Comparison of Transabdominal versus Transvaginal Ultrasound to Measure Thickness of the Lower Uterine Segment at Term

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Abstract: The number of women undergoing an elective cesarean delivery has increased worldwide over the past few decades ***(1).*** One of the most common indications for cesarean delivery is a previous cesarean delivery ***(2).*** Cesarean scar dehiscence is a serious complication of VBAC, with a uterine rupture rate of 0.7% and potentially lethal consequences for both mother and baby ***(3).*** Studies had showed that scar dehiscence is directly related to the sonographically-assessed thickness of the lower uterine segment (LUS) at between 37 and 40 weeks of pregnancy ***(4).*** **The aim of this study** was to compare the accuracy of transvaginal (TVS) versus transabdominal (TAS) ultrasound to assess the thickness of the lower uterine segment (LUS); to be a reliable method for assessment of strength of previous cesarean scar. **Patients and Methods:** In our study 200 pregnant women admitted for an elective cesarean delivery were enrolled. LUS thickness was measured using both TVS and TAS prior to the cesarean. The actual thickness of the LUS was measured using a sterile metal ruler after the neonate had been delivered. **Results**: 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. The thickness of the LUS measured with TAS showed a good correlation ($r=0.916$; $P<0.001$) with the actual thickness, the correlation with TVS was better ($r=0.986$; $P<0.001$). **Conclusion:** TVS is a more accurate method of assessing the thickness of the LUS compared with TAS.

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1. Introduction

The number of women undergoing an elective cesarean delivery has increased worldwide over the past few decades [1]. One of the most common indications for cesarean delivery is a previous cesarean [2]. A crucial strategy to reduce cesarean delivery rates would be to encourage more women who have had a previous cesarean delivery to attempt a vaginal birth after cesarean (VBAC).

Cesarean scar dehiscence is a serious complication of VBAC, with a uterine rupture rate of 0.7% [4] and potentially lethal consequences for both mother and baby. The outcome of VBAC depends primarily on the strength of the scar, which has been shown to be related to its thickness [5]. Sen et al. [5] showed that scar dehiscence is directly related to the sonographically-assessed thickness of the lower uterine segment (LUS) at between 37 and 40 weeks of pregnancy. Therefore, assessment of the thickness of the LUS at term has the potential to be used as a tool for predicting scar dehiscence [6].

Thickness of the LUS can be measured by either transabdominal (TAS) or transvaginal (TVS) ultrasound examination in the third trimester [6–9]. In general, image resolution, identification of layers, and the ease of measurement are better with TVS compared with TAS [10]. Hebisch et al. [11] showed that TVS provided more accurate information about the condition of the scarred LUS than magnetic resonance imaging. The main factors that limit an increased use of TVS for assessment of LUS thickness are discomfort and difficulty in performing the procedure in women at term. In addition, it requires greater expertise and has a longer learning curve [10].

Several studies have compared preoperative ultrasound measurements with visual assessment of the thickness of the LUS at cesarean delivery [12, 13]. However, none have measured the actual thickness of the LUS during the cesarean procedure. These studies have depended on visual classification of the thickness into various grades. Therefore, it is still unclear how well ultrasound measurements correlate with LUS thickness that has been measured objectively.

The aim of the study

To compare the accuracy of transvaginal (TVS) versus transabdominal (TAS) ultrasound to assess the thickness of the lower uterine segment (LUS); to be a reliable method for assessment of strength of previous

cesarean scar.

2. Material and Methods

A cross-sectional comparative study was carried out at Al khazendara general hospital, Cairo, Egypt. Two hundreds pregnant women admitted for an elective cesarean delivery over a period of 6 months, beginning in November 2017, were recruited to the study. The participants gave written informed consent and approval for the ethical aspects of the study. Inclusion criteria were history of at least previous one CS delivery, singleton pregnancy, gestational age (GA) between 36 and 39 weeks, average amniotic fluid volume and not in labor. Exclusion criteria were 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, multiple pregnancies, malpresentations, suspected placental abruption, accrete, or previa and abnormal amniotic fluid volume (oligohydramnios and polyhydramnios).

