

A Cohort Study to Compare Surgical Site Infection Rate Using Povidone Iodine Paint Alone versus Povidone Iodine Scrub, Chlorhexidine Alcohol, and Application of ; Povidone Iodine Paint in Clean General Surgeries in Adult Patients

ABSTRACT

Introduction: The normal skin of healthy human beings harbors a rich bacterial flora is an established fact now. Normally considered non-pathogenic, these organisms may be a potential source of infection of the surgical site or wound. Post-operative infections at operative site remain a major source of illness and of death in the surgical patient. Such infections lengthen bed stay of the patient and results in higher costs. To remove transient as well as pathogenic micro-organisms on the skin surface and to reduce the resident flora, it is the goal of surgical skin preparation with antiseptics. Povidone iodine (iodophors) and chlorhexidine are the most often used antiseptics for skin preparation preoperatively in clean and clean-contaminated general surgeries. **Aims and Objectives:** The objectives of the study are as follows: (1) Combined use of povidone iodine scrub, chlorhexidine alcohol, and povidone iodine paint is more time consuming and more expensive. (2) We find only povidone iodine paint as effective then it can be made standard practice to use povidone iodine paint only. (3) Comparing the effectiveness of using povidone iodine paint alone against a combination of the paint, chlorhexidine alcohol, and povidone iodine scrub for pre-operative skin preparation in clean elective procedures. (4) To study the incidence of surgical or operative site infections in patient undergoing clean surgeries. **Methodology:** Patients who are undergoing clean surgeries are taken up for the study and divided into two groups – one group includes combined use of povidone iodine scrub, chlorhexidine alcohol, and povidone iodine paint, while the other group includes 5% of povidone iodine paint alone. These groups are seen for infections developed in post-operative period. To check for any signs of infection, patients were monitored up until the time of suture removal (7–10 days). Antibiotic sensitivity testing and pus culture were performed if any purulent discharge was observed. **Results:** The results of the study showed that when compared to combined use of povidone iodine scrub, chlorhexidine alcohol, and povidone iodine paint versus 5% of povidone iodine paint alone, the rate of post-operative wound infections are not statistically significant. They are almost equal. **Conclusion:** Pre-operative skin preparation with 5% of povidone iodine paint is an effective antiseptic, and rate of post-operative wound infections, length of hospital stay is almost equal as compared to combined use of povidone iodine scrub, chlorhexidine alcohol, and povidone iodine paint.

Key words: Chlorhexidine, Povidone Iodine paint, Povidone iodine scrub, Skin disinfection

INTRODUCTION

Despite significant improvements in surgical methods over the last few years, post-operative wound infection is still a significant problem. Although it seldom causes death, it frequently increases morbidity, which prolongs the length of the patient's stay in the hospital and raises costs. About 5–6% of people undergoing major and minor procedures develop surgical site infections (SSIs). Despite the fact that several studies have been conducted by numerous researchers that have pointed in one direction or another.^[1] Regarding the cause of wound infections, misunderstanding still exists.^[2-5] Therefore, there is a further need for a methodical investigation of the specifics of the etiology of wound sepsis. The development of post-operative wound sepsis is influenced by a number of patient- and procedure-related variables. Any patient

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undergoing surgery runs the danger of contracting an infection from the hospital's environment, whether it is the operating room or the ward.^[6] According to Shooter (1956) and Blower (1960), the operating room and the ward are the respective

sources of post-operative wound infection. Naturally, a patient himself could spread an infection.^[3,7] Burke discovered in 1963 that in 50% of the surgeries, the staphylococcus aureus strains that were recovered were the same as those from the patients' noses. Burke came to the conclusion that the patient was the source of the infection. Undoubtedly, a patient's wound sepsis could be caused by a variety of different circumstances.^[8]

Aims and objectives

Combined use of povidone iodine scrub, chlorhexidine alcohol, and povidone iodine paint is more time consuming and more expensive.

- If we find only povidone iodine paint as effective then it can be made standard practice to use povidone iodine paint only.
- To evaluate the effectiveness of using povidone iodine paint alone against a combination of povidone iodine scrub, chlorhexidine alcohol, and povidone iodine paint for pre-operative skin preparation to avoid SSI in clean operations.
- To study the incidence of surgical or operative site infections in patient undergoing clean surgeries.

MATERIALS AND METHODS

Source of data

Cases coming to our hospital, fulfilling inclusion, and exclusion criteria, consenting to participate in my study and who are posted for clean general surgeries.

Study design

This is a comparative study conducted on 300 patients.

