The Effectiveness of Preoperative Bath with Chlorhexidine Gluconate for Prevention of Surgical Site Infection

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Running title:

Chlorhexidine Gluconate Bathing in SSI

Abstract

Background and aim: Surgical site infection (SSI) is a post-surgical wound infection, common after cesarean section with reported rates of 3-15%. Preoperative Chlorhexidine bath is a well accepted measure to prevent SSIs. However, the effectiveness of this approach remains uncertain. Assessing the effectiveness of a 4% chlorhexidine gluconate (CHG) bath before elective cesarean sections in reducing SSI.

Methods: A comparative and prospective trial was conducted on 180 pregnant women at term (37+0-41+6 wks. gestation), aged 18-45. All participants allocated into two groups: the interventional group (n=90), received preoperative baths with 4% CHG, and the control group (n=90), received preoperative usual baths. Data were coded and analyzed using SPSS v. 26.0 (IBM©, Armonk, NY, USA).

Results: All patients completed the study, and maternal sociodemographic characteristics were similar in both groups. SSI occurred in 5.6% of the chlorhexidine group and 8.9% of the control group, with no significant differences in outcomes.

Conclusion: Preoperative bathing with 4% CHG prior to elective cesarean section did not reduce the rate of SSIs.

Keywords: Chlorhexidine Gluconate; Elective Cesarean Sections; Surgical Site Infection; Antibiotics.

Synopsis: Using of 4% CHG bathing wan not effective in reducing the rate of SSIs prior to elective cesarean section.

Introduction

Cesarean sections are frequently conducted surgeries worldwide, with a growing number of planned surgeries. While this procedure can be life-saving for the mother and fetus, it also comes with potential risks, such as postoperative surgical site infections (SSIs) [1].

SSI is an infection that develops at a surgical incision site within 30-90 days after surgery, affecting both open and closed wounds. It leads to longer hospital stays, increased costs, and higher rates of patient morbidity and mortality. This can be detrimental, in terms of financial costs and the quality of healthcare services in hospitals [2].

SSI following cesarean section occurs at a rate of 3-15% and can be varied by factors such as the use of antibiotics, the surgeon's expertise, surgical methods, and the patient's preoperative, intraoperative, and postoperative conditions [3].

The risk of infection may rise if bacteria are present at the surgical site. Using chlorhexidine gluconate (CHG) reduces bacterial colonies by 9 times and also enhances the skin's ability to resist antiseptics for a longer time [4]. CHG is effective against fungi, Gram-positive, and Gram-negative bacteria. Its efficacy is concentration-dependent; it can inhibit bacterial growth by interfering with the cell wall at low concentrations, and cause cell death by precipitating cytoplasmic components at high concentrations [5].

Preoperative CHG bathing is a well-accepted method in reducing skin microflora, but it is unclear if it results in a lower incidence of surgical site infections [6].

This work aimed to evaluate the effectiveness of preoperative bath with 4% CHG before elective cesarean section in reducing the incidence of SSIs.

Material and Methods

This comparative and prospective cohort trial was conducted on 180 patients who underwent elective cesarean section delivery at Menoufia University Hospital, Shebeen El-Kom Teaching Hospital, and Mit-Ghamr Central Hospital, based on obstetric criteria, from June 2023 to June 2024.

Ethical considerations:

The ethical committee Faculty of Medicine, Menoufia University, gave its approval to this study. Informed consent was obtained from all participants, who could withdraw from the study at any time. The confidentiality and anonymity of the participants were assured through coding.

Inclusion criteria: All pregnant women at term (37+0-41+6 wks. gestation), aged 18-45, who were scheduled for elective cesarean sections, were required to be willing participants and cooperative. The procedures involved Pfannenstiel incisions and intact skin.

Exclusion criteria: Patients who required emergency or unscheduled cesarean sections, and any incisions other than Pfannenstiel. Procedures performed on suspected or probable infection elsewhere. Previous local infection was adjacent to the surgical site. Patients with severe anemia, diabetes mellitus, lupus, immunosuppression, corticosteroid treatment, BMI > 35, or a history of chlorhexidine allergy.

Manner of randomness:

The participants were divided into two groups by a computer-generated random-number sequence. The software generated 90 numbers out of a total of 180, which were given to the intervention group. The remaining 90 numbers were automatically assigned into the control group. These numbers were written on white cardboard and enclosed in a brown envelope. Patients who fulfilled the criteria and gave informed consent were assigned study sequential numbers and given opaque sealed envelopes with either "the chlorhexidine group" or "the control group" written on them.

