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Typhoid ileal perforation in Shisong, Northwestern Cameroon

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Abstract

Background: The study aims to provide an overview of the spectrum of perforated typhoid fever cases and their outcome that were managed in resource constrained rural mission hospital, Northwestern of Cameroon.

Methods: This was a retrospective observational study which was conducted in St Elizabeth Catholic General Hospital, Shisong, Northwestern region of Cameroon over a two year period covering January 2016 and December 2018. The patients included were those admitted and diagnosed of typhoid ileal perforation. Data collected were analyzed using SPSS computer software version 22.

Results: During the study period, thirty-eight patients underwent surgery for typhoid ileal perforation. They included 26 (68.43%) males and 12 (31.57%) females with Male to Female ratio of 2.2: 1. Sixty -five percent of cases occurred between the months of July and September. The most common presentations were with abdominal pains (92.11%), and abdominal distention (92.11%). X-ray abdomen revealed pneumo -peritoneum in 26 (68.4%) cases, while ultrasound detected free peritoneal collection in 34 (90%) cases. Perforations were surgically treated depending upon the number of perforations, general health status of patient and degree of fecal contamination. Perforated typhoid still carries dismal prognosis. The mortality was associated with duration of delay in obtaining blood pre - operatively for patients requiring transfusion ($p=0.018$) and duration of presentation to operation time interval ($p=0.026$).

Conclusion: Typhoid intestinal perforation is still endemic in our setting with dismal prognosis. Urgent public health concerted effort is required with emphasis on preventive measures such as safe drinking water, appropriate sewage disposal, and typhoid vaccination. Educating the populace on early and prompt diagnosis, adequate resuscitation as well as early surgery in patients with typhoid ileal perforation to keep the mortality low.

Keywords: Typhoid Fever; Ileal Perforation; Surgical Management; Outcome; Cameroon

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Introduction

Typhoid fever is a multi -systemic febrile illness which is transmitted by ingestion of food

or water contaminated with the typhoid bacillus [1,2]. The causative agent being the gram-negative bacillus, *salmonella enteritidis*, serovar *typhi* [1,3]. Historically, the pathology of the disease was first described by William Jenner in 1850 [4] and since then typhoid fever

remains a major public health concern in the developing countries like Nigeria, Cameroon etc. This is mainly because of its persistent high morbidity and mortality; especially in rural communities where poverty, ignorance and lack of adequate potable water supply remain the order of the day [5,6]. Typhoid is endemic in many rural and urban communities of the developing countries where the disease occurs throughout the year [5,6]. The most lethal complications of typhoid fever are intestinal bleeding and ileal perforations, both arising from necrosis of Peyer's patches in the terminal ileum [7]. Typhoid ileal perforation is a serious complication of typhoid fever. It is also a significant challenge to surgeons in the developing countries [8,9-14]. Many factors such as late presentation, adequate pre-operative resuscitation, delayed operation, the number of perforations and extent of fecal peritonitis have been found to have a significant effect on the prognosis [15-19]. The burden of typhoid disease remains a major concern to clinicians globally over the last thirty years due to the unabating menace it causes the victims in spite of improving therapeutics and surgical techniques. The enormity of the challenges faced in the care of such patient was described by Irabor et al in 2003 as a milestone around the Surgeon's neck or a complex sea of trouble [20,21]. Enteric fever remains a scourge in most developing countries; this is attributable to the limited availability of potable water supply, poor personal hygiene and food handling, as well as indiscriminate disposal of human waste, all of which form a formidable nidus for transmission of the infective agent *salmonella enteritidis, serovar typhi*. Therefore, poverty and low socioeconomic status are common associated factors [31].

Typhoid fever is a protracted disease that includes bacteremia phase with fever and chills during the first week, wide spread reticulo - endothelial involvement with rash, abdominal pain and prostration in the second week, and ulceration of Peyer's patches with intestinal bleeding and perforation during the third week.

There are longitudinal ulcers on anti-mesenteric border, situated within 45 cm of ileocaecal valve in majority of patients [2,5,6]. Furthermore, the diagnosis and management of typhoid perforation can also be challenging particularly those occurring during pregnancy or in the puerperal period and extreme of ages [2]. The resulting peritonitis in such a seriously ill patient may be rapidly fatal unless it is treated promptly and vigorously [22]. Initially 100% death rate was reported for the perforation [23,24]. Nowadays, the mortality rate although decreasing, still remains very high ranging from 15% to 39% in West African sub -region with significant morbidity in spite of therapeutic progress [25]. The improving clinical outcome in general is related to the availability of potent broad-spectrum antibiotics, improved methods of resuscitation, modern and safe anesthesia, surgery is now routinely used to manage ileal perforation and offers the best hope of survival [26]. There is paucity of data on the incidence, endemicity of typhoid fever, complications and outcome of management in all the local regions of Cameroon. Keeping this in view therefore, the study aims to provide an overview of the spectrum of perforated typhoid fever cases and their outcome that were managed in resource constrained rural mission hospital, Northwestern of Cameroon.

