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Single-layer closure of typhoid enteric perforation: Our experience

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ABSTRACT

Background: Typhoid enteritis is rare in developed countries. The increasing prevalence of typhoid fever with enteric perforation in our environment is alarming. Peritonitis follows enteric perforation due to typhoid enteritis. Surgical treatments and repair of the perforated areas due to typhoid enteritis varies between institutions with high mortality and morbidity. **Materials and Methods:** We retrospectively studied the effects of single versus double layer intestinal closure after typhoid enteric perforation with peritonitis in 902 pediatric patients from September 2007 to April 2012. All the patients underwent laparotomy after resuscitation and antibiotic cover. The patients were divided into two groups: group A (n = 454) double layer closure and group B (n = 448) single layer closure. **Results:** There were 554 males and 348 females with male to female ratio 1.6:1. Ages of the patients were three years to 14 years with mean age at eight years and mode at nine years. The following clinical outcomes were recorded: burst abdomen 38 (8.3%) vs 3 (0.6%), enterocutaneous fistula formation 52 (11.4%) vs 8 (1.7%), superficial wound infection 215 (47.3%) vs 91 (20.3%), ligature fistula 13 (2.8%) vs 7 (1.5%), mean length of 29.4 ± 7.8 vs 45.3 ± 11.6. **Conclusion:** Our results showed that single layer closure of the perforated ileum due to typhoid enteric perforation with peritonitis in children was effective by reducing complication rates.

Key Words: Children, single layer closure, typhoid enteric perforation

INTRODUCTION

Typhoid fever is a severe multisystemic infection caused by *Salmonella typhi* and occasionally *Salmonella paratyphi*. Typhoid enteritis is endemic in areas with poor socioeconomic facilities, including poor clean water supply and sanitary systems.[1-3] Typhoid infection is acquired by the faeco-oral route. Severe typhoid fever with enteric involvement perforates leading to serious surgical complications with high morbidity and mortality.[4-7] Peritonitis follows typhoid enteric perforation.[8] Management of typhoid enteric perforation is surgically challenging. There are various surgical treatment options for typhoid enteric perforation[8-12] but the superiority of any one procedure over the other remains controversial.[8] However, simple, quick and less traumatic surgical procedure is advocated in the treatment of typhoid enteric perforation.[10] This study reviewed single versus double-layer intestinal closure in the surgical management of typhoid intestinal perforations in children in our centre.

MATERIALS AND METHODS

Nine hundred and two children 902 with peritonitis secondary to typhoid enteric perforations were enrolled into the study prospectively from September, 2007 to April, 2012 at the Department of Surgery, Children Surgical Unit of Murtala Muhammad Specialist Hospital, Kano in Northern Nigeria.

All the admitted patients were operated by one surgical team of the unit that included a pediatric surgeon, a principle medical officer, senior medical officers and medical officers.

Upon admission, after routine clinical investigations; patients were adequately resuscitated for fluid and electrolytes imbalances including intravenous administration of antibiotics. Anaemic patients were transfused appropriately. Negative nitrogen equilibrium was evaluated and managed by administering IV Astymine® or Mekoamine® as we do not have facilities for total parenteral nutrition in our centres. Nasogastric tubes were inserted for decompression and urethral catheter for urine output monitoring.

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After adequate resuscitation with satisfactory urine output, patients were evaluated for peritonitis severity using Mannheim Peritonitis Index (MPI) and Multiple Organ Failure index (MOF) for prognostic purposes.[13,14] Careful evaluation of Shock Degree Index (SDI)[15] was also carried out as a monitoring guidance during surgical manipulations.

Laparotomy effected with gentle revision of the peritoneal cavity. Perforated intestines were identified and secured with stay sutures followed by wedge resection or refreshment of the perforated edges with sharp surgical scissors to avoid repeated tissue handling of fragile and friable intestine.

Throughout the study period, we adopt a policy of using Ethicon[™] Vicryl 2/0 or 3/0 with a round body needle size 18 mm or 22 mm to apply interrupted seromuscular single layer sutures [Figure 1]. Surgical knots are made with gentle pressure and an appropriate controlled tension to avoid tissue damage and ischemia to the secured edges [Figure 2]. Peritoneal lavage with warm normal-saline was carried out. Peritoneal drainage tubes were placed to the pelvic regions. Laparotomy wounds were closed in revised layers using nylon 2\0 and or 3\0 according to child's age. Continuation of the intravenous fluids and antibiotics are given in form of ceftriaxone, metronidazole to all our patients. Analgesics are given as required with continual monitoring of intake\output chart and electrolytes. On the resumption of the intestinal peristalsis and tolerable oral acceptance by the patients, a highly enriched meat/fish or chicken broth (bouillon) was introduced into the feeding menu that was followed by (PLUMPY) nuts from the pediatric unit of Murtala Muhammad Specialist Hospital, Kano. Protein-enriched milk powder formula COMPLAN® was provided to all the patients by the hospital authority free of cost.

