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Effect of Multiple Repeat Cesarean Sections on Intra-Abdominal Adhesions

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ABSTRACT

Background: Cesarean section (CS) births have substantially grown during the past several decades all across the world. Multiple caesarean sections are linked to a higher risk of placenta previa, abdominal adhesions, ureteric, bladder, and bowel injuries, as well as uterine rupture and dehiscence. When previous procedures cause inflammation and damage normal tissue, fibrous, band-like formations called abdominal and pelvic adhesions develop between the abdominal organs. The current study aims to compare the rate of adhesions based on number of CSs. **Patients and methods:** A total of 160 patients were recruited and divided into two groups: women with ≤3CS (100 patients) and women with ≥4 CS (60 patients). In the first group, 15 women had dense adhesions, 43 had filmy adhesions and 42 had no adhesions, and in the second group 42 women had dense adhesions, 15 women had filmy adhesions and only 3 had no adhesions.

Results: Operative data of both groups had important differences where women with ≥4 CS had significantly higher Nair's score and modified Nair's score compared with women with ≤3CS. Frequency of bladder injury was significantly lower among women with ≤3CS. Women with ≥4 CS had significantly higher amount of suction and longer duration of operation.

Conclusion: Multiple cesarean sections are associated with increased risk of intra-abdominal adhesions, bladder injury and longer operation time. Post-operative complications included wound infections and need for blood transfusions.

Keywords: Cesarean Sections, Intra-Abdominal Adhesions, Wound infections, Blood transfusions, Nair's score.

INTRODUCTION

Cesarean section (CS) births have substantially grown in frequency during the past few decades [(1)]. In the USA, the caesarean birth rate was 4.5% in 1965 but, according to data from 2007, it was 31.8% and is now expected to be over 50% [(2,3)]. The reasons for this include the women's advanced maternal age, a variety of causes, patient requests, the prevalence of women who have had prior caesarean sections, the fact that women frequently decline offers of sterilization, and the widespread use of assisted reproductive procedures [(4)].

While CS can be a life-saving procedure when a mother or her child has complications during pregnancy or birth, it is a major abdominal operation that carries risks for both the mother and the foetus as well as potential long-term effects on subsequent pregnancies. These include the potential for uterine rupture, anesthesia-related bleeding, organ damage, embolism, infections, aberrant placental invasion, intra-abdominal adhesions, and newborn morbidity and death [(5)].

In general, many obstetricians do not advise CS delivery after three CSs. The precise number of repeat CSs that are regarded safe has not yet been determined by study [(6)]. CS has a number of intrinsic difficulties, but factors like as the health of the mother and the foetus, the timing of the delivery, the surgeon's expertise, the center's competency, the surgical technique, and the danger of anaesthesia all play significant roles in the development of complications [(7)].

There are few studies that describe the rates of maternal and foetal complications in women who have had four or more CSs in the literature [(8, 9)].

The aim of the current study was: (1) To compare the rate of intra-abdominal adhesions in women who had four or more CSs with women who had fewer repeated (two or three) CSs. (2) To compare the maternal and neonatal complications in women who had four or more CSs with women who had fewer repeated (two or three) CSs.

PATIENTS AND METHODS

This cross sectional study was conducted at Assiut Women Health Hospital during the period from September 2019 to September 2021. A Total of 160 patients were recruited and divided into two groups: women with ≤ 3CS (100 patients) and women with ≥4 CS (60 patients). In the first group 15 women had dense adhesions, 43 had filmy adhesions and 42 had no adhesions, and in the second group 42 women had dense adhesions, 15 women had filmy adhesions and only 3 had no adhesions.

Inclusion criteria: Women with at least previous one CS, patient who were 18 to 50 years old, and women accepted to participate in the study.

Exclusion criteria: Previous abdominopelvic surgery other than CS, history of PID, placenta previa and accrete, women refuse to participate in the study, and intrauterine fetal death.

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Sample size:
In Uyanikoglu's study, the rate of intraabdominal adhesions in previous 4 or more CS was reported to be 58.6%. Assuming that women with two or three CS will have a 50% less rate of intraabdominal adhesions with α-error 0.05 and a β-error 0.05, a power analysis was performed and for each group we calculated that at least 80 patients would be sufficient (Odds ratio=3.4). So, the total sample size will be at least 160 patients.