Patients and Methods

Study design and setting

This observational retrospective study was conducted in the Department of Surgery over a two-year period covering January 2017 and December 2018. The St Elizabeth Catholic General Hospital is located in Shisong -Kumbo, Northwestern region of Cameroon. It serves as a referral hospital for a teeming population of five million people from the geo -political zone.

Study population and procedure

We included in this study all patients operated on for generalized peritonitis for which a final



diagnosis of perforated typhoid ileitis was made. The diagnosis of typhoid ileal perforation (or perforated typhoid ileitis as variably called) was made on the basis of patients' typical clinical presentations supported by radiological, laboratory investigations and confirmed by operative and histopathological findings. The exclusion criteria were the following:

- i. All the other causes of peritonitis such as ruptured appendix, traumatic perforations, tuberculosis enteric perforations, perforated peptic ulcer e.t.c, were excluded from the study.
- ii. All patients with suspected peritonitis due to perforated typhoid ileitis for whom a laparotomy was not performed.
- iii. All patients whose case file did not contain follow -up data.

Data source included admission registers of the emergency department, patient's admission files, post -operative note registers and report books of the surgical wards. For each patient included, we recorded on a pre-validated proforma designed for this study regarding patient's characteristics, to include demographic details, clinical features, past medical history, interval between onset of symptoms and hospital admission, operative findings, procedure performed, postoperative complications and duration of stay in hospital as well as the final outcome. The definition of sepsis, septic shock and multi -organ failure was according to the American College of Chest Physicians/ Society of Critical Care Medicine Consensus Conference Committee of 1991 as modified in 2001 [27,28]. While the Clavien -Dindo classification was used to determine severity of complications [29,30]. The patients included in the study were either typhi dot and /or blood culture positive as well as rising widal titer. Detail history and documentation of source of water supply, sewage disposal system and environmental hygiene of confirmed cases were routinely collected in the center. All the patients were resuscitated with intravenous fluids,

nasogastric tube to decompress the stomach and urethral catheter to monitor urine output. Adequate resuscitation was achieved within 6-10 hours of admission in 95% of patients. Intravenous antibiotics comprising ceftriazone, quinolones, and metronidazole were commenced immediately while gentamycin was added post -operatively, as well as blood transfusion as appropriate. The investigations carried out were full blood count, erythrocyte sedimentation rate (ESR), widal test, typhi dot, blood culture, blood urea, blood sugar, serum electrolytes, plain abdominal and chest radiographs as well as abdomino-pelvic ultrasound scan. The diagnosis of typhoid perforation was made by above investigations and on clinical grounds of abdominal pain, distension, tenderness, and confirmed by radiographic findings of pneumoperitoneum or air under the diaphragm. Also, diagnosis was further supported by operative findings of ileal perforation, and on acutely inflamed and edematous terminal ileum with associated peritoneal soiling. After resuscitation all patients under full general anesthesia were subjected to exploratory laparotomy within 24 hours. Laparotomy was performed by a midline incision; general survey of the peritoneal cavity was made. All pyogenic membrane carefully removed and residual fecopurulent material was aspirated from the peritoneal cavity. After dealing with the perforation, then the peritoneal cavity was thoroughly washed with copious amount of normal saline and drains were kept in the pelvis. Abdomen was closed by mass closure technique with prolene size 1 and skin was closed with interrupted size 2/0 prolene. Post -operatively patients were kept nil by mouth till return of bowel sounds and at that time nasogastric tubes were removed. Parenteral antibiotics were continued for about one week. Drains were removed on 7th post -operative day. The variables studied in the post -operative period were wound infection, wound dehiscence, entero -cutaneous fistula, residual abscess, mortality, hospital stay and incisional hernia.

Statistical Analysis

All data were entered in an excel database (Excel 2007, Microsoft corporation®) and analyzed using the Statistical Package for the Social Sciences (SPSS) version 22 (IBM Corp, Armonk, NY, USA). Absolute numbers and simple percentages were used to describe categorical variables. Similarly, quantitative variables were described using measures of central tendency mean and measures of dispersion such as range or standard deviation as appropriate. The associations between patient characteristics and mortality using Pearson and two -sample Wilcoxon test were carried out by using R version 2.10.1. A p -value <0.05 was considered statistically significant.

