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Original Article

Prediction of Preoperative Cesarean Scar Dehiscence by Using 2D Ultrasound in Pregnant Women with Previous Cesarean Section

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Abstract

Background: Cesarean scar dehiscence [CSD] during subsequent pregnancy is a serious complication that can lead to uterine rupture. Identifying risk factors and allowing close monitoring could help prevent such complications. Two-dimensional [2D] ultrasound is commonly used to evaluate cesarean scars, but its predictive value for CSD is unclear.

The aim of the work: To assess the accuracy of preoperative 2D transvaginal ultrasound in predicting cesarean scar dehiscence during repeat cesarean section.

Patients and Methods: Women with a history of one prior cesarean delivery and who required repeat cesarean were recruited. Transvaginal ultrasound [TAS] was performed on all women to measure the thickness of the lower uterine segment [LUS] at 36 to 40 weeks. The grade of LUS was then detected during surgery. The ultrasound measurement was correlated with intraoperative measurements.

Results: Lower uterine segment dehiscence stage 4 was discovered in 3 women [5%]. Ultrasonography thickness had a statistically significant negative correlation with the scar grade at a cutoff level of <1.550 mm. The US thickness had a sensitivity of 84.6% and specificity of 87.5% for predicting a grade 4 uterine scar.

Conclusion: Preoperative 2D transvaginal ultrasound appears to be a reliable method for predicting cesarean scar dehiscence prior to repeat cesarean delivery. This helps reduce complications.

Keywords: Dehiscence; Cesarean Section; Ultrasonography; Pregnancy.

INTRODUCTION

In the field of obstetrics, the commonest surgical procedure is the cesarean section [CS]. One of the most serious complications of the procedure is the dehiscence of the uterine scar leading to uterine rupture in the next pregnancy. This complication in addition to wound evisceration are associated with higher maternal mortality rate [12 to 30%, respectively]. The cesarean scars are usually detected by hysterosalpingograms as a n anterior pouch. Alternatively, magnetic resonance imaging or computed tomography can be used as a diagnostic method [1-3].

Uterine niche defined as uterine dimpling [2mm or more] at the CS scar site is one of CS complications that showed progressive increase due to increased rate of CS during last decades. It can be detected by ultrasound [4,5].

Several factors are proposed as significant influencers of cesarean scar healing. These include – but not limited to - suturing technique, materials of the suture, the anatomical site, and the myometrium apposition. In addition, a significant association between lower uterine segment [LUS] thickness as measured by ultrasound and the risk of cesarean scar dehiscence [CSD] [6].

The anatomical deviations in healing of the uterine scar after CS may lead to thinner uterine isthmus, with a subsequent thinner whole LUS scar in the next pregnancy. The thin scar of LUS is prone to rupture during delivery. The non-discovered thin LUS is a significant cause of recurrent dehisce of CS [7]. Pelvic pain, dysmenorrhea or post-menopausal spotting are the main symptoms indicating presence of the uterine niche. These manifestations may be related to ectopic pregnancy in CS scar [8].

The ultrasound used widely in the detection of CS scar as it is a simple, noninvasive and readily available in nearly all healthcare facilities. It is used to estimate the thickness of the lower uterine segment [LUS] or just the scars of the previous sections. Additionally, it can be used as sole diagnostic method or in associations with other modalities or clinical manifestations to predict the potentiality of uterine rupture or dehiscence in the next pregnancy [9,10].

AIM OF THE WORK

This study aimed to assess the accuracy of two-dimensional [2D] ultrasound in prediction of CS scars dehiscence in pregnant women with previous CS compared to measured lower uterine segment thickness detected intraoperatively.

PATIENTS AND METHODS

This prospective cohort study included full-term 60 pregnant women. They were recruited from the Department of Obstetrics and Gynecology, Al-Azhar University Hospitals. A written informed consent was obtained from each patient after informing her about the procedure and possible complications.

Inclusion criteria: We included full term [37-40 weeks] pregnant women with singleton pregnancy with one or more previous CS, and the ultrasound examination showed normal data for fetal structures and placental site.

Exclusion criteria: We excluded women with multiple pregnancy, or those with abnormal volume of the amniotic fluid. In addition, those with abnormal placentation [mainly placenta previa], previous classical CS, previous repair of ruptured uterus or pregnant female in the active phase of labor were excluded.

All participating women were evaluated by the full history taking [e.g., age, gravidity, parity, interval between the previous CS and current pregnancy, indications of the last CS]. The expected date was calculated from the last menstrual period and matched with ultrasound data. Then, the clinical examination was performed in a standard sequential started by general examination followed by local abdominal examination. The third step in assessment was the performance of abdominal ultrasound. Abdominal ultrasound was performed using a Voluson730 Pro [General Electric Medical Systems]. It was aimed to confirm gestational age, fetal lie and presentation, placental position and its relation to the previous CS scar. During examination, the LUS appeared as a three-layered structure [the chorioamnionitic membrane, the myometrium, and the uterovesical peritoneal reflection]. The thickness of LUS was measured from the muscularis and the mucosa of the bladder [on the outer side] to the chorioamnionitic membrane [on the inner side].

