

## Primary closure versus delayed primary closure in perforated appendix: a comparative study

Mir Arsalan Ali, Batool Zehra Asjad, Sughra Perveen, Zakia Nehal, Bushra Kiran Rajput

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### Abstract

**Introduction:** Primary closure has the potential benefit of rapid wound healing associated with the elimination of painful and time-consuming dressing changes, as well as a reduction in overall hospital costs. Although controversy persisted concerning the optimal methods of wound management, recent studies tend to recommend that perforated appendicitis most often can be primarily closed without an increase in the wound infection rate as compared to delayed primary closure.

**Objective:** To compare the primary closure versus delayed primary closure in patients with perforated appendix

**Study design:** Randomized controlled trial

**Setting:** Department of Surgery, Jinnah Postgraduate Medical Centre, Karachi

**Duration of study:** 1 year from January 27, 2016 to January 26, 2017

**Material and Methods:** All patients aged 18-45 years of either gender having perforated appendix undergoing appendectomy were enrolled. Appendectomy was performed in the conventional manner and the appendicular stump was not invaginated in any of the cases. Muscles was approximated with interrupted 2/0 vicryl. External oblique was closed by continuous suture using vicryl 0 in PC group. The wound was thoroughly cleansed with normal saline only. In patients undergoing delayed primary closure, daily dressing was changed and in case of the presence of infection it was changed twice daily when required, till the closure of the wound. Wound was closed after refreshing the edges after 3<sup>rd</sup> post-operative days or once the infection was settled in cases of infected wounds. Final outcome was assessed on 7<sup>th</sup> post-operative day in terms of wound infection and duration of hospital stay as per operational definition.

**Results:** Mean age of the patients was  $37.36 \pm 10.49$  years. Mean duration of hospital stay was  $7.38 \pm 1.25$  days. There were 37 (61.70%) females and 23 (38.30%) males. Wound infection was found in 13 (21.70%) patients. 11 patients in Group-A (primary closure group) developed wound infection as compare to 2-patients in Group-B (delayed primary closure). Statistically significant difference was found in the comparison of wound infection with group B to A p-value 0.005. Regarding duration of stay in hospital, the duration with group-A  $6.24 \pm 0.47$  to group-B  $8.53 \pm 0.51$  p-value 0.001.

**Conclusion:** There is a significant difference in primary closure versus delayed primary closure in patients with perforated appendix

**Keywords:** Primary closure (PC), delayed primary closure (DPC), perforated appendix

### Introduction:

Acute appendicitis is a common indication for emergency abdominal surgery. The peak incidence of the appendicitis is in the early childhood.<sup>1</sup> Then it decreases with the age. The male

to female ratio is 1.3:1. The incidence of perforated appendix is higher in males and also at the extremes of ages.<sup>12</sup>

The obstruction of the lumen of the appendix

Jinnah Postgraduate  
Medical Centre, Surgical  
Ward-3, Karachi

MA Ali  
BZ Asjad  
S Perveen  
Z Nehal  
BK Rajput

### Correspondence:

Dr Batool Zehra Asjad  
House No. E-4, Block-B,  
North Nazimabad Karachi  
Cell: 0334-2873262  
Email: drbatoolzehra@  
hotmail.com

is the main causative factor in the perforation of appendix.<sup>3</sup> Fecoliths are responsible for the perforation of appendix in about 90% of cases of perforated appendix.<sup>5</sup> There are many contributing factors in the perforation of appendix. The most important factor is the late presentation of the patients, since the onset of symptoms.<sup>6</sup> The incidence of post-operative wound infection after appendectomy substantially increases with the severity of the appendicitis treated, and most infections occur after emergency appendectomy for perforated appendicitis.<sup>7,8</sup>