Eligible participants underwent ultrasound examinations for foetal well-being within 48 hours prior to undergoing elective cesarean, according to the Unit's protocol. Examinations were performed with a scanner consisting of a transabdominal convex array transducer with a frequency of 3.75 MHz and a transvaginal probe with a frequency of 7 MHz. All ultrasound assessments were performed using the following protocol. The examinations were performed with a partially full bladder. A clear view of the LUS was obtained in the midsagittal plane in an adequately magnified view. The thickness of the LUS was measured as a single measurement from the mucosa of the bladder on the outer side to the chorioamniotic membrane up to one-tenth of a millimetre. A previous cesarean scar site (uterine niche) was identified as a small triangular anechoic defect in the anterior wall of the uterus [7]. Measurements were obtained by both TAS and TVS and the results were not revealed to the team that performed the cesarean delivery.

At the time of surgery, the LUS was identified as the part of the uterus below the loose reflection of the vesico-uterine serosa. After delivery of the neonate, the thickness of the LUS was measured by the surgeon using a sterile metal ruler up to the nearest millimetre in the following manner. Two Green-Armytage forceps were used to hold the lower flap of the uterine defect about 2 inches apart on either side of the midline. The flat upper end of a grasping forceps was placed on the inner aspect of the LUS between the two Green-Armytage forceps to demarcate the inner surface of the LUS. A sterile ruler was placed on the lower flap of the incision at a right angle to the surface of the grasping forceps and the measurement was taken.

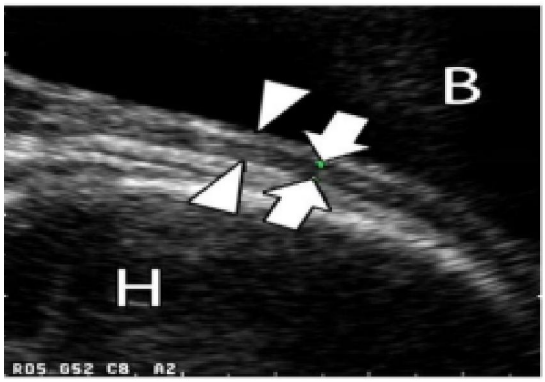

Fig.1:2D transabdominal longitudinal sonogram of the lower uterinesegment showing measurements of inner myometrial thickness (arrows) and full thickness (arrowheads). B, urinary bladder; H, fetal head.

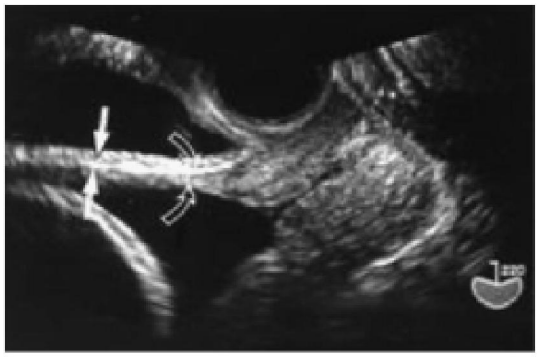

Fig. 2: TV U/S showing the LUS and bladder full. Open arrow indicates the uterine wall; solid arrow indicates the bladder wall

Statistical Analysis of data was done by using SPSS (statistical program for social science version 12) as follows:

Descriptionof quantitative variables as mean, SD and range.

Correlation coefficient test was used to rank different variables against each others.

P value >0.05 was considered statistically insignificant.

P value <0.05 was considered statistically significant.

P value <0.001 was considered statistically highly significant.

3. Results

This cross sectional study was conducted on 200 pregnant females with previous cesarean section presented to the Gynaecology and Obstetrics Department of Al-Khazendara general hospital for

repeated elective caesarean section from November 2017 to April 2018.

The main clinical features of study group are shown in the following tables and figures.

