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Effectiveness of Chlorhexidine and Povidone Iodine in Preventing Surgical Site Infections (SSIs) in C-Section Deliveries

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ABSTRACT

Objective: To compare the effectiveness of Chlorhexidine and Povidone iodine in preventing SSIs in C-section deliveries.

Methodology: The study was conducted at a medical university and hospital in Karachi, from January 2021 July 2021. A non-probability consecutive sampling technique was used to select 35 participants. The study included women aged 18 to 45 years. The efficacy of Chlorhexidine and Povidone iodine in preventing SSIs was evaluated. Two groups were randomly assigned, with Group 1 receiving Chlorhexidine gluconate and Group 2 receiving Povidone-Iodine for skin preparation. Data on various factors were recorded, and the occurrence of SSIs within ten days of cesarean delivery was assessed.

Results: The study included women aged 18 to 45 years. The efficacy of Chlorhexidine and Povidine iodine in preventing SSIs was evaluated. The results showed that Chlorhexidine was effective in preventing SSIs in 94.3% of cases, while Povidone iodine was effective in 91.4% of cases. However, no significant difference was observed between the two groups. The study results were consistent with previous research showing a reduction in SSI rates with the use of Chlorhexidine or Povidone- iodine. The overall rate of SSI was lower in the Chlorhexidine group, but contextual factors and adherence to infection control practices may influence outcomes.

Conclusion. This study augments existing knowledge on preventing SSIs in C-section deliveries. While both Chlorhexidine and Povidone-iodine demonstrated comparable efficacy, Chlorhexidine appeared slightly more effective in reducing SSIs. Nonetheless, the study's limitations underscore the necessity for further research in diverse healthcare settings.

Keywords: Surgical site infections (SSIs), Caesarean section, skin preparation

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Introduction

Surgical site infections (SSIs) pose a significant challenge in healthcare settings worldwide, contributing to increased morbidity, mortality, and financial burden.[1] It has been reported that SSIs account for the majority of nosocomial infections, with substantial implications for patients and healthcare resources.[2] Although complete eradication of SSIs is challenging, minimizing their incidence can greatly benefit patients and healthcare facilities.[3] SSIs typically manifest within a specific timeframe postoperatively, and their occurrence can lead to prolonged hospital stays, elevated costs, readmissions, and compromised patient outcomes.[4,5] However, it is important to recognize that SSIs can range from a relatively trivial wound discharge with no other complications to life threatening condition.[6] Choice of antiseptic for skin preparation is primarily based on surgeon's knowledge of the product's efficacy, cost and ease of use.[7]

Preventing SSIs through effective skin preparation using suitable antiseptic agents is crucial. Among the commonly used antiseptics, iodophor and Chlorhexidine gluconate-based products are prevalent.[8,9] However, there is a need to determine the comparative efficacy of these agents in preventing SSIs, as the choice of antiseptic is influenced by factors such as efficacy, cost, and ease of use.

Existing studies on this topic have produced varying results, with different efficacy rates observed internationally. For example, one study involving 60 cesarean section patients demonstrated a significant difference in efficacy, with higher SSI rates in the iodine group compared to the Chlorhexidine group.[10] Similarly, a study conducted on 388 patients in Pakistan found no significant difference in SSI rates between the two groups.[2]

To the best of our knowledge, there is limited research conducted in Pakistan on this subject, and the available studies have yielded controversial results. It is important to note that demographics and other contextual factors may influence the outcomes. Therefore, further studies are needed to establish a clearer understanding and enhance the current standards of care. The objective of this study is to assess the efficacy of Chlorhexidine and Povidone iodine in preventing SSIs in C-section deliveries, providing valuable insights for choosing the optimal antiseptic agent for skin preparation.

Methodology

The study was conducted in the Department of Obstetrics & Gynecology at Ziauddin Medical University & Hospital, Karachi from January 2021 July 2021. A sample size of 35 participants was calculated based on the prevalence of SSI in the Chlorhexidine group (10%) and Povidone group (43%), with a power of 80% and a significance level of 5%.[21] A non-probability consecutive sampling technique was used to select the participants. Women scheduled for cesarean delivery, aged 18 to 45 years, with gestational age between 37 and 42 weeks, and were included in the study. Participants with allergies to the antiseptic preparations or ongoing active skin or systemic infections were excluded. Informed consent was obtained from all participants.

