

Sonographic Lower Uterine Segment Thickness after Prior Cesarean Section to Predict Uterine Rupture

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Abstract

Introduction: Uterine rupture occurs in many pregnancies. The risk is higher for women who plan to have a normal birth after a previous cesarean section than for those who have another cesarean section. **Objectives:** This study aimed to predict the thickness of the lower uterine segment (LUS) by comparing a 2D transvaginal ultrasound with the findings during a cesarean section (C/S) in pregnant women with a history of previous cesarean sections. **Methodology:** This cross-sectional study was done at the Department of Obstetrics and Gynaecology, at the Institute of Child and Mother Health, Bangladesh from June 2023 to May 2024. A well-structured questionnaire was used for data collection. 100 women underwent transvaginal ultrasound followed by cesarean section (C/S) within a maximum of one week later. Also, an expert gynaecologist classified LUS thickness into four grades in the operation room. **Result:** The mean age of the women in the study was 30.7 years (± 9.62), while the mean thickness of the lower uterine segment (LUS) was 2.25 cm (± 0.55). Among the participants, 43 were classified as grade I for the LUS based on intraoperative findings. The results indicated a significant difference in the mean thickness of the LUS measured by ultrasound across the three grades identified by the gynaecologist ($P = 0.04$). However, there were no significant differences in maternal age, gestational age, parity, or the time since the last cesarean section among women with different LUS grades ($P > 0.05$). Transvaginal ultrasound may be useful in assessing the risk of scar dehiscence and uterine rupture in women with LUS grades I and II who have a history of previous cesarean sections. **Conclusion:** Sonographic lower uterine segment thickness prediction is very important in the study of lower uterine segment thickness after a prior cesarean section to predict uterine rupture. 2D vaginal ultrasonography can be used to assess the risk of uterine scar dehiscence of grades I and II.

Keywords: Sonographic, lower uterine thickness, vaginal ultrasonography, cesarean section, uterine rupture, normal birth, pregnancy.

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INTRODUCTION

Cesarean section (C/S) is the most commonly performed surgery by obstetricians worldwide [1, 2]. Various indications, such as breech presentation, macrosomia, labour arrest, cephalopelvic disproportion, multiple pregnancies, and serious fetal conditions (e.g., low birth weight, failed labour induction, pelvic cysts, and maternal infections), have led to an increase in the number of C/S procedures [3-5]. One of the most severe

complications during delivery is uterine rupture, which can occur due to scarring from a previous C/S. The estimated risk of uterine rupture in vaginal birth after C/S (VBAC) is about 74 per 10,000 cases [1, 6]. Therefore, accurately predicting scar rupture can assist patients in making informed decisions regarding VBAC. To assess the risk of uterine rupture, researchers have investigated the thickness of the lower uterine segment (LUS) and the characteristics of the C/S scar [7]. The cesarean section rate in the USA was 32.0% in 2015. In 2013, the trial of