The study was compared between the two groups and postoperative complications were recorded.

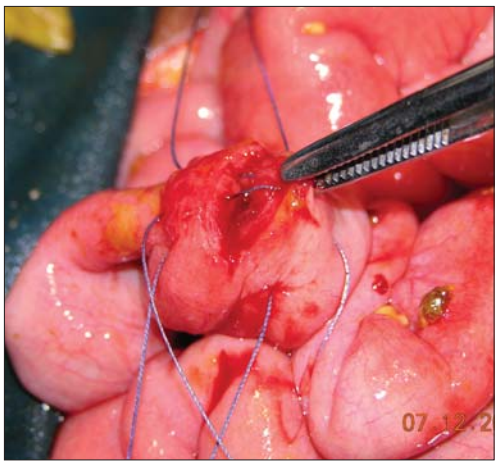


Figure 1: Single-layer seromuscular suture application

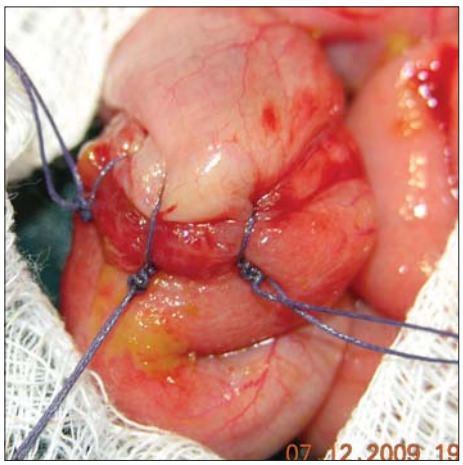


Figure 2: Appearance of single-layer seromuscular sutures

RESULTS

Within four years and seven-month period, a total number of 986 children with typhoid enteric perforations underwent surgical repair of the perforated intestine at Murtala Muhammad Specialist Hospital, Kano, in northern part of Nigeria. But only 902 patients had an adequate clinical data for analytical studies that are assigned into two groups: group A n = 454 (50.3%) and group B n = 448 (49.6%). There were 554 males and 348 females with male to female ratio 1.6:1. Ages of the patients were 3 years to 14 years with mean age of 8 years and mode of 9 years.

Eight hundred and eighty nine (97.9%) patients presented with classical clinical features of typhoid enteric perforation with generalized peritonitis[13] while 13 (1.4%) perforated few hours prior to surgical review and had a symptoms of appendicitis with localized peritonitis.

Forty-two patients 42 (4.6%) patients died out of which four death 4 (0.4%) occurred on table due to sudden cardiac arrest.

There were significant differences between overall complication rates and mean length of hospital stay between the two groups 75.7% in group A versus 27.4% in group B [Table 1].

DISCUSSION

Typhoid intestinal perforation is a principal cause of morbidity and mortality in children in an environment with poor socioeconomic and sanitary facilities.[16] Inappropriate and poor sewage disposal with unhealthy drinking water supply are the main causes of typhoid fever.[4,5,7,17,18] If not adequately treated, severe typhoid fever with enteric involvement perforates leading to generalized peritonitis with overwhelming septicaemia.

The management of typhoid enteric perforation is a serious and difficult surgical challenge.

In the early years of the 1960s and 1970s, the management of typhoid enteric perforation had high mortality and morbidity and for these reasons, few surgeons advocated a nonoperative approach.[19,20] However, in modern clinical medicine and surgical practice, surgery is the only treatment of choice for typhoid enteric perforation. Even in the recent literatures, management of typhoid enteric perforation has a high rate of morbidity and mortality.[4,8] Although, surgery is the treatment of choice, the mode to the surgery varies.[8-10,12,17,21] Some authors documented their experiences with double-layer intestinal closure after typhoid enteric perforation, while others argued that, resection and anastomosis is a suitable surgical technique,[8] some suggested that, T-tube insertion into the bowel lumen after closing distal perforation may be an effective approach.[9] In the year 2011, Hussain M *et al.*,[12] advocated for primary closure of the perforated ileum with additional omental patch for avoidance of faecal fistula formation.

