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Research Article

Comparison of chlorhexidine with povidone – iodine solution for skin disinfection in epidural and central venoues catheter insertion

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ABSTRACT

Background: Chlorhexidine and povidone – iodine solution are both well-known skin disinfectants. In this study we have compared the efficacy of chlorhexidine against povidone – iodine solution.
Methods: 100 patients undergoing elective surgeries were divided into 2 groups of 50 each. Group CHD was cleansed with chlorhexidine gluconate 2% in 80% alcohol and group PV-I group was treated with 10% aqueous solution of povidone iodine. Two swabs were taken from the site of surgery, one before skin disinfection and one after and sent to the microbiology lab where they were cultured on Mac Conkey and Blood Agar and the magnitude of growth was reported.
Results: The demographic details of both the groups were similar. 19 patients and 13 patients in the CHD and PV-I groups had growth prior to disinfection, while after disinfection, there was no bacterial growth in any of the patients in CHD group and 2 patients had poor growth in PV-I group.
Conclusions: Though both the disinfectants were very effective, CHD was slightly better than PV-I. The cost and side effects were similar in both the cases. Since the drying time of CHD was faster than that of PV-I, CHD was a better choice, especially in emergency cases.

Keywords: Chlorhexidine, Povidone- iodine solution, Skin disinfection, Catheter insertion

INTRODUCTION

Surgical site infections are the most important cause of morbidity and mortality in the intensive care units. They are also the main cause of longer hospital stay and increased health care costs[1] apart from stress and anxiety to family members. In spite of preoperative skin cleansing with povidone – iodine solution, surgical site infections are seen in about 300,000 to 500,000 patients in the US alone.[2-5] It is estimated that 38% of nosocomial infections are surgical site infections. 1 in every 24 surgeries in United States has post-operative nosocomial infection.[6,7] It is therefore important for a proper infection control to be a part of the regular hospital regimen.[8]

Skin is an important organ of the body which is a major source of microorganisms. During surgery, it is possible that these organisms invade the body and cause infections.[9] There are many antiseptic solution that are used to disinfect the skin before a surgery. Chlorhexidine and povidone – iodine are the most common of these skin disinfectants. These are mixed with either water or alcohol before use.[10,11]

There have been a few studies conducted on these antiseptics with varied results. In some studies on incidence of infection in catheter infection, chlorhexidine was found to be more effective than povidone – iodine solution[12] while in other studies, no difference was seen between the two.[13]

With the prevalence of bacterial resistance, it is beneficial to prevent the infection at the onset of the surgery itself. Very few studies have been done to compare the efficacy of povidone – iodine solution against chlorhexidine on skin bacterial flora which this study has aimed to do, in our geographical area.

METHODS

This randomized controlled study was conducted in the department of anesthesiology at Mallareddy institute of medical sciences over a period of 2 years 4 months. 100 patients undergoing elective surgeries who were given epidural or central venous catheters were included in the study. Patients with allergy to any of the anaesthetic drugs were excluded from the study.

The procedure was explained in detail to the patients and informed consent was taken from all the patients as per our hospital guidelines.

Detailed history and demographic details were taken from all the patients. Preoperative examination were performed including routine investigations like urine analysis, blood urea, blood sugar, bleeding time, clotting time, ECG and X ray chest were performed for all the patients. Patients with any type of skin infections or allergy to any of the antiseptic drugs were excluded from the study.

The patients were randomly assigned to 2 groups of 50 each using randomized computer table. Group CHD was cleansed with chlorhexidine gluconate 2% in 80% alcohol and group PV-I group was treated with 10% aqueous solution of povidone iodine.

All the patients were given bath with soap and water without antiseptic rub. All the medical staff underwent thorough timed scrubbing, capped and masked. After the patient was positioned, a skin swab from the selected site for insertion of epidural or central venous catheter. The skin was then cleaned with the respective antiseptic for 15 seconds and allowed to dry. Sterile drapes were placed around the site of surgery, and the area was cleansed once again in the same way. Another swab was taken from the site and then the surgery was started. Both the swabs, after being properly labelled were sent to the microbiology department for further procedure.

