Evaluation of the Effect of Two Different Types of Suture Patterns on Cesarean Scar Niche Formation in Elective Primary C.S

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Abstract

Background: Cesarean scar defects (CSDs) are a common complications of cesarean sections, potentially leading to various gynecological and obstetric issues. The impact of different uterine closure techniques on CSD formation remains debated.

Aim: To evaluate the influences of uterine closure techniques (whether single layer or double layer closure) on the development of CSDs and to assess the diagnostic accuracy of ultrasound and saline infusion sonohysterography (SIS) in the detection of CSDs.

Methods: A prospective randomized study included 140 women undergoing primary cesarean section, randomly assigned to single layer (n=70) or double layer (n=70) closure groups. Transvaginal ultrasound and saline infusion sonohysterography (SIS) were performed at 3 months postoperatively to assess CSD characteristics. The primary outcomes were CSDs formation rate and characteristics (length, depth, width and residual myometrial thickness) with regard to the uterine closure pattern. Secondary outcome included the diagnostic accuracy of ultrasound and SIS in the detection of CSDs.

Results: Demographic and clinical characteristics were matched between the two studied groups. The single layer group had a significantly higher rate of CSDs formation compared to the double layer group (64.3% versus 14.3%, $p<0.001$). In terms of CSDs characteristics among single layer group compared to double layer group, CSDs were significantly wider (5.65±1.18 vs 2.45±0.71 mm, p=0.037), deeper (4.35±0.69 vs 3.55±0.74 mm, p=0.041) with thinner residual myometrium (5.87±0.96 vs 7.99±0.99 mm, p=0.030). SIS demonstrated superior diagnostic accuracy (100%) compared to ultrasound (93.83%) for CSD detection.

Conclusion: Double layer cesarean section closure technique significantly reduces CSD occurrence and results in smaller defects with thicker residual myometrium compared to single layer suturing. SIS proves to be the most accurate method for CSD diagnosis and measurement.

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These findings suggest that adopting double-layer closure and using SIS for postoperative evaluation could improve outcomes and management of cesarean scar defects.

Keywords: Cesarean section, uterine closure, cesarean scar defect, single-layer, double-layer.

Introduction

Cesarean scar defect (CSD), also called isthmocele, niche or cesarean scar dehiscence, is defined as a pouch-like indentation at the site of the cesarean scar with a depth of at least 2 mm, and diagnosed by ultrasound. The cause of a cesarean scar niche appears to be multifactorial and likely a combination of technical factors (low incision location), anatomical factors (uterine retro-flexion), and patient factors, which might impair healing (body mass index, smoking, maternal age). The development and characteristics of CSDs are influenced by various factors, including the technique used for uterine closure [1]. Most patients with cesarean scar niche are asymptomatic; however, women can present with postmenstrual bleeding, pelvic pain, and subfertility. In pregnancy, cesarean scar niches have been associated with placenta accreta spectrum disorder and uterine rupture [2].

Uterine closure techniques have evolved over the years, with the single-layer and double-layer suturing techniques being the most commonly used. The choice of suturing technique is often guided by the surgeon's preference, training, and clinical guidelines [3]. Single-layer closure is believed to reduce operation time and suture material, while double-layer closure is thought to enhance uterine strength and integrity. However, there is ongoing debate regarding the superiority of one technique over the other in terms of reducing scar defects and improving long-term outcomes [4].

The objective of the current study was to evaluate the influences of 2 uterine closure patterns (single layer or double layer) on the development of CSDs to provide evidence-based recommendations for optimal uterine closure techniques to minimize cesarean scar defects and improve patient outcomes.

Methods

A prospective randomized study was conducted at Departments of Obstetrics and Gynecology in both Menoufia University Hospital and Shebin El- Kom Teaching Hospital. The study included 140 pregnant women scheduled for elective primary cesarean section (C.S.) during the period from October 2022 to January 2024. Ethical approval was obtained from the institutional ethics committee of Faculty of Medicine, Menoufia University and informed consents were obtained from all participants.

Inclusion criteria

- Primigravida or multigravida women scheduled for elective primary C.S.
- Singleton pregnancies at term (≥37 weeks gestation)
- No previous uterine surgery.

Exclusion criteria

- Previous cesarean section or previous uterine surgery (as myomectomy)
- Known uterine malformations or fibroids.
- Emergency C.S.
- Multiple pregnancies and patients with placenta previa.

