

Intraoperative Wound Irrigation for Prevention of Surgical Site Infections After Abdominal Surgery

Maryam Hameed¹, Muhammad Nazim Khan², Irmaghana Basharat³, Fahad Mudassar Hameed⁴, Umar Fayyaz Ghani⁵, Nauman Anwar Rana⁶

¹Postgraduate Resident, ²Professor of Surgery, ^{3,6}Assistant Professor, ⁴Associate Professor, ⁶Consultant, (Pakistan Air Force Hospital, Islamabad)

Author's Contribution

¹Concept/research design, data collection, ^{2,5,6}project management, and critical revision of the manuscript for important intellectual content, ^{3,4}statistical analysis and manuscript writing statistical analysis and manuscript writing edit of manuscript

Funding Source: None

Conflict of Interest: None

Received: April 24, 2023

Accepted: Aug 28, 2023

Address of Correspondent

Dr. Muhammad Nazim Khan
Professor of Surgery,
Pakistan Air Force Hospital,
Islamabad
mnazimkhan@yahoo.com

ABSTRACT

Objectives: To compare the frequency of surgical site infections after abdominal surgery with and without intraoperative irrigation of the surgical wounds.

Methodology: This randomized controlled trial was performed in general surgery department, PAF Hospital, Islamabad from Feb 2022 to Feb 2023. A total of 520 patients undergoing abdominal surgeries of any gender between the ages of 15–70 years were included. Patients were randomly divided in two groups on the basis of non-probability, consecutive sampling. The participants included in the group-A did not receive any intraoperative wound irrigation. The participants in the Group-B received intraoperative wound irrigation with antiseptic solution i.e., povidone-iodine in solution. Each patient was followed up respectively on 7th, 21st and 30th days postoperatively to observe surgical site infection. Chi square test was applied to compare SSI percentage between two groups. P-value of less than 0.05 was taken as significant.

Results: Mean age was 39.87±6.93 years in group-A and 37.67±7.56 years in Group-B. Out of 520 patients, 344 (66.15%) were males and 176 (33.85%) were females. Surgical site infection after abdominal surgery without intraoperative irrigation was found to be 34 (13.08%) and surgical site infection after abdominal surgery with intraoperative irrigation was 12 (4.62%), hence statistically significant (p-value = 0.0007).

Conclusion: This study concluded that intraoperative wound irrigation is effective to prevent the surgical site infections after abdominal surgery.

Keywords: Abdominal Surgery; Infection Control; Povidone-Iodine; Therapeutic Irrigation.

Cite this article as: Hameed M, Khan NM, Basharat I, Hameed FM, Fayyaz UF, Rana NA. Intraoperative Wound Irrigation for Prevention of Surgical Site Infections After Abdominal Surgery. *Ann Pak Inst Med Sci.* 2023; 19(3):294-297. doi: 10.48036/apims.v19i3.912

Introduction

Contamination of the surgical region between incision and closure causes surgical site infections (SSIs).¹ According to the CDC, SSIs are infections that arise in 30 days after surgery or 1 year if an implant has been placed. The CDC divides SSI into two categories: incisional SSI and organ/space SSI. Deep SSI often comprises deep soft tissues, whereas superficial incisional SSI usually comprise just the skin and subcutaneous tissue.² According to a recent worldwide study, the incidence of SSI following GI surgery remains around 9.4%, even across high-income nations.³

The patient may present with varying symptoms

postoperatively on the follow-up visits, like pain, redness, swelling and purulent discharge from the wound, the clinical signs of which can be assessed.⁴ They can result in poor patient outcome, prolonged hospital stay, financial burden, morbidity and re-operation. Recent high-level RCTs with standardized SSI criteria reveal postoperative SSI rates ranging from 14.5% to 25.0%, depending on the extent of intraoperative contamination.⁵ According to studies, SSI causes an increase in a typical length of hospitalization of 6-24 days.⁶

