Original Research Article

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Comparison of efficacy of chlorhexidine alcohol with povidone iodine for prevention of surgical site infection: a prospective study

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ABSTRACT

Background: Surgical site infections (SSI's) are the major risk factors of postoperative morbidity and mortality. The incidence of these SSI'scan be minimized by taking prophylactic measures such as using effective preoperative antiseptics such as chlorhexidine (CHG) or povidone-iodine (PVI). The aim of the present study was to compare the efficacy of 2.5% chlorhexidine-alcohol with that of 10% povidone iodine for preventing SSI'sin clean contaminated elective surgeries.

Methods: This prospective study included 100 patients who were undergoing for clean contaminated elective surgeries at Government Medical College, Kottayam from April 2014 to September 2015. Group A included 50 patients in which 2.5% chlorhexidine alcohol (chlorhexidine 2.5% in 70% ethanol) was used for preoperative skin cleansing and Group B included 50 patients in which 10% povidone-iodine aqueous was used. Incidence of SSI's in terms of efficacy was compared between the groups.

Results: Female preponderance was seen in both the groups, but the difference was not significant statistically. The SSI'swere seen in 5 patients in group A and in 12 patients in group B and this difference was found statistically significant (p=0.0084).Out of 5, in group A, 3 sites were culture positive showing the presence of *S. aureus* culture in 1 case and E. coli in 2 cases and in group B, out of 12, 6 sites were culture positive consisting of *S. aureus* and *E. coli* in 3 cases each.

Conclusions: Chlorhexidine (2.5%) significantly reduced the risk of postoperative SSIs and colonization of bacteria in elective surgeries when compared to 10% povidone iodine.

Keywords: Chlorhexidine-alcohol, Povidone iodine, Surgical site infections

INTRODUCTION

Surgical site infections (SSI's) are infections of tissues, organs, or spaces exposed by surgeons during performance of an invasive procedure. They are always been a major complication of surgery and trauma. The development of SSI related to three factors (a) the degree of contamination of the wound during surgery, the duration of the procedure, and host factors such as diabetes, malnutrition, obesity, immune suppression etc. SSI'sincreases morbidity, mortality length of hospital

stays and cost after surgical procedures.²⁻⁴ The incidence and the severity of SSI'svaries from hospital to hospital, from one surgical procedure to another, surgeon to surgeon and most importantly from one patient to another. This infection develops as a result of contamination of the surgical site with microorganisms.⁵ The source of these microorganisms is mostly patient's own flora (endogenous source) when the integrity of the skin and/or wall of hollow viscous is violated. Staphylococcus aureus is the microorganism most commonly cultured from SSIs.⁶

To minimize these infections, it is very much necessary to optimize thepre-operative skin antiseptics. The two most commonly used antiseptic agents are chlorhexidine (CHG) and povidone-iodine (PVI). Both the agents work with different mechanism action and with different spectrum of efficacy.⁷

Chlorhexidine widely used as a both bactericidal and bacteriostatic and shows its action by membrane disruption. Povidone-iodine has broad spectrum bactericidal action, fungicidal, antiviral and sporicidal action. The release of iodine is responsible for its antiseptic action; it causes precipitation of bacterial proteins and nucleic acids. The present study was conducted with the objective to compare the efficacy of 2.5% chlorhexidine-alcohol with that of 10% povidone iodine for preventing surgical site infection in clean contaminated elective surgeries.

METHODS

This prospective study was conducted on patients undergoing clean contaminated elective major surgeries under general or spinal anaesthesia Government Medical College, Kottayam from April 2014 to September 2015. The study included hundred patients, on the basis of prepared questionnaire, these cases were randomly allocated in control group and study group consisting of 50 cases in each from March 1st, 2015 to October 30th, 2015 (8 months).

Selection criteria

Inclusion criteria were patients with 18 years of age or older of either sex who undergo clean contaminated elective surgeries which are colorectal, small intestinal, gastro oesophageal, and biliary surgeries. Exclusion criteria were patients who had history of allergy to chlorhexidine, alcohol or iodophores and patients who have evidence of infection at or adjacent to the operative site.Group A included 50 patients in which 2.5% chlorhexidine alcohol (chlorhexidine 2.5% in 70% ethanol) was used for preoperative skin cleansing and Group B included 50 patients in which 10% povidoneiodine aqueous was used. All patients were given standard infection prophylaxis which includes preoperative intravenous antibiotic (Cefazolin 1gm) 30 minutes before surgery and repeated 6 hours and 18 hours after surgery and a culture swab was taken preoperatively and post operatively from surgical site. Comparison of the rate of surgical site infection at 30 days after post-operative in two above said groups was made and results are statistically analysed.

