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Original Research Article

Evaluation of partial wound closure in perforated appendicitis

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ABSTRACT

Background: Perforated appendicitis is a serious complication of acute appendicitis that usually occurs due to over delay in presentation, diagnosis, and surgical treatment. Wound infection is one of the important sequelae of perforated appendicitis. Method of the wound closure in perforated appendicitis is a critical factor that affects the incidence of wound infection and there is continuing controversy about the best method.
Methods: 362 patients with a diagnosis of acute appendicitis were enrolled in a prospective randomized study that extended over three years. The intraoperative gross pathological state of the appendix was recorded as either negative or uncomplicated or perforated appendicitis. The relationship between the wound infection with each one of the three methods of wound closure (primary closure, open wound with delayed primary closure and partial wound closure) had been reported. The hospital stays were recorded for each method.
Results: 18.78% of appendectomy was appendicitis negative, 62.98% uncomplicated appendicitis and 18.23% with perforated appendicitis. In the perforated appendicitis cases, Primary wound closure was used in 36.36%, open method and delay primary closure in 18.18% and partial wound closure in 45.45%. The wound infection rates were 37.5%, 16.66% and 13.33% in primary wound closure, open wound with delayed primary closure and partial wound closure respectively. Length of hospital stays were 7 days, 8 days and 4 days respectively.
Conclusions: Partial wound closure is superior to other methods of wound closure, which are primary wound closure and open wound with delayed primary wound closure.

Keywords: Closure, Perforated appendicitis, Wound

INTRODUCTION

Acute appendicitis is one of the most common causes of acute abdomen in children, adults and elderly patients.[1,2] In 1886, Fitz was the first who recognized and described acute appendicitis and recommended surgical treatment.[3] After that, early appendectomy became the standard treatment for acute appendicitis. Appendectomy is a usual operation in a daily surgical practice that is performed by emergency surgeons and it is often the first major procedure performed by a surgeon in training.[4] In spite of advances in diagnostic facilities, the diagnosis of acute appendicitis is remaining mainly clinical one. As such, the delay in diagnosis and treatment of acute appendicitis may lead to perforation.[5] Perforated appendicitis with its septic complications is one of the serious sequelae of acute appendicitis. Consequently, the problem of wound infection remains the most common complication after the appendectomy.

Although infection can occur in a number of locations, surgical site infection predominates. There is no unanimity about the method of wound closure in cases of perforating appendicitis, some advocating primary wound closure others advocating open wound and delayed primary closure. With the introduction of effective antimicrobial agents, there is a tendency toward primary wound closure in cases of perforated or gangrenous appendicitis.[6,7] These methods of closure (the primary

and open wound with delayed primary closure) both have points of strengths and weaknesses (with differences) regarding wound infections, hospital stays, socioeconomic effects and the need for another surgical intervention. In this study, I tried the method of partial wound closure in cases of perforated appendicitis and assessing its role in the aforementioned points.

METHODS

A prospective study that is conducted in Al-Sader Teaching General Hospital, Amara, Iraq for a period of about 3 years from May 2016 to April 2018. In this study, 362 patients were randomly enrolled [192 (≅ 53%) males vs. 170 (≅47%) females]. Their ages range is 5-82 years.

The diagnosed of acute appendicitis depended on clinical history and physical examination supported by some simple laboratory investigations (mostly complete blood picture and general urine examination)±ultrasound examination. With informed consent, all the patients had been operated on by the author surgeon with classical open appendectomy (through gridiron incision after a short period of preoperative preparation).

Preoperative antibiotics had been given to all of our patients in the form of i.v. third generation cephalosporin plus i.v. metronidazole one hour before surgery and had been continued for three days in uncomplicated cases and until complete apparent healthy wound healing in perforated cases.

During each appendectomy, the intraoperative gross pathological state of the vermiform appendix was recorded as either normal looking appendix (negative appendicitis) or inflamed appendix (positive appendicitis). The inflamed appendix was further divided into uncomplicated appendicitis and perforated appendicitis.

The exclusion criteria in this study were using another surgical incision other than gridiron incision to deal with other incidental intraabdominal pathologies.

