Surgical Wound Infection Post Surgery in Perforated Appendicitis in Children

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Abstract

Objective : To compare the rate of wound infection of perforated appendicitis in children between primary wound closure and delayed primary wound closure.

Study Design : Prospective clinical trial.

Material and Method : Children diagnosed with perforated appendicitis between January 1999 and December 1999 received gentamicin and metronidazole pre - and post-operatively. Intra-abdominal fluid cultured and tested for sensitivity. The rate of wound infection, skin closure for patients were compared between primary wound closure and delayed primary wound closure.

Results : Among 198 children diagnosed with appendicitis, 44 cases were perforated (22.22%). Of these 44 cases, 8 cases had wound infection (18.18%), 2 of 8 Infected cases (9.1%) were in the primary wound closure group, 6 of 8 (27.3%) were in the delayed primary wound closure group.

Conclusion : The rate of wound infection from perforated appendicitis in children is still high. Primary wound closure has a significantly lower rate of wound infection compared with delayed primary wound closure.

Key word : Surgical Wound Infection, Perforated Appendicitis, Primary Wound Closure

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J Med Assoc Thai 2002; 85: 572-576

Surgical wound infection from surgical cases of perforated appendicitis in children occurs in 17-25 per cent despite new regimen antibiotics (1-3). There are two different methods of wound management for perforated appendicitis. One is primary wound closure, the other is delayed primary wound closure. The principle of delayed closure of contaminated wounds after appendectomy was a direct application of measures taken during the First World War to lessen the morbidity and mortality

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of traumatic wounds. Recently, Janik and Firor[4], Bower et al[5], Elmore et al[6] introduced delayed primary wound closure, and claimed to have a lower wound infection rate. On the other hand, Neilson et al[7], Karp et al[8], Wajcharatit[9], Siriwanbus and Srikun[10] advocated primary wound closure. Controversy still remains between primary wound closure and delayed primary wound closure.

The aim of this study was to compare the rate of wound infection of perforated appendicitis in children between primary wound closure and delayed primary wound closure. Which one is more effective in reducing the wound infection rate.

MATERIAL AND METHOD

The study of surgical wound infection post surgery in perforated appendicitis in children aged under 15 years was conducted from January 1999 to December 1999, at the Division of Pediatric Surgery, Department of Surgery, Surin Hospital.

All patients diagnosed clinically with appendicitis received both gentamicin and metronidazole pre-operatively and continued receiving both drugs 5-10 days post-operatively in perforated cases. (gentamicin : dose 5 mg/kg/day divided in three doses, metronidazole : dose 25 mg/kg/day divided in three doses).

After removal of appendix, intra-abdominal fluid during operation was cultured and tested for sensitivity before swabbed until dry. With the facilities at Surin Hospital, culture was limited only to aerobic organisms. Penrose drain was placed selectively in cases with apparent loculated cavity. It was placed separately from the main surgical wound, and gradually shortened over a 3- to 5- day period before being removed. The abdominal wall was closed layer by layer. Muscular layer and subcuticular tissue were irrigated with normal saline solution.

For the management of wound closure, children were divided into two groups, the primary wound closure group and the delayed primary wound closure group. The patients were randomized by choosing each method alternatively. In the delayed primary wound closure group, the wound was dressed daily and packed with Betadine gauze 5-10 days until suitable for suture.

Wound infection was defined as having discharge of purulent material or surrounding cellulitis. If wound infection occurred, the wound must be re-opened and dressed daily for suturing later.

All patients were asked to inform the surgeon of any later complications. The data was collected from the time patients were admitted until discharge ; and followed-up 5-14 days afterwards.

RESULTS

There were 198 children diagnosed with appendicitis ; 44 cases were perforated and the perforation rate was 22.22 per cent.

Of the 44 perforated cases : there were 20 boys and 24 girls ; sex ratio between boy and girl was 0.83 : 1. Mean patient age was 9.86 years (range 4 to 15 years).

