Pediatric Surgery 3: 107-112, 1989

Controversial management of advanced appendicitis in children: An analysis of 110 cases

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Summary

110 advanced case with appendicitis were analysed retrospectively and evaluated for different treatment modalities such as primary or delayed wound closure, transperitoneal drainage and intraperitoneal drainage and also double antibiotic or triple antibiotics usage. The complications were wound infection, intestinal obstructions due to adhesions and intraabdominal abscess formation. The rate of wound infection was 10% in delayed wound closure, 27% in primary wound closure; 21% in intraperitoneal drainage and 39% in transperitoneal drainage. The results indicate that, delayed wound closure, peritoneal and wound irrigation, triple antibiotics decrease both the morbidity and mortality in the advanced cases.

Key words: *Advanced appendicitis, wound closure, drainage procedure, use of double and triple antibiotics.*

Introduction

The protean manifestations of acute appendicitis in infants and children may be confusing and lead to delay in diagnosis and consequently result in rupture with generalized or localized peritonitis and abscess formation [4]. Advances in fluid resuscitation and anaesthesia are largely responsible for the 75% reduction in mortality rate during the last three decades. Current topics of controversy include the indications for drainage, closure of contaminated wounds, irrigation of peritoneal cavity, use of antibiotics and of absorbable versus nonabsorbable suture material [2]. The aim of this paper is to present an eight-year experience in managing this condition and to test the efficacy of different treatment modalities.

Patients and Methods

A retrospective analysis was carried out on 386 patients who underwent appendicectomy for preoperative diagnosis of acute appendicitis during a period of eight years, from January 1980 to July 1988. Seventy of these children had either gangrenous appendicitis, generalized toxic peritonitis without perforation or localized peritonitis with abscess formation reaching 110 cases by adding the perforated cases (34%). Diagnosis was based on history and physical findings, and confirmed by operation and routine histopathological examination. Sixteen independent variables were defined and evaluated for each patient.

Within one to four hours after admission, resuscitation was usually accomplished. Patients received immediate fluid and electrolyte replacement, intravenous antibiotics, antipyretics when necessary, and underwent prompt surgical exploration. After further abdominal examination of the children under general anaesthesia; different incisions were used depending upon findings at deep palpation of the right iliac fossa. The appendix was removed and its stump embedded into the caecal wall in every case. Peritoneal irrigation was performed with two to four litres of warmed normal saline solution. Two penrose drains were brought out through the lateral margin of abdominal incision (transperitoneal) or-abdominal ends of the drain being placed to the caecal and pelvic site. The incisions were closed primarily or by delayed wound closure with regards to presence of severe generalized peritonitis and operative soiling of the incision. The antibiotics administered were an aminoglycoside derivative such as gentamycin, tobramycin, amikacin etc and ampicillin plus sulbactam or

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tertiary cephalosporins. In patients with severe peritonitis or abscess formation, clindamycin or ornidazole was added to the initial double antibiotic therapy. Wounds for delayed primary closure were irrigated with 1% bethadine solution and redressed at least twice a day. These were suture with 4/0 silk placed at the initial operation or sterile adhesive strips on the third postopeative day, when there were no wound infections or excessive wound drainage.

Results

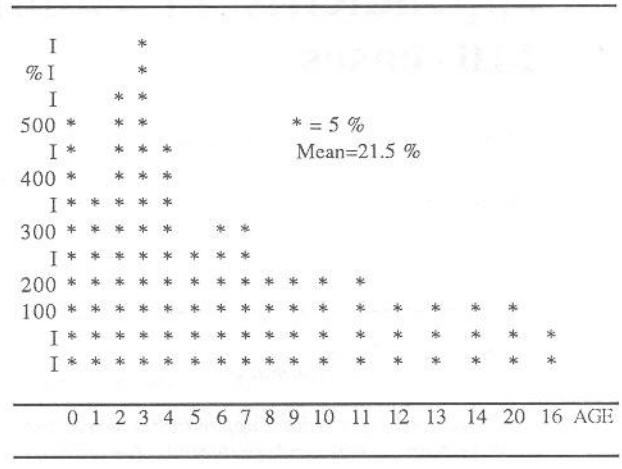
In the presented series 326 patients had acute appendicitis with histopathological confirmation, while 70 (21%) had perforated appendicitis and 110 (34%) had advanced appendicitis. Out of the 110 children 66 were boys (60%) and 44 were girls (40%). Their ages ranged form two days to 16 years (mean:9.4 years). 13.8% were younger than 6 years and 3% were younger than 2 years. The ages of 30% of the children ranged from 6 to 10 years and 53.2% were older than ten years.

The influence of age on the rate of perforation is demonstrated in figure 1. While children less than six years old, had a 59% perforation rate, those between 6-10 years of age had 25%. Those older than ten years had 15%. The highest rate of perforation was in the three-years-olds, being 63% (Figure 1).

The presenting symptoms were abdominal pain (99%) anorexia (75%), nausea (84%), vomiting (67%), fever (98%), rectal irritation and tenesmus (56%), abdominal distention (27%), diarrhoea (25%) and restlessness (7%). Restlessness, abdominal distension, and refusal to eat were among the early symptoms in infants.

