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Original Research Article

# Clinical Evaluation of Preoperativen Skin Preparation with Aqueous Povidone Iodine and in Combination with Alcoholic Chlorhexidine in Patients Undergoing Clean Elective Surgery

**Sudhakar Singh[1], Tripta Bhagat[2], Shalabh Gupta[3]**

[1]Postgraduate Department of General Surgery, Santosh Medical College & Hospital, Ghaziabad (UP), India

[2]Vice Chancellor and Professor, Department of General Surgery, Santosh Medical College & Hospital, Ghaziabad (UP), India

[3]Dean Academics and Professor, Department of General Surgery, Santosh Medical College & Hospital Ghaziabad (UP), India

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**Corresponding Author: Dr. Sudhakar Singh**

**Conflict of interest: Nil**

**Abstract:**

**Aim:** The aim of the present study was to compare the aqueous povidone iodine VS alcoholic chlorhexidine in patients undergoing clean elective surgeries.

**Methods:** The present study was conducted in the Department of General Surgery Santosh Medical College & Hospital, Ghaziabad on 73 patients in each groups.

**Results:** Mean age of group I patients was 48.95±16.69 years and group II patients was 50.21±16.97 years. Out of 350 patients, 57.7% patients had age of 38-57 years followed by 18-37 years (16.6%), 58-77 years (14%), and >77 years (11.7%). 60% patients in group I and 55.4% patients in group II belonged to 38-57 years of age. Out of 350 patients, 39.7% were females and 60.3% were males. In group I, 57.7% were males and 42.3% were females. In group II, 62.9% were males and 37.1% were females. Mean BMI of group I patients was 30.03±2.79 and group II patients was 29.82±2.42. Majority of the patients belonged to BMI group of ≥30 in group I (57.7%) as well as group II (56%). 56.9% patients had BMI more than or equal to 30, 34.9% had 25-29.9, and 8.3% had 18.5-24. This difference was not statistically significant. Out of 350 patients, 75.4% had no pre-operative growth, 12% had Staphylococcus aureus, 5.4% had E. coli, 4.3% had Staphylococcus albus, and 2.9% had Klebsiella species.

**Conclusion:** The findings concluded that antisepsis with chlorhexidine gluconate 2.5% v/v in 70% propanol significantly reduced the risk of postoperative SSI's and colonization of bacteria in clean contaminated elective surgeries compared to povidone iodine IP 5% w/v. iodine which is being used as the conventional preoperative skin cleansing agent for surgeries in our hospital. Regarding the cost add chlorhexidine is costly as it is providing better result with decrease rate of SSI, it proves to be a better antiseptic in terms of post-operative sepsis and recovery.

**Keywords:** aqueous povidone iodine, alcoholic chlorhexidine, patients undergoing clean elective surgeries.



## Introduction

Skin is the primary barrier against bacterial invasion. Following a skin incision, microorganisms of the standard skin flora may contaminate exposed tissues and cause an SSI. Despite many recent advances in surgical techniques in the past few years, post-operative wound sepsis remains a significant problem. SSIs are associated with longer hospital and intensive care unit stays, increased readmission to hospital after discharge, and a two-fold increase in mortality. Many factors contribute to the development of post-operative wound infections, some relating to the patient and some relating to the procedure itself. [1] The terms asepsis and antisepsis denote two policies whereby access to a wound and its consequent infection is halted. Moynihan (1920) [2] conducted his bacteriological experiment with one of the two intentions: 1. The exclusion of all organisms from the wound; 2. The destruction of all micro-organisms reaching the wound by a bactericide applied to the wound surface. Preoperative skin antisepsis has been proven to rapidly reduce local microorganism counts in the operational field. Of many techniques for skin preparation before surgery, initially with antiseptic soap solution, followed by painting the

