

Comparative Study of Irrigation with Povidone-Iodine versus Normal Saline on Wound Infection after Open Appendectomy for Prevention of Surgical Site Infection

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Abstract:

Introduction: Surgical site infections (SSIs) are a persistent issue for operating surgeons. It raises healthcare costs, increases morbidity and death, and sometimes results in re-explorations. The incidence of SSIs may be reduced by eliminating damaged or non-viable tissue, metabolic waste, and wound exudates; this can be accomplished via intraoperative irrigation of surgical wounds. Postoperative surgical wound irrigation is also possible. Even with preventive antibiotics and strict aseptic procedures, post-appendectomy wound infection persists. Although the efficiency of povidone-iodine on non-incised skin is widely documented, its use as an intraoperative irrigation solution in open surgical wounds is not common. Similarly, prophylactic irrigation using normal saline solution to prevent wound infection has been shown in certain trials to be helpful. The goal of this research is to examine the percentage of superficial SSI after appendectomy with 1% povidone-iodine solution intraoperative irrigation of subcutaneous plane against normal saline.

Methods: At Medical College, 100 patients of open appendectomy for acute appendicitis were randomly assigned to one of two arms. In group A, 0.9% Normal Saline was used to irrigate subcutaneous tissue prior to skin closure, while in group B, 1% diluted povidone-iodine solution was used. For five days following surgery, the patients were evaluated for infection in surgical wounds using the Southampton wound grading system, and they were monitored for thirty days.

Results: The participants in this research had an average age of 18.65 years. There were 50 patients in each group, and there were no significant differences in terms of age, gender, or operation results. Out of 100 patients, 19 (19%) had Southampton grade 2 or above, indicating wound infection. 15 (29%) were from Group A, and 5 (9%) were from Group B ($p=0.001$).

Conclusion: When compared to normal saline irrigation, 1% diluted povidone-iodine irrigation of the subcutaneous plane following appendectomy significantly reduces the risk of SSI.

Keywords: Wound infection, appendectomy, povidone-iodine.

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Introduction

With an annual incidence of 10 occurrences per 100,000 people, acute appendicitis is one of the most prevalent surgical emergencies in the world [1]. While appendicitis accompanied by a tumor or abscess is typically treated conservatively or with ultrasound-guided closed drainage, for acute uncomplicated appendicitis, appendectomy remains the gold standard therapy [2]. An appendectomy may be done either openly or laparoscopically. Surgical site infection (SSI), wound dehiscence, intestinal obstruction, abdominal/pelvic abscess, and stump appendicitis are all possible

complications of appendectomy [3]. Recent research [4] found that open appendectomy had a greater prevalence of overall and incisional SSI than laparoscopic appendectomy (6.7% vs 4.5%), although both groups had a comparable rate of organ/space SSI (3%). Another observational research [5] found that open appendectomy had a greater risk of superficial SSI (9%) than laparoscopic appendectomy (5%). Intracavity and wound irrigation with different solutions were used in an attempt to lower the incidence of SSI following appendectomy. A recent Cochrane

review [6] looked at 59 randomized controlled trials on various kinds of surgical wounds, such as clean, clean contaminated and contaminated wounds. The studies compared irrigation to no irrigation, and the irrigation groups included irrigation with various antibiotics, antiseptics, and non-antibacterial agents. According to the assessment, "the evidence base for Intracavity lavage and wound irrigation is generally of low certainty."

Large retrospective research [7] compared wound irrigation with antiseptic solution to normal saline in patients following open appendectomy and found that antiseptic wound irrigation was clearly better to normal saline.

The purpose of this study was to compare the effectiveness of layer-by-layer wound irrigation with povidone-iodine solution against normal saline solution in preventing incisional SSI following open appendectomy for acute appendicitis. For this experiment, there were two hypotheses: 1) wound irrigation with saline solution lowers SSI rates; 2) adding povidone-iodine to the irrigation solution lowers SSI rates even more than simple saline irrigation.