In appendectomy for cases with perforated appendicitis, the wounds were managed with either primary closure or open wound and delayed primary closure (if clean, after 5 days) or partial wound closure. The selection of any method was depended on the surgeon preference and intraoperative evaluation of the severity of perforation and contamination.

In partial wound closure, about 1/3-1/2 of the lower part of the wound (skin and subcutaneous tissue) was left opened (unsutured) and the wound was allowed to heal and close spontaneously without a second attempt of suturing.

Wound infection was determined based on clinical features of surgical site infection (local features include redness, induration, excessive pain, swelling and presence of purulent discharge at the incision site and systemic features which include fever, malaise, and asthenia) supported by bacteriological cultures.

The data were collected and analyzed by (SPSS 20.0) then presented as tables of numbers and percentages. Statistical significance was considered when p value equal to or less than 0.05.

RESULTS

About 71.45% of cases of acute appendicitis have occurred in ages between 15-45 years (Table 1).

Table 1: The demographic distribution of the patients with acute appendicitis.

Age (in years)	No. of patients		Total no.	≅ %
	Males	Females		
<15	32	25	57	15.75
16-30	64	73	137	37.85
31-45	66	56	122	33.70
46-60	23	13	36	9.94
>60	7	3	10	2.76
Total	192	170	362	≅100

Positive appendicitis was present in 294 (≅81.2) patients and 68 (≅18.78) had negative appendicitis. Out of 294 with positive appendicitis, 66 (≅ 22.45%) patients had perforated appendicitis (Table 2).

The surgical wound of the patients with perforated appendicitis had been managed by primary closure in 24 cases, open wound and delayed primary closure in 12 cases and partial wound closure in 30 cases (Table 2).

Table 2: The methods of wound closure in perforated appendicitis.

Type of closure	No. of cases	≅ %
Primary closure	24	36.36
Open wound	12	18.18
Partial wound closure	30	45.45

Table 3: The appendices pathological states with wound infection rate and LOS.

Pathological state	No. of cases	Wound infection		Average hospital stay (days)
		No.	≅%	
Negative appendicitis	68	3	4.41	1.5
Uncomplicated appendicitis	288	18	6.25	2
Perforated appendicitis	66	15	22.72	7

Table 4: The types of wound closure with the frequency of wound infection and LOS.

Type of wound closure	No. of cases	Wound infection		Average hospital stay
		No.	≅%	
Primary closure	24	9	37.5	7
Open wound and delayed closure	12	2	16.66	8
Partial wound closure	30	4	13.33	4

In all the patients, the development of wound infections and length of hospital stay (LOS) were recorded (Table 3).

Regarding the patients with perforated appendicitis, the cases that are complicated by wound infection and the hospitalization period were recorded in relation to each type of wound closure (Table 4).

