship between pre-operative AKI and post-operative morbidity



- **In-Hospital Delay:** The interval from presentation to surgery was longer in patients who died (51.17 ± 25.46 hours) than in survivors (39.02 ± 22.27 hours), a difference that approached statistical significance (p=0.101), aligning with meta-analytic evidence on its detrimental role (35).

Table 2: clinical factors affecting post-operative mortality

Clinical parameter		Post-operative mortality		Test statistic	p-value
		Yes	**No**		
Duration of onset of fever		18.00 ± 4.49 days	14.75 ± 4.43 days	2.285[A]	0.026
Pre-op AKI	**Yes**	7(41.12%)	10(58.88%)	7.891[B]	0.01
	No	5(10.4%)	43(89.6%)		
In-hospital delay		51.17 ± 25.46 hours	39.02 ± 22.27 hours	1.662[A]	0.101

A: T-test, B: Fischer's exact.

Non-Significant Factors: Age (p=0.941), Surgical Site Infection (p=0.516), and Iatrogenic ECF (p=0.396) were not significant predictors of mortality in this cohort.

Furthermore, there was no significant relationship between the duration of fever and the development of post-operative ECF (p=0.45)

IV. DISCUSSION

Patient Demographics and Clinical Profile

Our findings depict Typhoid Intestinal Perforation (TIP) as a disease primarily of the young and economically active, with a mean age of 18.2 years and a male preponderance (62.2%). This demographic profile is a recurrent theme in the literature across sub-Saharan Africa, underscoring the significant societal burden of this preventable disease (5,12,16,21,34). A critical factor influencing outcomes in our setting, as in other low-resource environments, is the profound delay in seeking care (1,5,8,24,25). The mean pre-hospital febrile period of 16.1 days in our cohort provides a protracted timeline for the condition to escalate into generalised peritonitis, sepsis and end-organ damage. This is starkly evidenced by the high prevalence of pre-operative acute kidney injury (AKI) (33.8%), a marker of severe physiological decompensation. Compounding this pre-hospital delay is the significant in-hospital delay to definitive surgical intervention (mean 41 hours), a systemic challenge reflective of the constraints on timely resuscitation, shortage of specialist health professionals and operating theatre access common to many tertiary centres in the region (5,16,26, 35).

Post-Operative Morbidity

The high post-operative morbidity observed in this study is a sequel of the advanced disease state at presentation. The high surgical site infection (SSI) rate of 58.6% is consistent with other Nigerian reports (18) and is an anticipated consequence of performing surgery in a grossly contaminated field, a scenario often exacerbated by limited resources (1,18,27). Of particular concern is the high proportion of organ/space infections (29.4%), which suggests ongoing, deep-seated intra-abdominal sepsis that may be related to the technical difficulty of achieving adequate source control in a septic abdomen. Also, the significant rates of

pulmonary complications—pneumonia (33.3%) and pleural effusion (15.0%)—are well-documented systemic manifestations of severe typhoid septicaemia and diaphragmatic irritation (1,5,28). Furthermore, the 8.2% rate of iatrogenic ECF, while lower than some series (10), underscores the formidable technical challenges inherent in operating on a friable and inflamed bowel (1,29). Collectively, this burden of morbidity culminates in a protracted convalescence, reflected in the long mean hospital stay (19.9 days) and a high re-operation rate (23.8%), consistent with the significant burden of TIP reported by Chalya et al. in Tanzania (5), Ugochukwu et al. in Nigeria (18) and other studies (8, 34).

Mortality and Its Predictors

The post-operative mortality rate of 18.5% observed in this study firmly places our experience within the recent Nigerian context, where rates have plateaued between 18-23% (5,18,19). This signifies a stalled progress in combating TIP in Nigeria, which is in stark contrast to developed nations, where low single-digit mortality rates are reported (20).

Our analysis identifies predictors and a possible pathway to mortality. The significantly longer duration of fever in non-survivors (18.0 days vs. 14.8 days, $p=0.026$) underscores that late presentation is a critical, independent risk factor. This prolonged period allows for uncontrolled sepsis to progress, causing significant physiological derangements before the patient even reaches the hospital (1,8,31). This culminates in pre-operative organ failure, powerfully demonstrated by the strong association between pre-operative AKI (sequelae of severe sepsis and hypoperfusion) and mortality ($p=0.004$), a finding consistent with other studies that identify renal dysfunction as a critical prognostic indicator (9,17,32,34).

Concerning in-hospital delays, while the p-value of 0.101 does not meet the strict threshold for statistical significance, the substantial mean difference (a 12-hour longer wait for non-survivors) strongly suggests a clinically important trend. It is widely recognised that further delays in source control exacerbates the septic insult in such critically ill patients who may progress to irreversible multi-organ dysfunction syndrome (MODS) in the immediate post-operative period (1,5,6,32-35).

Possible pathway to mortality in TIP (Triad of delays and organ dysfunction).

The findings allow us to construct a more definitive pathway to mortality: A patient experiences a prolonged febrile illness (>2 weeks), leading to sepsis, presents to the hospital with pre-operative organ failure, such as AKI. This combination of extreme physiological insult and delay then culminates in a high likelihood of death, even with surgical intervention.

The fact that post-operative complications like SSI and ECF were not significant predictors reinforces that mortality is driven by the systemic sequelae of sepsis present at admission, rather than by subsequent localised complications.

Limitations of the Study

This study retains the limitations of its retrospective design, including missing data for some variables, a reliance on hospital records and an inability to control all confounding variables. The sample size, while sufficient to detect the strong effects we found, may still be underpowered to identify subtle risk factors. The analysis of the in-hospital delay, while suggestive, would benefit from a larger prospective study to confirm its role.

V. Conclusion

This study has demonstrated that the clinical journey of TIP patients at our center is characterised by a triad of pre-hospital delay, pre-operative organ failure, and in-hospital delay to surgery, resulting in significant peri-operative morbidity and mortality rate. Addressing this requires a dual strategy of community education for early referral and hospital-based quality improvement to streamline emergency surgical care.

Recommendations

In order to disrupt this lethal pathway, a multi-pronged strategy is essential:

1. **Community-Level Intervention:** Implement aggressive public health campaigns in our catchment area, in line with WHO preventive strategies (36), to educate on the dangers of prolonged Typhoid fever and the imperative of seeking immediate, qualified medical care.
2. **Establish a "Sepsis and Peritonitis" Clinical Pathway:** Implement a standardised protocol to rapidly identify high-risk TIP patients and ensure their immediate, aggressive pre-operative resuscitation (with fluids, electrolytes, and empiric antibiotics) and expedited surgery.
3. **Quality Improvement:** Continue efforts to reduce in-hospital delays, potentially adopting frameworks from successful local interventions (37), and prevent post-operative complications to mitigate the substantial morbidity and economic burden of this disease.

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