Every patient underwent to the following: written informed consent, thorough history taking, and thorough clinical examination including General examination and full obstetric examination, followed by baseline preoperative investigations and obstetric ultrasound examination.

Application of Antiseptic Agent and Antibiotics:

Group I (Intervention group):

Before surgery, patients in the intervention group were instructed to take a preoperative bath with a solution containing (4%) chlorhexidine gluconate (CHG) the night before and the morning of their surgery. An instruction card was provided by the ward nurse to guide them through the process. During their shower, patients used normal shampoo to wash their hair as usual and then rinsed their hair and body thoroughly to remove any residue. To apply the CHG solution, patients turned off the water and applied 50 ml of undiluted liquid solution (CHG4soap®; 100 ml solution, albourak for industrial & commercial investment, Egypt) to their entire body from the jaw down, using a clean washcloth or their hands. They washed thoroughly for 5 minutes, paying special attention to the surgical area without scrubbing too hard. After the bathing, patients dried themselves with a freshly laundered towel and put on clean clothes. They were advised not to use any lotions or perfumes and to avoid touching the operation site.

Prophylactic antibiotics (cefaxone or clindamycin /gentamicin if allergic to penicillin) were administered one hour before surgery in accordance with each center's policy.

Group II (Control group):

Before surgery, patients in the control group were instructed to take their usual preoperative baths at night and in the morning, without using any preoperative chlorhexidine gluconate solution. The ward nurse provided clear instructions, and patients were asked to dry themselves with freshly laundered towels and wear clean clothes. They were also advised not to use any lotions or perfumes after their bath, and to avoid touching the operation site.

Prophylactic antibiotics (cefaxone or clindamycin /gentamicin if allergic to penicillin) were administered one hour before surgery in accordance with each center's policy.

Procedure for Cesarean Section:

During the cesarean section, all standard protocols were followed, including administering preoperative antibiotics and performing an immediate abdominal scrub with 10% povidone-iodine. Sterile drapes were applied after administration of spinal anesthesia. The procedures were performed by senior registrars and/or consultants who were unaware of the patient's assignment to either the intervention or control group. A Pfannenstiel abdominal incision was used for the CS, and a transverse lower segment uterine incision was used to deliver the fetus. The uterus was repaired in two layers using Vicryl 1, and the anterior abdominal wall was closed in layers to the SC. tissue reapproximation using Vicryl 1. Finally, the skin was closed subcuticularly using Prolene 2–0 as per the attending surgeons' preference.

Post-operative follow-up:

According to the standard of care after cesarean section, both groups were carefully monitored for any signs of infection. The patients were monitored daily during their postpartum rounds until their hospital discharge. Additionally, they were contacted over the phone within 7 days of their delivery to determine if they were experiencing any symptoms of SSI. On the 7th day after their delivery, the surgical wound was inspected at the clinic to identify any signs of infection in the operating area. SSI diagnosis was made by trained assistants who were unaware of the group allocation. Follow-up was done by conducting a comprehensive history check, physical examination, and urine analysis. For patients who were diagnosed with SSI, wound swabs were collected for microscopy, culture, and sensitivity.

Outcome measures:

The primary outcome was the postoperative wound infection (SSI) rate within 7 days after cesarean section. Postoperative wound infection was defined as redness (erythema)

around the incision site, tenderness, and purulent (pus-like) incisional drainage, with or without fever requiring antibiotic treatment. Postoperative fever was defined as having a temperature ≥ 38°C, excluding the 1st operative day and any other causes of fever including mastitis, urinary tract infection, and tonsillitis.

Secondary outcomes included wound complications like skin separation, hematoma, seroma, cellulitis, length of hospital stay, re-admission, and adverse effects of chlorhexidine.

Sample size estimation:

As Regard Prayugo et al. [7], the use of 4% CHG in a preoperative bathing intervention group resulted in no instances of surgical site infections (SSI). However, 8.3% (5 participants) in the control group experienced SSI. To conduct a study with 80% power and 95% confidence interval, a minimum of 180 participants equally divided into two groups with a total of 90 participants per group after accounting for a 5% attrition rate.

Statistical analysis

Data were coded and analyzed using SPSS v. 26.0 (IBM©, Armonk, NY, USA). Quantitative variables were presented as mean ± SD, while qualitative variables were given as counts and percentages. Chi-square test identified significant differences in categorical data, and Student's t-test compared means of independent samples. A p-value > 0.05 indicated non-significance, whereas a p-value of 0.05 or less was considered significant.