The swabs were cultured on Mac Conkey and blood agar overnight for the growth of bacterial colonies. The colonies were graded as poor growth if the colonies were < 10, 10 – 50 colonies were graded as moderate growth and > 50 colonies were graded as heavy growth.

RESULTS

The number of males and females in both the groups were almost equal, with 47 males and 53 females among the total 100 patients (Figure 1).

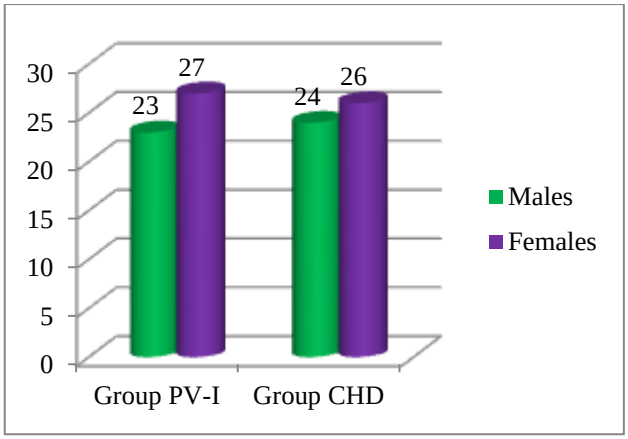

Figure 1: Sex wise distribution of the patients.

There was no significant difference in the other demographic details (Table 1).

Table 1: Demographic details of the patients.

	Group PV-I	Group CHD
Age	47 ± 11.23	49.17 ± 8.19
Weight (in kg)	62.67 ± 5.63	60.12 ± 9.34
Height (in cm)	161.3 ± 3.32	156.42 ± 7.17

The antibiotics given to the patients were either amoxicillin + clavulanic acid or cefotaxime (Figure 2). There was no statistical difference in the dosage and antibiotics given to the patients.

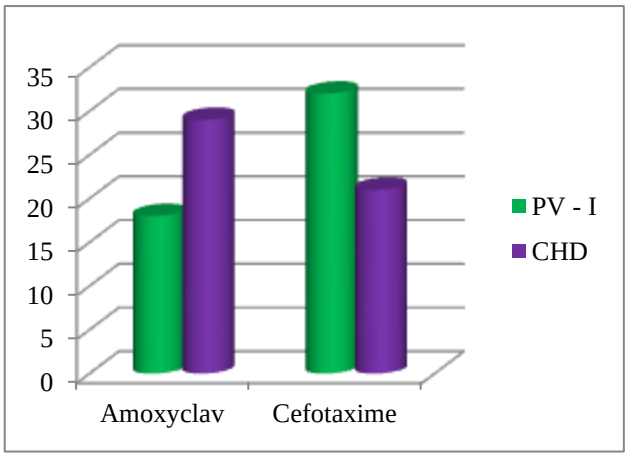

Figure 2: Antibiotic prophylaxis given to the patients.

100% of the patients had antibiotics initiated preoperative, while only around 65% of them were given post operatively (Table 2). Most of the surgeries were abdominal surgeries.

The epidural catheter insertion site was more in the upper thoracic region in the chlorhexidine group while lower thoracic region was more common in the povidone –

iodine group, although this fact did not show any relevant difference (Table 3).

Table 2: Demographic details of the patients.

	Group PV-I	Group CHD
Initiated preoperatively (in %)	50 (100%)	50 (100%)
Duration	1.7 ± 0.7	1.1 ± 0.9
Received post operatively	34 (68%)	32 (64 %)
Type of surgery		
Abdominal	32 (64 %)	35 (70%)
Non Abdominal	18 (36%)	15 (30%)

Table 3: Catheter insertion site.

Catheter Insertion Site	Group PV-I	Group - CHD
Epidural Catheter		
Upper Thoracic	16	26
Lower Thoracic	27	11
Lumbar	4	3
C V Catheter		
Int Jugular Vein	-	1
Subclavian Vein	3	9

13 (26%) and 19 (38%) in the PV-I and CHD groups respectively showed positive growth in culture. Of them 9 cases in the CHD group and 5 in PV-I group showed heavy growth (Table 4).

Table 4: Magnitude of bacterial growth - pre and post disinfectant.

