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COMPARATIVE STUDY BETWEEN TRANSABDOMINAL AND TRANSVAGINAL SONOGRAPHY IN THE ASSESSMENT OF LOWER UTERINE SEGMENT SCAR AT TERM

By

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ABSTRACT

Background: Sonography has proven to be a useful modality to determine abnormalities related to the lower uterine segment (LUS) (such as placenta previa or weak previous cesarean section scar).

Objective: To compare the accuracy of transvaginal ultrasound versus transabdominal ultrasound in assessment the lower uterine cesarean scar thickness at term, and compare them with actual intraoperative LUS thickness.

Patients and methods: This prospective observational study included one hundred forty seven pregnant women who have history of previous scar. All cases were selected from Obstetrics and Gynecology Department at Al-Hussein Hospital, Al-Azhar University, during the period from January 2021 to July 2021.

Result: LUS thickness detected by TAS (transabdominal sonography) was significantly higher than LUS thickness detected by TVS (transvaginal sonography). LUS thickness detected by TAS was significantly higher than LUS thickness detected intraoperatively, and LUS thickness detected by TVS was significantly higher than LUS thickness detected intraoperatively.

Conclusion: The LUS scar thickness measurement was most accurate with TVS in comparison with TAS. Ultrasonography evaluation permited better assessment of the risk of intrapartum complications for patients attempting VBAC (vaginal birth after cesarean section), and could allow for safer management of delivery.

Keywords: Lower uterine segment, Transvaginal sonography, Cesarean scar thickness, Transabdominal sonography.

INTRODUCTION

Recent times have seen an alarming rise in the rates of cesarean section (CS) worldwide *(Chanrachakul et al., 2011)*. Majority of pregnant women presenting to obstetricians are with previous CS. Furthermore, previous CS itself is becoming leading indication for CS *(Jastrow et al., 2013)*.

The risk of rupture of previous CS scar is 0.2-1.5% 3 Ultrasound estimation of lower uterine segment (LUS) provides a fairly simple and non-invasive method for prediction of scar dehiscence or rupture *(American College of Obstetricians and Gynecologists, 2012)*.

The successful outcome of trial of labor in women with previous CS depends

on the scar of previous CS, which is directly related to its thickness *(Jastrow et al., 2016)*.

Evaluation of thickness of LUS has been found to be a potential factor for predicting scar dehiscence. In late pregnancy, the LUS appears sonographically as a 2-layered structure comprising the echogenic muscularis and mucosa of the bladder wall, including part of the visceral–parietal peritoneum, and the relatively hypoechoic myometrial layer. The chorioamniotic membrane and the decidualized endometrial layer cannot usually be seen separate from the myometrium *(Jastrow et al., 2013)*.

The risk of scar dehiscence or rupture has been directly related to the thinning of LUS. However, there is limited data available on comparison of measurement of LUS thickness by trans-vaginal or trans-abdominalonography *(Coleman et al., 2016)*.

The aim of the present study was to compare the accuracy of transvaginal ultrasound versus transabdominal ultrasound in assessment the lower uterine cesarean scar thickness at term and compare them with actual intraoperative LUS thickness.

PATIENTS AND METHODS

This prospective observational study included one hundred forty seven pregnant women who have history of previous scar. All cases were selected from Obstetrics and Gynecology Department at Al-Hussein Hospital, Al-Azhar University, during the period from January 2021 to July 2021.

Inclusion criteria: Previous lower segment cesarean section, singleton pregnancy, gestational age (37-40) weeks, and average amniotic fluid volume.

Exclusion criteria: Multiple pregnancies, women who had undergone other uterine surgeries such as myomectomy; previous classical cesarean (vertical midline incision of the upper segment); and previous lower segment cesarean for delivery of a premature baby, abnormal amniotic fluid volume (oligohydraminos, polyhydraminos), active labor and suspected placental abruption, accrete, previa.

Operational design: The procedure was explained to all women participating in the study and a written consent was taken from all patients before starting the study with counseling about risk and benefit of study.

Patients were subjected to:

A. Full history taking.

B. Full general examination including general for vital data, cardiological, chest, abdominal and obstetric).

C. Routine preoperative investigations: Hb%, blood group, Rh, INR, fasting blood sugar and 2 hours post prandial blood sugar, KFTs and LFTs.

D. Transabdominal ultrasound was done for routine obstetrical assessment EFW, presentation, gestational age, placental site, maturity, liquor and Doppler, measurement of the lower uterine segment thickness on partially full bladder: Examinations were performed with a transabdominal convex array transducer.

