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Original Research Article

Comparison of superficial site infection between delayed primary and primary wound closures in ruptured appendicitis

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ABSTRACT

Background: The aim of the study was to compare the superficial surgical site infections between delayed primary closures and primary closures in ruptured appendicitis.
Methods: This study was a retrospective study conducted in Chalmeda Anand Rao Institute of Medical Sciences, Karimnagar during the period of August 2012 to October 2015.
Results: 86 patients with ruptured appendicitis were eligible and their data were retrieved; 66 (76.7%) patients had received DPC and 20 (23.3%) patients had received PC. The SSI rate was much lower in PC patients than in DPC patients. There was an approximately 77% lower risk of SSI in the PC group than in the DPC group, but this did not reach statistical significance.
Conclusions: This study concluded that in ruptured appendicitis, risk due to SSI showed no difference between PC and DPC techniques. In low risk SSI patients, PC does not increase risk of SSI

Keywords: Appendicitis, DPC, Peritonitis

INTRODUCTION

A ruptured appendix is a rupture spreads infection throughout your abdomen (peritonitis). Possibly life-threatening, this condition requires immediate surgery to remove the appendix and clean your abdominal cavity.[1] The appendix is a small extension of the intestine that is connected to the large intestine (colon). The appendix is usually located in the right lower side of the belly, and it is tubular in shape. Its length differs based on the age. The appendix has no known important function.[2,3]

Appendicitis is inflammation and infection of the appendix and often results from blockage of the appendix by stool (feces). Sometimes the feces forms a small stone called a fecalith. Other causes of appendicitis include swelling of lymph tissues within the appendix wall because of recent infection; sometimes worms can also block the appendix.[4] For ruptured appendicitis, the time interval between onset of symptoms and rupture of the appendix is about 36 to 72 hours. Rupture occurs in about one of three patients admitted to children's hospitals. The severity of ruptured appendicitis is different for every patient. Some children have a small rupture, while others may have a big spillage of stool and pus into the abdomen.[5] Still others can have problems with intestinal blockage from the inflammation and infection. Some children who have appendicitis going on for days before the diagnosis may be so sick that the infection spreads into the blood stream. This is a serious condition and can be life-threatening. These patients will need to be stabilized before undergoing surgery. Therefore, the treatment including timing of surgery depends on how sick the patient is. After appendectomy, the most common postoperative complication is superficial surgical site infection, which commonly occurs in complicated appendicitis i.e. gangrenous and ruptured appendicitis. Increased hospital stay, nursing care,

treatment of antibiotic and readmission is caused by superficial surgical site infection which finally results in medical costs increasing for both health care providers and patients directly or indirectly. Superficial surgical site infection can be decreased by avoiding smoking, controlling glucose levels, use of antibiotics, avoiding surgical drain and hair removal unnecessarily. For a contaminated wound, closing it by delayed primary closure also causes surgical site infection. The wound is left open with standard wound care and it is later closed on the 3rd or 4th day, instead of closing the wound primarily. This causes local wound resistance to increase and decreases the bacterial contamination. Delayed primary closure has disadvantages also like increased hospital stay and cost of treatment. However, delayed primary closure is currently used. This study compares the superficial surgical site infections between delayed primary closures and primary closures in ruptured appendicitis.

METHODS

This study was a retrospective study conducted in Chalmeda Anand Rao Institute of Medical Sciences, Karimnagar during the period of August 2012 to October 2015. The patient's medical records were reviewed if they were eligible.

Inclusion criteria was that age of greater or equal to 15 years, patient should have an appendectomy with right lower quadrant incision and who had diagnosis of ruptured appendicitis.

