

Exteriorized versus in-situ repair of the uterine incision at cesarean delivery: a randomized controlled trial

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Summary

Purpose of Investigation: To compare advantages and disadvantages of exteriorized and *in situ* repair techniques of uterine incision during cesarean section. **Methods:** A total of 338 patients delivered by cesarean section were included in the study. Patients were randomized according to the location of uterine incision repair; the uterus was exteriorized ($n = 171$) or not (*in situ* repair group) ($n = 167$) during cesarean section. Two groups were compared in terms of blood loss, operation time, temperature patterns, analgesic dosage, length of hospital stay, incidence of nausea and vomiting. **Results:** There was no significant difference in postoperative analgesic dosage, temperature patterns, drops in hemoglobin or hematocrit levels and in the incidence of postoperative nausea and vomiting between the two groups. Operation time and length of hospital stay were significantly shorter in the *in situ* repair group, when it was compared to those of which the uterus was exteriorized (30.64 ± 8.65 vs 33.02 ± 9.54 min., $p = 0.011$ and 2.23 ± 0.49 vs 2.45 ± 0.94 days, $p = 0.045$). **Conclusions:** Exteriorized and *in situ* repair of uterine incisions have similar effects on blood loss, temperature patterns, postoperative analgesic dosage and the incidence of postoperative nausea and vomiting. Although both methods of uterine incision repair are valid options during surgery, cesarean sections took less time and length of hospital stay was shorter when uterine incision was repaired *in situ*.

Key words: Cesarean section; Exteriorization; Uterus; Repair technique.

Introduction

During cesarean section, obstetricians can repair the uterus *in situ* or it can be exteriorized. The technique of uterine exteriorization was described by Sanger in 1882 [1]. It was suggested that exteriorization of the uterus for repair might be useful in facilitating repair and thus contributing to a decrease in blood loss [2]. There are studies that indicate advantages and disadvantages of both methods [1, 3, 4]. It is believed that extra-abdominal repairing technique of the uterine incision does not bring any greater morbidity to the mother. Although some investigators suggest that extra-abdominal repair of uterine incision might decrease blood loss, different studies revealed that there was no significant difference between *in situ* and extra-abdominal repair groups in terms of amount of blood loss [5, 6]. Although both techniques show overall similarities, it was found that significantly more patients in the group whose uterus was repaired intraabdominally had a higher morbidity, whether the membranes were intact or ruptured at the time of surgery [3]. Identification of this increased morbidity in women in whom the uterine incision was repaired *in situ*, favors the exteriorization of the uterus. The authors suggested that there was no apparent way to predetermine which patients would be unfortunate enough to experience increased morbidity. Diminished blood loss is attributed to ease in suturing the uterine incision of an exteriorized uterus, however fundal traction may decrease the blood loss by reducing the intraluminal diameter of uterine vessels [3, 5].

The aim of the study was to determine the effect of the site, *in situ* vs exteriorized, of uterine incision repair on operating time, blood loss, hospital stay time, postoperative intestinal gas evacuation time, temperature patterns, postoperative analgesic dosage and incidence of postoperative nausea and vomiting in women delivered by cesarean section.

Materials and Methods

This was a prospective randomized trial for which ethical approval was granted by the Research Ethics Committee of Firat University, School of Medicine. A total of 338 consecutive patients delivered by cesarean section between January 2005 and January 2007 were recruited in the study. All operations were performed at the same hospital (Ahlat Government Hospital, Bitlis, Turkey) by the same operator. Exclusion criteria were placenta previa, placental abruption, multiple pregnancy, polyhydramnios and chorioamnionitis. Time of rupture of membranes (ROM) prior to operation was shorter than four hours in all patients. Patients were randomly divided into two groups. Randomization was carried out by closed envelopes where the technique of uterine repair was stated on a paper. Group 1 consisted of 171 patients in whom the uterus was exteriorized; group 2 consisted of 167 patients in whom the uterus was repaired *in situ*. Four patients in group 2 were excluded from the study because of partial ablation, all of which were recognized during operation. Cesarean deliveries were performed for fetal distress, cephalopelvic disproportion, failure to progress and repeat cesarean births.

After an indication for cesarean section, hemoglobin and hematocrit concentrations were obtained preoperatively and 48 hours after surgery in all patients. Anemia is defined as a hemoglobin value less than 11 g/dl [7]. All operations were performed under general anesthesia. Cefazolin sodium (Sefazol, Mustafa Nevzat, Istanbul, Turkey) was administered as a single

1 g intravenous injection intraoperatively after clamping of the umbilical cord for prophylaxis. Lower uterine segment cesarean section through a Pfannenstiel incision was performed by the same technique. Layers of abdomen including uterine incision, visceral peritoneum, parietal peritoneum, rectus muscle, fascia and skin were repaired in all patients. Placental removal was performed manually in all patients. Operating time was recorded by the anesthesia team, beginning from incision to closure of the skin.

