Original Article

Ultrasound Evaluation of Cesarean Uterine Scar Following Single Compared to Double Layer Closure

Mohamed Kandil, Tarek Sayyed, Eman Badr and Abd Elhamid Shaheen

Department of Obstetrics and Gynecology, Faculty of Medicine, Menoufia University, Egypt

ABSTRACT

Objective: To compare residual myometrial thickness (RMT) and the size of the Cesarean scar defect after single compared to double-layer uterine closure following elective Cesarean section by Transvaginal ultrasound and saline infusion sonography.

Background: Worldwide caesarean section (CS) delivery is the most common major operation. Saline infusion Sonohystrography (SIS) has been used extensively to assess the uterine cavity in patients with suspected endometrial or intracavitary disease in which transvaginal sonography alone fails to suggest a definitive diagnosis.

Patient and Methods: A prospective, randomized clinical study was conducted in the department of obstetrics and gynecology, Menoufia University Hospital, Shebin El-kom, Egypt during September 2018 to December 2020.

Result: There was no statistically significant difference between single- and double-layer groups regarding age, gravidity, parity, height, weight, BMI and gestational age (P>0.05). Also, there was no statistically significant difference between single- and double-layer groups regarding type and indications of C.S (P>0.05). There was a statistically significant difference between single- and double-layer groups regarding width of the defect, depth of the defect, fundal myometrial thickness and RMT overlying the scar defect on ultrasound and Sonohystrography on the postoperative 6 months (P<0.05). There was high statistically significant correlation between Sonohystrography and width of the defect, depth of the defect, fundal myometrial thickness, RMT on the postoperative 6 months (P<0.001),

Conclusion: Our results suggest that single-layer closure leads to smaller RMT compared with that following double-layer closure and the difference was statistically significant, there was a statistically significant difference between single- and double-layer groups regarding width of the defect, depth of the defect, fundal myometrial thickness and RMT overlying the scar defect on both ultrasound and Sonohystrography on the postoperative 6 months. Also, there was high statistically significant correlation between Sonohystrography and width of the defect, depth of the defect, fundal myometrial thickness, RMT on the postoperative 6 months.

Key Words: Cesarean section, scar, sonohystrography, ultrasound, uterine.

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Corresponding Author: Eman Badr, Department of Obstetrics and Gynecology, Faculty of Medicine, Menoufia University, Menoufia, Egypt, **Tel.:** +20 10 9065 0463, **E-mail:** emanbadr122333@gmail.com

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INTRODUCTION

In recent decade, the percentage of Cesarean section (CS) deliveries has dramatically increased in most developed countries. Worldwide CS delivery is the most common major operation. Approximately 25% of pregnant women undergo a CS in the UK for delivery of their babies. Sepsis and post-natal infection constitute significant maternal mortality and morbidity. Infection following a CS has a number of primary sources including endometritis occurring in 7–17% of women[1].

There are some well-known complications, such as uterine rupture and pathologically adherent placenta in future pregnancy but there is now an increasing interest in the long-term effects of this procedure. Several techniques for myometrium closure have been described, including the use of interrupted, locked, and unlocked continuous sutures with single- or double-layer closure[2].

There is controversy regarding the association between the risk of uterine rupture and uterotomy closure by a single- or double-layer technique. In fact, the use of a single-layer locked suture may carry a larger risk of uterine rupture than would use of a single-layer unlocked suture, which itself may carry a higher risk than using a double-layer suture technique[3]. Instead of assessing uterine rupture as the outcome, several groups have considered the presence of a uterine scar defect or decreased thickness of the remaining myometrium (or residual myometrial thickness, RMT) after CS delivery as a marker of poor scar healing[2].

Saline infusion Sonohystrography (SIS) has been used extensively to assess the uterine cavity in patients with suspected endometrial or intracavitary disease in which transvaginal sonography alone fails to suggest a definitive diagnosis. While performing SIS, a triangular anechoic “filling defect” under the bladder recess, in the region between the uterine body and the cervix, in the

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typical location where low-transverse cesarean deliveries are performed had been observed in patients who had 1 or more cesarean deliveries[4]. Therefore, this study aims to compare RMT and the size of the Cesarean scar defect after single compared to double-layer uterine closure following elective CS by Transvaginal ultrasound and SIS.

