Sonographic Assessment of the Lower Uterine Segment (LUS) Thickness and Integrity in Patients with Previous Cesarean Delivery

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Objective: To evaluate the appearance of the LUS in patients with previous cesarean section compared to an unscarred uterus.

Design: A Prospective Study.

Setting: Maternity and Children Hospital, Arar, Saudi Arabia.

Method: The study was performed from 1 March 2018 and 31 December 2018. One hundred twenty pregnant women were recruited from the antenatal clinic. Study group consisted of 60 patients with one or more previous cesarean delivery and control group consisted of 60 patients with no history of cesarean delivery. All patients were pregnant at 36 to 38 weeks gestation.

A transabdominal ultrasound examination with a partially filled bladder followed by a transvaginal sonographic examination was performed. The obstetrician who performed the surgery documented the appearance of the LUS. Statistical analysis was performed using student t-test and Fisher exact test when appropriate. P-value<0.05 was considered significant.

Result: No significant difference was found between both groups regarding maternal age, parity, gestational age and cephalic presentation. The sonographic measurement of the LUS in study group was significantly thinner compared to control group.

A statistically significant progressive thinning of the LUS was found with the increased number of cesarean deliveries. Two (3.3%) patients were confirmed to have uterine dehiscence. Twelve (20%) were reported to have a paper-thin LUS, two (3.3%) patients had transparent LUS, and 44 (73.3%) had normal LUS thickness.

Conclusion: The lower uterine segment was thinner in women with previous cesarean delivery compared to women with unscarred uterus.

INTRODUCTION

The incidence of cesarean sections has increased over the last few decades because of the relative safety and advantages over vaginal delivery complicated pregnancies, especially in breach presentation[1,2]. However, this is associated with an increased risk of maternal mortality and morbidity, such as uterine rupture, placenta previa/accrete[1,3-4]. Trial of labor is commonly associated with uterine rupture after one or more previous cesarean section[5-7]. Studies showed that there is a direct relationship between the risk of ruptured uterus and the presence of scar defects in the LUS[7-8].

The value of sonography for LUS thickness measurements in the management of VBAC remains unclear[9]. In ultrasound, the LUS appears as a 2-layered structure that consists of the urinary bladder inward of the echogenic visceral-parietal reflection including the muscularis and mucosa of the urinary bladder (the outer layer) and the relatively hypo-echoic myometrial layer. Usually, at late gestation, the chorioamniotic membrane and the decidualized endometrial layer could not be seen as layers separate from the myometrium[7-10]. If the fetus is vertex presenting, the presenting part may be sitting against the LUS, and no amniotic fluid could be seen between these two structures. However, very little has been published on sonographic LUS measurement and the technique for measuring the LUS thickness has not been standardized.

The aim of this study was to evaluate the integrity and measurement of the thickness of the LUS in pregnant women with a previous cesarean section compared to an unscarred uterus.

METHOD

The study was performed from 1 March 2018 to 31 December 2018. One hundred twenty pregnant women were recruited from the antenatal clinic. Study group consisted of 60 patients with one or more previous cesarean delivery and control group consisted of 60 patients with no history of cesarean delivery. All patients were pregnant at 36 to 38 weeks gestation, not in labor at the time of scanning. The exclusion criteria included patients with multiple gestations, abnormal amniotic fluid volume, and patients with placenta previa.

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A transabdominal ultrasound examination with a partially filled bladder followed by transvaginal sonographic examination was performed[11]. The LUS was assessed longitudinally and transversely to exclude any dehiscence or rupture. Any balloon effect or abnormal bulging of the LUS associated with fetal movement or uterine contraction was noted behind the urinary bladder[10]. If the LUS appeared intact, an attempt would be made to identify the previous uterine scar, and the appearance was documented. The thinnest zone of the LUS was identified visually at the midsagittal plane along the cervical canal. This area was magnified to some extent that any slight movement of the caliper would produce a change in measurement by only 0.1 mm.

