Archives of Clinical and Experimental Surgery
2021 VOL 10, NO. 9 , PAGE 01-05

RESEARCH ARTICLE

Open Access

Post-Operative Wound Complications Following Abdominal Surgery in Children: A Single Centre Experience

Chukwubuike Kevin Emeka*
Pediatric Surgery Unit, Department of Surgery, Enugu State University Teaching Hospital, Enugu, Nigeria

ABSTRACT

Background: Post-operative wound complication may be defined as any negative wound outcome as perceived either by the surgeon or by the patient. The aim of this study was to evaluate a single center's experience with regards to the pattern and management outcome of post-operative wound complications in children who underwent abdominal surgery.

Materials and methods: This was a retrospective study conducted on children who had laparotomy (emergency and elective) at the pediatric surgery unit of Enugu State University Teaching Hospital (ESUTH), Enugu, Nigeria between January 2010 and December 2019.

Results: A total of 1,914 laparotomies were performed during the study period but only 402 cases had post-operative wound complications, accounting for 21% of all the laparotomies. There was male predominance and children younger than 6 years of age were mostly affected. Majority of the patients presented more than 72 hours after onset of their symptoms that necessitated the initial surgery and the mean duration of hospital stay was 21 days. Typhoid intestinal perforation was the most common pathology and most of the cases were emergencies. Surgical site infection was the most common post-operative wound complication and mortality occurred in 2 (0.5%) patients.

Conclusion: Post-operative wound complications are not uncommon and may be associated with some morbidity and mortality. Future studies should identify modifiable factors that may reduce the occurrence of these post-operative complications.

ARTICLE HISTORY
Received: September 08, 2021
Accepted: September 22, 2021
Published: September 29, 2021

KEYWORDS
Colorectal liver metastases; Surgery; Liver-first approach; Classical approach; Colon-first approach

Introduction

Post-operative wound complications may be defined as complications arising from the surgical wound occurring within 30 days of a surgical procedure. It is significant source of post-operative morbidity and a burden on both the patients and the surgeons [1]. Post-operative wound complications range from mild cases requiring local wound care and antibiotics to severe cases needing reoperation; wound infections and wound dehiscence are well known post-operative complications [2]. Wound complications are associated with prolonged hospitalization and associated increased expense [3]. Several studies have reported wide variations in the incidence of post-operative wound complications ranging from 2.5% to 20% [4,5]. Factors affecting post-operative wound complications may be local or systemic. The local factors include the degree of wound contamination and surgical technique [6]. Neonatal age and coexisting morbidity are some of the systemic factors that may play important roles in the etiopathogenesis of wound complications [7]. Surgical incision during surgical procedure is associated with disruption of local vascular supply, thrombosis of the vessels and tissue hypoxia. Disruption of the tissue integrity goes with proliferation of bacteria in the wound and tissues; this affects the healing process and increases the risk of wound infection and wound dehiscence [8]. Presence of bacteria affects all the processes of healing and promotes impairment of collagen synthesis which promotes wound dehiscence by decreasing suture-holding capacity of the tissue [9-27]. Generally, post-operative wound complications can be patient related, disease related, surgeon related and treatment related [20]. The aim of this study was to evaluate a single center's experience with regards to the pattern and management outcome of post-operative wound complications in children who underwent abdominal surgery.

Contact: Chukwubuike Kevin Emeka, E-mail: chukwubuikeonline@yahoo.com; Post-operative Wound Complications Following Abdominal Surgery in Children: A Single Centre Experience

Results

Patients' demographics

A total of 1,914 laparotomies were performed during the study period but only 402 cases had post-operative wound complications, accounting for 21% of all the laparotomies, and form the basis of this report. There were 303 males (75.4%) and 99 females (24.6%), which corresponds to a male to female ratio of 3:1. Details are depicted in Table 1.

Table 1. Demographic characteristics of the patients (N=402).

Gender	
Male	303 (75.4%)
Female	99 (24.6%)
Age group of the patients	
Neonate (less than one month)	35 (8.7%)
One month-6 years	187 (46.5%)
Greater than 6 years	180 (44.8%)
Median age of the patients	6 years (1 week - 15 years)
Median duration of symptoms prior to presentation	3 days (1–14)
Presented within 24 hours	41 (10.2%)
Presented between 24 and 72 hours	92 (22.9%)
Presented after 72 hours	269 (66.9%)
Median duration from presentation to surgery	5 days (1 - 10)
The mean duration of hospital stay	5 days (1 - 10)

Clinical diagnosis: The clinical diagnoses of the patients are shown in Table 2.

