

## ASSESSMENT OF WOUND MANAGEMENT IN TERMS OF DELAYED PRIMARY CLOSURE VERSUS PRIMARY CLOSURE IN PERFORATED APPENDICITIS

Chandra Mauli Vyas<sup>1</sup>, Mohd. Abbas Ali<sup>2\*</sup>

1. Assistant Professor, Department of Department of Surgery, Jhalawar Medical College, Jhalawar (Raj), India, 2. Associate Professor, Department of Department of Sugary, RUHS College of Medial Sciences, Jaipur

\*Email id of corresponding author- [dr.abbasalizaidi@gmail.com](mailto:dr.abbasalizaidi@gmail.com)

Received: 06/01/2017

Revised: 11/07/2017

Accepted: 20/07/2017

### ABSTRACT

**Background:** Appendectomy is the most common emergency surgical procedure and most common cause of acute abdomen pain in adults is acute appendicitis. Despite the use of broad spectrum antibiotics postoperative wound infection remains the most frequent complication. The method of wound closure has been implicated as an important factor influencing postoperative wound infection out of the many risk factors. **Material & Methods:** The present prospective comparative study carried out among 200 patients of perforated appendicitis. History and data were recorded on a pre-tested proforma. After the written informed consent was obtained all study patients were randomly allocated in to two groups A and B using lottery method. All patients were followed up to 8th post closure days to detect effectiveness of procedure and wound infection. **Results:** out of total 200 patients 94 (47%) patients in the range of 15–25 years, 70 (35%) patients in the range of 26–35 years and 36 (18%) patients in the range of 36–45 years. In Primary closure group 33% male and 67% females and in Delayed primary group 38% male and 62% females. 22.5% patients developed wound infection. In the primary closure group, wound infection was observed in 39% patients and in the Delayed primary closure group, wound infection was observed in 6% patients (P value < 0.001). **Conclusion:** we concluded that delayed primary closer is the better method for perforated appendicitis in terms of wound management because of it has lower incidence of wound infection and greater effectiveness when compared with primary closer.

**Key words:** Delayed primary closure, primary closure, perforated appendicitis.

### INTRODUCTION:

Hydatidosis Appendectomy is the most common emergency surgical procedure and most common cause of acute abdomen pain in adults is acute appendicitis with male preponderance.(1) Despite the use of broad spectrum antibiotics which covers both the aerobic and anaerobic organisms, postoperative wound infection

remains the most frequent complication and can increase post-operative morbidity.(2) Which indirectly results in increase post-operative pain, sepsis, hospital stay, cost burden and over all patient dissatisfaction.(3) Incidence of wound infection in perforated ones is 15–20% and in non-perforated appendicitis is reported to be less

than 10%.(1) The method of wound closure has been implicated as an important factor influencing postoperative wound infection out of the many risk factors.(4) Primary closure and Delayed primary closure are two commonly used methods, but there is no general agreement about the optimal method.(5) . The foremost reason for this controversy between primary closure and delayed primary closure after the perforated appendicitis surgery is post-operative wound infection. Recent research suggest that even in perforated appendicitis wound can be closed by primary closure in addition with the antimicrobial regimes and also gives better outcomes than delayed primary closure in terms of treatment tolerability and cosmetic outcome.(6)

We conducted a this prospective study on patients with perforated appendicitis and the objective of present study was to compare the efficacy of primary wound closure with delayed primary wound closure which could result in a decreased rate of wound infection after surgery and get evidence of the effectiveness of either procedure.

## **MATERIALS & METHODS**

The present study was randomized controlled trial carried out in the department of general surgery at SRG hospital, Jhalawar medical college, Jhalawar (Rajasthan) during the period of May 2017 to August 2017. Non-probability sampling method was used and 100 Patients in each group divided using 20% proportion of post-operative wound infection in primary closure group and 5% proportion of post-operative wound infection in delayed primary closure group at 95% confidence interval and 90% power of the test by using Epi info v7. (7) All patients with perforated appendicitis of either sex of 18–65 years were included in the study. Patients with appendicular abscess, previous history of surgery, steroids history and having diabetes mellitus and HIV/AIDS were excluded from the study. The demographic and clinical history of all patients i.e., name, age, gender, were recorded on a pre-designed proforma and

history was taken (pain in right iliac fossa, vomiting) followed by physical examination (tenderness in right iliac fossa) and blood work (white cell count  $\geq 11000$  cm<sup>3</sup> /dl) and thereafter diagnosed per operatively as perforated appendix. After the written informed consent was obtained all patients were randomly allocated in to two groups A and B using lottery method. Group-A was underwent primary closure of the skin (immediately after surgery) and group-B was underwent delayed primary closure of the skin (3 days after surgery). All patients were followed up to 8th post closure days to detect effectiveness of procedure and wound infection, skin stitches were removed 10 days after wound closure. The data were analyzed using MS Excel 2010, Epi Info v7 and SPSS v22.