After surgery all patients were mobilized with the help of a nurse after six hours, and oral liquid intake was allowed 12 hours after the operation. A standard dose of 1000 ml of saline infusion with the addition of 10 IU of oxytocin was given to reduce postpartum bleeding in all patients. Temperatures were recorded every 12 hours during the first and second postoperative days. The dosage of analgesics needed in the first six hours following surgery was recorded, either 50 or 100 mg of pethidine HCL (Aldolan, Liba, Istanbul, Turkey), according to the patient's pain level. Patient pain levels were determined by a visual analog scale (VAS); 0 defines no pain and 10 is the worst imaginable pain. Pethidine HCL (100 mg, intramuscularly) was applied to patients if their VAS score exceeded 6 [8].

Time of intestinal gas evacuation after the surgery and occurrence of nausea and vomiting in the first six hours following surgery were also recorded. Intravenous metoclopramide HCL 10 mg (Metpamid, Yeni Ilaç, Istanbul, Turkey) was applied in case of nausea and vomiting.

The primary objective of the study was to compare the amount of blood loss during surgery in the exteriorization group and the *in situ* repair groups. Secondary outcome measures were duration of operation, analgesic use, hospital stay time, postoperative intestinal gas evacuation time, temperature patterns, postoperative analgesic dosage and incidence of postoperative nausea and vomiting.

Power analysis was undertaken according to our primary objective and drops in hemoglobin parameters were analyzed. Power of the study was calculated as 0.99 for 338 patients, where delta, SD and alpha were 0.05, 0.123 and 0.05, respectively.

Data were stored and analyzed with the SPSS program (Statistical Package for Social Science, release 11.0; SPSS, Chicago, IL) for Windows. Distributions of variances of all the parameters in the study were evaluated by the Kolmogorov-Smirnov test to identify the normally distributed parameters. Continuous variables were analyzed with independent-sample *t*-tests if distributional assumptions were consistent with normality. Otherwise, Mann-Whitney U tests were performed for the parameters that were not normally distributed. For univariate analysis and comparisons between proportions the chi-square test was used; *p* values by Fisher's exact test were reported when the assumptions for the chi-square analysis were not met. Statistical significance was defined as $p < 0.05$.

Results

Patient characteristics of the two groups are shown in Table 1. Mean age, parity, maternal weight, membrane rupture time and the number of previous operations or cesarean sections were similar between the two groups (ns). The number of patients with ruptured membranes were not significantly different between the *in situ* repair ($n = 60$) and the exteriorization ($n = 57$) groups.

There was a significant difference in the mean \pm SD operation time between the exteriorization group and the

Table 1. — Patient characteristics of the two groups.

	Exteriorization group ($n = 171$)	<i>In situ</i> repair group ($n = 167$)	<i>p</i>
Age (years)	27.82 ± 6.89	26.33 ± 5.98	0.063
Parity	1.62 ± 1.58	1.61 ± 1.81	0.468
Maternal weight (kg)	80.20 ± 8.73	78.98 ± 9.40	0.222
Membrane rupture time (min)	167.28 ± 59.53	162.66 ± 56.11	0.533
Previous cesarean sections (n)	1.16 ± 0.47	1.15 ± 0.39	0.775
Previous abdominal operations (n)	0.03 ± 0.18	0.03 ± 0.17	0.790

Table 2. — Operative and postoperative morbidities of the two groups.

	Exteriorization group ($n = 171$)	<i>In situ</i> repair group ($n = 167$)	<i>p</i>
Operation time (minutes)	33.02 ± 9.54	30.64 ± 8.65	0.011
Drop in hemoglobin (g/dl)	1.69 ± 1.14	1.69 ± 1.10	0.996
Drop in hematocrit (%)	5.53 ± 3.79	4.84 ± 4.74	0.173
Anemia (n, %)	94 (54.9%)	92 (55%)	0.767
Nausea (n, %)	10 (5.8%)	7 (4.1%)	0.487
Vomiting (n, %)	1 (0.5%)	2 (1.1%)	0.549
Analgesic dosage	62.28 ± 21.58	64.37 ± 22.69	0.385
Intestinal gas evacuation time (hours)	22.01 ± 5.49	21.01 ± 5.47	0.102
Length of hospital stay (days)	2.45 ± 0.94	2.23 ± 0.49	0.045

in situ repair group (33.02 ± 9.54 vs 30.64 ± 8.65 minutes, $p = 0.011$). Anemia developed in 92 and 94 patients in the *in situ* repair and exteriorization groups, respectively. Postoperative nausea was observed in seven women in the *in situ* repair group whereas in ten patients in the exteriorization group. Postoperative vomiting developed in two and one patients in the *in situ* repair and exteriorization groups, respectively. The mean postoperative drops in hemoglobin and hematocrit levels, incidence of postoperative anemia, incidence of postoperative nausea and vomiting, dosage of analgesics used postoperatively or postoperative intestinal gas evacuation time did not differ between exteriorization and *in situ* repair groups, but the length of hospital stay after operation was shorter in the *in situ* repair group ($p = 0.045$) (Table 2).