E. Transvaginal ultrasound was done post voiding by transvaginal probe which was inserted into vagina with the patient in supine position, knees gently flexed and hips elevated slightly on a pillow to allow free movement of operatoer. L.U.S thickness was measured by identification of the reflection of the bladder, then measurement taken from the mucosa of the bladder on the outer side to the chorioamniotic membrane up to one-tenth of a millimeter **(Figure 1** and **2)**.

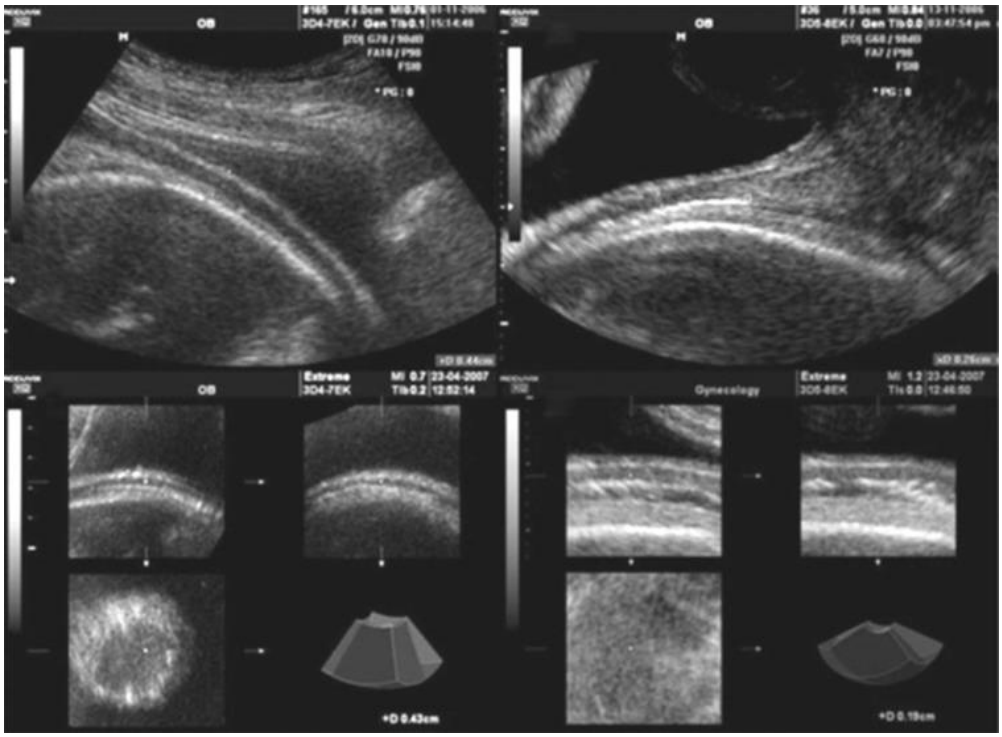

Figure (1): Measurement of the entire thickness of the lower uterine segment (LUS) by transabdominal two-dimensional (a) and three-dimensional **(c)** ultrasound and of the muscular layer of the LUS by transvaginal two-dimensional **(b)** and three-dimensional **(d)** ultrasound.

Figure (2): LUS and bladder full. Open arrow indicated the uterine wall and solid arrow indicated the bladder wall, LUS, lower uterine segment; TVS, and transvaginal ultrasound.

Ethical Consideration: Study protocol had been submitted for approval by Institution Research Board (IRB) of Faculty of Medicine Al-Azhar University. Informed verbal consent had been obtained from each participant sharing in the study. Confidentiality and personal privacy had been respected in all levels of the study.

Statistical analysis:

All statistical calculations were done using computer programs Microsoft Excel version 7 (Microsoft Corporation, NY, and USA) and SPSS version for Windows. (Statistical Package for the Social Sciences; SPSS Inc., Chicago, IL, USA). Mean, Standard deviation (± SD) and range for parametric numerical data, P value < 0.05 was considered significant. freidemen test was used to compare between more than two means (because data are more parametric), if data not significant, we use post hoc test to compare each mean with each other mean, one way ANOVA to compare each BMI, and use williams test to compare the non-parametric variables

RESULTS

The patients' age ranged 20 – 39 years with mean BMI 26.92 kg/m2. Mean GA 38.24 weeks **(Table 1)**.