## **RESULTS**

A total of 200 patients, 35% male and 65% female were included in the study. The mean age of the patients was  $27.51 \pm 7.12$  years within a range of 18–45 years. There were 94 (47%) patients in the range of 15–25 years, 70 (35%) patients in the range of 26–35 years and 36 (18%) patients in the range of 36–45 years (Table-2). There was no subjects withdrawn from the study, and there was also no peri-operative mortality and no major complication such as intra-abdominal abscess, appendical stump leakage or organ failure. The patients were divided into two equal groups. Each Primary closure group and delayed primary closure group had 100 patients. In Primary closure group 33% male and 67% females and in Delayed primary group 38% male and 62% females (Table-3). The mean age of patients in the primary closure group was  $26.7 \pm 7.32$  years while in the delayed primary group was  $28.2 \pm 6.88$  years. In the entire series, 22.5% patients developed wound infection. In the primary closure group, wound infection was observed in 39% patients and in the Delayed primary closure group, wound infection was observed in 6% patients and P value  $< 0.001$ (Table-1).

**Table-1: Wound infection rate in different groups**

<b>Wound infection</b>	<b>Primary closure group</b>	<b>Delayed primary closure group</b>	<b>Total</b>
<b>Yes</b>	39	6	45 (22.5%)
<b>No</b>	61	94	155(77.5%)
<b>Total</b>	100	100	200

\*p value< 0.001

Daily saline soaked packing used for wounds of patients which were opened by removing the skin stitches only and managed by the open technique. There was statistically significant result found between primary closure and delayed primary closure in age group 15-25years. Results were highly significant in the age group of 26-35 years and 36-45 years (p value<0.001).[table 2]

It was observed that effectiveness of delayed primary closure over primary closure was statistically significant with age and the similar results found when effectiveness of wound healing was compared with sex and this difference was also highly statistically significant (p value<0.001). [table 3]

**Table-2: Effectiveness in different age groups**

<b>Age groups</b>	<b>Effectiveness</b>	<b>Primary closure group</b>	<b>Delayed primary closure group</b>	<b>Total</b>	<b>P value</b>
<b>15-25 years</b>	No	25(83.3%)	5 (16.7%)	30(100%)	<b>&lt;0.001</b>
	Yes	30(46.9%)	34(53.1%)	64(100%)	
	Total	55(58.5%)	39(41.5%)	94 (100%)	
<b>26-35 years</b>	No	12(92.3%)	1(7.7%)	13(100%)	<b>&lt; 0.001</b>
	Yes	17(29.8%)	40(70.2%)	57(100%)	
	Total	29(41.4%)	41(58.6%)	70 (100%)	
<b>36-45 years</b>	No	3 (100%)	0 (00%)	03(100%)	<b>&lt; 0.001</b>
	Yes	12(36.4%)	21(63.6%)	33(100%)	
	Total	15(41.7%)	21(58.3%)	36 (100%)	

**Table-3: Effectiveness in different gender groups**

Gender groups	Effectiveness	Primary closure group	Delayed primary closure group	Total	P value
Male	No	12(85.7%)	2 (14.3%)	14(100%)	<0.001
	Yes	20(35%)	37(65%)	57(100%)	
	Total	32(46.5%)	39(53.5%)	71 (100%)	
Female	No	28(87.5%)	4(12.5%)	32(100%)	< 0.001
	Yes	39(84.4%)	58(59.8%)	97(100%)	
	Total	67(51.9%)	62(48.1%)	129 (100%)	

## DISCUSSION

For centuries open-wound management of contaminated wounds was a practical measure. In 1860s, Theodor Billroth was a proponent in the management of open wounds.(8) The use of Delayed primary closure was popularized by military surgeons during world war two At that time Delayed primary closure was performed only after the appearance of a healthy wound, usually after post-operative period of 3-7 days.(9) The incidence of wound infection after appendectomy increases nowadays and most infections occur after emergency appendectomy. Bacterial contamination of the wound in peri-operative period is the major factor responsible for the subsequent wound infection and this leads to financial burden and complications of wound infection and its consequences.

