Drainage Systems' Effect on Surgical Site Infection in Children with Perforated Appendicitis

Drenaj Sistemlerinin Perfore Apandisitli Çocuklarda Cerrahi Alan Enfeksiyonuna Etkisi

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Özet

Amaç: Perfore apandisit nedeni ile opere edilen çocuklarda, kapalı drenaj sistemi kullanımının Cerrahi Alan Enfeksiyonuna (CAE) etkisi araştırılmıştır. Gereç ve Yöntem: Perfore apandisit nedeni ile 2004-2010 tarihleri arasında opere edilmiş olan hastaların; dosyaları ve bilgisayar kayıtları retrospektif olarak değerlendirilmiştir.Açık drenaj sistemi (Grup I) 70 hastada ve kapalı drenaj sistemi 40 hastada kullanılmıştır. Bulgular: On bir vakada yüzeyel enfeksiyon ve 3 vakada organ/ boşluk enfeksiyonu saptandı. Grup I'de CAE oranı 15,7% ve Grup II'de 7,5% saptandı. Grup I'de antibiyotik tedavi süresi 7,5 ± 3,4 gün ve Grup II'de 6,4 ± 2,2 gün saptandı ve gruplar arası istatistiksel fark yoktu. Hastanede kalış süresi Grup I'de 8,2 ± 3,1 gün ve Grup II'de 6,8 ± 1,9 gün saptandı ve fark istatistiksel olarak anlamlıydı. Tartışma: CAE, hastanede kalış ve antibiyotik tedavi sürelerini artırarak, morbidite ve tedavi maliyetlerini artıran çok önemli bir problemdir. Kapalı sistem ile karşılaştırıldığında açık drenaj sistemi kullanılan perfore apandisit olgularında CAE sıklığının daha yüksek olduğu anlaşılmıştır. Perfore apandisit nedeni ile opere olan hastalarda drenaj sistemi kullanılacak ise kapalı drenaj sistemleri tercih edilmelidir.

Anahtar Kelimeler

Perfore Apandisit; Çocuk; Drenaj Sistemi; Cerrahi Alan Enfeksiyonu

Abstract

Aim: Effect of replacing open drainage system to closed drainage system on surgical site infection (SSI) in children operated for perforated appendicitis was evaluated. Material and Method: Hospital files and computer records of perforated appendicitis cases operated in 2004-2010 were evaluated retrospectively. Open drainage systems were used for 70 in cases (group I) and closed systems were used in the others (group II). Results: Eleven of SSI cases had superficial infection and 3 had the organ/space infection. SSI rate was 15.7% for group I and 7.5% for the group II. The antibiotic treatment length was 7.5 ± 3.4 days for group I and 6.4 ± 2.2 days for group II and the difference between groups was not statistically significant. Hospitalization length for group I was 8.2 ± 3.1 days and 6.8 ± 1.9 days for group II and the difference was statistically significant. Discussion: SSI is an important problem increasing morbidity and treatment costs through increasing hospitalization and antibiotic treatment length. Open drainage system used in operation in patients with perforated appendicitis leads an increased frequency of SSI when compared to the closed drainage system. Thus, closed drainage systems should be preferred in when drainage is necessary in operations for perforated appendicitis in children.

Keywords

Perforated Appendicitis; Children; Drainage System; Surgical Site Infection

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Introduction

Appendectomy is the most commonly performed emergency surgery in childhood. In case of perforated appendicitis appendectomy can result in surgical site infection (SSI). Since SSI is the second most common cause nosocomial infections and results preventable complications. Additionally, it may lead serious morbidity and mortality besides the economical burden. Rate of SSI is an important parameter determining the quality of health care [1].

Drains are open or closed system surgical devices used to remove infected fluid from the surgical site to prevent SSI. They are also used prophylactically to remove blood, serum, lymph, and other fluids, which may serve as media for bacteria to grow in [2]. On the other hand, a drain provides a pathway for bacteria to get into the wound leading to SSI itself. In this retrospective study the effect of drainage system on SSI rate in perforated appendicitis cases is evaluated. Patients operated for perforated appendicitis were assessed in terms of the parameters affecting the development of SSI and effect of SSI on morbidity.

Material and Method

This retrospective clinical research was approved by Hacettepe University Medical Faculty Surgical and Pharmaceutical Research Ethics Committee with the 410.01-3240 project reference number. Hospital files and computer records of perforated appendicitis cases operated between 2004 - 2010 in Hacettepe University Faculty of Medicine Pediatric Surgery Clinic were evaluated.

