

Chlorhexidine versus Povidone-Iodine for the prevention of surgical site infections: A review

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REVIEW

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ABSTRACT

Background

Surgical Site Infections (SSIs) are the third most frequently reported health care-associated infection and it remain a major clinical problem despite improvements in prevention, as they are associated with significant mortality and morbidity. Prevention strategies for SSIs are based on reducing the risk of infection by bacteria, So many antiseptic agents are used, the most common one are Chlorhexidine and Povidone-Iodine.

Aims

To discuss the findings of RCTs that compare Chlorhexidine versus Povidone-Iodine in the prevention of Surgical Site Infections (SSIs).

Methods

This systematic review was carried out, including PubMed, Google Scholar, and EBSCO that examining randomized trials of Chlorhexidine and Povidone-Iodine to summarize the major RCT that compare Chlorhexidine versus Povidone-Iodine in the prevention of Surgical Site Infections (SSIs).

Results

The review included six randomized studies that compare between Chlorhexidine and Povidone-Iodine for the prevention of SSIs. The findings showed that many studies prefer using Chlorhexidine over Povidone-Iodine to reduce SSIs, few studies prefer using PVI as antiseptic and other studies reported that there is no significant difference between both.

Conclusion

Majority of results prefer using Chlorhexidine than Povidone-Iodine as antiseptics but there were few findings prefer PVI and other studies reported that there was no significant difference between using them as antiseptics.

Key Words

Surgical site infections, chlorhexidine gluconate, povidone-iodine

What this study adds:

1. What is known about this subject?

Several methods can be applied to prevent Surgical Site Infections, such as strict hand antiseptic, preoperative antibiotic, strict aseptic operation as well as preoperative skin antiseptic.

2. What new information is offered in this study?

Preoperative skin antiseptic, especially with Chlorhexidine,

is one of the most critical factors for postoperative surgical site infection.

3. What are the implications for research, policy, or practice?

Superiority of single agent (Chlorhexidine or Povidone-iodine) cannot conclude and further studies are needed for definite results.

Background

Surgical Site infections (SSIs) are defined as infections that result from surgical or invasive operations or infections that need to be remedied by a surgical intervention within 30 days of surgery.¹ SSIs remain a major clinical problem despite improvements in prevention, as they are associated with significant mortality and morbidity.²

The importance of this review based on data derived from the Centers for Disease Control and Prevention (CDC)-National Healthcare Safety Network that informed: SSIs are the third most frequently reported health care-associated infection.³ SSIs have significant medical and health care consequences, including increased mortality, longer hospitalisation durations, higher re-operation and re-admission rates, and surely, higher health care costs.⁴ The risk of wound contamination and consequent SSI is dependent on many factors as: location, nature of the surgical wound, the procedure that was carried out and patient related factors. The classification of CDC wounds' system defines the risk-based wound classes and divided into four categories: clean, clean-contaminated, contaminated, and dirty.⁵

In certain surgical procedures, pre-operational antibiotic therapy decreases the frequency of infection at the surgical site. Time, type and dosage of antibiotic administration play an important role in the prevention of postoperative infections. Also essential is pre-operative skin antiseptic.⁶

For preoperative preparation of the skin at the incision site, many antiseptic agents are available. An efficient preoperative skin antiseptic is an agent that decreases the number of transient and resident microorganisms in the surgical field rapidly (i.e., within 10 minutes of application) before wound incision and inhibits rebound growth for six hours after application. The well-known antiseptics used for surgical-site skin preparation are Povidone Iodine (PVI) and Chlorhexidine Gluconate (CHG).⁷ This review was conducted to summarize the major RCT that compare Chlorhexidine versus Povidone-Iodine in the Prevention of surgical site infections.

Method

A systematic review was carried out, including PubMed, Google Scholar, and EBSCO using the following terms in different combinations: Surgical Site Infections (SSIs), Chlorhexidine, Povidone-Iodine. We included all full texts randomized controlled trials, observational, and experimental studies which compare Chlorhexidine versus Povidone-Iodine in the prevention of surgical site infections. The authors extracted the data, and then the author's names, year and region of publication, the study type, period of study, and the result were reported (Table 1).

Results

The search of the mentioned databases returned a total of 107 studies that were included for title screening. 69 of them were included for abstract screening, which lead to the exclusion of 56 articles. The remaining 13 publications full-texts were reviewed. The full-text revision lead to the exclusion of seven studies, and six were enrolled for final data extraction (Table 1). The included studies had different study designs.

Discussion

How to maximally remove bacteria from the incision is a scientific challenge worthy of surgeons' attention, as the frequency of infection with a postoperative incision results from the interaction of several factors and is closely correlated with intraoperative bacteria colonization. To minimize the risk of SSIs by removing soil and transient organisms from the skin where a surgical incision is made, preoperative skin antiseptic using antiseptics is performed. It is known that antiseptics are poisonous to bacteria and thus help their mechanical removal.¹⁴

This review was conducted to summarize the major RCT that compare Chlorhexidine versus Povidone-Iodine for the prevention of Surgical Site Infections. Our review included the major six studies from different countries that compare between the efficacy of Chlorhexidine and Povidone-Iodine in the prevention of SSIs.

