

ORIGINAL RESEARCH

Clinical evaluation of preoperative skin preparation with aqueous povidone-iodine alone and in combination with alcoholic chlorhexidine in patients undergoing elective surgery

¹Dr. Furquan Ahmad, ²Dr. Yogesh Yadav, ³Dr. Deepak Chopra

^{1,2}Assistant Professor, ³Professor and HOD, Department of General Surgery, Rama Medical College and Hospital, Hapur, UP, India

Correspondence:

Dr. Furquan Ahmad

Assistant Professor, Department of General Surgery, Rama Medical College and Hospital, Hapur, UP, India

ABSTRACT

Aim: Clinical evaluation of preoperative skin preparation with aqueous povidone-iodine alone and in combination with alcoholic chlorhexidine in patients undergoing elective surgery

Material and methods: This observational study was carried out in the Department of General Surgery Rama Medical College and Hospital Hapur. 120 Patients of all age groups undergoing elective surgery in the Department of General Surgery with a clean wound were included in this study. 120 patients divided into 2 equal groups. For Group-1 antiseptic regimen used is three coats of aqueous povidone-iodine IP 5% w/v. For Group-2 antiseptic regimen used is 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 is Cefotaxime 1 gram I.V given following a test dose; one hour prior to incision.

Results: There are 7 patients in group-1 and 2 patients in group-2 who had positive culture which is found to be statistically significant. 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 7 cases in group-1 and 2 cases in group-2 who developed postoperative wound infections. It is noted that out of 7 cases with growth in group-1, only 4 had post-operative wound infection and the other 3 were ward acquired. Similarly, the only infection in group-2 is hospital acquired.

Conclusion: 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.

Keywords: Preoperative skin, aqueous povidone-iodine, alcoholic chlorhexidine

INTRODUCTION

Surgical-site infection (SSI) represents a major source of morbidity and mortality among surgical patients.^{1,2} Infection of the surgical wound can prolong hospitalization,³ increase

the rate of intensive care unit admission,⁴ and significantly increase the cost of treatment.^{5,6} Integral to the prevention of SSI is the adherence to aseptic techniques, one of which is the preoperative preparation of the operative site. Several skin preparation modalities are approved by the Food and Drug Administration and are in use in operating rooms today. ChlorPrep (Cardinal

Health) is a commercially available combination of 2% chlorhexidine and 70% isopropyl alcohol. The combination of chlorhexidine and isopropyl alcohol (or 70% isopropyl alcohol alone) has significantly better immediate antimicrobial activity than does 4% chlorhexidine. Also, the combination of chlorhexidine and isopropyl alcohol has demonstrated better residual antimicrobial activity than either 70% isopropyl alcohol alone or 4% chlorhexidine alone.⁷ In other trials, 2% chlorhexidine and 70% isopropyl alcohol demonstrated better immediate and long-term residual antimicrobial activity than did povidone-iodine alone.⁸ This finding has been observed clinically as well: Maki et al⁹ observed that cutaneous disinfection with chlorhexidine before insertion of an intravascular device and for postinsertion site care can substantially reduce the incidence of device-related infection, compared with cutaneous disinfection with povidone-iodine. Another skin disinfectant solution, consisting of iodine povacrylex in isopropyl alcohol (DuraPrep; 3M), is commercially available and has become popular for surgical disinfection.^{10,11} Iodine povacrylex in isopropyl alcohol solution may provide longer-lasting antisepsis than other iodophor-based products because, when placed on skin, it dries to a film of disinfectant. It has been suggested that this film may resist being washed away by fluids and blood and thus may provide potential for longer-term protection than traditional povidone-iodine.¹²

MATERIAL AND METHODS

This observational study was carried out in the Department of General Surgery after taking the approval of the protocol review committee and institutional ethics committee. 120 Patients of all age groups undergoing elective surgery in the Department of General Surgery with a clean wound were included in this study. Patients with immunocompromised, on long-term steroids, patients with septicaemia and having a focus of infection somewhere on the body manifested clinically with fever and increased total and differential counts and Clean contaminated and contaminated surgeries in which viscous was opened were excluded from the study.

