

Research Article

Open Access, Volume 4

Clinical evaluation of preoperative skin preparation with aqueous povidone iodine only and in combination with alcoholic chlorhexidine in patients undergoing clean elective surgeries

Nihir Gupta; Anju Nagar; Dharmraj Meena; Radhey Shyam Meena*; Surendra Kumar

Department of General Surgery, Government Medical College, Kota, Rajasthan, India.

***Corresponding Author: Radhey Shyam Meena**

Department of General Surgery, Government Medical College, Kota, Rajasthan, India.

Tel: 9414180444

Email: rs_meenaa@yahoo.com

Received: Feb 09, 2023

Accepted: Mar 03, 2023

Published: Mar 10, 2023

Archived: www.jcimcr.org

Copyright: © Meena RS (2023).

DOI: www.doi.org/10.52768/2766-7820/2319

Abstract

Background: Surgical site infections (SSIs) is a dangerous condition posing a heavy burden on the patient and social health system. Adequate pre-operative skin preparation helps in reducing the SSIs and this study is undertaken to compare the efficacy of povidone-iodine alone and in combination with chlorhexidine.

Methods: This is an observational study in which 100 patients admitted for elective clean surgery in Government Medical College, Kota during the period of 2 years from November 2020 – October 2022 studied in two groups where preoperative skin preparation is done using povidone-iodine alone and in combination with alcoholic chlorhexidine. The surgical wounds were examined for presence of any infections.

Results: In Group I, 6 patients whereas in Group II, only 2 patients had microbial colonization of the site of incision. Of the patients with positive culture results from site of incision, 4 patients in Group I developed wound infection where as in Group II none of the patients developed wound infection.

Conclusion: Preoperative skin preparation with chlorhexidine gluconate 2.5% v/v in 70% propanol followed by aqueous povidone-iodine is an ideal regime as it has a broader antimicrobial spectrum and the rate of post operative wound infections is much lower as compared to povidone iodine alone.

Keywords: Surgical site infections; Chlorhexidine; Propanol; Povidone-iodine; Bacterial colonization; Wound infection.

Abbreviations: SSI: Surgical Site Infections, CHX: Chlorhexidine gluconate, PVP-I: Povidone-iodine, SD: Standard Deviation.

Introduction

Skin is the primary barrier against bacterial invasion. Following a skin incision, microorganisms of the standard skin flora may contaminate exposed tissues and cause an SSI. Despite many recent advances in surgical techniques in the past few

years, post-operative wound sepsis remains a significant problem. SSIs are associated with longer hospital and intensive care unit stays, increased re admission to hospital after discharge, and a two-fold increase in mortality. Many factors contribute to the development of post-operative wound infections, some

Citation: Gupta N, Nagar A, Meena D, Meena RS, Kumar S. Clinical evaluation of preoperative skin preparation with aqueous povidone iodine only and in combination with alcoholic chlorhexidine in patients undergoing clean elective surgeries. *J Clin Images Med Case Rep.* 2023; 4(3): 2319.

relating to the patient and some relating to the procedure itself [1].

The terms asepsis and antisepsis denote two policies whereby access to a wound and its consequent infection is halted. Moynihan [2] (1920) conducted his bacteriological experiment with one of the two intentions:

1. The exclusion of all organisms from the wound;
2. The destruction of all micro-organisms reaching the wound by a bactericide applied to the wound surface.

Preoperative skin antisepsis has been proven to rapidly reduce local microorganism counts in the operational field. Of many techniques for skin preparation before surgery, initially with antiseptic soap solution, followed by painting the prepared area with sterile paint solution is most common. Degerming of the skin done with antiseptics used for less than a minute is as effective as a five-minute scrub with a germicidal soap solution followed by painting with antiseptics [3]. Commonly used agents for skin antisepsis are chlorhexidine gluconate (CHX) or povidone-iodine (PVP-I).

The 2017 Centre for Disease Control and Prevention Guideline for Prevention of SSIs recommends, with high-quality evidence, the use of intraoperative skin preparation with an alcohol-based antiseptic agent; however, due to a lack of conclusive randomized controlled trials (RCTs), no specific antiseptic agent is endorsed [4].

Other institutions, such as Health Protection Scotland and the Canadian Patient Safety Institute, recommend the use of CHX [5,6]. These recommendations are based on the remnant effect against bacterial regrowth and thus prolonged activity that can be attributed to CHX [7,8]. Furthermore, CHX remains activated in the presence of organic fluids such as blood or pus, in contrast to iodophors, which become inactivated [9]. This study is undertaken to compare the efficacy of povidone-iodine alone and in combination with alcoholic chlorhexidine against bacterial flora on the skin of the operation site under conditions, encountered in operating rooms.

