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Pressure Saline Irrigation During Open Appendectomy and Its Impact on Surgical Site Infection in Complicated and Uncomplicated Appendictis

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ABSTRACT

Objective: To evaluate the frequency of surgical site infection after pressure saline irrigation in open appendectomy for uncomplicated and complicated cases.

Study Design: Quasi-experimental study.

Place and Duration of Study: Surgical Department, Combined Military Hospital, Rawalpindi Pakistan, from Sep 2017 to Mar 2018.

Methodology: A total of 300 patients of both gender with inflamed appendix perioperative who underwent open appendectomy were included. The per-operative procedure and post-operative findings were recorded. The patients were grouped into experimental and control Groups on basis of whether saline irrigation was done or not. Then the patients were monitored again on 5th and 10th post-operative day for any surgical site infection. The maximum follow-up time was for a month.

Results: Age range in this study was from 10-50 years with mean age of 29.280±6.40 years in Group-A while 29.446±8.28 years in Group-B. Male gender was dominant in both Groups. Surgical site infection was seen in 10(6.7%) patients in Group-A (saline irrigation Group) as compare to 35(23.3%) cases in Group-B (p<0.001). Pressure Saline irrigation did not significantly prevent surgical site infection in uncomplicated cases (p-value=0.331), however, it was effective in preventing infection in complicated cases (p-value<0.001 OR 0.074 95% CI 0.024-0.230).

Conclusion: Saline syringe irrigation of wound is a nontoxic, economical, and easily available procedure in any operation theatre to decrease the rate of surgical site infection especially in complicated appendectomy.

Keywords: Open appendectomy, Pressure saline irrigation, Surgical site infection.

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INTRODUCTION

Vermiform appendix is notorious for getting inflamed and present as one of the most common cause of the acute abdomen i.e. acute appendicitis.[1] Appendectomy is still the most frequently performed emergency surgery.[2] With the peak age of 20 years, acute appendicitis becomes common in childhood and early adult life, effecting males more than females.[3] Around 6% of the population will get acute appendicitis in their lifetime.[4]

Conventionally appendectomy is done using a Gridiron or Lanz incision. Inflamed appendix had already contaminated the pelvic peritoneum and the wound gets contaminated inevitably as the appendix is delivered leading to a fair chance of surgical site infection which according to a latest study is around 10.6% & the most common complication in open appendectomy.[5]

Surgical site infection after open appendectomy presents with pain, inflammation and purulent discharge on the 4th or 5th post-operative day. It increases the hospital stay and cost of treatment along with patient discomfort, skin discoloration, pain and frequent painful change of dressings.[6] In support of the theory that wound is infected by inflamed appendix, the organisms cultured were typically bowel as opposed to skin flora, E. coli being most common.[7]

Prophylactic antibiotics, application of povidone-iodine solution preoperatively and frequent postoperative monitoring are a few methods preferably used to prevent these surgical site infections. There is some evidence that sterile pressure saline irrigation may reduce the chances of infection mainly by diluting the microorganisms hence decreasing the bacterial load. It can therefore be hypothesized that generous irrigation of 300 ml of saline solution that is sprinkled using a 20-ml syringe with an 18-gauge intravenous (IV) catheter must reduce the incidence of surgical site infection.[8] In a study the irrigated Group had infection rate of 8.6% which was significantly less as compared to the control Group which was 25%.[9]

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The rationale of this study was to determine efficacy of pressure saline irrigation in achieving the required dilution of bacterial load so much so that the greatest cause of morbidity i.e. surgical site infection after open appendectomy, can be avoided by this simple and cost-effective technique. This study will also aim to make it a regular practice instead of casual attitude towards wound closure.

METHODOLOGY

The quasi experimental trial was carried out at Combined Military Hospital Rawalpindi Pakistan from September 2017 to March 2018. Sample size was calculated by WHO calculator keeping level of significance to 5%, power of test 95%, P0 was 0.250 and P1 was 0.086.[9] The ratio between two Groups was kept at 1 and 150 were put in experimental Group and 150 in control Group.

Inclusion Criteria: Patients of acute appendicitis with perioperative findings of inflamed appendix using conventional Lanz or Gridiron incision were included.

