

The hazardous impacts of multiple repeated cesarean deliveries on adhesion formation and obstetric outcomes

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Abstract

Aim: The aim of this study was to determine whether the impact of repeat cesarean deliveries (CD) and abdominal adhesions on maternal and fetal complications exists in patients with a history of one previous CD and ones with three or more prior CD.

Material and Methods: A total of one hundred-one pregnant women with a history of at least one previous CD were included in this prospective observational study. Participants were divided into two groups, patients with a single CD were added to the control group (n=56) and patients with a history of three or more CD were included in the study group (n=45). Preoperative scar characteristics and hemoglobin levels, intraoperative adhesion severity and grade were evaluated by using Linsky and Nair classifications for adhesion. In addition, duration of surgery, maternal complications and fetal status by using APGAR scoring system was analyzed, respectively.

Results: Demographic features were comparable between the groups. The differences among the groups were found to be statistically significant in terms of adhesion intensity and grade (1.13 vs 0.42, p<0.01 and 1.80 vs 0.89, p<0.01, respectively), hemoglobin change (1.42 vs 0.83 mg/dL, p=0.011) and operation duration (47.60 vs 36.82 min, p<0.01). In addition, APGAR scores were significantly lower in the multiple repeat cesarean group (1.min; 8.31 vs 8.64, p=0.02 and 5.min 9.37 vs 9.64, p=0.04, respectively).

Conclusion: Multiple repeat CD was associated with poor obstetric outcomes and complications. Careful preoperative evaluation and preparation might be useful in reducing complications, especially in patients with a history of three or more CD.

Keywords: Cesarean; adhesion; complication; pregnancy

INTRODUCTION

Cesarean section is one of the most common surgical operations in the obstetrics field and accounts for about one third of all births worldwide (1). Although cesarean delivery (CD) is becoming more and more acceptable by the patients and provides advantages for obstetricians in terms of avoiding medico-legal problems, it still is a difficult procedure with a wide range of both maternal and neonatal complications. These complications, which may cause maternal morbidity and mortality, include hemorrhage, placental adhesion abnormalities, ureteral and bladder injury, infection, vessel and bowel injury (2,3). In addition, one of the most influential and critical complication is intra-abdominal adhesions.

As a known fact, abnormal tissue and wound healing after surgery results in adhesion formation (4). The physical trauma and tissue ischemia are the major factors in that process (4,5). Intraperitoneal adhesions, associated with the number of prior surgeries and inflammation, are related with an increased possibility of pelvic pain, elevated infertility rates due to anatomic distortion and complications in consecutive surgeries (6). Previous studies have shown that the enlarged uterus may prevent intestinal adhesions relatively in the first few days after surgery and amniotic fluid itself may decrease the adhesion due to its fibrinolytic effect (7,8). However, as the number of CD increased, severity and extent of adhesions are augmented, and that leads to difficulties in surgical dissection and extended duration of operations.

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In known literature, the severity and effect of adhesion due to increased number of cesarean sections has not been adequately investigated. Although the maternal and neonatal impacts of increased number of CD were evaluated separately in previous studies, it is observed that all possible complications were not evaluated comprehensively (9-11). Therefore, it is thought that the relationship between number of previous CD and complications should be examined by using objective adhesion classification systems. The aims of the present study was to determine whether the impact of repeat cesarean sections and abdominal adhesions on maternal and fetal complications exists in patients with a history of one previous CD and ones with three or more prior CD, and investigate the association with maternal and neonatal outcomes.

MATERIAL and METHODS

This prospective observational study was planned to carry out at a single tertiary center between October 2018 and January 2019. The study was approved by the local ethics committee and organized in accordance with the institutional guidelines and Helsinki declaration (reference number: 2018-202). The informed consents were obtained from all participants just prior to study.

Study population

Therefore, a total of 101 Caucasian pregnant women with a history of low segment transverse CD and no vaginal delivery history were enrolled for the study. Patients with singleton and term (37th or further weeks) pregnancies included. Women with multiple pregnancies, prominent obesity (body mass index (BMI) >35 kg/m²), prior classic or vertical incisions, history of any other abdominal surgical procedures, presence of chronic disease that may affect wound formation or may require steroid use and patients who underwent urgent CD were also excluded from this study because they might not have go through similar intraoperative evaluation by the same surgeons.

All pregnant women recruited for the study were divided into two groups. While patients with a history of one previous CD were included in the control group, patients who had three or more prior CD were included in the study group. All surgical procedures and intraoperative assessment evaluated by the same surgeons (OK and UG).