Aim and objectives

1. To evaluate the efficacy of povidone-iodine alone and in combination with an antiseptic agent containing alcoholic chlorhexidine on preoperative skin preparation by taking swab culture.
2. To compare the rate of postoperative wound infection in both groups.

Inclusion criteria

Patients of all age groups undergoing elective surgery in the Department of General Surgery with a clean wound.

Exclusion criteria

1. Patients undergoing emergency surgery.
2. Immunocompromised patients and patients on long-term steroids.
3. Patients with septicemia and having a focus of infection

somewhere on the body manifested clinically with fever and increased total and differential counts.

4. Patients suffering from malignancies or undergoing chemotherapy or radiation therapy.
5. Clean contaminated and contaminated surgeries in which viscous was opened were excluded from the study.
6. Patients with comorbid medical conditions like diabetes, hypertension, etc.

Methodology

This is an observational study in which 100 patients admitted for elective clean surgery in the Department of General surgery of Government Medical College, Kota, Rajasthan, India during the period of 2 years from November 2020 – October 2022 was studied in two groups. Cases were selected at random irrespective of each case preoperatively, shaving of the parts was done at the same time on the previous evening for all the patients. The preoperative skin preparation in each group was done with the respective antiseptic regimen. For Group-1 antiseptic regimen used was three coats of aqueous povidone-iodine IP 5% w/v. For Group-2 antiseptic regimen used was a single coat of agent containing chlorhexidine gluconate 2.5% v/v in 70% propanol followed by two coats of aqueous povidone-iodine IP 5% w/v. The pre-operative antibiotic used was Cefotaxime 1 gram I.V given following a test dose; one hour prior to incision. A sterile saline swab culture and sensitivity was done from the site of incision immediately in both the groups was transferred to microbiology department to determine whether any microorganisms were left behind and hence to compare the efficacy of both the regimes of skin preparation. Post operatively, first dressing was done on third postoperative day with aqueous solution of povidone iodine alone and patients were followed up till the time of sutures removal (7-10 days) to look for any signs of wound infection according to Southampton wound grading system. If any purulent discharge was seen, pus culture and antibiotic sensitivity tests were done to know whether causative organisms were same which were left behind preoperatively after skin preparation and hence incomplete disinfection was the cause for wound infection or whether the infection was acquired in the ward. Statistical analysis was performed using SPSS Statistics V22.0. Results were represented with frequencies and percentages. The Chi-square test and Fischer exact test were applied to find significance. $P < 0.05$ was considered statistically significant.

Results

A total of 100 patients who were planned for clean elective surgery were studied in two groups (50 in each group). The Age distribution of subjects is shown in Table 1. The Mean (SD) value of the age for group I was 39.46 +18.28 and that for group II was 41.6+18.85 years and the difference was not statistically significant as shown in Table 2. There were 64 males (Group I - 30; Group II – 34) and 36 females (Group I - 20; Group II –16) as shown in Table 3. Duration of surgeries varied from 45 minutes to 3 hours and since all the surgeries were clean and elective, the duration of surgery had no effect on the number of cases with positive culture swabs. The diagnosis and nature of operations were variable and thus site of incisions also varied

and incisions were found all over the body as summarized in Table 4. There were 6 patients in group I and 2 patients in group II who had positive culture which was found to be statistically significant as shown in Table 5. The culture and antibiotic sensitivity results of the patients with growth in both groups are summarized in Table 6. Post-operatively patients were followed up to the time of suture removal (usually 7-10 days) to know the percent of cases who developed wound infections. There were 6 cases in group I and 2 cases in group II who developed postoperative wound infections. It was noted that out of 6 cases with growth in group I, only 4 had post-operative wound infection and the other 2 were ward acquired. Similarly, both the infections in group II were ward acquired as summarized in Table 7.

Table 1: Age distribution of study subjects.

Age group (years)	Group I		Group II		Total	
	N	%	N	%	N	%
<20	6	12	4	8	10	10
20-39	22	44	18	36	40	40
40-59	13	26	17	34	30	30
60-79	8	16	10	20	18	18
80-99	1	2	1	2	2	2
Total	50	100	50	100	100	100

Chi-square = 1.556 with 4 degrees of freedom; P = 0.817

Table 2: Comparison of mean age (years) among study groups.

Group	N	Mean ± SD	Median (Range)
Group I	50	39.46 ± 18.28	37.5 (3 – 81)
Group II	50	41.6 ± 18.85	40.5 (3 – 84)

t = -0.576 with 98 degrees of freedom; P = 0.566

Table 3: Gender distribution of study subjects.