Table 2. Clinical diagnosis of the patients (N=402).

Clinical diagnosis	**Number of patients (%)**
Typhoid intestinal perforation (TIP)	135 (33.6)
Intussusception	131 (32.6)
Complicated external hernia (CEH)	46 (11.4)
Intestinal atresia	33 (8.2)
Perforated appendix	32 (8.0)
Adhesive intestinal obstruction (AIO)	14 (3.5)
Abdominal trauma	11 (2.7)

Urgency of the operation: Three hundred and sixty-nine (91.8%) cases were performed as emergencies while 33 (8.2%) cases were performed as elective cases.

Intra-operative finding and definitive operative procedure performed: The operative findings and the treatment rendered is shown in Table 3.

Table 3. Operative findings and treatment.

Pathology	**Operative finding**	**Treatment**	**Number of patients (%)**
TIP	Single ileal perforation	Primary closure	90 (66.7)
	Multiple perforations	Ileostomy	45 (33.3)
Intussusception	Viable bowel	Manual reduction	33 (25.2)
	Non-viable bowel	RHC + ITA	98 (74.8)
Complicated hernia	Viable bowel	Repair	13 (28.3)
	Non-viable bowel	Resection and anastomosis	33 (71.7)
Intestinal atresia	Viable bowel	Resection and anastomosis	33 (100)
Ruptured appendix	Pyoperitoneum	Abscess drainage	32 (100)
AIO	Viable bowel	Adhesiolysis	10 (71.4)
	Non-viable bowel	Resection and anastomosis	4 (28.6)
Abdominal trauma	Shattered spleen	Splenectomy	11 (100)

RHC=Right Hemicolectomy; ITA=Ileotransverse Anastomosis; TIP=Typhoid Intestinal Perforation; AIO=Adhesive Intestinal Obstruction.

Wound complications: The complications that happened to the wounds are reflected in Table 4.

Table 4. Post-operative wound complications (N=402).

Complications	**Number of patients (%)**
Surgical site infection	
Superficial	218 (54.3)
Deep	66 (16.4)

Wound disruption (wound dehiscence)	42 (10.4)
Wound and fascial rupture (burst abdomen)	28 (7.0)
Incisional hernia	19 (4.7)
Hypertrophied scar	15 (3.7)
Keloid	14 (3.5)

Outcome of treatment: Three hundred and seventy-one (92.3%) patients achieved full recovery and were discharged home. Twenty-nine (7.2%) patients who had keloid and hypertrophied scars were referred to the plastic surgery unit. Two (0.5%) patients expired due to overwhelming sepsis.

Discussion

Some authors have defined post-operative complications as any negative post-operative outcome as perceived either by the surgeon or by the patient [10]. The history of wounds and its healing is, in a sense, the history of humankind. One of the oldest manuscripts known to man is a clay tablet that dates back to 2200 BC. This tablet describes the "three healing gestures"- washing the wounds, making the plasters and bandaging the wound [11]. There are factors that may predispose the patient to problems of healing. Technical (intra-operative) problems may increase the likelihood of wound infection and dehiscence [12]. There are also post-operative management protocols that can prevent or increase wound healing problems.

In the present study, the incidence of wound complication is comparable to the report of a study from Kaduna, Nigeria [13]. However, a study from Manipal, India reported a wound complication incidence of 13%. The differences in the incidence of post-operative wound complications may be due to the nature of the surgery such as clean or dirty surgeries. Immune status of the patient is also an important consideration:

Immunosuppressed patients are prone to wound complications [14]. There was male predominance in the current study. This is consistent with the findings of other researchers [2, 15]. In the index study, children who were less than 6 years of age were mostly affected. Vary et al., also reported higher incidence of post-operative wound complications in older children [16]. The septic nature of the abdominal pathologies with associated peritonitis may explain the high incidence of wound complications in older children. The late presentation of our patients is reflected in the 3-day lag period between the onset of symptoms and presentation to the hospital. Low level of parental enlightenment and poverty may explain this delayed presentation. One study from Mozambique reported distance from the hospital as a predictor of mortality in children who presented with pediatric emergencies [17]. The median interval between presentation and surgery of 5 days was the time required to investigate and optimize the patient. It took this long to get the patients to theatre because some of the cases were elective cases. Again, deranged hematological and biochemical parameters entailed prolonged period of optimization prior to surgery. The mean duration of hospital stay of 21 days could be explained by the prolonged hospitalization and morbidity associated with treating the post-operative wound complications. Tumescent et al reported the morbidity associated with post-operative wound complications [18]. The increased hospital stay is also tied to higher treatment cost.

