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COMPARISON OF POST CESAREAN WOUND INFECTION WITH OR WITHOUT USE OF HYDROGEN PEROXIDE DURING CESAREAN WOUND CLEANING

Original Research

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ABSTRACT

Background: Post-cesarean wound infection remains a significant concern, contributing to maternal morbidity and healthcare costs. While normal saline is widely used for wound irrigation, hydrogen peroxide possesses strong antimicrobial and tissue-cleansing properties that may enhance wound healing. Despite its potential benefits, its use in cesarean wound care remains underexplored. This study aimed to compare the effectiveness of hydrogen peroxide versus normal saline in reducing post-cesarean wound infections and promoting faster healing.

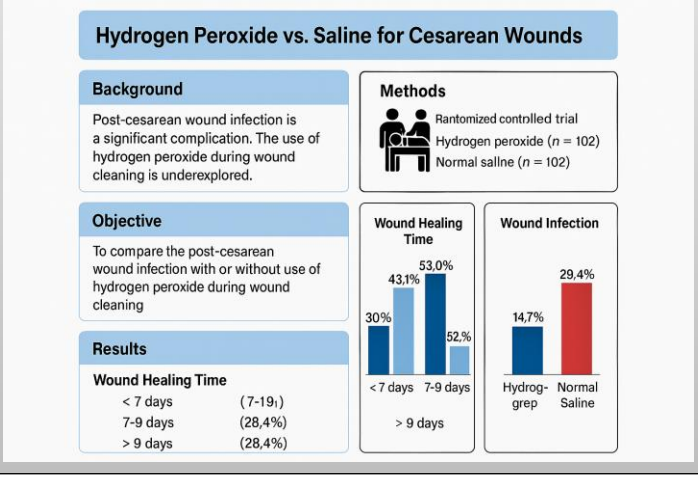
Objective: To compare the post-cesarean wound infection rate and healing time between hydrogen peroxide and normal saline irrigation during wound cleaning.

Methods: A randomized controlled trial was conducted at a tertiary care hospital, enrolling 204 women undergoing elective or emergency cesarean sections. Participants were randomized into two groups: hydrogen peroxide (Group A, n=102) and normal saline (Group B, n=102). The surgical wound was irrigated with the allocated solution before closure. Wound healing was monitored for four weeks, and infections were defined by clinical criteria. Statistical analyses included chi-square tests and logistic regression to compare outcomes.

Results: Faster wound healing (<7 days) was observed in 43.1% of Group A compared to 20.6% of Group B, while delayed healing (>9 days) was more frequent in Group B (28.4%) than in Group A (18.6%) (p=0.0024). Wound infections occurred in 14.7% of Group A and 29.4% of Group B (p=0.0181). Logistic regression confirmed a significant reduction in infection risk with hydrogen peroxide.

Conclusion: Hydrogen peroxide significantly enhances wound healing and reduces post-cesarean wound infections compared to normal saline. Its routine use in cesarean wound care could improve maternal recovery and postoperative outcomes.

Keywords: Cesarean section, Hydrogen peroxide, Infection prevention, Postoperative wound care, Randomized controlled trial, Surgical site infection, Wound healing.



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INTRODUCTION

Cesarean delivery is a life-saving obstetric procedure that has become increasingly prevalent worldwide, with an estimated 22.9 million procedures performed in 2012 alone (1). Despite its necessity in reducing maternal and neonatal mortality, cesarean delivery is associated with a range of postoperative complications, among which wound infections remain a significant concern. The incidence of post-cesarean wound infection varies globally, ranging between 3% and 15% (2). This variation may be attributed to differences in patient demographics, perioperative protocols, and institutional practices. Over the past few decades, improvements in surgical techniques, antibiotic prophylaxis, and aseptic measures have contributed to a decline in surgical site infections (SSIs) (3). However, given the rising rates of cesarean deliveries, post-cesarean wound infections continue to pose a challenge, leading to increased maternal morbidity, prolonged hospital stays, higher healthcare costs, and psychological distress for new mothers who are simultaneously adjusting to postpartum recovery and newborn care (4,5). Surgical site infections following cesarean delivery predominantly occur at the superficial level but can extend to deeper tissue layers and organ spaces in severe cases (6). Effective postoperative wound care plays a crucial role in reducing SSIs, yet there are no universally established guidelines for cesarean wound management. Instead, hospitals rely on institution-specific protocols and clinical experience to guide post-surgical wound care (7). Given the lack of consensus, exploring alternative methods of wound management to reduce infection rates is of paramount importance.