Inclusion criteria

The following criteria were included in the study:

- 1) General surgery patients
- 2) Clean surgeries
- 3) Prosthesis (e.g., mesh)
- 4) Immunocompromised patients.

Exclusion criteria

The following criteria were excluded from the study:

- 1) People who are allergic to iodine
- 2) Patients <18 years
- 3) Contaminated cases, dirty wounds.

Method of collection of data

Patients in this comparative study will be divided into two groups. To rule out any acute or chronic infection in the research population, a thorough medical history was obtained from each patient before to surgery, and standard investigations such as hemoglobin, total leukocyte count, random blood sugar, liver function test, and chest X-ray were performed.

Pre-operative skin preparation is carried out according to the appropriate antibacterial regimen in each group.

- Group A: Povidone iodine scrub, 2% chlorhexidine alcohol (2% in 70% isopropyl alcohol), and 5% of povidone iodine paint make up the antiseptic regimen used for pre-operative skin preparation.
- Group B: Antiseptic regimen 5% of povidone iodine.

The first dressing was applied following surgery on the 3rd post-operative day. Until the sutures were removed, patients were monitored to look for any indications of wound infection at the surgical site. For example:

- Purulent/serous discharge from the wound
- Redness of the surrounding area
- Pain associated with discharge
- Increased local temperature
- Swelling of the surrounding area.

RESULTS

This comparative study was conducted in the Department of General Surgery of our hospital over a period of July 1, 2019–March 2021 undergoing clean general surgeries.

The patients were divided in following two groups:

- Group A – Combined use of povidone iodine scrub, 2% of chlorhexidine alcohol and povidone iodine paint group
- Group B – Use of 5% of povidone iodine paint only

The information was tabulated and evaluated using rates, ratios, and percentages in a Microsoft Excel spreadsheet. The statistical analysis of the data gathered for this study is done by computing the descriptive statistics, such as mean, percentages, and SD. Data presentation is using graphs and tables. The measures of association between the qualitative variables are evaluated using the Chi-square test, and the difference in mean is tested using the Z-test. When the p-value is < 0.05, the inference is regarded as statistically significant.

In the present study in Group A, 5.33% of patients had SSIs compared to 6.66% in Group B and this difference was statistically not significant ($P = 0.62$) [Table 1 and Figure 1].

In the present study in Group A, 5.33% of patients had superficial SSIs compared to 6.66% in Group B and this difference was not statistically significant ($P = 0.62$) [Tables 2 and 3 & Figures 2 and 3].

In this study, among the patients who had SSIs the microbiological examination revealed *Escherichia coli* as the

Table 1: SSI among groups

SSI	Povidone iodine scrub, chlorhexidine, alcohol, povidone iodine paint		Povidone iodine paint	
	n	%	n	%
Present	8	5.33	10	6.66
Absent	142	94.66	140	93.33
Total	150	100	150	100

Chi-square value: 0.24; P value: 0.6242 (not significant). SSI: Surgical site infection

