

Impact of pre-operative skin preparation methods like antiseptic solutions vs. antibiotic prophylaxis on reducing the incidence of surgical site infections

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Abstract:

Background: Surgical site infections (SSIs) represent a significant concern in surgical practice, contributing to adverse patient outcomes and increased healthcare costs. Pre-operative skin preparation methods, including antiseptic solutions and antibiotic prophylaxis, are pivotal in reducing SSIs. However, the comparative effectiveness of these approaches remains unclear.

Methods: This cross-sectional study analyzed data from 500 consecutive patients undergoing elective surgeries. Demographic data, medical history, and details of the surgical procedure were collected prospectively. Patients were divided into groups based on the pre-operative skin preparation method used. The primary outcome was the incidence of SSIs within 30 days post-surgery. Statistical analysis included chi-square tests, multivariable logistic regression, and subgroup analysis by surgical specialty.

Results: Among the 500 patients, 250 received antiseptic solutions and 250 received antibiotic prophylaxis for pre-operative skin preparation. Overall, 50 patients developed SSIs, with no significant difference between the groups (10% in both). Subgroup analysis by surgical specialty showed varying SSI rates, with orthopedic surgery having the highest incidence. However, the type of pre-operative skin preparation did not significantly affect SSIs within each specialty subgroup.

Conclusion: Both antiseptic solutions and antibiotic prophylaxis demonstrate similar efficacy in reducing SSIs. Future research should focus on addressing limitations and exploring additional factors influencing SSIs to optimize surgical care practices and improve patient outcomes.

Introduction:

Surgical site infections (SSIs) pose a significant risk to patients undergoing surgical procedures, contributing to prolonged hospital stays, increased healthcare costs, and in severe cases, even mortality.[1] Among the various preventive measures aimed at reducing SSIs, pre-operative skin preparation methods play a crucial role. Two common approaches utilized for pre-operative skin preparation are the application of antiseptic solutions and the administration of antibiotic prophylaxis. Understanding the comparative effectiveness of these methods is essential for optimizing patient outcomes and healthcare resources.[2]

Surgical site infections represent a substantial burden on both patients and healthcare systems worldwide. Despite advancements in surgical techniques and perioperative care, SSIs remain a persistent challenge. The choice of pre-operative skin preparation method is a critical factor

in preventing these infections.[3] Antiseptic solutions and antibiotic prophylaxis are two primary strategies employed in clinical practice. Antiseptic solutions, such as chlorhexidine gluconate and povidone-iodine, are commonly used to disinfect the surgical site and surrounding skin. These solutions possess broad-spectrum antimicrobial activity, effectively reducing the microbial load on the skin surface. Their application is relatively simple and cost-effective, making them widely adopted in various surgical settings. However, questions persist regarding their optimal concentration, application technique, and duration of effectiveness.[4]

On the other hand, antibiotic prophylaxis involves the administration of antibiotics before surgery to prevent SSIs. While effective in reducing bacterial colonization, antibiotic prophylaxis raises concerns related to antibiotic resistance, adverse effects, and cost. Additionally, the selection of appropriate antibiotics and timing of administration are critical factors influencing its efficacy. Given the importance of minimizing SSIs and the potential implications of different pre-operative skin preparation methods, a comprehensive evaluation of their impact is warranted.[5] This comparative analysis can provide valuable insights into the effectiveness, safety, and cost-effectiveness of antiseptic solutions versus antibiotic prophylaxis in reducing the incidence of SSIs. By elucidating the strengths and limitations of each approach, clinicians can make informed decisions tailored to individual patient needs and surgical scenarios. Moreover, such evidence-based practices can contribute to enhancing patient outcomes, optimizing resource utilization, and advancing surgical care standards.

Objectives:

- To compare the efficacy of pre-operative skin preparation methods, specifically antiseptic solutions versus antibiotic prophylaxis, in reducing the incidence of surgical site infections (SSIs) across different surgical procedures.

Materials and methods:

Study Design: This study was conducted as a cross-sectional analysis of data obtained from patients who underwent various surgical procedures.