The collected data was gained by direct observation and recording of the case information once admitted to the hospital till discharge.

The collected data was categorized into 3 parts:
I- Preoperative data:

This includes the patient demographic characteristics as maternal age, gravidity, parity, gestational age at presentation, types of delivery, educational level, working status, socioeconomic level, previous uterine surgery or CS. The presenting symptoms of the women as pain, bleeding, rupture of membrane, asymptomatic or others were recorded, together with the results of abdominal examination. Finally, the values of preoperative laboratory tests especially blood group, RH status, hemoglobin and haematocrit levels were registered.

Cesarean scar characteristics: (1) Abdominal scar length and width was measured with a plastic ruler preoperatively. (2) Shape of the scar: Scars was categorized as elevated, flat or depressed relative to the level of the surrounding skin. (3) Color of the scar: Scars was categorized as hyperpigmented or non-pigmented compared to the neighboring skin.

II- Intraoperative data:

This includes type of anesthesia, type of abdominal incision, any intra operative complications occurred, any associated visceral injuries, the amount of blood loss during surgery, demand for tubal ligation and the duration of surgery from skin incision till complete closure.

During surgery, intra-abdominal peritoneal adhesions were evaluated and classified according to the modified Nair scoring system **[10];**

Nair *et al.* **[10]** described their classification system as follows: Grade 0: complete absence of adhesions; Grade 1: single band of adhesion between viscera or from one viscera to the abdominal wall; Grade 2: two bands either between viscera or from viscera to the abdominal wall; Grade 3: more than two bands between viscera or from viscera to the abdominal wall, and Grade 4: multiple dense adhesions or viscera directly adherent to the abdominal wall, irrespective of number or extent of adhesive bands.

A modified Nair's scoring system was used to understand the relationship between abdominal striae, scar characteristics and the adhesion scoring system. According to this modified classification system, adhesions were classified as grade 1 or 2 if filmy intraabdominal adhesions were present and as grade 3 or 4 if dense intraabdominal adhesions were present.

III- Postoperative data:

The value of postoperative laboratory tests especially haemoglobin and hematocrit levels at 6 hours. Any postoperative complications were recorded including postpartum haemorrhage, disseminated intravascular coagulopathy, emergency hysterectomy, wound dehiscence and wound infection.

Follow up:

All surgeries were performed by a senior resident or assistant lecturer. The surgeons were asked to report the intraoperative adhesions density and locations by completing an adhesion sheet after performing the surgery. The adhesion sheet data included a description of the site and severity of adhesions are categorized into no adhesions, filmy adhesions (thin sheets of tissue similar to plastic wrap, easily separated without bleeding) and dense adhesions (adhesions of the omentum to the abdominal wall or to the uterus, peritoneum to the uterus, abdominal muscles to the uterus and frozen pelvis).

Ethical consent:

An approval of the study was obtained from Assiut University Academic and Ethical Committee. Every patient signed an informed written consent for acceptance of participation in the study. This work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Statistical analysis

Data was collected and analyzed by using SPSS (Statistical Package for Social Sciences, version 20, IBM, and Armonk, New York). The Shapiro test was used to determine compliance of the data to normal distribution. Quantitative data with normal distribution are expressed as mean ± standard deviation (SD) and compared with Student's t-test. Quantitative data with abnormal distribution expressed as median (minimum-maximum) and compared by Mann-Whitney U test was used. Nominal data are given as number (n) and percentage (%). Chi square test ($\chi 2$) or Fisher's exact test was implemented on such data. Level of confidence was kept at 95% and hence, P value was considered significant if ≤ 0.05.

RESULTS

It was found that mean age women with ≤3 CS was significantly lower in comparison to those with ≥4 CS [32.71 ± 5.03 vs. 36.35 ± 3.17 (years); p <0.001]. Only

14 (14%) women with ≤3 CS and 6 (10%) women with ≥4 CS were working with no significant difference between both groups (P-value 0.31). There was significant difference between both groups as regard socioeconomic status. Sixty five (65%), 209 (29%) and 6 (6%) women with ≤3 CS had low, moderate and high socioeconomic status, respectively. Out of women with ≥4 CS; 57 (95%) had low socioeconomic status and three women had moderate status (**Table 1**).