Cesarean technique

Before the surgical procedure, the patient was informed about the type of anesthesia and the possible risks and their consent was obtained. Skin and subcutaneous tissues were cut transversely with a Pfannenstiel incision, 2 cm above the pubic bone. The rectus sheath and fascia were separated by blunt dissection and entered into the abdomen. Subsequent to the cutting of the lower uterine segment by the Kerr incision, the newborn was delivered. Uterin incision was closed continuously with 1-0 absorbable Vicryl suture (Ethicon, Piscataway, NJ). Routinely, peritoneal closure was not performed.

After bleeding control, the rectus fascia was closed with continuous 1-0 absorbable Vicryl suture (Ethicon®, Piscataway, NJ, USA). Just prior to the operation, 2 grams of antibiotic prophylaxis (Sefazol®, Mustafa Nevzat, Turkey) was given and the skin was closed in anatomical plan.

Study parameters and definitions

Following data were noted for each participant; maternal age, gestational age, gravida and parity, number of previous CD, BMI, birth weight of neonates, APGAR scores at 1-min and 5-min, intraoperative evaluation (including pfannnestiel scar characteristics, presence of hyperpigmentation, intensity and grade of adhesions, dehiscence), complications (including presence of placental invasion, bladder and/or bowel injury), lastly, duration of operation and hemoglobin change after operation.

The level of the previous abdominal scar was defined as depressed, flat or elevated. The change in hemoglobin values was calculated on the difference between preoperative and postoperative 6th hour hemoglobin values (mg/dL). Operation duration was calculated as the time between the application of anesthetic agents and closure of the skin. Bowel and bladder injury was defined as surgical intervention related adjacent organ injury.

Adhesion scoring systems

Grade of adhesion was evaluated by Nair scoring system (12). Adhesions were classified as; 0 point for no presence of adhesions, 1 point for one adhesion band between viscera and abdominal wall, 2 points for two bands, either between viscera or from viscera to abdominal wall, 3 points for more than two bands, between viscera, or viscera to abdominal wall, or whole of intestines forming a mass without being adherent to abdominal wall, and lastly 4 points for viscera directly adherent to abdominal wall, irrespective of number and extent of adhesive bands. Grade 1 and 2 classified as insubstantial adhesions and grade 3 and 4 as firm adhesions.

On the other hand, density and severity of adhesions was analyzed with Linsky adhesion scoring system (13). In that scoring system, the intensity of adhesion was assessed macroscopically as follows: 0 point for no adhesion, 1 point for 25% of surface covered, 2 points for 50% of surface covered and 3 points for completely covered. The severity of the adhesions was evaluated as follows: 0 point for no resistance, 0.5 point low degree resistance and lastly 1 point for sharp dissection needed to separation. Total adhesion score is calculated from the sum of these measurements.

Statistical analysis

All data analyses were performed using SPSS (Statistical Packages for The Social Sciences) software, version 22.0 (SPSS Inc., Chicago, USA). Shapiro-Wilk and Kolmogorov-Smirnov tests were used to evaluate distribution of variables. Continuous parameters were presented as mean ± standard deviation (SD). Continuous variables

were compared using independent samples t-test due to normally distributed data. Spearman and Pearson tests were used to analyze whether number of previous CD showed any significant linear correlation with other variables. A p value less than 0.05 was considered as statistically significant.

RESULTS

The demographic characteristics and clinical features of patients are shown in Table 1. Of 101 women recruited in the study, fifty-six patients had one previous CD as the control group and forty-five had 3 or more previous CD as the study group. There was no statistically significant

difference in terms of maternal age, BMI, gestational age at birth and fetal birth weights between the groups ($p>0.05$ for all). As expected, gravidity, parity and number of previous CD are significantly higher in the study group (4.5 vs 2.5, 3.0 vs 1.2 and 3.5 vs 1.0; $p<0.001$ for all, respectively).

Adhesion presence and severity, complication rates, maternal and fetal outcomes are reported in Table 2. According to Linsky adhesion classification system, total adhesion score was significantly higher in multiple repeated CD group (2.6 ± 0.8 vs 1.2 ± 0.5 , $p<0.001$). Similarly, adhesion grade was found significantly higher in study group according to Nair adhesion scale (1.8 ± 1.0 vs

Table 1. Demographic and clinical features of patients

	Control group (55.4%, n=56)	Study group (44.5%, n=45)	p value
Maternal age (years)	28.6 (± 4.6)	31.4 (± 4.8)	0.662
BMI (kg/m ²)	29.6 (± 4.9)	29.2 (± 5.2)	0.925
Gravida	2.5 (± 1.0)	4.5 (± 1.1)	<0.001*
Parity	1.2 (± 0.7)	3.0 (± 0.5)	<0.001*
Number of previous CD	1.0 (± 0.0)	3.5 (± 0.55)	<0.001*
Gestational age at birth	38.4 (± 0.4)	38.1 (± 0.8)	0.074
Fetal birth weight (gr)	3263.3 (± 406.6)	3191.0 (± 474.0)	0.160