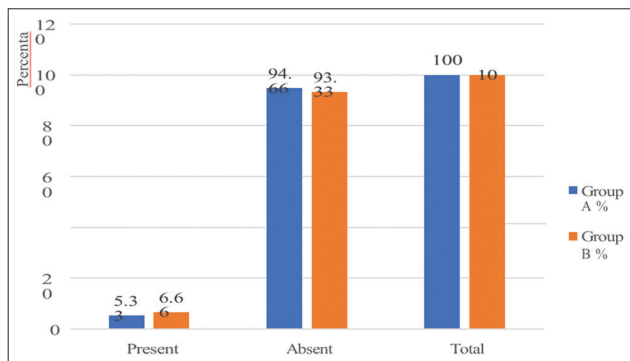


Figure 1: Surgical site infection between the two groups

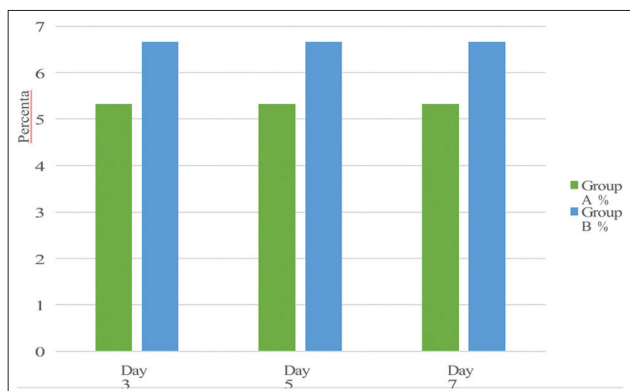


Figure 2: Post-operative inspection findings

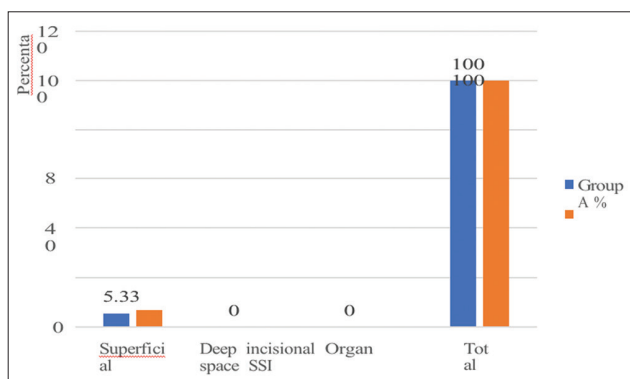


Figure 3: Surgical site infection among groups

organism in 37.5% of patients and *Staphylococcal aureus* in 62.5% of patients present in Group A. In Group B, 40% of patients had infection with *E. coli* and 60% of patients had infection with *S. aureus* [Table 4 and Figure 4].

In the present majority of patients, 86.66% of patients in Group A and 85.33% of patients in Group B had hospital stay up to 2 days, in Group A, 7.33% of patients and 8% of patients in Group B had hospital stay between 3 and 4 days. In Group A, 6% of patients and in Group B, 6.66% of patients had stay more than 4 days. Duration of stay is almost same

Table 2: Post-operative inspection findings

Interval	Group A		Group B	
	n	%	n	%
Day 3	8	5.33	10	6.66
Day 5	8	5.33	10	6.66
Day 7	8	5.33	10	6.66

P>0.05 not significant

Table 3: SSI among groups

SSI	Group A		Group B		P value
	n	%	n	%	
Superficial incisional SSI	8	5.33	10	6.66	P=0.62 (not significant)
Deep incisional SSI	0	0	0	0	NA
Organ space SSI	0	0	0	0	NA
Total	8	100	10	100	

Chi-square value: 0.24; P value: 0.62 (not significant). SSI: Surgical site infection

Table 4: Type of organism in SSI between the two groups

Culture	Group A		Group B	
	n	%	n	%
<i>Escherichia coli</i>	3	37.5	4	40
<i>Staphylococcus aureus</i>	5	62.5	6	60
Total	8	100	10	100

Chi-square value: 1.85; P value: 0.84 (not significant). SSI: Surgical site infection

in Group B patients that is povidone iodine group which is statistically insignificant (P = 0.267) [Tables 5 and 6 & Figures 5 and 6].

DISCUSSION

Despite significant advancements over the past century in our understanding of the origins and prevention of SSIs, post-operative wound infections (both superficial and deep incisional infections) continue to be a major contributor to sepsis, particularly in developing nations. Since the majority of SSIs are caused by the patient’s own endogenous germs contaminating an incision after surgery, almost all of these infections are possibly avoidable. Later, external microbial infection of the surgical site is less frequent. The development of an infection or sepsis, however, depends on the quantity and pathogenicity of the microorganisms present as well as the suitability of the patients in both situations. Their comorbidity was in turn connected to the host reaction. In comparison to povidone iodine, chlorhexidine in alcoholic solution was found to be more efficient in minimizing incision site colonization and subsequent wound infection in several randomized, controlled trials looking into various regimens for skin disinfection before surgery. This may be partially explained by the fact

