



ORIGINAL RESEARCH PAPER

General Surgery

DELAYED PRIMARY CLOSURE VERSUS PRIMARY CLOSURE FOR WOUND MANAGEMENT IN PERFORATED APPENDICITIS :A PROSPECTIVE RANDOMIZED CONTROLLED TRIAL

KEY WORDS: Delayed primary closure; primary closure; perforated appendicitis

Dr. M. S. Nirmal Kumar*

Post Graduate, Meenakshi Medical College Hospital & Research Institute, Enathur, Karrapettai Post, Kanchipuram-631 552. Tamilnadu. *Corresponding Author

Dr. P. Seetha

Post Graduate, Meenakshi Medical College Hospital & Research Institute, Enathur, Karrapettai Post, Kanchipuram-631 552. Tamilnadu.

ABSTRACT

Background: As a matter of fact, it is still a point of discussion whether delayed primary closure (DPC) is better in reducing surgical site infections as compared with primary closure (PC) in case of contaminated abdominal incisions. The aim of this study was to ascertain the optimal method of wound closure for patients with perforated appendicitis.

Methods: This randomized controlled trial was conducted in department of surgery at a tertiary care teaching hospital at KANCHIPURAM (TAMILNADU) from DECEMBER 2019 to DECEMBER 2020. It included a total of 70 patients with perforated appendicitis. They were divided in to two random groups one with PC and other left open with Betadine-soaked gauze packing for DPC on the fifth postoperative day or later in case of appropriate conditions. Wound infection was considered when pus discharge was present with redness and swelling. The main outcome measures were the incidence of wound infection and the length of hospital stay (LOS).

Results: In the entire series, wound infection developed after incision closure in 21.4% of the patients. The PC group had a higher incidence of wound infection (36.1% vs. 6.2%, $p < 0.001$) and longer LOS (8.2 days vs. 6.5 days, $p = 0.041$).

Conclusions: The optimal management strategy for perforated appendicitis wounds is delayed primary closure. It considerably decreases the wound infection rate and length of stay.

INTRODUCTION:

Acute appendicitis is one of the most common causes of acute abdomen. Appendectomy is one of the most commonly performed emergency surgical procedures world-wide. In spite of appropriate use of antibiotics and proper peri-operative care procedures, post-operative surgical wound infection (SWI) still remains as one of the most common post-operative complication.¹ The infection rates range between 25% - 50% in most reported series.²

Open wound management was the treatment of choice previously for these cases but not preferred these days due to cosmetic purposes.³ Primary closure of wound is considered after an uncomplicated appendectomy procedure.⁴ The grossly contaminated wounds can be left open for secondary healing or delayed primary closure which is closed after a few days when the incision site permits closure.⁵ Such type of closure aids in lowering the SWI and hence reduces the length of hospital stay.

A few prospective randomized studies on management of perforated appendicitis showed almost no advantage⁶ of DPC over PC but the other set of retrospective studies revealed that DPC could more effectively reduce wound infection with significant reduction⁷ in hospital stay. Post-operative SWI is a major controversial parameter which makes it a necessity to compare the outcomes of primary and delayed wound closure. This study was curated to conduct a randomized controlled trail on patients with perforated appendicitis to determine whether choosing the method of DPC over PC could result in the decrease of SWI and reduction on the length of hospital stay.

METHODS:

This randomized controlled trial was carried out after obtaining the Ethical committee clearance from the institute in the department of general surgery, Meenakshi medical college and research institute. The present study was carried out for one year (December 2019 to December 2020) on 70 patients in which 32 patients were subjected to DPC and remaining 38 patients for PC. All cases of perforated appendicitis with grossly evident perforation identified by surgeons at the time of operation were included and

microscopical perforations identified by pathologists were not included. All patients received perioperative intravenous antibiotics with anaerobic coverage until normalization of temperature, white blood cell (WBC) count and gastrointestinal function. The patients had undergone a conventional appendectomy through a McBurney's point muscle-splitting incision and the stump of the appendix buried.

The two strategies of wound management were PC and DPC. The patients who were operated on odd dates were managed with PC and those who were operated on even dates were managed with DPC. The skin and subcutaneous tissue were packed with diluted Betadine-soaked gauze that was changed daily to prevent excessive collection of exudate. If the appearance of the wound was clean on postoperative Day 5, the wound was repaired under local anesthesia in the operating room. Else, wet packing was continued and when the wound appeared clean DPC was performed. Wound infection was defined as the presence of evident purulent discharge present at the incision site, with or without a positive bacterial culture. In both groups the infected wound were opened and packed, and bacterial culture of the pus was made.