Exclusion criteria aged 15 years, had an appendectomy with right lower quadrant incision, and had pathological diagnosis of ruptured appendicitis. Patients with an additional midline incision, apart from the right lower quadrant incision

Baseline characteristics of the patients like sex, age, clinical data like diabetes, patients on immunosuppressive drugs, ASA classification, surgical data were noted. Surgical site of infection was classified as within 30 days, infection should occur after operation, infection which involves skin and subcutaneous tissue. Infection must have purulent drainage from the superficial incision, from the superficial incision, organisms isolated from an aseptic culture of fluid or tissue, had one of the signs of tendeness, pain, redness or heat, and the incision was opened by the surgeon with or without positive culture.

Analysis was performed by STATA version 12.0; $p<0.05$ was considered as statistically significant.

RESULTS

The medical records of 86 cases identified during the study period were reviewed. The mean age of the patients was 38 years and 75 (87%) were men. All patients were prescribed a prophylaxis antibiotic.

Table 1: Patient characteristic in study.

Variables	PC N=10	DPC N=76	P value
Age (SD)	38 (15)	42 (16)	>0.05
Sex			
Male	8 (80%)	66 (86.8%)	>0.05
	2 (20%)	10 (17.2%)	>0.05
Diabetes	1 (10%)	6 (7.8%)	>0.05
Symptom duration	24 (1, 96)	24 (14, 48)	>0.05
ASA classification			
ASA 1,2	9 (90%)	68 (89%)	>0.05
ASA 3,4	1 (10%)	18 (11%)	>0.05
Operative duration			
<60 mins	4 (40%)	20 (26.4%)	>0.05
>60 mins	6 (60%)	56 (73.6%)	>0.05

The median duration of symptoms before admission was 24 hours, with a range of 1- 96 hours. The median operative time was 78 minutes. The average duration of re-suture after DPC was 4 days (SD 1.6) post-operation. The average length of stay (LOS) was 6 days (SD 3). Among 86 patients, 76 (88%) DPC (delayed primary closure) and 10 (12%) PC (primary closure), respectively. Characteristics of the patients were compared between the two groups (Table 1).

Table 2: Risk factors for postoperative superficial surgical site infection.

	Superficial SSI		
Factors	**Yes (n=20)**	**No (n=66)**	**P value**
Type of closures			
DPC	19 (95%)	60 (91%)	
PC	1 (5%)	6 (9%)	
Age(SD)	36 (16)	39 (16)	>0.05
Sex			
Male	13 (65%)	45 (68%)	>0.05
	7 (35%)	21 (32%)	>0.05
Diabetes	2 (10%)	6 (9%)	>0.05
Symptom duration	32 (6,72)	24 (1,96)	>0.05
ASA classification			
ASA 1,2	17 (85%)	62 (94%)	>0.05
ASA 3,4	3 (15%)	4 (6%)	>0.05
Operative duration			
<60 mins	4 (20%)	34 (36.5%)	>0.05
>60 mins	16 (80%)	42 (63.5%)	>0.05

20 patients had superficial incisional SSI, overall rate of 23.2%. The SSI rate with an tended to be lower in the PC than the DPC group, with rates of 5% versus 9% respectively (Table 2). Patients who received PC would be at an approximately 77.8% lower risk of SSI than

patients who received DPC, but this was not significantly different. LOS was 6days (SD 3.1) and 5.8 days (SD 2.5) after DPC and PC, respectively (p>0.05). The average day of resuture after DPC was 4.7 days (SD 2.2) and 4.2 days (SD 1.3) in SSI and non-SSI, respectively. No other risk factors were significantly associated with SSI, except duration of operation, which showed a trend of association. This suggested that an operative time >60 minutes might increase the risk of wound infection.

DISCUSSION

We conducted a retrospective cohort study including 86 patients with ruptured appendicitis. The superficial SSI rate was approximately 77.8% lower in PC than in DPC patients, although this was not significant. An operative time > 60 inutes seemed to be a risk factor for SSI.

Our results are similar to those of a previous systematic review and meta-analysis in pediatric patients and randomized controlled trial of ileostomy closure, which found that PC did not increase the rate of wound infection after operation, thus encouraging applying PC due to the lack of benefit of DPC. By contrast, some studies found a considerable benefit of DPC.