However, Uba AF *et al.*,[10] advised simple, quick and less traumatic surgical procedure in the treatment of typhoid perforation. They found that, simple closure, rather than resection and anastomosis was associated with the least incidence of anastomotic breakdown and reduction in operation time.

Table 1: Postoperative outcomes

Complications	Group A double layer *n* = 454	Group B single layer *n* = 448	*P*
Death	27 (5.9%)	15 (3.3%)	0.032
Burst abdomen	38 (8.3%)	3 (0.6%)	0.00001
Enterocutaneous fistula	52 (11.4%)	8 (1.7%)	0.00001
Ligature fistula	13 (2.8%)	7 (1.5%)	0.09242
Superficial wound infection	215 (47.3%)	91 (20.3%)	0.00001
Length of hospital stay	45.3 ± 11.6 SD	29.4 ± 7.8 SD	0.49962
Total complications	345 (75.7%)	124 (27.4%)	0.00001

Many authors argued that, choice of surgical approach could affect the morbidity and mortality rates in the treatment of typhoid enteritis with perforation with various suggestions on the surgical closure of the perforated intestines. In their analysis of 100 cases, Shukla VK *et al.*,[22] found out that, those patients who had double-layer intestinal closure had 42% morbidity rate, while in the year 1986 and 1989, Efem SE *et al.*,[23,24] advocated for seromuscular continuous 3\0 chromic catgut suture application. They found out that, the use of a two-layer anastomosis for closure of a perforation confers no advantage and might lengthen operating time. The authors reduced mortality rates to six percent (6%), but did not elaborate on the morbidity. Gedik E *et al.*,[25] attributed the high rate of morbidity to severity of peritonitis rather than the surgical technique. In their analysis of 178 patients with typhoid enteric perforation, AA Nasir *et al*,[26] attributed attention to surgical details in reducing morbidity and mortality in patients with typhoid enteric perforation.

In purulent generalized peritonitis, the entire intestinal layers and particularly the subserosal and the muscular layers that provide blood circulations for the viability of the organ/tissue are grossly edematous. Therefore, applying double layer sutures could limit the circulations which could lead to ischemia and tissue necrosis with possible leakage [Figures 3 and 4].

In addition, small intestinal mucosal layers are enriched with micro-villi that has abundant capillary circulations which clusters together to seal up defects effectively as single layer is applied [Figures 5 and 6]. When double layer is applied on an edematous small intestine, there is a tendency of narrowing the intestinal lumen at the

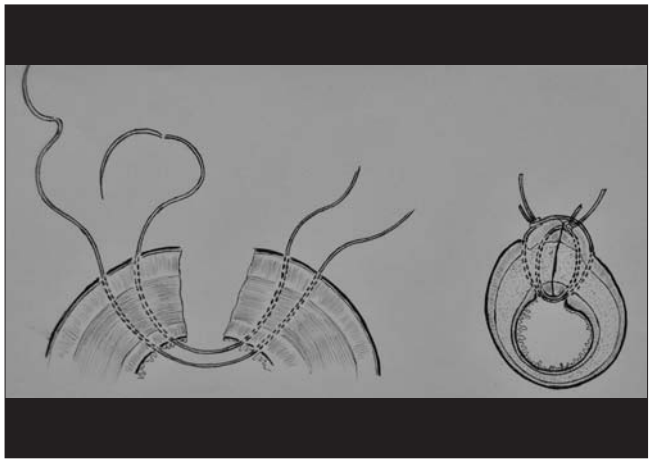


Figure 3: Schema of double layer intestinal closure can worsen the tissue ischaemia