Results

Regarding sociodemographic data, there was no statistically significant difference between the two groups in terms of age, residency, weight, height, and body mass index (p> 0.06). Table (1)

As regards obstetric history, there were no significant differences between the two groups in terms of gravidity, parity, gestational age at delivery, or type and indication of cesarean section (p> 0.25). Table (2)

According to past medical history, there was no statistically significant difference between the studied groups regarding to mitral valve prolapse (MVP), anemia, gestational hypertension (HTN), bronchial asthma, peptic ulcer (gastritis), gastroesophageal reflux disease (GERD), epilepsy, gross varicose veins, and arthritis (p> 0.09). Table (3)

According to past surgical history, there was no statistically significant difference between the two groups regarding prior cesarean section and other past surgical procedures (p> 0.10). Table (4)

According to pre-operative history, there was no statistically significant difference between the two studied groups regarding pre-incisional antibiotics and previous scar for any lesion (p> 0.12). Table (5)

According to operative data, there was no statistically significant difference between the two studied groups regarding surgical time, estimated blood loss, and pre- and post-operative hemoglobin level (p> 0.35). Table (6)

According to outcome measures, there were 5 (5.6%) patients in the intervention group, and 8 (8.9%) patients in the control group had SSIs by 1 week post-delivery (P=0.39). As regards other wound-related complications, skin separation was noticed of (4.4%) patients in the control group vs. (2.2%) in the chlorhexidine group. Wound hematoma was also observed (4.4%) in the chlorhexidine group and (2.2%) in the control group. Wound seroma incidence was 3.3% in the chlorhexidine group and 4.4% in the control group. Purulent cellulitis incidence was reported (2.2% in the chlorhexidine group vs. 1.1% in control), with no significant differences (p> 0.23). The length of hospital stay was comparable between both groups. The mean (SD) length of hospital stay was 1.7 (0.4) and 1.8 (0.6) days in the groups of the intervention and the control, respectively (P=0.37). Table (7)

Discussion

In the current study, there was no significant differences were found between the two groups regarding maternal demographic characteristics.

This is in agreement with Stone et al. [8], who aimed to determine whether the application of chlorhexidine gluconate impregnated cloths the night before and the morning of scheduled cesarean delivery decreases the risk of surgical site infections by 6 weeks postdelivery compared to placebo cloths. 1,356 patients were enrolled: 682 were assigned to chlorhexidine group and 674 to placebo group. They revealed that there was no significant difference in age and BMI between the two studied groups.

Also, our findings are in line with Chelsea Ann DeBolt et al. [9], who evaluated the effectiveness of (2%) chlorhexidine gluconate abdominal cloth and (4%) chlorhexidine gluconate vaginal scrub before cesarean delivery to reduce SSIs by 6 weeks post-delivery. The study included 319 patients undergoing cesarean delivery after labor, with 160 assigned to the chlorhexidine gluconate group and 159 to the standard care group. They demonstrated no significant differences in maternal demographics between the two groups.

As well, our findings are in line with a Cochrane review conducted by Webster and Osborne [10], which examined seven randomized controlled trials comparing preoperative shower or bath with any antiseptics to reduce SSIs. All trials examined chlorhexidine, but there was no significant difference between groups in terms of participants' sociodemographic characteristics.

Similarly, our study is consistent with earlier randomized controlled trials (RCTs) Wihlborg et al. [11]; Hayek and Emerson, [12]; & Byrne et al. [13] evaluated whole-body preoperative shower with chlorhexidine versus placebo or no bath for prevention of SSI. Overall, 7, 278 patients who underwent clean-contaminated /contaminated surgeries were followed up until hospital discharge or by 6 weeks after discharge. They found that baseline patient characteristics including age, gender, and type of surgery were comparable between the studied groups.

In the current study, there was no significant differences were found between the two studied groups in terms of maternal comorbidities and previous surgeries, including cesarean sections.

This is in agreement with Stone et al. [8], who reported no statistically significant difference between the two groups in the terms of repeated cesarean sections and maternal comorbidities such as chronic hypertension, preexisting diabetes, gestational hypertension, gestational diabetes, preeclampsia, and cholestasis. With one notable exception, the prevalence of asthma was higher in the group treated with chlorhexidine gluconate (6.9% vs. 4.2%, p=0.03).