PATIENT AND METHODS

Study Design: A prospective, randomized clinical study was conducted on Pregnant women at the department of obstetrics and gynecology, Menoufia University Hospital, Shebin El-kom, Egypt during September 2018 to December 2020.

Ethical consideration

After obtaining approval from the local ethics committee, women who agreed to participate gave their signed informed consent after explanation of the trial benefits and hazards. All procedures were carried out in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. The trial was registered with local ethics committee of the Faculty of Medicine, Menoufia University, Egypt.

Inclusion criteria

Primary cs, gestational age >37 weeks and singleton pregnancy.

Exclusion criteria

Pregnant women who declined to participate, Multiple pregnancies, Previous cesarean section, Medical disorders affecting wound healing as anemia (preoperative hemoglobin value below 10 gm/dl), and diabetic patients., History of uterine surgery e.g., hysterotomy, myomectomy.

Methods

The assessment included the following: In the transverse section. Measurement of cesarean scar width and in the sagittal section Measurement of RMT.

RMT was defined as the distance between the tip of the hypoechoic triangle and the surface of the anterior uterine wall. Thus, RMT represents the thickness of the myometrial layer at the site of hysterotomy. In cases with completely healed CS scars, only this parameter was measured.

Assessment of uterine niche by Sonohystrography: Transvaginal ultrasound examination was performed prior to SIS when the presumed site of the uterine scar was carefully inspected. SIS was then performed as described by Goldstein[5]. The following measurements were systematically recorded: the RMT, the thickness of the myometrium bordering the scar (the anterior myometrium) and the depth of the 'niche'.

Technique and procedural steps

SIS ideally should be performed early in the follicular phase of the menstrual cycle (after cessation of menstrual flow) before day 10[6]. A thin endometrium is critical so that the saline can more easily distend the uterine cavity and better accentuate endometrial pathology.

Although anesthesia or analgesia is not required for SIS, a nonsteroidal anti-inflammatory drug may be offered 30 min prior to examination to help reduce the pain of cramping. A negative pregnancy test must be obtained from the patient before SIS commences.

The patient is placed in the lithotomy position. After applying betadine to the cervix, a speculum is inserted into the vaginal introitus and the cervical os is localized and cleaned with povidone iodine solution. A Non self-retaining catheter is inserted through the cervical os and into the cervical canal, taking care to evacuate air bubbles first.

The speculum is subsequently removed. A standard transvaginal ultrasound probe is then inserted alongside the catheter. Warm sterile saline is instilled into the endometrial cavity via a 20 mL syringe attached to the catheter while the transducer is moved from side to side (cornua to cornua) in a long axis position. The amount of fluid instilled will vary depending on distention of the uterus and patient tolerance. Usually, the amount of saline instilled is 40 mL. More fluid is instilled to obtain a detailed survey of the endometrium. Ideally, all portions of the endometrium should be imaged to exclude any abnormalities.

Statistical Analysis

Our data were tabulated and analyzed statistically using MICROSOFT EXCEL 2019 and SPSS v. 21 (SPSS Inc., Chicago, IL, USA. Statistical analysis was done using descriptive and analytical tests. Descriptive includes percentage (%), mean and standard deviation. Analytical includes Chi-square ($\chi 2$), Fischer exact test, student t test, Mann-Whitney test and Pearson correlation. considering *P-value* < 0.05 statistically significant.

RESULTS

In the present study, there was no statistically significant difference between single- and double-layer groups regarding age, gravidity, parity, height, weight,

BMI and gestational age (P>0.05), (Table 1). Also, there was no statistically significant difference between single- and double-layer groups regarding type and indications of C.S (P>0.05), (Table 2).