After ethical review board clearance, a randomized controlled trial (RCT) was conducted at the Department of Surgery, SCB Medical College and Hospital, Cuttack from January 2019 to February 2019.

Patients of either gender over the age of 13 who arrived to the emergency room with acute appendicitis were included in the research. Clinical examination and surgical findings revealed acute appendicitis, which was verified by histopathologic study of the excised appendix. Patients with appendicular mass, appendicitis associated with generalized peritonitis, acute abdomen due to other causes as revealed intraoperatively, patients with normal appendix as revealed intraoperatively and after histopathologic examination, patients on long-term steroid therapy or immunosuppressive treatment, and patients unwilling to participate in the trial were excluded.

Using the WHO sample size calculator, sample size was calculated with a level of significance of 5% and a confidence interval of 90%. The non-probability consecutive sampling method was used. This research comprised 200 individuals, both male and female, over the age of 13, who were clinically diagnosed with acute appendicitis and registered for interval appendectomy, as well as those undergoing emergency or elective open appendectomy. Patients under the age of 13 were excluded from the research. Patients with diabetes, uremia, jaundice, rheumatoid arthritis, compromised immunity, cancer patients with chronic illnesses, bedbound patients, patients on

certain drugs, such as steroids and cytotoxic drugs, patients undergoing radiation therapy, and patients with generalized peritonitis were excluded. Inclusion in the study was also ruled out if a synchronous pathology other than appendicitis was discovered. Thirteen of the 23 patients that were removed from this study had widespread peritonitis, and ten were diabetic. All participants in this study provided informed and written permission. Using computer-based randomization software (Research randomizer), patients were randomly assigned to one of two arms: A (normal saline) or B (povidone iodine). To reduce bias, a standard technique was implemented that included a 10-minute washing with 1% povidone-iodine, a skin crease incision (Lanz), minimum tissue manipulation, and the use of the same suture material, polyglactin suture, for tying the mesoappendix and the base of the appendix. The same stitch was used to close the peritoneum, muscle layers, and sheath, with a fresh set of gloves used following fascia closure to perform irrigation and skin closure using a running non-absorbable 2/0 polypropylene monofilament suture. A single dosage of before producing anesthesia.

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the postoperative phase, two further doses of 2nd generation cephalosporin and metronidazole were administered intravenously. All procedures were carried out by consultant surgeons (Assistant Professors and Senior Registrars). The processes were aided by postgraduate trainees, house officers, and OT technicians.

All participants' surgical wounds were covered with aseptic dry dressings, which were removed by the main surgeons before to release on the second postoperative day. All patients, regardless of group, had their surgical wounds checked for wound infection on the 5th postoperative day at their initial follow-up visit in the outpatient department and were followed up on until the 30th post-operative day. The surgical wounds were scored using the Southampton wound rating method (Figure 1).

Southampton grade 2 were identified as having wound infection. On a daily basis, primary surgeons handled all of these patients with aseptic dressings. To document information, a predesigned proforma was employed. It comprised demographic information, patient groups, elective vs emergency operations, and inspection results of surgical wounds suggesting the appropriate Southampton grade. September 2019, Volume 24 (3) SPSS version 19 was used to analyze the data. Age was estimated as a mean, while qualitative characteristics such as gender and Southampton wound grade were calculated as frequencies. The Chi square test was used to determine if there was a significant difference in proportions. The significance level was set at $p < 0.05$.

Table 1: Southampton wound scoring system

Southampton Scoring System	
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 sutures
C	Along wound
D	Around wound
III Clear or Hemoserous discharge	
A	At one point only (<2 cm)
B	Along wound (>2 cm)
C	Large Volume
D	Prolonged (>3 days)
Major Complication IV plus:	
A	At one point only (<2 cm)
B	Along wound (>2 cm)
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 complications
 (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 hematoma – wound or scrotal haematomas requiring aspiration or evacuation.

