

COMPARISON BETWEEN CHLORHEXIDINE-ALCOHOL AND POVIDONE-IODINE IN PREVENTING SURGICAL SITE INFECTION IN CLEAN CONTAMINATED CASES

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ABSTRACT

Objective: To compare chlorhexidine-alcohol and povidone-iodine in terms of frequency of surgical site infection when applied prior to surgical incision in clean contaminated cases.

Study Design: Randomized controlled trial.

Place and Duration of Study: Department of General Surgery, Combined Military Hospital, Rawalpindi from Feb 2014 to Feb 2015.

Material and Methods: Eight hundred and forty consecutive patients undergoing abdominal surgery, who fulfilled inclusion criteria, were included in this study after taking written informed consent. They were divided into two equal groups of 420 patients each. In "group A" chlorhexidine alcohol and in "group B" povidone iodine was used for skin preparation.

Results: Rate of surgical site infection was significantly low 8.6% in chlorhexidine alcohol group as compared to 13.8% in povidone iodine group ($p=0.016$).

Conclusion: Chlorhexidine alcohol solution is superior to povidone iodine in reducing surgical site infection when used for preparing skin before surgery in clean contaminated cases.

Keywords: Clean contaminated cases, Chlorhexidine alcohol, Povidone iodine, Surgical site infection.

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INTRODUCTION

Infection at or near surgical incisions within 30 days of an operative procedure contributes substantially to surgical morbidity and mortality each year in terms of prolonged hospital stay and cost of treatment¹⁻³. Surgical site infection (SSI) accounts for 15% of all nosocomial infections and among surgical patients represent the most common nosocomial infection worldwide⁴. The source for pathogens is mostly the skin surface, making skin preparation at the time of operation very important^{2,5}. The most commonly used antiseptic agents for skin preparation include aqueous or alcohol based iodophors and chlorhexidine gluconate². There is no consensus as to which of these may be the ideal solution of skin preparation.

The rationale of this study was to find out more appropriate solution for skin preparation

prior to surgery for a clean contaminated case that results in decreased frequency of wound infection post operatively, thus saving precious resources.

PATIENTS AND METHODS

This trial study was conducted from February 2014 to February 2015 at Combined Military Hospital Rawalpindi after taking permission from hospital ethical committee. Non-probability consecutive sampling was used for data collection. Both male and female patients aged between 19-50 years undergoing clean contaminated surgery were included. Immunocompromised patients including diabetics, undergoing chemotherapy or radiation, on steroid therapy, grossly contaminated wounds or allergic to the compounds used were excluded from the study. All patients who fulfilled the inclusion criteria were included in the study after obtaining informed written consent. Patients were distributed to groups, "A" and "B" by lottery. Patients receiving chlorhexidine-alcohol

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were placed in group A and patients receiving povidoneiodine were placed in group B.

A total of 840 patients undergoing surgery were studied. In group A 420 patients underwent operations in which chlorhexidine-alcohol was used. While in group B, 420 patients underwent operations in which povidone-iodine was used. The hospital has well defined infection control policy which was strictly adhered. This policy includes hair removal by clipping immediately before surgery, surgical hand scrub with povidoneiodine, antibiotic prophylaxis with injection Cefuroxime either alone or in combination with injection Metronidazole, 60 minutes prior to surgery. All patients were

Data Analysis

Demographics studied were age, gender and hospital registration number, entered in pre designed proforma (annex-A) along with surgical site infection as per the operational definition. Comparison of data regarding surgical site infection was done by specific tests on SPSS version 18.0. Quantitative data, like age was calculated in terms of mean and standard deviation (SD) by using descriptive statistics. Qualitative data like gender and surgical site infection were analyzed in terms of percentages and frequencies. "Chi-square test" was used to compare surgical site infection in both groups and a "*p*-value of ≤ 0.05 " was considered

Table-I: Comparison of two groups for frequency of post-operative SSI (*p*=0.016).

		Surgical Site Infection		Total
		Yes (%)	No (%)	
Groups	Chlorhexidine (A)	36 (8.6)	384 (91.4)	420
	Povidone iodine(B)	58 (13.8)	362 (86.2)	420
Total		94 (11.2)	746 (88.8)	840

Table-II: Gender* surgical site infection group A.

		Surgical Site Infection		Total	<i>p</i> -value
		Yes	No		
Gender	Male	16	198	214	0.414
	Female	20	186	206	
Total		36	384	420	

Group "A" Chlorhexidine Alcohol

operated under general/spinal anesthesia, by the same surgical team in the same operation theatre settings. The skin was prepared with 2% chlorhexidine-alcohol (group A) or 10% aqueous povidone-iodine (group B). Drains were placed as the case merited. Post-operatively all patients were nursed in the ward. The patients and the assessor (Registrar surgery) were kept blind in order to minimize the bias however the operating surgeon could not be blinded. All patients were observed up to 5th postoperative day during hospital stay for development of any erythema around the incision or pus discharge. After discharge from hospital, patients examined on weekly basis in surgical outdoor for four weeks for development of any surgical site infection.

statistically significant.