In the current study, typhoid intestinal perforation was the most common pathology that resulted in post-operative wound complications. Other authors also reported high occurrence of wound complications following surgery for typhoid intestinal perforation [19, 20]. Typhoid fever, also known as enteric fever, is a common multisystem infection caused by the bacteria Salmonella enterica serovar typhi and Salmonella enterica serovar paratyphi A and B which are transmitted through feco-oral route [21]. Typhoid perforations occur due to ulceration of the Peyer's patches mostly at the terminal ileum. Exposure of the surgical wound to unsterile intestinal contents and infectious agents including pus during surgery may explain the high wound infections in typhoid intestinal perforation. Operation for intussusception accounted for the second most common cause of post-operative wound complication. One study from Lagos, Nigeria reported wound complications, following surgery for intussusception, in about one-third of the patients [22]. In a developing country like Nigeria, late presentation of children with intussusception and associated intestinal gangrene with perforation may explain the high wound complication rate. Surgeries that entail entering the bowel lumen and contact with pus such as in perforated appendix and strangulated hernias are also associated with wound complications.

More than 90 percent of the cases in the present study were performed as emergency surgeries. Other studies also reported more post-operative wound complications in emergency surgeries when compared with elective surgeries [2,10]. The reason for the higher complications following emergency surgery may be due to risks (life threatening) associated with emergencies, inadequate preparations and little or no time for the patient optimization before surgery. Second-

ly, the best of hands may not be available to handle emergency surgeries which mostly happen at night.

The operative procedure performed depended on the findings at surgery. For instance, where there is gangrenous bowel, resection of the non-viable bowel was done and the bowel continuity restored by anastomosis. When there is intestinal perforation like in typhoid intestinal perforation, the edges of the perforation was freshened and the perforation repaired. However, segmental bowel resection and anastomosis can also be performed in typhoid intestinal perforation [23].

Surgical site infection was the most common post-operative wound complication in the current study. Surgical site infection which was previously known as post-operative wound infection is defined as that infection presenting up to 30 days after a surgical procedure if no prosthetic is placed and up to 1 year if a prosthetic is implanted in the patient [24]. In the index study, the diagnosis of surgical site infection was made based on seropurulent wound effluent and growth of an organism on culture. Escherichia coli were the most commonly grown organism. Other series on wound complications also reported surgical site infection as the most common post-operative wound complication [2,10]. Wound dehiscence and burst abdomen may have resulted from the surgeon's factor such as surgeon's technique or from the patient's factor such as co-morbidities. One study from Netherlands reported that the major risk factors for abdominal wound dehiscence are age younger than 1 year, wound infection, median incision and emergency surgery [25]. Incisional hernia may not be obvious during the initial hospital admission but manifest a few months after surgery. Incisional hernia may result from poor surgical technique or use of inappropriate suture during fascia closure. Keloid and hypertrophic scars are pathological scars that result from aberrant wound healing [26]. Treatment of these pathological scars is handled by the plastic surgeons.

Treatment of the specific post-operative wound complication depended on the specific type. For instance, wound infection was handled by serial wound dressing and antibiotics based on the laboratory results. Wound dehiscence and burst abdomen require delayed wound closure and surgical closure using tension sutures respectively. The overall outcome of treatment post-operative wound complication was good. However, mortality may occur from recalcitrant infections. Ameh et al., also reported mortalities in children who developed post-operative complications [27].

Conclusion

Post-operative wound complications are not uncommon and may be associated with some morbidity and mortality. Surgeon-related and patient-related factors may be involved and require modification to decrease the incidence of these complications. Future prospective studies are required to determine the factors that influence post-operative wound complications.