Data Management And Analysis:

Data was coded and entered in ms excel sheet and analysis done using spss 17. Results were drawn on the basis of analysis and observation and compared with other relevant literature. The chi-square and Fisher exact tests were used to determine whether any association between the presence of wound infection and the type of skin closure existed.

RESULTS:

During study period 70 patients with perforated appendicitis were studied out of which 41 were males and 29 were females. All 70 patients received the allocated interventions. 32 patients were there in the DPC group and 38 in the PC group. The sex, age and underlying medical conditions in patients belonging to either groups were similar. The proportion of patients with one or more risk factors in both groups were DPC 25% vs. PC 13.6%, $p = 0.378$. The p value of duration of symptoms and WBC count between both groups were 0.265

and 0.179, respectively). These results are shown in **Table 1**.

Table: 1 Patient demographics and clinical manifestation

	DPC (n = 32)	PC (n = 38)	p value
Male/Female	21/14	20/15	0.908
Mean age (y)	37.2 ± 15.8	36 ± 17.2	0.672
Risk factors			
Patient with ≥ one risk factor	8 (25%)	5 (13.16%)	0.378
Diabetes mellitus	3	2	
Malnutrition	2	1	
Steroid use	2	1	
Cardiovascular disease	2	1	
Obesity (body mass	3	2	
Duration of symptoms (d)	2.8 ± 0.3	2.1 ± 0.2	0.265
WBC (× 1000/ul)	15.5 ± 1.0	14.5 ± 0.5	0.179

In the entire series, 15 patients (21.4%) developed wound infection after DPC or PC. The most common organisms cultured from the wounds were *Escherichia coli* (53%), *Bacteroides fragilis* (27%), and various *Streptococci* (20%). These organisms were compatible with those cultured from ascites during operation (**Table 2**).

Table: 2 Bacteria cultured from ascites and wound pus

	Ascites (n = 70)		Wound pus (n = 15)	
	DPC (n = 32)	PC (n = 38)	DPC (n = 1)	PC (n = 14)
No growth	3	3	0	1
<i>Escherichia coli</i>	20	27	2	6
<i>Bacteroides fragilis</i>	19	19	0	4
<i>Streptococcal species</i>	18	9	0	3
<i>Pseudomonas aeruginosa</i>	4	1	0	2
<i>Clostridial species</i>	4	3	0	0

One wound infection in the DPC group was identified, purulent discharge in the wound was noted after 3 days since DPC. The wound was then reopened and the pus culture yielded *E coli*, which was identical to the bacteria cultured from ascites during operation. All the other wounds were observed for a minimum of two weeks after DPC, and none had to be reopened.

Thus, the wound infection rate for DPC was 2/32 (6.25%) which was much lesser than that of PC group which was 13/38 (36.1%). The length of stay in hospital also showed significant difference between the two groups which were 6.5 ± 0.5 days for DPC group and 8.2 ± 0.8 days for PC group. These results are shown in **Table 3**.

Table: 3 Wound infection rate and length of stay

	DPC (n = 32)	PC (n = 38)	p value
WI	2 (6.25%)	13 (36.1%)	< 0.001
LOS (d)	6.5 ± 0.5	8.2 ± 0.8	0.041

There was a significant association between wound infection and type of skin closure (DPC 6.25% vs. PC 36.1%, p < 0.001).

DISCUSSION:

For centuries, open-wound management of contaminated wounds was the standard practical procedure.⁵ DPC was used popularly by military surgeons and was performed only after the wound appeared healthy.⁹ The post-operative wound infection is generally increased in emergency appendectomy performed for perforated appendicitis.¹⁰

Bacterial contamination of the wound during surgery is a primary factor responsible for the development of a subsequent wound infection and the bacteria from the colonic flora are the main contributors. Henceforth, PC and DPC of acute appendicitis have found their ways into the management

algorithm.

