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## Review Article

# Comparison Between Chlorhexidine Alcohol Solution And Povidone Iodine Solution For Skin Preparation Before The Surgery To Avoid Surgical Site Infection -A Review

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## ABSTRACT

SSI occurs when bacteria introduced into the incision site during the surgical process proliferate in the wound, causing inflammation, pus, wound breakdown, or fever. SSI symptoms can take several days to develop and may not become obvious until the patient is discharged from the hospital. Most SSIs affect just the surface tissues, but others damage deeper tissues or other sections of the body that were touched during the surgery. A significant number of microorganisms known as the 'resident' or 'normal' flora colonise human skin and dwell deep in the skin folds, sebaceous glands, and hair follicles. Microorganisms can also contaminate skin surfaces via bodily excretions/secretions, filth, or contact with contaminated surfaces or products ('transient' flora). All of these bacteria are innocuous on the skin's surface; but, if they enter a surgical wound, they can cause a surgical site infection. Prior to surgery, the skin must be cleansed to eliminate as many bacteria as possible from the skin surface. Soap and water physically remove dirt and secretions, as well as germs that are only present temporarily. Alcohol, chlorhexidine, triclosan, and iodine are antiseptic chemicals that may quickly destroy both resident and transitory germs. Some medications can also prevent regrowth during the surgical process.

## INTRODUCTION

**A superficial incisional surgical site infection** develops within 30 days near the skin incision; the

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infection is restricted to tissue above the fascia. Pus discharge, organism identification in wound secretions, or iatrogenic incision opening are the defining factors. (1)

**Deep incisional surgical site infection (SSI)** occurs within 30 days (or a year for implants), affecting tissues beneath the fascia. Defining factors include pus discharge, organism detection in wound secretions, or iatrogenic incision opening, including deeper structures. (1)

The term "organ or space infection" refers to an abscess or other symptoms of infection in the bodily cavity. Purulent discharge following cavity drainage, discovery with an adequate investigation (histology or radiography), or diagnosis after a reoperation are the defining criteria. (1)

**The risk of surgical site infections depends on many factors**

**Clean Wound and Risk of SSI:**

A clean wound is one that is not infected, does not open the gastrointestinal or genitourinary tract, and does not cause inflammation, reducing the risk of SSI. Staphylococci are the most common cause of SSI, with a risk of less than 2% (in individuals without risk factors).(1)

**Clean-contaminated Wound and Risk of SSI:**

The gastrointestinal or urogenital tract was opened in a controlled manner and without unusual contamination of the wound. The risk for wound infection is 2–4% for urinary tract interventions and 5–10% for colon surgery. In addition to staphylococci, the most common pathogens for SSI are enterobacteria and enterococci. Anaerobe pathogens are possible after bowel surgery.(1)

**Contaminated Wound and Risk of SSI:**

Contaminated wounds pose a risk of SSI due to uncontrolled contamination with infectious urine or gastrointestinal fluid, or from recent trauma. The probability of wound infection is 10-15%, with the most prevalent bacteria falling into the clean-contaminated group. (1)

**Dirty-infected Wound and risk of SSI:**

Dirty-infected wounds are caused by surgical operations in areas of the body that are heavily contaminated with bacteria from previous infections or trauma. The likelihood of wound infection ranges between 15 and 40%, with the most prevalent pathogens falling into the clean-contaminated group.(1)

**CHLORHEXIDINE:**

Chlorhexidine gluconate, a long-lasting antimicrobial skin cleanser, is often used with a gauze dressing for burn wound coverage in superficial partial-thickness burns. Chlorhexidine dressings do not interfere with wound reepithelialisation, in contrast to silver sulfadiazine (2),(3)

**Dosing Form & Strengths**

**liquid/foam**

- 0.75%
- 2%
- 4%

**Lotion**

- 1%

**Swab**

- 3.15%

**Swab sticks**

- 2%
- 3.15%

**solution**

- 2%

**Towelette**

- 0.5% plus isopropyl alcohol 70%/5mL

**Sponge**

- 2%
- 4%

**Cleanser & Antiseptic**

- Indicated as a surgical hand scrub, wound cleanser, and preoperative skin cleanser

• **Surgical scrub:**

Scrub for 3 min, rinse and wash for another 3 min

- **Preoperative skin cleanser:**

Apply to surgical site and swab for 2 minutes, allow to dry, repeat once

- **Wound cleaning:**

Rinse area with water, apply to wound area and wash gently, and then rinse thoroughly

- **Hand sanitizer:**

Dispense in palm of one hand, dip fingertips of opposite hand into solution and work it under nails; spread remainder covering all surfaces of above elbow and over hand; repeat on other hand, allow to dry before using gloves

- **Hand wash:**

Wash for 15 seconds and rinse

- **Hand rinse:**

Rub 15 seconds and rinse (2),(3)

**MECHANISM OF ACTION:**

Polybiguanide antiseptic and antimicrobial drug with bactericidal activity; at high concentrations of chlorhexidine the cytoplasmic contents of the bacterial cell precipitate and result in cell death (2),(3)

**Pharmacokinetics:**

- Duration of antibacterial protection: 6 hr (2),(3)

**Adverse Effects:**

- Frequency Not Defined
- Irritation
- Sensitization
- Allergic reactions (particularly in genital areas)
- Dyspnoea
- Nasal congestion
- Facial oedema

**Post marketing Reports:**

- Allergic reaction (wheezing/difficulty breathing, shock, facial swelling, hives, rash) (2),(3)

**Povidone-iodine:**

Povidone-iodine ointment, including a liposomal preparation, effectively combines antimicrobial therapy with a desired moist wound environment.