In 2013 in Poland, Bartłomiej Perek⁸ Conducted a prospective, randomized clinical study involved 91 consecutive patients who underwent elective cardiac procedures, patients divided into two groups. Group H (46 Patient) managed with Chlorhexidine and group B (45 Patient) received Povidone-Iodine. The study found that chlorhexidine in 70 per cent ethanol is a more effective surgical site antiseptic agent in cardiac surgery as compared to povidone-iodine in 50 per cent propanol.¹³ Similar results

reported by other studies carried out in different countries as India in 2017 and 2020 that the preoperative preparation of the patients' skin with chlorhexidine-alcohol-based solutions has been found to be superior to PVI solutions for preventing SSI. In 2017 in United Kingdom, Patrick found that using CHG with PVI in a combination reduces surgical wound contamination relative to using PVI alone.¹¹

In United States, in 2017, Springel reported that there is no significant difference between using CHG and PVI as antiseptics.¹⁰ Another randomized, controlled, comparative study in 2019, Australia, found that no difference was observed in the primary outcome of superficial wound complications when chlorhexidine alcohol and povidone-iodine alcohol were compared but, on a secondary assessment, found that Povidone-Iodine alcohol was more effective in reducing surgical site infection than chlorhexidine alcohol.

Conclusion

This review concluded that there are several studies compare using chlorhexidine versus Povidone-Iodine for the prevention of SSIs. We found that different results reported from all included studies. However, the majority of results prefer using CHG than PVI as antiseptics but there were few findings prefer PVI and other studies reported that there was no significant difference between using them as antiseptics. So finally, we recommend further studies should be done to decide which one of them better than the other for the prevention of SSIs.

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PEER REVIEW

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CONFLICTS OF INTEREST

The authors declare that they have no competing interests.

Table 1: Author, country, year of publication, methodology and results

Author, years, country	Method	Results
<p>Bartłomiej Perek.^[8] 2013 Poland</p>	<p>A prospective, randomized clinical study involved 91 consecutive patients who underwent elective cardiac procedures. In order to disinfect the chest patients were randomized in 2 groups: Chlorhexidine in 70% ethanol was used in Group H (n=46) and Povidone-Iodine in 50% propanol was used in Group B (n=45).</p>	<p>The findings of this prospective randomized analysis showed that chlorhexidine in 70% ethanol is a more effective surgical site antiseptic agent in cardiac surgery as compared to povidone-iodine in 50% propanol.</p>
<p>Geetha Danasekaran.^[9] 2017 India</p>	<p>A randomized controlled trial was conducted in 120 patients undergoing abdominal surgeries. The patients were divided into two groups 60 in each group by computer randomization Group A: 2% Chlorhexidine-alcohol group. Group B: 5% Povidone-Iodine group.</p>	<p>The randomized clinical trial showed that chlorhexidine preoperative skin washing substantially decreases the risk of postoperative SSIs and bacterial colonization in clean abdominal operations.</p>
<p>Edward H. Springel.^[10] 2017 (United States)</p>	<p>An open-label randomized controlled trial on pre-operative skin antiseptic preparation for women undergoing caesarean delivery. 932 women were randomized in 2 groups: 461 assigned to chlorhexidine-alcohol. 471 assigned to povidone-iodine.</p>	<p>The study reported that Pre-operative antiseptic skin preparation with chlorhexidine-alcohol before caesarean did not result in less frequent surgical site infection when compared with povidone-iodine.</p>
<p>S. Patrick.^[11] 2017 United Kingdom</p>	<p>A randomized controlled trial was undertaken, involving 407 patients who underwent elective spinal surgery. Patients divided randomly into 2 Groups: In 1st group: 203 patients where the skin was disinfected before surgery using Povidone-Iodine alcohol (PVI) In 2nd group: 204 patients using Povidone-Iodine alcohol once followed by chlorhexidine gluconate-alcohol (CHG).</p>	<p>The findings of this study concluded that more effectively, skin antiseptics with sequential application of PVI and CHG reduces surgical wound contamination relative to PVI alone.</p>

<p>N T Peel.^[12] 2019 Australia</p>	<p>A randomized, controlled, single-blinded, trial in patients undergoing elective hip or knee arthroplasty. 780 participants were included: 390 participants were allocated chlorhexidine alcohol and 390 participants were allocated povidone-iodine alcohol.</p>	<p>The study found that no difference was observed in the primary outcome of superficial wound complications when chlorhexidine alcohol and povidone-iodine alcohol were compared. Nevertheless, on a secondary assessment, Iodine alcohol was more effective in reducing surgical site infection than chlorhexidine alcohol.</p>
<p>Shi Chen.^[13] 2020 India</p>	<p>A total of 30 studies including 19 RCTs, 4 retrospective studies, 7 observational studies and cohort studies in this meta-analysis were conducted. A total of 29,006 patients including adult and paediatric were involved. Patients were divided into 2 groups: 15,263 cases were in chlorhexidine group. 13,437 in povidone-iodine group.</p>	<p>The study concluded that In the prevention of postoperative SSI, chlorhexidine was superior to povidone-iodine, especially for clean-contaminated surgery. However, no statistically significant difference was found in the incidence of skin adverse reactions between CH and PI groups.</p>

Figure 1: Flow diagram through the different phases of the systematic review (PRISMA flowchart)