Randomization

Participants were randomly assigned into two groups using a computer-generated randomization table:

- **Group A (Single continuous unlocked layer suturing, n=70)**
- **Group B (Double continuous unlocked layer suturing, n=70)**

Preoperative evaluation

All participants were subjected to: 1- Detailed history taking. 2-Complete physical and obstetric examination. 3- Obstetric ultrasound including fetal biometry, amniotic fluid index, estimated fetal weight, biophysical profile and umbilical artery Doppler.

Surgical Procedure

All cesarean sections were performed by 2 senior obstetricians following standardized surgical protocols. After spinal anesthesia, both groups were exposed to the following surgical steps: catheterization, sterilization and toweling, Pfannenstiel abdominal incision, opening of abdominal wall in layers, opening of visceral peritoneum at uterovesical fold with blunt dissection of the plane between the uterus and bladder, transverse incision of the lower uterine segment and delivery of the baby and placenta. Thereafter, closure of the low transverse uterine incision was done (according to the group allocation) then closure of abdominal wall layers in order under good hemostasis and aseptic conditions. The same type of suture material (e.g., Vicryl 1-0) was used for both groups.

Uterine incision closure patterns

- Group A (Single continuous unlocked layer suturing, n=70): uterine incision was closed with a single continuous unlocked layer including the whole myometrial thickness with decidual involvement.
- Group B (Double continuous unlocked layer suturing, n=70): uterine incision was closed with a double continuous unlocked layer pattern. The first continuous unlocked running suture including decidua & part of myometrium and the 2nd continuous unlocked running suture including the rest of myometrium.

Trans-vaginal ultrasound and SIS evaluation

Timing: Trans-vaginal ultrasound and SIS were performed at 3months postoperatively (by experienced sonographer blinded to the group allocation) during the early follicular phase (as detection of niche and its measurements may be better evaluated in thin endometrium)

Position: Patients were in lithotomy position with complete evacuation of the urinary bladder before the imaging.

The following parameters were assessed: 1.Position of the uterus (anteverted or retroverted). 2. Niche evaluation; that includes measurement of its length, depth, width, RMT (thickness of the residual myometrium over the cesarean scar) and AMT (myometrial thickness above the uterine scar), along with documentation and measurement of the present niche's branches. RMT, length and depth of the niche were measured in the sagittal plane, while its width and branches in the transverse plane. Large niche is defined when it penetrates to a depth of at least 50%-80% of the uterine muscle or when RMT is < 2.2mm in TVUS.

Outcome Measures

The primary outcome measures were CSDs formation rate and characteristics (length, depth, width and residual myometrial thickness) with regard to the uterine closure pattern.

Secondary outcome measure included the diagnostic accuracy of ultrasound and SIS in the detection of CSDs.

Sample size estimation

Based on a previous study [5] in which rates of isthmocele development in the double-layer, far-far-near-near (FFNN) unlocked technique and a single layer continuous locked (SLL) technique were 10% and 40.2%; respectively. Total sample size calculated using statistical and sample size pro program was 60 participants divided into 2 groups each of 30 participants at 80% power and at 95% CI.

Statistical Analysis

Data analysis was performed using IBM SPSS version 28.0 for Windows. Descriptive statistics were calculated as numbers and percentages for categorical variables and mean ± standard deviation (SD) for continuous variables. Normality testing was conducted for continuous variables. For inferential statistics, the Chi-square test was used to assess associations between categorical variables, while the Mann-Whitney U test and paired sample t-test were applied to continuous variables based on normality. A p-value of less than 0.05 was considered statistically significant.

Results

One hundred fifty candidates were assessed for eligibility to participate in the current study. Ten patients were excluded (of these, 6 did not meet the inclusion criteria and 4 declined to participate). So, one hundred forty participants were available for random allocation into two equal groups (70 in single layer group and 70 in double layer group). All participants completed the trial and ready for analysis, as shown in CONSORT flow chart (Figure 1).

There were no significant differences between the two studied groups regarding the demographic and clinical characteristics. The mean age of participants in group A was 27.11 ± 4.47 years, while group B had a mean age of 25.33 ± 4.30 years (P=0.78). BMI was 25.24 ± 3.81 for group A and 28.85 ± 3.85 for group B (P=0.57). Gestational age showed no significant differences (Table 1).