prepared area with sterile paint solution is most common. Degerming of the skin done with antiseptics used for less than a minute is as effective as a five-minute scrub with a germicidal soap solution followed by painting with antiseptics. [3] Commonly used agents for skin antisepsis are chlorhexidine gluconate (CHX) or povidone-iodine (PVP-I). The 2017 Centre for Disease Control and Prevention Guideline for Prevention of SSIs recommends, with high-quality evidence, the use of intraoperative skin preparation with an alcohol-based antiseptic agent; however, due to a lack of conclusive randomized controlled trials (RCTs), no specific antiseptic agent is endorsed. [4] Other institutions, such as Health Protection Scotland and the Canadian Patient Safety Institute, recommend the use of CHX. [5,6] Surgical site infection (SSI) is a dreaded postoperative complication that affects approximately 5% of all patients undergoing surgery. [1] It is associated with prolonged length of hospital stay, prolonged postoperative recovery time, higher hospital readmission rates, and higher morbidity and mortality rates than patients without SSI. [7] The majority of SSIs are caused by contamination of a surgical incision with bacteria from the patient's own body. [8] There are several antiseptic skin cleansing agents available to the surgeon to use for patients undergoing clean, clean-contaminated, contaminated, and dirty surgery. [8] The traditional antiseptic cleansing agent of choice is povidone iodine (PI). It is cheap, effective, and the most commonly used agent of choice worldwide. [9] Chlorhexidine-alcohol (CHA) is a newer skin preparation agent, commonly composed of 2% chlorhexidine gluconate and 70% isopropyl alcohol. [10]

The aim of the present study was to compare the aqueous povidone iodine VS alcoholic chlorhexidine in patients undergoing clean elective surgeries.

## Materials and Methods

The present study was conducted in the Department of General Surgery Santosh Medical College & Hospital, Ghaziabad on 73 patients in each groups.

### Inclusion criteria

1. In the general surgery department, patients receive elective, clean procedures. A "clean" surgical procedure is one in which the viscus is not opened in any way.
2. Patients who are cold, without fever, and exhibiting normal white blood cell counts.
3. Patients of any age or gender.
4. Not on long-term steroids, and not immunocompromised.
5. This also includes patients who have had hernias repaired with mesh.

### Exclusion criteria

1. Individuals having urgent surgical procedures.
2. Individuals with impaired immune systems or those using long-term steroids.
3. Patients with an infection focused on a specific area of the body experience fever and elevated total and differential counts as clinical manifestations of septicemia.
4. Cancer patients undergoing radiation or chemotherapy
5. This research did not include clean, contaminated, or viscous procedures that were going to be opened.
6. The patient's suffering from many medical issues, such as diabetes and high blood pressure.

### Method of collection of data

We examined two groups of patients in this comparative study. In order to rule out acute or chronic infection or cancer, standard investigations such as hemoglobin, total count, differential count, ESR, RBS, and chest X-ray were performed on each patient prior to surgery. All patients had their parts shaved at the same time the night before surgery. Each group used its own unique antibacterial regimen to prepare their skin before surgery.

- Group I: Antiseptic regimen was used for pre-operative skin preparation is three coats of aqueous povidone iodine IP 5% w/v.
- Group II: Antiseptic regimen used was single coat of agent containing chlorhexidine gluconate 2.5% v/v in 70% Propanol.

The microbiology department inoculated swabs into nutritional broth, McConkey's agar plates, and blood agar plates. Aerobic incubation at 37 °C for one to two days is required for the inoculated medium. We cultivated nutrient broth if the original plates fail to produce any microbes. We identified the recovered bacteria using their physical and cultural traits. To assess the success of the antiseptic regimen, we did Gram staining, biochemical tests, and antibiotic sensitivity tests as needed. We looked for differences in colonization rates. The results of the antibiotic sensitivity test helped determine which bacterial strains were responsible for the illnesses that patients had after surgery. In order to determine which bacterial strains were responsible for postoperative infections, it is necessary to do antibiotic sensitivity tests. We used traditional antibiotic panels that include both gram-negative and gram-positive bacteria for antibiotics testing. On the third day following surgery, we apply the initial dressing using an aqueous solution of povidone iodine only. We monitor patients for wound infection symptoms until we remove the sutures, which typically takes 7–10 days. In cases where a pus-like discharge was seen, pus culture and antibiotic sensitivity tests

were done to find out if the infection started in the ward or if it was caused by the same organisms that were left behind when the skin was cleaned up before surgery.