In the current study, there was no significant differences were found between the two studied groups in terms of pre-operative history, including pre-incisional antibiotics and previous scars for any lesions. This is in agreement with Chelsea Ann DeBolt et al. [9] & Stone et al. [8], who noted that there was no significant difference between the two studied groups regards their use of prophylactic antibiotics. In contrast, our study disagreed with earlier trials Wihlborg et al. [11] & Byrne et al. [13] who showed that the reported rate of antimicrobial prophylaxis use was low (1% to 15%). However, they mentioned that the frequency of prophylactic antibiotic was similar both in intervention and comparator groups, without providing data.

In the current study, there was no significant differences between the two groups in terms of pre-and post-operative hemoglobin levels, and surgical characteristics. This is in agreement with Chelsea Ann DeBolt et al. [9] & Stone et al. [8], who noted that there was no statistically significant difference between

the two studied groups regarding length of operation and estimated blood loss during operation.

In the current study, there were 5 (5.6%) patients in the intervention group, and 8 (8.9%) patients in the control group developed SSIs within 1 week after delivery, with no significant difference between the two groups. (P=0.39). Minor cases of wound infection were treated by removing sutures and using topical antiseptics. Patients who required antibiotics were prescribed penicillin-based preparations, such as co-amoxiclav. Swabs were taken from the wounds to determine the appropriate antibiotic treatment.

This is in agreement with Chelsea Ann DeBolt et al. [9], who demonstrated that there was no statistically significant difference in SSI rate within 6 weeks post-delivery (6.6% in chlorhexidine vs. 5.3% standard of care, p=0.65). Also, our findings are in line with Stone et al. [8], who showed that there were 17 (2.6%) patients in the CHG group and 24 (3.7%) patients in the placebo group who received a diagnosis of surgical site infection at 6 weeks post-delivery, with no statistically significant difference between the studied groups (p=0.23).

To our knowledge, this is the only prospective comparative trial study the efficacy of a preoperative 4% chlorhexidine bath on reducing SSIs in women undergoing scheduled cesarean sections. In the per-protocol analyses, we couldn't find any differences between the groups. The low prevalence of SSI in both groups in this current study are due to the effectiveness of showering itself. Additionally, we also excluded a few confounding variables that raise the chance of SSIs including D.M, morbid obesity, immunosuppression, and emergency CS.

The results of this study align with findings in the general surgical literature. A meta-analysis Chlebicki et al. [14] revealed no conclusive advantage to preoperative whole-body chlorhexidine bath in terms of SSI prevention. Nevertheless, most studies lacked details regarding chlorhexidine application. Better-designed trials are needed to determine if preoperative whole-body chlorhexidine bath reduces SSI.

A Cochrane review Webster and Osborne [10], found that preoperative bathing is beneficial in lowering the incidence of SSI. Nonetheless, the use of chlorhexidine as a cleansing agent was not found to be more effective than plain soap or detergent. Additionally, chlorhexidine was not cost-effective. The review's limitation is that only 1 study was published in the last 20 years.

A systematic review Jakobsson et al. [15] examined the effects of antiseptic showers on SSI. Ten studies, involving a total of 7,351 participants, were reviewed. Eight of these studies suggested that the use of chlorhexidine reduced the presence of skin bacteria. However, a definitive conclusion regarding the ideal number of preoperative showers could not be drawn. It's crucial to understand that the level of skin bacteria does not necessarily correlate with the risk of SSIs. Most studies had limitations, with the number of showers being of secondary importance. Only 4 studies provided high-quality evidence.

A systematic review Kamel et al. [16] also examined 20 studies (n=9520) to evaluate the effectiveness of different preoperative antiseptics. The studies showed no conclusive evidence on the most effective antiseptic. However, the authors found preoperative showering can reduce bacterial levels, but its impact on SSIs was inconclusive.

Ultimately, researches indicate that preoperative bathing with antiseptics may not effectively prevent SSIs, and it is unclear which type of antiseptic wash is most effective. Nevertheless, this does not change the recommendation in the NICE NG25 guidelines to shower or bath with soap before surgery. More trials are needed to compare no bathing versus single/multiple baths and soap versus different antiseptics [17].

SSIs following CS vary worldwide (3-15%). Different denominators such as comorbidities, antibiotics, surgeon's grade, and surgical techniques contribute to this variation. After taking these factors into account, the variation becomes narrower (4.9-9.8%) as reported by Wloch et al. [18] & Martin et al. [19]

In contrast, our results disagreed with Prayugo et al. [7], who tested the effectiveness of preoperative antimicrobial showers using 4% chlorhexidine gluconate to prevent SSIs.