Results

This research comprised 100 patients, 66 (66%) of whom were male and 34 (34%), female. The mean SD age of the patients was 18.65 4.76 years. Patients were above the age of 13 (Table 1). The mean age difference between Group A (18.59 4.84 years) and Group B (18.72 4.70 years) was not statistically significant ($p=0.848$). There were 50 patients in each group, and no statistically significant variation in gender distribution was identified across groups (Table 2). Five of the 100 patients got elective appendectomies, while the other 95 suffered emergency appendectomies. Three of the five elective surgeries were from group A, while two came from group B. According to the surgical results, 64 individuals had no fluid around the appendix, 28 had serous fluid, and 8 had purulent fluid locally. In terms of operational results, the groups did not vary significantly (Table 3). The surgical wounds of patients in both groups were evaluated on the fifth post-operative day for

SSI at the first outpatient clinic visit. The wounds were monitored until the 30th post-operative day. Southampton grade 2 or higher was seen in 19 (19%) of the 100 patients, indicating wound infection. All of these individuals had emergency appendectomies. 29 (29%) were from Group A, while 9 (9%) were from Group B. The difference in wound infection incidence between Normal Saline Irrigation Group A and Povidone Iodine Irrigation Group B was therefore statistically significant ($p=0.001$).

About 13 (12.5%) patients had serious wound infection, as shown by serous or purulent discharge (Southampton wound grades 3 & 4), 21 of whom were in Normal Saline irrigation group A and 4 in group B. The difference between groups A and B in the development of serous discharge (Southampton grade 3) and purulent discharge (Southampton grade 4) in appendectomy sites was statistically significant. (Table 4) No patients had deep tissue infection (Southampton grade 5).

Table 2: Sample Characteristics

	Table 1. Sample Characteristics Mean Age +/- SD (Years)	Age Range (Min-Max)	Emergency Cases	Elective Cases
Group A	18.59 +/- 4.84	13-40	3 (3%)	97 (97%)
Group B	18.72 +/- 4.70	12-39	2 (2%)	98 (98%)
All Participants	18.65 +/- 4.76	12-40	95 (95%)	5 (2.5%)

Table 3: Gender Distribution

Gender	Total Patients n = 100 (%)	Group A n = 50 (%)	Group B n = 50 (%)	p-value
Female	34 (34%)	16 (32%)	17 (34%)	0.903
Male	76 (76%)	34 (68%)	33 (66%)	0.931

Table 4: Operative Findings

Operative Findings	Group A n = 50 (%)	Group B n = 50 (%)	p-Value
No fluid	32 (64)	32 (64)	0.929
Serous	14 (28)	15 (30)	0.789
Purulent	4 (8)	4.5 (9)	0.808

Table 5: Comparison of wound infection between normal saline versus povidone-iodine after appendectomy

Southampton Wound Grade	Total Patients n = 100 (%)	Group A Normal Saline Irrigation n = 50 (%)	Group B Povidone iodine irrigation n = 50 (%)	p- Value
Grade 0: Normal healing	65 (65)	25 (50)	34 (68)	0.082
Grade 1: Normal healing + mild Bruising	21 (21)	10 (10)	11 (22)	0.879
Grade 2: Erythema/ Tenderness/ heat	7 (7)	4 (8)	03 (6)	0.405
Grade 3: Serous Discharge	7 (7)	5 (10)	01 (2)	0.013
Grade 4: Purulent Discharge	6 (6)	5 (10)	01 (2)	0.021
Grade 5: Deep tissue infection	0 (0)	0 (0)	0 (0)	-

