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ORIGINAL ARTICLE

The Effect of Subcutaneous Saline Irrigation on Surgical Site Infection During Cesarean Section

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Abstract

Introduction: Postoperative wound site infection is an important source of morbidity in surgeries. This leads to financial burden in patients and healthcare systems. There is a need for simple and inexpensive methods in order to reduce surgical site infection (SSI). In this study, we aimed to retrospectively investigate the effect of saline irrigation on the reduction of surgical wound site infections following cesarean section.

Methods: A total of 2,220 patients who underwent cesarean section in the obstetrics and gynecology clinic of our hospital between January 2017 and December 2020 were included in the study. A total of 1,090 cesarean sections with skin irrigation were compared with 1,130 cesarean sections performed without irrigation. Variable factors that could affect infection such as cesarean technique, patient population's characteristics, and operating room conditions were completely same for both groups.

Results: SSI was detected in 22 (1%) of the 2,220 patients. Nine (0.8%) patients in Group 1 and 13 (1.1%) patients in Group 2 were infected. The difference between both groups was statistically insignificant (p>0.05). Patients' age, body mass index (BMI), gestational week, length of stay, pre-cesarean hemoglobin, the rates of urgent cesarean sections, smokers, and diabetes mellitus (DM) were similar between both groups (p>0.05). The rates of DM (p=0.056) and BMI (p=0.022) were statistically higher compared to general patients.

Discussion and Conclusion: Our results indicated that saline irrigation was not effective in surgical wound site infections.

Keywords: Cesarean; saline irrigation; surgical site infection.

Cesarean section is a fetal delivery operation performed through an abdominal incision (laparotomy) and an incision in the uterus[1]. The frequency of cesarean sections is increasing all over the world[2]. Our country is one of the countries with the highest cesarean frequency among the Organization for Economic Co-operation and Development countries[3,4].

Due to the continuous increase in the incidence of cesarean section in the world and in our country, the number of women with postpartum infection is expected to increase[5,6]. Cesarean delivery carries a 5 to 20 times greater risk of infection than a normal delivery[7]. Surgical site infections (SSI) are the most common nosocomial infections, and the frequency of hospital-acquired infections varies between 2% and 10%[8-12].

There are some risk factors for SSI. These risk factors are higher a maternal age, incision site hematoma, intraoperative blood loss, emergency cesarean section, obesity,

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duration of hospital stay, diabetes, history of urinary tract infection, and premature rupture of membranes[13,14].

In women undergoing cesarean section, the use of prophylactic antibiotics reduces the incidence of wound infection, endometritis, and serious infection complications by 60–70%[15]. On the other hand, SSI remain. In SSI, there may be internal factors related to the patient that cause the infection, as well as external factors that may affect the risk of infection such as operative management and surgical field care. Although the internal factors of the patient can not be changed, external factors are definable and manageable in terms of the risk of infection.

However, it is not yet clear what type of skin disinfection and surgical site care would be most effective in preventing and reducing SSI after cesarean section[16]. SSI increase the cost burden on healthcare systems in addition to the medical adverse effects they give to the patient[17]. Increase in the frequency of cesarean operations has increased both the frequency of surgical wound infections and the need for the use of antiseptics required for skin cleansing. Developing countries have sought simple and cheaper solutions to this increasing financial burden[18].

In this study, we aimed to investigate whether there is a difference between surgical wound infections in patients who were applied saline infusion irrigation to the surgical incision area after cesarean section in order to reduce microbial load and those who were not. The literature does not agree on the effect of subcutaneous irrigation on SSI. There are studies showing that it is beneficial as well as there are studies that say it is ineffective. Our study makes a reliable and strong contribution to the literature, as the sample size is high and all other factors that may affect wound infection are equalized.

Materials and Methods

This is a retrospective study of 2,220 patients who underwent cesarean section in our hospital's obstetrics and gynecology clinic between January 2017 and December 2020, in terms of wound infection. Our study was approved by the medical ethics committee of our hospital, and the provisions of the Helsinki convention were adhered to in its design and implementation.

In our study, it was investigated whether washing the skin with saline, which is a simple and inexpensive method, has a decreasing effect on the SSI during cesarean section.

All patients who were selected between the specified dates, who were taken to cesarean section by two surgeons for various indications, and whose file information could be reached were included in the study. Information such as surgical indication, elective or emergency operation, age, parity, body mass index (BMI), preoperative hemoglobin (hgb) value, diabetes, history of smoking, length of hospitalization were obtained from hospital archives and patient files. The wound infection status of the patients during hospitalization was obtained from the examination notes.