Values are presented as mean (\pm SD)

Abbreviations: BMI- body mass index; CD- cesarean delivery; gr- grams

* p-values indicate statistically significant ($p< 0.05$)

Table 2. Maternal and fetal outcomes of the patients

	Control group (55.4%, n=56)	Study group (44.5%, n=45)	p value
Haemoglobin change (mg/dL)	0.83 (± 0.44)	1.42 (± 0.72)	0.011
Adhesion points	0.83 (± 0.88)	1.56 (± 0.86)	<0.001*
Intensity of adhesion	0.42 (± 0.56)	1.13 (± 0.84)	<0.001*
Grade of adhesion	0.89 (± 1.07)	1.80 (± 1.08)	<0.001*
Hyperpigmentation	0.17 (± 0.38)	0,57 ($\pm 0,49$)	<0.001*
Operation duration (min)	36.82 (± 16.04)	47.60 (± 14.76)	<0.001*
Dehiscence	0.01 (± 0.13)	0.20 (± 0.40)	0.002*
APGAR score (1. min)	8.64 (± 0.55)	8.31 (± 0.76)	0.024*
APGAR score (5. min)	9.64 (± 0.55)	9.37 (± 0.68)	0.040

Values are presented as mean (\pm SD), Abbreviations: min-minutes

* p-values indicate statistically significant ($p< 0.05$)

0.8±1.0, p<0.001). In addition, patients in study group had significantly higher hemoglobin change (1.4±0.7 vs 0.8±0.4 mg/dL, p =0.011), duration of operation (47.6±14.7 vs. 36.8±16.0 minutes, p<0.001), hyperpigmented scar (0.5±0.4 vs. 0.1±0.3, p<0.001) and dehiscence (0.2±0.4 vs 0.01±0.1, p<0.001) rates compared to control group. On the other hand, no significant difference was found in terms of bladder injury, bowel injury or hysterectomy rates (p>0.05, for all). Moreover, atony, placental invasion and uterine rupture rates were comparable between the groups. When fetal outcomes are examined, 1-min and 5-min APGAR scores were significantly lower in Group 2 (1-min; 8.3±0.7 vs. 8.6±0.5, p=0.02 and 5-min; 9.3±0.6 vs 9.6±0.5, p=0.04, respectively). No difference was observed between the groups in terms of need for neonatal intensive care (p>0.05).

Analysis of correlations between increased number of previous CD and complications are shown in Table 3. A negative correlation was found between hemoglobin levels and increased number of CD, while a positive correlation was detected with adhesion score and grade of adhesions, bowel adhesions, hyperpigmentation, bladder injury, presence of placental invasion, placental invasion intensity, operation duration and dehiscence rates.

Table 3. Correlation of previous cesarean delivery count with the operative complications

	Correlation Coefficient	p value
Postoperative Hb	-0.334	0.001*
Hb change	0.413	<0.001*
Existence of adhesion	0.354	<0.001*
Adhesion point	0.377	<0.001*
Intensity of adhesion	0.376	<0.001*
Grade of adhesion	0.419	<0.001*
Hyperpigmentation	0.371	<0.001*
Bladder damage	0.236	0.018*
Bowel adhesion	0.234	0.017*
Placental invasion (PI)	0.197	0.048*
Intensity of PI	0.199	0.046*
Operation duration	0.550	<0.001*
Dehiscence	0.359	<0.001*

Abbreviations: Hb-hemoglobin

* p-values indicate statistically significant (p< 0.05)

DISCUSSION

In the current study, we have mainly investigated the impact of previous CD count on adhesion formation. Also, we have compared the maternal and fetal complication rates between women who had undergone only one CD with women who had undergone three or more CDs. In last two decades, the rate of CD has globally increased. As a result of growing numbers of advanced maternal age pregnancies, increasing incidences of maternal disease and increasing CD safety. In addition, women who have one CD are at far greater risk of having subsequent CDs. Because recurrent cesarean delivery is associated with increased maternal and fetal complications compared with vaginal and first cesarean deliveries, the rate of complications also increases (14-16). Maternal morbidity increases with each additional CD, especially for women who undergo three or more cesarean deliveries (17). In the existing literature, reported complications include increased blood loss, prolonged operation time, adhesions, placental invasion anomalies, placenta previa, hysterectomy and visceral injuries (18).