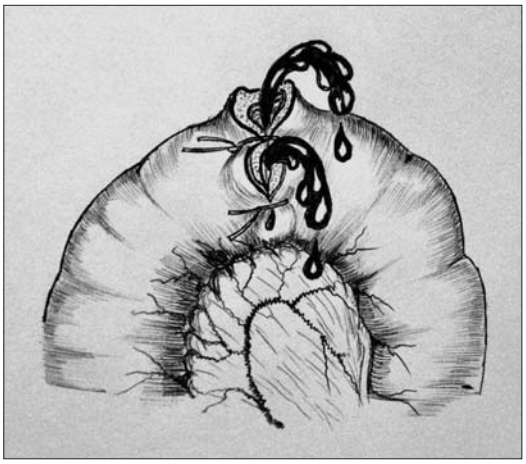


Figure 4: Schema of anastamotic break down and leakage

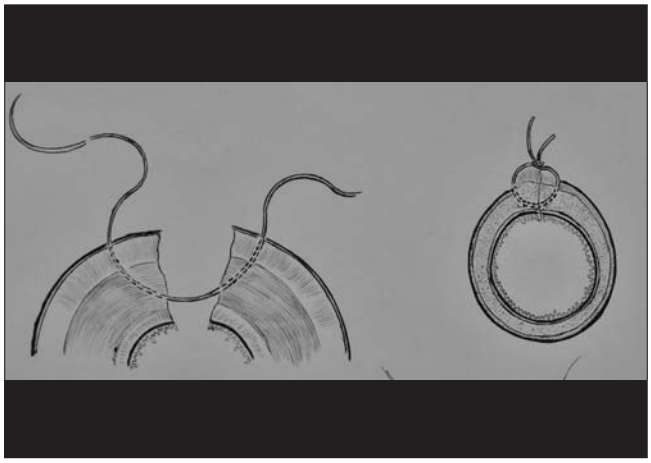


Figure 5: Schema of single layer seromuscular suture application

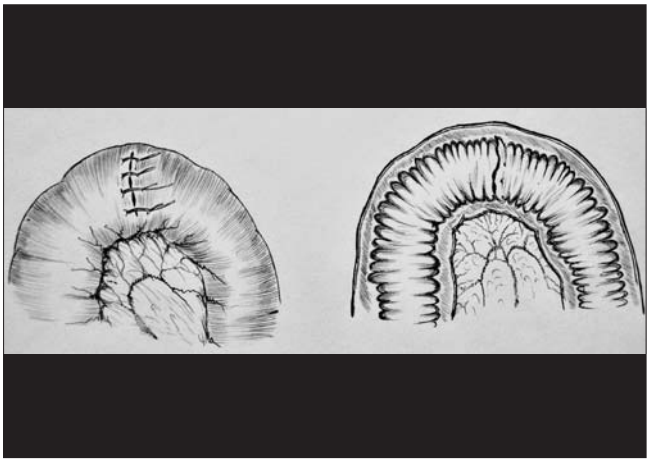


Figure 6: Schema of intestinal lumen when single layer is applied

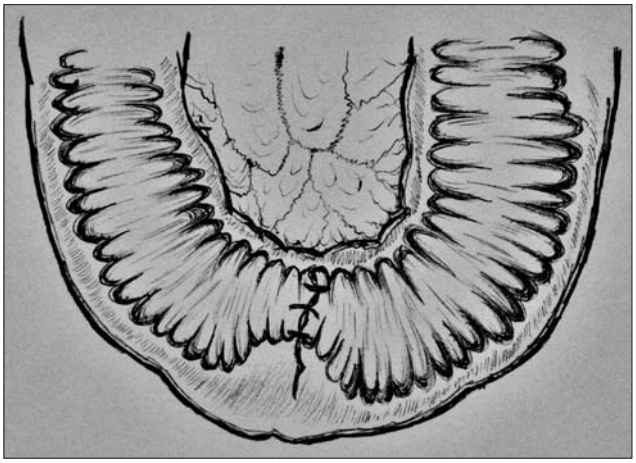


Figure 7: Schema of narrowing of the intestinal lumen due to double-layer suture application

suture sites [Figure 7] and this could as well increase intra-luminal pressure which might increase the chances of indehiscence.

Therefore, if all factors are excluded such as perforation-operation interval, severity of peritonitis, electrolytes and nitrogen equilibrium, multiorgan failure; then we can achieve relatively low mortality and morbidity rate by meticulously applying simple, quick and less traumatic surgical principles. Seromuscular single layer intestinal closure provides satisfactory tissue viability, less surgical trauma, less postsurgical tissue oedema, less ischemia, effective sealing effect without narrowing the intestinal lumen. From our series, the rate of complication is reduced by 48.3% and mean length of hospital stay to by 15.9 ± 3.8 days.

CONCLUSIONS

Our single centre experience showed that, meticulously applying surgical principles, single-layer closure of the perforated ileum due to typhoid enteric perforation with peritonitis in children was an effective method.

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