The single layer group showed a significantly higher rate of CSDs formation compared to the double layer group (64.3% versus14.3%, p<0.001).Our study compared the depth and width of the scar defect, fundal myometrial thickness, and residual myometrial thickness (RMT) overlying the scar defect by ultrasound & SIS (performed 3-months postoperatively). The mean width of the defect on ultrasound was significantly greater in the group A (5.65 ± 1.18 mm) compared to group B (2.45 ± 0.71 mm) (P=0.037). Similarly, the mean depth of the defect was greater in group A (4.35 ± 0.69 mm) compared to group B (3.55 ± 0.74 mm) (P=0.041). The thickness of the residual myometrium over the cesarean scar was significantly lower in group A (5.87 ± 0.96 mm) than in group B (7.99 ± 0.99 mm) (P=0.030). Myometrial thickness over the fundus was also significantly lower in group A (8.08 ± 1.08 mm) compared to group B (11.07 ± 1.11 mm) (P=0.022). These findings were confirmed by SIS, which showed similar significant differences between the two groups for all measured variables (Table 2).

Table 3 summarizes the accuracy of SIS and ultrasound in diagnosing cesarean scar defect (CSD) formation. Ultrasound findings demonstrated an accuracy of 93.83%, with a negative predictive value (NPV) of 92.44%, a positive predictive value (PPV) of 95%, a specificity of 100%, and a sensitivity of 88.71%. In contrast, SIS findings exhibited perfect accuracy, with an NPV, PPV, specificity, and sensitivity all recorded at 100%. This indicates that SIS is highly reliable in diagnosing CSD formation, outperforming ultrasound in terms of diagnostic accuracy.

Discussion

Cesarean section is a common surgical procedure with potential complications, including CSDs. The choice of uterine closure technique can significantly impact CSD formation and characteristics [6]. Our study aimed to evaluate the influences of uterine closure techniques whether single layer or double layer closure on the development of CSDs assessed by ultrasound and saline infusion sonography performed 3 months after caesarian section and also to assess the diagnostic accuracy of ultrasound and SIS in the detection of CSDs.

Our study compared single unlocked layer

suturing with double continuous unlocked layer suturing in cesarean sections, focusing on the formation of CSDs. The current findings revealed significant differences between the two techniques in terms of CSD occurrence and characteristics. Our results showed that the double continuous unlocked layer technique was associated with significantly fewer CSDs (14.3%) compared to the single unlocked layer technique (64.3%). Ultrasound and saline infusion sonohysterography (SIS) performed at 3 months postoperatively revealed that the single layer group had wider and deeper scar defects, as well as thinner residual myometrium over the scar and fundus compared to the double layer group. These differences were statistically significant. SIS demonstrated superior accuracy (100%) in diagnosing CSDs compared to ultrasound (93.83%).

The current study found no significant differences between the groups in terms of demographic or clinical characteristics. No significant differences were observed between the two groups in terms of age, BMI, and gestational age. This demographic homogeneity strengthens the validity of our findings by reducing potential confounding factors. Similar demographic consistency has been reported in other comparative studies of uterine closure techniques, allowing for more reliable comparisons of surgical outcomes [7].

The most striking finding in the current study is the significant difference in CSD occurrence between the two groups. The single unlocked layer group had a much higher rate of defects (64.3%) compared to the double continuous unlocked layer group (14.3%). This finding aligns with several previous studies that have reported lower CSD rates with double-layer closure [3]. However, it contrasts with some studies that found no significant difference between single and double-layer closure [8].

Our findings support the hypothesis that double-layer closure provides better wound healing and reduced risk of CSD formation. The mechanism behind this could be related to improved approximation of the myometrial layers and enhanced wound strength with the double-layer technique [9].

These findings have important clinical implications. They suggest that adopting a double continuous unlocked layer suturing technique could significantly reduce the occurrence of CSDs. This could lead to improved outcomes in subsequent pregnancies and reduced long-term complications associated with CSDs.