All patients were operated with the same open surgical technique and the diagnosis of perforated appendicitis was confirmed by the pathological examination of the specimen removed. Patients who were diagnosed as perforated appendicitis according to clinical signs but perforation was not confirmed pathologically were excluded from the study. Criteria of Centers for Disease Control and Prevention (CDC) accepted by Hacettepe University Infection Control Committee were used to diagnose SSI [3], These criterias are;

Superficial Incisional SSI

Infection occurs within 30 days after the operation and infection involves only skin or subcutaneous tissue of the incision and at least one of the following: Purulent drainage from the superficial incision. Organisms isolated from an aseptically obtained culture of fluid or tissue from the superficial incision. At least one of the following signs or symptoms of infection: pain or tenderness, localized; swelling, redness, or heat and superficial incision is deliberately opened by surgeon, unless incision is culture-negative. Diagnosis of superficial incisional SSI by the surgeon or attending physician.

Deep Incisional SSI

Infection occurs within 30 days after the operation if no implant is left in place or within 1 year if implant is in place and the infection appears to be related to the operation and infection involves deep soft tissues of the incision and at least one of the following: Purulent drainage from the deep incision but not from the organ/space component of the surgical site.
A deep incision spontaneously dehisces or is deliberately opened by a surgeon when the patient has at least one of the following signs or symptoms: fever (>38ºC), localized pain, or tenderness, unless site is culture-negative. An abscess or other evidence of infection involving the deep incision is found on direct examination, during reoperation, or by histopathologic or radiologic examination. Diagnosis of a deep incisional SSI by a surgeon or attending physician.

Organ/Space SSI

Infection occurs within 30 days after the operation if no implant is left in place or within 1 year if implant is in place and the infection appears to be related to the operation and infection involves any part of the anatomy, other than the incision, which was opened or manipulated during an operation and at least one of the following: Purulent drainage from a drain that is placed through a stab wound into the organ/space. Organisms isolated from culture of fluid or tissue in the organ/space. An abscess or other evidence of infection involving the organ/space that is found on direct examination, during reoperation, or by histopathologic or radiologic examination. Diagnosis of an organ/space SSI by a surgeon or attending physician. The effect of drainage system on SSI development is investigated. Patients who received open or closed system drainage are compared in terms of SSI frequency, length of hospitalization and antibiotic treatment as well as gender, age, concomitant presence of systemic disease, duration of symptoms, history of antibiotic treatment before surgery and prophylactic antibiotics.

Numerical data are expressed as mean±standard deviation. Statistical analysis is made with SPSS 19 (IBM Corporation) computer program using 'Fischer's exact test' and 'Mann Whitney U test'.

Results

All patients received prophylactic antibiotics. Most frequently used prophylactic antibiotic combinations were penicillin/sulbactam-ampicillin combined with metronidazole and amikacin or netilmisin. In patients with SSI antibiotic treatment was changed according to the recommendations of Infection Control Committee regarding the results of microbiological examinations.

Fourteen patients (12%) had SSI, 11 of which were superficial wound infections and other 3 patients had intraabdominal abscesses.

Group I involved 70 patients with open drainage system (Penrose drain) and Group II involved 40 patients with closed drainage system (Jackson Pratt drain). General characteristics of patients are shown in Table .

In Group I, Male/Female: 2 and in Group II Male/Female: 1.3 were found. There was not any statistically significant difference between groups (Fischer's exact test, $p = 0.39$).

Mean age was 9.0 ± 3.9 years in Group I and 10.0 ± 3.4 years in Group II. There was not any statistically significant difference between groups (Mann Whitney U test, $p = 0.20$).

In Group I, there was not any associated systemic disease. In Group II; 2 patients had epilepsy, 1 patient had coarctation of the aorta, 1 patient had thalassemia and 1 had familial Mediterranean fever (7.1%).

Table: Comparison of general characteristics of patients in Group I and II.