Davey and Nathwani found in their study that excess in financial burden per wound infection cost of \$600 for an inguinal hernia repair and around \$2,152 for colorectal surgery. (10)

Other authors also have reported the increased costs associated with the prolongation in hospital stay. Riou *et al* reported in their study a wound infection rate of 45% among 2,761 patients

undergoing major abdominal surgery during a 5-year period.(11)

Bucknall *et al* found in a prospective study of 1129 major laparotomies that incidence of 1.7% of burst abdomen and a 7.4% incidence of incisional hernia where wound infection was a significant contributing factor (p value < 0.05). (12) These findings which were suggestive of increased incidence and significant complications associated with wound infection recommends that it is essential to avoid wound infection at foremost.

Solit recorded in his case reports in 1968 and compared the primary closer and delayed primary closer and found near similar results to present study, he reviewed the perforated appendiceal wounds however, before current antimicrobial regimens were available and found a wound infection rate of 2.3% for delayed closure compared to 14.6% with Primary closure. (13)

Many years later, Lemieur *et al* in 1999 found that wound infection rate in perforated appendicitis of 24% among 319 patients when

the wound closed by primary closer technique, (14) and Yellin *et al* conducted a Prospective randomized study in the management of perforated appendicitis in 1993 found that wound infection rate of approximately 4% after Delayed Primary Closure of advanced appendicitis wounds. (15)

On the contrary to present study and all studies did in past by many authors, Tsang *et al* did a prospective controlled study in 1992 in 63 children with gangrenous or perforated appendicitis and found no statistical difference in the rate of wound infection between primary closer and delayed primary closer groups. (16)

These above listed studies were at least 20 years old, which highlighting the need of time to conduct a trial to address this issue. Our study compared the wound infection rate and effectiveness between primary closer and delayed primary closure techniques after perforated appendicitis. Being categorized as contaminated surgery because the chances of wound infection are high after appendiceal perforation due to colonic bacteria and delayed primary closure has been considered as a better option for its management. But on the other hand the cosmetic results and patient tolerability of delayed primary closure are not as good as compared to the results in primary closure. An international systematic review and meta-analysis by Henry *et al* in 2005 have shown that primary closure is well tolerated and after perforated appendicitis when the wound is thoroughly washed with normal saline and with perioperative antibiotics coverage results are good and concluded that primary closure is a safe and practical treatment option.(17)

Similar results were also found by Rucinski *et al* in 2000 in a meta-analytic study of 2532 patients indicates that the incision should be closed primarily.(18)

The study population of present study was almost similar to the study conducted by Khan *et al* in 2012 and also done on sample size of 100 patients but results stated that Primary Closure not only reduces the cost of treatment, but is also be more satisfying for the patients on the other hand our study showed that delayed primary

closure is more suitable for wound management after perforated appendicitis. (19)

This was against our tested hypothesis. We found that delayed primary closure was more effective than primary closer in the management of perforated appendicitis wounds. The wound becomes more contaminated during operative period for perforated appendicitis seepage of purulent exudate into the wound and by manipulation. Primary closure of these contaminated wounds creates a closed space infection. Therefore it is better to manage such a wound with delayed primary closure.

## CONCLUSION

Our study found that in patients undergoing open appendectomy procedure for perforated appendicitis, delayed primary closer was the better method for wound management because of its lower incidence of wound infection and greater effectiveness when compared with primary closer. In conclusion, a strategy of delayed primary closure should be considered in the management of perforated appendicitis cases to prevent patients from complications.