Our study provides valuable insights into the effects of single unlocked layer suturing versus double continuous unlocked layer suturing on cesarean scar defect (CSD) characteristics. In the current investigation, the single unlocked layer group demonstrated significantly wider and deeper scar defects compared to the double continuous unlocked layer group, both on ultrasound and SIS performed at 3 months postoperatively. These findings are consistent with several previous studies that have reported larger scar defects with single-layer closure [10]. For instance, Verberkt and his colleagues [11] found that single-layer closure was associated with a higher prevalence of large dehiscence compared to double-layer closure.

The wider and deeper defects observed in the single-layer group may be explained by the reduced tissue approximation and potential for gap formation during the healing process. This aligns with the hypothesis proposed by Téot et al., [12] that double-layer closure provides better wound edge adaptation and reduces the risk of scar dehiscence.

Our study also found significantly thinner residual myometrium over the cesarean scar and reduced myometrial thickness over the fundus in the single-layer group. This is in agreement with Marchand et al., [8] who reported that double-layer closure resulted in greater residual myometrial thickness. The thicker myometrium associated with double-layer closure may contribute to improved uterine integrity and potentially reduce the

risk of uterine rupture in subsequent pregnancies [13].

The clinical implications of these findings are significant. The larger defects and thinner myometrium associated with single-layer closure may increase the risk of complications such as abnormal uterine bleeding, pelvic pain, and potential complications in future pregnancies [14]. Therefore, our results support the use of double continuous unlocked layer suturing to potentially reduce these risks.

Our study demonstrates the superior accuracy of saline infusion sonohysterography (SIS) compared to ultrasound in diagnosing CSDs. SIS showed perfect accuracy, sensitivity, and specificity (all 100%), while ultrasound, although highly accurate (93.83%), had lower sensitivity (88.71%).

These findings are consistent with several studies that have reported the superior diagnostic performance of SIS for detecting CSDs [13]. The enhanced visualization of the scar area provided by SIS allows for more precise measurement of defect dimensions and residual myometrial thickness.

Our results support the use of saline infusion sonohysterography (SIS) as the preferred method for evaluating CSDs, particularly when precise measurements are required. This aligns with the recommendations of Alalfy, et al. [15], who suggested that SIS should be considered the gold standard for CSD assessment.

The high accuracy of both methods in our study may be partly attributed to the timing of the assessment (3 months postoperatively), allowing for complete healing of the uterine incision. Some studies have suggested that earlier evaluations might lead to overestimation of defect size due to ongoing healing processes [16].

Conclusion

Double layer cesarean section closure technique significantly reduces CSD occurrence and results in smaller defects with thicker residual myometrium compared to single layer suturing. SIS proves to be the most accurate method for CSD diagnosis and measurement. These findings suggest that adopting double-layer closure and using SIS for postoperative evaluation could improve outcomes and management of cesarean scar defects.