The prevalence of superficial SSI after PC in rupture appendicitis varied from 9% to 50%.[6,7] This may be explained by a different definition of superficial SSI, different care, and setting of patients. DPC may be of benefit if the SSI rate is low, as demonstrated by one costutility analysis. Improvement of healthcare and operative techniques can decrease postoperative superficial SSIs and thus DPC may be required less.

Other studies Siribumrungwong B et al conducted a multicenter randomized controlled trial which was conducted in 6 hospitals.[6] Superficial SSI was defined by the Center for Disease Control criteria. Secondary outcomes included postoperative pain, length of stay, recovery time, quality of life, and cost of treatment. In all the patients, 303 and 304 patients were randomized to PC and DPC groups, and 5 and 4 patients were lost to follow-up, respectively, leaving 300 and 298 patients in the modified intention-to-treat analysis. The superficial SSI rate was lower in the PC than DPC groups [ie, 7.3% (95% confidence interval 4.4, 10.3) vs. 10% (95% Cl 6.6, 13.3) with a risk difference (RD) of 2.7% (-7.1%, 1.9%), but this RD was not significant. Post-operative pain, length of stay, recovery times, and quality of life were non-significantly different with corresponding RDs of 0.3 (2.5, 3.0), 0.1 (0.5, 0.3), 0.2 (0.8, 0.4), and 0.02 (0.01, 0.04), respectively. Korol et al findings, Median SSI incidence was 3.7%, ranging from 0.1% to 50.4%.[7] Incidence of overall SSI and *S. aureus* SSI were both highest in tumor-related and transplant surgeries. Median time until SSI onset was 17.0 days, with longer time-to-onset for orthopedic and transplant surgeries. Risk factors consistently identified as associated with SSI included co-morbidities, advanced age, risk indices, patient frailty, and surgery complexity. Thirteen studies considered diabetes as a risk factor in multivariable analysis; 85% found a significant association with SSI, with odds ratios ranging from 1.5-24.3. Longer surgeries were associated with increased SSI risk, with a median odds ratio of 2.3 across 11 studies reporting significant results.

Wilasrusmee C et al, a two-phase cross-sectional study patients with abdominal pain and suspected of having appendicitis were enrolled.[8] Multiple logistic regression was applied to develop a parsimonious model. Calibration and discrimination performances were assessed. In addition, our RAMA-AS was compared with Alvarado's score performances using ROC curve analysis. The RAMA-AS consisted of three domains with seven predictors including symptoms (i.e., progression of pain, aggravation of pain, and migration of pain), signs (i.e., fever and rebound tenderness), and laboratory tests (i.e., white blood cell count (WBC) and neutrophil). The model fitted well with data, and it performed better discrimination than the Alvarado score with C-statistics of 0.842 (95% CI 0.804, 0.881) versus 0.760 (0.710, 0.810). Internal validation by bootstrap yielded Sommer's D of 0.686 (0.608, 0.763) and C-statistics of 0.848 (0.846, 0.849). The C-statistics of two external validations were 0.853 (0.791, 0.915) and 0.813 (0.736, 0.892) with fair calibrations.

St. Peter et al reported records of all patients undergoing laparoscopic appendectomy for appendicitis during the immediate 2 years before using the definition were compared to those treated in the 2 years after the definition was implemented.[9] Interval and incidental appendectomies were ruled out. The postoperative abscess rate (when perforation was not defined) was compared to the abscess rate of those for whom perforation was strictly defined. There were 292 patients treated for acute non-perforated appendicitis in the 2 years before the definition and 388 patients after the definition. There were 131 patients treated for perforated appendicitis before the definition and 161 after the definition was implemented. The abscess rate in those with perforated appendicitis increased from 14% to 18% after the definition was used. However, after the definition began to be used, the abscess rate for those patients treated as non-perforated decreased from 1.7% to 0.8%.