Wound irrigation tries to minimize the bacteria from the surgical area prior to site closure. Normal saline, antiseptic agents, and antibiotic agents are the three

types of irrigant.⁷ Intraoperative irrigation and lavage include cleaning the surgical site while it is still open. This irrigation may help to limit the number of SSIs by removing dead or wounded tissue, metabolic waste, and site exudation. Antiseptic chemicals or antibiotic may minimize contamination by bacteria and SSI. Physiologic saline alone or in conjunction with antiseptic medications can be used to irrigate the surgical site during the procedure.⁸

Intraoperative surgical site irrigation is standard practice in all surgical procedures, with all professions recommending some sort of irrigation prior to incision closure. However, this practice has not been standardized, and there is no strong evidence that it successfully decreases the risk of SSIs. In order to achieve this goal, we planned to compare intraoperative wound irrigation prior to closure versus traditional closure of wounds without irrigation in terms of the development of SSIs.

Methodology

This prospective randomized controlled study was carried in the department of surgery, Pakistan Air Force (PAF) Hospital, Islamabad from Feb 2022 to Feb 2023. By using WHO calculator, sample size was calculated as 520 patients, the parameters were as follows; 5% level of significance, 80% power of test, anticipated population proportion for two groups was 4.5% and 10.2%.⁹ Patients were randomized into two groups (n=260 patients in each group) by non-probability consecutive sampling technique.

Study began after approval of the ethics review board of the hospital. Informed written consent was taken from each patient before commencement of data collection. Patients of both genders ranged age from 15–70 years, who were underwent abdominal surgeries (laparoscopic and open cholecystectomy, laparoscopic and open appendectomy and exploratory laparotomy), regardless of the class of contamination of wounds (I – IV) were included in study. While, patients with diabetes mellitus, abdominal malignancy, using steroids and abdominal hernia repair due to the use of mesh and patients with any active infection in the body were excluded. The patients underwent abdominal surgical procedures were divided into two groups i.e., Group-A and Group-B. The participants included in the group-A did not receive any intraoperative wound irrigation (IOWI). The participants included in the Group-B

received IOWI with antiseptic solution i.e., readily available povidone-iodine in solution. IOWI was done by the surgeon, scrubbed throughout the entire case, who performed the surgery. Each patient was followed up respectively on 7th, 21st and 30th days postoperatively to observe the outcome variable i.e., SSI, redness, swelling and purulent discharge at surgical site.

Data was analyzed using SPSS V 25. Mean and standard deviations were derived for numerical data, whereas frequencies and percentages were derived for categorical data. Chi square test was applied to compare SSI percentage between two groups. P-value of less than 0.05 was taken as significant.

Results

Overall mean age was 38.52 ± 7.41 years. Mean age was 39.87 ± 6.93 years in group-A and 37.67 ± 7.56 in Group-B. Out of 520 patients, 344 (66.15%) were males and 176 (33.85%) were females having male to female ratio of 1.9:1. There were a total 148 smokers in the study participants out of which 76 were in group-A and 72 in Group-B. Class of wound in most of the patients was class-II followed by Class-I (Table I).

Table I: Distribution of patients with respect to class of wound. (n=520)

Class	Group A (n=260)		Group B (n=260)	
	Frequen cy	%age	Frequen cy	%age
I	71	27.31	72	27.69
II	126	48.46	125	48.08
III	35	13.46	54	20.77
IV	28	10.77	09	3.46

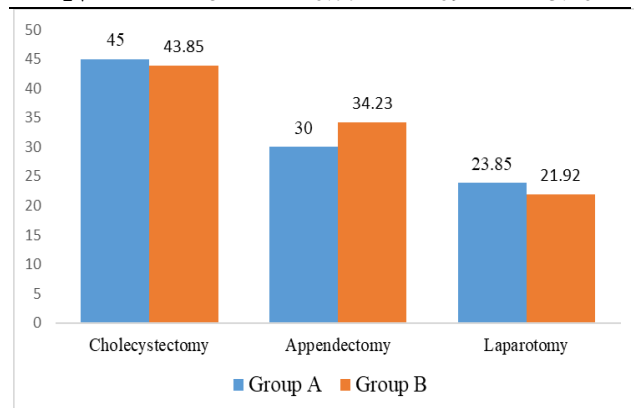


Figure I: Type of surgery.