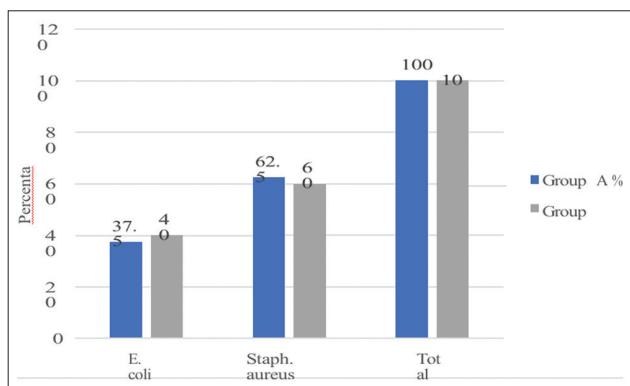


Figure 4: Type of organism in surgical site infection between the two groups

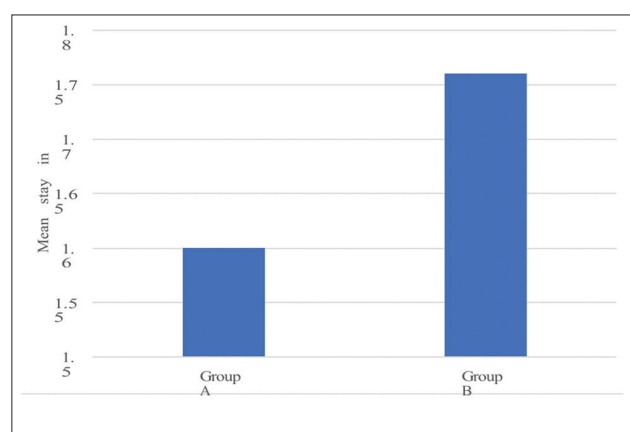


Figure 5: Duration of stay between the two groups

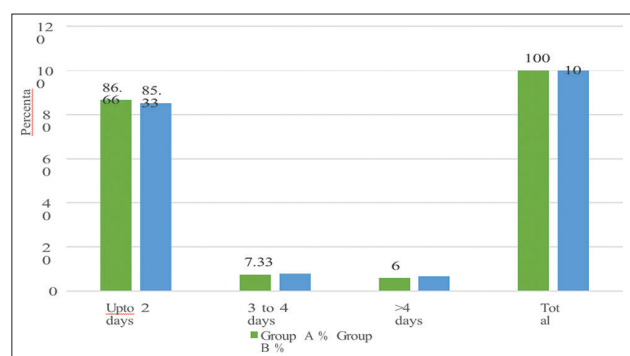


Figure 6: Duration of stay in two groups

that, as compared to other antiseptic solutions, Chlorhexidine solution has a stronger impact on Gram-positive bacteria, particularly coagulase-negative staphylococci. To control SSI in clean and clean contaminated general surgical operations, our study demonstrated that povidone iodine paint alone is just as effective as the combination of povidone iodine scrub, chlorhexidine in alcohol, and povidone iodine paint.

Table 5: Duration of stay between the two groups

Stay	Mean	SD	P value
Group A	1.60	1.15	0.267
Group B	1.76	1.33	

Table 6: Duration of stay in two groups

Post of hospital stay in days	Group A		Group B	
	n	%	n	%
Up to 2 days	130	86.66	128	85.33
3–4 days	11	7.33	12	8
>4 days	9	6	10	6.66
Total	150	100	150	100

A study by Langgartner *et al.* revealed that the lowest rate of microbial colonization of central venous catheters was connected with skin disinfection using a solution of povidone iodine and propanol/chlorhexidine.^[9]

Majidipour *et al.* conducted a study which showed that skin disinfection with povidone iodine 10% was more effective on reducing bacterial skin colonies compared to chlorhexidine 2%. In this study, the effects of both solutions were similar on Gram-positive as well as Gram-negative bacteria.

The risk factors in the current investigation, such as wound classification, underlying host characteristics, and operating duration, did not differ statistically significantly between the two groups of sample patients. Both groups received surgical care according to the same accepted standards.

After skin preparation using a combination of povidone iodine scrub, chlorhexidine alcohol, and povidone iodine paint in the present study, the most frequently isolated organism was staphylococcal aureus. In the post-operative period, 5.33% of patients in Group A had superficial incisional SSIs compared to 6.66% of patients in Group B. Both groups' bacterial colonization decreased after the use of antiseptic treatments.

CONCLUSION

The results from the present study show that pre-operative skin preparation with 5% of povidone iodine only versus combined use of povidone iodine scrub, chlorhexidine alcohol, and povidone iodine paint.

- The rate of post-operative wound infections is almost equal to combined use of povidone iodine scrub, chlorhexidine alcohol, and povidone iodine paint.
- Povidone iodine has rapid lethal action against both transient and resident flora.
- Use of povidone iodine paint alone is as effective as combined use of povidone iodine scrub, chlorhexidine alcohol, and povidone iodine paint for pre-operative skin preparation.

d. Gram-positive and Gram-negative organisms are both sensitive to PVP-iodine and, in addition, PVP iodine have sporicidal property. Therefore, it can be safely concluded that povidone iodine paint alone should be followed in pre-operative topical skin preparation in clean surgeries. Since the effectivity of povidone iodine paint alone was proved almost equal to combined use of povidone iodine scrub, chlorhexidine alcohol, and povidone iodine paint for pre-operative antisepsis, it is prudent to use this solution in clean surgical procedures.

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