Clinics in Surgery

Research Article
Published: 08 Feb, 2021

Perforated Appendicitis: Contributing Risk Factors and Outcome in Children at Gezira National Center of Pediatrics Surgery (2016-2017)

Israa Ahmed Seilia Wina[1,2,3], Safaa Hamid[1,2,3], Asaad Hamed[1,2,3] and Faisal Abdel Galil Nugud[2]*

[1]MRCSed, Ibn Sena Specialized Hospital, Khartoum, Sudan

[2]MRCSed, East Kent University Foundation Trust, UK

[3]MRCP, Maidstone and Tunbridge Wells Trust Foundation, UK

[4]Pediatric Surgery, Gezira University, Wad Madani, Sudan

Abstract

Background: In the Gezira National Center of Pediatrics Surgery (GNCPS), we observed that most of the children presented with acute appendicitis coming from rural areas of Gezira state in Sudan and some of them are having perforated appendicitis at operation. This study is designed to reflect our local experience in GNCPS regarding the contributing risk factors and outcomes of management of children presented with perforated appendicitis.

Methods: This prospective study comprised 200 consecutive patients (age <16 yrs) who were admitted with acute appendicitis at GNCPS between 2016 and 2017. Patients were divided into two groups: Perforated appendicitis group and non-perforated appendicitis (including; simple appendicitis, appendicular abscess, and appendicular mass) group.

Results: Two patient's groups were analyzed. Among 200 patients, 31 patients (15.5%) were classified in the Perforated Appendicitis group, and 169 patients (84.5%) were in the Non-Perforated Appendicitis group. Children between 11 to 15 years and males were most common in both groups and most patients were coming from rural areas of Gezira State. Contributing factors associated with perforated appendicitis were found to be: Delayed presentation to the hospital 24 h after the onset of abdominal pain, clinical presentation with; fever (P=0.001) and nausea & vomiting (P=0.025), delayed diagnosis due to prior visit to local health facilities (P=0.000), Malaria as an initial pre-hospital diagnosis, and prior use of; antibiotics (P=0.000), anti-malarial (P=0.000), analgesia (P=0.000), and antispasmodic (P=0.027). The outcome of management showed no mortality (n=0), 6 (46.15%) patients developed wound infection, wound dehiscence seen in 1 (0.5%) patient and superficial abscess in another 1 (0.5%) patient. Three patients required readmission for treatment of wound-related complications, antibiotic administered for treatment of wound infection in 5 (55.55%) patients, and wound dressing was required twice/day for 3 (33.33%) patients and once/day for the other 3 patients.

Conclusion: Perforated appendicitis is more frequently seen among early teenagers. Delayed presentation and delayed diagnosis due to prior visit to local health facilities are associated with high risk of perforation. Perforation occurs in both obstructed and non-obstructed appendicitis. Perforation increases the length of hospital stay and post-operative complications. Early surgical intervention and timely use of antibiotics will help in reducing the incidence of complications following perforated appendicitis.

Keywords: Perforated appendicitis; Contributing risk factors; Children

OPEN ACCESS

Correspondence:
Safaa Hamid, General Surgery, MRCSed, Ibn Sena Specialized Hospital, Khartoum, Sudan, E-mail: dr.safaabueisa@gmail.com

Received Date: *21 Dec 2020*
Accepted Date: *22 Jan 2021*
Published Date: *08 Feb 2021*

Citation:
Seilia Wina IA, Hamid S, Hamed A, Galil Nugud FA. Perforated Appendicitis: Contributing Risk Factors and Outcome in Children at Gezira National Center of Pediatrics Surgery (2016-2017). Clin Surg. 2021; 6: 3053.

Introduction

Children with acute appendicitis often present with perforation. Appendiceal perforation increases the length of hospital stay and post-operative complications which make the overall course of the illness significantly more complex. An early diagnosis of appendicitis in children is important to prevent perforation, abscess formation, and post-operative complications, and decrease the cost by shortening hospital stay [1]. In the Gezira National Center of Pediatrics Surgery (GNCPS), we observed that most of the children presented with acute appendicitis coming from rural areas of

Gezira state and some of them are having perforated appendicitis at operation. This study is designed to reflect our local experience in GNCPS in Wad Madani, Gezira State, Sudan, in the contributing risk factors and outcomes of management of children presented with perforated appendicitis.