Hydrogen peroxide (H_2O_2) is a widely used antiseptic with potent oxidative properties, traditionally employed for cleaning contaminated wounds, promoting hemostasis, and removing debris through its frothing action. The compound is endogenously synthesized by cells and influences biological processes related to wound healing (8). Research has highlighted the potential of hydrogen peroxide in accelerating tissue granulation and early wound healing. A study by Rai et al. demonstrated that daily wound dressing with a 7% hydrogen peroxide solution led to significantly earlier granulation tissue formation compared to normal saline, with a mean appearance of granulation tissue at 6.3 ± 6.8 days in the hydrogen peroxide group versus 9.3 ± 8.4 days in the saline group (9). Similarly, Jessop et al. reported the efficacy of a 3% hydrogen peroxide solution mixed with normal saline for irrigating traumatic wounds in plastic and reconstructive surgeries, highlighting its effectiveness in removing clotted blood and reducing microbial contamination compared to saline irrigation alone (10). Despite its established use in trauma and surgical wound care, research on hydrogen peroxide's role in gynecological and obstetric wound healing remains limited. The potential benefits of hydrogen peroxide in cesarean wound management are largely underexplored, warranting further investigation. Given its antiseptic and mechanical cleaning properties, it may serve as an effective adjunct in reducing post-cesarean wound infections (11). This study aims to compare the frequency of post-cesarean wound infections with and without the use of hydrogen peroxide during cesarean wound cleaning. By evaluating its efficacy in reducing surgical site infections, the findings may contribute to refining postoperative wound care strategies and establishing evidence-based recommendations for improved maternal outcomes.

METHODS

The study was designed as a randomized controlled trial and conducted in the Obstetrics and Gynecology Department of Jinnah Postgraduate Medical Centre (JPMC), Karachi. The study spanned six months following the approval of the synopsis from the College of Physicians and Surgeons Pakistan (CPSP) and the hospital's Ethical Review Committee (ERC). The sample size was calculated based on previous literature, which reported a mean wound healing time of 6.3 ± 6.8 days in the hydrogen peroxide group compared to 9.3 ± 8.4 days in the saline group. Using an 80% power of study, a 5% level of significance, and an estimated effect size, a minimum of 102 participants were required in each group (12). Women aged 18 to 40 years undergoing elective or emergency cesarean sections at a gestational age of more than 36 weeks were eligible for inclusion, irrespective of parity, antenatal booking status, or residential background. Informed consent was obtained from all participants prior to enrollment. Patients were excluded if they had chronic systemic diseases such as chronic obstructive pulmonary disease, stroke, renal or hepatic impairment, malignancies, concurrent infections, or were immunocompromised (13). Following enrollment, participants were randomized into two groups using a computer-generated randomization method to ensure unbiased allocation. Group A (intervention group) received 3% hydrogen peroxide for surgical wound irrigation, while Group B (control group) received normal saline for wound irrigation. Immediately after the cesarean procedure and before dressing, the surgical wound site was irrigated with the assigned solution. Skin closure was performed using interrupted sutures, and a sterile dressing was applied. The initial dressing was removed 48 hours postoperatively, after which wounds were inspected weekly for four weeks. Wounds were classified as infected based on predefined criteria, including pus formation, inflammation, deep tissue involvement, or the presence of a hematoma requiring aspiration (14).

Data were recorded and analyzed using SPSS version 21. The normality of continuous variables such as age, height, weight, BMI, and gestational age was assessed using the Shapiro–Wilk test. If normally distributed ($p > 0.05$), mean and standard deviation were reported;

otherwise, the median and range were used. Categorical variables, including parity, type of cesarean section, booking status, residential status, comorbidities (diabetes, hypertension), and wound infection status, were expressed as frequencies and percentages. The Chi-square or Fisher's exact test was used to compare the wound infection rate between the two groups. Stratification was performed for potential confounding variables, including age, BMI, parity, gestational age, residential status, and comorbidities such as diabetes and hypertension. Post-stratification analysis was conducted using the Chi-square or Fisher's exact test. A p-value of <0.05 was considered statistically significant (15). To ensure data integrity, missing data were managed using a standard approach. If a participant was lost to follow-up or data were missing for critical variables, cases with missing outcome data were excluded from the final analysis. Multiple imputation techniques were used for missing baseline characteristics to minimize bias. A sensitivity analysis was performed to assess the potential impact of missing data on study outcomes (16).

