

Intra-Operative Wound Irrigation with Normal Saline Solution Versus Topical Antibiotics to Avoid Wound Infection

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ABSTRACT

Objective: To compare intra-operative wound irrigation with normal saline versus irrigation with Imipenem and Cilastatin solution to develop surgical site infections in open appendectomy wounds.

Study Design: Quasi-experimental study.

Place and Duration of Study: Department of Surgery, Combined Military Hospital, Bahawalnagar Pakistan, from Oct 2015 to Oct 2017.

Methodology: Patients diagnosed with cases of acute appendicitis and planned to undergo open appendectomy were randomly divided into two equal groups; Group-A and Group-B. Group-A was subjected to intra-operative wound irrigation with 100 ml saline solution before skin closure. Group-B was irrigated with Imipenem and Cilastatin solution (500 mg diluted in 10ml of distilled water). Development of post-operative Surgical Site Infection was checked till the 30th Post-Operative Day.

Results: Frequency of post-operative Surgical Site infection was comparatively less in Group-B (2.4%) as compared to Group-A (8%), which was found to be statistically significant (p -value=0.046)

Conclusion: Intra-operative wound irrigation with Imipenem and Cilastatin solution was superior to normal saline irrigation regarding the development of Surgical Site Infection in cases undergoing open appendectomy.

Keywords: Appendectomy, Anti-bacterial agents, Wounds and Injuries, Surgical wound infection, Imipenem, Cilastatin.

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INTRODUCTION

One of the most common causes of acute abdomen is acute appendicitis in tertiary care hospitals and surgical emergency departments.¹ It is considered that the estimated prevalence of acute appendicitis is 28.6%.² In surgical practice, closure of the wound is an important step in any surgical procedure, and it is commonly related to several known complications, including wound Surgical Site Infections (SSIs), wound dehiscence, burst known abdomen, neuropathic pain and hernias. Considering all these complications, SSI is considered to be the most common complication, resulting in poor wound healing and poor surgical scar.³ It is considered that SSIs are the third most common hospital-acquired infections and result in 14% to 16% of all kinds of infections.⁴⁻⁵ Around the globe, Surgeons are trying to find out preventive measures that can result in a reduction of rates by the use of prophylactic measures, resulting in significant improvement in surgical outcomes as SSIs and their related complications like fascial dehiscence and

incisional hernias reduced long run.⁶ In surgical practice, established and commonly practised prophylactic measures include prophylactic antibiotics, operation theatres sterile surgical techniques, antibiotic-coated sutures used during the surgical procedures and irrigation of the wounds before closure with topical antibiotics and normal saline.⁷ According to local studies, the infection rate in clean cases is 4.88%; in clean-contaminated wounds, it is 8.39% and 20.45% in Contaminated. It is seen that wound length is inversely proportional to the frequency of SSI.⁸

One of the common surgical procedures performed around the globe is appendectomy for acute appendicitis. In the post-operative period, superficial SSI is one of the most common complications following appendectomy.⁹ Many risk factors are associated with increased risk of post-operative (SSIs), including Diabetes, length of incision, and technique of surgical procedure.¹⁰ Post-operative infections, particularly in the surgical site, are associated with increased morbidity, prolonged hospital stays, and additional healthcare costs. Therefore, exploring optimal intra-operative wound irrigation methods is essential to enhance patient outcomes and minimize complications.

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METHODOLOGY

The quasi-experimental study was conducted at Combined Military Hospital Bahawalnagar, Pakistan from October 2015, to October 2017 after IERB approval. The sample size was calculated using the WHO Sample size calculator, taking population proportion of 4.4% and 2.2% in Groups A and B, respectively.¹¹ The sampling technique was non-probability consecutive sampling.

Inclusion Criteria: Patients of either gender who were diagnosed with acute appendicitis and planned to undergo open appendectomy were included.

Exclusion Criteria: Patients having diabetes mellitus, chronic liver disease, abdominal malignancies and patients using steroids were excluded.

A total of 250 patients were included in the study. Informed written consent were obtained from every individual. All patients included in the study were randomly distributed in Groups A and B by lottery method (Figure-1).