Clinical assessment

Preoperative evaluation was included a medical history taking, physical examination, routine hematological and

biochemical laboratory tests. The surgical site and the patient's vital signs were assessed at least once a day during hospitalization, on discharge, at the time of follow up evaluation, and whenever surgical site infection occurs. After discharge, the patients were called once in a week during 30 days follow-up period and arrange for prompt clinical evaluation if infection is suspected. Whenever surgical-site infection is suspected or diagnosed, clinically relevant microbiological samples were sent for culture and sensitivity and managed accordingly. The data obtained was tabulated on Microsoft Excel Sheet and analyzed by rates, ratios and percentages.

RESULTS

Baseline characteristics of the study population in both the groups were given in Table 1. Both the groups were comparable in terms of age, gender and associated comorbidities. The male to female ratio in group A was 0.724:1 and in group B it was 0.851:1 (p-value=0.5688). The most common age group among patients in group A was 21 to 30 years (26%) and in group B it was also 21 to 30 years (30%). The mean age in group A was 40±13 years with range being 18 to 70 years and in group B mean age was 40.48±15.91 years with range being 18 to 74 years.

Total of 17 (17%) patients had associated co-morbidities out of which 12 were males and 5 were females (one patient was diabetic and hypertensive in group A). No signs of tuberculosis were seen in both groups. Table 2 presents the types of elective surgeries undergone by the patients in both groups. Most of the patients in Group A 11 (22%) and Group B 10 (20%) underwent surgeries for cholelithiasis.

Table 1: Baseline characteristics of study participants in both groups.

Characteristics	Group A (n=50)		Grou (n=5		P value	
	N	%	N	%		
Sex						
Male	21	42	23	46	0.5688	
Female	29	58	27	54		
Age group (in years)						
10-20	4	8	6	12		
21-30	13	26	15	30		
31-40	10	20	8	16	0.0830	
41-50	12	24	5	10	0.0830	
51-60	8	16	10	20		
>60	3	6	6	12		
Associated co-morbidities						
Diabetes	5	10	4	8		
Hypertension	4	8	5	10		
Tuberculosis	0	0	0	0		

Table 2: Types of elective surgeries.

T	Group A (n=50)		Group B (n=50)
Types of surgeries	N	%	N	%
Ca stomach pylorus	1	2	3	6
Ca lower end of esophagus	1	2	0	0
Cholelithiasis+ Choledocholithiasis	1	2	1	2
Jejunal GIST	0	0	1	2
Cholelithiasis	11	22	10	20
Ca recto sigmoid	7	12	5	10
GIST	1	2	0	0
A/c appendicitis	9	18	5	10
Ca head of pancreas	1	2	4	8
CCP	3	6	1	2
Intussusception of ileum	1	2	2	4
G00	1	2	0	0
Ileal neoplasm	1	2	1	2
Mucocoele of gallbladder	0	0	1	2
Ca ascending colon	4	8	0	0
Ca descending colon	3	6	0	0
Jejunal neoplasm	1	2	0	0
Periampullaryca	2	4	3	6
Ca stomach	1	2	2	4
Liver cyst	0	0	1	2
Pancreatic pseudocyst	0	0	1	2
Jejunal diverticulam	0	0	1	2
Duodenal tumor	0	0	2	4
Meckel's diverticulam	0	0	2	2
Ca distal CBD	0	0	1	2
Ulcerative colitis	0	0	1	2
Ca tail of pancreas	0	0	2	4
FAP	0	0	1	2

Ca- Cancer, GIST- Gastrointestinal stromal tumours, CCP- Chronic pancreatitis, GOO- Gastric outlet obstruction, CBD- Common bile duct carcinoma, FAP-Familial adenomatous polyposis.

In the present study, postoperatively at discharge, the clinical wound infection at surgical site were seen in 5 patients in group A and in 12 patients in group B, at follow up on day seven clinical wound infection were in 5 patients in group A and in 12 patients in group B, at follow up day fifteen clinical wound infection were in 3 patients in group A and in 8 patients in group B and at follow up day thirty no clinical wound infection was present in both groups.