Ethical Considerations

Ethical approval was obtained from the Institutional Ethical Committee. Confidentiality was ensured by not writing the names of patients on proforma.

Reporting

The STROBE guidelines were used in reporting this study [31].

Results

Patient’s characteristics

A total of 56 patients were admitted in the institution with the clinical diagnosis of generalized peritonitis secondary to perforated typhoid ileitis over the study period between January 2016 and December 2018. Twelve records had incomplete data. These included six patients with a presumptive diagnosis of perforated typhoid ileitis who died before a laparotomy could be performed. In the final analysis therefore, thirty-eight patients had post-operative diagnosis of typhoid ileal perforation. Our samples included 26 (68.43%) males and 12 (31.57%) females with the Male

to Female ratio is 2.2:1. The age range was 12 to 55 years with a mean of 24.43 years±SD 10.21 years). Majority of patients were in the second and third decades. (Table 1). Sixty -five percent of cases occurred between the months of July and September.

Table 1: Age distribution of patients.

AGE (YEARS)	NUMBER (n=38)	PERCENTAGE
<10	0	0
10-19	9	23.68
20-29	18	47.37
30-39	6	15.79
40 -49	3	7.89
>50	2	5.27
TOTAL	38	100

Characteristics of the perforated typhoid ileitis

Most of the patients presented with abdominal pains (92.11%), abdominal distention (92.11%), nausea and vomiting (81.58%), constipation (56.3%) diarrhea (55.26%) and fever (52.63%) (Table 2). Most of the patients presented more than 24 h after the onset of peritonitis and some as late as 96 h. Mean duration of fever before presentation was 8 days (Range 3-14 days). Mean duration of abdominal pain was 5.2 days (Range 2-11 days). Mean temperature was 101.8^oF (Range 99.5-103^oF). Pulse rate ranged between 102 -140 beats per minute with a mean pulse rate of 118. Widal test >1:320 was positive in 32 (84.2%) cases and typhi dot (IgM in all cases and IgG in 18) was positive in all cases. Blood culture was positive in 28 (73.7%) cases. X -ray abdomen revealed pneumo -peritoneum in 26 (68.4%) cases. Ultrasound detected free peritoneal collection in 34 (90%) cases, hypokalemia was found in 10 (26.3%) cases. Blood complete picture revealed leucopenia in 13 (34%) leukocytosis in 5 (13%) patients while total leukocyte count was normal in 20 (53%) patients with raised ESR ranging from 48 to 74 mm of Hg in the first hour. Stool culture was done in 22(58%) patients, but was only positive

in 8 patients. All the patients had HIV tests done routinely and none in our series was positive.

Table 2: Clinical features of patients with typhoid ileal perforation.

CLINICAL FEATURE S	NUMBER OF PATIENT S (n=38)	PERCENTAGE
Fever	20	52.63
Abdominal pain	35	92.11
Abdominal distention	35	92.11
Diarrhea	21	55.26
Nausea and Vomiting	31	81.58
Constipation	22	57.89

Operative findings were; abdominal cavity heavily contaminated in 25 (65.78%) patients while in 13 (34.22%) patients the peritoneal cavity was found in a comparatively better condition. 25 (65.78%) patients had single perforation and 13(34.22%) had more than one perforation. In all cases perforations were within the last 50 cm of ileum. Perforations were surgically treated depending upon the number of perforations, general health status of patient and degree of fecal contamination. In 28 (73%) patients’ perforations after freshening the ulcer were closed by double layered interrupted sero -muscular technique with vicryl 2/0 and 3/0 prolene respectively. Four (11%) needed resection and anastomosis and in another 4 (11%) loop ileostomy was made while 2(4%) patients had limited right hemicolectomy.

Risk Factors Determination

Ten patients of 38 patients (26.3%) requiring pre -operative transfusion (i.e., hematocrit <30%) had a delay in obtaining necessary blood for transfusion before operation, which was defined as being greater than six hours. The

mean duration of this delay was 14.2 ± SD 10.8 hours. Using the Pearson test for univariate analysis statistically -significant associations with mortality were found with gender (p=0.008), presence of neurological manifestation upon presentation (delirium, seizure or loss of consciousness) (p=0.012), and delay in securing blood pre -operatively for patients requiring pre-operative transfusion (p=0.018) (Table 3). No associations were found between mortality and any other sign or symptom besides neurological manifestations, or receiving pre - presentation treatment of any type. When the two -sample Wilcoxon test for univariate analysis, was used; the associations with mortality were found to be statistically - significant for duration of delay in obtaining blood pre-operatively for patients requiring transfusion (p=0.018) and duration of presentation-operation time interval (p=0.026) (Table 4-6). The mean time interval between presentation and operation was 15.0±SD 11.6 hours in those who died and 20.0±SD 8.9 hours in those who survived. The median delays in obtaining blood were 18.5±SD 9.6 hours for those with a delay who died and 11.4±SD 7.5 hours for survivors who had a delay. We did not observe any statistically significant difference in mortality rates for those patients with initial symptoms to presentation, as well as other factors like age, vital signs, duration of any sign or symptom and hematocrit or white blood cell count.