Table 1: Comparison between the two studied groups regarding clinical characteristics

Demographic Characteristics	Layer closure		Test of significance	
	Single layer group N=63	Double layer group N=63	Independent t test	*P value*
Age (years) Mean ± SD	31.11±4.47	31.33±4.30	0.28	0.78
Gravidity Mean ± SD Range Median	3.16±1.36 1-7 3	3. 06±1.48 1-7 3	Mann– Whitney test	0.54
Parity Mean ± SD	1.70±1.03	1.52±0.10	0.97	0.34
Height Mean ± SD	165.40±3.88	165.83±3.80	0.63	0.53
Weight Mean ± SD	74.43±10.25	73.68±9.98	0.41	0.68
BMI Mean ± SD	27.24±3.81	26.85±3.85	0.57	0.57
Gestational age/Weeks Mean ± SD	39.87±0.86	39.81±0.88	0.336	0.74

BMI: body mass index

Table 2: Comparison between two studied groups regarding type and indication of cesarean section

Cesarean sections	Layer closure		Test of significance	
	Single layer group (N=63)	Double layer group (N=63)	$\chi 2$	*P value*
Type of C. S				
Emergent	37(48.1%)	40(51.9%)	0.30	0.58
Elective	26(53.1%)	23(46.9%)		
Indications for C. S				
Bad obs history	6(42.9%)	8(57.1%)		
Elderly	6(42.9%)	8(57.1%)		
Macrosomic baby	10(47.6%)	11(52.4%)		
Oligohydramnios	4(57.1%)	3(42.9%)	FET= 1.33	0.97
Post date	21(50.0%)	21(50.0%)		
PROM	12(57.1%)	9(42.9%)		
Patient request	4(57.1%)	3(42.9%)		

Furthermore, there was a statistically significant difference between single- and double-layer groups regarding width of the defect, depth of the defect, fundal myometrial thickness and residual myometrial thickness overlying the scar defect on ultrasound and Sonohystrography on the postoperative 6 months (P<0.05), (Table 3). Moreover, there was high statistically significant correlation between Sonohystrography and width of the defect, depth of the defect, fundal myometrial thickness, residual myometrial thickness on the postoperative 6 months (P<0.001), (Table 4, Figures 1,2,3,4).

Table 3: Comparison between two studied groups regarding Ultrasound findings and Sonohystrography findings postoperative 6th months

Variables	Findings postoperative 6th month		Test of significance	
	Single layer group (N=63)	Double layer group (N=63)	t	*P value*
Ultrasound findings postoperative 6 month				
Width of the defect (mm) Mean ± SD	4.46 ±1.18	2.63 ±0.71	3.89	0.037*
Depth of the defect (mm) Mean ± SD	3.66 ±0.69	2.57 ±0.74	2.68	0.041*
Thickness of the residual myometrium over the cesarean scar (mm) Mean ± SD	5.87 ±0.96	7.99 ±0.99	3.95	0.030*
Myometrial thickness over the fundus (mm) Mean ± SD	8.08 ±1.08	11.07 ±1.11	5.42	0.022*
Sonohystrography findings postoperative 6 months				
Width of the defect (mm) Mean ± SD	4.69±1.20	2.53±1.30	2.83	0.039*
Depth of the defect (mm) Mean ± SD	3.88±0.59	2.27±0.62	2.10	0.045*
Thickness of the residual myometrium over the cesarean scar (mm) Mean ± SD	5.83±0.97	7.96±1.00	2.67	0.040*
Myometrial thickness over the fundus (mm) Mean ± SD	10.16±1.20	13.15±1.23	4.15	0.012*

Table 4: Correlation between Sonohystrography and ultrasound findings postoperative 6th months

		Sonohystrography findings	
		r	*p-value*
Ultrasound findings	Width of the defect (mm)	0.99	<0.001*
	Depth of the defect (mm)	0.60	<0.001*
	Thickness of the residual myometrium over the cesarean scar (mm)	0.99	<0.001*
	Myometrial thickness over the fundus (mm)	0.98	<0.001*

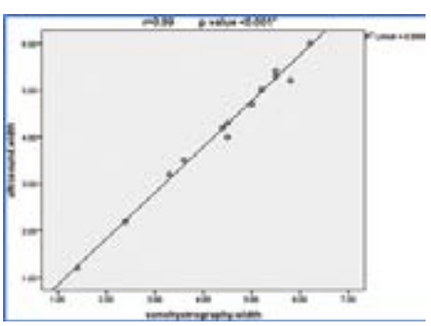

Fig. 1: Correlation between sonohystrography width and ultrasound width postoperative 6 months.

