

## COMPARATIVE STUDY OF SURGICAL SKIN PREPARATION BY POVIDONE IODINE (10%) AND CHLORHEXIDINE (2%) – ALCOHOL (70%)

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### Abstract

**Background:** Surgical Site Infection is a dangerous condition, a heavy burden on the patient and social health system. The use of preoperative skin preparation by effective antiseptic plays an important role in reducing postoperative wound infections. Hence the present study was undertaken to compare and evaluate the efficacy of 2% Chlorhexidine in 70% isopropyl alcohol versus 5% Povidone Iodine in clean and clean contaminated surgeries for prevention of SSI.

**Method:** The present one and half year randomized controlled trial was conducted in the Department of General Surgery, National Institute of medical Sciences and research, Jaipur, over a period from 1st January 2019 to 30th June 2020 on 150 patients undergoing elective clean and clean contaminated surgeries. The patients were divided into two groups by computer randomization that is Group A (Chlorhexidine group) and Group B (Povidone Iodine group). The surgical wounds were examined for any infections present according to CDC criteria.

**Results:** The results of the study showed that the rate of post-operative surgical site infections are less if the pre-operative skin preparation is done with 2% Chlorhexidine in 70% isopropyl alcohol compared to 5% povidone iodine.

**Conclusion:** Preoperative skin preparation with 2% chlorhexidine in 70% isopropyl alcohol is an ideal regime as it has a broader antimicrobial spectrum and the rate of post-operative wound infections is much lower as compared to 5% povidone iodine alone.

**Keywords:** Antiseptic skin preparation; Chlorhexidine; Clean contaminated; Povidone iodine; Surgical site infections

## I. INTRODUCTION:

Surgical Site Infections (SSIs) are infections of tissues, organs, or spaces exposed by surgeons during performance of an invasive procedure.<sup>1</sup> Postoperative SSIs remain a major source of illness and a less frequent cause of death in the surgical patient. These infections number approximately 500,000 per year, among an estimated 27 million surgical procedures,<sup>2,3</sup> and account for approximately one quarter of the estimated two million nosocomial infections in the United States each year.<sup>4</sup>

Surgical site infection is a dangerous condition, a heavy burden on the patient and social health system. Such infections lengthen bed stay for an average of seven days and results in higher costs.<sup>5</sup> The incidence of infection varies from surgeon to surgeon, from hospital to hospital, from one surgical procedure to another, and most importantly from one patient to another.<sup>6</sup> Surgical site infections are among the most common hospital acquired infections comprising 14 to 16% of inpatient infections.<sup>7</sup> Potential sources of infection are the patient (especially contamination by alimentary tract bacteria), hospital environment, food, other patients, staff,

infected surgical instruments, dressings, and even drugs and injections.<sup>8</sup>

Chlorhexidine antimicrobial effects are due to the attractions between Chlorhexidine (cation) and negatively charged bacterial cells. After Chlorhexidine is absorbed on to the organisms cell wall, it disrupts the integrity of the cell membrane and causes the leakage of intracellular components of the organisms.<sup>9</sup>

Povidone iodine (Betadine) is an antiseptic solution used topically on skin. It contains polyvinyl pyrrolidone with water, iodide and one percent available iodine. It has bactericidal ability against a large number of pathogens. Povidone iodine function by release of elemental iodine which binds irreversibly with protein. Although less reactive than chlorine, iodine is rapidly bactericidal, fungicidal, tuberculocidal, virucidal, and sporicidal.<sup>10</sup>

The present study was undertaken to compare and evaluate the efficacy of 2% chlorhexidine in isopropyl alcohol versus 5% povidone iodine in elective clean and clean contaminated surgeries for prevention of SSI in a tertiary care institute.

## Methodology

The present study was conducted in the Department of General Surgery, National Institute of Medical Science and Research, Jaipur between 1 January 2019 to 30 June 2020.

Study design -The study design was one and half year randomized controlled trial.

Study period and duration -The present one and half year study was conducted during the period 1 January 2019 to 30 June 2020.

## Place

Department of General Surgery, National Institute of Medical Science and Research, Jaipur Patients undergoing clean and clean contaminated elective surgeries in the wards admitted in Department of General Surgery, National Institute of Medical Science and Research, Jaipur

## Inclusion Criteria

Patients of both sexes of adult age (18-75 years) undergoing elective surgical procedures or operations at National Institute of Medical sciences and Research.

## Exclusion criteria

- Patients undergoing emergency surgery.

- Immuno compromised patients
- Patients on long term steroids
- Patients with septicemia and having focus of infection somewhere on the body manifested clinically by fever and increased total and differential counts.
- Patients suffering from malignancies or undergoing chemotherapy or radiotherapy
- Patients with diabetes mellitus.
- Patients with history of allergy to study agents

## Results

The present one and half year randomized controlled trial was conducted in the Department of General Surgery, National Institute of Medical Science and Research, Jaipur, over a period from 1 January 2019 to 30<sup>th</sup> June 2020 on 150 patients undergoing clean and clean contaminated elective surgeries. The patients were divided into two groups by computer randomization that is;

- Group A - Chlorhexidine group.
- Group B - Povidone Iodine group.

Age and sex wise difference in both groups found statistically Insignificant. Both groups were comparable.