The mean duration of surgery in Group-A was 76.54 ± 10.66 minutes and in Group-B was 74.68 ± 11.5

minutes. Type of surgery was cholecystectomy in majority of the patients as shown in figure 1.

In this study, SSIs after abdominal surgery without intraoperative irrigation was found to be 34 (13.08%) and SSIs after abdominal surgery with intraoperative irrigation was 12 (4.62%) (Table II).

Table II: Frequency of SSIs after abdominal surgery in both groups. (n=520)

	Group-A (n=260)		Group-B (n=260)		p-value
	Yes	No	Yes	No	
SSI	34 (13.08%)	226 (86.92%)	12 (4.62%)	248 (95.38%)	0.0007

Discussion

Postoperative SSI is a common cause of postoperative morbidity and a significant health care related illness (HAI). SSIs impact around 2% of operations in high-income nations. Although SSI rates are modest in the United States and Europe, it is the second most common kind of HAI. According to WHO, SSIs are the most often reported kind of HAI in countries with low or middle incomes with a total frequency of 11.8 SSI/100 surgical operations.¹⁰

In our study, SSIs after abdominal surgery without intraoperative irrigation was found to be 13.1% and SSIs after abdominal surgery with intraoperative irrigation was 4.6% (p-value = 0.0007). Results of our study validates previous results of same study by Khan et al with postoperative SSI lower in patients with wound irrigation (4.5%) than in patients without irrigation (10.2%).⁹ However, they used saline irrigation in their study as compared to Povidone-iodine used in our study.

Ghafari et al compared wound irrigation of povidone-iodine with normal saline in simple traumatic wounds and found SSI in 7.7% of the povidone-iodine group and 7.3% of the normal saline group.¹¹ Lammers et al evaluated bacterial counts of 33 severely polluted acute traumatic wounds in their study. According to this research, bathing wounds for 10 minutes with 1% povidone-iodine is no better than soaking them in regular control group.^{12,13}

Ali et al evaluated the incidence of SSI following wound irrigation with normal saline and povidone-iodine solutions in polluted and filthy wounds. SSI was observed in 32.2% of normal saline patients and 28.8% of aqueous povidone-iodine patients ($p=0.627$). In terms of surgical site infection, there

was no significant difference between the two groups.¹⁴

In another study, Mirani et al determined the rate of deep SSI in patients treated with an exploratory laparotomy surgery with or without wound irrigation. On third day, SSIs were found in 6.9% patients with irrigation and 7.2% without irrigations, 6.7% with wound irrigations and 6.4% without wound irrigations had deep SSI after surgery. They found that per-operative wound irrigations are ineffective for lowering the risk of SSIs.¹⁵ Another study by Haider et al found that wound irrigation prior to skin closure is ineffective in preventing SSI. Their findings revealed that SSI was 6.8% in the group without irrigation and 8.7% in the group with irrigation.¹⁶

Conclusion

This study concluded that intraoperative wound irrigation is effective to prevent the surgical site infections after abdominal surgery. So, we recommend that intraoperative irrigation of the surgical wounds should be done routinely after abdominal surgery for preventing surgical site infections.

References

1. Abboud K, Blee J, Shah PJ. Antibiotic irrigation solutions for prevention of surgical site infections: A call to action. *Am J Health Syst Pharm.* 2020;77(24): 2040-2041.
<https://doi.org/10.1093/ajhp/zxaa316>
2. Bhangu A, Ademuyiwa AO, Aguilera ML, Alexander P, Al-Saqqa SW, Borda-Luque G, et al. Surgical site infection after gastrointestinal surgery in high-income, middle-income, and low-income countries: a prospective, international, multicentre cohort study. *Lancet Infect Dis.* 2018;18(5):516-525.
[https://doi.org/10.1016/S1473-3099\(18\)30101-4](https://doi.org/10.1016/S1473-3099(18)30101-4)
3. Maemoto R, Noda H, Ichida K, Tamaki S, Kanemitsu R, Machida E, et al. Superiority trial comparing intraoperative wound irrigation with aqueous 10% povidone-iodine to saline for the purpose of reducing surgical site infection after elective gastrointestinal surgery: study protocol for a randomized controlled trial. *BMJ Open.* 2021;11(6):e051374.
<https://doi.org/10.1136/bmjopen-2021-051374>
4. Edmiston Jr CE, Spencer M, Leaper D. Antiseptic irrigation as an effective interventional

