ORIGINAL ARTICLE

COMPARISON OF INTRAOPERATIVE WOUND IRRIGATION WITH AQUEOUS POVIDONE-IODINE SOLUTION TO NORMAL SALINE IN PREVENTING SURGICAL SITE INFECTIONS

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Background: A surgical site infection (SSI) is a wound infection caused by pathogens, particularly bacteria, that occurs within 30 days of the surgery. Various methods have been employed to minimise infection rates of infection one of which is intra-operative wound irrigation. This study aims to compare the frequency of surgical site infections after wound irrigation of contaminated and dirty wounds with normal saline and aqueous povidone-iodine solutions. **Methods:** This randomized controlled trial was carried out in the surgical department of Federal Government Polyclinic Hospital from January to December 2022. A total of 180 patients were randomly divided into two equal groups using blocked randomization. Group A had normal saline irrigation while Group B had aqueous povidone-iodine irrigation before surgical incision closure. Patients were followed till 30th post-operative day. Data was collected, entered and analyzed using SPSS 20.0. **Results:** A total of 180 patients were recruited in this study, equally divided into Group A and Group B with 90 patients each. Fifty-three patients (58.9%) from group-A and 58 patients (64.4%) from group-B were having contaminated wounds and 37 patients (41.1%) and 32 patients (35.6%) had dirty wounds respectively. Surgical site infection was found in 29 patients (32.2%) of group-A and 26 patients (28.8%) of group-B (p=0.627). there was no significant difference between the two groups concerning surgical site infection. **Conclusion:** Irrigation of surgical wounds with aqueous povidone-iodine solution before primary closure was statistically similar to normal saline in preventing surgical site infections in contaminated and dirty wounds.

Keywords: Surgical Site Infection; Normal Saline; Povidone-Iodine; Irrigation; Wound Closure

Citation: 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):371–4.

DOI: 10.55519/JAMC-03-12158

INTRODUCTION

In abdominal procedures, wound closure is related to various complications such as wound infection, dehiscence, burst abdomen, incisional hernias and persistent pain at the surgical site.[1] A surgical site infection (SSI) is a wound infection caused by pathogens, particularly bacteria, that occurs within 30 days of the surgery.[2] Surgical site infections represent 14–16% of all hospital-acquired infections, making them the third most prevalent type of infection.[3,4] Surgical site infections cause a significant delay in healing, resulting in increased healthcare costs.[5] In developing countries, SSI occurs at a rate of 1–2% in clean wounds, 6-9% in clean-contaminated wounds, 13–20% in contaminated wounds, and 40% in dirty wounds.[6]

In order to minimize the rates of infection, various methods have been employed such as prophylactic antibiotics administration, sterile techniques, irrigation of the wound, preventing and minimizing the spillage of gut contents, and use of antibiotics coated sutures.[5,7]

Intraoperative wound irrigation (IOWI) is done to clean the surgical wound of tissue debris, tissue exudate, and metabolic waste while minimizing bacterial load prior to wound closure.[7,8] Normal saline is one of the various solutions that can be used for wound irrigation. It is a common choice for IOWI irrigation fluid because it is an isotonic solution that does not hinder wound healing.[7,8] Another solution, aqueous povidone-iodine (PVP-I), has been used for wound irrigation.[9]

This study aims to compare the frequency of surgical site infections after wound irrigation of contaminated and dirty wounds with normal saline and aqueous povidone-iodine solutions. This will help determine the solution for wound irrigation to minimize the frequency of surgical site infections.

MATERIAL AND METHODS

This randomized controlled trial (RCT) was carried out in the surgical department of the Federal Government Polyclinic Hospital from January to December 2022. All patients were included as per the criteria. Approval was obtained from the institutional ethical committee and informed written consent was taken from every individual. A total of 180 patients were enrolled in the study. All patients presenting to the outpatient and emergency department, 12–65 years of age of both

genders undergoing exploratory laparotomy or open appendectomy with pus, or any surgery with contaminated or dirty wounds at incision sites which required closure, were included in the study. Patients having suture sinuses that healed spontaneously after removal of sutures, who were diabetic, immunocompromised, on steroids or chemotherapy, burn patients and patients with clean and clean-contaminated wounds were excluded from the study.