No correlations between operation time and drop in hemoglobin or in hematocrit levels, postoperative nausea and vomiting were found. Type of surgery did not show a correlation with the incidences of postoperative nausea ($p = 0.486$) and vomiting ($p = 0.619$).

As shown in Table 3, postoperative temperature patterns were similar in both groups of patients ($p = 0.765$).

The relation between the operation time and number of cesarean sections in the *in situ* repair group was significant (eta coefficient = 0.167, $p = 0.03$). However no correlation was found in the exteriorization group ($p = 0.08$).

In a further analysis, a subgroup analysis was done for patients who had repeat cesarean sections. The total number of patients with previous cesarean sections was

Table 3. — Postoperative temperature values of the groups.

Postoperative temperature values (°C)				
	First 12 hours	Second 12 hours	Third 12 hours	Fourth 12 hours
Exteriorization group (n = 171)	36.71 ± 0.34	36.65 ± 0.34	36.58 ± 0.30	36.60 ± 0.31
In situ repair group (n=167)	36.74 ± 0.36	36.69 ± 0.31	36.56 ± 0.29	36.58 ± 0.28
Postoperative temperature values (°C) of the two groups in the repeat cesarean subgroup				
	First 12 hours	Second 12 hours	Third 12 hours	Fourth 12 hours
Exteriorization group (n = 22)	36.72 ± 0.33	36.65 ± 0.28	36.59 ± 0.28	36.52 ± 0.24
In situ repair group (n = 24)	36.60 ± 0.30	36.76 ± 0.27	36.61 ± 0.26	36.63 ± 0.28

Table 4. — Patient characteristics, operative and postoperative morbidities of the two groups in repeat cesarean subgroup.

	Exteriorization group (n = 22)	In situ repair (n = 24)	p
Age (years)	28 ± 4.76	27.45 ± 4.33	0.688
Parity	1.36 ± 0.58	1.08 ± 0.28	0.440
Maternal weight (kg)	83.31 ± 8.77	78.95 ± 8.84	0.101
Membrane rupture time (min)	206 ± 13.41	158.33 ± 51.31	0.062
Operation time (min)	34.13 ± 8.91	33.33 ± 11.05	0.789
Postoperative			
Drop in hemoglobin (g/dl)	1.54 ± 1.16	1.75 ± 1.29	0.553
Drop in hematocrit (%)	4.87 ± 3.38	5.72 ± 5.67	0.544
Anemia (n, %)	10 (45.5%)	10 (41.7%)	0.801
Nausea (n, %)	2 (9.1%)	2 (8.3%)	0.929
Vomiting (n, %)	0 (0%)	0 (0%)	—
Analgesic dosage (mg.)	59.09 ± 19.73	66.66 ± 24.07	0.248
Intestinal gas evacuation time (hours)	20.54 ± 5.71	21.93 ± 5.87	0.421
Length of hospital stay (days)	2.81 ± 1.73	2.41 ± 0.71	0.486

46; 22 in the exteriorization and 24 in the *in situ* repair groups. These two subgroups did not show a significant difference by means of age, parity, maternal weight, membrane rupture time, length of operation, drop in hemoglobin, drop in hematocrit, postoperative nausea and vomiting incidence, postoperative anemia incidence, dosage of analgesic used postoperatively, postoperative intestinal gas evacuation time and the length of hospital stay after operation (Table 4). Postoperative temperature patterns were also similar between these two groups (Table 3).

Discussion

In this prospective randomized study, uterine incision repair performed either exteriorized or *in situ* did not significantly affect operative and postoperative outcomes except for the operation time and length of hospital stay which were significantly shorter in women whom uterine incision was also repaired *in situ*. Length of hospital stay was reported to be longer in patients with extra-abdominal closure of uterine incision by Jacobs-Jokhan *et al.* [9]. It was reported that overall there were no statistically significant differences between the groups except for febrile morbidity and length of hospital stay, however no clear evidence was found in favor of either method.