labor after cesarean section (TOLAC) rate was 20% for women with one prior cesarean and 7% for those with two or more, with success rates for vaginal birth after cesarean being 70.4% and 51.4%, respectively. The TOLAC rate has significantly decreased over the years; in California from 1983 to 1992, it was 80% for one prior cesarean, compared to lower rates today. This decline may be due to fears of complications, particularly uterine rupture, which carries risks of 0.52% for spontaneous labor, 0.77% for labor induced without prostaglandin, and 2.45% for labor induced with prostaglandin. Factors influencing rupture risk include the type of uterine closure, inter-delivery interval, and previous cesarean and vaginal deliveries. While some studies have proposed ultrasound cutoff values for measuring lower uterine segment thickness to predict rupture risk in TOLAC, methodologies vary, resulting in inconsistent recommendations [8]. Several methods have been employed for this assessment, including hystero-graphy, sonohysterography, hysteroscopy, and sonography [3, 7]. Some studies have measured the entire thickness of the LUS, while others have focused solely on the thickness of the muscular layer of the uterus [9-11]. Evidence suggests that two-dimensional (2D) ultrasound is effective for evaluating uterine scarring during the third trimester of pregnancy, with the optimal time for assessment being between 36 and 39 weeks of gestation [12-16]. The stretching and thinning of the LUS can increase the risk of uterine rupture during normal delivery [15]. A study by Mutlaq and Hamad [16] found that using both 2D and 3D ultrasound to determine the LUS thickness and its correlation with intraoperative findings showed an incidence of scar dehiscence of 6.67%. The recommended cut-off measurements for 2D and 3D transvaginal ultrasound were 2 mm and 1.9 mm, respectively [16]. Additionally, another study reported that the mean thickness of the scar measured by ultrasound was 4.63 cm [17]. Previous research indicated that if the LUS thickness exceeds 2.5 mm, the likelihood of dehiscence during labour is very low, allowing for a safe vaginal delivery. However, Boutin *et al.*, [20] reported a median full-thickness measurement of the LUS at 3.6 mm [20]. Consequently, the present study aims to compare the LUS thickness obtained through 2D transvaginal ultrasound with intraoperative findings during C/S in pregnant women with a history of previous C/S. This research seeks to predict uterine rupture through sonographic LUS thickness following a prior cesarean section. Ethical clearance and written consent were assured before the study.

Objectives

- *General objective:* The objective of this research is to study sonographic lower uterine segment thickness to predict uterine rupture.
- *Specific objective:* This study aims to predict uterine rupture by comparing a 2D transvaginal ultrasound with the findings during a cesarean section (C/S) in pregnant women with a history

of previous cesarean sections.

METHODOLOGY

In this cross-sectional study was done on 100 patients, who visited the Department of *Obstetrics and Gynaecology* at the Institute of Child and Mother Health, Bangladesh with prior cesarean section. The female population were aged between 18 and 40 and the study duration was from June 2023 to May 2024.

- *Inclusion criteria:* This study involves patients at least 18 years of age, residing in Bangladesh, and underwent transvaginal ultrasound followed by C/S within a maximum of one week later, singleton pregnancy, history of C/S in previous deliveries, the cephalic presentation of the fetus, not being in the labor phase, and unruptured membranes.
- *Exclusion criteria:* Patients aged below 18 or over 40 were excluded from this study who had no history of pregnancy, or amniotic disorders, placenta previa, uterine surgeries, and any type of uterine ruptures in current pregnancy.

Age, number of previous pregnancies, parity, menstrual cycle, history of diseases, and medications used were recorded. One week before cesarean section, all mothers underwent 2D transvaginal ultrasound by an experienced radiologist for the measurement of LUS. Patients were divided into 4 grades based on uterine contents, uterine rupture, communication between uterine cavity and abdominal cavity and development and thickness of uterine. 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. P value > 0.05 was considered significant. The ethical review committee of the Institute of Child and Mother Health, Bangladesh has approved the study. A well-informed written consent paper was signed by the patients.

RESULT

The highest mean age of women was 30.7±9.62 years [Table-1]. The mean GA and mean time from the last cesarean section were 5.5 years [Table-1]. Table-2 shows intraoperative LUS grading, where most women (43) have grade I, and there were no women with grade IV. The mean of LUS thickness based on ultrasonography was 2.25 ± 0.55 cm. The ANOVA test showed that the mean age of women was not significantly different between LUS grades (F=0.73, P=0.49, Table 1, 2). Additionally, there were no significant differences in mean GA, time from the last C/S, and parity between women with different grades (P>0.05). As shown in Table-3, minimum and maximum LUS thickness were observed in women with Grade II and III, respectively.