Of the many risk factors influencing post-operative wound infection, the method of skin closure has been implicated as an important factor. Delayed primary closure (DPC) and primary closure (PC) are two commonly used methods, but there is no consensus as to the optimal method. Open-wound management of contaminated wounds is a practical measure that has been used for centuries.<sup>9</sup> Three prospective randomized studies<sup>10</sup> for management of perforated appendicitis wounds showed no advantage to delayed primary closure in terms of decreased wound infection compared with PC, whereas another retrospective studies<sup>11</sup> showed delayed primary closure could more significantly reduce wound infection rate than PC. Bacterial contamination of the wound during surgery is the major factor responsible for the development of a subsequent wound infection. The offending organisms are predominantly bacteria from the colonic flora.<sup>12</sup> Recently, several groups have published updated guidelines for the choice of appropriate prophylactic antibiotics in abdominal surgery.<sup>10,13</sup> Some authors consider that perioperative antibiotic administration which allows primary closure of all appendectomy wounds, despite data suggesting that contaminated wounds have a higher rate of wound infection.<sup>11</sup>

This practice has been aggressively pursued by surgeons on the basis of its association with a "low" incidence of infectious complications, the elimination of painful and time-consuming dressing changes and reduction in cost.<sup>9,14</sup> Primary closure of appendicitis with perforation has also found its way into the management

algorithm, without adequate assessment of adverse outcomes. More recently, Yellin and colleagues<sup>15</sup> found a wound infection rate of 4% after delayed primary closure of all their advanced appendicitis wounds.

**Objective:** To compare the Primary closure verses delayed primary closure in patients with perforated appendix.

#### **Materials and Methods:**

This is a randomized controlled trial carried out in the Department of surgery, Jinnah Postgraduate Medical Centre, Karachi. All the patients were admitted from January 27, 2016 to January 26, 2017 are included in the study. The total of 60 patients with perforated appendix divided into two groups of 30 patients. Our sample technique was non-probability consecutive sampling. We included all patients of perforated appendix undergoing appendectomy, aged 18-50 years and either gender. Our exclusion criteria was pregnant women, patients with appendicular mass, Those patients who did not given consent also excluded from the study. Patients undergoing laparoscopic appendectomy, diabetic, liver cirrhosis are also excluded.

The patients were divided into two equal groups by lottery methods. Surgery was performed by a surgeon having more than 3 years post-fellowship experience. Appendectomy was performed in the conventional manner and the appendicular stump was not buried in any of the cases. Muscles were approximated with interrupted 2/0 vicryl. External oblique was closed by continuous suture using 0 vicryl in PC group. The wound was washed with normal saline. In patients undergoing delayed primary closure, dressing was be changed daily and if the infection is present then it was changed twice daily when required, till the closure of the wound. Wound was closed on 3<sup>rd</sup> post-operative day or in cases of infected wounds after settlement of infection. Final outcome was assessed on 7<sup>th</sup> post-operative day in terms of wound infection and duration of hospital stay. This information and the patient's demographics were noted in the proforma (attached as annexure) by the re-

Table-1: Age of the patients (60)

	Mean± SD	Minimum	Maximum
Age of the patients (in years)	37.36± 10.49	18	45

Table-2: Comparison of wound infection within group (60)

Group	Wound Infection			p-value
	Yes	No	Total	
Primary Closure Group-A	11 (36.7)	19 (63.3)	30 (100)	
Delayed Primary Closure Group-B	2 (6.7)	28 (93.3)	30 (100)	
Total	13 (21.7)	47 (78.3)	60 (100)	

Table-3: Comparison of duration of hospital stay within group

Group	N	Mean ±SD	p-value	95% CI
Primary Closure	30	6.24 ±0.47		
Delayed Primary Closure	30	8.53 ±0.51	0.001	-2.54 to -2.03

searcher.

The data was analyzed on SPSS version 21.0 for windows. The quantitative variables like age, duration of hospital stay was presented by their mean + SD. Frequency and percentages was calculated for gender, wound infection and hospital stay. Wound infection in the two groups were compared using chi square test, and hospital was compared using un- paired t test,  $p \leq 0.05$  was taken as significant. Confounders like age, gender, and obesity was controlled through stratification, chi-square test in case of infection and t-test was applied in case of duration of hospital stay to see the effect of these on outcomes.