Data was collected about patients' age, gender, diagnosis and type of intervention done. Non-probability consecutive sampling was done. The patients were randomly divided into two equal groups by blocked randomization making permuted blocks of 6. Group A had normal saline irrigation before surgical incision closure. Group B had aqueous povidone-iodine (Pyodine and normal saline) irrigation before closure. The solution was made by mixing 10% PVP-I solution ¼ parts and normal saline ¾ parts as required. Wash was done using a feeding syringe (low-pressure system) and no rubbing with gauze or finger was done during irrigation. The wound was irrigated with approximately 50–100 ml of solution per centimetre of the wound length.

All the surgeries were performed by the same surgical team and the dressing protocols remained the same for all the patients. Antibiotic protocols remained the same for trauma/abdominal surgeries. For contaminated wounds, a 3rd generation cephalosporin was started and was changed according to culture if needed. In dirty wounds, 3rd generation cephalosporin with metronidazole were started and changed according to culture or if the patient's condition deteriorated. Patients were followed up for 30 days post-operatively to look for the development of SSI. Surgical site infection was judged by clinical parameters (redness, discharge and fever) and microbiological assessment. Cultures of wounds were taken on suspicion within 30 days of post-operative period, and patients were categorized as infected or non-infected wound groups according to the results of the wound culture.

Data was entered and analyzed using SPSS version 20.0. Quantitative variables like age, height, weight and BMI were measured as mean±SD. Categorical variables like gender, infection and wound type were measured as frequencies and percentages. Chi-square test was used for the comparison of infection between the groups. A *p*-value of <0.05 was considered significant. Effect modifiers like age, gender, BMI and type of wound was controlled by stratification. Post-stratification Chi-square test was applied and a *p*-value of <0.05 was taken as significant.

RESULTS

A total of 180 patients were recruited in this study. Group A had normal saline irrigation before surgical incision closure (n=90). Group B had aqueous povidone-iodine irrigation before closure (n=90). Patients ranged between 12–65 years of age with a mean age of 37.6±14.9 and 36.0±15.1 in group-A and B respectively. 53 patients (58.9%) in group-A and 50 patients (55.6%) in group-B were males while 37 (41.1%) in group-A and 40 (44.4%) in group-B were females. The mean BMI in group-A was 23.6±3.9 and in group-B was 22.5±3.9 kg/m^2. 53 patients (58.9%) from group-A and 58 patients (64.4%) from group-B were having contaminated wounds and 37 patients (41.1%) in group-A and 32 patients (35.6%) had dirty wounds. Surgical site infection was found in 29 patients (32.2%) of group-A and 26 patients (28.8%) of group-B (*p*=0.627) which was statistically not significant shown in Table-1. Stratification of the type of wound according to the procedure is shown in Table-2. Stratification for age, gender, BMI and type of wound was also carried and no statistically significant difference was found in any stratified variable shown in Table-3.

Table-1: Distribution of parameters according to irrigation solution

Variables	Group-A Normal Saline (n = 90)	Group-B Aqueous Povidone-Iodine (n = 90)
Age (Years)		
12-35	40 (44.4%)	44 (48.8%)
36-65	50 (55.6%)	46 (51.2%)
Mean ± SD	37.6 ± 14.9	36 ± 15.1
Gender		
Male	53 (58.9%)	50 (55.6%)
Female	37 (41.1%)	40 (44.4%)
BMI (kg/m^2)		
≤25	54 (60.0%)	67 (74.4%)
>25	36 (40%)	23 (25.6%)
Mean ± SD	23.6 ± 3.9	22.5 ± 3.9
Wound type		
Contaminated	53 (58.9%)	58 (64.4%)
Dirty	37 (41.1%)	32 (35.6%)
Surgical site infection		
Infected	29 (32.2%)	26 (28.8%)
Non-Infected	61 (67.8%)	64 (71.2%)

Table-2: Distribution of type of wound according to diagnosis

Type of wound	Diagnosis	Group A Normal Saline (n = 90)	Group B Aqueous Povidone-Iodine (n = 90)
Contaminated (n=111)	Acute Appendicitis	40	45
	Open Cholecystectomy (with biliary spillage)	6	5
	Trauma wound larger than 5cm	7	8
Dirty (n=69)	Perforated Appendix	17	13
	Appendicular Abscess	3	4
	Perforated Viscus having Abscess/ faecal contamination	17	14
	Trauma wound larger than 5cm	0	1