Outcome

The outcome data are shown in Table 5 and 6. The complications were wound infection in 12 patients (31%), wound dehiscence in 10 patients (26%), and intra -abdominal abscess in 4 patients (11%), entero-cutaneous fistula in 6 patients (16%). In this series there were 6 (16%) deaths. Sixteen (42%) patients developed incisional hernia. In 6 patients, in whom loop ileostomy and limited hemicolectomy was made stoma related complications like stomal prolapse in 3 (50%) patients, retraction in 2 (33%) patients, bleeding in 1 (17%) patients

and skin excoriation was seen in 6 (100%) cases. Mean hospital stay was 15.46 days ranging from 10 to 45 days.

Table 3: Assessing the associations between risk factors and mortality. (nominal variables)

RISK FACTOR	NUMBER OF PATIENTS (n)	SURVIVED (n=32)	DIED (n=6)	P-VALUE
Any Pre -presentation treatment	38	25	5	0.68
Female Gender	12	8	4	0.012
Presence of Abdominal Distension	35	28	6	0.45
Presence of Abdominal Pain	35	29	6	0.36
Presence of Constipation	22	18	4	0.41
Presence of Diarrhea	21	18	14	0.54
Presence of Fever	20	14	6	0.33
Presence of Neurological deficits	18	8	2	0.012
Presence of Vomiting	31	28	16	0.82
Presence of abnormal bowel sounds (hypoactive sounds)	26	21	5	0.22
Pre-operative blood procurement delay	10	8	4	0.018

Table 4: Assessing the associations between risk factors and mortality. (continuous variables).

RISK FACTOR	NUMBER OF PATIENTS (n=38)	SURVIVED (n= 32)	DIED (n= 6)	P-VALUE
Age (years)	6	6	6	0.48
Blood Pressure -Diastolic (mmHg)	72	74	62	0.09
Blood Pressure -Systolic (mmHg)	120	115	110	0.66
Duration of Abdominal Distension (days)	2	1	3	0.75
Duration of Abdominal Pain (days)	5	5	5	0.62
Duration of Constipation (days)	4	4	4	0.28
Duration of Diarrhea (days)	3	4	4	0.70
Duration of fever (days)	7	7	10	0.88
Duration of Vomiting (days)	2	1	3	0.34
Duration of pre -operative blood delay (hours) (n=10, 4, 6 patients)	10	8	4	0.018
Duration of Presentation-Operation interval (hours)	14	15	20	0.026
Hematocrit (%)	30.5	32	29.5	0.56
Initial symptom to presentation our hospital interval (days)	10	10	10	0.44
Pulse (Beats per Minute)	90	88	110	0.21
Temperature (° Celsius)	38	38.2	39	0.67
White Blood Cell Count (x 10 ⁹ /Liter)	9.2	8.2	7.0	0.46

Table 5: Post -operative complications.

FACTOR	FREQUENCY (n= 38)	PERCENTGE
POST OP COMPLICATION		
Infection	12	31
wound dehiscence	10	26
Intra -abdominal abscess	4	11
fistula	6	16
OUTCOME		
Discharged	32	84
Death	6	16
DAMA	0	0
Total	38	100

Table 6: Comparing the outcome with: the duration of illness; use and type of medication before presentation; and number of perforations.

OUTCOME					P
FACTOR	DISCHARGED	DIED	DAMA	TOTAL	VALUE
DURATION OF ILLNESS: a					
<1week	4	1	0	5	
1-2weeks	18	3	0	21	
>2weeks	10	2	0	12	
Total	32	6	0	38	0.419
USE OF MEDICATIONS: b					
Orthodox	22	3	0	25	
Traditional	10	3	0	13	
Total	32	6	0	38	0.751
NUMBER OF PERFORATIONS: c					
1	25	1	0	26	
2	2	1	0	3	
3	2	1	0	3	
>3	3	3	0	6	
Total	32	6	0	38	0.058

DAMA=Discharged against medical advice.