DISCUSSION

Surgical site infection is a significant distressful complication that may occur after any surgical procedure. These infections are associated with increased morbidity and mortality, increased the length of hospital stay and higher healthcare costs.[8] It is worthy here to remember the surgical wound classification system,[9] and the subsequent risks of surgical site infection. The surgical wound classification system is based on the type of surgical procedure and the suspected bacterial load present in the wound at the time of surgery.[10] In that system, the wounds are categorized into four classes, which are class I (clean), class II (clean-contaminated), class III (contaminated), and class IV (dirty-infected). Uncomplicated appendicitis is considered to be in class II, that carries < 10% infective risk which agrees with our study reported wound infection rate in uncomplicated and in negative appendicitis (≅6.25% and 4.41% respectively). Perforated appendicitis is scored between class III and IV that carries about 20-40% infective risk.[9,11] In the present study, the wound infection rate following appendectomy for perforated appendicitis was 22.72 and it is within these limits. Antibiotics have an important role in minimizing wound infection as the rate may be reduced to 3-4%,[12] and there are several studies that have recommended certain guidelines about the selection of appropriate antibiotics in some surgical procedures.[13-15] In spite of using perioperative antibiotics in all of our patients, we have not seen the former reduction in wound infection rate and this may be explained on the presence of other risk factors that predispose to wound infection in our patients like general health of the patients and the length of the delay in presentation and diagnosis. "Despite the routine use of prophylactic antibiotics that target both aerobic and anaerobic organisms, post-operative surgical wound infection remains the most common complication and the most common cause of morbidity after appendectomy".[16] Therefore, the surgeons struggle to prevent or to reduce the incidence of wound infection by undertaking some perioperative measures, which concentrate on controlling the risk factors and applying the proper surgical techniques. The proper surgical technique consists of drainage of all purulent material, debridement of all infected, devitalized tissue, and debris, and/or removal of foreign bodies at the site of infection, plus control of the underlying cause of infection.[17] In addition, type of wound closure is a critical factor in the development of wound infection. The wound becomes contaminated during operation for perforated appendicitis by manipulation and seepage of purulent exudate into the wound. Primary closure of such a wound creates a potential closed space infection.[18] Most of the studies that have dealt with this problem, concentrated on primary wound closure and the open wound with delay primary closure modalities.[16,19-21] Of course, each method has its advantages and disadvantages. The open wound with delayed primary closure for the dirty wounds was developed by French surgeons in the first world war for the management of contaminated war wounds.[22] Then, its application expanded and advocated by most surgeons especially in the pre-antibiotic era. In that modality, the wound is cleansed and irrigated with normal saline then packed with gauze (that is daily soaked with antiseptic solution) with insertion interrupted fine nylon sutures (through the skin and subcutaneous tissue) which are left untied. On the 3-5 postoperative day, delayed primary wound closure was performed at the bedside. The open wound with delayed primary closure was once considered the standard of surgical care in perforated appendicitis.[16] The open wound with delayed primary closure has the advantages of reduction of wound infection rate, but with disadvantages of the inconvenience of repeated wound dressings, longer hospital stays and higher healthcare cost.[16,23-26] Our study reported wound infection rate of the open method about 16.66% and this is higher than that recorded by the former studies, where the rate was around 4%. This is probably explained by that, in our study the open wound method was applied mostly in severe cases of perforation that is associated with relatively extensive inflammation and contamination. Taking into consideration the disadvantages of the open method, and with the introduction of effective antibiotics, the situation has been changed favoring the primary closure.[19,21,27,28] Moreover, these studies have encouraged primary wound closure and concluded that there was no significant difference in wound infection rate between two common methods of skin closure. Currently, primary wound closure has been the preferred method in perforated appendicitis in paediatric surgery field.[26,29,30] The related studies in this aspect reported different rates of wound infection with primary wound closure. The studies that had reported high rates include 43.9%, 55.6, 48%, and 37%, while the low rates of 0%, 1.4, 7.7%, and 11%.[16,20,26,28,31-33] Authors present series recorded high wound infection rate (37.5%).

In authors study, we also applied partial wound closure of appendectomy wound in some of the cases of perforated appendicitis. With this method, the wound is also cleansed with saline and irrigated by povidone iodine solution then we close the wound and subcutaneous tissue by deep interrupted nylon sutures, and about 1/3-1/2 half of the lower part of the wound was left opened (for self-drainage) and then covering the wound with the sterile dressing.

This method also needs a repeated clinical examination of the wound starting from the 3rd postoperative day (usually at the outpatient clinic). In most of author cases, the wounds became dry and healed with a very acceptable cosmetic appearance in the usual period like that of a completely closed wound. In author study, the partial wound closure method has lower wound infection rate in comparison with primary closure (13.33% vs. 37.5%) and it is a statistically significant difference (P value = 0.03). In addition, the partial wound closure has also lower wound infection rate in comparison with delayed closure methods (13.33% vs. 16.66%) but there is no statistical difference (p=0.7).

Furthermore, the partial wound closure method in the present study has a shorter period of hospitalization than other methods (4 days) vs. (7 days) in primary wound closure method and (8 days) in the open wound with delayed primary closure method) and so with lower health care costs. In our study, all cases that developed wound infection with partial wound closure were treated locally by just slight separation of lower part of wound edges with an artery forceps at the bedside (without using any anaesthesia) followed by irrigation with an antiseptic solution with dressing and all of them healed with the expected time. In authors study, there was no recorded mortality.

CONCLUSION

The surgeons have to remember the three methods of wound closure during appendectomy for perforated appendicitis, and we strongly recommend the using partial closure method as it has lower wound infection rate, lower hospital stays, less discomfort to the patient and less healthcare cost with very acceptable cosmetic appearance.

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