Table (1): Baseline data of studied women based on the number of caesarean sections

Variable	Number of cesarean section		P-value
	Three or less (n= 100)	Four or more (n= 60)	
Age (years)	32.71 ± 5.03	36.35 ± 3.17	**< 0.001**
Working	14 (14%)	6 (10%)	0.31
Socioeconomic status **Low** **Moderate** **High**	65 (65%) 29 (29%) 6 (6%)	57 (95%) 3 (5%) 0	**< 0.001**

Data expressed as frequency (percentage), mean (SD). P value was significant if ≤0.05.

There were significant differences between both groups of women as regard gravidity, parity and previous CS (P <0.001). No significant differences between both groups were observed as regard gestational age and previous vaginal delivery (P >0.05) (**Table 2**).

Table (2): Obstetric history in studied women based on the number of cesarean sections.

Variable	Number of cesarean section		P-value
	Three or less (n= 100)	Four or more (n= 60)	
Gestational age (week)	37.25 ± 5.23	37.35 ± 2.57	0.88
Gravidity	5 (2-8)	6 (5-10)	< **0.001**
Parity	3 (1-6)	5 (4-9)	< **0.001**
Previous vaginal delivery	1 (0-4)	1 (0-3)	0.17
Previous CS	2 (1-3)	4 (4-6)	< **0.001**

Data expressed as frequency (percentage), mean (SD), median (range). P value was significant if ≤0.05. CS: caesarean section.

It was found that three women in each group presented with vaginal bleeding while abdominal pain was present in 14 (14%) and 15 (25%) women of those with ≤3 CS and ≥4 CS, respectively. Majority of both groups was asymptomatic. Women with ≤3 CS had significantly higher hemoglobin level [11.91 ± 1.32 vs. 11.22 ± 1.23 (g/dl); p <0.001] and haematocrit value (34.43 ± 4.16 vs. 32.38 ± 6.47 (%); P-value 0.03) in comparison to those with ≥4 CS (**Table 3**).

Table (3): Clinical presentation and preoperative laboratory data in studied women

Variable	Number of cesarean section		P-value
	Three or less (n= 100)	Four or more (n= 60)	
Pain	14 (14%)	15 (25%)	0.06
Bleeding	3 (3%)	3 (5%)	0.40
PROM	10 (10%)	6 (10%)	0.61
Asymptomatic	74 (74%)	42 (70%)	0.35
Hemoglobin (g/dl)	11.91 ± 1.32	11.22 ±1.23	**< 0.001**
Hematocrite value (%)	34.43 ± 4.16	32.38 ± 6.47	**0.03**

Data expressed as frequency (percentage), mean (SD). P value was significant if < 0.05. PROM: premature rupture of membrane.

Flat CS was found in 62 (62%) women with ≤3 CS and 45 (75%) of those with ≥4 CS, while 38 (38%) and 15 (25%) women ≤3 CS and ≥4 CS, respectively had elevated scare. Majority (83% of women with ≤3 CS and 85% of women with ≥4 CS) of both groups had non-pigmented scare. Women with ≥4 CS had significantly higher scare length [19.50 ± 2.26 vs. 15.02 ± 2.92 (cm); p< 0.001) and scare width (4.95 ± 0.98 vs. 4.12 ± 0.83 (mm); p< 0.001] in comparison to those with ≤3 CS (**Table 4**).

Table (4): Characteristics of caesarean scar in studied women based on number of CS

Variable	Number of cesarean section		P-value
	Three or less (n= 100)	Four or more (n= 60)	
Shape **Elevated** **Flat**	38 (38%) 62 (62%)	15 (25%) 45 (75%)	0.06
Colour **Hyperpigmented** **Non-pigmented**	17 (17%) 83 (83%)	9 (15%) 51 (85%)	0.46
Length (cm)	15.02 ± 2.92	19.50 ±2.26	**< 0.001**
Width (mm)	4.12 ± 0.83	4.95 ± 0.98	**< 0.001**

Data expressed as frequency (percentage), mean (SD). P value was significant if ≤0.05.CS: caesarean section.