**Results:**

There were 37(61.70%) females and 23(38.30%) males. (Figure 1) Wound infection was found in 13(21.70%) patients. (Figure 2) 11 patients in group-A (primary closure) developed wound infection as compared to 2 patients in group-B developed wound infections. This is statistically significant p-value 0.005. Regarding duration of stay in hospital in group-A  $6.24 \pm 0.47$  and in group-B  $8.53 \pm 0.51$  which is statistically significant p-value 0.001.

**Discussion:**

After an appendectomy procedure is completed, the most common morbidity is wound infection, and it may result increase pain in the pa-

tient, longer hospital stay, poor cosmesis, and overall higher costs. Two routinely employed methods of wound management following an appendectomy are delayed primary closure (DPC), which involves packing an open wound for 4 to 5 days followed by wound closure, and primary closure (PC).<sup>15</sup> It is well accepted that, once appendiceal perforation occurs, complication rates increase with wound infection and can rise to 15% to 25%.<sup>15,16</sup> Traditionally, in order to decrease the risk of infection at the surgical site, wounds associated with perforated appendicitis have been dealt with DPC. However, none of any large randomized trial proved the benefit of DPC in reducing the wound infection rate in patients following an appendectomy over primary closure. By contrast, clinical trials in the 1990s reported low rates of infection using PC in patients with perforated appendicitis.<sup>17</sup> Recent studies<sup>15,16</sup> mentioning meta analyses indicated that here is no increase risk of wound infection after primary closure in patients treated by appendectomy in complicated appendicitis. Chiang and others<sup>18</sup> in 2006 found a wound infection rate of 4.2% in delayed primary closure group of patients with perforated appendicitis compared with 43.9% in primary closure group.

Primary closure has the benefit of rapid wound healing associated with the decrease use of painful and time-consuming dressing changes, as well as a reduction in overall hospital costs as well as duration of hospital stay. Although controversy remains concerning the optimal methods of wound management, recent studies tend to recommend that perforated appendicitis most often can be primarily closed without an increase in the wound infection rate as compared to delayed primary closure.<sup>15</sup>

In this study, overall mean duration of hospital stay was  $7.38 \pm 1.25$  days. Wound infection was found in 13(21.70%) patients. 11 in group-A and 2 in group-B. Statistically significant difference was found in the comparison of wound infection with group-B (p-value 0.005) and in terms of duration of stay in hospital in group-A  $6.24 \pm 0.47$  and in group-B  $8.53 \pm 0.51$  which is statistically significant p-value 0.001

In a recent local study on complicated appendicitis the wound infection in primary and secondary closure was found in 5(10%) and 4(8%) patients respectively and no difference in the two groups was noted ( $p=0.699$ ). Length of hospital stay (in days) was  $2.30\pm 0.51$  and  $3.94\pm 0.84$  ( $p < 0.05$ ) in PC and DPC groups respectively.<sup>19</sup>

A latest international study, on the use of delayed primary closure to prevent wound infection after appendectomy for perforated appendicitis reported that there was only 1 wound infection in the delayed primary closure 1/34; (2.9%) and in the primary closure group, there were 14(38.9%) wound infections. There was a significant association between wound infection and the type of skin closure (DPC 2.9% vs. PC 38.9%;  $p < 0.001$ ). Analyzing the length of stay, there also was a noticeable difference in the duration of stay between both groups (DPC  $6.3\pm 0.7$  days vs. PC  $8.4\pm 0.9$  days;  $p=0.038$ ). This study provided valuable information about the possibility of DPC as a method of choice to reduce the incidence of wound infection after appendectomy.<sup>20</sup>

#### Conclusion:

There is a difference in Primary closure verses delayed primary closure in patients with perforated appendix

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#### Role and contribution of authors:

Dr Mir Arsalan Ali, concept & design, collection & assembly of data, analysis and interpretation of data, drafting of article, critical revision of article

Dr Batool Zehra Asjad, concept & design, analysis and interpretation of data, drafting of article, critical revision of article