Wahab *et al.* and Ezechi *et al.* [6, 10] found that exte-

riorization of the uterus for repair following cesarean delivery was not associated with significant problems and was associated with less blood loss. Conversely, Hershey *et al.* [3] reported similar blood loss, operating time, length of postoperative hospital course and temperature patterns in patients where either the uterus was exteriorized or repaired *in situ*. Also Magann *et al.* [4, 5] and Edi-Osagie *et al.* [1] found no clinically significant differences regarding blood loss between uterine exteriorization and *in situ* repair groups, and reported that uterine position did not affect blood loss significantly. In line with findings of these four reports, drop in hematocrit and hemoglobin levels showed no significant difference between the two groups in our study. It can be stated that uterine position does not seem to affect blood loss significantly during cesarean section. Within a different perspective, regarding the effect of the method of placental removal on blood loss, Magann *et al.* and Ramadani *et al.* [4, 5, 11] suggested that amount of blood loss was significantly less in women who had spontaneous removal of the placenta. Since all placentas were removed manually in both groups, the effect of method of placental removal on blood loss could not be assessed in this study.

Depending on the clinician's experience, obstetricians generally have the idea that repairing uterine incisions outside the abdomen takes less time than *in situ* repair. However, Magann *et al.* [4] identified women with manual placental removal and exteriorization for repair as having the longest operative procedure compared to the *in situ* repair technique. On the contrary, some other authors favored the exteriorization technique reporting that it had shorter operative time, less blood loss and similar morbidity profile as the *in situ* repair technique [10]. In line with Magann *et al.*, the current study found that *in situ* repair significantly shortened the operation time compared to the exteriorization technique, although the three-minute difference of half an hour cesarean operation may not be considered a clinically relevant and significant issue [4]. However, this result may differ with the surgeon's experience or with the number of previous operations, namely cesarean sections, that the patient had. In the current study, operation time increased with the number of previous operations the patients had undergone in the *in situ* repair group, but this was not determined in the exteriorization group. In our opinion a possible explanation for this result is that although exteriorization can cause difficulties in patients with previous operations due to possible adhesions, once the uterus is exteriorized, repairing the lower incision may be easier compared to the *in situ* repair technique. In this way, surgeons can perform more freely on the uterus outside the abdominal cavity. Likewise, in patients with adhesions, *in situ* repair might be relatively difficult.

The incidence of infectious morbidity after cesarean section has been reported to range between 20% and 85% in an indigent population [12]. Duration of labor, operative time and skill of the surgeon were reported to be factors influencing the incidence of postoperative endometritis [13]. Prophylactic antibiotics at the time of

cesarean delivery are reported to decrease the incidence of postoperative endometritis [14]. In terms of infectious morbidity, Magann *et al.* [4] reported a significant rise in post-cesarean endometritis in women with manual removal of the placenta and with the repair of uterine incision by the exteriorization technique. During a period of two postoperative days, no endometritis was observed in this current study in either group. Prior to use of antimicrobial prophylaxis the incidence of uterine infection was reported between 13% and 27% in indigent women [15]. The current study included indigent women as well, but no uterine infection was observed. A tentative explanation of this phenomenon might be excluding women with chorioamnionitis from the study, also with prophylactic antibiotic use, using external monitorization and follow-up of patients by the same clinician. In a recent review by Jacobs-Jokhan *et al.* [9] febrile morbidity was determined to be lower with extra-abdominal closure of the uterine incision. Moreover, febrile morbidity in the current study, measured by postoperative temperature follow-up, did not differ between the exteriorization and *in situ* repair groups.

Vomiting is a potential complication of cesarean section, especially when performed under regional anesthesia, irrespective of the uterine repair technique [1]. Hershey *et al.* [3] reported a higher vomiting rate in an exteriorized repair group, compared to an *in situ* repair group. Since all of the patients in this study were operated under general anesthesia, there was no statistically significant difference in terms of nausea and vomiting between women in whom the uterus was exteriorized or repaired *in situ*.

Conclusion

In conclusion, the current study results suggest that technique of uterine incision repair, either *in situ* or exteriorized, did not cause a significant difference regarding postoperative intestinal gas evacuation time, temperature patterns, blood loss during operation, postoperative analgesic dosage or incidence of nausea and vomiting. *In situ* repair technique has the advantage of shorter operation time and length of hospital stay compared to the exteriorization technique, but has the disadvantage of a longer operation time with increasing number of previous operations the patient had.

On the other hand, operation time did not differ in the repeat cesarean subgroup between the two groups; for this reason, clinical recommendations must await further studies involving a larger number of patients to determine the best technique for uterine incision repair during cesarean section. As there are no significantly detrimental differences regarding disadvantages and advantages of both uterine incision repair techniques, it can be said that the decision to repair uterine incision *in situ* or exteriorized should be left to the surgeon, depending on his experience and route of the operation.

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