Table (1): Demographic data

	Mean	±SD	Range
Age (years)	26.0000	4.18452	19-35
Gestational age (weeks)	38.3858	0.75897	37-40
BMI	26.4031	2.02817	22.2-33.2

The mean age of studied group was 26 years, the mean gestational age was 38.38±0.75 weeks at time of measurements.

Table (2): Comparison between the TAS and TVS measurements in all the study cases:

	MEAN	SD±	RANGE	P value
TAS (mm)	6.7960	1.84534	(3.6-11)	P<0.001
TVS (mm)	4.1140	1.29851	(3-10.1)	HS

Table (3): Comparison between the actual intraoperative measurements and the TAS in all the study cases:

	MEAN	SD±	RANGE	P value
TAS (mm)	6.7960	1.84534	(3.6-11)	P<0.001
ACTUAL (mm)	3.7280	1.26734	(3-9)	HS

Table (4): Comparison between the actual intraoperative measurements and these of TVS in all the study cases:

	MEAN	SD±	RANGE	P value
TVS (mm)	4.1140	1.29851	(3-10.1)	P<0.001
ACTUAL (mm)	3.7280	1.26734	(3-9)	HS

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 P value was<0.001 and that is considered statistically highly significant. And by comparing the mean actual thickness to mean thickness by TVS the P value was<0.001and that is considered statistically highly significant.

So, TVS was more accurate than TAS when comparing both to intraoperative LUS thickness (4.11, 6.79, 3.72) respectively.

4. Discussion:

VBAC is an important strategy in curtailing the rising cesarean delivery rates. However, the percentage of women having VBAC has declined recently [14], which is most likely a result of the common belief that the risk of dehiscence or rupture of a cesarean scar cannot be reliably predicted. Studies have shown that the thickness of the LUS is directly related to this risk [5, 15]. Thickness of the LUS is also one of the factors that determine the success of a VBAC [16–18]. Since the risk of dehiscence or rupture is higher with a thin LUS [5], an objective measurement of the thickness of the LUS prior to delivery would therefore increase the safety of VBAC by helping to predict its most dangerous complication and by providing an additional element in predicting its success [18,19].

Several studies have compared the thickness of the LUS measured by ultrasound with the thickness assessed during surgery [5, 9, 20]. Cheung et al. [9] assessed the accuracy of TAS in predicting the thickness of LUS during cesarean delivery as a dichotomous categorical variable. In a similar study, Suzuki et al. [20] used presence or absence of subperitoneal separation of the uterine scar in the LUS to diagnose dehiscence. Sen et al. [5] assessed the LUS by categorizing it into 4 grades: grade I indicating a well-developed LUS and grade IV indicating a uterus with a dehisced or a ruptured scar. Although TVS has been known to produce clearer images of the structures of the female pelvis with proven benefits over TAS [21, 22], these have not been compared in the context of a previous cesarean.

In the present study the mean thickness of the LUS measured by TAS at 37-40 weeks in all study cases was 6.7960 ±1.845 mm whereas mean thickness of the LUS measured by TVS was 4.1140± 1.298 the two sonographic measurement was compared to the actual measurement during the CS delivery and

measurement of the mean thickness of the LUS was 3.7280 ± 1.267 mm, the means that the measurement near the actual obtained from TVS.

Rozenberg et al. [23] demonstrated a sensitivity of 88.0% and specificity of 73.2% in detecting defective scars with a cut-off thickness of 3.5 mm in the LUS. Cheung [15] demonstrated a sensitivity of 88.9% and a specificity of 59.5% in predicting a paper-thin or dehisced LUS with a cut- off thickness of 1.5 mm.

Data from the present study demonstrate the superiority of TVS over TAS for the assessment of LUS thickness. Measurement of LUS thickness by TVS, if incorporated into guidelines on the management of women who have undergone a previous cesarean, could provide valuable information in planning for delivery and counseling women undergoing VBAC, by predicting its safety and success. Ithas the potential to be a useful addition to management protocols for women who have previously delivered by cesarean.

Conflict of interest

None.

Conclusion:

In this study we found that transvaginal ultrasound is more accurate in assessment of thickness of the lower uterine segment than transabdominal ultrasound.

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