Exclusion Criteria: Pregnant women, patients with severe medical diseases, appendicular abscess and appendectomies with laparotomy incisions were excluded from study.

After approval from hospital ethical committee (adm/2571), patients were recruited with their consent that were fulfilling the selection criteria based on non-probability consecutive sampling method for 6 months. Patients were selected with acute appendicitis planned for open appendectomy. Patient's particulars were noted. A Performa was filled and attached with the admission documents. Demographic factors including age, height, weight, occupation, previous illness, delayed presentations etc. were recorded by a resident. All data was collected in presence of attendant/ chaperon. The per-operative procedure and post-operative findings will also be recorded. The patients were Grouped into experimental and control Groups on the basis of whether saline irrigation was done or not. Saline irrigation was done in Group A, Group B being the control Group. Saline irrigation of subcutaneous fat tissue was performed by generous sprinkling of 300 ml of saline solution using a 20-ml syringe with an 18-gauge intravenous (IV) catheter, the force of one hand generated the required amount of pressure needed, at a distance of 2 cm from the wound tissues. The patients were monitored again on 5th and 10th post-operative day for any surgical site infection. The maximum follow up time was for a month.

Data obtained was entered and analyzed using Statistical Package for Social Sciences (SPSS) version 20. Mean±Standard Deviation for age, BMI, height and weight was calculated. Frequency and percentage for gender, occupation, socio-economic status, type of incision, appearance of appendix and surgical site infection for both Groups was evaluated. Chi-square was applied to compare frequency and percentage for surgical site infection at 30th post-operative day between the two Groups. Post stratification Chi-square was again applied to compare frequency and percentage for both Groups.

RESULTS

A total of 300 patients were recruited in study. Group-A was the experimental Group having 150 cases and Group-B had 150 patients. Age range in this study was from 10-50 years with mean age of 29.280± 6.40 years in Group-A while 29.446±8.28 years in Group-B. Mean weight was 72.913±13.85 Kg in Group-A and 77.020±12.21 Kg in Group-B. Mean height was 1.580±0.10 meters in Group-A and 1.557±0.10 meters in Group-B. Mean BMI was 29.325±5.41 Kg/m^2 in Group A and 32.063±5.86 Kg/m^2 in Group B. Frequency and percentage of occupation, socioeconomic status, type of incision and appearance of appendix are shown in Table-I.

Table-I: Distribution of Occupation, socioeconomic status, type of incision and appearance of appendix in both Groups (n=300)

Variables	Group A n=150	Group B n=150
Occupation		
Army	86(57.3%)	123(82%)
Civilian	64(42.7%)	27(18%)
Socioeconomic status		
Poor	34(22.7%)	18(12%)
Middle	108(72%)	118(78.7%)
Rich	8(5.3%)	14(9.3%)
Type of Incision		
Gridiron	117(78%)	84 (56%)
Lanz	33(22%)	66 (44%)
Severity of appendicitis		
Uncomplicated	115(76.7%)	112(74.6%)
Complicated	35(23.3%)	38(25.3%)

Surgical site infection was seen in 6.7% patients in Group A as compare to 23.3% in Group B (p<0.001) as shown in Table-II.

Table-II: Comparison of Surgical Site Infection in both Groups (n=300)

Surgical site infection	Group A n=150	Group B n=150	p-value
Yes	10(6.7%)	35(23.3%)	<0.001
No	140(93.3%)	115(76.7%)	

Stratification of surgical site infec-tion in both Groups with regards to severity of appen-dicitis was done. Complicated cases were those in which the appendix was either gangrenous, perforated or there was abscess. The result is shown in Table-III. The saline irrigation did not significantly prevent infection in uncomplicated cases, however, in complex cases there was statistically significant odds of preven-ting infection (*p*-value<0.001, OR 0.074 95% CI 0.024-0.230).