Table 3: Postoperative wound clinical inspection finding.

Types of	Group A (n=50)		Group B (n=50)		
surgeries	N	%	N	%	
At discharge	5	10	12	24	
After 7 days	5	10	12	24	
After 15 days	3	6	8	16	
After 30 days	0	0	0	0	

Thus inspection findings revealed significantly high rate of infection in group B compared to group A (p=0.0084).

In the present study in group A, 3(6%) patients had superficial SSIs compared to 9(18%) in group B, in group A, 1(2%) patients had seroma SSIs compared to 2(4%) in group B and in group A, 1(2%) patients had deep SSIs compared to 1(2%) in group B. This difference was statistically significant (p=0.0084) as shown in Figure 1. Table 4 presents the prevalence of bacterial culture in SSI's in both groups. Out of 5, in group A, 3 sites were culture positive showing the presence of *S. aureus* culture in 1 case and *E. coli* in 2 cases and in group B, out of 12, 6 sites were culture positive consisting of *S. aureus* and *E. coli* in 3 cases each.

Table 4: Culture of wound discharge.

Culture of wound discharge		Group A (n=50)		Group B (n=50)	
	N	%	(n=	%	
S. aureus	1	2	3	6	
E. coli	2	4	3	6	

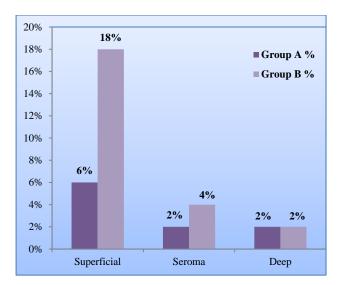


Figure 1: Type of surgical site infection.

DISCUSSION

The aim of the present study was to compare the efficacy of chlorhexidine-alcohol and povidone iodine for preventing the incidence of SSI's during elective surgeries. In the present study, 100 patients were included after meeting the requirements of inclusion criteria. 50 patients received 2.5% chlorhexidine alcohol as preoperative skin cleansing agent (GroupA) and the other 50 patients received 10% povidine iodine (Group B).

In the present study, risk factors for development of surgical site infection except preoperative skin preparation using two different antiseptic agents were controlled. There was no significant statistical difference of the risk factors between the two groups of patients such as age, operative time, wound classification, or underlying host factors. Surgeries were performed in both the groups under the same standard guidelines.

In the present study, in both groups male and female were approximately equal (in group A, 42% male and 58% female, in group B 46% male and 54% female). The male to female ratio in group A was 0.724:1 and in group B it was 0.851:1 suggesting both the groups were comparable. Most common age group among patients in group A was 21 to 30 years (26%) and in group B it was also 21 to 30 years (30%). The mean age in group A was 40±13 years with range being 18 to 70 years and in group B mean age was 40.48±15.91 years with range being 18 to 74 years suggesting that, in both groups the age was comparable. Similar difference in sex and age between the groups was also observed in studies done by Davies et al.⁹

In the present study, postoperative inspection was done at discharge, at seven days, at fifteen days and at thirty days and revealed significantly high rate of infection in group B (24% versus 10%; p=0.0084). The organisms found in the culture specimen included were S. aureus and E. coli. These findings were similar to the results of a study done

in Paocharoenet al. 10 In his study, wound infection decreased from 3.2% to 2% after chlorhexidine skin preparation and the organisms identified in the culture specimen were S. epidermidis, S. aureus and Enterococcus species.

Overall the present study showed that preoperative skin cleansing with chlorhexidine-alcohol significantly reduced the rate of postoperative SSIs. However, the choice of preoperative surgical-site antiseptic agent is still remains a controversial topic for the surgeons.

Limitation of the study were smaller sample size and risk factors for SSIs in abdominal surgeries such as age, obesity, anemia, and immunocompromised patients not taken into consideration. Hence further studies with larger sample considering these risk factors would explore outcomes of SSIs using skin antisepsis with chlorhexidine.

CONCLUSION

The findings of the study concluded that, antisepsis with 2.5% chlorhexidine significantly reduced the risk of postoperative SSI's, colonization of bacteria and duration of hospital stay in clean contaminated elective surgeries compared to 10% povidone iodine which is being used as the conventional preoperative skin cleansing agent for surgeries in our hospital.

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Ethical approval: The study was approved by the

 $Institutional\ Ethics\ Committee$

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