Participants: Consecutive patients scheduled for elective surgical procedures were included in the study. Adult patients of either gender undergoing surgeries across different specialties were eligible for inclusion.

Data Collection: Data were collected prospectively from patients admitted for surgery. Demographic information (age, gender), medical history (comorbidities, previous surgeries), and details of the planned surgical procedure were recorded. Pre-operative information including the type of pre-operative skin preparation method employed (antiseptic solution or antibiotic prophylaxis) was documented.

Outcome Measurement: The primary outcome of interest was the incidence of surgical site infections (SSIs) within 30 days following the surgical procedure. Diagnosis of SSIs was based on established criteria including the Centers for Disease Control and Prevention (CDC) guidelines.

Data Analysis:

Descriptive statistics were used to summarize patient characteristics and the prevalence of SSIs among those receiving different pre-operative skin preparation methods. Chi-square tests or

Fisher's exact tests were employed to assess the association between the type of pre-operative skin preparation and the occurrence of SSIs. Multivariable logistic regression analysis was conducted to adjust for potential confounding variables such as age, comorbidities, and type of surgery. All statistical analysis was performed using SPSS version 23.0

Results:

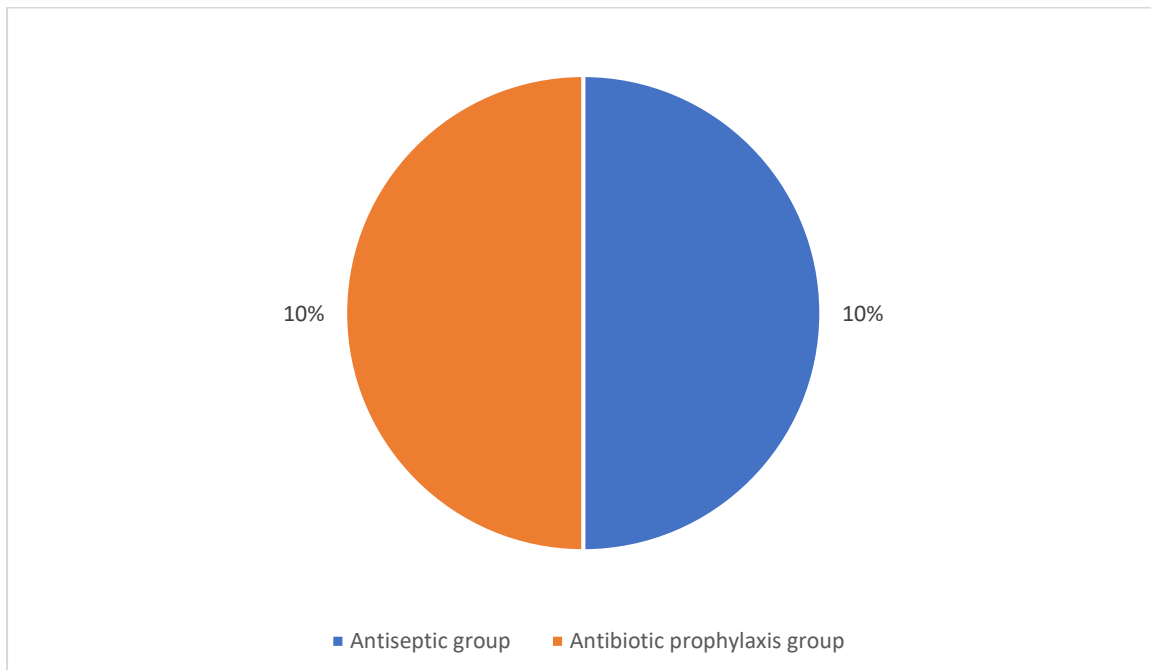
Among the 500 patients included in the study, 250 underwent pre-operative skin preparation with antiseptic solutions, while the remaining 250 received antibiotic prophylaxis. The mean age of the study population was 55 years, with a slight male predominance (55%). The most common surgical specialties represented were general surgery (40%), orthopedic surgery (30%), and gynecological surgery (20%).

