Comparison of lower uterine segment thickness among nulliparous pregnant women without uterine scar and pregnant women with previous cesarean section: ultrasound study

Taravat Fakheri (1)
Irandokht Alimohammadi (2)
Nazanin Farshchian (3)
Maryam Hematti (4)
Anisodowleh Nankali (1)
Farahnaz Keshavarzi (1)
Soheil Saeidiborojeni (5)

(1) Department of Obstetrics and Gynecology, College of Medicine, Kermanshah University of Medical Sciences, Kermanshah, Iran
(2)Research Committee of Students, Kermanshah University of Medical Sciences, Kermanshah, Iran
(3) Department of Radiology, College of Medicine, Kermanshah University of Medical Sciences, Kermanshah, Iran
(4) Kermanshah University of Medical Sciences, Kermanshah, Iran
(5) Science undergraduate student. Simon Faster University, Canada.

Correspondence
Anisodowleh Nankali ,
Department of Obstetrics and Gynecology, Kermanshah University of Medical Sciences, Kermanshah, Iran
Email: anis_nankali@yahoo.com

Abstract

Objective: To compare the Lower Uterine Segment (LUS) thickness among nulliparous pregnant women without uterine scar and pregnant women with previous cesarean section (CS) using trans-abdominal ultrasound in the third trimester.

Methods: Three groups were included as 20 nulliparous women (group 1), 31 pregnant women with a single previous CS, and 27 pregnant women with two or more previous CS at gestational weeks 36 to 40. LUS thickness was measured by transabdominal ultrasound. The measured thickness was compared between the three studied groups and the cut-off value was determined by Receiver Operating Characteristic (ROC) curve. Uterine dehiscence during delivery was also compared between the three groups.

Results: Mean (±SD) LUS thickness in groups 1, 2, and 3 was respectively 6.05 (±2.5), 5.33 (±1.33), and 4.49 (±1.54) mm (P= 0.01). Three patients (9.7%) in group 2 has dehiscence during CS. Mean (±SD) LUS thickness in these three patients was 4.40 (±0.36) mm. In group 3, two patients (7.4%) experienced dehiscence during CS with a mean (±SD) LUS thickness of 1.2 (±0.6) mm. Cut-off value to predict uterine dehiscence and rupture was 1.7 mm with a sensitivity of 78% and specificity of 76%

Conclusions: LUS thickness was significantly lower in pregnant mothers with previous CS and this led to dehiscence in such patients. In case of LUS thickness of < 1.7 mm, the risk of dehiscence and rupture increases.

Key words: Ultrasonography; Cesarean section; lower uterine segment; scar

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Introduction

Cesarean section (CS) has faced a growing trend worldwide. During a 25-year period (1990 to 2014), the average CS rate has grown from 6.7% to 19.1% translated to an average rise of 12.4% (1).

One of its consequences may be cesarean scar defect (CSD) (2). This may cause dysmenorrhea and post menstrual bleeding in non-pregnant uterus and uterine rupture or dehiscence during labor or cesarean operation (3). Dehiscence represents separation of low uterine segment with intact serosa in contrast to uterine rupture(4). Many investigations are conducted for early diagnosis of uterine rupture during trial of labor (TOL) by LUS thickness measurement(4-5) either by Trans abdominal or Trans vaginal Ultrasonography(5,6).

Lower uterine segment (LUS) thickness is one of the factors suggested to have prognostic value for uterine rupture during delivery in women with previous CS surgery (7). Uterine rupture, though rare, is a grave complication with significant morbidity and mortality (7). Hence, ultrasound examination of the LUS thickness in the third trimester has gained attention to predict possible uterine rupture and to implement appropriate obstetrical decisions.

Thinning of the LUS has been significantly associated with uterine scar defect at week 37 in a way that a threshold of 2.5 mm for LUS thickness was proposed as a risk factor (8). LUS is thinner in the third trimester compared to the second trimester. Ultrasound examination of LUS is a simple and non-invasive method which can provide useful information about the thickness of the LUS as well as prognostic value for uterine rupture. Integrating LUS measurement by ultrasound has been shown to result in lower risk of uterine rupture (9).

Although most studies have proposed cut-off values of about 2.5 to 3.5 mm for LUS thickness, there is controversy in the literature about the exact thickness that can be used for prognostic objectives (10).