The intra-operative peritoneal cultures were Eschericia coli (72.8%), Pseudomonas (18.2%) Klebsiella (4.5%) and Proteus (4.5%). Effective antibiotics from sensitivity test for each gram-negative bacilli are shown in Table 1. Two cases (9.1%) of the primary wound closure group had post-operative wound infection, compared with 6 cases (27.3%) of the delayed primary wound closure group.(Table 2) However, there was no secondary wound infection in the delayed primary wound closure group.

The length of hospitalization in the primary wound closure group and the delayed primary wound closure group were on average 6.34 and 7.45 days respectively.

Table 1. Per cent of sensitivity test.

Antibiotic	Sulbactam/ cefoperazone	Amikacin	Netilmicin	Gentamicin	Cefoperazone
1. *Eschericia coli*	100	93.46	91.46	77.96	65.88
2. *Pseudomonas* spp.	100	87.50	87.50	75	75
3. *Klebsiella* spp.	100	100	100	100	50
4. *Proteus* spp.	100	100	100	100	100
Average (%)	100	95.24	94.74	88.24	72.72

Table 2. Results of treatment.

	Primary wound closure (n =22)	Delayed primary wound closure (n = 22)
No complication	20	16
Wound infection	2	6
Per cent of wound infection	9.1	27.3

DISCUSSION

Overall incidence of perforated appendicitis in this series was 22.22%, which is comparable with other series(15-25%)[3,7,11,12].

Comparing the sensitivity test of 2 aminoglycosides, gentamicin was nearly as effective as amikacin (88.24% *vs* 95.24%). However, considering the cost of each drug, gentamicin was 3 times cheaper than amikacin. In addition gentamicin also 5-10 times cheaper than sulbactam/cefoperazone and netilmicin. Because of its effectiveness and lower price, gentamicin in terms of cost-effectiveness still remained an appropriate antibiotic of choice for gram-negative bacilli[13-16].

From an other Thai series[11], metronidazole was an appropriate antibiotic to cover anaerobic organisms. However, it must be administrated preoperatively and 5-10 days post-operatively or until the patient has recovered[17-19].

Current controversy in the management of perforated appendicitis includes whether the wound should be left open. The present series attempted to answer this controversy. The principle of delayed closure of contaminated wounds was a direct application of measures taken to lessen the morbidity. In 1979, Janik and Firor[4] reported a decrease in wound infections after appendectomy in children from 31.9 per cent to 7.1 per cent when wound closure was delayed rather than primary. The skin left open with delayed closure after complicated appendicitis was reported in two pediatric series in 1981 and in 1987[5,6]. Nonetheless, Krukowski et al in 1988[19], after reviewing extensively, stated that delayed wound closure in adults continued to be popular with North American surgeons but not with most British surgeons. Most of the North American series showed that delayed primary wound closure had a lower infection rate, In contrast British series had a lower infection rate in primary wound closure. This issue is still being debated.

In 1990 Neilson et al[7] introduced that primary closure in children could be accomplished in all cases of appendicitis, with measures to limit peritoneal contamination and broad-spectrum antibiotics. Primary skin closure not only encouraged early mobilization and but also avoided psychologically traumatic and painful dressing changes in young patients. Should a wound infection develop, the incision could be easily opened in the ward or in the clinic. Although delayed closure of the wound on the third to fifth post-operative day allowed an acceptable cosmetic result, it was often inferior to what could be achieved with subcuticular closure. Leaving the wound open required more nursing care, necessitated delayed closure, and would increase the duration and cost of hospitalization. Karp et al[8] managed perforated appendicitis in children without using transperitoneal drainage, delayed wound closure, and antibiotic lavage. Subcuticular incisional closure resulted in minimal wound care and excellent cosmetic results.

Recently, two Thai series agreed with primary skin closure. Wajcharatit[9] retrospectively studied 214 cases of appendectomy in Taksin Hospital. In perforated cases, post-operative wound infection with delayed primary closure was 31.5 per cent, with primary skin closure 21.4 per cent. In

Table 3. Comparison of series (per cent of wound infection).