All patients underwent Pfanenstiel incision. Caesarean section was done under general anesthesia in only three women with ≤3CS and six women with ≥4 CS while spinal anesthesia was performed in all other women. Number of used intraoperative towels was significantly higher among those with ≥4 CS. Frequency of visceral injury was significantly lower among women with ≤3CS [3 (3%) vs. 9 (15%); p <0.001]. Women with ≥4 CS had significantly higher amount of suction [655 ± 207.83 vs. 343 ± 148.05 (ml); p< 0.001] and longer duration of operation [57.75 ± 20.51 vs. 37.40 ± 15.53 (minute); p <0.001]. Also, women with ≥4 CS had significantly higher Nair's score [2.85 ± 1.16 vs. 1.19 ± 0.19; p <0.001] and modified Nair's score. Only three women with ≥4 CS had no adhesion while 42 (42%) of those with ≤3CS had no adhesion (**Table 5**).

Table (5): Operative data among studied women based on number of cesarean section

Variable	Number of cesarean section		P-value
	Three or less (n= 100)	Four or more (n= 60)	
Type of anesthesia General Spinal	3 (3%) 97 (97%)	6 (10%) 54 (90%)	0.06
Type of incision Pfanenstiel	100 (100%)	60 (100%)	---
Visceral injury	3 (3%)	9 (15%)	**< 0.001**
Number of towels	3 (2-6)	5 (3-8)	**< 0.001**
Amount of suction (ml)	343 ± 148.05	655 ± 207.83	**< 0.001**
Duration of surgery (minute)	37.40 ± 15.53	57.75 ± 20.51	**< 0.001**
Nair's score	1.19 ± 0.19	2.85 ± 1.16	**< 0.001**
Modified Nair's score None Filmy adhesion Dense adhesion	42 (42%) 43 (43%) 15 (15%)	3 (5%) 15 (25%) 42 (70%)	**< 0.001**

Data expressed as frequency (percentage), mean (SD), median (range). P-value was significant if ≤0.05.

Both groups of women had insignificant differences as regard postoperative haemoglobin level, haematocrit value and frequency of blood transfusion. Frequency of wound infection was significantly higher among women with ≥4 CS [2 (2%) vs. 6 (10%); P-value 0.03] (**Table 6**).

Table (6): Postoperative data in studied women based on number of caesarean section.

Variable	Number of cesarean section		P-value
	Three or less (n= 100)	Four or more (n= 60)	
Hemoglobin (g/dl)	10.41 ± 1.17	10.49 ± 1.53	0.71
Hematocrite value (%)	29.23 ± 4.28	29.27 ± 5.12	0.94
Wound infection	2 (2%)	6 (10%)	**0.03**
Blood transfusion	10 (10%)	9 (15%)	0.24

Data expressed as frequency (percentage), mean (SD). P-value was significant if ≤0.05.

Neonates of women with ≤3CS had significantly higher Apgar score [8.31 ± 0.69 vs.7.80 ± 0.51; p <0.001] and estimated fetal weight [3422 ± 310.77 vs. 3180 ± 293.75 (gm); p <0.001]. Admission to NICU was significantly lower among women with ≤ 3CS [2 (2%) vs. 12 (20%); p <0.001] (**Table 7**).

Table (7): Apgar score and estimated fetal weight among studied women

Variable	Number of cesarean section		P-value
	Three or less (n= 100)	Four or more (n= 60)	
Apgar score	8.31 ± 0.69	7.80 ± 0.51	**< 0.001**
Estimated fetal weight (gm)	3422 ± 310.77	3180 ± 293.75	**< 0.001**
NICU admission	2 (2%)	12 (20%)	**< 0.001**

Data expressed as frequency (percentage), mean (SD), median (range). P-value was significant if ≤0.05. NICU: neonatal intensive care unit

DISCUSSION

The current study was designed to compare the rate of intra-abdominal adhesions in women who had four or more CSs with to women who had fewer repeated (two or three) CS. The study enrolled 160 women were scheduled for CS. Out of them; 100 women had ≤3 CS while the others had ≥4 CS. We found that mean age of those with ≥4 CS was significantly higher than the other group. Also, parity and gravidity were significantly higher in group with ≥4 CS.