The participants were randomly assigned to two groups. Group 1 received 2% Chlorhexidine gluconate in 70% isopropyl alcohol, while Group 2 received 10% Povidone-Iodine. All participants underwent the same preoperative skin preparation as per guidelines. Data on age, height, weight, gestational age, parity, previous C-sections, socioeconomic status, and educational status were recorded. Prophylactic antibiotic injection (Ceftriaxone) was administered before skin incision, and postoperative antibiotic treatment was given for seven days.

Follow-up was conducted after ten days for suture removal and assessment of surgical site infection. The primary outcome variable was the occurrence of any SSI within ten days of cesarean delivery.

Data was entered and analyzed using SPSS version 19. Descriptive statistics such as mean and standard deviation were calculated for continuous variables, while frequency and percentage were calculated for categorical variables. The efficacy of the two groups was compared using the Chi-square test. Stratification and post-stratification Chi-square tests were used to control for effect modifiers.

Results

The study included women between the ages of 18 and 45 years. The mean age, BMI, ASA status, gestational age, previous caesarean sections, and type of caesarean section are presented in Table I.

Table I: The mean of age, BMI, ASA status, gestational, age, previous Caesarean sections and type of caesarean section.

	Mean
AGE	
Group A	30.37 + 9.40
Group B	29.93 + 11.1
BMI	
Group A	30.19+ 3.94
Group B	31.96+ 4.2
Gestational Age	
Group A	39.21 + 1.53
Group B	40.09 + 1.41
Previous CS	
Previous CS 1	
Group A	7(20%)
Group B	9(25.7%)
Previous CS 2	
Group A	21(60%)
Group B	20 (57.1%)
Previous CS 3	
Group A	3(8.6%)
Group B	5(14.2%)
Type of CS	
Elective	
Group A	21(60%)
Group B	20 (57.1%)
Emergency	
Group A	14 (40%)
Group B	15(42.8%

In Group-A, 3 (8.2%) women had a monthly income of less than Rs. 20,000, 17 (49%) had a monthly income between Rs. 21,000 and Rs. 50,000, and 15 (42.8%) had a monthly income greater than Rs. 50,000. In Group-B, 3 (8.2%) women had a monthly income of less than Rs. 20,000, 19 (54.2%) had a monthly income between Rs. 21,000 and Rs. 50,000, and 13 (37.1%) had a monthly income greater than Rs. 50,000.

In Group-A, none of the women were illiterate, 1 (2.9%) had primary education, 6 (17.1%) had secondary education, 11 (31.4%) had intermediate education, and 17 (48.5%) were graduates or above. In Group-B, none of the women were illiterate, 2 (5.7%) had primary education, 5 (14.2%) had secondary education, 13 (37.1%) had intermediate education, and 15 (42.8%) were graduates or above.

In Group A, 2 (5.7%) women experienced surgical site infections, while in Group-B, 3 (8.57%) women had surgical site infections. Chlorhexidine was effective in preventing surgical site infections in 33 (94.3%) cases, and Povidone iodine was effective in 32 (91.4%) cases. However, no significant difference was observed between the two groups (p-value > 0.05), as shown in Table II. The outcome variable was stratified based on age, gestational age, BMI, income status, and education status. No significant difference was observed among these factors.

Table II: Frequency of Surgical Site Infection. (n=70)

	Surgical Site Infection		P Value
Group	Yes	No	
Chlorhexidine (n = 35)	2 (5.7%)	33 (94.3%)	1.000
Povidine Iodine (n = 35)	3 (8.57)	32 (91.4%)	

Discussion

Surgical site infections (SSIs) are persistent and preventable healthcare-associated infections. The increasing number of surgical procedures performed and the associated morbidity and cost make the prevention of SSI a matter of utmost importance.

In this study, the efficacy of Chlorhexidine-Alcohol (CA) and Povidone-Iodine (PI) in decreasing SSI among pregnant women undergoing elective cesarean sections (CS) was compared. The maternal and operative characteristics were similar between the two treatment groups. No significant difference was observed in the incidence of SSI, hospital stay, and wound complications (cellulites) between the two groups.

Chlorhexidine remained effective in preventing surgical site infections in 33 (94.3%) cases, while Povidone remained effective in 32 (91.4%) cases. These results are consistent with previous studies conducted by Darouiche et al. and Amer-Alshiek et al[4, 6], which also reported a reduction in the rate of SSI. However, studies conducted by Menderes G et al., Elshamy et al., and Springel EH et al. showed no significant difference in the rate of SSI between the two groups.[7,9]

In this study, the overall rate of SSI was lower in the Chlorhexidine-alcohol group compared to the Povidone-Iodine alcohol group, both within a week and during the 30-day follow-up period. This included both superficial incisional and deep incisional infections.