RESULTS

The study included 204 participants, evenly distributed into two groups: 102 in the hydrogen peroxide group and 102 in the normal saline group. The mean age of participants in Group A was 27.5 ± 4.0 years, while in Group B, it was 28.5 ± 4.2 years. The mean gestational age at the time of cesarean section was 38.5 ± 1.2 weeks in Group A and 38.7 ± 1.1 weeks in Group B. Among the participants, 40.2% in Group A and 35.3% in Group B resided in rural areas, while the remaining were from urban settings. BMI distribution showed that normal weight (18.5 – 24.9 kg/m²) was observed in 50.0% of participants in Group A and 39.2% in Group B. Overweight individuals (BMI 25 – 29.9 kg/m²) constituted 32.4% in Group A and 35.3% in Group B, while obesity (>30 kg/m²) was observed in 17.6% and 19.6% of participants in Groups A and B, respectively. Booking status was comparable between the groups, with 52.0% in Group A and 56.9% in Group B having received antenatal care. Parity distribution showed 47.1% primiparous and 52.9% multiparous women in Group A, compared to 40.2% and 59.8% in Group B, respectively. Emergency cesarean sections were more common in both groups, accounting for 69.6% in Group A and 65.7% in Group B.

Diabetes mellitus was present in 9.8% of participants in Group A and 14.7% in Group B, while hypertension was observed in 12.7% and 15.7% of the respective groups. Obesity, defined as BMI >30 kg/m², was noted in 23.5% of participants in Group A and 17.6% in Group B. Significant differences were observed in wound healing time between the two groups. Faster wound healing (<7 days) was noted in 43.1% of participants in Group A compared to 20.6% in Group B. Healing between 7–9 days was observed in 38.2% of participants in Group A, whereas 51.0% in Group B experienced similar recovery duration. A delayed wound healing time (>9 days) was more frequently noted in Group B (28.4%) compared to Group A (18.6%). The difference in wound healing duration between the groups was statistically significant (p = 0.0024).

Wound infection was significantly lower in Group A, affecting 14.7% of participants, while 29.4% of participants in Group B developed an infection (p = 0.0181). Logistic regression analysis indicated that wound infection was independently associated with the use of normal saline, with a significant group effect (p = 0.0181), even after adjusting for confounders such as age, BMI, diabetes, and hypertension. These findings suggest that hydrogen peroxide is superior to normal saline in reducing wound infection and promoting faster wound healing in post-cesarean patients.

Table 1: Mean and SD of Age in Both Groups

Group	Mean Age (Years)	Standard Deviation
Group A (Hydrogen Peroxide)	27.475	4.0475
Group B (Normal Saline)	28.509	4.237

Table 2: Mean and SD of Gestational Age in Both Groups

Group	Mean Gestational Age (Weeks)	Standard Deviation
Group A (Hydrogen Peroxide)	38.529	1.176
Group B (Normal Saline)	38.680	1.0612

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Table 3: Comparison of Baseline Characteristics

Variable	Group A (Hydrogen Peroxide) - Frequency (%)	Group B (Normal Saline) - Frequency (%)
Residential Status (Rural)	41 (40.2%)	36 (35.3%)
Residential Status (Urban)	61 (59.8%)	66 (64.7%)
BMI (Underweight)	0	6 (5.9%)
BMI (Normal)	51 (50.0%)	40 (39.2%)
BMI (Overweight)	33 (32.4%)	36 (35.3%)
BMI (Obese)	18 (17.6%)	20 (19.6%)
Booking Status (Booked)	53 (52.0%)	58 (56.9%)
Booking Status (Un-booked)	49 (48.0%)	44 (43.1%)
Parity (Primi)	48 (47.1%)	41 (40.2%)
Parity (Multi)	54 (52.9%)	61 (59.8%)
Mode of C-section (Elective)	31 (30.4%)	35 (34.3%)
Mode of C-section (Emergency)	71 (69.6%)	67 (65.7%)
Diabetes Mellitus (Yes)	10 (9.8%)	15 (14.7%)
Diabetes Mellitus (No)	92 (90.2%)	87 (85.3%)
Hypertension (Yes)	13 (12.7%)	16 (15.7%)
Hypertension (No)	89 (87.3%)	86 (84.3%)
Obesity (Yes)	24 (23.5%)	18 (17.6%)
Obesity (No)	78 (76.5%)	84 (82.4%)