Most previous studies have included patients with previous CS and investigated the risk of thin LUS with VBAC and uterine rupture (11, 9, 12). It should be noted that some limited studies included patients with and without history of CS (13-15). However, we think that more studies are required to precisely answer the question as to if there is a real difference regarding LUS thickness between pregnant women with and without history of CS. Therefore, we conducted the current study to compare the LUS thickness among nulliparous pregnant women without uterine scar and pregnant women with previous cesarean section using trans-abdominal ultrasound in the third trimester.

Materials and Methods

From December 2014 to Dec 2016 this cross sectional descriptive-analytic study took place in Imam Reza hospital, Kermanshah Iran. The study sample consisted of 78 pregnant women divided into three groups: 20 nulliparous women without previous CS (group 1), 27 pregnant women with a single previous CS (group 2) and 31pregnant women with two or more previous CSs (group 3). They were recruited consecutively in their 36th to 40th week of gestation when they presented for delivery or ultrasound examination to our university obstetric department.
The sample size was calculated using previous data about mean (SD) LUS thickness of 4.7 (1.2) mm and 6.6 (2) mm in patients with and without previous CS (9). Considering α=0.05, power= 90%, the estimated sample size was calculated as at least 20 subjects in each group (a total of 60 cases).

Inclusion criteria were singleton pregnancy, gestational age of 36 to 40 weeks, according to LMP cephalic presentation, and normal volume of amniotic fluid.

Exclusion criteria were multiple pregnancy, active labor, abnormal amniotic fluid volume, previous uterine rupture, placenta previa, fetal congenital malformations, and uterine surgical interventions other than CS.

Gestational age was estimated using the LMP and the first-trimester ultrasound report. LUS thickness was measured by trans-abdominal ultrasound (VINNO, G80) with a 3.5 MHz convex probe. The examinations were done with the bladder half-full (bladder extension at sagittal plane was 6 to 7 cm) and in the absence of uterine contractions. The LUS thickness was measured as the distance between myometrium-urinary bladder wall interface and myometrium-chorioamniotic membrane interface. The thickness was measured successively for three times by a board-certified radiologist and the mean value was documented as the final mean LUS thickness. The measurements were made in a perpendicular plane to the uterine body.

The gathered data (maternal age, gestational age, parity, and LUS thickness) were entered into a checklist. In addition, the patients were followed and the following variables were recorded at the time of delivery: Apgar scores at minutes 1 and 5, birth weight, and dehiscence at delivery.

Statistical analyses

The data were gathered and entered into the SPSS software for Windows (ver. 21.0). Descriptive indices such as frequency, percentage, mean and its standard deviation (±SD) were used to express data. The Kolmogorov-Smirnov test was used to determine normal distribution of continuous variables. One-way ANOVA (analysis of variance) was used to compare continuous data with normal distribution (maternal age, BMI, birth weight, and LUS thickness) and the Kruskal-Wallis for non-normally distributed variables (gestational age). In order to compare LUS thickness of

patients in groups 2 and 3 who experienced dehiscence during CS, the Student's t test was applied. Significance level was set at 0.05.

Ethics

The study protocol was approved by the Ethics Committee of our medical university. The study objectives were explained for the patients prior to participation and if agreed, written informed consent was obtained from them.

Results

A total of 78 subjects were included. There were 20 nulliparous women (25.6%) with a mean (SD) age of 26.16 (1.33) years, 31 with one previous CS (39.7%) with a mean (SD) age of 31.46 (0.96) years, and 27 subjects (34.6%) who had undergone CS at least twice and had a mean (SD) age of 32.5 (0.99) years. A significant difference existed among the groups regarding age (P< 0.001). Mean gestational age in groups 1, 2, and 3 was respectively 38, 37.26, and 37 weeks (P= 0.12).

There was no significant difference regarding mean (±SD) birth weight among the three groups (3,400 (±327.26) gr in group 1, 3,253.35 (±379.81) in group 2, and 3,247.35 (±388.25) in group 3); P= 0.3. Mean BMI values in groups 1, 2, and 3 were respectively 29.93, 29.89, and 29.25 kg/m2 (P= 0.79).

Mean (±SD) LUS thickness in groups 1, 2, and 3 was respectively 6.05 (±2.5), 5.33 (±1.33), and 4.49 (±1.54) mm (P= 0.01). Range of LUS thickness in groups 1, 2, and 3 was 1 to 11 mm, 3 to 8.5 mm, and 0.8 to 7.3 mm.