A total of 60 samples were included and then subdivided into the pre-operative bath intervention group with 4% CHG (n=30) and the control group (n=30) was not given any treatment. They found that no SSI was found in the intervention group (CHG 4%), while the incidence of SSI in the control group was 5 (8.3%). They found that using 4% CHG significantly reduced the incidence of SSIs. They attributed this to the 4% CHG's long-lasting bacteriostatic and bactericidal effects on the skin.

There are several possible reasons for this contradiction: These reasons include differences in sample size and inclusion criteria, the effectiveness of chlorhexidine gluconate in clean surgeries, and the lack of measurement of certain confounding factors such as length of bath, duration of surgery, prophylaxis, and type of wound care that could impact the validity of the results.

In the current study, the incidence of skin separation (<2cm in length) was 1.1% in the chlorhexidine group and 3.3% in the control group. Wound hematoma incidence was 1.1% in the chlorhexidine group vs. 2.2% in the control group. This was small and treated conservatively. Wound seroma was observed (3.3% in the chlorhexidine group vs. 4.4% in control). This was treated by needle aspiration, followed by compression dressing to prevent re-accumulation.

Purulent cellulitis was reported in 2.2% of patients in the chlorhexidine group and 1.1% in the control group. The treatment for this involved oral antibiotics (co-trimoxazole or clindamycin), incision and drainage, and wound dressing. The length of hospital stay in our study was comparable between both groups.

In the current study, the mean (SD) length of hospital stay was 1.7 (0.4) and 1.8 (0.6) days in groups of intervention and control respectively, with no significant differences (P=0.37).

There were no hospitalizations, skin rashes, or adverse events related to use of the chlorhexidine, in either group.

Similarly, our study is in agreement with Chelsea Ann DeBolt et al. [9] & Stone et al. [8], who demonstrated that secondary outcomes including the length of hospital stay and the rates of hospital re-admission for infection-related complications, and adverse skin reactions were similar in the two groups, and the rates of other wound complications were comparable among the two groups.

The current study had multiple strengths including a well-designed prospective comparative trial with a specified primary endpoint that had not been previously studied. It was conducted in three hospital settings for increased generalizability to all populations. Last, all patients completed follow-up with excellent adherence to the protocol, and data interpreting and telephone surveys were carried out by blinded researchers, thereby limiting bias.

Limitations: The current study was limited by several factors, such as an unexpectedly low incidence of SSIs after elective cesarean sections. The overall rate of SSIs was observed to be 8.9%, lower than the anticipated 15%, decreasing the study's power. The slight decrease in SSIs rates in the Chlorhexidine group compared to the control group is not clinically significant. The study may have been underpowered, as long as lower-than-expected infection rates were observed, indicating a need for a larger sample size.

Another limitation is that emergency cesarean sections were not included in our study due to a lack of informed consent discussions. Additionally, a one-week follow-up period was not enough time to identify any long-term problems. However, wound infections usually occur between 4 to 7 days after cesarean sections. Even though endometritis can be classified as an organ/space SSIs, our study was not designed to assess this complication.

Conclusion

Our research revealed that a pre-operative bath with (4%) Chlorhexidine gluconate prior to elective cesarean section did not reduce the incidence of SSIs.

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Conflict of Interest: Nil

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Table (1): Demographic data between the studied groups

		Interventional Group (n=90)	Control group (n=90)	P-value
Age (yr) Mean ± SD.		26.32 ± 5.11	27.12 ± 4.75	0.27
Residency	**Rural**	42 (46.67%)	33 (36.67%)	0.17
	Urban	48 (53.33%)	57 (63.33%)	
Weight (kg) Mean ± SD.		82.56 ± 6.32	83.53 ± 5.25	0.26
Height (m) Mean ± SD.		162.9 ± 4.69	162.38 ± 4.42	0.44
BMI (kg/m^2) Mean ± SD.		29.15 ± 1.8	29.64 ± 1.7	0.06

Table (2): Obstetric history between the studied groups

	Interventional Group (n=90)	Control group (n=90)	P-value
Gravidity Mean ± SD.	26 ± 1.37	2.2 ± 1.05	0.44
Parity Mean ± SD.	1.02 ± 1.3	1.15 ± 0.99	0.45
GA at delivery Mean ± SD.	37.65 ± 0.98	37.82 ± 1.03	0.44
Type of cesarean delivery			