METHODOLOGY

120 patients divided into 2 equal 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 is done with the respective antiseptic regimen. For Group-1 antiseptic regimen used is three coats of aqueous povidone-iodine IP 5% w/v. For Group-2 antiseptic regimen used is 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 is Cefotaxime 1 gram I.V given following a test dose; one hour prior to incision. A sterile saline swab culture & sensitivity is done from the site of incision immediately in both the groups. This has important implications in knowing whether these strains were responsible for causing infections in the post-operative period.

STATISTICAL ANALYSIS

Statistical analysis was performed using SPSS Statistics V25.0. 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 120 patients who were planned for clean elective surgery were studied in two groups (60 in each group). The Mean (SD) value of the age for group-1 was 39.7 ± 13.4 and that for group-2 was 37.7 ± 14.9 years and the difference is not statistically significant.

There were 72 males (Group I - 32; Group II - 40) and 48 females (Group I - 28; Group II - 20). Duration of surgeries varied from 46 minutes to 3.10 hours and since all the surgeries were clean and elective, the duration of surgery has no effect on the number of cases with positive cultures swabs.

There are 7 patients in group-1 and 2 patients in group-2 who had positive culture which is found to be statistically significant. The culture and antibiotic sensitivity results of the patients with growth in both groups are summarized in table 5.

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 7 cases in group-1 and 2 cases in group-2 who developed postoperative wound infections. It is noted that out of 7 cases with growth in group-1, only 4 had post-operative wound infection and the other 3 were ward acquired. Similarly, the only infection in group-2 is hospital acquired.

Table 1: Age and gender distribution

Gender	Group I		Group II		Total
	No. of cases	Percentage	No. of cases	Percentage	
Male	32	53.33%	40	66.67%	72
Female	28	46.67%	20	33.33%	48
Age	39.7 +13.4		37.7 +14.9		

Table 2: Nature of operations

Diagnosis of subjects	Group I		Group II	
	Number	Percentage	Number	Percentage
Excision	16	26.67%	19	31.67%
Excision Biopsy	6	10%	-	-
Hemithyroidectomy	1	1.67%	-	-
Hernioplasty	22	36.67%	28	46.67%
Superficial Parotidectomy	1	1.67%	1	1.67%
Total Thyroidectomy	7	11.67%	5	8.33%
Trendelenburg Procedure	7	11.67%	7	11.67%
Total	60		60	

Table 3: Culture report

Microbiology report	Group I		Group II	
	Number	Percentage	Number	Percentage
No growth	53	88.33%	58	96.67%
Growth present	7	11.67%	2	3.33%
Total	60	100	60	100

Table 4: Sensitivity report

Antibiogram	Group I		Group II
	Patient 1-6	Patient 7	Patient 1 and 2
	S. epidermidis	S. aureus	S. epidermidis
Amoxicillin	S	S	S
Cefotaxime	S	S	S
Ciprofloxacin	S	S	S
Gentamycin	S	S	S
Amikacin	S	S	S

*S=Sensitive

Table 5: Relationship between Microbiological report and post-operative wound infection rate

Microbiological report	Group I			Group II		
	No infection	Infection	Total	No infection	Infection	Total
No Growth	49	3#	53	56	2#	58
Growth	4	4*	7	2	0*	2
Total	53	7	60	58	2	60
	Chi-Square=14.4;p<0.001 & Fisher's Exact value			Chi-Square=0.03;p=0.7 & Fisher's Exact value		

* - Post-operative infections with Positive culture report#-
Hospital infections

Table 6: Sensitivity report of post-operative infections with positive culture report

Antibiogram	Group I	
	Patient 7	Patient 2,3,4
	S.aureus	S.epidermidis
Amoxicillin	S	S
Cefotaxime	S	S
Ciprofloxacin	S	S
Gentamycin	S	S
Amikacin	S	S

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 has 11.67% in group-1 and 3.33% in group-2 had colonization of site of incision even after skin disinfection whereas the respective values in Julia L. et al.¹³ studies were 35.3% and 4.7% and in Ajay et al.¹⁴ study were 20.8% and 3.3%. This shows that when compared 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-1 is 6.67% and of group-2 is 0% whereas the respective values in Brown et al.¹⁵ studies were 8.1% and 6.0%, Ajay et al.¹⁴ studies were 13.3% and 0%. The difference in the results was not that significant in studies done by Park et al.¹⁶, Sistla et al.¹⁷ and Paocharoen et al.¹⁸. 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

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.