Three patients (9.7%) in group 2 has dehiscence during CS. Mean (±SD) LUS thickness in these three patients was 4.40 (±0.36) mm. In group 3, two patients (7.4%) experienced dehiscence during CS with a mean (±SD) LUS thickness of 1.2 (±0.6) mm. There was a significant difference regarding mean LUS thickness between groups 2 and 3 who experienced dehiscence (P= 0.03).

Paper-thin LUS was documented in 4 patients (12.9%) of group 2 with mean (±SD) LUS thickness of 4 (±0.81) mm. This finding was seen in more patients of group 3 (11 cases, 40.7%) with a mean (±SD) LUS thickness of 3.44 (±0.75) mm. Uterine rupture occurred in only one patient who was in group 3 whose LUS thickness was 2.5 mm. This was not observed by ultrasound and rupture was diagnosed during CS.

Ultrasound showed dehiscence in only one patient in the second group whose LUS thickness was 3 mm. However, three more patients in group 2 were diagnosed with rupture during CS with LUS thickness values of 4, 4.5, and 4.7 mm. In group 3, two patients were diagnosed to have rupture by ultrasound. LUS thicknesses of these two patients were 0.8 and 2.5 mm. These were confirmed during CS.
Cut-off value to predict uterine dehiscence and rupture was 1.7 mm with a sensitivity of 78% and specificity of 76% (Figure 1).

Discussion

Based on the obtained findings, those who had previous CS had significantly thinner LUS. This resulted in dehiscence and rupture in these patients. On the other hand, none of the nulliparous women with thicker LUS experienced dehiscence or rupture. The neonates' birth weight did not show difference among groups, so it is highly likely that dehiscence and rupture occurred due to thinner LUS. The obtained results are in agreement with some previous reports. In a study involving 106 patients with previous CS and 68 without, LUS was thinner in the first group with a mean value of 4.58 mm than in the second group (4.8 mm) (16).

Ultrasound can detect dehiscence by showing a defective area where no myometrial layer is seen (17). In this study, in patients with more than one previous CS, US findings were in agreement with findings during CS. The cut-off value we obtained here (1.7 mm) is very close to the reported value by a previous study (1.8 mm) (18). However, some studies have proposed higher values at 2.5 to 3.5 mm among patients with previous CS (11).

Although we observed dehiscence and rupture in patients with LUS thickness of more than 3 mm, one patient who experienced rupture had a LUS thickness of 2.5 mm. A previous study showed that none of the patients with LUS thickness of <3 mm experienced dehiscence or rupture (9). In a former meta-analysis of about 2,700 patients, sensitivity and specificity for cut-off values for LUS thickness to predict uterine defects was 76% and 92% for values between 0.6 and 2 mm (19).

Ultrasound is a non-invasive method to measure LUS thickness and its ability to predict dehiscence and rupture has been investigated previously (9, 10). One of the limitations in this study was that we were not able to gather all details about previous CS. Although CS per se is considered a risk factor for scar formation and thinner LUS, other factors can also have a role in LUS thickness. In a previous study, maternal age of more than 35 years, single layer uterine closure, and non-elective CS were factors to be associated with LUS thickness (12). All these factors can affect healing of the LUS after CS and influence the integrity of LUS.