Abdominal tenderness was the most consistent finding in 110 patients. Rebound tenderness was positive in 99% of the patients and tenderness was more marked on right lower quadrant in 60% of these patients. A mass was palpable in 21 percent of the cases, being noticed in 12% at physical examination and in 9% during examination under anaesthesia just prior to operation. Abdominal distention was noted in 45% of the patients. In 80% of patients there was tenderness on rectal examination. Axillary temperature was

Fig. I. Influence of age on rate of perforation in acute appendicitis



higher than 37.2 degrees. Mean temperature being 38.3 degrees.

The abdomen was explored through a Rockey-Davis incision in 60 cases, a right paramedian incision in 30, a Mc Burney'ms incision in 8, and a right lower quadrant transverse incision in another 12 cases.

Postoperative complications included 27 wound infections; six small intestinal obstructions (five of which required operative lysis of adhesions while one gave favourable results to conservative measures); two complete wound dehiscenses (which occured in patients with perforated appedicitis and paramedian incisions); bronchopneumonitis in 10 patients; lower pneumonitis in a patient; two intraabdominal abscesses in two patients having insufficient irrigation of their peritoneal cavities (one intrapelvic and one between the loops of the small intestine) (Table 1).
110 cases had transperitoneal or intraperitoneal drainage with two penrose drains. In 87 cases the drainage was intraperitoneal and in 23 cases transperitoneal. The rate of wound infection of the patients who drained intraperitoneally was 21% while those drained transperitoneally was 39. For these patients the mean hospital stay was 8.4 days and 9.5 days respectively. In 20 patients, primary wound closure was 27.7%, where a further 10% percent wound infection rate was achieved in patients with delayed wound closure.

Table I. Complications in advanced appendicitis

COMPLICATIONS	NO.	FREQUENCY %
MAJOR COMPLICATIONS N:11		
Intestinal Obstruction	6	5.4
Intraabdominal Abscess	2	1.8
Wound Dehiscence	2	1.8
Pneumonia	1	0.9
No of patients:8		9.9-6.4 %
MINOR COMPLICATIONS N:37		
Wound Infection	27	24.6
Bronchopnomonia	10	9.1
No of Patients : 32		33.7-% 29.9

Table 2. Route of drainage and wound closure and wound infection

Perforated or Advanced Appendicitis Drained. N: 110	N	Wound Infection %	Mean Hos. Stay Days
Delayed Wound Clos.	20	2-10.0	7.4
Primary Wound Clos.	90	25-10.0	8.54
Transperitoneal Drain.	23	25-27.7	9.5
Intraperitoneal Drain.	87	9-39.0	8.4

The mean duration of hospital stay in the patients with delayed and primary wound closure was 7.40 days and 8.54 days respectively (Table 2).

27 patients with appendiceal perforation received clindamycin or ornidazole in combination with an aminoglycoside derevative and ampicilin plus sulbactam or tertiary cephalosporins. In this group the mean duration of hospitalization was 8.5 days which was lower than the mean duration of patients with perforated appendicitis (9.38 days). On the other hand, however, the rate of wound infection was not different from those patients receiving ampicilin or cephalosporins and aminoglycosides (30% versus 30.2%) Table 3.

A male patient with 20 days delay-perforated appendicitis and generalized peritonitis and intraperitoneal abscess formation died due to septic shock, the mortality rate in the whole group was 0.90 percent.

Discussion

The development of antibiotic therapy and advances in anaesthesia and fluid resuscitation have produced important reductions in the morbidity and mortality of acute appendicitis. At present, appendicitis stands as the most common cause of abdominal surgery in the paedicatric age group [18].

Another well known fact is that, the rate of perforation in children is higher than that of adults [12,22]. The younger the children, the higher seems to be the rate of perforation. The high rate of perforation in children and in infants is blamed on the smaller and shorter omentum, a thin walled appendix, insufficient immunological response to wall-off the inflammation and the inability of the child to communicate accurately and effectively when there is abdominal pain [3].

Late or wrong diagnosis, and the suppression of the inflammatory process with antibiotics or other medicine can cause perforation and advanced acute appendicitis in children [5,6,9,10,12,16,18].

Table 3. Frequency of wound infection and abscess formation as compared to the usage of double and triple antibiotics in perforated appendicitis

N:70	Abscess %	Wound Infection	Mean Hosp.
Double Antibiotics N:43	2-5 %	13-30.2 %	10.15 Days
Triple Antibiotics N:27	0-0 %	8-30 %	8.59 Days

Double Antibiotics: Cephoperazone or Ampicilin plus an Aminoglycoside
Triple Antibiotics: Double antibiotics plus Clindamycine or Orinidazole

There were twenty children in our series who had been misdiagnosed and suppressed with antibiotics, all of them resulting in perforations or advanced appendicitis. The inability to wall-off the inflammatory process may be solved by earlier diagnosis and intervention. This depends largely on increasing professional and public awareness of acute abdominal diseases [4,5,6,9,15,21].