Table (1): Demographic characteristics of the studied patients

Patients / Parameters	(n=147)
Maternal age (years)	
Mean ± SD	27.54 ± 4.81
Range	20 – 39
Gestational age (weeks)	
Mean ± SD	38.24 ± 1.33
Range	37 – 40
BMI (kg/m^2)	
Mean ± SD	26.92 ± 2.65
Range	22 – 32

More about 44.2% of the patients had one previous CS, about 27% of the patients had two previous CS, 19% of the patients had three previous CS and about 10% the patients had four or more previous CS. 51.7% of the patients were grade I, 41.5% of the patients were grade II, and 6.8% of the patients were grade III **(Table 2)**.

Table (2): Obstetric characteristics and LUS grades detected intraoperatively among the patients

Patients (N=147) / Number of previous CS		
	N	**%**
One previous CS	65	44.2
Two previous CS	39	26.5
Three previous CS	28	19.1
Four or more previous CS	15	10.2
Duration of last previous CS (years) Mean ± SD	3.92 ± 3.14	
Grade I	76	51.7
Grade II	61	41.5
Grade III	10	6.8

LUS thicknesses detected by TAS were significantly higher than LUS thickness detected by TVS and intraoperatively **(Table 3)**.

Table (3): LUS thickness detected by TAS compared to according to LUS thickness detected by TVS and intraoperatively

(N=147)	**TAS**	**TVS**	**Intraoperative**	**P**
LUS thickness (mm) Mean ± SD	5.86 ± 1.43	4.06 ± 1.19	3.84 ± 1.23	**>0.00**

There was a significant difference between the groups regarding BMI, parity and number of previous CS **(Table 4)**.

Table (4): Demographic and clinical characteristics of the groups according to grades detected intraoperatively

Grades / Parameters	Grade I (n=76)	Grade II (n=61)	Grade III (n=10)	P
Age (years) Mean ± SD	28.22 ± 4.11	27.33 ± 4.91	28.56 ± 4.31	0.453
BMI (kg/m^2) Mean ± SD	27.73 ± 3.69	29.12 ± 3.39	30.8 ± 3.84	**0.010**
Gravidity Mean ± SD	3.74 ± 1.12	3.81 ± 1.19	4.2 ± 1.92	0.529
Parity Mean ± SD	2.46 ± 0.724	2.78 ± 0.708	2.84 ± 0.758	**0.023**
Previous CS No. Mean ± SD	1.76 ± 0.925	2.13 ± 0.998	2.24 ± 1.14	**0.044**
GA (weeks) Mean ± SD	37.73 ± 0.927	37.92 ± 0.877	37.8 ± 0.926	0.477

DISCUSSION

Patients' age ranged 20 – 39 years with mean 27.54 ± 4.81 years and mean BMI 26.92 kg/m2. Mean GA 38.24 weeks. Our results were in agreement with study of *Maarouf et al. (2018)* as they reported that the mean age of studied group was 26 years, the mean gestational age was 38.38±0.75 weeks at time of measurements. The mean BMI was 26.4 kg/m2. Furthermore, in the study of *Kalyankar et al. (2021)*, the total numbers of cases included in their study were 211. The mean age was 25.60 years with ± 3.67 years of standard deviation.

The present study showed that about 44.2% of the patients had one previous CS, about 27% of the patients had two previous CS, 19% of the patients had three previous CS, and about 10% the patients had four or more previous CS. *Moustafa et al. (2020)* illustrated that most of the studied cases had only one previous section (54%). *Mutlaq and Hamad (2021)*, reported that in their study group, 36 (60%) patients had one cesarean delivery, 17 (28.3%) had two cesarean deliveries and 7 (11.7%) had three cesarean deliveries.

The current study showed as regard LUS grades that 51.7% of the patients were grade I, 41.5% of the patients were grade II, and 6.8% of the patients were grade III. Our results were in line with study of *Abosrie and Farag (2015)* as they reported that the numbers of the patients had one previous CS (42.9%) and with two previous CS (31.4%) and with intraoperative LUS grade I (50%), intraoperative LUS grade II of LUS (44.3%), intraoperative grade of III LUS (5.7%) according to *Qureshi et al. (2010)*.

In the study of *Moustafa et al.(2020)* 10, 88% of the cases had intact scar thickness (3–9mm), and 12% of the cases had uterine dehiscence with scar thickness less than 3mm, without any case of complete uterine rupture intraoperatively at the time of delivery.