Limitations

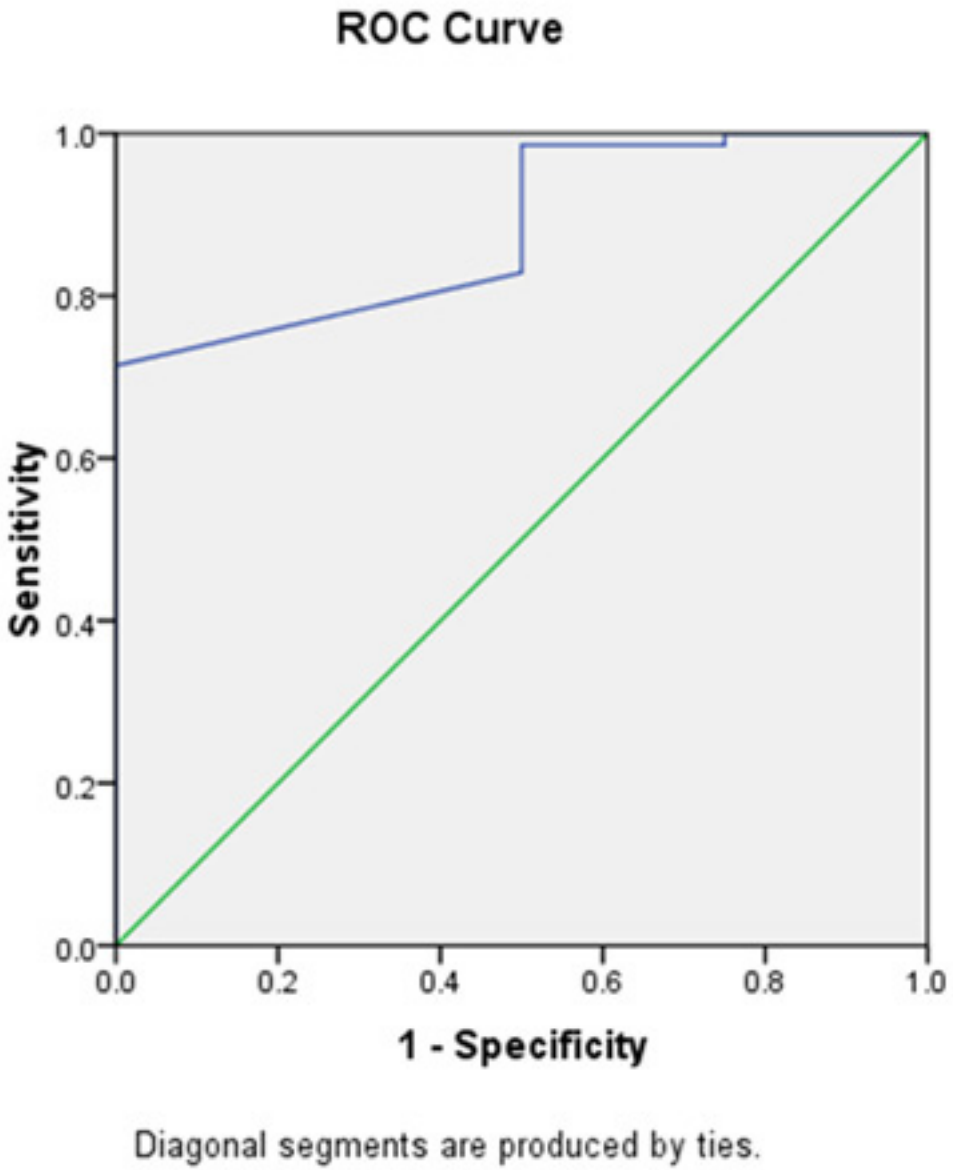
We intended to determine the effect of multiple previous CS on LUS thickness, and it was found that LUS was thinner in those with multiple CSs, however as the rate of dehiscence and rupture was a secondary objective; the sample size was not large enough to achieve a conclusion in this regard. Future studies with larger sample size can answer the question of the effect of multiple CSs. Another limitation is that we were not able to perform transvaginal ultrasound as some studies have demonstrated that transvaginal ultrasound provides better information about myometrial thickness than transabdominal ultrasound (20). However, this may not be regarded as a significant limitation as there is evidence of more than 90% correlation between trans-abdominal and transvaginal ultrasonography and a cut-off value of 2.5 mm (21).

Table 1: Apgar scores at minutes 1 and 5 in the three studied groups

	Apgar score minute 1				Apgar score minute 5			
	7	8	9	10	7	8	9	10
Group 1	1 (5%)	3 (15%)	16 (80%)	0	0	1 (5%)	3 (15%)	16 (80%)
Group 2	1 (3.2%)	3 (9.7%)	27 (87.1%)	0	0	0	4 (12.9%)	27 (87.1%)
Group 3	2 (7.4%)	3 (11.1%)	21 (77.8%)	0	0	1 (3.7%)	4 (14.8%)	21 (77.8%)

Group 1= nulliparous women without previous CS
Group 2= pregnant women with a single previous CS
Group 3= pregnant women with two or more previous CSs

Figure 1: Receiver operating curve for lower uterine segment thickness of 1.7 mm with sensitivity of 78% and specificity of 76% for predicting uterine dehiscence and rupture



Conclusion

LUS thickness was significantly lower in pregnant mothers with previous CS and this led to dehiscence in such patients. In case of LUS thickness of < 1.7 mm, the risk of dehiscence and rupture increases.

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