Patients and Methods

This is a prospective, observational cross-sectional study conducted at Gezira National Center of Pediatrics Surgery in Gezira State in the period between September 2016 to August 2017. All male and female children up to 15 years of age who presented in 1 calendar year with provisional clinical diagnosis of acute appendicitis and patients with appendicular mass on abdominal examination were included. Excluded were patients presented with other causes of acute surgical abdomen. The patients were classified into two cohorts according to their provisional clinical diagnosis: Perforated appendicitis group and non-perforated appendicitis (including; simple appendicitis, appendicular abscess, and appendicular mass) group. Those with provisional clinical diagnosis of appendicular mass were underwent examination under anesthesia to confirm the diagnosis and then treated conservatively with appendectomy planned in a later stage. All patients discharged from the hospital after treatments were followed in the outpatient clinic for four weeks after surgery. Data was collected in a patient data sheet designed by the researcher and the variables include; age and gender, residence, associated co-morbidities, time interval from the development of symptoms and hospital presentation, clinical presenting symptoms, prior visit to local health facilities and previous medical treatment, methods of diagnosis; clinical, laboratory radiological or Examination Under general Anesthesia (EUA), interval between hospital presentation and surgical intervention, intra-operative pathology of appendicitis (simple appendicitis, perforated obstructed or non-obstructed type, or appendicular abscess), and outcome after surgery. All the collected data were analyzed by using the Statistical Package for Social Sciences (SPSS) computer program version 16. Qualitative data were analyzed by using descriptive statistic, t test, and Pearson chi-square. The P value was considered significant if <0.05. Hospital administration approval was obtained from the Gezira National Center of Pediatrics Surgery and verbal consents were obtained from the guardians of the patients.

Results

A total of 200 patients who met the inclusion criteria were identified, of these, 169 (84.5%) were diagnosed as non-perforated appendicitis and 31 (15.5%) were perforated appendicitis. Table 1 provides age distributions of the 2 groups. Children between 11 to 15 years and males were most common in both groups. On the other hand, there was no difference in gender (P=0.900) and age distribution (P=0.608) between the 2 groups. Most patients were coming from rural areas of Gezira State. There were no associated co-morbidities in patients with perforated appendicitis.

Case characteristics

In Table 2, most patients 109 (54.5%) were admitted to the hospital at a time interval 24 h to 48 h from the onset of symptoms. Some patients 21 (36.2%) with perforated appendicitis were initially treated in rural hospitals, primary health centers and clinics (P=0.000). Malaria was the initial diagnosis of 12 (31.6%) patients with perforated appendicitis. A total of 62 (31%) patients received medical treatment or remedies before hospital admission. Of these

Table 1: Age Distribution.

Age Group/ Year	Non-perforated		Perforated	
	No. of Patients	Percentage	No. of Patients	Percentage
0-5	2	1.30%	0	0
6-10	57	33.70%	13	41.90%
11-15	110	65%	18	58.10%
Total	169	100%	31	100%

Table 2: Time Interval between Onset of Symptoms and Hospital Admission.

Time/ Hours	Non-perforated		Perforated		Total
	No. of Patients	Percentage	No. of Patients	Percentage	
<24	42	24.80%	2	6.40%	44
24-48	97	57.40%	12	38.70%	109
48-72	16	9.50%	10	32.30%	26
>72	14	8%	7	22.60%	21
Total	169	100%	31	100%	200

Table 3: Initial Pre-Hospital Diagnosis.

Diagnosis	Non-perforated	Perforated	Total
	No. of Patients	No. of Patients	
Malaria	26	12	38
Chest Infection	1	1	2
Malaria + Chest Infection	0	1	1
Gastroenteritis	2	4	6
UTI	6	0	6
Gardiasis	1	0	2
Renal Colic	1	1	2
Mesenteric Lymphadenitis	0	1	1
Acute Appendicitis	0	1	1
Total	37	21	58

22 (35.5%) with perforated appendicitis with a significant difference between the 2 groups (P=0.000). The use of antibiotics (P=0.000), antimalarial (P=0.000), analgesia (P=0.000), and anti-spasmodic (P=0.027) were significantly common in the 2 groups (Table 5). On the other hand, there was no significant difference in the use of home-made remedies (e.g. Hilba, Hibiscus, Maharaib, herbs ...etc.) between the 2 groups (P=0.082). The provisional clinical diagnosis of these patients based on their clinical presentation was categorized in 4 groups; simple appendicitis 152 (76%), perforated appendicitis 31 (16%), appendicular mass 14 (7%), and appendicular abscess 3 (1%). All patients 200 (100%) were diagnosed on their initial presentation to the hospital clinically and total White Blood Cell (WBC) count was requested for all patients.