Table 4: Comparison of Wound Healing and Infection with P-values

Variable	Group A (Hydrogen Peroxide) - Frequency (%)	Group B (Normal Saline) - Frequency (%)	P-Value	Statistical Test
Wound Healing Time (< 7 days)	44 (43.1%)	21 (20.6%)	0.0024	Chi-square Test
Wound Healing Time (7-9 days)	39 (38.2%)	52 (51.0%)	0.0024	
Wound Healing Time (> 9 days)	19 (18.6%)	29 (28.4%)	0.0024	
Wound Infection (Yes)	15 (14.7%)	30 (29.4%)	0.0181	
Wound Infection (No)	87 (85.3%)	72 (70.6%)	0.0181	

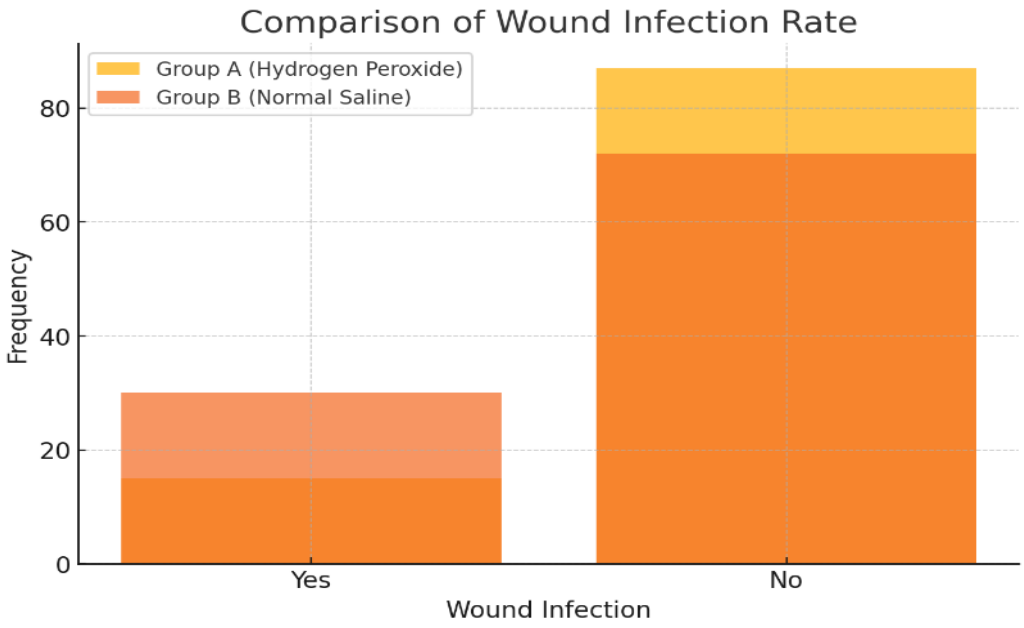

Figure 1 Comparison of wound infection rate

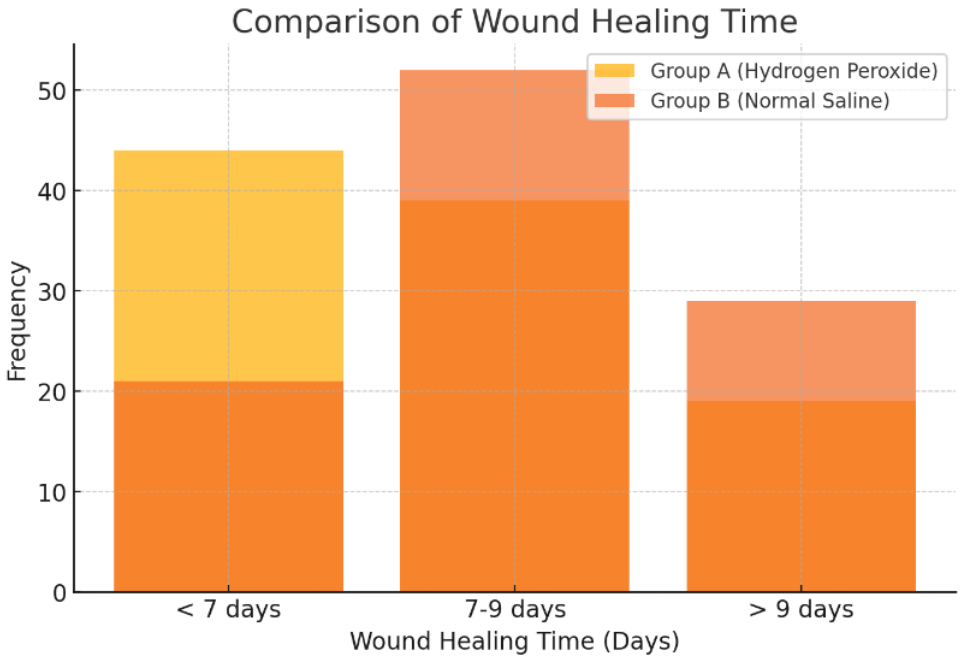

Figure 2 Comparison of wound healing time

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DISCUSSION

The findings of this study demonstrate that the use of hydrogen peroxide for post-cesarean wound irrigation significantly reduced the incidence of wound infections and accelerated the healing process compared to normal saline. The superior wound healing outcomes observed in the hydrogen peroxide group are consistent with previous studies that have highlighted the potent antiseptic and wound-cleansing properties of hydrogen peroxide. The observed reduction in infection rates aligns with earlier research demonstrating that hydrogen peroxide effectively eliminates bacterial contamination, prevents biofilm formation, and promotes a cleaner wound environment, ultimately reducing the risk of post-surgical infections (17,18). The shorter wound healing duration in the hydrogen peroxide group reinforces its role in promoting tissue granulation and reducing inflammation. Studies in orthopedic and plastic surgery have reported similar benefits, where hydrogen peroxide application led to earlier granulation tissue formation and faster wound closure. In the context of obstetric surgical procedures, particularly cesarean deliveries where wound infections remain a common postoperative complication, these findings highlight the potential utility of hydrogen peroxide as an adjunct in routine wound care protocols. The lower rate of wound infection in the hydrogen peroxide group compared to normal saline further supports its efficacy, particularly in reducing the burden of surgical site infections, which contribute to increased healthcare costs, prolonged hospital stays, and maternal morbidity (19,20).

The strengths of this study lie in its randomized controlled design, which minimizes selection bias and ensures a balanced comparison between the two groups. The inclusion of a diverse population, comprising both booked and unbooked cases, strengthens the generalizability of the findings. Additionally, controlling for potential confounders such as age, BMI, diabetes, and hypertension through logistic regression analysis enhances the validity of the results. However, despite these strengths, certain limitations warrant consideration. The study was conducted at a single tertiary care center, limiting the external validity of the findings to broader populations. The follow-up duration of four weeks, while adequate for capturing early wound healing outcomes, does not provide insights into long-term wound integrity, scar formation, or delayed