Discussion

In this series we reported the highest incidence of perforation from typhoid disease compare to other health institutions in Cameroon followed by Buea and Yaoundé [32,33]. Although, the

incidence of typhoid disease in Cameroon in general continue to rise yearly despite vigorous public health measures [32,33]. These generally apply to the entire nation of Cameroon where general public sanitation is poor and there is no proper controlled waste disposal systems. Most

people obtain their water supply from the public tap whenever available and individual household shadow wells [21]. The difference in our findings may be explained by the on-going anglophone crisis in the northwestern region of Cameroon; where many public social amenities have been destroyed due to war. Access roads in some instances to major referral health facilities are completely cut off; therefore impacting negatively on the overall public healthcare delivery system. Moreover, seasonal variations have been reported with two peak periods in the rainy and dry season, which is similar to findings in this study [34,35]; we recorded the highest numbers of new cases between July and September corresponding to the peak of rainy season also synonymous to pollution of the sources of major surface drinkable water in our rural communities. [34,35] Other literature did not report this seasonal variations [36].

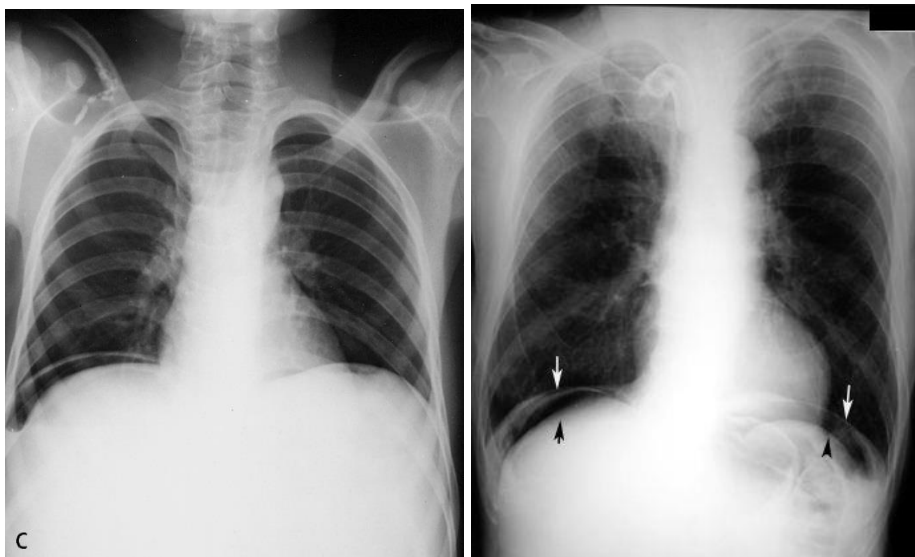
Our results demonstrate that the current delays in the interval between hospital presentation and operation, as well delays in obtaining donated blood for transfusion, are associated with increased mortality in typhoid patients with intestinal perforation. Previous studies of patients with intestinal typhoid perforations have demonstrated statistically significant associations with pre-operative factors including female gender, presenting systolic blood pressure less than 90 mmHg, abdominal tenderness, prolonged time interval between presentation and operation [14,37], duration of abdominal pain [37,38], presenting temperature greater than 38.5°C [37,39]. We presume that the natural physiological demands in female patients such as menstruation, lactation, breast-feeding and pregnancy could be responsible for the physiological anemia and relative immune-compromise which inadvertently could increase the severity of typhoid in such patients and increased mortality in our study; there are similar reports on the etiopathogenesis of typhoid [2-4]. Interestingly, this is not the first time this type of association with female gender has been observed [14]. Typhoid psychosis

which is characterized by neurological manifestations such as delirium, seizure or loss of consciousness is often associated with mortality therefore our findings of such neurological deficits are not unexpected [14,37,39]. These neurological manifestations also indicate severe sepsis or blood loss, and ultimately precede death for many medical conditions [14,37,39]. In our series, majority of the patients presented with anemia, in which their overall mean hematocrit of all the patients was 30.5%. There are reports by many authors, suggesting that typhoid is a multi-systemic illness therefore leads to anemia through bone marrow suppression, hemophagocytosis, occasionally hemolysis, and intestinal hemorrhage [37,40]. The delays in procuring blood for pre-operative transfusion were major contributors to this delayed pre-operative interval. Some of the misconceptions being reported in literature that are associated with low donation rates include fear of contracting HIV or hepatitis from blood-donation, weight-loss, sexual failure (reduced libido), high blood pressure, sudden death, and seizure etc., [41-43]. In agreement with other reports, the clinical features of this disease as outlined in this study (Table 2) include fever, abdominal pains, abdominal distention and vomiting which have been relatively constant and render the disease readily recognizable at presentation [1,13,17,19]. Other features include anemia due to bone marrow depression and cardiovascular instability and toxic myocarditis with bronchopneumonia [30]. The rate of hemoperitoneum in this series was 68.4%, which is low compared to other series, which have up to 75% [14,38-40]. The value of the radiological investigation has been compared with other writers and with current radiological techniques; 70-90% of cases are correctly diagnosed. Findings from this study demonstrated free gas under the diaphragm on abdominal and chest radiographs in more than sixty-five percent of cases which is consistent with other studies [44-46]. A plain abdominal or chest radiograph with free air under the diaphragm is a fairly frequent but variable

