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The Role of Lower Uterine Segment Thickness in Predicting Cesarean Scar Defects: Two-Dimensional Transvaginal Ultrasound Vs. Intraoperative Findings

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ABSTRACT

Background & Objective: To evaluate the risk of uterine rupture during pregnancy, researchers use two-dimensional (2D) transvaginal ultrasound to assess lower uterine segment (LUS) thickness in the third trimester of pregnancy. This study aimed to compare the thickness of the LUS provided in a 2D transvaginal ultrasound with the findings during a cesarean section (C/S) of pregnant women with a history of previous C/S.

Materials & Methods: This cross-sectional study was performed on 40 pregnant women referred to Izadi Obstetrics and Gynecology Hospital in Qom. All the women underwent transvaginal ultrasound followed by C/S within a maximum of one week later. Also, an expert gynecologist classified LUS thickness into four grades in the operation room.

Results: The mean age of women was 31.58 ± 4.56 years, and the mean thickness of the LUS was 2.17 ± 0.51 cm. Moreover, 57.5% of the women have graded I of LUS based on intraoperative findings. Results indicated that the mean thickness of the LUS measured by ultrasound significantly differed between the three grades detected by the gynecologist (P=0.04). However, there were no significant differences between maternal age, gestational age, parity, and time of last C/S among women with different LUS grades (P>0.05). Transvaginal ultrasound could be helpful in evaluating the risk of scar dehiscence and uterine rupture among women with LUS grades I and II with a history of previous C/S.

Conclusion: Transvaginal Ultrasonography, Lower Uterine Segment Thickness, Cesarean Section.

Keywords: Endometriosis, Epidemiology, Prevalence, Pregnancy

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Introduction

Cesarean section (C/S) is the most common surgery performed by obstetricians worldwide **(1, 2)**. Increased indications such as breech presentation, macrosomia, arrest of labor, cephalopelvic disproportion, multiple pregnancies, and lethal fetal conditions (e.g., low birth weight, failed labor induction, pelvic cysts, and maternal infections) lead to increase in C/S **(3-5)**. Uterine rupture due to scarring of a previous C/S is one of the most catastrophic complications that can occur during delivery. The risk of uterine rupture in vaginal birth after C/S (VBAC) is estimated to be 74 per 10,000 cases **(1, 6)**. Hence, the prediction of scar rapture could help patients in choosing the VBAC delivery. For this purpose, researchers investigated the lower uterine segment (LUS) thickness and the C/S scar for assessment of the risk of uterine rupture **(7)**. Various methods were introduced, including hysterography, sonohysterography, hysteroscopy, and sonography **(3, 7)**. Some studies have measured the entire thickness of the LUS, while others examined only the thickness of the muscular layer of the uterus **(8-10)**.

Evidence recommended the application of two-dimensional (2D) ultrasound to assess uterine scarring in the third trimester of pregnancy (11-15). Indeed, previous studies suggested that the best time to assess the thickness of the LUS is between 36 and 39 weeks of gestation (11). The stretching and thinning of the LUS can increase the risk of uterine rupture in normal delivery (14). Mutlaq and Hamad (15) revealed that by using 2D and 3D ultrasound to determine the thickness of LUS and its correlation with the intraoperative findings, the incidence of scar dehiscence is 6.67% (15). Moreover, the best cut-off for 2D and 3D transvaginal ultrasound was 2 and 1.9 mm, respectively (6). In another study, the mean thickness of the scar measured by ultrasound was 4.63 cm (15). Also, previous studies showed that if the thickness of the LUS is more than 2.5 mm, the possibility of dehiscence during labor is very low, and safe vaginal delivery can be achieved (16). However, Boutin, et al. (17) reported that the median full-thickness of the LUS was 3.6 mm (17). Therefore, the present study aimed to compare the thickness of LUS provided 2D transvaginal ultrasound with the intraoperative findings during C/S in pregnant women with a history of previous C/S.

Methods

1. Subjects

This cross-sectional study was performed on pregnant women who were referred to the Izadi Obstetrics and Gynecology Hospital, Qum city, Iran, during 2020-2022 for C/S.

2. Sample Size Calculation

Regarding previous studies (6), considering the type I error of 1% and power of 80%, the minimum sample size of 40 subjects was estimated based on the following formula:

$$n = \frac{2(Z_{1-\frac{\alpha}{2}} + Z_{1-\frac{\beta}{2}})^2 s^2}{\Delta^2}$$

3. Inclusion and Exclusion Criteria

All the subjects were selected by using the convenience sampling method. Inclusion criteria included gestational age (GA) between 36 and 39 weeks, singleton pregnancy, history of C/S in previous deliveries, the cephalic presentation of the fetus, not being in the labor phase, and unruptured membranes. Also, women with a history of amniotic disorders, placenta previa, uterine surgeries (e.g., myomectomy), and any type of uterine ruptures were excluded from the study.

4. Data Collection

At first, a complete history, including age, number of previous pregnancies, parity, menstrual cycle, history of diseases, and medications used was recorded. Then, complete obstetric examinations were performed by an expert gynecologist.

4.1. Measurement of LUS thickness with 2D-ultrasound

One week before cesarean section, all mothers underwent 2D transvaginal ultrasound by an experienced radiologist for the measurement of LUS. Briefly, the LUS of the woman with a full-filled bladder was evaluated longitudinally and transversely for obvious ruptures. The thinnest part of the LUS on the anterior wall was then measured in the midsagittal view. The image was magnified to measure the thickness, and one caliper was placed on the border between the bladder and the myometrium on one side and the other on the border between the myometrium and the chorioamniotic membrane of the amniotic fluid on the other side. All the measurements were repeated three times, and the lowest amount was recorded (15).