Discussion

Despite medical improvements, SSI following appendectomy remains a severe issue [2]. This study compared two substances (normal saline against povidone-iodine) that may aid in reducing wound infection rates [5,9]. The overall incidence of wound infection (Southampton grade 2 or above) in our research was 19% (29% in the normal saline group and 9% in the povidone-iodine group), which is consistent with the 2.1 to 20% post-appendectomy wound infection rate reported in national and international literature [5,13]. Povidone iodine failed to reduce SSI % in trials performed by S Patel and KS Sharma, but it did reduce the incidence of purulent flow from wounds, hence ameliorating the severity of wound site infection [14,15]. Similarly, Chundamala J examined 15 trials, 5 of which found that povidone-iodine irrigation was no more effective than regular saline, water, or no irrigation in avoiding surgical site infection. However, the other ten investigations found that povidone-iodine irrigation was considerably more effective than regular saline, water, or no fluid-irrigation in avoiding surgical site infection [7]. These studies' findings support the beneficial function of povidone-iodine irrigation in minimizing surgical site infection when compared to irrigation with normal saline, which is consistent with our findings. Because of its isotonic composition and lack of interference with wound healing, normal saline is a popular irrigation solution [8]. Furthermore, it is often used to clean wounds of blood clots and nonviable tissue. Carlos and Cervantes investigated syringe pressure irrigation of subcutaneous tissue with normal saline and concluded that it significantly reduced the risk of postoperative SSI in difficult (perforated) cases [16]. Shrikrishna Singh also discovered that regular saline wound irrigation reduces the risk of postoperative SSI following appendectomy [17]. As GS Bhandari discovered in his study [18], meticulous saline irrigation is an effective approach in patients with ruptured appendicitis and wound infection. Shah and his colleagues at Sagar discovered that 13.1% of open appendectomy patients experienced postoperative superficial wound infection [19]. Other studies, however, revealed lower infection rates. In their separate investigations, Gupta et al and Chaudhary et al found wound infection in 5% and 6.4% of the study populations, respectively [20,21]. The varied or non-specific definitions of superficial surgical site infection in these studies are to blame for the varying percentage of SSI post-appendectomy. In reality, the bulk of the local studies reviewed above lacked any definition or criteria for identifying wound infection. This research used the Southampton wound grading system to grade the

postoperative wound infection, which is a legitimate wound grading classification alongside the ASEPSIS score and the Centers for Disease Control and Prevention (CDC) classification and is used by many authors throughout the world [23]. When wound infection following appendectomy was compared, irrigation with povidone-iodine resulted in a substantially decreased SSI rate and incidence of Southampton grade 3 & 4 wound (p-value 0.05).

Povidone-iodine irrigation reduced the incidence of purulent discharge from the surgical site (p-value=0.030) in this research. Harsh Khemani and colleagues reported a favorable result of povidone-iodine usage in their research of 59 patients randomly allocated to two groups. Povidone-iodine gel was applied to the wound site before skin closure in one group, while no povidone-iodine gel was applied to the wound site in the other. Infection occurred in 18 patients' wounds, with 5 (16%) vs 13 (46%), in the povidone-iodine gel group. In a study of 200 clean cases, both general and gynecological, there was one instance of wound infection in the 100 cases that had their wounds cleansed with normal saline, whereas 8 incidents of wound infection were documented in the opposite arm with no intervention. *Staphylococcus aureus* was the most often isolated organism, with *Streptococcus Pyogenes*, *Proteus*, *Klebsiella*, *E coli*, and *Pseudomonas* all being identified. MRSA was not found [9]. Vinay and colleagues published the findings of their research in 2019 and found that wound infection rates were higher in the povidone-iodine irrigation group (10%) than in the usual saline irrigation group (7.8%) [25]. They found that irrigating the lesion with regular saline or povidone-iodine solution had no effect on the infection rate. They did, however, investigate irrigation on laparotomy wounds, and their findings contradict those of our research. In terms of efficacy in avoiding surgical site infections, the literature on both normal saline and povidone-iodine irrigation yielded disparate outcomes. In our research, we compared both solutions and discovered that povidone-iodine was more efficient than plain saline in avoiding SSI following appendectomy.

Conclusion

This research showed that the incidence of SSI is considerably reduced following intraoperative povidone-iodine irrigation compared regular saline irrigation. Patients who had their wounds irrigated with povidone-iodine had a lower rate of serious wound infection. As a result, subcutaneous tissue irrigation with 1% diluted povidone-iodine following appendectomy significantly lowers the surgical site infection rate when compared to standard saline irrigation.

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