In the study in our hands, LUS thickness detected by TAS was significantly higher than LUS thickness detected by TVS. LUS thickness detected by TAS was significantly higher than LUS thickness detected intraoperatively. LUS thickness detected by TVS was significantly higher than LUS thickness detected intraoperatively. Our results were supported by study of *Moustafa et al. (2020)* as they reported that comparing the mean thickness of CS scar by TAS, there was a statistically significant difference between the two measurements. The mean thickness of CS scar by TAS compared with obtained by TVS at 38 weeks, there was a statistically significant difference between the two measurements. Comparing the actual mean thickness with mean thickness by TAS, which was considered statistically insignificant. Comparing the actual mean thickness with mean thickness by TVS was considered statistically insignificant. Therefore, TVS was more accurate than TAS when comparing both to intraoperative LUS thickness.

In the study of *Gad et al. (2015)*, the mean thickness of the LUS measured by TAS in those who had a previous cesarean section was 2.49 ± 0.39 mm, whereas the mean thickness of the LUS measured by TVS was 2.34 ± 0.39 mm in the same group. The mean thickness of LUS measured by TAS in those who never had any cesarean section was 5.19 ± 0.81 mm, whereas the mean thickness of LUS measured by TVS was 5.1 ± 0.930 mm. The two sonographic measurements were compared with the actual measurement during the cesarean section delivery and the mean thickness of the LUS was 2.19 ± 0.39 and 5.11 ± 0.91 mm, respectively; this means that the measurement near the actual obtained from TVS.

According to *Maarouf et al. (2018)*, in all the study cases, when the mean thickness of lower uterine segment obtained by TAS was compared to that obtained by TVS then each of them was compared to the mean actual thickness and that is considered statistically significant. By comparing the mean actual thickness to mean thickness and that is considered statistically highly significant. So, TVS was more accurate than TAS when comparing both to intraoperative LUS thickness.

Mutlaq and Hamad (2021), showed the comparison between the intraoperative appearances of the LUS and sonographic measurements of the LUS thickness. The intraoperative findings of the LUS were graded as described by Qureshi et al. (2010): Class I: well developed LUS. Class II: a thin LUS but uterine content not visible. Class III: translucent and uterine content visible through LUS. Class IV: well-circumscribed defect in LUS. For study group A who had cesarean delivery, the intra-operative findings were compared with the sonographic description and the measurement of the LUS and that comparison was statistically significant.

Kushtagi and Garepalli et al. (2013) carried out a study to correlate LUS thickness measured by TAS at term pregnancy with that measured manually using vernier caliper at cesarean delivery and to determine the minimum LUS thickness indicative of its integrity in women who had undergone a previous cesarean section. LUS measurement with the caliper was recorded before fetal head

delivery than after delivery as LUS would become thicker after delivery with the release of stretch factor of fetus/amniotic fluid and oxytocin. They found that ultrasonographic measurements were correlated with manual measurements of the lower flap of the LUS. Sonographically determined LUS was thinner among women with a previous cesarean delivery than those with vaginal delivery after ceserian section (VBAC). Directly measured LUS thickness before the delivery of the baby showed smaller differences among them. This difference could be because of the inclusion of the posterior wall of the bladder during ultrasonographic measurements. Some stretch of the lower uterine flap may have reduced the thickness to some extent while measuring it with calipers. They suggested that LUS thickness of at least 3 mm measured by abdominal ultrasonography before delivery at term in women with previous cesarean section is suggestive of stronger LUS, but is not a reliable safeguard for trial of labor.

The present study showed that there was a significant difference between the groups regarding BMI, parity and number of previous CS. There was no significant difference between the groups regarding birth weight and Apgar score at 1 min and 5 min.

In the study of *Abosrie and Farag (2015)*, in the uterine dehiscence group, the mean age of the women was 29.0 ± 3.5 years, mean parity was 1.0 ± 0, and the mean GA at delivery was 40.5 ± 0.7 weeks, whereas in the group with no uterine dehiscence, the mean age was 30.2 ± 3.5 years, mean parity was 1.1 ± 0.4, and the mean GA at delivery was 39.9 ± 1.7 weeks. Scar dehiscence was reported in 9/186 (4.84%) cases; six of these were found accidentally at emergency CS, two at planned repeat CS, and one after VBAC. The mean LUS thickness was significantly lower in women who had scar dehiscence compared with women with an intact scar (1.7 ± 0.7 vs. 2.6 ± 0.8 mm, respectively; the sensitivity was 77.8% and specificity was 88.6%. This may be because they measured only the muscle layer at its thinnest portion by TVS.