finding signifying perforated hollow viscus, but its absence does not exclude the diagnosis as seen in [figure 1](#). Abdominal ultrasonography has also been found to be superior to plain radiographs in the diagnosis of free intraperitoneal air as confirmed by the present study [44-46]. Additional definitive diagnosis of typhoid fever is made with typhi dot, widal test, and blood culture which were positive in 100%, 84.2%, 73.7% of patients respectively. A rising titer of agglutinin (the Widal test) is usually diagnostic, but a single test may mislead, especially if the patient had previous typhoid

vaccination. In this review, the single titer levels ranged from 1:160 -1:640 with a mean of 1:320. Reports from the literature also suggest that the spectrum and frequency of complications remain largely the same over the last decade irrespective of surgical techniques and recent potent antibiotics [20, 47-49]. The mortality rates similarly remained relatively unchanged averaging 35% with others below 15% and this is corroborated by the mortality rate of 16% in this study [20,47-49].

Figure 1: Air under hemidiaphragm.

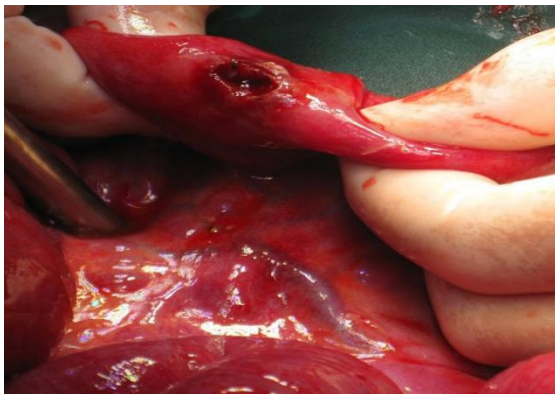


Furthermore, typhoid affects several organs including the heart, lungs, kidneys and intestinal tract [47-49]; mediated via endotoxin and/ or Swartzmann-Sanarelli type of hypersensitivity reaction [20,50-53] which is reportedly responsible for the ulceration of the Peyer's patches and the ileal typhoid perforations as demonstrated in [figure 2](#) [20,50-53]. Hence antibiotics are unable to prevent the complications of bleeding and perforation [20,50-53]. Therefore, lending credence to the aforementioned mechanism. According to reports from the other regions of the world, perforation rate ranges from 0.6% to 4.9% of enteric fever cases [54-58], but in West Africa,

higher rates of 10%-33% have been reported [50-53]. In this review, the rate of typhoid intestinal perforation represented 11.5% of cases which is in agreement with that reported in Western Africa sub-region [19,57-60]. The high rate of intestinal perforation in this sub-region is related to a more virulent strain of *Salmonella typhi* among West Africans, coupled with increased hypersensitivity reaction in the Peyer's patches. In the present study, the highest incidence of typhoid intestinal perforation occurred in the first and second decades of life which is in keeping with other studies done elsewhere [61-63]. The increasing occurrence of typhoid intestinal

perforation in this age group in our setting can be explained by the fact that youths are generally more adventurous and mobile as well as more likely to consume unhygienic food outside the home [61-63]. Another cause is connected to the high risk of fecal contamination as they visit the toilets at school or public toilets especially with improper hand hygiene [61-63]. It is important to emphasize the negative socio-economic impact of the burden of the disease to the nation especially because the economically productive age -group is mostly affected. This call for an urgent public policy response on preventive measures such as safe drinking water and appropriate sewage disposal, and typhoid vaccination [56,57,63].

Figure 2: Typhoid ileal perforation.