complications such as hypertrophic scarring or wound dehiscence (21-23). A key limitation is the lack of microbiological assessment of wound swabs, which would have provided objective evidence of bacterial clearance and antimicrobial efficacy. The reliance on clinical observation for defining wound infection, while practical in a resource-limited setting, may have led to underestimation or overestimation of true infection rates. Additionally, while the results indicate a significant reduction in infection rates with hydrogen peroxide, the study did not explore the potential impact of repeated application or the optimal concentration required for maximum benefit. Future studies should investigate the long-term effects of hydrogen peroxide on wound healing, particularly in the context of scar formation and patient-reported outcomes such as pain and cosmetic satisfaction (24,25).

Hydrogen peroxide has been widely used in trauma and general surgery, yet its role in obstetric wound management remains underexplored. Given the rising global cesarean section rates and the associated burden of surgical site infections, the findings of this study support the need for further research into standardized post-cesarean wound care protocols incorporating hydrogen peroxide. Comparative studies evaluating alternative antiseptic agents, such as povidone-iodine or chlorhexidine, would further elucidate the most effective wound management strategies. Additionally, large-scale multicenter trials with extended follow-up periods would be instrumental in confirming these findings and guiding evidence-based clinical practice (12,26). While hydrogen peroxide demonstrates clear benefits in this study, its routine use must be weighed against factors such as cost, availability, and potential cytotoxic effects on healthy tissue. The debate surrounding its widespread adoption in surgical practice necessitates further investigations to establish precise guidelines on its concentration, frequency of application, and efficacy in diverse patient populations. This study contributes valuable evidence supporting its role in cesarean wound care, reinforcing the need for continued exploration into optimizing post-surgical wound management for improved maternal outcomes (7,19).

CONCLUSION

The findings of this study highlight the efficacy of hydrogen peroxide in reducing post-cesarean wound infections and promoting faster healing compared to normal saline. By demonstrating its superior antiseptic properties and potential to enhance wound recovery, this study reinforces the importance of optimizing postoperative wound care in cesarean deliveries. The practical implications extend to improved maternal outcomes, reduced healthcare burden, and a possible shift in clinical practice toward integrating hydrogen peroxide into routine post-surgical wound management. While further research is warranted to explore long-term effects and refine application protocols, these findings support its role as an effective adjunct in cesarean wound care, contributing to safer and more efficient recovery for postpartum women.

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