Dr Sughra Perveen, critical revision of article

Dr Zakia Nehal, collection & assembly of data,

drafting of article

Dr Bushra Kiran Rajput, collection & assembly of data

#### References:

1. Khattak S, Aslam S, Kamal A. Acute Appendicitis: An audit of 663 cases. *Gomal Journal of Medical Sciences*, 2010; 8(2):209-211.
2. Baloch I, Bhatti Y, Abro H. Complications of acute appendicitis: A review of 120 cases. *Pak J Med Res*. 2009; 48(4).
3. Ng CP, Chiu HS, Chung CH. Significance of appendicoliths in abdominal pain. *J Emerg Med* 2003; 24: 459-61.
4. Wightman JR. Foreign body induced appendicitis. *S D J Med*. 2004; 57: 137.
5. Lodhi F, Ayyaz M, Majeed H3, Afzal F, Farooka MW, Choudhary Z. Etiological factors responsible for abdominal wound dehiscence and their management. *Ann KE Med Coll* 1999; 5: 312-4.
6. Ozguner IF, Buyukayavuz BI, Savas MC. The influence of delay on perforation in childhood appendicitis. A retrospective analysis of 58 cases. *Saudi Med J*. 2004;25: 1232-6.
7. Thomas SH, Silen W. Effect on diagnostic efficiency of analgesia for undifferentiated abdominal pain. *Br J Surg* 2003;90:5-9.
8. Andersen BR, Kallehave FL, Andersen HK. Antibiotics versus placebo for prevention of postoperative infection after appendectomy. *Cochrane Database Syst Rev* 2005;(3):CD001439.
9. Styruud J, Eriksson S, Nilsson I, Ahlberg G, Haapaniemi S, Neovius G, et al. Appendectomy versus antibiotic treatment in acute appendicitis: a prospective multicenter randomized controlled trial. *World J Surg* 2006;30:1033.
10. Temple CL, Huchcroft SA, Temple WJ. The natural history of appendicitis in adults: a prospective study. *Ann Surg* 1995;221:278-81.
11. Sauerland S, Lefering R, Neugebauer EA. Laparoscopic versus open surgery for suspected appendicitis. *Cochrane Database Syst Rev* 2004;(4):CD001546.
12. Abou-Nukta F, Bakhos C, Arroyo K, Koo Y, Martin J, Reinhold R, et al. Effects of delaying appendectomy for acute appendicitis for 12 to 24 hours. *Arch Surg* 2006;141:504-7.
13. Bickell NA, Aufses JAH, Rojas M, Bodian C. How time affects the risk of rupture in appendicitis. *J Am Coll Surg* 2006;202:401-6.
14. Kathkouda N, Mason RJ, Towfigh S, Gevorgyan A, Essani R. Laparoscopic versus open appendectomy: a prospective randomized double-blind study. *Ann Surg* 2005;242:439-48, discussion 448-50.
15. Guttman R, Goldman RD, Koren G. Appendicitis during pregnancy. *Can Fam Physician* 2004;50:355-7.
16. Henry MC, Moss RL. Primary versus delayed wound closure in complicated appendicitis: an international systematic review and meta-analysis. *Pediatr Surg Int*. 2005;21:625e30.
17. Pettigrew RA. Delayed primary wound closure in gangrenous and perforated appendicitis. *Br J Surg*. 1981;68:635e8.
18. Terasawa T, Blackmore CC, Bent S, Kohlwes RJ. Systematic review: computed tomography and ultrasonography to detect acute appendicitis in adults and adolescents. *Ann Intern Med* 2004;141:537-46.
19. Khan KI, Mahmood S, Akmal M, Waqas A. Comparison of rate of surgical wound infection, length of hospital stay and patient convenience in complicated appendicitis between primary closure and delayed primary closure. *J Pak Med Assoc*. 2012;62(6):596-8.
20. Chiang RA, Chen SL, Tsai YC. Delayed primary closure versus primary closure for wound management in perforated appendicitis: a prospective randomized controlled trial. *J Chin Med Assoc*. 2012;75:156e9.