Gender	Group I		Group II		Total	
	N	%	N	%	N	%
Female	20	40	16	32	36	36
Male	30	60	34	68	64	64
Total	50	100	50	100	100	100

Chi-square = 0.391 with 1 degree of freedom; P = 0.532

Discussion

The use of PVP-iodine in surgeries dates to 1955. Chlorhexidine gluconate with its increased efficiency has been recently made available all over as an antiseptic and disinfectant. In this study, we compared the efficacy of povidone-iodine alone and in combination with alcoholic chlorhexidine in elective clean surgeries for the prevention of surgical site infections. The present study was done on 100 patients who were to undergo elective clean cases in the Department of General Surgery, Government Medical College, Kota with the aims of evaluating the efficacy of povidone-iodine alone and in combination with an antiseptic agent containing alcoholic chlorhexidine on preoperative skin preparation, and to compare the rate of postoperative wound infections in both the groups. In present study 12% in group-I and 4% in group-II had colonization of site of incision even after skin disinfection whereas the values in study by Julia L et al. [10] were 35.3% and 4.7% and by Ajay et al.[11] were 20.8% and 3.3% respectively. This shows that when compared

Table 4: Nature of operations.

Diagnosis	Group I		Group II		Total	
	N	%	N	%	N	%
Fibroadenoma B/L	1	2	0	0	1	1
Fibroadenoma Left	3	6	3	6	6	6
Fibroadenoma Right	2	4	3	6	5	5
Ca Breast Left	2	4	0	0	2	2
Ca Breast Right	0	0	1	2	1	1
Gynecomastia Left	2	4	3	6	5	5
Gynecomastia Right	0	0	2	4	2	2
Lipoma Axillary Right	1	2	0	0	1	1
Lipoma Axillary Left	0	0	1	2	1	1
Lipoma Ant Abd Wall	1	2	0	0	1	1
Lipoma Back	1	2	4	8	5	5
Lipoma Neck	0	0	1	2	1	1
Inguinal Hernia B/L	0	0	1	2	1	1
Inguinal Hernia Left	5	10	4	8	9	9
Inguinal Hernia Right	6	12	11	22	17	17
Congenital Right Inguinal Hernia	1	2	1	2	2	2
Incisional Hernia	2	4	0	0	2	2
Epigastric Hernia	1	2	0	0	1	1
ParaUmbilical Hernia	1	2	0	0	1	1
Supra Umbilical Hernia	0	0	1	2	1	1
Umbilical Hernia	2	4	1	2	3	3
Hydrocele Left	3	6	0	0	3	3
Hydrocele Right	1	2	1	2	2	2
Varicocele Right	1	2	0	0	1	1
Varicocele Left	2	4	2	4	4	4
Varicose Vein Leg Right	1	2	0	0	1	1
Varicose Vein Leg Left	1	2	1	2	2	2
Ovarian Cyst Left	1	2	0	0	1	1
Ovarian Cyst Right	1	2	0	0	1	1
Ovarian Mucous Cystadenoma Left	0	0	1	2	1	1
Inguinal Cyst Left	1	2	0	0	1	1
Epididymal Cyst Right	1	2	0	0	1	1
Cystic Swelling Neck Left	0	0	1	2	1	1
Hydatid cyst Liver	2	4	3	6	5	5
Nephrolithiasis Right	3	6	0	0	3	3
Cholelithiasis	0	0	2	4	2	2
Vesicle Calculi	1	2	1	2	2	2
UDT Right	0	0	1	2	1	1
Total	50	100	50	100	100	100

Table 5: Culture report.

Culture results	Group I		Group II		Total	
	N	%	N	%	N	%
No growth	44	88	48	96	92	92
Growth	6	12	2	4	8	8
Total	50	100	50	100	100	100

Chi-square = 1.223 with 1 degree of freedom; P = 0.269

Table 6: Sensitivity report.

Antibiogram	Group I						Group II	
	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6	Patient 1	Patient 2
	Staphylococcus aureus	Staphylococcus albus	Staphylococcus aureus	Staphylococcus aureus	Staphylococcus aureus	Staphylococcus albus	Staphylococcus aureus	Staphylococcus aureus
Amoxycillin	S	S	S	S	R	S	S	S
Cefatoxime	S	S	S	S	S	S	S	S
Ciprofloxacin	S	S	S	S	S	S	S	S
Gentamycin	S	S	S	S	S	S	S	S
Amikacin	S	S	S	S	S	S	S	S

*S = Sensitive

Table 7: Relationship between Microbiological report and post-operative wound infection rate.