Intraoperatively [CS] the LUS was assessed according to the system developed by **Fukuda *et al*.** [11]. It categorized LUS into four grades [I, II, III and IV]. Grade I defined as a well-developed LUS. Grade II describes a thin LUS. However, the contents are not visible. Grade III when LUS was translucent permitting vision of the structures and Grade IV recognized when there was a well circumscribed defect, either dehiscence or rupture. The obtained results were compared to the data obtained by US examination and submitted to analysis.

Statistical analysis: Data collected were reviewed and coded to assure anonymity. Then all data were transferred to a software computer package used for calculation of all statistical values. The SPSS for windows, version 22 was used for this purpose. The qualitative data were presented as numbers [relative frequencies] and percentages, while quantitative data were presented by their arithmetic mean [a measure of central tendency] and the standard deviation [a measure of dispersion].

RESULTS

In the current work, patient age ranged between 19 and 40 years [the mean age was 7.70 years]. The majority of women were overweight and the mean BMI was 2.017 kg/m^2. Majority of them were p2 [41.7%] followed by P1 and P3 [33.3% and 20.0% respectively]. The gestational age ranged between 37 and 39 weeks and the interval from the last CS to the current pregnancy ranged between 1 and 10 years, the mean was 3.475 years [Table 1]. Table [2] demonstrated correlation between the LUS thickness measured by ultrasound and different patient characteristics. The correlation between LUS and parity was inverse, moderate and significant. In addition, the correlation with intraoperative scar grading was inverse, powerful and statistically significant [$r = -0.902$, $p < 0.001$]. furthermore, there was proportionately moderate and significant correlation between LUS and time interval between the last CS and the current pregnancy. Otherwise, no other significant correlation was recorded.

Comparison different intraoperative grades of LUS with the preoperative ultrasound LUS thickness revealed significant differences between grades. The lower grade had the highest value of thickness. Then, LUS thickness was progressively decreased with increased intraoperative grade. For example, the mean LUS was 2.96±0.44, 1.40±0.12, 0.74±0.11 and 0.23±0.06 mm for grades, I, II, III and IV successively [Table 3]. Building receiver operation characteristic [ROC] curve revealed that the ultrasound LUS thickness is a good predictor [area under the curve [AUC] was 0.978 of intraoperative grade 4 at the values < 1.550 mm, with sensitivity of 84.6% and specificity of 87.5% [Table 4].

Table [1]: Demographic and obstetric data of the studied patients

		No.= 60
Age [years]	Min. – Max.	19 – 40
	Mean ± SD	27.700 ± 5.218
BMI [kg/m^2]	Range	18 – 32
	Mean ± SD	25.017 ± 3.563
Parity [n,%]	P1	20 [33.3%]
	P2	25 [41.7%]
	P3	12 [20.0%]
	P4	2 [3.3%]
	P5	1 [1.7%]
Gestational age [weeks]	Min. – Max.	37 – 39
	Mean ± SD	37.583 ± 0.962
Interval from the last CS [years]	Min. – Max.	1 - 10
	Mean ± SD	3.475 ± 1.925

Table [2]: Correlation between ultrasonography thickness and other clinical data of the studied groups

	LUS Ultrasonography thickness	
	r	**p-value**
GA [weeks]	0.211	0.105
Age [years]	-0.048	0.717
Parity	-0.373	0.003*
BMI	0.010	0.940
Time interval from last CS [years]	0.342	0.007*
Intraoperative scar grade	-0.902	< 0.001*

Table [3]: Comparison between Intraoperative scar grades to ultrasound thickness of LUS

		Ultrasound LUS thickness [mm]		One way ANOVA	
		Mean ± SD	**Min. - Max**	**test**	**P-value**
Intraoperative grading	I	2.96±0.44	2.10-3.70	114.922	<0.0001
	II	1.40±0.12	1.0- 1.60		
	III	0.74±0.11	0.60-0.90		
	IV	0.23±0.06	0.20- 0.30		

Table [4]: Sensitivity, specificity and cutoff value of US thickness for prediction of grade 4 uterine scar

Measures	Values
Cutoff point	<1.550
AUC	0.978
Sensitivity	84.6%
Specificity	87.5%
95% CI	0.935-1.0

DISCUSSION

The LUS thickness is used as a measure of LUS quality of its integrity. During gestation, there is a progressive thinning of the LUS due to stretch exerted by the gestation itself. The scar tissue did not respond to gestation by the same way [the scar tissues are rigid with no tensile power]. During labor, the fetal head lead to further thinning during its descent. Presence of scarred tissue with low tensile power may lead to uterine rupture. Hence, the importance of LUS measurement before gestation and delivery [12-14].