- strategy for reducing the risk of surgical site infections. *Surg Infect.* 2018;19(8):774-780. <https://doi.org/10.1089/sur.2018.156>
5. Ambe PC, Rombey T, Rembe JD, Dörner J, Zirngibl H, Pieper D. The role of saline irrigation prior to wound closure in the reduction of surgical site infection: a systematic review and meta-analysis. *Patient Saf Surg.* 2020;14(1):1-8. <https://doi.org/10.1186/s13037-020-00274-2>
 6. Mueller T, Dimpel R, Kehl V, Friess H, Reim D. Surgical site infection prevention in abdominal surgery: is intraoperative wound irrigation with antiseptics effective? Protocol for a systematic review and meta-analysis. *BMJ Open.* 2023;13(2):e066140. <https://doi.org/10.1136/bmjopen-2022-066140>
 7. Norman G, Atkinson RA, Smith TA, Rowlands C, Rithalia AD, Crosbie EJ, et al. Intracavity lavage and wound irrigation for prevention of surgical site infection. *Cochrane Database Syst Rev.* 2017(10):CD012234. <https://doi.org/10.1002/14651858.CD012234.pub2>
 8. Papadakis M. Wound irrigation for preventing surgical site infections. *World J Methodol.* 2021;11(4):222-227. <https://doi.org/10.5662/wjm.v11.i4.222>
 9. Khan R, Asghar MU, Siyar F, Saleem MM, Safdar MHK. Role of wound irrigation in Prophylaxis of surgical site infection in clean contaminated wounds. *Pak Armed Forces Med J.* 2019;69(1):60-64.
 10. World Health Organization. Global guidelines for the prevention of surgical site infection. World Health Organization; 2016.
 11. Ghafouri HB, Zavareh M, Jalili F, Cheraghi S. Is 1% povidone-iodine solution superior to normal saline for simple traumatic wound irrigation?. *Wound Med.* 2016;15:1-5. <https://doi.org/10.1016/j.wndm.2016.08.001>
 12. Lammers RL, Fourré M, Callahan ML, Boone T. Effect of povidone-iodine and saline soaking on bacterial counts in acute, traumatic, contaminated wounds. *Ann Emerg Med.* 1990;19(6):709-714. [https://doi.org/10.1016/S0196-0644\(05\)82486-2](https://doi.org/10.1016/S0196-0644(05)82486-2)
 13. Luwang AL, Saha PK, Rohilla M, Sikka P, Saha L, Gautam V. Chlorhexidine–alcohol versus povidone–iodine as preoperative skin antisepsis for prevention of surgical site infection in cesarean delivery—a pilot randomized control trial. *Trials.* 2021 Dec;22(1):1-7.
 14. Ali A, Din SS, Baig I, Hussain MT, Sadiq A, Syed A. Comparison of intraoperative wound irrigation with aqueous povidone-iodine solution to normal saline in preventing surgical site infections. *J Ayub Med Coll Abbottabad.* 2023;35(3):366-369. <https://doi.org/10.55519/JAMC-03-12158>
 15. Mirani SH, Khan AW, Nsar AR. Deep surgical site infections (DSSIS): determine the prevalence of deep surgical site infections (DSSIS) in patients treated laparotomy procedure with or without post-operative wound irrigation. *Prof Med J.* 2019;26(03):484-487. <https://doi.org/10.29309/TPMJ/2019.26.03.3258>
 16. Haider S, Basit A, Abbasi SH, Shah FH, Kiani YM. Efficacy of irrigation with povidone iodine solution before skin closure to reduce surgical site infections in clean elective surgeries. *Rawal Med J.* 2018;43(3):467-70.