Micro-biological report	Group I			Group II		
	No infection	Infection	Total	No infection	Infection	Total
No Growth	42	2 #	44	46	2 #	48
Growth	2	4*	6	2	0*	2
Total	44	6	50	48	2	50
	Chi-square = 13.86at 1 df P < 0.001 (S)			Chi-square = 17.589, 1 df; P < 0.001 (S)		

* - Post-operative infections with Positive culture report

- Ward infections

to povidone-iodine alone, using a combination of povidone iodine and an alcoholic solution of chlorhexidine, the colonization rates of the sites of incision were reduced significantly. The rate of postoperative wound infections (after excluding ward infections) in group I was 8% and of group II was 0% whereas the respective values in study by Brown et al. [12] were 8.1% and 6.0% and by Ajay et al. [11] were 13.3% and 0%. The difference in the results was not that significant in studies done by Park et al. [13], Sistla et al. [14], and Paocharoen et al. [15]. The results from the present study show that pre-operative skin preparation using chlorhexidine gluconate 2.5% v/v in 70% propanol followed by aqueous povidone-iodine 5% w/v is effective when compared with aqueous povidone-iodine alone. The limitations of our study include convenient sample size and lack of diversity in patients, as it is a single-center study.

Conclusion

Despite many recent advances in surgical techniques in the past few years, post-operative wound sepsis remains a significant problem. There is now an increase in evidence that a high proportion of SSIs is caused by bacterial access into deeper skin structures during skin incision. Therefore, proper skin antiseptics might be one of the keys to reducing the colonization of the site of incision and thus reducing the incidence of subse-

quent infection. The present study confirms the superiority of povidone-iodine in combination with alcoholic chlorhexidine over povidone-iodine alone in pre-operative skin preparation and warrants recommendation of it as a preferred antiseptic in skin preparation for elective clean surgery. Since the superiority of this regimen was proved in decreasing incision site colonization and postoperative wound infection, it is prudent to use this regimen in contaminated and emergency surgeries. However, further studies are needed to explore the comparative efficacy of these agents in a larger number of patients with clinically relevant endpoints.

References

1. Gottrup F. Prevention of surgical-wound infections. N Engl J Med. 2000; 342: 202-204.
2. Moynihan, Sir Berkeley GA. The ritual of a surgical operation. British journal of surgery.1920; 8: 27.
3. Richard Howard J. "Surgical infections." Schwartz textbook of principles of surgery, McGraw Hill Company.1999; 7: 132.
4. Berrios-Torres SI, Umscheid CA, Bratzler DW, Leas B, Stone EC, Kelz RR, et al. Centers for Disease Control and Prevention guideline for the prevention of surgical site infection, 2017. JAMA Surg. 2017; 152: 784-91.
5. Canadian Patient Safety Institute. Safer healthcare now! Getting started kit: prevent surgical site infections.
6. Health Protection Scotland. Targeted literature review: what are the key infection prevention and control recommendations to inform a surgical site infection (SSI) prevention quality improvement tool?
7. Leaper D et al. Prevention and treatment of surgical site infection: summary of NICE guidance. BMJ.2008;337:1924.
8. Anon. Prävention postoperativer Wundinfektionen. Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz. 2018; 61: 448-73.
9. Lim KS, Kam PC. Chlorhexidine–pharmacology and clinical applications. Anaesth Intensive Care. 2008; 36: 502-12.

-
10. Julia Langgartner, Hans-Jorg Linde, Norbert Lehn, Reng Schol M, Erich J, Gluck T. Combined skin disinfection with Chlorhexidine/Propanol and aqueous povidone-iodine reduces bacterial colonization of central venous catheter. *Intensive care medicine*. 2004; 30: 1081-88.
 11. Ajay Kumar Mareedu. Comparative study of Preoperative skin preparation with aqueous povidone iodine only versus povidone iodine in combination with chlorhexidine in clean elective surgeries. *IOSR journal of dental and medical sciences (IOSR-JDMS)*. 2018; 17: 1-6.
 12. Brown TR et al. A clinical evaluation of chlorhexidine gluconate spray as compared with iodophor scrub for preoperative skin preparation. *Surgery, Gynecology and Obstetrics*. 1984; 158: 363.
 13. Park HM, Han SS, et al. Randomized clinical trial of preoperative skin antisepsis with chlorhexidine gluconate or povidone-iodine. *BJS*. 2017; 104: 145-50.
 14. Sistla SC, Prabhu G, Sadasivan J. Minimizing wound contamination in a 'clean' surgery: comparison of chlorhexidine-ethanol and povidone-iodine. 2010; 56: 261-7.
 15. Veeraya Paocharoen. Comparison of surgical wound infection after preoperative skin preparation with 4% Chlorhexidine and povidone-iodine: a prospective randomized trial *J med assoc Thai*. 2009: 92.