Both surgeons performed surgeries on the patients in accordance with the standardized surgical procedure described below.

The patients were operated in four standard operating rooms used for obstetric surgery with two surgical nurse teams. Before each operation, the hands were washed with antiseptic soap for at least 2 min, routinely without using a brush and by rubbing the entire surface of the hand, including between the fingers. Sterile surgical gowns and gloves were worn in accordance with American College of Surgeons recommendations[19]. The skin was cleaned in at least two layers using tampons mounted with povidin-based preparations and then covered with surgical drapes. The covering was provided with six sterile green drapes, starting from the feet and head, respectively, and two layers on the feet and head and one layer on the sides. The incision site was not shaved before the operation. Each patient received prophylaxis with 2 g cefazolin 60 min before surgery, and 3 g cefazolin for patients weighing more than 120 kg. The operation times were approximately 15–20 min and were similar for both surgeons.

Pfannenstiel incision was made into the abdomen. The uterine lower segment was incised with a transverse incision and the baby was delivered. Parietal peritoneum was not closed. In this way, both surgeons applied a similar surgical technique. Differently, one surgeon irrigated the subcutaneous skin with 100 cc saline at the end of the surgery, while the other did not. Irrigation was performed with pure saline at room temperature kept in a sterile container after the anterior abdominal wall fascia was closed. With the help of a sterile sponge, the subcutaneous space was thoroughly irrigated with saline and cleaned. At the end of the surgery, the wound surface was wiped with a povidin-based antiseptic solution and sterile dressing was applied.

The patients were hospitalized for 2 days as per postoperative standard care. All patients were given a second-generation cephalosporin orally for 1 week postoperatively. Dressings of the patients were opened and examined on the 2nd postoperative day, and those with clean incision were discharged without recommending further dressing. Patients were allowed to take a bath after discharge and were called for control 10 days later.

Patients with postoperative purulent discharge, antibiotherapy, and having daily dressing were included in our study. In our study, patients who underwent other any major operation in addition to cesarean section or who underwent re-laparotomy for various reasons after cesarean were excluded. In addition, patients with subcutaneous hematoma, seroma, dehiscence, and skin hyperemia that did not require treatment were excluded from the study.

Statistical Analysis

In the descriptive statistics of continuous variables, mean and standard deviation (Mean±SD), median, minimum, and maximum values are given, while in the definition of categorical variables, frequency (n) and percentage (%) values are given. Normality assumptions of continuous variables were examined by Skewness and Kurtosis coefficients, Kolmogorov Smirnov test, and Histogram. Mann–Whitney test was used to compare continuous variables that did not show normal distribution with two-level variables, and Independent samples t-test was used to compare continuous variables with normal distribution. Relationships between categorical variables were examined using Chi-square/Fisher exact analysis. The data were entered in the EXCEL file and transferred to the IBM SPSS 23 program and evaluated by statistical analysis. The significance level was accepted as $p<0.05$ in all analyzes.

Results

A total of 2,220 patients were included in the study, with 1,090 patients in the skin irrigation group (Group 1) and 1,130 patients in the non-skin irrigating group (Group 2). In Groups 1 and 2; the average age was 29.76±5.66/30.17±5.93, BMI was 30.22±4.71/30.22±5.0, gestational week was 37.802±2.31/37.51±2.5, length of stay in hospital was 2.77±0.48/2.85±0.50 days, pre-cesarean hgb level was 11.79±1.68/11.63±1.49 g/dL, rate of emergency cesarean sections was %37.6/%44, rate of smokers was %14.7/%18, diabetes mellitus (DM) %14.7/%13, number of previous cesarean sections were 2.28±1.12/1.93±1.03, respectively. Of these, age, BMI, gestational week, length of stay in hospital, hgb level before cesarean section, emergency cesarean section rate, rate of smokers, and DM rate were similar for the two groups ($p>0.05$), only the C/S numbers of the patients in Group 1 were found to be significantly higher than Group 2 ($p=0.017$). In Table 1, the general characteristics of the patients with and without skin irrigation are compared.

SSI was detected in 22 (1%) of 2220 patients. Nine (0.8%) patients in Group 1 and 13 (1.1%) patients in Group 2 were infected. The difference between the groups was statistically insignificant ($p>0.05$). When the infected patients in the groups were compared, BMI, gestational week, length of stay, emergency cesarean rate, rate of smokers, DM rate, C-reactive protein, and white blood cell values during admission to hospital were similar for the two groups ($p>0.05$). On the other hand, as a result of the Mann-Whitney U test, the average age of infected patients in Group 2 was found to be significantly higher than the average age of infected patients in Group 1 ($p=0.035$). In addition, in independent samples t-test, the mean preoperative hgb value of infected patients in Group 2 was found to be significantly lower than the mean preoperative hgb value of the infected patients in Group 1, $p=0.033$. Table 2 compares patients with wound infection between the groups.