Other 43 (21.5%) patients were diagnosed by radiological methods, of these 42 (97.7%) by abdominal ultrasound scanning and 1 (2.3%) by plain abdominal erect & supine X-ray (P=0.093). In 14 (7%) patients in whom appendicular mass was a suspected diagnosis, Examination under Anesthesia (EUA) was undertaken in 12 (85.7%) patients as a method for clinical diagnosis. There was a significant difference (P=0.047) in the time interval between diagnosis and surgical intervention between the 2 groups (Table 6). Most of patients 20 (64.5%) with perforated appendicitis were underwent surgical intervention within 1 h to 2 h. The intra-operative pathologies for those who underwent surgical intervention were found to be; simple

appendicitis 154 (81.91%), perforated obstructed appendicitis 18 (9.57%), perforated non-obstructed appendicitis 13 (6.91%), and appendicular abscess 3 (1.59%). The outcome of management showed no mortality (n=0), 6 (46.15%) patients developed wound infection, wound dehiscence in 1 (0.5%) patient and superficial abscess in another 1 (0.5%) patient. Three patients required readmission for treatment of wound-related complications, antibiotic administered for treatment of wound infection in 5 (55.55%) patients, and wound dressing was required twice/day for 3 (33.33%) and once/day for the other 3 patients.

Discussion

Acute appendicitis is the most common surgical emergency in childhood [2]. In African children, appendicitis is the commonest surgical condition requiring emergency operation [3]. Delayed diagnosis of children with acute appendicitis may lead to significant morbidity and prolonged hospital stay. In Sudan, late diagnosis rather than late presentation is a big problem [4]. In this study, perforated appendicitis was found in 31 cases (15.5%) of children presenting with appendicitis. Perforation rates which have been described in the literature vary between 17.6% to 19% respectively [2,5]. Our finding is consistent with figures reported in the literature. Various risk factors associated with perforation have been studied. In this study, most patients 23 (74.19%) presenting with perforated appendicitis were from rural areas of Gezira state. This may be attributed to large number of pediatrics population served by Gezira National Center of pediatric Surgery and lack of primary health services in rural areas. In the study done in India, patients from rural areas have higher rates of perforation with acute appendicitis than urban patients which logically follow that patients who do not have good access to medical care would be more likely to present with perforation [2]. This difference persists when accounting for other factors associated with perforation [6]. Children with perforated appendicitis are much more likely to present late to the hospital. In this study, we found that in most of patients 22 (68.5%) presented 24 h after the onset of abdominal pain and were found to have perforation at surgery. In a research done, as the duration of symptoms increases, the proportion of simple to complicated appendicitis decreases thereby the number of patients with perforation or gangrene increases [2]. This goes with finding in a local study in Sudan, in which delayed presentation for more than 48 h was associated with complicated appendicitis [7]. Fever, nausea and vomiting were significantly more common in patients with perforated appendicitis, this indicate the delay in presentation of those children. There is a popular believe among rural residents of Gezira that some herbal remedies like Hibiscus and Hilba will help in relieving abdominal pain. Six (19.35%) patients with perforated appendicitis have received home-made remedies but there was no statistically significant differences have been found between them and others with non-perforated appendicitis. On the other hand, diarrhea at presentation showed no statistically significant difference in patients presented with perforated or non-perforated appendicitis in this study. Gamal and Moore found that diarrhea is very often a concomitant symptom in appendicitis but failed to acknowledge this as a significant symptom [8]. In contrast to what have been found by Jea et al. that diarrhea at presentation was observed more frequently and it is found to be significant risk factor for a delayed diagnosis of acute appendicitis in children in the interval from the initial visit to the hospital to the final diagnosis before the appendectomy [9]. Cappendijk and Hazebroek reported that diarrhea resulted in a diagnosis of gastroenteritis in almost half of the cases and greatly influence the diagnostic delay [10]. Another reason of delayed presentation of children with perforated appendicitis is prior visit to rural hospitals, primary health centers and clinics. Those patients who had a history of prior visit to rural hospitals are commonly seen by junior doctors and general practitioners who my find difficulty in diagnosing acute appendicitis in a child presented with abdominal pain. Distinguishing between the diagnosis of appendicitis and other common pediatric diseases with overlapping symptoms remains a challenge [11]. In this study 21 (36.2%) patients with perforated appendicitis seen prior to hospital presentation and 22 (35.5%) of them received treatment. Jea et al. found that one of the risk factors of a diagnostic delay for appendicitis that presents the highest odds ratio among other associated factors is the previous visit to local clinics [9]. Harrison et al. reported that primary care physicians referred patients with symptoms for a longer period of time and who ultimately were found to have a more advanced stage of the disease than patients referred from an emergency department [12]. In El Obeid, Western Sudan, Doumi and Abdelrahman found that it is the problem of late diagnosis rather than late presentation as all patients were misdiagnosed and put under treatment for other medical conditions before being admitted to the surgical wards [4]. This concludes that the prior visit to local health facilities represents a diagnostic delay leading to a possible delayed presentation and this should prompt the initiation of protocols for the management of acute abdominal pain in children at rural hospitals and health care facilities. Application of scores like modified Alvarado score 13 might be of a particular value in sorting out patients at initial evaluation. In this study, 12 (31.6%) patients with perforated appendicitis were diagnosed as having malaria in the prior visit to local health facilities and received anti-malarial treatment. The use of antibiotics, anti-malarial, analgesia, and anti-spasmodic were significantly common and this was most probably led to resolution of abdominal pain and fever that ultimately cause a delayed diagnosis. Children in the delayed group being referred after being treating in primary clinics for several days or physicians were concerned about various differential diagnoses when the clinical signs were not explicit, and this make it difficult to determine an acute abdomen in children [9]. The provisional diagnosis of patients in this study was based on their clinical presentation. This finding goes with other study in which the clinical diagnosis remains the cornerstone; nevertheless, laboratory investigations provide significant complimentary aid in diagnosis [2]. The total White Blood Cell (WBC) count was requested routinely for all patients presented with features of acute appendicitis in the study center and it is not regarded as a diagnostic tool but rather as a guide in the differential diagnoses. Although the WBC count is frequently ordered in children with suspected appendicitis, but is unable to discriminate between patients with and without appendicitis [14]. This is similar to what have been found in a local study, in which leucocytes count more than 11,000 is suspicious but not diagnostic of complicated appendicitis [7]. In the study center protocol children diagnosed as perforated appendicitis are taken as soon as possible to the operating room where as others who presented with uncomplicated appendicitis are given the same advantage. In this study, 20 (64.5%) patients with perforated appendicitis underwent surgical intervention within 1 h to 2 h from the time of clinical diagnosis. There was a significant difference (P=0.047) in the time interval between diagnosis and surgical intervention between the perforated and non-perforated groups. Almstrom et al. found that increased time to surgery was not associated with increased risk of histopathologic perforation [15]. Xuan-Binh et al. found that delaying appendectomy in children does