Series	Number of patients	Per cent of wound infection	
		Primary wound closure	Delayed primary wound closure
Wajcharatit (1987)[9]	47	21.4	31.5
Siriwanbus-Srikun (1988)[10]	124	22.8	59.7
Present Series (1999)	44	9.1	27.3

pre-operative and post-operative antibiotic treatment, the wound infection rate was found to be significantly different. In 1988 Siriwanbus and Srikun (10) studied a prospective randomized control In ruptured appendicitis. Wound infection developed in 13 cases (22.8%) of primary wound closure and 40 cases (59.7%) of delayed primary closure. They concluded that in ruptured appendicitis, primary wound closure was the procedure of choice.

In the present series, the wound infection rate of perforated cases with primary wound closure group occurred less in the delayed primary wound closure group (9.1% *vs* 27.3%), and was similar to other Thai series(9,10) (Table 3). The length of hospitalization in the primary wound closure group was also less than the delayed primary wound closure group as well. Therefore this study confirms that primary wound closure was suitable for perforated appendicitis not only to decrease wound infection rate but also to avoid pain from daily wound dressing(7,8).

SUMMARY

The rate of wound infection from perforated appendicitis in children is still high. Antibiotics must be administrated pre-operatively and post-operatively to cover both aerobic and anaerobic organisms. Primary wound closure is more appropriate than delayed primary wound closure to reduce the wound infection rate.

ACKNOWLEDGEMENT

The author wishes to thank Professor Soottiporn Chittmittrapap, Department of Surgery, Faculty of Medicine, Chulalongkorn University for his useful comments on this paper.

(Received for publication on November 24, 2001)

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แผลผ่าตัดติดเชื้อจากไส้ติ่งอักเสบแตกทะลุในเด็ก

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วัตถุประสงค์ : เพื่อศึกษาอัตราการเกิดแผลผ่าตัดติดเชื้อในไส้ติ่งอักเสบแตกทะลุในเด็ก โดยเปรียบเทียบระหว่างผู้ป่วยที่เย็บผิวหนังปิดและผู้ป่วยที่เปิดแผลผ่าตัดโดยไม่เย็บปิด

รูปแบบการศึกษา : เป็นการศึกษาไปข้างหน้าทางคลินิก

วัสดุและวิธีการ : ศึกษาผู้ป่วยเด็กที่ป่วยเป็นโรคไส้ติ่งอักเสบแตกทะลุ ผ่าตัดรักษา ตั้งแต่ 1 มกราคม พ.ศ. 2542 ถึง 31 ธันวาคม พ.ศ. 2542 ผู้ป่วยจะได้รับยาปฏิชีวนะ Gentamicin และ Metronidazole ทั้งก่อนและหลังผ่าตัด ส่งหนองในช่องท้องเพาะเชื้อและหาความไวต่อยาปฏิชีวนะ สำหรับแผลชั้นผิวหนังเปรียบเทียบผู้ป่วย 2 กลุ่ม กลุ่มแรก เย็บผิวหนังปิด กลุ่มที่สอง เปิดแผลโดยไม่เย็บผิวหนังปิด

ผลการศึกษา : ผู้ป่วยเด็กที่ได้รับการวินิจฉัยว่า เป็นโรคไส้ติ่งอักเสบ จำนวน 198 ราย พบเป็นไส้ติ่งอักเสบแตกทะลุ 44 ราย คิดเป็นร้อยละ 22.22 พบแผลผ่าตัดติดเชื้อร้อยละ 18.18 โดยในกลุ่มเย็บผิวหนังปิดพบร้อยละ 9.1 เทียบกับกลุ่มเปิดแผลโดยไม่เย็บปิดพบร้อยละ 27.3

สรุป : ผู้ป่วยเด็กที่เป็นโรคไส้ติ่งอักเสบแตกทะลุ มีโอกาสเกิดแผลผ่าตัดติดเชื้อ การเย็บผิวหนังปิดเป็นทางเลือกที่เหมาะสมกว่าการเปิดแผลผ่าตัดโดยไม่เย็บผิวหนังปิด

คำสำคัญ : แผลผ่าตัดติดเชื้อ, ไส้ติ่งอักเสบแตกทะลุ, การเย็บผิวหนังปิด

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จดหมายเหตุทางแพทย์ ฯ 2545; 85: 572-576

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