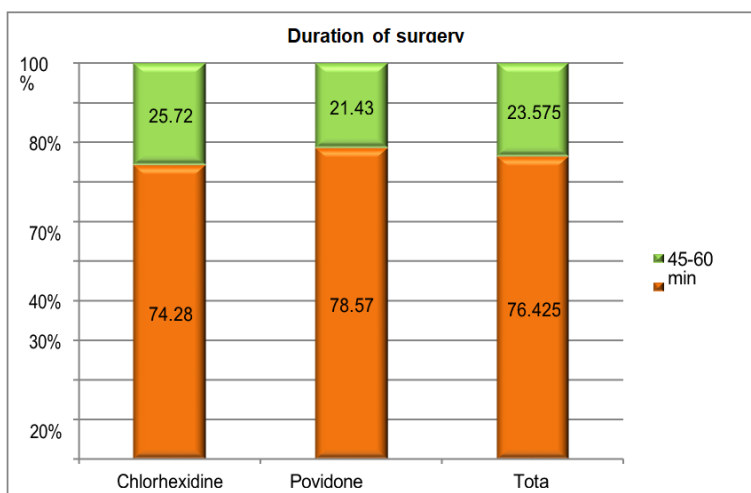


Figure No.1: Duration of Surgery

In this study, the duration of surgery was between 15 and 45 minutes in 74.28% of patients in group A and 78.57% in group B. In the remaining patients (25.72% in group A;

21.43% in group B) had duration of surgery between 45 to 60 minutes.

Table 1: Surgical site infection

SSI	Chlorhexidine		Povidone Iodine		Total	
	N	%	N	%	N	%
Yes	5	7.15	11	15.71	16	11.42
No	65	92.85	59	84.29	124	88.58
Total	70	100	70	100	140	100

P value=0.11 NS

In the present study in group A 5 patients (7.15%) had SSIs compared to 11 patients (15.71%) in group B and this difference was statistically significant ( $p=0.11$ ).

**Table 2: Type of SSI**

Types of SSI	Chlorhexidine		Povidone Iodine		Total	
	N	%	N	%	N	%
Superficial Surgical Site Infection	5	7.15	11	15.71	16	11.42
Deep Surgical Site Infection	0	0	0	0	0	0
Organ Space Infection	0	0	0	0	0	0

In present study out of 140 subjects 16 patients (5 from chlorhexidine group and 11 from povidone group) developed surgical site infection and among all the patients the type of SSI was Superficial SSI and no patients in both study groups developed Deep SSI or Organ Space infection.

Out of the 5 patients who developed SSI in chlorhexidine group; 4 patients (5.71%) had culture result positive for *Staphylococcus aureus* and 1 patient (1.42%) for *Escherichia coli*. In the povidone iodine Group out of 11 patients who developed SSI 9 patients (12.86%) had culture result positive for *Staphylococcus aureus* and 1 patients (1.42%) for *Escherichia coli* and 1 patient (1.42%) for *Pseudomonas aeruginosa*. Overall the most common organism isolated from the patients who developed SSI from both groups were *Staphylococcus aureus* (9.28%) followed by *Escherichia coli* (1.42%) and *Pseudomonas aeruginosa* (0.72%).

### Discussion

Although considerable progress has been made in understanding the cause and prevention of Surgical Site Infections during the past 100 years, postoperative wound infections (incisional and deep) remain a leading cause of infections, especially in developing countries.<sup>3</sup>

Most SSIs are potentially preventable as their occurrence usually depends on contamination of an incision during surgery with the patient's own endogenous organisms. Later contamination with exogenous organisms is less common. In both cases however the establishment of an infection relates to the amount and pathogenicity of the microorganisms present and the adequacy of patients host response, in turn related to their comorbidity.<sup>3</sup>

In the present study in group A 5 patients developed superficial SSIs compared to 11 patients in group B and this difference was statistically significant ( $p=0.11$ ). No patient in this study had developed deep or organ space infection in both the groups.

These findings were similar to the results of a study<sup>9</sup> done in Thailand. The study reported that, wound infection decreased from 3.2% to 2% after chlorhexidine skin preparation and the organisms found in the culture specimen included *Streptococcus epidermidis*, *Staphylococcus aureus*, *Streptococcus species* and *Enterococcus species*. The bacterial colonisations reduced significantly after skin preparations in all types of organisms. The authors also suggested other disadvantages of using povidone iodine are

hypersensitivity and colour staining. The study recommended, chlorhexidine antiseptic should be the first consideration for preoperative skin preparation.

Another randomized controlled trial was conducted on patients undergoing clean-contaminated surgery in six hospitals to preoperative skin preparation with either chlorhexidine–alcohol scrub or povidone–iodine scrub and paint. The primary outcome was any surgical-site infection within 30 days after surgery. Secondary outcomes included individual types of surgical-site infections. A total of 849 subjects (409 in the chlorhexidine–alcohol group and 440 in the povidone–iodine group) qualified for the intention-to-treat analysis. The overall rate of surgical-site infection was significantly lower in the chlorhexidine – alcohol group than in the povidone– iodine group (9.5% vs. 16.1%;  $p=0.004$ ; relative risk, 0.59; 95% confidence interval, 0.41 to 0.85). Chlorhexidine–alcohol was significantly more protective than povidone–iodine against both superficial incisional infections (4.2% vs. 8.6%,  $p=0.008$ ) and deep incisional infections (1% vs. 3%,  $p=0.05$ ) but not against organ- space infections (4.4% vs. 4.5%). The study concluded that , preoperative cleansing of the patient's skin with chlorhexidine–alcohol is superior to cleansing with povidone– iodine for preventing surgical-site infection after clean contaminated surgery.<sup>11</sup>

In a randomized study,<sup>12</sup> the application of chlorhexidine–alcohol reduced the risk of surgical-site infection by 41% as compared with the most common practice in the United States of using aqueous povidone–iodine.

### Conclusion

Preoperative skin preparation with 2% chlorhexidine in 70% isopropyl alcohol is an ideal regime as it has a broader antimicrobial spectrum and the rate of post-operative wound infections is much lower as compared to 5% povidone iodine alone.

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