Table-III: Surgical Site Infection with respect to Severity of Appendicitis (n=300)

For Uncomplicated Cases					
Surgical Site Infection					
Group	No	Yes	*p*-value	Odds Ratio	95% CI
A	111(96.5)	4(3.5)	0.331	0.541	0.154-1.900
B	105(93.8)	7(6.%)			
For Complicated Cases					
Group	No	Yes	*p*-value	0.074	0.024-0.230
A	29(8.9%)	6(91.%)	<0.001		
B	10(29.1%)	28(70.9%)			

DISCUSSION

Our study clearly depicted that the frequency of wound infection is exponentially reduced when using pressure saline irrigation along with prophylactic antibiotics as compared to control Group in which only antibiotics were used in appendectomy. The frequency of surgical site infection is directly related to the amount of contamination incurred during surgery and many practices are in vogue to reduce such contamination.[10] The risk factors of wound infection are manifold that not only include perioperative care but intraoperative management as well.[10] In order to decrease the infection rate, all of aforementioned risk factors must be carefully controlled to achieve the desired outcome.[11] These variables were appropriately managed in our study, therefore we can claim that outcome in terms of post-operative wound infection is directly related to saline irrigation. Wound washing and debridement are the fundamentals of wound management shown in many trauma cases.[12] The bacteria are removed efficiently after irrigation because of pressure generated during rinsing.[13] Efficacy of novel solutions.[14,15] and advanced methods of pressure irrigation,[12,14,16,17] has been extensively studied and it has been deduced that the best solution for washing wound is saline and the best method for irrigation is using a 20-25 ml syringe attached to a 19-gauge cannula. On the contrary if an antiseptic solution is added while irrigating, it increases the risk for infection because at effective concentration the tissue necrosis is imminent and if diluted they are ineffectual.[18] Rodeheaver *et al* compared the effects of scrubbing and irrigation for wound toilet and showed that pulsating water jets are more efficient as well as less irritating.[14] They produce less edema in comparison to scrubbing with a sponge.[14] Mechanical rubbing causes increase wound inflammation and no data exist that shows scrubbing is better than irrigation in terms of preventing infection.[19] However, Wheeler and colleagues found that irrigation with high-pressure aggravates tissue damage, impairs healing and causes further infection.[20] It is pertinent to mention here that increased rate of infection occurred with high irrigation pressure that is >70 psi but not at low pressure irrigation (8-25 psi).[20] Therefore, saline irrigation using syringe is considered safe for patients. In another study, Pigman and coworkers recommended using eye protective gadgets to avoid contamination because of splatter during jet irrigation but in our study we used gauze with the catheter to prevent spread of splatter in addition to using goggles.[21] In the present clinical trial, our data clearly demonstrated that Surgical site infection was seen in 6.7% patients in Group-A as compare to 23.3% in Group-B (*p*<0.001). Badia and coworkers,[22] compared prophylaxis with antibiotics to irrigation with different solution in patients with uncomplicated appendicitis to prevent wound infection, and found no significant statistical difference when comparing both Groups (*p*-value=0.06). In our study, we found no difference in the uncomplicated appendicitis cases with similar antibiotic prophylaxis for both Groups (*p*-value=0.331), confirming their findings. Stratification of data based on severity of appendicitis showed that saline irrigation in complicated cases has significant effect on prevention of surgical site infection (*p*-value 0.331 versus *p*-value<0.001, OR 0.074 95% CI 0.024-0.230). This means that the patients who had complicated appendectomies that were with perforations, appendicular abscesses and phlegmons showed a significant reduction in the wound infection as compared to uncomplicated cases. A systematic review also revealed that any irrigation would substantially reduce chances of surgical site infection in contaminated cases (*p*-value<0.001, OR 0.54 95% CI 0.42-0.69).[23] Similarly, Sanchez *et al* found out that pressure saline irrigation is statistically effective in preventing infection during complicated appendectomy (16.3-72.5% *p*-value <0.001).[9] However, a study done by Owais MA and colleagues showed that infection rate is statistically reduced in cases where diluted povidone is used as compared to simple saline (9% SSI vs 29% *p*-value<0.001).[24] This is contrary to our findings.

CONCLUSION

Saline syringe irrigation of wound is a nontoxic, economical, and easily available procedure in any operation theatre which does not impair the healing process and effectively prevents infection in complicated cases of appendicitis.

Conflict of Interest: None.

Author's Contribution

Following authors have made substantial contributions to the manuscript as under:

MML &ABS: Critical review, data acquisition, drafting the manuscript, approval of the final version to be published.

SAA & ST: Data acquisition, data analysis, data interpretation, critical review, approval of the final version to be published.

YH & KK: Conception, study design, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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