4.2. Intraoperative LUS Grading

All the subjects underwent C/S by an expert gynecologist. In the operation room, after the incision of the abdominal layer, the intraoperative LUS thickness was determined by the surgeon based on Qureshi, Inafuku (14) classification. Hence, LUS thickness was graded as follows: Grade I: the LUS is well-formed; Grade II: the LUS is thin, but the contents are not visible; Grade III: the LUS is transparent, and the contents are visible; Grade IV: there is an obvious pervasive disorder, detachment, and/or rupture.

4.3 Ethical Considerations

This study was approved by the Ethical Committee of Qum Medical Sciences University (approval code:). Also, informed written consent was obtained from women before the study.

5. Statistical Analysis

Data were presented as mean and standard deviation (SD) or frequency and percentages. All the analysis was performed using IBM SPSS Statistics for Windows, version 19 (IBM Corp., Armonk, N.Y., USA). One-way ANOVA and Fisher's exact tests were applied. The significance level was considered less than 0.05.

Results

The mean age of women was 31.57±4.56 years (ranged 23 to 40 years). Also, the mean GA and mean time from the last C/S were 36 weeks and 5.5 years, respectively. Based on intraoperative LUS grading, most women (57.5%) have grade I, and there were no women with grade IV (Table 1). The mean of LUS thickness based on ultrasonography was 2.17 ± 0.51 cm. As shown in Table 1, minimum and maximum LUS thickness were observed in women with Grade II and III, respectively. The results of the present study revealed that the mean thickness of LUS measured by ultrasound significantly differed between grades

determined by the gynecologist (F=3.5 and P=0.04, Table 1). The Tukey post hoc test showed that the mean LUS thickness was statistically different between grades I and II (P=0.04). However, there was no statistically significant difference in LUS thickness between either grades I and III or grades II and III (P>0.05, Table 1). Also, the ANOVA test showed that the mean age of women was not significantly different between LUS grades (F=0.73, P=0.49, Table 2). Additionally, as the showed in Table 2, there were no significant differences in mean GA, time from the last C/S, and parity between women with different grades (P>0.05).

Table 1. The mean thickness of LUS among women with different intraoperative LUS grades

Grades	n (%)	Mean	SD	P-value
I	23()	2.25	0.55	0.04
II	12()	1.8	0.4	
II	5()	2.26	0.23	

Table.2. Baseline characteristics of women based on Intraoperative LUS Grade

Variables	Grade I (n=23)	Grade II (n=12)	Grade III (n=5)	P-value
Age, y	31.3±5.08	32.7±3.62	30.±4.12	0.49
GA, Mo	36.7±1.04	37.1±1.26	37.2±0.83	0.54
Parity, n (%)				
1	11 (68.8)	3 (18.8)	2 (12.4)	0.79
2	6 (42.9)	6 (42.9)	2 (14.2)	
3	5 (56.6)	3 (33.3)	1 (11.1)	
4	1 (100)	0 (0)	0 (0)	
Last C/S, y	5.54±4.03	6.25±2.89	3.9±1.4	0.46

GA: Gestational age; Mo: Months; C/S: Cesarean section

Discussion

The present study indicated that using 2D vaginal ultrasound for measured LUS thickness was consistent with intraoperative findings and could be applied for the prediction of uterine rupture, especially scar grades I and II.

Women with a previous C/S have two options for their subsequent deliveries; VBAC delivery and elective repeat cesarean (ERC) **(4, 6)**. The benefits of VBAC include avoiding major abdominal surgery, reducing the risk of bleeding and infection, and shortening the period of postpartum recovery. Moreover, VBAC eliminates the potential risks associated with multiple C/S, e.g., hysterectomy, damage to the bladder and intestines, blood transfusions, infection, and misplaced placental positions (i.e., placenta previa and placenta accreta). A successful VBAC delivery has fewer complications than the ERC method, while a failed VBAC delivery has far more complications than the ERC **(5, 6)**.

According to the results of our study, the mean thickness of the LUS was 2.11 cm. Maged, et al. **(6)** estimated the sensitivity and specificity of 2D and 3D ultrasound for evaluating the thickness of LUS **(6)**. Indeed, the sensitivity for both 2D and 3D ultrasound was reported as 100% and the specificity as 65.7% and 87.1%, respectively **(6)**. However, due to the small sample size of the current study, we cannot determine the sensitivity and specificity of 2D ultrasonography.

Abosrie and Farag **(11)** revealed that the best cut-off value for predicting uterine scar dehiscence measured with 3D abdominal ultrasound was lower than 2.75 mm–with the highest diagnostic accuracy–with a sensitivity of 25%, specificity of 100%, the positive predictive value of 100%, and the negative predictive value of 95% **(11)**.

In addition, Vedantham, et al. **(18)** showed that transabdominal ultrasound evaluation of LUS thickness had a significant relationship with intraoperative LUS thickness during surgery. Indeed, ultrasonography assessment of the LUS can be used as a screening test to predict LUS scar dehiscence **(18)**.

A possible reason for the difference between the results of this study and our findings is that this study used abdominal ultrasound for evaluations. Bujold, et al. **(19)** showed that 3.6 mm could be considered as the cut-off thickness of LUS in women with a history of previous C/S.

In line with previous studies (17-19), our results indicated that maternal age, parity, number of previous deliveries, GA, and time of last C/S were not significantly different based on LUS grading during C/S.

Conclusion

According to our results, 2D vaginal ultrasonography could be applied to determine the risk of uterine scar dehiscent of grades I and II. However, further studies with a larger sample size are required to determine the best cut-off for the prediction of uterine rupture.

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Authors' Contribution

Each author participated in data analysis, drafting, and revising of the manuscript, and consented to assume responsibility for all aspects of this project.

Conflict of Interest

The authors declared no conflicts of interest.

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