Growth	Group PV – I		Group CHD	
	Pre disinfection	Post disinfection	Pre disinfection	Post disinfection
None	31	49	37	50
Poor	7	2	2	0
Moderate	3	0	6	0
Heavy	9	0	5	0
Total	50	50	50	50

Table 5: Microorganisms isolated in the swabs.

Organisms	Group PV-I		Group CHD	
	Pre disinfection	Post disinfection	Pre disinfection	Post disinfection
B haemolytic streptococci	2	0	3	0
Staphylococcus epidermidis	6	0	8	0
Staphylococcus aureus	3	2	5	0
MRSA	0	0	1	0
Other gram positive *cocci*	1	0	2	0
Gram negative bacilli	1	0	0	0
Total	13	2	19	0

Staphylococcus aureus was the most common organism isolated in both the groups (8 in PV-I group and 10 in CHD group) followed by other gram positive *cocci*. Gram negative *Bacilli* was observed in two cases in the PV-I group and methicillin resistant *S. aureus* (MRSA) was observed in one case in CHD group (Table 5).

DISCUSSION

Iodine in the PV-I complex exists as a combination of negatively charges iodide and available iodine. There is only very little free iodine present in the solution, therefore there is very little toxicity. Povidone and iodophor reacts with oxygen containing functional groups. Free iodine has a broad spectrum bactericidal, veridical and fungicidal activity along with the total iodine. It quickly penetrates micro-organisms and attacks nucleotides, fatty acids and thiol groups. It inhibits protein synthesis by oxidizing the thiol group.[14,15] Chlorhexidine on the other hand is a cationic biguanide and binds to the negatively charged surface of bacterial cell wall leading to alteration in permeability, thereby leading to leakage of cytoplasmic contents and finally cell death.[16] At the same time CHD also binds to the epidermal layer and mucous membranes, there by leading to continuous antibacterial effect. CDC, Atlanta also has recommended the use of 2% chlorhexidine glutamate as a skin disinfection before invasive procedures.[17,18]

We, in our study, have reported a slight preponderance of females over males although this difference was not significant. Also, the other demographic details like age, height and weight were similar in both the groups, so had no significant difference. Over two thirds of the surgeries

done in this study were abdominal surgeries and only about less than one thirds were other surgeries.

All our patients received preoperative prophylaxis of either amoxycillin-clavulanic acid combination or cefotaxime, both being broad spectrum antibiotics. There was bacterial growth in 19 of the patients among 50 in the chlorhexidine group and 13 in povidone – iodine group prior to skin disinfection. After the disinfection, there was marked decrease in bacterial growth in both the groups, but two samples had poor bacterial growth of *S. aureus* (Mthicillin sensitive) in the povidone-iodine group, showing that CHD was slightly superior as a skin disinfectant than PV-I.

Though *Staphylococcus epidermis* is one of the most common skin contaminant, *S. aureus* was the most common causes of epidural infections, in a large systematic review on epidural abscesses.[19] In another study, coagulase negative *Staphylococci* were found to be responsible for 37-60% of the infections while *S. aureus* could be isolated from only 5-12% of the cases. This is probably related to the fact that *S. aureus* is more resistant to skin disinfections than other organisms.[20] It could also be because the bactericidal effects of some of the disinfectants is not as rapid as to prevent the inoculation and subsequent multiplication of the organism in the epidural space.[20]

In contrast to our study, Majidipour et al reported PV-I to be better than CHD in neonates[21] and similar was the case in a study by Garland et al.[9] Our study was corroborated by a study by Valles et al[8] who also reported that CHD was more effective than PV-I and also by few other studies, although Khera et al[22] found no difference between the two disinfectants as in another study by Kulkarni et al.[14]

The drying time in chlorhexidine was slightly faster than povidone – iodine group and there was no difference in the cost of the two disinfectants.

CONCLUSIONS

Both of the disinfectants seemed to be very similar in efficacy, although chlorhexidine seemed to be slightly better than the other. As there is not much difference in the cost or side effects, and since the contact time of chlorhexidine is lesser than povidone complex, it is preferable to use chlorhexidine as a skin disinfectant especially in an emergency.

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