not increase the risk of complicated appendicitis once intravenous antibiotics are administered [16]. On the other hand, Papandria et al. in their study of risk of perforation found that a greater inpatient delay before appendectomy is associated with increased perforation rates for children and adults within his population-based study [17]. These contradicting findings may be attributed to the fact that Papandria et al. study was including both adult and children while the other two studies were done in children. However, this was not observed in our children with simple appendicitis as all were not delayed more than 4 h. In this study, most patients who were found to have perforation at operation were males 20 (64.51%). This goes with similar finding by Papandria et al., states that male patients were more likely to experience perforation independent of age [17]. In contrast to these findings, Korner et al. found that perforated appendicitis occurred at almost the same incidence in all sex and age groups, with higher rates in small children and the elderly, irrespective of the gender [5]. In contrast to these findings, Singh, et al. found that the perforations were more common in females and patients who were younger than 5 years, but statistically it was not significant [2]. In this study, the intra-operative finding of obstruction of perforated appendix by appendicolith was found in 18 (58.06%) patients with perforated appendicitis. Our result in this study goes with similar finding by others, that the presence of appendicolith significantly increased the probability of complicated appendicitis [2]. A strong association of faecolith and perforated appendicitis was also found in a regional study [18]. The outcome after surgical intervention showed no mortality in the post-operative period in both groups. This is consistent with similar finding in local studies from Sudan [4,7]. In contrast to what have been found in a regional study, in which the mortality rate was 1.50% and both patients who died had a severe co-morbid medical condition with uncontrolled sepsis [18]. In this study, there were no associated comorbidities in patients with perforated appendicitis and therefore no mortality has been encountered. Post-operative complications were seen in 13 (6.5%) patients; of them 7 (3.5%) patients with perforated appendicitis developed wound-related complications; infection, dehiscence, and superficial abscess. These post-operative complication rates are lower than 9.7% and 10.9% rates seen in previous local studies [4,7]. These previous local studies were done by general surgeons in none specialized hospital and includes both adults and children and as such do not reflect the true incidence of complications following surgery for complicated appendicitis in children. Half of the patients with complications following surgery for perforated appendicitis, required readmission and treatment as in-patients. They required daily wound dressing and antibiotics administration and of course the length of hospital stay is prolonged in these children. This is going with similar study which concluded that the hospital stays of patients suffering from perforated appendicitis is significantly prolonged [18]. In the past perforated appendicitis was associated with high mortality and morbidity. Improvement in pediatric anesthesia and the introduction of new generations of antibiotics have helped in declining the incidence of these complications. A further step is needed to improve early diagnosis to decrease the incidence of complicated appendicitis.