In this study, we determined the value of transabdominal US examination of LUS in patient with full-term pregnancy with previous cesarean section and its ability to predict the risk of uterine dehiscence. The results showed that, LUS is significantly correlated with intraoperative grading of lower uterine segment thickness and the value of 1.55 mm was detected as the cutoff value below which the grade IV is highly predicted, with its higher risk of uterine rupture. Both sensitivity and specificity at this value are 84.6% and 87.5% respectively. These results reflected the importance of the transabdominal ultrasound in prediction of potential uterine dehiscence or rupture. It may be set as rule to permit or prevent vaginal trial after CS. These results are comparable to those reported by **Asakura *et al.*** [15] who reported uterine dehiscence for 9 patients [4.7%] with no uterine rupture in any patient. The LUS thickness in dehiscence was significantly lower than those without dehiscence. They calculated the LUS thickness of lower than 1.6 mm [by ROC] to be the best cut off for prediction of dehiscence. The sensitivity and specificity were 77.8% and 88.6% respectively. Of note, their sensitivity was lower than the current study and this could be related to the higher number of patients in their than the current study [186 vs 60 women, respectively].

In a meta-analysis carried out by **Swift *et al.*** [16], they were able to include 28 studies and their analysis indicated that, the US measurement of LUS was correlated with delivery outcome or LUS thickness at the repeated CS. The cut off values in different studies ranged between 1.5 and 4.05 mm [the current is 1.55 with that range]. The association between thin LUS and uterine rupture of dehiscence was reported in 4 and 27 studies, respectively. In all studies, uterine rupture was recorded for 18 cases [1.0%] and dehiscence reported in 120 patients [6.6%]. The overall sensitivity of US measurement of LUS to predict uterine dehiscence was 88.0% and specificity was 77%. The reported sensitivity in the current study is close to, while the specificity is higher than the reported values.

On the other side, **Schmitz *et al.*** [17] conducted a retrospective study for 631 pregnancies after previous CS and measured full LUS or myometrial LUS thickness for 339 women. They detected uterine defects in 28 [4.4%] of patients and the sensitivity of UL measurement of full or myometrial LUS was low at a cutoff value of 2 mm [13.6%] for myometrial LUS. However, the sensitivity was increased at a cutoff value of 1 mm [reached 75% with a 96% sensitivity]. They concluded that, the value of LUS thickness measurement by US appears to be overestimated and attributed this to different methodological factors, inconsistent protocols, inclusion of trans-abdominal and trans-vaginal US and the experience of operator. However, the retrospective nature of their study could explain the contradiction [with the high rate of bias]. In addition, they reported higher sensitivity of value <1 mm of myometrial LUS. If the other layers of LUS were added, their results become consist with literature and the current study.

More recently, **Cui and Wu** [18] reported better results for ultrasound measurement of LUS in prediction of dehiscence or rupture. The sensitivity and specificity were 100.0%, 91.8%, respectively. However, the results still agree with the current work, irrespective of the higher accuracy than the current study which may be related to the different inclusion criteria and sample size. **Alalaf *et al.*** [19] conducted a cross-sectional study for 161 women in the active phase of labor, who had one previous CS. They conducted LUS assessment by ultrasound and vaginal ultrasound by two different observers and correlated the results with the uterine defect. They found that, uterine defects were not associated with maternal characteristics [age, gestational age, body mass index, birth weight and interpregnancy interval]. They demonstrated that the LUS thickness is potentially linked to the uterine defect [AUC 0.60, p = 0.044]. myometrial thickness was also linked to the uterine defects [AUC of 0.61 and P = 0.025]. Full LUS of 2.3 mm and myometrial thickness of 1.9 mm were the best cutoff values to predict uterine defect. This can help in planning of delivery.

Interestingly, **Marchant *et al.*** [2] conducted a study to compare the value of transabdominal, transvaginal or combined approaches measurements in the prediction of uterine defects. Each of two approaches provide an acceptable AUC [0.78 and 0.88 for transabdominal and transvaginal approaches, respectively, that was increased to 0.90 with combined approaches]. Thus, the sensitivity of transabdominal was lower than transvaginal and combined approaches. They concluded that, the US approach affect the measurement of LUS thickness and the combination of two modalities seems to be superior than the single approach for detection of uterine defects.

Finally, **Eleje *et al.*** [20] answered the question is they would advocate routine antenatal uterine scar thickness emergency CS after previous emergency CS. According to their results, they reported that, it is useful to routinely assess LUS scar for women with previous emergency CS using available ultrasound facilities. However, they recommended future studies for more validation.

At the end, it is crucial to remember that the interpretation of any diagnostic test is affected by the clinical suspicion. For patients with a good scar thickness on US and a suspicious history or clinical examination, repeated ultrasound may be performed. Clinical data and experience are two important tools that can never be dispensed. It would be wise to perform a repeat CS in any patient on clinical suspicion, even if US fails to see evident scar thinning. However, applying sonographic scar thickness measurement to determine vaginal delivery after CS needs further studies.

Conclusion: The ultrasonographic measurement of the LUS thickness is helpful in prediction of scar dehiscence or uterine defect. The best timing to perform the scan is at late third trimester [37-40 weeks]. This will permit better planning during delivery or the second CS. However, and due to limitation of the small sample size, future large-scale studies are recommended. It addition, results of the current work must be treated with caution before generalization.

Disclosure

No conflict of interest or financial disclosure

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