One of the most controversial issues in the management of perforated appendicitis is the use of transperitoneal drains. Some investigators have advocated that traansperitoneal drains be used in the management of all patients with perforated appendicitis [5,13,16,19]. While Othersen [13] stated that, drains brought through the wound will also provide drainage for all layers of the abdominal wound.

Marchildon [16] reported a 8% wound infection rate with perforated appendicitis. On the contrary, the wound infection rate is somewhat higher (39%) in the transperitoneal drainage group than the intraperitoneal drainage group (21%), but both groups have a higher wound infection rate in the presented series.

This may be the result of continuous contamination of wounds with infected peritoneal fluid or inefficacy of our drainage procedure in the transperitoneal drainage group and may be the result of creating a closed space which has a high density of bacteriae due to contamination of infected peritoneal fluid in primary wound closure. On the other hand Marchildon [16] reported that only three of 83 patients with perforated appendix developed an intraabdominal abscess when transperitonal drains were used. Janik [10] had a 20% rate of intraabdominal abscess with transperitoneal drainage.

Heller [8] et al, getting high intraabdominal abscess rate, concluded that trasperitoneal drainage intraabdominal abscess rate was nil in the patients who drained transperitoneally.

Another controversy in the treatment of perforated appendicitis is primary versus delayed wound closure. The rate of wound infection in patients with perforated appendicities, where the wounds left open, is lower than that of those patients, whose wounds are closed primarily [7,19]. In the reported series the rate of wound infection of patients with primary wound closure ranges from 1.4% to 44.7% regardless of peritoneal irrigation [2,6,10,16,17,18,19,21]. On the contrary, the incidence of postoperative wound infection of the patients with delayed wound closure ranges from nil to 7% [1,2,7,10,16,17,18,21]. In the presented series, the wound infection rate was 10% in the patients with delayed wound closure and 27.7 % in the patients whose wounds closed primarily. Delayed wound closure is one of the factors that reduces the morbidity of perforated or advanced appendicitis and our result correlate with this finding.

Raahave [17] studied 65 cases of perforated appendicitis and found that patients with wound sepsis had significantly higher densities of bacteriae at all sampling sites (incision, appendix, peritoneal fluid) than the noninfected patients. Raahave [17] has prefered to close the incisions primarily, without irrigatin but using 1 gram of ampicilin in powdered form topically at the incision, asite, yet again resulting in 23% wound infection rate.

This study along with that of Sherman's [20] indicate that the idea of topical antibiotic therapy is not as effective as expected, while irrigation of the peritoneal cavity and incisions to reduce the bacterial density seems somewhat more effective.

Many surgeons are opposed to peritoneal irrigation in any form, fearing that it may spread the bacterial inoculum. It has been well documented, however, that the fluid within the peritoneal cavity has an established circulation [19]. Thus, fluid with becterial contamination present in the right lower quadrant will reach the subdiaphragmatic space within minutes anyhow.

A greater benefit may be derived from reducing the peritoneal cavity. Peritoneal irrigation enhances the removal of the fibrin debris trapped and sequestered the bacteriae. Peritoneal irriga-

tion was used by Graham [5], Marchildon [16], Othersen [13] Bower [2] Haller [8], Schwarts [19] and Samelson [18] in addition to peritoneal drains. This has played an important role in their excellent results, with respective postoperative abdominal abscess rates ranging from 0% to 3%. Schwarts [19] and Graham [5] used antibiotic added irrigation of the peritoneal cavity, but the double-blind study by Sherman [20] revealed no difference in complication rates between irrigating with normal saline or saline with antibiotic for wound and intraabdominal inflammation. Samelson's [18] patients with perforated appendicitis were copiously irrigated with normal saline solution only, achieving 1.8% rate of intraabdominal abscess formation. Bower's [2] rate of intraabdominal abscess with perforated appendicitis which were irigated only with saline was 3%. Schwarts [19] used cepholatin with normal saline solution for peritoneal irrgation and the rate of intraabdominal abscess was nil. In our series 110 patients with perforated or advanced appendicitis were irigated with normal warmed saline solution to which no antibiotics were added. The rate of intraabdominal abscess was 1.8% (2/110) and the wound infection rate was 24.54% (27/110). The rate of intraabdominal abscess was very low, but the rate of wound infection can not be considered low enough. This part, may be due to primary wound closure and transperitoneal drains.

The use of triple antibiotics has reduced intrabdominal abscess formation and the duration of hospital stay; but has not changed the rate of wound infection in our series. Triple antibiotics usage has given similar results, except wound infection rate [10,16,18,19].

In conclusion, increasing the public and professional awareness of acute appendicitis as a cause of acute abdomen leads to early diagnosis and intervention, thus reducing morbidity and mortality due to this entity. Our results and the current literature indicate that reduction of wound infection and intraperitoneal abcess formation depends on peritoneal irrigation with copious quantities of saline solution, delayed primary wound closure and the use of triple antibiotics and peritoneal drains when required.

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