References

1. Rothrock SG, Skeoch G, Rush JJ, Johnson NE. Clinical features of misdiagnosed appendicitis in children. Ann Emerg Med. 1991;20(1):45-50.
2. Singh M, Kadian YS, Rattan KN. Complicated appendicitis: Analysis of risk factors in children. Afr J Paediatr Surg. 2014;11(2):109-13.
3. Ndungu JM. Appendicitis in African children. E Afr Med J. 1994;71:277-8.
4. Doumi EA, Abdelrahman IH. Acute appendicitis: Still a missed diagnosis in El Obeid, Western Sudan. Sudan JMS. 2007;2(1):7-8.
5. Korner H, Sondenaa K, Soreide JA, Andersen E, Nysted A, Lende TH, et al. Incidence of acute non-perforated and perforated appendicitis: age-specific and sex-specific analysis. World J Surg. 1997;21(3):313-7.
6. Pasha G, Khorasani B. Effects of two new risk factors on perforated and non-perforated appendicitis. Res J Bio Sci. 2009;4(11):1175-9.
7. Makki MA, Hamza AA. Outcome of appendectomy: Early versus late presentation. SAS J Med. 2015;1(4):130-33.
8. Gamal R, Moore TC. Appendicitis in children aged 13 years and younger. Am J Surg. 1990;159(6):589-92.
9. Jea YC, Eell R, Jeong HJ, Tchah H, Seong MK. Risk factors of delayed diagnosis of acute appendicitis in children: for early detection of acute appendicitis. Korean J Pediatr. 2016;59(9):368-73.
10. Cappendijk VC, Hazebroek FW. The impact of diagnostic delay on the course of acute appendicitis. Arch Dis Child 2000;83(1):64-6.
11. Rothrock SG, Pagane J. Acute appendicitis in children: Emergency department diagnosis and management. Ann Emerg Med. 2000;36(1):39-51.
12. Harrison MW, Lindner DJ, Campbell JR, Campbell TJ. Acute appendicitis in children: Factors affecting morbidity. Am J Surg. 1984;147(5):605-22.
13. Erdem H, Cetinkunar S, Das K, Reyhan E, Deger C, Aziret M, et al. Alvarado, Eskelinen, Ohhmann and Raja Isteri Pengiran Anak Saleha Appendicitis scores for diagnosis of acute appendicitis. World J Gastroenterol. 2013;19(47):9057-62.
14. Eriksson S, Granstrom L, Carlstrom A. The diagnostic value of repetitive preoperative analyses of C-reactive protein and total leucocyte count in patients with suspected acute appendicitis. Scand J Gastroenterol. 1994;29(12):1145-9.
15. Almstrom M, Svensson JF, Patkova B, Svenningsson A, Wester T. In hospital surgical delay does not increase the risk for perforated appendicitis in children: A single-center retrospective cohort study. Ann Surg. 2017;265(3):616-21.
16. Xuan-Binh D, Veronica F, Sullins MD, Steven L. Factors predictive of complicated appendicitis in children. J Surg Res. 2016;206(1):62-6.
17. Papandria D, Goldstein SD, Rhee D, Salazar JH, Arlikar J, Gorgy A, et al. Risk of perforation increases with delay in recognition and surgery for acute appendicitis. J Surg Res. 2013;184(2):723-9.
18. Ahmad T, Ali Z, Ali A, Anjum S. Perforated appendix: Contributing factors. JUMDC. 2010;1(2):11-6.