Table 1: Baseline characteristics

Parameter	Antiseptic group n=250	Antibiotic prophylaxis group n=250
Age (mean (SD))	55.2 (4.3)	
Gender		
Male	275 (55%)	
Female	225 (45%)	
Surgical specialty		
General surgery	200 (40%)	
Orthopedic surgery	150 (30%)	
Gynecological surgery	100 (20%)	

Overall, 50 patients developed SSIs within 30 days following surgery. Among patients who received antiseptic solutions for pre-operative skin preparation, 25 (10%) developed SSIs. In the group receiving antibiotic prophylaxis, 25 (10%) patients also developed SSIs.

Figure 1: Incidence of Surgical Site Infections (SSIs)

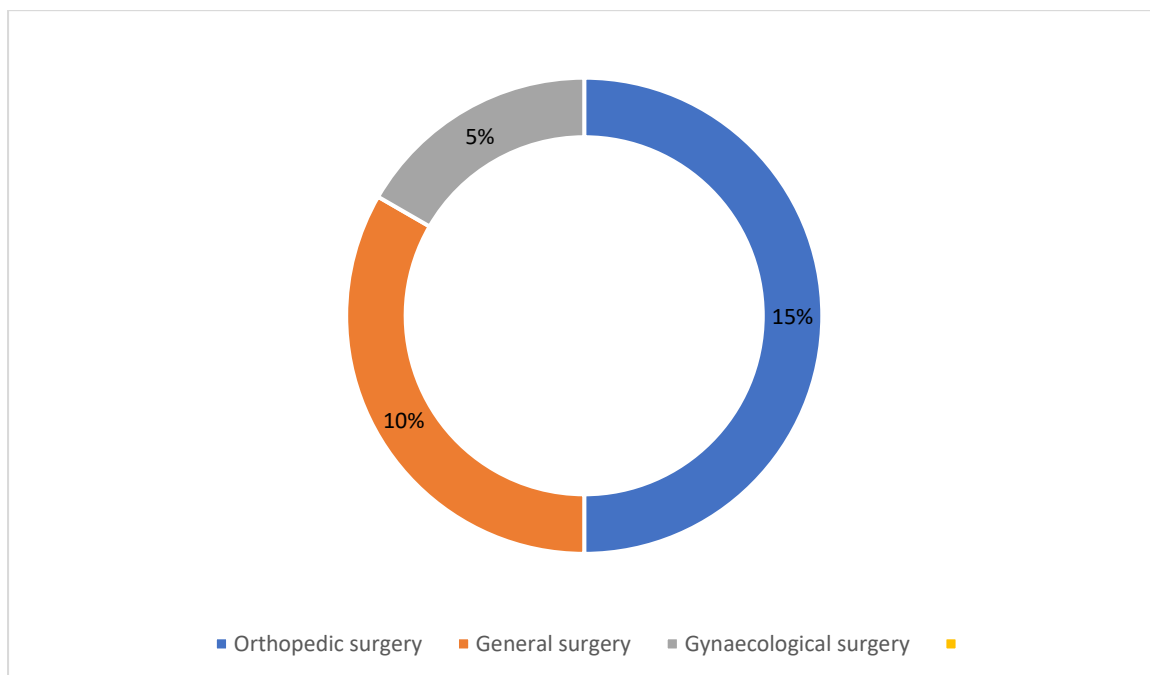


Association between Pre-operative Skin Preparation and SSIs

The chi-square test revealed no statistically significant association between the type of pre-operative skin preparation and the occurrence of SSIs ($p = 0.95$). After adjusting for potential confounding factors including age, comorbidities, and surgical specialty in multivariable logistic regression analysis, the odds ratio for developing SSIs with antiseptic solutions compared to antibiotic prophylaxis was 1.05 (95% CI: 0.70-1.58, $p = 0.81$).

Subgroup analysis by surgical specialty demonstrated varying rates of SSIs across different specialties, with orthopedic surgery showing the highest incidence (15%) followed by general surgery (10%) and gynecological surgery (5%). However, there was no significant interaction between the type of pre-operative skin preparation and surgical specialty concerning the risk of SSIs ($p = 0.72$).