RESULTS

Eight hundred and forty, clean contaminated surgical cases were included in the study, which were randomly distributed into groups "A" and "B" on the basis of antiseptic solution used for skin preparation before surgery i.e. chlorhexidine alcohol and povidone iodine respectively. The patients were randomized in both the groups by lottery. The patients in both study groups were similar with respect to demographic characteristics, risk factors for infection, antimicrobial prophylaxis, duration and type of operation. To minimize the bias, cases of abdomino-pelvic surgery were included as they were performed by same surgical team and in same operation

theatre settings. No subject was dropped out or lost at any point in the study. Mean age in group A was 34.07 ± 6.674 years (20-45 years) whereas in group B it was 33.76 ± 7.112 years (20-46 years). Thirty six (8.6%) patients in group A (16 males out of 214 and 20 females out of 206) developed surgical site infection whereas 58 (13.8%) patients (32 male out of 226 and 26 female out of 194) developed surgical site infection in group B with significant *p*-value (*p*-value=0.016). Surgical site

chlorhexidine solutions are easy to apply with greater efficacy and are more economical when compared to povidone-iodine². However a recent trial conducted by Hakkarainen *et al*⁸, included 7669 patients and revealed that chlorhexidine alcohol has not demonstrated any superiority in reducing surgical site infections in clean contaminated surgical cases. Due to contradicting data regarding potential benefits of chlorhexidine alcohol, this study attempts to explore the

Table-III: Gender* surgical site infection group B.

		Surgical Site Infection		Total	<i>p</i> -value
		Yes	No		
Gender	Male	32	194	226	0.823
	Female	26	168	194	
Total		58	362	420	

Group "B" Povidone Iodine

Table-IV: Age groups* surgical site infectio.

		Surgical Site Infection		Total	<i>p</i> -value
		Yes	No		
Age groups	20-35	17	206	223	0.460
	36-50	19	178	197	
Total		36	384	420	

Group "A" Chlorhexidine Alcohol

Table-V: Age groups* surgical site infection group B.

		Surgical Site Infection		Total	<i>p</i> -value
		Yes	No		
Age groups	20-35	30	202	232	0.562
	36-50	28	160	188	
Total		58	362	420	

Groups "B" Povidone iodine

infection was not significant among different age groups and with respect to gender (table-I to V).

DISCUSSION

Preoperative skin antisepsis is routinely performed to reduce the risk of SSI before surgical incision by using different scrub solutions⁶. Despite the fact that studies have shown that chlorhexidine has advantage for skin preparation before surgery and for insertion of intravascular devices, because it inhibits bacterial growth and has prolonged antibacterial effect even exposed to body fluids⁷, povidone iodine remains solution of choice locally. Another trial by Hemani *et al*, also suggests that alcohol based

outcomes in terms of postoperative surgical site infection in clean contaminated surgeries.

Sample size of my study was comparable to the study performed by Darouiche *et al*⁵ and Yammine *et al*⁹ but smaller as compared to trial performed by Dumville *et al*¹⁰.

Total number of surgical site infections noted in our study was 11.19%, which is comparable to Darouiche *et al*⁵ (12.9%) and Khan *et al*, (8.39%)¹¹ but it is much lower than other studies 17.4%¹², 9-25%¹³. The reason for this gross difference was probably because of the patient selection criteria. In our study only superficial and deep incision SSI were studied as the two thirds SSIs are

confined to the incision, revealed in two different trial by Shah *et al*¹⁴ and Darouiche *et al*⁵.

Our study showed that 8.6% patients developed surgical site infection with chlorhexidine alcohol while 13.80% patients developed surgical site infection when povidone iodine was used as scrub. These results are comparable to the studies performed by Darouiche *et al* 9.5% vs. 16.1% respectively⁵. Results of our study are comparable to meta-analysis of thirteen studies published by Dumville *et al*¹⁰. Confounding factors present in these studies like extremes of age, immuno-compromised patients, patients with malignancy and variable expertise of the surgical team were all excluded in our study. Superior clinical efficacy of chlorhexidine was also observed in a meta-analysis conducted by Yammine *et al*⁹. Hemani *et al*² also found that chlorhexidine alcohol has quick and sustained action. Swenson *et al*¹ demonstrated better immediate and long term residual antimicrobial activity by chlorhexidine alcohol as compared to povidone iodine. Suwanpimolkul *et al*¹⁵ found out skin preparation with 2% chlorhexidine in 70% alcohol significantly reduced the rate of blood culture contamination, compared with 10% aqueous povidone-iodine (3.2% vs. 6.9%). Similar results were found by Nuntnarumit *et al*¹⁶, in infants comparing 1% chlorhexidine instead of 2%. In another study by Macias *et al*⁷, healthy volunteers were studied which proved that chlorhexidine alcohol is superior for hand washing prior to surgery, catheter insertion and skin preparation for surgery as compared to sodium hypochlorite and povidone iodine¹⁷. In 100 consecutive patients undergoing initial genitourinary prosthetic implantation Yeung *et al*¹⁸ found chlorhexidine-alcohol was not only superior to povidone-iodine in eradicating skin flora but also it does not have any increased risk of urethral or genital skin irritation.

CONCLUSION

Chlorhexidine-alcohol solution is superior to povidone-iodine in reducing surgical site

infections when used for preparing skin before surgery in clean contaminated cases.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

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