In agreement with other studies, typhoid intestinal perforation in the present study was more common in males than in females [19,62-66]. Even though, the exact reason for this male preponderance is unknown, it is possible that men have an increased risk of exposure to typhoid fever resulting from spending longer time and consuming more food outdoors which could account for more frequent contact with the causative bacteria and genetic predisposition also heightens the risk [62-66]. In a related development, typhoid ileal perforation has been reported to be more prevalent in people with low socio-economic status [63]. This observation is equally reflected in this series where majority of patients are farmers and therefore came from the rural areas

of Kumbo in the Northwestern region of Cameroon. The month of September witnessed the highest numbers of typhoid ileal perforation in our study; this observation was comparable to those of Ugochukwu et al [67], Gupta et al [68] and Anyanwu et al [69] but in contrast to that of Ugwu et al [63] who documented more cases between November and March. Surgery remains the mainstay of treatment for typhoid ileal perforation; however, this will require efficient resuscitation and correction of deficits such as electrolyte derangements and shock before surgery. Early surgery may determine the outcome, especially following effective resuscitation. About 65% of our cases were operated on within 13-24 hours post-admission. Gupta et al [68] reported that early surgical intervention improves the prognosis. There are different surgical methods of repairing the perforation including primary closure, excision and closure, resection and primary anastomosis, limited right hemicolectomy and ileostomy [70]. However, early daily diagnosis, prompt and adequate resuscitation and early treatment, avoid the need for extensive surgical procedure and is associated with low morbidity and mortality [71,72]. Late presentation results in extensive pathological changes in the terminal ileum and caecum and therefore requiring more formidable and extensive surgical procedure such as resection anastomosis and right hemicolectomy all of which contribute to higher morbidity and mortality [73].

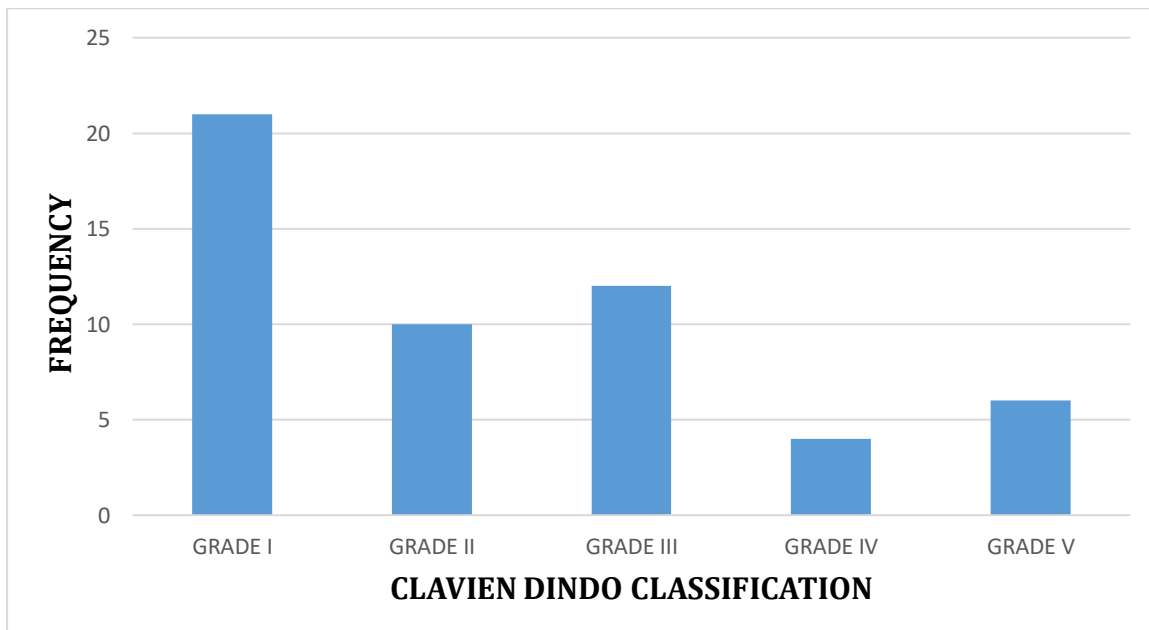
The choice of surgical technique is influenced by the severity of illness such as the number of perforations and the expertise of the surgeon. In our study, excision and simple closure was the most common procedure done; this observation was similar to that of Ugochukwu et al [67], and Edino et al [64]. This procedure is easy and less time-consuming, though the risk of postoperative fistula is higher; however, we reported 25 (65.78%) cases of single perforation. The number of perforations in our study ranged from one to six, which was similar to the one to eight reported by Anyanwu et al [69]. Single perforation was the most common

intraoperative observation in our study; this was similar to other reports [57,71-74].