Similarly, a recent study enrolled of 100 participants, 50 were of higher order (4 or more than 4 previous CS) and 50 of lower order (3 or less than 3 CS) CSs. The authors found that age of the higher order CS group was significantly higher (29.48 vs. 27.28 years) and also, this group had significantly higher parity [11]. Also, **Uyanikoglu *et al.*** [9] reported similar findings.

Also, another prospective observational study included a total of 5750 patients with prior CS who were divided into two groups; first group with previous 1-2 CSs (n=4122) and a second group with previous ≥3 CSs (n=1628). The authors found that there was no significant difference between the two groups regarding maternal body mass index, gestational age at inclusion and the presence of underlying medical disorders complicating pregnancy (P <0.05) with patients in the second group being significantly older [12].

Four hundred and fifty (450) women undergoing repeat CS studied by **Abdelazim *et al.*** [14]; 32.2% (145/450) had ≥3 previous CSs (group 1), and 67.8% (305/450) had previous one CS (group 2). The authors found no significant differences between both groups as regard baseline data including maternal age and parity. The discrepancy with our study may be secondary to different sample size and study design and grouping.

In the preoperative assessment, we found that both groups had insignificant differences as regard abdominal pain and vaginal bleeding. Women with ≤3 CS had significantly higher hemoglobin level [11.91±1.32 vs. 11.22 ±1.23 (g/dl); P <0.001] and hematocrit value [34.43 ± 4.16 vs. 32.38 ± 6.47 (%); P-value 0.03] in comparison to those with ≥4 CS. **Uyanikoglu *et al.*** [9] stated that abdominal pain and vaginal bleeding were comparable in both groups.

As regard characteristics of CS scar we found that shape and color of scar didn't significantly differ between both groups but women with ≥4 CS had significantly higher scar length [19.50 ± 2.26 vs. 15.02 ± 2.92 (cm); P <0.001] and scar width [4.95 ± 0.98 vs. 4.12 ± 0.83 (mm); P <0.001] in comparison to those with ≤3 CS. This may be anticipated secondary to frequent sections.

The current study revealed that operative data of both groups had many significant differences where Frequency of bladder injury was significantly lower among women with ≤3 CS [3 (3%) vs. 9 (15%); P <0.001]. Women with ≥4 CS had significantly higher amount of suction, longer duration of operation. Also, women with ≥4 CS had significantly higher Nair's score [2.85 ± 1.16 vs. 1.19 ± 0.19; P <0.001] and modified Nair's score [1.65 ± 0.57 vs. 0.73 ± 0.16; P <0.001].

Nisa *et al.* [14] found that all maternal complications were recorded to be significantly higher in study group (higher order) as compared to control group (lower order cesareans). The main difficulty recorded is presence of dense adhesions in almost all higher order CSs. Presence of dense adhesions is responsible for bladder (12% versus 1%) in study and control group respectively.

These results coincide with results of other studies conducted on this issue [15, 16]. In one study authors attributed increased risk of adhesions formations in higher order cesareans to individual factors rather than higher order of CS [17].

In line with the current study, **Masood *et al.*** [12] stated that patients with ≥3 CSs exhibited higher rates of longer operative time of CS more than one hour (46.6% vs 22.1%), severe intra-abdominal adhesions (50% vs 9.66%), urinary injuries (2.21% vs 1.16%), blood transfusion (10.3% vs 0.58%), peripartum hysterectomy (13.02% vs 0.19%), the need for re-operation (2.83% vs 0.15%) and longer hospital stay (14.62% vs 1.1%) compared to those with prior one or two CSs respectively.