Limitations of the Study

1. This study is a single center experience and may not be generalizable to other centers.

2. The specific factors that affect the occurrence of these wound complications were not assessed.

References

1. Horwitz JR, Chwals WJ, Doski JJ, Suescun EA, Cheu HW, Lally KP. Pediatric wound infections: a prospective multicenter study. Ann Surg 1998; 227(4): 553-8
2. Sorensen LT. Risk factors for tissue and wound complications in gastrointestinal surgery. Ann Surg 2005; 241(4): 654-8
3. Taylor GD. The effect of surgical wound infection on postoperative hospital stay. Can J Surg 1995; 38: 149-53
4. Doig CM. Wound infection in a children's hospital. BJ Surg 1976; 63: 647-50
5. Bhattacharyya N, Kosloske AM. Postoperative wound infection in pediatric surgical patients: a study of 676 infants and children. J Pediatr Surg 1990; 25(1): 125-9
6. Cruse PJ, Foord R. A five-year prospective study of 23, 649 surgical wounds. Arch Surg 1973; 107(2): 206-10
7. Riou JP, Cohen JR, Johnson H K Jr. Factors influencing wound dehiscence. Am J Surg 1992; 163(3): 324-30.
8. De Haan BB, Ellis H, Wilks M. The role of infection on wound healing. Surg Gynecol Obstet 1974; 138(5): 693-700.
9. Ahrendft GM, Tanftry US, Barbufl A. Inftra-abdomfinafl sepsis impairs colonic reparative collagen synthesis. Am J Surg 1996; 171(1): 102-7
10. Dhaigude BD. Post-operative wound complications following emergency and elective abdominal surgeries. Int Surg J 2017; 5(1): 232-7
11. Shah JB. The history of wound care. J Am Col Certif Wound Spec 2011; 3(3): 65-6
12. Schweinberger MH, Roukis TS. Wound complications. Clin Podiatr Med Surg 2009; 26(1): 1-10
13. Kache SA, Mshelbwala PM, Ameh EA. Outcome of primary closure of abdominal wounds following laparotomy for peritonitis in children. Afr J Paediatr Surg 2016; 13: 185-8

14. Coccolini F, Improta M, Cicutin E, Catena F, Sartelli M, Boya R et al. Surgical site infection prevention and management in immunocompromised patients: a systemic review of the literature. World J Emerg Surg 2021; 16:33

15. Offner PJ. Male gender is a risk factor for major infections after surgery. Arch Surg 1999; 134(9): 935-8

16. Varik K, Kirsimagi U, Varimae EA, Eller M, Loivukene R, Kubarsepp V. Incidence and risk factors of surgical wound infection in children: A prospective study. Scand J Surg 2010; 99(3): 162-6

17. Brugnolaro V, Fovino LN, Calgaro S, Putoto G, Muhelo AR, Gregori D et al. Pediatric emergency care in a low-income country: characteristics and outcomes of presentations to a tertiary-care emergency department in Mozambique. PLos One 2020; 15(11): e0241209

18. Temesgen F, Gosaye A, Sftarr N, Kfiflu W, Geftachew H, Dejene B. Early Outcome of Laparotomy Wounds in Pediatric Patients in TASH, Addis Ababa, Ethiopia: A Six-Months Prospective Study. Ethiop J Health Sci 2021; 31(1): 111-8

19. Chalya PL, Mabula JB, Koy M, Kataraihya JB, Jaka H, Mshana SE, et al. Typhoid intestinal perforations at a University teaching hospital in Northwestern Tanzania: A surgical experience of 104 cases in a resource-limited setting. Word J Emerg Surg 2012; 7: 4.

20. Nuhu A, Dalwa S, Hamza A. Operative management of typhoid ileal perforation in children. Afr J Paediatr Sur 2010; 7: 9-13

21. Chukwubuike KE. Typhoid intestinal perforation in children. Still a persistent problem in a developing country Clin Surg Res Commun 2020; 4(2): 26-31

22. Bode CO. Presentation and management outcome of childhood intussusception in Lagos. A prospective study Afr J Paediatr Surg 2008; 5: 24-8

23. Ameh EA. Typhoid ileal perforation in Nigerian children: A scourge in developing countries. Ann Trop Paediatr 1999; 19: 267-73.

24. Khairy GA, Kambal AM, Al-Dohayan AA, Al-Shehri MY, Zubaidi AM, Zubaidi AM et al. Surgical Site Infection in a Teaching Hospital: A Prospective Study. J. Taibah Univ. Medical Sci 2011; 6(2): 114-20

25. von Ramshorst GH, Salu NE, Bax NM, Hop WC, van Heum E, Aronson DC. Risk factors for abdominal wound dehiscence in children: World J Surg 2009; 33(7): 1509-13

26. Wang ZC, Zhao WY, Cao Y, Liu Y, Sun Q, Shi P et al. The role of inflammation in Keloid and hypertrophied scars Front. Immunol 2020; 11: 603187.

27. Ameh EA, Mshelbwala PM, Nasir AA, Lukong CS, Jabo BA, Anumah MA et al. Surgical site infection in children: prospective analysis of the burden and risk factors in a sub-Saharan African setting. Surg Infect (Larchmt) 2009; 10(2): 105-109.