REFERENCES

1. Astagneau P, Rioux C, Golliot F, Brucker G. Morbidity and mortality associated with surgical-site infections: results from the 1997–1999 INCISO surveillance. *J Hosp Infect.* 2001;48:267–274. [PubMed:11461127]
2. Kirkland KB, Briggs JP, Trivette SL, Wilkinson WE, Sexton DJ. The impact of surgical-site infections in the 1990s: attributable mortality, excess length of hospitalization, and extra costs. *Infect Control Hosp Epidemiol.* 1999;20:725–730. [PubMed:10580621]
3. Kurz A, Sessler DI, Lenhardt R. Perioperative normothermia to reduce the incidence of surgical-wound infection and shorten hospitalization. Study of Wound Infection and Temperature Group. *N Engl J Med.* 1996;334:1209–1215. [PubMed:8606715]
4. Greif R, Akca O, Horn EP, Kurz A, Sessler DI. Supplemental perioperative oxygen to reduce the incidence of surgical-wound infection. Outcomes Research Group. *N Engl J Med.* 2000;342:161–167. [PubMed:10639541]
5. Gaynes RP, Culver DH, Horan TC, Edwards JR, Richards C, Tolson JS. Surgical-site infection (SSI) rates in the United States, 1992–1998: the National Nosocomial Infection Surveillance System basic SSI risk index. *Clin Infect Dis.* 2001; 33(Suppl 2):S69–S77. [PubMed:11486302]
6. Swenson BR, Hollenbeak CS, Koltun WA. Hospital costs and risk factors associated with complications of the ileal pouch-anal anastomosis. *Surgery.* 2002;132:767–773. [PubMed:12407364]
7. Hibbard JS, Mulberry GK, Brady AR. A clinical study comparing the skin antiseptics and safety of Chloraprep-70% isopropyl alcohol, and 2% aqueous chlorhexidine. *J Infus Nurs.* 2002;25:244–249. [PubMed:12131506]
8. Hibbard JS. Analyses comparing the antimicrobial activity and safety of current antiseptic agents: a review. *J Infus Nurs.* 2005;28:194–207. [PubMed:15912075]
9. Maki DG, Ringer M, Alvarado CJ. Prospective randomised trial of povidone-iodine, alcohol, and chlorhexidine for prevention of infection associated with central venous and arterial catheters. *Lancet.* 1991;338:339–343. [PubMed:1677698]
10. Birnbach DJ, Meadows W, Stein DJ, Murray O, Thys DM, Sordillo EM. Comparison of povidone-iodine and DuraPrep, an iodophor-in-isopropyl alcohol solution, for skin disinfection prior to epidural catheter insertion in parturients. *Anesthesiology.* 2003;98:164–169. [PubMed:12502993]
11. Gilliam DL, Nelson CL. Comparison of a one-step iodophor skin preparation versus traditional preparation in total joint surgery. *Clin Orthop Relat Res.* 1990; 250:258–260. [PubMed:2293938]
12. Jeng DK, Severin JE. Povidone-iodine gel alcohol: a 30-second, one-time application preoperative skin preparation. *Am J Infect Control.* 1998;26:488–494. [PubMed:9795677]
13. Julia Langgartner, Hans-Jörg Linde, Norbert Lehn, Rengschol 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(6):1081-88.
14. Ajay Kumar Maredu. 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)* eISSN:2279-0853, p-ISSN:2279-0861. 2018;17(5):01-06.
15. Brown TR, Clarence Ehrlich E, Frederick Stehman B, Alan Golichowski M, James Madura A, Harold EE. “A clinical evaluation of chlorhexidine gluconate spray as compared with iodophor scrub for preoperative skin preparation”. *Surgery, Gynecology and Obstetrics* 1984;158(4):363.

16. Park HM, Han SS, et al. Randomized clinical trial of preoperative skin antisepsis with chlorhexidine gluconate or povidone-iodine. *BJS* 2017;104(2):e145-e150. Doi:10.1002/bjs.10395. Epub 2106 Nov 23.
17. Sistla SC, Prabhu G, Sadasivan J. Minimizing wound contamination in a 'clean' surgery: comparison of chlorhexidine-ethanol and povidone-iodine. *Chemotherapy* 2010;56(4):261-7. Doi:10.1159/000319901. Epub 2010 Aug 9.
18. Veeraya Paچارoen. 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.