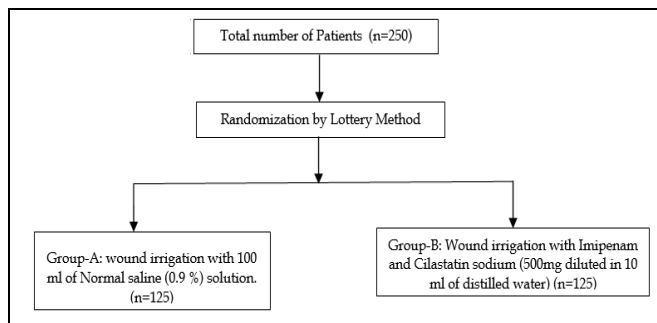


Figure-1: Patient Flow Diagram (n=250)

After the closure of external oblique aponeurosis, Group-A patients were subjected to wound irrigation with 100 ml of Normal saline (0.9 %) solution. Group-B was irrigated with Imipenam and Cilastatin sodium (500mg diluted in 10 ml of distilled water). All patients received prophylactic intravenous ceftriaxone at the time of induction and were advised ceftriaxone and metronidazole as per body weight till five days post-operatively. Dressing protocol and techniques for all patients remained the same (Mepore dressing opened 72 hrs post-operatively and onwards changed 24 hrly). Prolene skin stitches were removed on seventh post-operative day. The same surgical team performed all the surgeries, and patients were followed up 30 days post-operatively to look for the development of SSI. Wounds were graded per the Southampton Wound

grading system (Figure-2), and wounds fulfilling Class-II and above criteria were considered positive for SSI. Contact numbers of patients were taken and all data was entered in the data collection proforma.

Grade	Appearance
0	Normal healing
I Normal healing with mild bruising or erythema:	
A	Some bruising
B	Considerable bruising
C	Mild erythema
II Erythema plus other signs of inflammation:	
A	At one point
B	Around suture
C	Along wound
D	Around wound
III Clear or haemorrhous discharge:	
A	At one point only (<2cm)
B	Along wound (>2cm)
C	Large volume
D	Prolonged (>3 days)
Major complication	
IV Pus:	
A	At one point only (<2cm)
B	Along wound (>2cm)
V Deep or severe wound infection with or without tissue breakdown; haematoma requiring aspiration	

The wound grading system used was simplified for the use of analysis. By using the worst wound score recorded and information about any treatment instituted either in hospital or the community, wounds were regarded in four categories: (A) normal healing; (B) minor complication; (C) wound infection-wounds graded IV or V or wounds treated with antibiotics after discharge from hospital, irrespective of the wound grading given to them by the nurse; and (D) major haematoma-wound or scrotal haematoma requiring aspiration or evacuation.

Figure-2: Southampton Scoring System

Statistical Package for Social Sciences (SPSS) version 20.0 was used for the data analysis. Quantitative variables were expressed as Mean±SD and qualitative variables were expressed as frequency and percentages. Chi-square test was applied to explore the inferential statistics. The p-value lower than or up to 0.05 was considered as significant.

RESULTS

Two hundred fifty patients undergoing open appendectomy were included. The minimum age was 14 years, and the maximum was 63 years, with a mean age of 35.38±10.19 years. Of the 250 patients, 143(57.2 %) were males, and 107(42.8%) were females. The frequency SSI in both males and females is shown in the Table-I. Group-A revealed an 10(8%) SSI frequency compared to Group-B, which was 3(2.4%). The groups had a statistically significant difference (p-value of 0.046) as given in Table-II.

Table-I: Comparison of Male Patients with Female Patients in terms of Surgical Side Infection (n=250)

Surgical Side Infection	Gender		p-value
	Male Patients n (%)	Female Patients n (%)	
Yes	6(4.2)	7(6.5)	0.516
No	137(95.8)	100(93.5)	

Table-II: Comparison of Surgical Side Infection between Study Groups (n=250)

Surgical Side Infection	Study Groups		p-value
	Group-A (Normal Saline irrigation) n=125 n (%)	Group-B (Imipenem/ Cilastatin irrigation) n=125 n (%)	
Yes	10(8)	3(2.4)	0.046
No	115(92)	122(97.6)	