## Results

**Table 1: Demographic details**

| Age (In years) | | Group I | Group II | Total |
|---|---|---|---|---|
| | 18-37 | 33 | 25 | 58 |
| | | 18.9% | 14.3% | 16.6% |
| | 38-57 | 105 | 97 | 202 |
| | | 60.0% | 55.4% | 57.7% |
| | 58-77 | 22 | 27 | 49 |
| | | 12.6% | 15.4% | 14.0% |
| | >77 | 15 | 26 | 41 |
| | | 8.6% | 14.9% | 11.7% |
| Total | | 175 | 175 | 350 |
| | | 100.0% | 100.0% | 100.0% |
| Mean±SD | | 48.95±16.69 | 50.21±16.97 | |
| p-value | | 0.485 (NS) | | |
| **Gender** | | | | |
| | Female | 74 | 65 | 139 |
| | | 42.3% | 37.1% | 39.7% |
| | Male | 101 | 110 | 211 |
| | | 57.7% | 62.9% | 60.3% |
| Total | | 175 | 175 | 350 |
| | | 100.0% | 100.0% | 100.0% |
| p-value | | 0.326 (NS) | | |
| **BMI** | | | | |
| | 18.5-24.9 | 10 | 19 | 29 |
| | | 5.7% | 10.9% | 8.3% |
| | 25-29.9 | 64 | 58 | 122 |
| | | 36.6% | 33.1% | 34.9% |
| | ≥30 | 101 | 98 | 199 |
| | | 57.7% | 56.0% | 56.9% |
| Total | | 175 | 175 | 350 |
| | | 100.0% | 100.0% | 100.0% |
| Mean±SD | | 30.03±2.79 | 29.82±2.42 | |
| p-value | | 0.463 (NS) | | |

Mean age of group I patients was 48.95±16.69 years and group II patients was 50.21±16.97 years. Out of 350 patients, 57.7% patients had age of 38-57 years followed by 18-37 years (16.6%), 58-77 years (14%), and >77 years (11.7%).

60% patients in group I and 55.4% patients in group II belonged to 38-57 years of age. Out of 350 patients, 39.7% were females and 60.3% were males. In group I, 57.7% were males and 42.3% were females. In group II, 62.9% were males and 37.1% were females.

Mean BMI of group I patients was 30.03±2.79 and group II patients was 29.82±2.42. Majority of the patients belonged to BMI group of ≥30 in group I (57.7%) as well as group II (56%). 56.9% patients had BMI more than or equal to 30, 34.9% had 25-29.9, and 8.3% had 18.5-24. This difference was not statistically significant.

**Table 2: Pre-op microbial growth distribution in study population**

| Pre-op growth | | Group I | Group II | Total |
|---|---|---|---|---|
| | E. Coli | 9 | 10 | 19 |
| | | 5.1% | 5.7% | 5.4% |
| | Klebsiella species | 6 | 4 | 10 |
| | | 3.4% | 2.3% | 2.9% |
| | No growth | 127 | 137 | 264 |
| | | 72.6% | 78.3% | 75.4% |

| | | | | |
|---|---|---|---|---|
| | Staph albus | 11 | 4 | 15 |
| | | 6.3% | 2.3% | 4.3% |
| | Staph aureus | 22 | 20 | 42 |
| | | 12.6% | 11.4% | 12.0% |
| Total | | 175 | 175 | 350 |
| | | 100.0% | 100.0% | 100.0% |
| p-value | | 0.380 (NS) | | |

Out of 350 patients, 75.4% had no pre-operative growth, 12% had Staphylococcus aureus, 5.4% had E. coli, 4.3% had Staphylococcus albus, 2.9% had Klebsiella species. In group I, 72.6% had no pre-operative growth, 12.6% had Staphylococcus aureus, 5.1% had E. coli, 6.3% had Staphylococcus albus, 3.4% had Klebsiella species. In group II, 78.3% had no pre-operative growth, 11.4% had Staphylococcus aureus, 5.7% had E. coli, 2.3% had Staphylococcus albus, 2.3% had Klebsiella species.

**Table 3: Distribution of prophylactic antibiotics in study population**

| **Prophylaxis** | | **Group** | | |
|---|---|---|---|---|
| | | **I** | **II** | **Total** |
| | Ceftriaxone | 65 | 67 | 132 |
| | | 37.1% | 38.3% | 37.7% |
| | Augmentin | 110 | 108 | 218 |
| | | 62.9% | 61.7% | 62.3% |
| Total | | 175 | 175 | 350 |
| | | 100.0% | 100.0% | 100.0% |
| p-value | | 0.825 (NS) | | |

Out of 350 patients, ceftriaxone was given to 37.7% patients and augmentin was given to 62.3% patients. In group I, 62.9% patients were given augmentin and 37.1% were given ceftriaxone. In group II, 61.7% patients were given augmentin and 38.3% were given ceftriaxone.