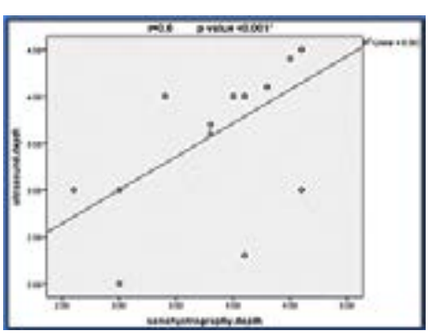

Fig. 2: Correlation between sonohystrography depth and ultrasound depth postoperative 6 months.

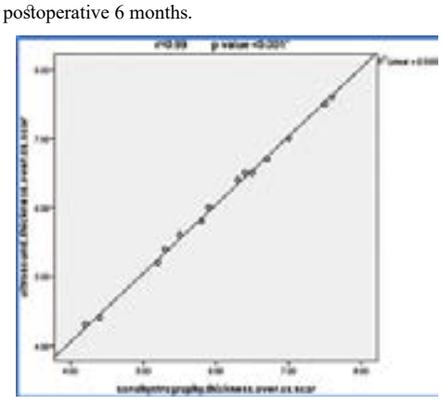

Fig. 3: Correlation between sonohystrography thickness over CS scar and ultrasound thickness over CS scar postoperative 6 months.

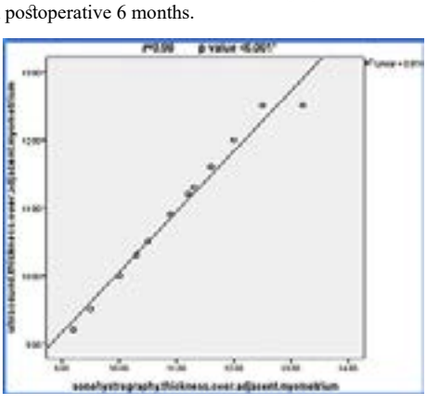

Fig. 4: Correlation between sonohystrography thickness over adjacent myometrium and ultrasound thickness over thickness over adjacent myometrium postoperative 6 months.

DISCUSSION

The current findings agreed also with Tekiner *et al*.,[7] who found no statistically significant difference in the mean weight, height, gravida, parity, tobacco use or diabetes between the two study groups ($p > 0.05$). The number of emergency cesareans was higher than elective cesareans in both groups ($p>0.05$). The indications for cesarean delivery were fetal distress in 25%, breech presentation in 17%, multiple pregnancy in 9%, cephalopelvic disproportion in 9%, failure of labour to progress in 7.5%, unsuccessful induction of labour in 7.5%, macrosomic baby in 7.5% and other reasons including maternal lumbar disc hernia, severe preeclampsia, fetal mal-formations, cord prolapse, placenta previa, and footling presentation in 17.5% of women. There was no statistically significant difference between the groups regarding indications for cesarean delivery.

In this context Bamberg *et al*.,[8] showed no significant difference between the sigle layer (locked and unlocked) and the double layer techniques regarding age, nulliparity, body mass index, gestational age, birthweight, preterm delivery and elective cesarean. On the other hand, Hamar *et al*.,[9] found the women in the one-layer group were significantly older, but there were no other significant demographic differences between groups. Also, Vachon-Marceau *et al*.,[10] no significant difference between the two groups regarding elective C.S.

The current findings showed there was a statistically significant difference between single- and double-layer groups regarding width of the defect, depth of the defect, fundal myometrial thickness and residual myometrial thickness overlying the scar defect on ultrasound on the postoperative 6 months ($P<0.05$). In this line, Sevket *et al*.,[11] found that; RMT covering the defect was 9.95±1.94 mm after a double-layer closure and 7.53±2.54 mm after a single-layer closure (p=0.005). Also, Roberge *et al*.,[12] found that compared to single-layer closure, double-layer closure with unlocked first layer was significantly associated with thicker RMT ($p<0.001$). Bamberg *et al*.,[8] reported previously that in women with an elective cesarean and in women with a primary cesarean section, the cesarean scar thickness after two-layer closure was significantly thicker than with one-layer unlocked sutures at least six months after delivery. In conflict with our results, Glavind *et al*.,[13] demonstrated that, there was no significant difference in median defect depth or width between the two groups. Also, Bennich *et al*.,[14] found that there was no difference in RMT between the two groups, both at time of discharge and after 5 months post-partum. RMT was approximately half that of the normal myometrium at both examinations. They suggested that double-layer closure of a cesarean uterine incision does not increase RMT compared with single layer closure when an unlocked technique is used. In the same line Roberge *et al*.,[12] found double-layer closure with locked first layer was not significantly different than single-layer closure in either RMT.