DISCUSSION

In abdominal surgery, surgical site infections are one of the serious and common post-operative complications that are the main source of problems for both surgeons and patients.^{11,12} Surgical site infection is a common complication around the globe; preventive measures are under process and one of the research topics. Surgical site infection is a cost problem for both patients and hospitals. In all wounds, superficial SSI infections are commonly associated with surface contamination by microorganisms. One of the major factors for the development of SSIs is spillage of gut contents.¹³ Some studies in different parts of Pakistan revealed that the rate for clean wounds is 4.88%, the rate of clean contaminated wounds is 8.39%, and 20.45% for contaminated cases.⁶ Due to the importance of SSIs, multiple methods were adopted to avoid SSIs. These days, multiple trials are being conducted on different prophylactic methods to avoid SSIs; two common research topics are antibiotic-coated sutures and intraoperative surgical wound irrigation. A meta-analysis showed that the SSI rate is reduced by using antibiotic-coated sutures (10.4%) versus controls where antibiotic-coated sutures were not used (13.0%).¹³

It is common practice in surgery that intra-operative wound irrigation is carried out commonly in all surgical disciplines. Irrigation of wounds has many advantages: it keeps the bed hydrated; secondly, it allows the surgeons better visualisation of the wound before closure; and finally, wound irrigations help in removing wound contaminations and lowering bio-burden and enhancing the healing process.⁵ Wound irrigation practice, however, has yet to be standardised, and there is no strong evidence that it reduces SSIs. More studies are underway on which type of wound is better for irrigation purposes. Around the globe, many irritants are used, including Gentamycin and Isotonic saline. A study was carried out to identify the role of gentamycin in reducing SSI in colorectal surgery, and it revealed that SSIs were reduced post-operatively.¹⁴ It is also seen that topical antiseptic solutions, including Chlorhexidine and Pyridine-Iodine, result in delayed wound healing.¹⁵ In extremity traumatic wounds, dual antibiotics loaded in chitosan sponge were utilised to assess the efficacy of local antibiotic effects, and it revealed that it reduces better control of wound infections.¹⁶ Triple-absorbed saline irrigation was utilised during breast surgery, which revealed that it reduces the rate of surgical wound infections.¹⁷ In another study, triple antibiotics

or Chlorhexidine were utilised for irrigation of wounds in breast surgery, and they were irrigated for at least 30 minutes. It revealed that triple antibiotic irrigation reduces the rate of surgical site infections.¹⁸

The cost-effectivity of normal saline makes this solution common for irrigation purposes. Keeping this in view, we studied the effects of open appendectomy wound irrigation with normal saline and topical antibiotics.

CONCLUSION

There was a tendency for the lesser frequency of wound infection rates in patients among whom the wound was irrigated intra-operatively with Imipenem and Cilastatin solution compared to normal saline irrigation following an open appendectomy.

Conflict of Interest: None.

Authors Contribution

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

SK & ASA: Data acquisition, data analysis, data, critical review, approval of the final version to be published.

UA & RK: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

HA: Conception, data acquisition, 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.

REFERENCES

1. Khatun S, Thakur D, Shah DK. Prevalence of Retrocaecal Appendix among Patients with Appendicitis in A Tertiary Care Hospital of Nepal. *J Nepal Med Assoc* 2019 ; 57(217): 150-153. <https://doi.org/10.31729/jnma.4370>.
2. Huckins DS, Simon HK, Copeland K, Spiro DM, Gogain J, Wandell M. A novel biomarker panel to rule out acute appendicitis in pediatric patients with abdominal pain. *Am J Emerg Med* 2013; 31(9): 1368-1375. <https://doi.org/10.1016/j.ajem.2013.06.016>.
3. Barbadoro P, Marmorale C, Recanatini C, Mazzarini G, Pellegrini I, D'Errico MM, et al; Drainages Collaborative Working Group. May the drain be a way in for microbes in surgical infections? *Am J Infect Control* 2016; 44(3): 283-288. <https://doi.org/10.1016/j.ajic.2015.10.012>.
4. Baracs J, Huszár O, Sajjadi SG, Horváth OP. Surgical site infections after abdominal closure in colorectal surgery using triclosan-coated absorbable suture (PDS Plus) vs. uncoated sutures (PDS II): a randomized multicenter study. *Surg Infect* 2011; 12(6): 483-489. <https://doi.org/10.1089/sur.2011.001>.
5. Edmiston CE Jr, Leaper DJ. Intra-Operative Surgical Irrigation of the Surgical Incision: What Does the Future Hold-Saline, Antibiotic Agents, or Antiseptic Agents? *Surg Infect* 2016; 17(6): 656-664. <https://doi.org/10.1089/sur.2016.158>.