Table-3: Stratification of patients according to different parameters

Parameter	Stratification	Group	Surgical Site		Total	*p*-value
			Infected	Non-Infected		
Age (Years)	12-35	Group-A	7	33	40	0.625
		Group-B	6	38	44	
	Total		**13**	**71**	**84**	
	36-65	Group-A	22	28	50	0.959
		Group-B	20	26	46	
	Total		**42**	**54**	**96**	
Gender	Male	Group-A	12	41	53	0.559
		Group-B	9	41	50	
	Total		**21**	**82**	**103**	
	Female	Group-A	17	20	37	0.761
		Group-B	17	23	40	
	Total		**34**	**43**	**77**	
Wound Type	Contaminated	Group-A	10	43	53	0.810
		Group-B	12	46	58	
	Total		**22**	**89**	**111**	
	Dirty	Group-A	19	18	37	0.528
		Group-B	14	18	32	
	Total		**33**	**36**	**69**	
BMI (KG/M^2)	≤25	Group-A	14	40	54	0.514
		Group-B	21	46	67	
	Total		**35**	**86**	**121**	
	>25	Group-A	15	21	36	0.115
		Group-B	5	18	23	
	Total		**20**	**39**	**59**	

DISCUSSION

Globally, infection is one of the most common post operative complications and research into preventive measures is still a priority.[10] Several techniques have occasionally been tried for SSI prevention with mixed results. The use of antibiotic-coated sutures and intra-operative surgical wound irrigation are currently the commonly studied preventive strategies to avert SSIs.[11] The use of intra-operative surgical site irrigation is advocated by many studies.[7]

At present, there are no recommended guidelines on wound irrigation. Different solutions have been employed for irrigation such as normal saline, antibiotics and antiseptics.[9]

When used for irrigation of wounds, normal saline is a widely accessible and more affordable solution than topical antibiotics. It has a favourable safety profile because it is hypertonic for bacteria and isotonic with normal human tissue. In addition to this, irrigation with a 10% aqueous PVP-I solution is recommended by various guidelines for SSI prevention.[12,13]

In our study, there was no statistically significant difference in the incidence of wound infection after irrigation of the surgical site with aqueous PVP-I as compared to normal saline. A review by Chundamala *et al*. exhibited similar results in five studies which showed no significant benefit of povidone-iodine irrigation in comparison to normal saline irrigation.[14] Similarly, Maemoto *et al*. discussed trials which also showed no response in reducing the incidence of infection after PVP-I irrigation.[15] This can be attributed to the fact that our study included contaminated and dirty wounds. Irrigation of the wound does lower the incidence of infection but both normal saline and PVP-I has comparable efficacy in decreasing the incidence of SSIs.

On the contrary, a recent meta-analysis showed decreased incidence of infection (59% reduction) after IOWI with 10% PVP-I.[16] Similar

results were shown in other analysis showing the benefit of irrigation with PVP-I.[9,17]

In our study, patients with ages more than 35 years had a higher incidence of post-operative wound infections as compared to patients who had ages less than 36 years. This may be caused by a variety of factors such as low healing rate, malabsorption, malnutrition, and low immunity.

The limitation of our study includes a small sample size and a single-center study. Rigor was employed in data collection and analysis which is one of the strengths including randomization that ensured random assignment and equal size in both groups. Blinding could be employed which would have given more strength to the study. Wound size, depending on the type of surgery, was not constant. There is also a need for comparing irrigation with antibiotics. The effect of irrigation in patients with diabetes mellitus and immunocompromised states should be evaluated.

CONCLUSION

Irrigation of surgical wounds with aqueous povidone-iodine solution before primary closure was statistically similar to normal saline in preventing surgical site infections. Surgical site infections depend upon various factors. Further multicentric studies with larger sample size need to be done for helping in the standardization of wound irrigation techniques to decrease the incidence of SSIs.

AUTHORS' CONTRIBUTION

AA: Conceptualization, data collection, data analysis and interpretation, literature search, write-up. SS: Data analysis, write-up, literature search, proofreading. IB: Write-up, supervision, proofreading. MTH: Conceptualization, literature search, proofreading. AS: Data collection, data analysis, write-up. AS: Data collection data analysis, literature search.

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Submitted: June 8, 2023	Revised: July 3, 2023	Accepted: July 6, 2023

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