Women who undergo multiple repeated CD were at increased risk of having intra-abdominal adhesions which can lead to prolonged operation time, bleeding, chronic pelvic pain and intestinal problems (4, 19, 20). A retrospective cohort analysis with a chart review indicated that the incidence of adhesions was boosted from 46% to 75% after third CD (20). In our study, we observed even higher adhesion rates in multiple repeated CD group. This may be explained with different techniques used in prior surgeries. Lyell et. al. evaluated the number of adhesions sustained by 173 women who underwent a second CD with or without closure of the parietal peritoneum during their first CD (21). They reported that women who had peritoneal closures in their previous CD had significantly lower rates of dense and filmy adhesions. On the other hand, Bamigboye and Hofmeyr did not find an association between peritoneal closure and adhesion formation in cesarean patients in their comprehensive review (22). Other researchers stated that peritoneal wound healing begins from the whole surface, different from other tissues in which healing process initiates from the edges of the disrupted epithelial layer (23, 24). We did not use peritoneal closure at our clinic routinely; however, since all patients were not operated formerly in our clinic, this condition could not be evaluated precisely.

Placental invasion anomalies are one of the most significant and life threatening complications of pregnancy and the odds are augmented as the number of previous cesarean operations increases. As stated in the ACOG bulletin, the most important reason behind the increase in this mortal spectrum is the striking cesarean rates (25). In the pathophysiology of these abnormalities, it is thought that injury of the endometrial-myometrial interface leads to abnormal placental invasion by disrupting normal decidualization (26, 27). It was reported that the risk of placental invasion did not become statistically significant

unless the number of previous cesarean sections increased to two or more (17). In addition, placenta accreta rates are continued to rise with increasing numbers of previous CD and was as high as 6.74%, with an odds ratio (OR) of 29.8, for women who had had five or more CD compared with women who had never had a C-section. In accordance with the literature, we found a positive correlation between placental invasion anomalies and number of previous CD.

Hysterectomy is another important morbidity associated with repeated CD (28, 29). As a known fact, placenta accreta and uterine rupture are the most common indications for post-cesarean hysterectomy (30). In our study, hysterectomy was performed for two patients in multiple repeated CD group for abnormal placental invasion. However, because of the small sample size, we could not establish a statistically significant difference between the groups. Wound dehiscence was positively correlated with the number of CD. However, none of the patients in either group experienced uterine rupture. This is because follow-up was more frequent in patients who had history of multiple CD and planned deliveries beforehand and not scheduled after the 39th week of gestation.

In our study, we found statistically significant difference in the postoperative hemoglobin levels and duration of operation among the groups. Both variables were positively correlated with number of previous CD. Similar to our results, Nisenblat et. al. found a significant difference in excessive blood loss between women who underwent three or more CD compared to those with one and two (18). Moreover, Makoha et. al. found increasing rates of postoperative hemoglobin deficits and blood transfusion (31). These results can be explained by the increase in the adhesion formation.

Fetal APGAR score is a significant indicator of fetal well-being, with mixed findings in the literature in terms of the relationship between this score and CD frequency. Some studies show that there is a difference in APGAR score which correlates to number of previous CD whereas other studies have found no difference (18, 32). Our study determined there was a significant difference in newborn health between the two groups, with the APGAR score decreasing as the number of CD increased. However, fetal birth weights were similar between the two groups. This indicates that although placental invasion anomalies increase, placental deficiency does not increase as a result of previous CD.

Study Limitations

The main limitations of our study were its relatively small sample size and lack of previous surgery notes. Therefore, we could not extrapolate the differences between the groups based on the number of previous CD. However, this was a prospective study and we evaluated both maternal and fetal effects of multiple repeated CD. We observed that many studies failed to evaluate the association between CD and concurrent maternal and especially fetal complications in the literature. In addition, adhesion presence is predominately used to determine the effect of

CD on the abdominopelvic peritoneum in many studies. However, we took it one step further and determined not only the presence of adhesion, but also intensity and grade, which is more powerful and proper approach for evaluating adhesion and CD interaction. We used both Nair and Linsky adhesion scoring systems to evaluate adhesion intensity and grade more precisely and well-rounded different from other studies in the literature.

CONCLUSION

In conclusion, our findings confirm that maternal and fetal complications boost as the number of cesarean sections increase. Consequently, recurrent CD should be performed by experienced surgeons in advanced centers, and patients who will undergo repeated CD also should be informed in detail of these possible complications. Hence, CD operations without an obstetric indication should not be performed in order to avoid from hazardous complications related to multiple repeat CD. Further investigations are required for minimizing the possible intra- and post-operative problems.

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