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6. Walming S, Angenete E, Block M, Bock D, Gessler B, Haglind E. Retrospective review of risk factors for surgical wound dehiscence and incisional hernia. *BMC Surg* 2017; 17(1): 19. <https://doi.org/10.1186/s12893-017-0207-0>.
 7. Heal CF, Banks JL, Lepper PD, Kontopantelis E, van Driel ML. Topical antibiotics for preventing surgical site infection in wounds healing by primary intention. *Cochrane Database Syst Rev* 2016; 11(11): CD011426. <https://doi.org/10.1002/14651858.CD011426.pub2>.
 8. Khan M, Khalil J, Rooh-ul-Muqim, Zarin M, Touseef Ul Hassan, Ahmed N, et al. Rate and risk factors for surgical site infection at a tertiary care facility in Peshawar, Pakistan. *J Ayub Med Coll Abbottabad* 2011; 23(1): 15-18.
 9. Sanger PC, van Ramshorst GH, Mercan E, Huang S, Hartzler AL, Armstrong CA, et al. A Prognostic Model of Surgical Site Infection Using Daily Clinical Wound Assessment. *J Am Coll Surg* 2016; 223(2): 259-270.e2. <https://doi.org/10.1016/j.jamcollsurg.2016.04.046>.
 10. Bucknall TE. Factors influencing wound complications: a clinical and experimental study. *Ann R Coll Surg Engl* 1983; 65(2): 71-77.
 11. Pianka F, Mihaljevic AL. Vermeidung postoperativer Infektionen : Evidenzbasierte Prinzipien [Prevention of postoperative infections : Evidence-based principles]. *Chirurg* 2017; 88(5): 401-407. <https://doi.org/10.1007/s00104-017-0384-5>.
 12. Andersen BR, Kallehave FL, Andersen HK. Antibiotics versus placebo for prevention of postoperative infection after appendectomy. *Cochrane Database Syst Rev* 2003;(2):CD001439. Update in: *Cochrane Database Syst Rev* 2005; (3): CD001439. <https://doi.org/10.1002/14651858.CD001439>.
 13. Alfonso-Sanchez JL, Martinez IM, Martín-Moreno JM, González RS, Botía F. Analyzing the risk factors influencing surgical site infections: the site of environmental factors. *Can J Surg* 2017; 60(3): 155-161. <https://doi.org/10.1503/cjs.017916>.
 14. Podda M, Cillara N, Di Saverio S, Lai A, Feroci F, Luridiana G, et al; ACOI (Italian Society of Hospital Surgeons) Study Group on Acute Appendicitis. Antibiotics-first strategy for uncomplicated acute appendicitis in adults is associated with increased rates of peritonitis at surgery. A systematic review with meta-analysis of randomized controlled trials comparing appendectomy and non-operative management with antibiotics. *Surgeon* 2017; 15(5): 303-314. <https://doi.org/10.1016/j.surge.2017.02.001>.
 15. Xiao Y, Shi G, Zhang J, Cao JG, Liu LJ, Chen TH, et al. Surgical site infection after laparoscopic and open appendectomy: a multicenter large consecutive cohort study. *Surg Endosc* 2015; 29(6): 1384-1393. <https://doi.org/10.1007/s00464-014-3809-y>.
 16. Tennent DJ, Shiels SM, Jennings JA, Haggard WO, Wenke JC. Local control of polymicrobial infections via a dual antibiotic delivery system. *J Orthop Surg Res* 2018; 13(1): 53. <https://doi.org/10.1186/s13018-018-0760-y>.
 17. Campbell CA. The Role of Triple-Antibiotic Saline Irrigation in Breast Implant Surgery. *Ann Plast Surg* 2018; 80(6S Suppl 6): S398-S402. <https://doi.org/10.1097/SAP.0000000000001345>.
 18. Zhadan O, Becker H. Surgical Site Irrigation in Plastic Surgery. *Aesthet Surg J* 2018; 38(3): 265-273. <https://doi.org/10.1093/asj/sjx171>.
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