A recent meta-analysis, including six randomized controlled trials (RCTs), compared the use of CA with PI as skin preparation agents to reduce SSI. The analysis reported that CA was significantly associated with fewer SSIs, with a risk ratio of 0.60 and a 95% confidence interval of 0.45-0.79. [10] Another RCT specifically focused on CD reported a lower incidence of SSI in the CA group compared to the Iodine-Alcohol group, with a significant p-value of 0.02.[11]

A prospective observational study that compared the incidence of SSI between the CA and PI group among pregnant women indicated for elective CS reported that SSI was 3.7% in the CA group compared with 4.6% in the PI group, with odds ratio as 0.78 and difference was not statistically significant as p-value was 0.35 thus demonstrating that both antiseptic agents were suitable for preparing skin prior to elective CS.[12]

Another RCT reported no significant difference in SSI in two treatment arms as incidence was 4.6% vs. 4.5% for PI and CA groups.[13] A Cochrane systemic review that included 6 trials and 3607 women reported that Chlorhexidine-gluconate before CS, when compared with PI, made little difference to the incidence of SSI with relative risk as 0.80 and 95% CI as 0.62 to 1.02, while little or no difference to the incidence of endometritis with relative risk as 1.01 was identified.[14] The result of a recent meta-analysis published in 2019 included four randomized controlled trials comparing CA with PI skin preparation solutions for women undergoing CD reported that risk of SSI was significantly reduced around 28% with CA, while superficial or deep SSI alone did not show difference statistically significant.[15]

In another randomized controlled trial (RCT), it was found that there was no statistically significant distinction in surgical site infection (SSI) between the two treatment groups. The incidence of SSI was 4.6% in the PI group and 4.5% in the CA group. Additionally, there was no significant distinction observed in the occurrence of superficial and deep SSIs between the two treatment arms.[16.]

The result our study contrasts to a very recent systemic and meta-analysis 16 studies which meticulously evaluated the occurrence of surgical site infections (SSIs) following

preoperative skin antisepsis using either Chlorhexidine or povidine-iodine. The findings unveiled a statistically significant contrast in the overall SSI rates between the two antiseptic agents. Specifically, patients subjected to preoperative skin disinfection with chlorhexidine demonstrated lower SSI incidences compared to those treated with povidone-iodine. The combined Relative Risk (RR) was 0.75, with a 95% Confidence Interval (CI) ranging from 0.64 to 0.88 ($p < 0.001$).[17]

Furthermore, other studies have also reported similar findings, showing a lower rate of SSI in the CA group compared to the PI group. However, some studies did not find a significant difference between the two treatment arms.[18, 19]

It should be noted that the variation in the incidence of SSI following elective CS in different studies could be attributed to factors such as institutional perioperative practices, differences in surgical drapes used, adherence to manufacturer recommendations, and post-surgery washing of antiseptic solutions, which may impact the efficacy of the products. Additionally, healthcare settings in developing countries with lower adherence to infection control practices may experience higher incidence of SSI following elective CS.

Most of the research reported in the literature is from developed countries where more efficient infection control measures are adopted. Therefore, studies conducted in developing and underdeveloped countries may yield interesting findings regarding the comparison of SSI incidence with different antiseptic solutions.[20]

Overall, the present study provides evidence that Chlorhexidine-Alcohol is superior to Povidone-Iodine in reducing SSI among pregnant women undergoing elective CS. However, further research is needed, especially in diverse healthcare settings, to validate and expand upon these findings.

Conclusion

In summary, the ongoing challenge of surgical site infections (SSIs) underscores the importance of implementing robust preventive strategies. The selection of antiseptic agents for skin preparation emerges as a pivotal factor in mitigating SSI occurrence rates. Conducting a comparative evaluation of Chlorhexidine and Povidone iodine effectiveness in preventing SSIs during C-section deliveries promises to enrich existing research and provide valuable insights for clinical practices, ultimately enhancing patient welfare.

Limitation: The utilization of a non-probability consecutive sampling technique raises concerns regarding the generalizability of the findings to the overall population. Furthermore, the sample size was insufficient, which further questions the ability to draw broad conclusions.

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