Complications recorded were wound infection 31%, wound dehiscence 26%, and intra-abdominal abscesses 16% [19] as demonstrated in Table 3. The enterocutaneous fecal fistula and re-perforation (16%) recorded in this series were similar to other reports that suggests that late presentation is associated with these complications [15,19,74,75] as seen in Table 4. The degree of the surgical complications in this series was also presented using Clavien -Dindo classification [76] as shown in Figure 3. The mortality rate of typhoid ileal perforation ranged from 9% to 43% in the West African sub-region [19]. Consequently, a mortality rate of 16% was recorded in this study; this figure was

similar to those of Adesunkanmi and Ajao [19] but higher than those of Edino et al [64] and the 10.9% reported by Anyanwu et al [69]. The reason for the high mortality is multifactorial. We observed from this study that late presentation, delay in diagnosis, and inappropriate or partial treatment of typhoid fever were the main causative factor. The majority of our patients were from the rural communities with a limited health infrastructure. In addition, the other contributory factor is the ongoing anglophone crisis that sometimes make transportation of ill patients so difficult and during such crisis some patients had to travel for days before accessing a secondary or tertiary healthcare facility.

Figure 3: Distribution of complications recorded in our patients according to the clavien -dindo classification.



Conclusion

Typhoid fever remains a serious public health problem in the developing countries with a devastating impact on resources-limited setting. The high mortality rate is still unacceptable

despite some improvements in the last decade. Typhoid ileal perforation was almost invariably fatal but with development of newer broad-spectrum antibiotics, safe and modern anesthesia, surgery is now routinely used to manage ileal typhoid perforation and offers the



best hope of survival. Several modifiable factors observed in our study can be improved, this eventually could result in decreased mortality for typhoid patients. Lessons learnt from this study especially those relating to the risk determinants are adoptable to other clinicians in similar settings for improvement in outcome. Most importantly, future clinical research in this field should assess mortality in patients with intestinal perforation or other surgical emergencies before and after establishing interventions to reduce presentation to operation interval and delays in obtaining blood for transfusion. We also envisage that such interventions would definitely improve the overall outcome of patients requiring emergency abdominal operations in the Cameroon and Africa at large. In the meantime, there is an urgent public health concerted effort needed with emphasis on preventive measures such as safe drinking water, appropriate sewage disposal, typhoid vaccination. A clarion call is also made for an urgent resolution of ongoing Anglophone crisis; whereby many public social amenities have been destroyed due to war. Access roads in some instances to major referral health facilities are completely cut off; therefore, impacting negatively on the overall public healthcare delivery system. Finally, educating the populace on early and prompt diagnosis, adequate resuscitation as well as early surgery in patients with typhoid ileal perforation to keep the mortality low.

Limitations of The Study

1. Retrospective nature of the study with causal effect of missing data on the case files of some patients.
2. Lack of Electronic Medical Record System in the hospital in the past years until January 2018 with resultant loss of data.
3. Delay in patients' presentation, and compounded by the on-going anglophone-crisis
4. Poverty, ignorance, and safe drinking water, inappropriate sewage disposal insufficient health infrastructure, in the sub-region of Cameroon are amongst the lists of possible limitations of this study.

Recommendations

1. Full implementation of Electronic Medical Record System in our local hospitals in the sub -regions for a comprehensive data base will support improved future research on the disease.
2. There is an urgent public health concerted effort needed with emphasis on preventive measures such as safe drinking water, appropriate sewage disposal, and typhoid vaccination.
3. Provision of public treated tap water and sinking of bore-hole water in remote communities.
4. Educating the populace on early and prompt diagnosis, adequate resuscitation as well as early surgery in patients with typhoid fever to keep the morbidity and mortality low.
5. Effective government legislation on hand hygiene, proper sewage and waste disposals.
6. Several modifiable factors observed in our study can be improved, this eventually could result in decreased mortality for typhoid patients especially those with bowel or intestinal perforation and those other patients requiring operations.
7. Lessons learnt from this study especially those relating to the risk determinants are adoptable to other clinicians in similar settings for improvement in outcome.
8. Future research in this area should assess mortality in patients with intestinal perforation or other surgical emergencies before and after establishing interventions to reduce presentation to operation interval and

delays in obtaining blood for transfusion.

9. Finally, a clarion call for early resolution of ongoing Anglophone crisis and in resource constrained setting as ours, it is also important to raise awareness through public health campaign on prevention of water-bored disease and improvement of existing health infrastructure.

Declarations

Availability of data and Materials:

Availability of data and materials confirmed by the author and available for review by the Editor-in-Chief of this journal.

Authors' Contributions: BJA conceived of the study and participated in its design and coordination as well as helped to draft the manuscript; the author also read and approved the final manuscript.

Ethics Approval and Consent to Participate:

Ethical approval was obtained from the Institutional Ethical Committee. Confidentiality was ensured by not writing the names of patients on proforma. A copy of the written Approval is available for review by the Editor-in-Chief of this journal.

Consent for Publication: Written informed consent was obtained from the patients for publication of this clinical research study and any accompanying images. A copy of the written consents is available for review by the Editor-in-Chief of this journal.

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