In a study by *Sen and Salhan et al. (2014)*, pregnant women with previous CS were included as a study group. In the study group, mean ± SD age was 25 ± 3 years, mean parity was 1.3 ± 0.5, and the mean pregnancy duration was 39.5 ± 0.9 weeks. *Sen and Salhan et al. (2014)* reported that the thickness of the LUS ranged between 1.7 and 7.3 mm (mean: 3.29 ± 1.09 mm) in the study group, whereas the mean lower segment thickness was 3.63 ± 0.64 mm in the control group. Comparing the transabdominal and transvaginal US findings in the study and the control groups, statistically significant. Thus, lower segment thickness in the study group was significantly less than that in the control group.

In the study of *Mutlaq and Hamad (2021)*, no significant difference was found between both groups regarding maternal age, parity, gestational age and cephalic presentation. However, the sonographic measurement of the lower uterine segment in the study group was significantly thinner compared to control group.

Furthermore, *Moustafa et al. (2020)* revealed the relation between the number of CS and scar dehiscence. Among studied cases with three or more CS, there was a higher significant percentage than those with only one CS.

In the study of *Kalyankar et al. (2018)*. Strong association was seen between scar thickness and scar shape, border, continuity and echogenicity.

CONCLUSION

The LUS scar thickness measurement was most accurate with TVS in comparison with TAS. Ultrasonography evaluation permited better assessment of the risk of intrapartum complications for patients attempting VBAC, and allowed safer management of delivery.

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مقارنة بين الفحص بالموجات فوق الصوتية عبر جدار البطن والفحص بالموجات فوق الصوتية عبر المهبل في تقييم سمك ندبة الجزء السفلي لجدار الرحم قرب الولادة

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خلفية البحث: أثبت التصوير بالموجات فوق الصوتية أنه طريقة مفيدة لتحديد ما إذا كانت التشوهات المتعلقة بالجزء السفلي من الرحم (مثل المشيمة المنزاحة أو ندبة الولادة القيصرية الضعيفة) موجودة.

الهدف من البحث: مقارنة دقة الموجات فوق الصوتية عبر المهبل مقابل الموجات فوق الصوتية عبر البطن في تقييم سماكة ندبة الرحم القيصرية السفلية عند المدى، ومقارنتها بسمك الجزء السفلي لجدار الرحم الفعلي أثناء العملية.

المريضات وطرق البحث: شملت هذه الدراسة الاستطلاعية مائة وسبعة وأربعون إمرأة حامل لديها تاريخ من الندبات السابقة وقد تم اختيار جميع الحالات من قسم النساء والولادة بمستشفى الحسين بجامعة الأزهر خلال الفترة من يناير 2021 إلى يوليو 2021.

نتيجة البحث: كانت سماكة الجزء السفلي من الرحم المكتشفة بواسطة التصوير فوق البطني أعلى بكثير من سماكة الجزء السفلي من الرحم التي تم الكشف عنها بواسطة التصوير فوق الصوتي عبر المهبل. وكان سمك الجزء السفلي من الرحم المكتشف بواسطة التصوير فوق البطن أعلى بكثير من سماكة الجزء السفلي من الرحم المكتشفة أثناء الجراحة، وكان سمك الجزء السفلي من الرحم الذي تم إكتشافه بواسطة التصوير فوق الصوتي عبر المهبل أعلى بكثير من سماكة الجزء السفلي من الرحم المكتشفة أثناء الجراحة.

الاستنتاج: يعتبر قياس سمك ندبة الجزء السفلي من الرحم أكثر دقة مع التصوير فوق المهبلي بالمقارنة مع التصوير فوق البطن و يسمح تقييم التصوير بالموجات

فـــوق الصـــوتية بتقيـــيم أفضـــل لخطـــر حـــدوث مضـــاعفات أثنـــاء الـــولادة للمريضـــات اللاتـــى يحـــاولن الـــولادة المهبليـــة بعـــد الـــولادة القيصـــرية، ويمكـــن أن يســـمح بـــإدارة أكثـــر أمانًا للولادة.

الكلمـــات الدالـــة: الجـــزء الســـفلي مـــن الـــرحم، الموجـــات فـــوق الصـــوتية عبـــر المهبـــل، سماكة الندبة القيصرية، التصوير فوق البطن بالموجات فوق الصوتية.

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