Many recent studies have shown that the SWI rate of primarily closed wounds in perforated appendicitis was 24% which was higher than compared to 4.2% of SWI rate as in DPC in perforated appendicitis.¹¹⁻¹⁴

In our study it was clearly evident that DPC reduces the rate of wound infection and the length of hospital stay is also considerably lower in DPC than in PC. The main advantage of DPC is that it reduces the number of colonic bacteria particularly anaerobes in contaminating the wound and at the same time DPC can also have the disadvantage of allowing the exogenous bacteria like *staphylococcus* to contaminate the wound.¹⁵ In this study, cross infection was not being a problem in patients treated with DPC. The organism that was cultured from the intra-operative peritoneal fluid was identical to the organism that caused the wound infection. With expert hands in practice laparoscopic appendectomy is quite effective and safer these days. This can in fact reduce the hospital stay and can also minimize the complications that occur in conventional open surgeries. Yet, they are a tad more complicated and not widely available. The clarity in diagnosis of complications, skill and experience in performing the management procedures, proper assessment of the patient's health status and a regular observation should all be given importance to.

CONCLUSION:

In our study it was found that DPC is a better and optimal method in wound management of perforated appendicitis due to the lower incidence of wound infection and reduced length in hospital stay in comparison with PC. In conclusion it is better to consider the strategy of delayed primary closure in wound management.

REFERENCES:

- Hindosh LN, Kamal ZB, Rezzqallah RE. Evaluation Of Risk Factors In Perforated Acute Appendicitis In Al-Kindy Teaching Hospital. Al-Kindy College Medical Journal. 2016 Jun 30;12(1):112-7.
- Williams RS, Wilson SE. Appendicitis. In: Howard RJ, Simons RL, eds. Surgical Infectious Disease, 3rd edition. Norwalk, CT: Appleton and Lange, 1995; 1167-77.
- Duttaroy DD, Jitendra J, Duttaroy B, Bansal U, Dhameja P, Patel G, Modi N. Management strategy for dirty abdominal incisions: primary or delayed primary closure? A randomized trial. Surgical infections. 2009 Apr 1;10(2):129-36.
- Bahar MM, Jangjoo A, Amouzesi A, Kavianifar K. Wound infection incidence in patients with simple and gangrenous or perforated appendicitis. Archives of Iranian medicine. 2010 Jan 1;13(1):13-6.
- Misteli H, Kalbermatten D, Settelen C. Simple and complicated surgical wounds. Therapeutische Umschau. Revue therapeutique. 2012 Jan 1;69(1):23-7.
- Pettigrew R. Delayed primary wound closure in gangrenous and perforated appendicitis. Br J Surg 1981;68:635e8
- Lemieur TP, Rodriguez JL, Jacobs DM, Bennett ME, West MA. Wound management in perforated appendicitis. Am Surg. 1999 May;65(5):439-43. PMID: 10231213.
- Stone HH, Hester Jr TR. Topical antibiotic and delayed primary closure in the management of contaminated surgical incisions. Journal of Surgical Research. 1972 Feb 1;12(2):70-6.
- Hester TR. Topical Antibiotics and Delayed Primary Closure in the Management of Contaminated Abdominal Wounds. Journal of Surgical Research. 1972;12:70.
- Berry Jr JO, Malt RA. Appendicitis near its centenary. Annals of surgery. 1984 Nov;200(5):567.
- Chiang RA, Chen SL, Tsai YC, Bair MJ. Comparison of primary wound closure versus open wound management in perforated appendicitis. Journal of the Formosan Medical Association. 2006 Jan 1;105(10):791-5.
- Yellin AE, Berne TV, Heseltine PN, Appleman MD, Gill M, Chin A, Baker FJ. Prospective randomized study of two different doses of clindamycin admixed with gentamicin in the management of perforated appendicitis. The American surgeon. 1993 Apr 1;59(4):248-55.
- Cohn SM, Giannotti G, Ong AW, Varela JE, Shatz DV, McKenney MG, Sleeman D, Ginzburg E, Augenstein JS, Byers PM, Sands LR. Prospective randomized trial of two wound management strategies for dirty abdominal wounds. Annals of surgery. 2001 Mar;233(3):409.
- Inyang AW, Usang UE, Talabi AO, Anyanwu LJ, Sowande OA, Adejuyigbe O. Primary versus delayed primary closure of laparotomy wounds in children following typhoid ileal perforation in Ile-Ife, Nigeria. African journal of paediatric surgery: AJP. 2017 Oct;14(4):70.
- Siribumrungwong B, Chantip A, Noorit P, Wilasrusmee C, Ungpinitpong W, Chotiya P, Leerapan B, Woratanarat P, McEvoy M, Attia J, Thakkinstian A. Comparison of superficial surgical site infection between delayed primary versus primary wound closure in complicated appendicitis: a randomized controlled trial. Annals of surgery. 2018 Apr;267(4):631.