Earlier study reported increased rates of placenta previa, placenta accreta and peripartum hysterectomy with each successive CS. Hysterectomy was required in 0.65% after the 1st, 0.42% after the 2nd, 0.90% after the 3rd 2.41% after the 4th, 3.49% after the 5th, and 8.99% after the 6th or more CSs among cohort of 30,132 women who had CS without labour in 19 academic centers over 4 years [18].

Biler *et al.* [19] concluded that the higher incidence of adhesion in multiple repeated CS group is mainly resulted from the higher total number of recurrent surgery on the abdominal wall. CSs are often associated with desiccation of peritoneal surfaces, exposure to vaginal flora and residual blood. There is no doubt that every additional CS is at least as morbid as the first one. It is also possible that adhesions are affected by the surgical technique, gentle tissue management and general health situation of the patient influence tissue healing [20].

Grobman *et al.* [21] found that even one prior cesarean delivery increases the risk of an adverse maternal outcome in the form of blood transfusion, hysterectomy, coagulopathy, venous thrombosis, pulmonary edema, and death from 15% to 23%. In addition; **Zia *et al.*** [22] concluded that women with repeat CS are at increased risk of having multiple intra-operative surgical complications which increase with each subsequent CS.

Gasim *et al.* [8] Showed that in a study of 144 cases, in patients who had had four or more CSs, complications such as abdominal adhesions, blood transfusion, placenta previa, and premature birth rate were more prevalent than in the control group; however, for placenta accreta, bladder-bowel injury, and serious complications such as cesarean

hysterectomy, there were no significant differences between the two groups.

Uyanikoglu *et al.* [9] stated no difference in complications such as gestational age at birth, bladder and intestinal injury, and serious complications such as uterine rupture and cesarean hysterectomy between our two groups. Perioperative bleeding, need for blood transfusion, necessity of maternal intensive care, and infant mortality rate were higher in the first group but this difference was not statistically significant between the groups. The complication rate was greater due to the higher number of patients with placental invasion abnormality, which may have been because their hospital is a tertiary care center.

Postoperatively, both groups of women in the current study had insignificant differences as regard postoperative hemoglobin level, hematocrit value and frequency of blood transfusion. Frequency of wound infection was significantly higher among women with ≥4 CS [2 (2%) vs. 6 (10%); P-value 0.03]. Also, Neonates of women with ≤3CS had significantly higher Apgar score and estimated fetal weight. Admission to NICU was significantly lower among women with ≤3CS [2 (2%) vs. 12 (20%); P <0.001].

Biler *et al.* [19] found that preoperative and postoperative hemoglobin levels and the incidence of blood transfusion was similar in the two groups. However, the number of blood transfusion was significantly greater in those women with 4 or more previous CSs.

Similarly, **Gasim *et al.* [8]** reported that the risk of blood transfusion increased significantly as the number of previous CSs increased. In that study, blood transfusion rates of women with 1, 2, 3, 4, and at least 5 CSs were found to be 1.8%, 2.6%, 4.3%, 4.6%, and 14.6%, respectively (P <0.001). **Silver *et al.* [18]** observed that the risk of transfusions of ≥4 units of red blood cells was associated significantly with an increased number of CSs. Major reason for excessive hemorrhage after CS was thought to be adhesions.

Masood *et al.* [12] stated that multiple repeat CSs were associated with poorer perinatal outcome in terms of higher rates of prematurity (4.18% vs 2.13%), low birth weight (6.27% vs 2.28%), low Apgar scores at 5 minutes (19.29% vs 6.98%), admission to NICU (7.13% vs 2.62%), respiratory morbidity (2.33% vs 0.24%), early onset neonatal sepsis (1.97% vs 0.15%), poor suckling (2.83% vs 0.29%) and longer stay at NICU (6.88% vs 2.52%) among patients with ≥3 CSs compared to those with one or two CSs respectively.

The main limitations of the current study included; relatively small size and we didn't perform a long-term follow up after discharge to assess long term effect repeated CSs and frequency of readmission in such cases. Also, Inability to stratify the confounding factors affecting the perinatal morbidity as well as non-inclusion of vaginal delivery group.

In conclusion, multiple CSs are associated with increased risk of intra-abdominal adhesions, bladder injury and longer operation time. Post-operative complications include wound infections and blood transfusions.

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