Despite a broad spectrum of antimicrobial activity, use of povidone-iodine-containing products in burn care is controversial because of cytotoxicity and delay in wound reepithelialisation. Another drawback to povidone-iodine ointment compared with other topical agents is that it must be applied four times a day for maximal antimicrobial effect.(4),(5),(6)

**Topical Antiseptic:**

- Apply to clean wound PRN
- Surgical Scrub
- Apply solution to wet hands and scrub for 5 min
- Endophthalmitis (Orphan)
- Orphan designation for treatment of endophthalmitis (4),(5),(6)

**Mechanism of Action:**

**Wide spectrum microbicidal;**

oxidizes cell constituents; iodates proteins and inactivates them (4),(5),(6)

Pharmacokinetics:

**Absorption:**

Systemic absorption as iodine (4),(5),(6)

**Adverse Effects:**

- Severe pain on application
- Irritation
- Pruritus
- Erythema
- Rash
- Oedematous erythema
- Acneiform eruption (4),(5),(6)

Patient's skin is a major source of pathogens that cause surgical-site infection, optimization of preoperative skin antisepsis may decrease postoperative infections. The recent literature (mostly human) suggests that chlorhexidine provides better asepsis than Povidone Iodine. The reduction in surgical site infection is significantly lower with chlorhexidine scrub. A total duration of five minutes of contact time seems universally accepted. The aim of this review is to find out



povidone iodine or chlorhexidine is better for pre-operative preparation of skin and how long it will prevent the Surgical site infection. (7),(8)

### **1. COMPARISON ON THE BASIS OF SPECTRUM ACTIVITY**

According to the studies, Chlorhexidine is a broad-spectrum biocide effective against Gram-positive bacteria, Gram-negative bacteria and fungi. Chlorhexidine inactivates microorganisms with a broader spectrum than other antimicrobials (e.g. antibiotics) and has a quicker kill rate than other antimicrobials (e.g. povidone-iodine). It has both bacteriostatic (inhibits bacterial growth) and bactericidal (kills bacteria) mechanisms of action, depending on its concentration. It has also shown activity against enveloped viruses in vitro (e.g., herpes simplex virus, HIV, cytomegalovirus, influenza, and RSV) but has substantially less activity against nonenveloped viruses (e.g., rotavirus, adenovirus, and enterovirus).it acts within 60s.(7),(8)

Povidone iodine is also broad – spectrum effective against Gram- positive bacteria, Gram -Negative bacteria, actinobacteria, antiviral, antifungal, anti- protozoal & anti spore.it is biocidal against MSSA / MRSA within 1 minute and active against Staph. aureus regardless of the presence of antibiotic or antiseptic resistance. (7),(8)

### **2. COMPARISON OVER THE DURATION OF ACTION**

Preoperative skin preparation with chlorhexidine helped to reduce surgical wound infections by reducing the normal skin flora. A combination of chlorhexidine and alcohol showed the greatest reduction in bacteria, lasting up to 48 hours, Unlike Povidone iodine, it will only be lasting up to 12 hrs. In one study, chlorhexidine gluconate was shown to have a greater skin flora reduction than povidone-iodine. The use of preoperative chlorhexidine antiseptic has been shown to reduce bacterial colonization nine-fold.(9),(10)

In topical applications, chlorhexidine is shown to have the unique ability to bind to the proteins present in human tissues such as skin and mucous membranes with limited systemic or bodily absorption. Protein bound chlorhexidine releases slowly leading to prolonged activity. This phenomenon is known as substantivity and allows for a longer duration of antimicrobial action against a broad spectrum of bacteria and fungi. (9),(10)

### **3. COMPARISON OVER COST EFFECTIVENESS**

According to studies, chlorhexidine has a superior result as skin antiseptics. The high cost and the availability of this preparation became potential drawbacks to surgeons. A study on cost benefit model comparing to the economic value of using chlorhexidine compared to povidone iodine that chlorhexidine is costly (Rs.200) than Povidone Iodine (Rs.110), the dramatic reduction of SSIs will likely result in greater overall cost savings with chlorhexidine use.(9),(10)

### **4. COMPARISON OVER ADVERSE EVENTS**

Chlorhexidine shows allergic contact dermatitis.it involves a non – immediate (non -IGE Mediated) allergic response, it typically occurs 12-48 hours after the contact with chlorhexidine.it is necessary to perform the Allergy skin test to conclude and exclude immediate chlorhexidine allergy.(10),(11). Povidone iodine is classified as a non -irritant antiseptic, it is not completely devoid of corrosive action. Severe irritant contact dermatitis induced by povidone iodine can be an unfortunate adverse reaction.it can be treated with the tobramycin ointment .it cause excessive burden for the patient in spite of hospital stay. Povidone Iodine can be used for all types of surgeries for skin preparation. But chlorhexidine should not be used for eyes, ears, mouth or nose, accidental administration causes ocular damage, hearing loss etc.it cannot be used for cleaning genital areas,

when it touches the mucosal layer, it causes irritations. (9),(10),(11)

### CONCLUSION:

In this review, we concluded that chlorhexidine is way better than Povidone iodine, according to their spectrum of activity and duration of action in the skin to eradicate the surgical site infections. Factors like types of cases (clean / clean contaminated), duration of surgery, Length of hospital stay had significant impact in the development of surgical site infection. SSI can be rectified by the proper handling of surgical measures & through this we can reduce the mortality.

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