**Table 4: Distribution of site of incision in study population**

| **Site of incision** | | **Group** | | |
|---|---|---|---|---|
| | | **I** | **II** | **Total** |
| | Non-Abdominal | 110 | 107 | 217 |
| | | 62.9% | 61.1% | 62.0% |
| | Abdominal | 65 | 68 | 133 |
| | | 37.1% | 38.9% | 38.0% |
| Total | | 175 | 175 | 350 |
| | | 100.0% | 100.0% | 100.0% |
| p-value | | 0.741 (NS) | | |

62% patients were given non-abdominal incision and 38% were given abdominal incision. In group I, abdominal incision was given in 37.1% patients and non-abdominal incision was given in 62.9% patients. In group II, abdominal incision was given in 38.9% patients and non-abdominal incision was given in 61.1% patients.

**Table 5: Distribution of duration of surgery in study population**

| **Duration of surgery (in minutes)** | | **Group** | | |
|---|---|---|---|---|
| | | **I** | **II** | **Total** |
| | >60 | 65 | 67 | 132 |
| | | 37.1% | 38.3% | 37.7% |
| | <60 | 110 | 108 | 218 |
| | | 62.9% | 61.7% | 62.3% |
| Total | | 175 | 175 | 350 |
| | | 100.0% | 100.0% | 100.0% |
| Mean±SD | | 61.02±30.78 | 61.34±30.63 | |
| p-value | | 0.924 (NS) | | |

Mean duration of surgery in group I was 61.02±30.78 minutes and in group II was 61.34±30.63 minutes. Majority of the patients had surgery duration less than 60 minutes in Group I (62.9%) as well as group II (61.7%).

**Table 6: Distribution of surgical site infection in study population**

| SSI | | Group | | |
|---|---|---|---|---|
| | | I | II | Total |
| | Present | 43 | 16 | 59 |
| | | 24.6% | 9.1% | 16.9% |
| | Absent | 132 | 159 | 291 |
| | | 75.4% | 90.9% | 83.1% |
| Total | | 175 | 175 | 350 |
| | | 100.0% | 100.0% | 100.0% |
| p-value | | 0.001 (Sig.) | | |

In 16.9% patients, surgical site infection (SSI) was present. In group I, 24.6% patients developed SSI and in group II, only 9.1% patients developed SSI. This difference was found statistically significant.

**Table 7: Post-op microbial growth distribution in study population**

| Post-op-microbial growth | | Group | | |
|---|---|---|---|---|
| | | I | II | Total |
| | Staph aureus | 17 | 11 | 28 |
| | | 9.7% | 6.3% | 8.0% |
| | Staph albus | 11 | 4 | 15 |
| | | 6.3% | 2.3% | 4.3% |
| | No growth | 132 | 156 | 288 |
| | | 75.4% | 89.1% | 82.3% |
| | Klebsiella species | 6 | 4 | 10 |
| | | 3.4% | 2.3% | 2.9% |
| | E. Coli | 9 | 0 | 9 |
| | | 5.1% | 0.0% | 2.6% |
| Total | | 175 | 175 | 350 |
| | | 100.0% | 100.0% | 100.0% |
| p-value | | 0.003 (Sig.) | | |

Out of 350 patients, 82.3% had no post-operative growth, 8% had Staphylococcus aureus, 4.3% had Staphylococcus albus, 2.9% had Klebsiella species, and 2.6% had E. coli. In group I, 75.4% had no post-operative growth, 9.7% had Staphylococcus aureus, 6.3% had Staphylococcus albus, 5.1% had E. coli, and 3.4% had Klebsiella species. In group II, 89.1% had no post-operative growth, 6.3% had Staphylococcus aureus, 2.3% had Staphylococcus albus, 2.3% had Klebsiella species, and 0% had E. coli.

## Discussion

The skin acts as a first line of defence against microbes. Surgical site infections (SSIs) may occur when bacteria from the normal skin flora invade exposed tissues after a skin incision.