Primary CS	37 (41.4%)	31 (34.4%)	0.30
Repeated CS	53 (58.8%)	59 (65.6%)	
Indication of cesarean section			
Previous CS	53 (58.8%)	59 (65.6%)	0.30
Malpresentations	8 (8.9%)	10 (11.1%)	0.62
Multiple gestation	3 (3.3%)	2 (2.2%)	0.65
Fetal macrosomia	4 (4.4%)	2 (2.2%)	0.60
Oligohydraminos	3 (3.3%)	2 (2.2%)	0.65
Precious gestation	5 (5.55%)	3 (3.33%)	0.46
Gestational HTN	6 (6.7%)	3 (3.3%)	0.30
Maternal request	4 (4.4%)	4 (4.4%)	1.0
Fail to initiate labor	3 (3.33%)	5 (5.55%)	0.46
Others	1 (1.1%)	0 (0%)	0.32

Table (3): Medical history between the studied groups

	Interventional Group (n=90)	**Control group (n=90)**	**P-value**
Past medical history			
Nil	72 (80%)	80 (88.88%)	0.09
MVP	2 (2.22%)	1 (1.11%)	0.56
Anemia	0 (0%)	2 (2.22%)	0.15
Gest. HTN	8 (8.88%)	3 (3.33%)	0.12
Asthma	3 (3.33%)	5 (5.55%)	0.46
Peptic ulcer	1 (1.11%)	0 (0%)	0.32
GERD	1 (1.11%)	0 (0%)	0.32
Epilepsy	1 (1.11%)	0 (0%)	0.32
Gross VV	1 (1.11%)	0 (0%)	0.32
Gouty arthritis	1 (1.11%)	0 (0%)	0.32

Table (4): Surgical history between the studied groups

	Interventional Group (n=90)	**Control group (n=90)**	**P-value**
Past surgical history			
Nil	36 (40%)	27 (30%)	0.1
Cesarean section	53 (58.8%)	59 (65.6%)	0.3
Ovariotomy	6 (6.7%)	1 (1.1%)	0.054
D&C	2 (2.2%)	3 (3.3%)	0.65
Myomectomy	0	1 (1.1%)	0.32
Cervical cerclage	2 (2.2%)	0	0.16
Cholecystectomy	3 (3.3%)	2 (2.2%)	0.65
Tonsillectomy	1 (1.1%)	0	0.32
Open-heart	4 (4.4%)	2 (2.2%)	0.41
Brain shunt	0	1 (1.1%)	0.32
Carpel tunnel	0	1 (1.1%)	0.32

Table (5): Pre-operative data between the studied groups

	Interventional Group (n=90)	Control group (n=90)	P-value
Pre-incisional antibiotics			
Cefaxone	88 (97.8%)	88 (97.8%)	1.0
Clindamycin/gentamicin	2 (2.2%)	2 (2.2%)	
Previous scar for any lesion			
nil	78 (86.7%)	75 (83.3%)	0.53
Papules	0	2 (2.2%)	0.16
Depression	2 (2.2%)	4 (4.4%)	0.41
Keloid	6 (6.7%)	3 (3.3%)	0.30
Thickening	8 (8.9%)	10 (11.1%)	0.62

Table (6): Pre-and post-operative Hb & operative data between the studied groups

	Interventional Group (n=90)	Control group (n=90)	P-value
Hemoglobin (Hb) level g/dl			
Preoperative Mean ± SD.	10.50 ± 0.56	10.32 ± 0.48	0.38
Postoperative day 1 Mean ± SD.	9.80 ± 0.54	9.75 ± 0.35	0.35
Operative characteristics			
Surgical time (min) Mean ± SD.	47.94 ± 13.8	51.6 ± 17.6	0.12
EBL (ml) Mean ± SD.	693.6 ± 104.5	717.97 ± 95.65	0.10

Table (7): Outcome data between the studied groups

	Interventional Group (n=90)	Control group (n=90)	P-value
Primary outcome			
Postoperative wound infection (SSI)	5 (5.6%)	8 (8.9%)	0.39
Secondary outcomes			
Wound complications			
Skin separation	1 (1.1%)	3 (3.3%)	0.45
Seroma	3 (3.3%)	4 (4.4%)	0.78
Hematoma	1 (1.1%)	2 (2.2%)	0.56
Cellulitis	2 (2.2%)	1 (1.1%)	0.56
Hospital stay (day)	1.7 ± 0.4	1.8 ± 0.6	0.37