Table-1: Basic characteristics of the study patients

Variables	Grade I (n=43)	Grade II (n=32)	Grade III (n=25)	P-value
Age	25.3±5.08	28.±4.12	30.7±9.62	0.49
Gestational age, (month)	35.7±1.04	38.1±1.01	36.2±0.83	0.54

Table-2: Intraoperative LUS grade and parity of the study patients

Parity, n (%)	Grade I (n=43)	Grade II (n=32)	Grade III (n=25)	P-value
1	68	19	12	0.79
2	43	43	15	
3	56	33	11	
4	100	0	0	
Last C/S, y	5.64±4.03	6.25±3.89	3.9±1.5	0.46

Table-3: The mean thickness of LUS among study patients with different intraoperative LUS grades

Variables	n	Mean	SD	P-value
Grade I	43	2.25	0.55	0.04
Grade II	32	1.8	0.4	
Grade III	25	2.26	0.23	

DISCUSSION

The present study indicates that the use of 2D vaginal ultrasound to measure lower uterine segment (LUS) thickness is consistent with intraoperative findings. This method can be useful for predicting uterine rupture, particularly in cases with scar grades I and II.

Women with a previous cesarean section (C/S) have two options for their subsequent deliveries: vaginal birth after cesarean (VBAC) or elective repeat cesarean (ERC) [4, 6]. The benefits of choosing VBAC include avoiding major abdominal surgery, reducing the risks of bleeding and infection, and shortening the postpartum recovery period. Additionally, VBAC eliminates potential complications associated with multiple cesarean sections, such as hysterectomy, damage to the bladder and intestines, blood transfusions, infections, and abnormal placental positions (e.g., placenta previa and placenta accreta). While a successful VBAC delivery typically has fewer complications compared to the ERC method, a failed VBAC can result in significantly more complications than an ERC) [5, 6].

The current research findings indicate that the mean thickness of the lower uterine segment (LUS) is 2.11 cm. According to Maged *et al.*, [6], the sensitivity and specificity of both 2D and 3D ultrasound for evaluating LUS thickness are reported as follows: both techniques demonstrated a sensitivity of 100%, while the specificity was 65.7% for 2D ultrasound and 87.1% for 3D ultrasound [6]. However, due to the limited sample size of the present study, we are unable to determine the sensitivity and specificity of 2D ultrasonography. In a separate study, Abosrie and Farag [11] found that the optimal cut-off value for predicting uterine scar dehiscence using 3D abdominal ultrasound was less than 2.75 mm, which provided the highest diagnostic

accuracy. Their findings reported a sensitivity of 25%, a specificity of 100%, a positive predictive value of 100%, and a negative predictive value of 95% [11].

Studies have compared the thickness of the full lower uterine segment and myometrium with the occurrence of uterine dehiscence or rupture. In 2015, Sharma *et al.*, [18] found statistically significant correlations between the thickness of both the full thickness and myometrium with dehiscence during repeat cesarean sections. Conversely, Bujold [19] found that while lower uterine segment thickness was linked to uterine rupture and defects in the uterine scar, myometrial thickness did not show a similar association.

Additionally, Vedantham *et al.*, [20] demonstrated that the transabdominal ultrasound assessment of lower uterine segment (LUS) thickness had a significant correlation with intraoperative LUS thickness during surgery. In fact, ultrasonography can be utilized as a screening tool to predict LUS scar dehiscence [20]. One possible explanation for the discrepancy between the results of this study and our findings is that the previous study relied on abdominal ultrasound for its evaluations. Bujold *et al.*, [21] established that a thickness of 3.6 mm could be considered the cutoff for LUS in women with a history of previous cesarean sections (C/S). Consistent with these earlier studies [17, 20, 21], our current results indicated that maternal age, parity, number of previous deliveries, gestational age (GA), and the timing of the last C/S did not show significant differences based on LUS grading during C/S.

CONCLUSION

According to the current study, 2D vaginal ultrasonography can assess the risk of uterine scar

dehiscence of grades I and II, aiding in the prediction of uterine rupture after a previous cesarean section.

Limitations of the study

A limited population and longer study duration may affect the overall outcome of the study.

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Conflicts of interest: N/A

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