	Group I	Group II
Gender (male/female ratio)	2	1.3
Mean age (years)	9.0 ± 3.9	10.0 ± 3.4
Accompanying systemic disease	7.1%	-
Duration of symptoms (days)	2.6 ± 2.2	2.7 ± 1.8
Wrong diagnosis by another doctor before the diagnosis of appendicitis	32%	22.5%
Antibiotic treatment before the diagnosis of appendicitis	20%	5%
SSI rate	15.7%	7.5%
Duration of antibiotic treatment (days)	7.5 ± 3.4	6.4 ± 2.2
Duration of hospitalization (days)	8.2 ± 3.1	6.8 ± 1.9*

*: Statistically significant difference (p < 0.007)

Duration of symptoms was 2.6 ± 2.2 days in Group I and 2.7 ± 1.8 days in Group II. There was not any statistically significant difference between groups (Mann Whitney U test, p = 0.21).

A false diagnosis by a different doctor before having the correct diagnosis of appendicitis was made in 32% of patients in Group I and 22.5% of patients in Group II. There was not any statistically significant difference between groups (Fischer's exact test, p = 0.28).

There was history of antibiotic use before application in 20% of cases in Group I and 5% of cases in Group II. There was not any statistically significant difference between groups (Fischer's exact test, p = 0.47).

SSI rate was 15.7% in Group I and 7.5% in Group II. The distribution of data was not suitable for statistical analysis.

Duration of antibiotic treatment was 7.5 ± 3.4 days in Group I and 6.4 ± 2.2 days in Group II. There was not any statistically significant difference between groups (Mann Whitney U test, p = 0.20).

Duration of hospitalization was 8.2 ± 3.1 days in Group I and 6.8 ± 1.9 days in Group II. There was statistically significant difference between groups (Mann Whitney U test, p = 0.007).

Discussion

Urinary tract infection is the most frequently cause of nosocomial infection that results important cause of morbidity and mortality. Second most common cause of nosocomial infections are SSI [4]. SSI consists 14 - 16% of all nosocomial infections and 38% of nosocomial infections of surgical patients [5].

According to the CDC in the United States 250.000 - 1.000.000 of 26.6 million surgical procedures in a year developed SSI. Duration of hospitalization caused by SSI was determined as 3.7 million days per year and the cost of SSI's was estimated as 1.6 - 22 billion U.S. $ [6]. Readmission to hospital in following 30 days of discharge is increased 15 times in patients with SSI [7]. Rate of SSI as a preventable complication leading an important economical loss is an important parameter determining the quality of healthcare.

Most frequent emergency surgical operation is appendectomy in children. It can result in SSI especially in cases with perforated appendicitis. According to literature wound infection rate for perforated appendicitis is 2.7 - 9.2% and 1.8 - 3.3% of patients have intraabdominal abscess [8 - 10]. In this study 10% of cases had wound infection and 2.7% of cases had intraabdominal abscess.

Drainage of surgical site and evacuation of infected fluid is an important step in prevention of SSI. Surgical drains are used to prevent accumulation of fluid (blood, pus and other infected fluids) in surgical site and air in dead spaces or to characterize the fluid (eg., early detection of anastomotic leakage) [11]. On the other hand, a drain provides a pathway for bacteria to get into the surgical site leading to wound infection or deep surgical site infection. Open drainage systems drain fluid on to a gauze or stoma bag. Closed drainage systems consist tubes draining into a bag or bottle. SSI rate in patients with closed drainage system were significantly lower than those with open drainage system [12]. Although the data was not suitable for statistical analysis in this study, SSI rate in group I (15.7%) was found to be remarkably higher than Group II (7.5%). Besides, SSI rate in Group I is apparently higher when compared to the studies in literature [13]. According to this study closed system drainage decreases the rate of SSI and shortens the length of hospitalization significantly (p < 0.007) in children operated for perforated appendicitis.

A false diagnosis by a different doctor before having the correct diagnosis of appendicitis was made in 32% of patients in Group I and 22.5% of patients in in Group II. Antibiotic and analgesic treatment before the correct diagnosis may lead further delay and increase the incidence of complications including SSI. Since SSI is occasionally seen in acute appendicitis cases, the importance of early diagnosis can not be overemphasized.

The data obtained in this study indicates that open drainage system used in patients with perforated appendicitis increases SSI rate and length of hospital stay. Thus these drains should not be used. According to the literature surgical drains do not decrease SSI rate in children with perforated appendicitis [14]. They are only recommended when there are multiple abscesses in the abdominal cavity [15]. Drainage systems should only be used in selected cases to decrease SSI and treatment costs.

Competing interests

The authors declare that they have no competing interests.

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