## REFERENCES

1. Williams NS, Bulstrode CJK (Christopher JK., O'Connell PR, Love RJM (Robert JM, Bailey H. Bailey & Love's short practice of surgery. CRC Press; 2013. 1517 p.
2. Mehrabi Bahar M, Jangjoo A, Amouzeshi A, Kavianifar K. Wound infection incidence in patients with simple and gangrenous or perforated appendicitis. *Arch Iran Med* [Internet]. 2010 Jan;13(1):13–6. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/20039763>
3. Bickel A, Gurevits M, Vamos R, Ivry S, Eitan A. Perioperative Hyperoxygenation and Wound Site Infection Following

- Surgery for Acute Appendicitis. *Arch Surg* [Internet]. 2011 Apr 1;146(4):464. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/21502457>
4. Misteli H, Kalbermatten D, Settelen C. [Simple and complicated surgical wounds]. *Ther Umsch* [Internet]. 2012 Jan;69(1):23–7. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/22198933>
  5. Duttaroy DD, Jitendra J, Duttaroy B, Bansal U, Dhameja P, Patel G, et al. Management Strategy for Dirty Abdominal Incisions: Primary or Delayed Primary Closure? A Randomized Trial. *Surg Infect (Larchmt)* [Internet]. 2009 Apr;10(2):129–36. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/19388835>
  6. Sookpotarom P, Khampiwmar W, Termwattanaphakdee T. Vigorous wound irrigation followed by subcuticular skin closure in children with perforated appendicitis. *J Med Assoc Thai* [Internet]. 2010 Mar;93(3):318–23. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/20420106>
  7. Chiang R-A, Chen S-L, Tsai Y-C, Bair M-J. Comparison of Primary Wound Closure Versus Open Wound Management in Perforated Appendicitis. *J Formos Med Assoc* [Internet]. 2006 Oct;105(10):791–5. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/17000451>
  8. Meissner K, Meiser G. Primary open wound management after emergency laparotomies for conditions associated with bacterial contamination. Reappraisal of a historical tradition. *Am J Surg* [Internet]. 1984 Nov;148(5):613–7. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/6388381>
  9. McLachlin AD, Wall W. Delayed primary closure of the skin and subcutaneous tissue in abdominal surgery. *Can J Surg* [Internet]. 1976 Jan;19(1):37–40. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/1106827>
  10. Davey PG, Nathwani D. What is the value of preventing postoperative infections? *New Horiz* [Internet]. 1998 May;6(2 Suppl):S64-71. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/9654314>
  11. Riou JP, Cohen JR, Johnson H. Factors influencing wound dehiscence. *Am J Surg* [Internet]. 1992 Mar;163(3):324–30. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/1531739>
  12. Bucknall TE, Cox PJ, Ellis H. Burst abdomen and incisional hernia: a prospective study of 1129 major laparotomies. *Br Med J (Clin Res Ed)* [Internet]. 1982 Mar 27;284(6320):931–3. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/6279229>
  13. Grosfeld JL, Solit RW. Prevention of wound infection in perforated appendicitis: experience with delayed primary wound closure. *Ann Surg* [Internet]. 1968 Nov ;168(5):891–5. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/4879203>
  14. Lemieur TP, Rodriguez JL, Jacobs DM, Bennett ME, West MA. Wound management in perforated appendicitis. *Am Surg* [Internet]. 1999 May;65(5):439–43. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/10231213>
  15. Yellin AE, Berne T V, Heseltine PN, Appleman MD, Gill M, Chin A, et al.

Prospective randomized study of two different doses of clindamycin admixed with gentamicin in the management of perforated appendicitis. *Am Surg* [Internet]. 1993 Apr;59(4):248–55. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/8489087>

16. Tsang TM, Tam PKH, Saing H. Delayed Primary Wound Closure Using Skin Tapes for Advanced Appendicitis in Children. *Arch Surg* [Internet]. 1992 Apr 1 ;127(4):451. Available from: <http://archsurg.jamanetwork.com/article.aspx?doi=10.1001/archsurg.1992.01420040097017>
17. Henry MCW, Moss RL. Primary versus delayed wound closure in complicated appendicitis: an international systematic review and meta-analysis. *Pediatr Surg Int* [Internet]. 2005 Aug 26 ;21(8):625–30. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/16044261>
18. Rucinski J, Fabian T, Panagopoulos G, Schein M, Wise L. Gangrenous and perforated appendicitis: A meta-analytic study of 2532 patients indicates that the incision should be closed primarily. *Surgery* [Internet]. 2000 Feb ;127(2):136–41. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/10686977>
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* [Internet]. 2012 Jun ;62(6):596–8. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/22755347>