When we compare the infected patients with all the patients, the rate of diabetes in infected patients (31.8%) was found to be marginally significantly higher than the diabetes rate of the total patients (14.0%) $p=0.056$. In addition, the mean BMI of infected patients (32.99±5.37) was found to be significantly higher than the mean BMI of the total patients (30.22±4.85) $p=0.022$. In Table 3, all infected patients and all cesarean patients are compared.

Table 1. Comparison of general characteristics between the groups

	Groups		Total, n (%)	P
	Group 1 n (%)	Group 2 n (%)		
Smoking				
None	930 (85.3)	920 (81.4)	1850 (83.3)	0.435*
Yes	160 (14.7)	210 (18.6)	370 (16.7)	
Diabetes				
None	930 (85.3)	980 (86.7)	1910 (86.0)	0.763*
Yes	160 (14.7)	150 (13.3)	310 (14.0)	
Emergency/Elective				
Elective	680 (62.4)	622 (55.1)	1302 (58.7)	0.064*
Emergency	410 (37.6)	508 (44.9)	918 (41.3)	
	Study group Mean±SD	Control group Mean±SD	P	
Age	29.76±5.66	30.17±5.93	0.744**	
BMI	30.22±4.71	30.22±5.00	0.893**	
Gestational week	37.80±2.31	37.51±2.50	0.378**	
How many CS	2.28±1.12	1.93±1.03	0.017**	
Hospital stay (days)	2.77±.48	2.85±.50	0.258**	
Preop hgb	11.79±1.68	11.63±1.49	0.432***	

*Chi-square test; **Mann Whitney U test; ***Independent samples t-test, hgb: Hemoglobin.

Table 2. Comparison of patients with wound infection between the groups

	Groups		Total, n (%)	P
	Group 1 n (%)	Group 2 n (%)		
Smoking				1.00*
None	8 (88.9)	12 (92.3)	20 (90.9)	
Yes	1 (11.1)	1 (7.7)	2 (9.1)	
Diabetes				1.00*
None	6 (66.7)	9 (69.2)	15 (68.2)	
Yes	3 (33.3)	4 (30.8)	7 (31.8)	
Emergency/ Elective				0.384*
Elective	4 (44.4)	9 (69.2)	13 (59.1)	
Emergency	5 (55.6)	4 (30.8)	9 (40.9)	
Wound dehissence?				0.736**
Yes	0 (0.0)	3 (23.1)	3 (13.6)	
Partial	6 (66.7)	4 (30.8)	10 (45.5)	
No	3 (33.3)	6 (46.2)	9 (40.9)	
	Group 1 Mean±SD	Group 2 Mean±SD	P	
Age	28.00±5.63	33.62±4.56	0.035***	
BMI	31.89±5.88	33.75±5.09	0.350***	
Gestational week	37.11±3.33	37.69±2.63	0.535***	
How many CS	1.78±1.09	2.08±.86	0.303***	
Hospital stay (days)	3.00±.50	2.85±.69	0.532***	
Preop hgb	13.22±1.70	11.57±1.64	0.033****	
Admission CRP	70.87±86.11	73.60±91.97	0.894***	
Admission WBC	10.52±2.30	10.10±3.66	0.664***	

*Fisher's Exact test; **Chi-square analysis; ***Mann Whitney U test; ****Independent Samples t-test, CRP: C-reactive protein, WBC: White blood cell, BMI: Body mass index, hgb: Hemoglobin.

Table 3. Comparison of all cesarean patients (n=2220) and all infected patients (n=22)

	Groups		P
	All patients n (%)	Infected patients n (%)	
Smoking			
None	1850 (83.3)	20 (90.9)	0.543*
Yes	370 (16.7)	2 (9.1)	
Diabetes			
None	1910 (86.0)	15 (68.2)	0.056*
Yes	310 (14.0)	7 (31.8)	
Emergency/ Elective			
Elective	1302 (55.9)	13 (59.1)	0.771**
Emergency	918 (44.1)	9 (40.9)	
	All patients Mean±SD	Infected patients Mean±SD	P
Age	29.97±5.79	31.32±5.65	0.287***
BMI	30.22±4.85	32.99±5.37	0.022***
Gestational week	37.65±2.41	37.45±2.87	0.952***
How many CS	2.10±1.09	1.95±.95	0.662***
Hospital stay (days)	2.81±.49	2.91±.61	0.454***
Preop hgb	11.71±1.59	12.25±1.82	0.137****
Admission CRP	72.48±87.52	72.48±87.52	1.000***
Admission WBC	10.27±3.12	10.27±3.12	1.000***

*Fisher's Exact test; **Chi-square analysis; ***Mann Whitney U test; ****Independent Samples t-test, CRP: C-reactive protein, WBC: White blood cell, BMI: Body mass index, hgb: Hemoglobin.