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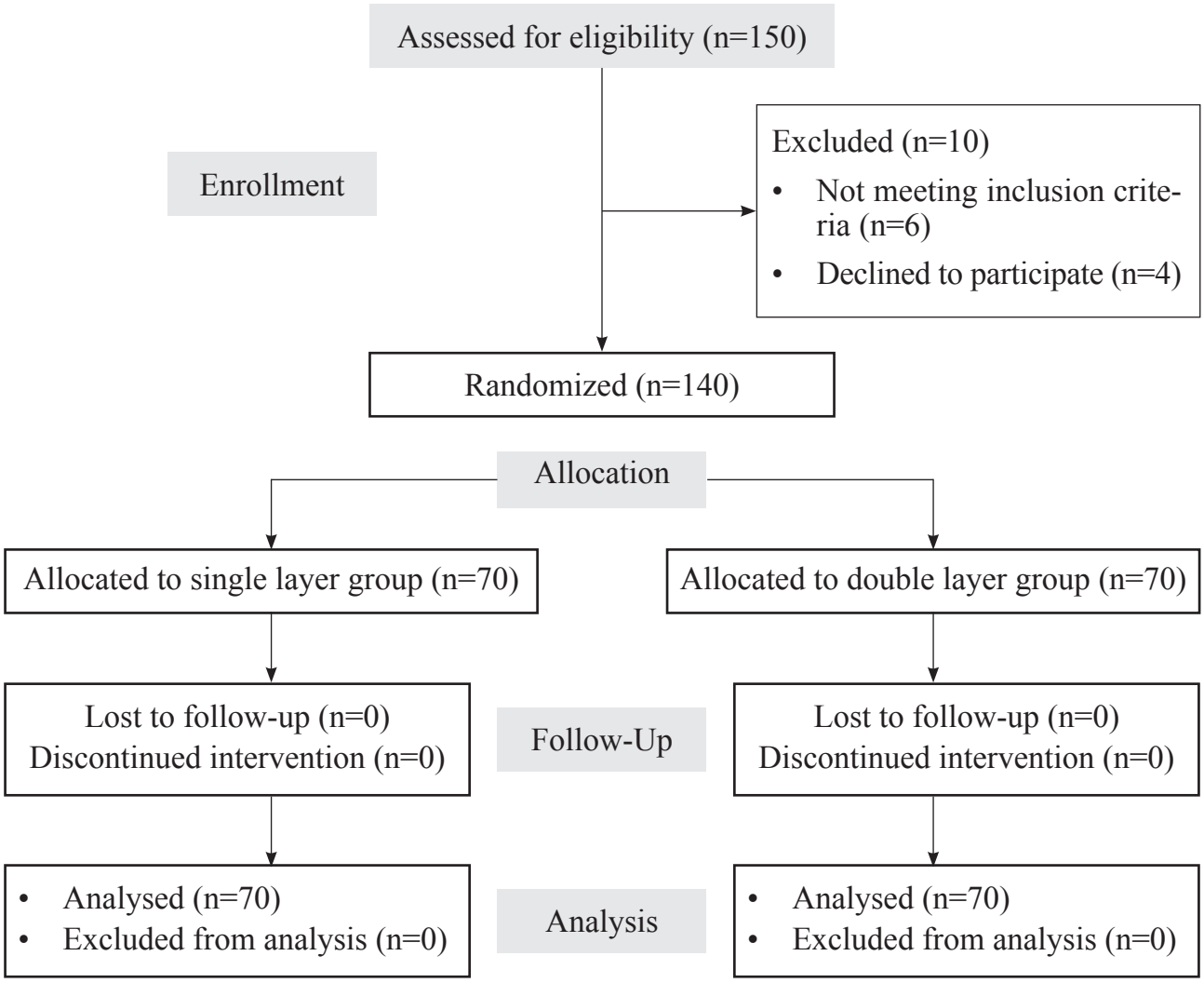

Figure (1): The CONSORT flow chart

Table (1): Demographic and clinical characteristics among the studied groups

Demographic and clinical characteristics	Uterine closure technique		Test of significance	
	Group A N=70	Group B N=70	t	P value
Age (years) Mean ± SD	27.11 ± 4.47	25.33 ± 4.30	0.28	0.78
BMI (kg/m²) Mean ± SD	25.24±3.81	28.85±3.85	0.57	0.57
Gestational age (weeks) Mean ± SD	40.87±0.86	37.81±0.88	0.336	0.74

BMI: Body mass index

Table (2): Cesarean scar defect characteristics by ultrasound & SIS (performed 3 months postoperatively)

Variables	Ultrasound findings 3 month postoperative		Test of significance		SIS findings 3 months postoperative		Test of significance	
	Group A N=70	Group B N=70	t	P value	Group A N=70	Group B N=70	t	P value
Width of the defect (mm) Mean ± SD	5.65 ±1.18	2.45 ±0.71	3.89	0.037*	5.45 ±1.20	2.63 ±1.30	2.83	**0.039***
Depth of the defect (mm) Mean ± SD	4.35 ±0.69	3.55 ±0.74	2.68	0.041*	2.95 ±0.59	3.25 ±0.62	2.10	**0.045***
Thickness of the residual myometrium over the cesarean scar (mm) Mean ± SD	5.87 ±0.96	7.99 ±0.99	3.95	0.030*	4.77 ±0.97	8.45 ±1.00	2.67	**0.040***
Myometrial thickness over the fundus (mm) Mean ± SD	8.08 ±1.08	11.07 ±1.11	5.42	0.022*	12.16 ±1.20	15.15 ±1.23	4.15	**0.012***

SIS: Saline Infusion Sonohysterography

Table (3): Accuracy of SIS and ultrasound in evaluation of cesarean scar defects

Method	Accuracy	NPV	PPV	Specificity	Sensitivity
Ultrasound findings	93.83%	92.44%	95%	100%	88.71%
SIS findings	100%	100%	100%	100%	100%

NPV: negative predictive value **PPV:** positive predictive value