By only including elective cesarean cases into their study, they were able to eliminate the effects of cervical dilatation, oxytocin augmentation and duration of labour on cesarean scar healing. Even though we included both emergency and elective cases into the present study and the number of emergency cesareans was higher than elective cesareans, we did not find any difference between the two groups with respect to the length and depth of the scar defect and the residual myometral thickness over the defect.

The present study revealed there was a statistically significant difference between single- and double-layer groups regarding width of the defect, depth of the defect, fundal myometrial thickness and residual myometrial thickness overlying the scar defect on Sonohystrography on the postoperative 6 months ($P<0.05$). Another study conducted by Regnard *et al*.,[15] evaluated 33 patients with a past history of cesarean delivery using SIS. The mean duration of time between the day of SIS evaluation and delivery was 5.5 months. A niche was detected in 57.5% of patients. The mean depth of the scar defect was 4.27 ± 2.5 mm and the mean residual myometrial thickness was 6.5 ± 2.7 mm. The mean myometrial thickness in patients without a niche was 8.9 ± 2.0 mm. Also, Vikhareva Osser *et al*.,[16] revealed that, SIS was found to be more successful than ultra-sonography in demonstrating the scar defect. Furthermore, defects not observed on ultrasonography became visible when SIS was performed.

Our study found high statistically significant correlation between Sonohystrography and width of the defect, depth of the defect, fundal myometrial thickness, residual myometrial thickness on the postoperative 6 months ($P<0.001$). in this line, Rasheedy *et al*.,[17] reported TVS had 84.72% sensitivity, 100% Specificity with accuracy of 89.21% with a good agreement between SIS, and TVS regarding evaluation of CS scar formation. the mean RMT did not differ when assessed by both TVS and SIS (12.7 and 2.04 mm), while regarding the mean niche width, the mean depth and the mean residual myometrium there was very strong correlation between TVS and SIS, and the defects seems larger with SIS than they appear with TVS. In the same line Baranov *et al*.,[18] results showed that there was 96.4% agreement in detection of any scar defect by conventional TVS and SIS. Also, Roberge *et al*.,[12] in their systematic review reported that TVS and SIS were good tools to detect uterine scar defects. Moreover, Antila-Långsjö *et al*.,[19] found that the agreement between TVS and SIS was not good; half of the CS scar defect diagnosed with SIS was missed by TVS. The number and size of scar defects or the RMT may better be assessed by SIS. They found also that median niche depth was 3.0 by TVS and 3.3 by SIS with underestimation of 1.1 mm for TVS compared to SIS. While its width range between in TVS

with median 3.5 and was 4.9 by SIS, and median RMT was 3.3 and 3.7 for TVS and SIS respectively showing under estimation of RMT by 0.3 mm in TVS compared to SIS. While Vikhareva Osser *et al*.,[16] found that the width and the length of the defects and AMT were significantly larger by SIS. There was no significant difference in RMT or healing ratio between TVS, SIS for women underwent one CS.

CONCLUSION

Our results suggest that single-layer closure leads to smaller RMT compared with that following double-layer closure and the difference was statistically significant, there was a statistically significant difference between single- and double-layer groups regarding width of the defect, depth of the defect, fundal myometrial thickness and residual myometrial thickness overlying the scar defect on both ultrasound and Sonohystrography on the postoperative 6 month, there was high statistically significant correlation between Sonohystrography and width of the defect, depth of the defect, fundal myometrial thickness, residual myometrial thickness on the postoperative 6 month.

CONFLICT OF INTERESTS

There are no conflicts of interest.

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