Discussion

Cesarean delivery may be associated with negativities ranging from maternal mortality to infections in the postoperative period[20]. After cesarean section, delivery complications may include pain, endomyometritis, surgical wound infection, urinary tract infection, gastrointestinal problems, deep vein thrombosis, and septic thrombophlebitis[21]. The risk of infection has increased five times in cesarean delivery compared to normal delivery. Infections are the most known maternal morbidity[22,23]. This common infection situation has prompted surgeons to seek simple and economical solutions. As an example of simple applications, it has been reported that cleaning the vagina with povidone-iodine before cesarean delivery decreases the risk of post-cesarean endometritis, postoperative fever, and postoperative wound infection[24].

In our study, no significant correlation in terms of SSI was found between the patients who underwent saline irrigation before closing the surgical wound incision and those who were not (p>0.05). The number of relevant publications in the literature after cesarean delivery is not sufficient. In a prospective randomized study, Aslan et al. compared 204 women who were irrigated with saline before the incision was closed after primary cesarean section and 184 control groups. They found no significant difference between the groups in terms of SSI rates (14.3% in the saline group, 12.8% in the control group, p=0.76). However, they reported that the presence of hematoma and seroma in the saline irrigation group was significantly lower than the control group[25]. Güngördük et al. reported that the SSI incidence was 7.3% for the control group and 6.5% for the saline group in a prospective randomized study in which they compared 260 patients with saline irrigation after cesarean section with the same number of control groups, and this difference was not significant[26]. Al-Ramahi et al. reported that saline irrigation was not helpful in reducing the incidence of SSI in their study where they applied sub-

cutaneous saline irrigation after abdominal gynecological surgery[27].

While there are studies in the literature that find saline irrigation beneficial, saline irrigation has also been reported to be useless[28]. Edmiston and Leaper found the incision saline irrigation favorable in three aspects. First, it counts as hydration of the surgical area, secondly, allowing better examination of the area just before closing, and finally, accelerating the healing process by eliminating the contamination in the incision area and reducing the microbiological burden[29].

Some studies suggest that, in addition to saline irrigation, adding simple antiseptic irrigation of the surgical field may be more effective[30,31]. On the other hand, there are studies reporting that irrigation with antibiotic solutions is a more effective and simpler method than saline irrigation and irrigation with antiseptics[32]. Ngai et al.[33] however, reported that all these methods are unnecessary and do not change the infection rates after cesarean section and that no additional prevention is required.

It has been determined that evidence-based measures are effective for the prevention of SSI[34]. Each hospital can plan these evidence-based simple precaution packages in accordance with its own conditions. Although we planned our study on the thesis that saline irrigation would be an alternative and inexpensive method, our result showed us that it makes no difference. Nevertheless, hospitals can implement simple, reliable, cheap, and feasible evidence-based measures due to increasing cesarean rates worldwide, associated increased infection rates, and financial burdens. These measures can be listed as follows; preoperative standard antibiotics, skin preparation with chlorhexidine-alcohol, use of scissors instead of razors, vaginal cleaning with povidone-iodine, removal of the placenta by pulling the umbilical cord, closing the subcutaneous tissue with sutures if the subcutaneous thickness is more than 2 cm, skin closure with sutures instead of closing with staples, removal of the dressing between 24 and 48 h postoperatively, daily use of chlorhexidine gluconate soap after dressing removal[35-38].

The limitations of our study are that it is a retrospective study and there is no distinction between primary and previous surgeries. The strength of our study is that it contributes to the limited literature, the number of cases is high and the groups are well designed.

Conclusion

Increasing cesarean rates in the world increase the frequency of surgical wound infection. This situation leads to new simple, cheap and safe searches. Our study was made to contribute to these pursuits. Our results show that saline irrigation is not effective in preventing surgical wound infections. It is beneficial to continue the existing evidence-based protocols in preventing surgical wound infections.

Ethics Committee Approval: Health Sciences University Gazi Yaşargil Training and Research Hospital Clinical Research Ethics Committee. (Date: 26/03/2021 - Number: 738).

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