Bahar M et al conducted an observational study which was carried out on 400 patients with gangrenous or perforated (50%) and simple appendicitis (50%). Both groups underwent primary wound closure.[10] Patients were followed for wound infection for at least one month after surgery. Data including age, sex, operating time, pathologic report and wound infection were collected. A comparison between the studied groups was made using Student's t-test for continuous variables and 2 test for categorical variables. The median age of the patients was 23 years. There were 141 (35.2%) females and 259 (64.8%) males. The median operating time was 30

minutes. Wound infections were observed in 15 patients (3.7%), including 6 cases of simple and 9 cases of gangrenous or perforated appendicitis which was not statistically significant.

Pettigrew conducted a prospective randomized trial was performed on 122 patients with perforated or gangrenous appendicitis to determine whether delayed primary wound closure lowered morbidity from wound infection.[11] The 54 per cent wound infection rate with delayed primary closure was significantly inferior to the 18 per cent infection rate for primary closure with topical ampicillin powder (p=0.0082), but not significantly different from the 37 per cent infection rate for primary closure alone. Furthermore, patients disliked delayed primary closure, their hospital stay was prolonged and 17 per cent of their wounds became contaminated with *Staphylococci* before being closed. Delayed primary wound closure should not be used in treating perforated and gangrenous appendicitis wounds.

CONCLUSION

This study concluded that in ruptured appendicitis, risk due to SSI showed no difference between PC and DPC techniques. In low risk SSI patients, PC does not increase risk of SSI.

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REFERENCES

1. Duttaroy DD, Jitendra J, Duttaroy B, et al. Management strategy for dirty abdominal incisions: primary or delayed primary closure? A randomized trial. Surg Infect (Larchmt). 2009;10:129–36.
2. Brasel KJ, Borgstrom DC, Weigelt JA. Cost-utility analysis of contaminated appendectomy wounds. J Am Coll Surg. 1997;184:23–30.
3. Leaper DJ, Edmiston CE. World Health Organization: global guidelines for the prevention of surgical site infection. J Hosp Infect. 2017;95:135-6.
4. Solomkin JS, Mazuski JE, Bradley JS, Rodvold KA, Goldstein EJ, Baron EJ, et al. Diagnosis and management of complicated intra-abdominal infection in adults and children: guidelines by the Surgical Infection Society and the Infectious Diseases Society of America. Clin Infect Dis. 2010;50:133–64.
5. Horan TC, Andrus M, Dudeck MA. CDC/NHSN surveillance definition of health care-associated infection and criteria for specific types of infections in the acute care setting. Am J Infect Control. 2008;36:309–32.
6. Siribumrungwong B, Chantip A, Noorit P, Wilasrusmee C, Ungpinitpong W, Chotiya P, et al. Comparison of Superficial Surgical Site Infection Between Delayed Primary Versus Primary Wound Closure in Complicated Appendicitis. Ann Surg. 2018;267(4):631-7.
7. Korol E, Johnston K, Waser N, Sifakis F, Jafri HS, Lo M, et al. A systematic review of risk factors associated with surgical site infections among surgical patients. PLoS One. 2013;8:e83743.
8. Wilasrusmee C, Phuwapraisirisan S, Poprom N, Siribumrungwonget B, Woratanarat P, Lertsithichai P, et al. Developing and validating of Ramathibodi Appendicitis Score (RAMA-AS) for diagnosis of appendicitis in suspected appendicitis patients. World J Emerg Surg. 2017;12:49.
9. St Peter SD, Sharp SW, Holcomb GW 3rd, Ostlie DJ. An evidence-based definition for perforated appendicitis derived from a prospective randomized trial; J Pediatr Surg. 2008;43(12):2242-5.
10. Mehrabi Bahar M, Jangjoo A, Amouzeshi A, Kavianifar K; Wound infection incidence in patients with simple and gangrenous or perforated appendicitis; Arch Iran Med. 2010;13(1):13-6.
11. Pettigrew RA; Delayed primary wound closure in gangrenous and perforated appendicitis; Br J Surg. 1981;68(9):635-8.

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