The problem of post-operative wound infection persists, despite several improvements in surgical procedures over the last few years. SSIs double the risk of death, increase the number of readmissions to the hospital after release, and lengthen stays in the critical care unit and other hospitals. Infections that manifest after surgery may have several causes, some of which are associated with the patient and others with the operation itself. [1] Postoperative wound sepsis is still a big concern, even though surgical methods have improved greatly in recent years. Any surgical procedure exposes the patient to the danger of infection from the surrounding environment, be it the operating room or the ward. A postoperative wound infection may originate in the operating room, according to Shooter (1956) and on the battlefield, according to Blower (1960). [11,12] Patients in the chlorhexidine group had an average age of 50.21±16.97 years, whereas those in the povidone iodine group had an average age of 48.95±16.69 years. There was no statistically significant difference between the two groups. In a study conducted by Bommareddy RR et al [13], the same findings were seen: the average (SD) age of the povidone iodine group was 40.7±14.4 years, while the chlorhexidine group's average age was 38.7±15.9 years, with no statistically significant difference as well. The age group receiving chlorhexidine had a mean (SD) value of 41.6±18.85 years, whereas the group receiving PI had a mean (SD) value of 39.46±18.28 years, and there was no statistically significant difference between the two groups. Out of the 350 patients enrolled, 39.7% were female and 60.3% were male. There were 57.7% men and 42.3% women in

Group I. Among those in Group II, men made up 62.9% and females 37.1%.

Statistical analysis did not reveal a meaningful difference. Bommareddy RR et al [13] conducted comparable research with 58% men and 42% females. The sample sizes were 25 for group PI and 33 for group chlorhexidine. In a similar vein, Gupta N et al [14] found that, whereas 36% of the participants were female, 64% were male (Group PI: 30; Group chlorhexidine: 34). The current investigation found no statistically significant difference between the two groups in terms of mean body mass index (BMI). Group I patients had a BMI of 30.03±2.79 and group II patients had 29.82±2.42. Takalkar YP et al [15] found no statistically significant changes in patients' body mass index (BMI).

The study revealed significant differences in the body mass index (BMI) between the two groups of infected patients. Group I had an average surgery time of 61.02±30.78 minutes, whereas group II had an average surgery time of 61.34±30.63 minutes, according to the current research. All of the operations in Bommareddy RR et al.'s research [13] were clean and elective; therefore, the length of the procedures did not affect the frequency of positive culture swabs.

The duration of the surgeries ranged from 45 minutes to 3 hours. Among the patients surveyed, 16.9% had an infection at the surgery site (SSI). Patients in the chlorhexidine group (9.1% of patients) were more likely to develop SSI than those in the povidone-iodine group (24.6%). Bommareddy RR et al [13] found that group 1 had a postoperative wound infection rate of 6% and group 2 had a rate of 0%. In comparison, the investigations by Brown et al [16] and Ajay et al [17] found rates of 8.1% and 6.0%, respectively.

In this study, there was no pre- or post-operative growth in 75.4% and 82.3% of the patients, respectively. Both before and after surgery, Staphylococcus aureus was the most prevalent bacteria found in patient samples. Both groups' microbial growth rates were similar before surgery, but after the procedure, the difference became statistically significant. Staphylococcus aureus was the most often identified bacterium in previous research that was comparable to the current study. [13,14,18] Mimoz et al [19] allocated skin preparation with either povidone-iodine in an aqueous solution or 0.5% chlorhexidine in alcohol to patients. Chlorhexidine significantly reduced contamination rates with a 0.40 odds ratio (95% CI, 0.21-0.75; P = 0.004) compared to the other group. In inpatients with amniocentesis, 2% chlorhexidine lowered the colony count more than povidone iodine solution. [20]

The methodology of our research was its strongest point, as there is a dearth of randomized, controlled, double-blind, prospective trials that compare the effectiveness of chlorhexidine with povidone iodine. Our study's shortcomings include a lack of patient variety and a small sample size due to its single-location research.

Despite the fact that cost is an issue when selecting an antiseptic, we neglected to look at the cost-effectiveness analysis for either group. Allergic responses, especially cutaneous hypersensitivity, may occur with any antiseptic solution. Neither group showed signs of hypersensitive responses.

## Conclusion

The findings concluded that antisepsis with chlorhexidine gluconate 2.5% v/v in 70% propanol significantly reduced the risk of postoperative SSI's and colonization of bacteria in clean contaminated elective surgeries compared to povidone iodine IP 5% w/v. iodine which is being used as the conventional preoperative skin cleansing agent for surgeries in our hospital. Regarding the cost add chlorhexidine is costly as it is providing better result with decrease rate of SSI, it proves to be a better antiseptic in terms of post-operative sepsis and recovery.

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