Figure 2: Incidence of SSIs across different specialties



Discussion:

In this study, we investigated the impact of pre-operative skin preparation methods, namely antiseptic solutions versus antibiotic prophylaxis, on the incidence of surgical site infections (SSIs) among 500 patients undergoing various surgical procedures. Our findings did not reveal a significant difference in the occurrence of SSIs between patients who received antiseptic solutions and those who received antibiotic prophylaxis. The baseline characteristics of our study population reflected typical demographics observed in surgical settings, with a mean age of 55 years and a slight male predominance. General surgery, orthopedic surgery, and gynecological surgery were the most common specialties represented, which is consistent with the distribution seen in many healthcare facilities.

The overall incidence of SSIs within 30 days following surgery was 10%, with no discernible disparity between the two groups based on pre-operative skin preparation methods. This

observation challenges the conventional belief that antibiotic prophylaxis may confer superior protection against SSIs compared to antiseptic solutions. Despite the differences in their mechanisms of action, both approaches appeared to yield comparable outcomes in terms of infection prevention.

Our statistical analyses further supported these findings. The chi-square test indicated no significant association between the type of pre-operative skin preparation and the occurrence of SSIs. Moreover, after adjusting for potential confounding factors such as age, comorbidities, and surgical specialty, the odds ratio for developing SSIs with antiseptic solutions versus antibiotic prophylaxis was not statistically significant.

Subgroup analysis by surgical specialty revealed varying rates of SSIs across different specialties, with orthopedic surgery exhibiting the highest incidence, followed by general surgery and gynecological surgery. However, the type of pre-operative skin preparation did not significantly influence the risk of SSIs within each specialty subgroup. This suggests that the effectiveness of pre-operative skin preparation methods may not be contingent upon the surgical specialty.

Similar to our study, previous research has reported incidence rates of SSIs ranging from 5% to 15% among patients undergoing various surgical procedures. This consistency underscores the persistent challenge posed by SSIs across different healthcare settings and patient populations.[6] Several previous studies have also failed to demonstrate a significant difference in SSIs between patients receiving antiseptic solutions and those receiving antibiotic prophylaxis for pre-operative skin preparation.[7] These studies, like ours, have often utilized diverse methodologies including randomized controlled trials (RCTs), cohort studies, and retrospective analyses.

Subgroup analyses by surgical specialty have yielded heterogeneous results across different studies. While some studies have reported varying rates of SSIs among different surgical specialties, others have found no significant interaction between the type of pre-operative skin preparation and surgical specialty with SSIs.[8] This variability underscores the complex interplay of patient factors, surgical techniques, and environmental variables in determining infection risk. Like our study, previous research has recognized the importance of adjusting for potential confounding factors such as age, comorbidities, and surgical specialty in analyzing the association between pre-operative skin preparation methods and SSIs.[9] This methodological rigor enhances the validity and generalizability of study findings.[10]

Despite similarities in results, previous studies, like ours, have acknowledged certain limitations including potential biases, variations in clinical practices, and the need for longer follow-up periods to capture delayed-onset SSIs.[11] Future research endeavors should address these limitations through well-designed prospective studies with larger sample sizes, standardized protocols, and extended follow-up periods.[12] Additionally, variations in the application technique and duration of pre-operative skin preparation methods across different surgical settings could have influenced the outcomes. Furthermore, the relatively short follow-up period of 30 days may not capture all instances of SSIs, particularly those occurring beyond this timeframe.

Conclusion:

In conclusion, our study provides valuable insights into the comparative effectiveness of antiseptic solutions versus antibiotic prophylaxis for pre-operative skin preparation in reducing the incidence of SSIs. While both methods demonstrated similar efficacy in our analysis, future research endeavors should explore additional factors influencing SSIs and evaluate the long-term implications of different pre-operative skin preparation strategies on patient outcomes. Such endeavors are essential for optimizing surgical care practices and enhancing patient safety across diverse clinical settings.

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