Two measurements were taken at the urinary bladder-myometrium interface and the myometrium chorioamniotic membrane-amniotic fluid interface in the midsagittal plane, and the lowest value was taken as the LUS thickness. LUS thickness was classified into three grades: grade 1 (less than 1 mm), grade 2 (from 1 to 2 mm), and grade 3 (more than 2 mm). All examinations were performed using Toshiba machine with 3.5 or 5.0 – MHZ 2mmconvex transducers.

During cesarean section, the obstetrician documented the appearance of the LUS as follows:[10-12]: 1) Normal thickness; 2) Paper-thin but not enough to visualize the uterine contents; 3) thin transparent lower segment; 4) Rupture.

Statistical analysis was performed with the Student t-test, x2 test, and Fisher exact test when appropriate. P-value <0.05 was considered significant.

RESULT

Two groups of patients were recruited; 60 pregnant women with previous cesarean delivery (study group) and 60 pregnant women without uterine scar (control group). In the study group, 36 (60%) patients had one cesarean delivery, 17 (28.3%) had two cesarean deliveries and 7 (11.7%) had three cesarean deliveries.

No significant difference was found between both groups regarding maternal age, parity, gestational age and cephalic presentation, see table 1. However, the sonographic measurement of the lower uterine segment in the study group was significantly thinner compared to control group (P-value < 0.05).

Table 1: Characteristics of the Study Group A and Control Group B

Characteristics	Group A (n=60)	Group B (n=60)	Mean ± SD
Maternal age (Y)	29.1 ± 5.2	31.8 ± 4.7	NS
Parity	1.8 ± 0.7	1.5 ± 0.8	NS
Gestational age (weeks)	37.8 ± 1.5	37.4 ± 1.2	NS
Cephalic presentation at Scanning	97%	95%	NS
LUS thickness (mm)	1.7 ± 0.8	3.1 ± 0.9	S

LUS = Lower Uterine Segment, NS=not significant (P-value ≥ 05), S=Significant (P-value < .05)

Table 2 shows that there was a statistically significant thinning of the LUS in study group A compared to control group B. The normal sonographic appearance of the LUS in group A was found in 54 (90%) patients and the previous uterine scar could not be identified. Abnormal appearance of LUS was found in 6 (10%) cases. LUS defect suggestive of dehiscence was defined as a defective area in the LUS with no evidence of myometrial layer, which was found in one (1.7%) patient. An area of increase echogenicity was found in three patients whereas the myometrial layer underneath appeared asymmetrically thinned out compared with the adjacent myometrium.

Table 2: Sonographic LUS Thickness Comparison between Both Groups

Sonographic Measurement of LUS	Group A (n=60)	Group B (n=60)	P-value
<1 mm n (%)	6 (10%)	0	<.05
1-2 mm n (%)	36 (60%)	18 (30%)	<.05
>2 mm n (%)	18 (30%)	42 (70%)	<.05

A statistically significant progressive thinning of the LUS was found with the increased number of cesarean deliveries, see table 3.

Table 3: LUS Thickness and Number of Previous Cesarean Section in Group A

Sonographic LUS thickness (mm)	Number of Previous CS			P-value
	One CS (n=36)	Two CS (n=17)	Three CS (n=7)	
<1 mm (n=6)	0	4 (6.7%)	2 (3.3%)	<.05
1 - 2 mm (n=36)	22 (36.7%)	10 (16.7%)	4 (6.7%)	<.05
> 2 mm (n=18)	14 (23.3%)	3 (5%)	1 (1.7%)	<.05

CS: cesarean section, P<0.05 is significant, LUS: lower uterine segment

Table 4 shows 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[13]: 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.

Two (3.3%) patients were confirmed to have uterine dehiscence. Twelve (20%) were reported to have a paper-thin LUS, two (3.3%) patients had transparent LUS, and 44 (73.3%) had normal LUS thickness.

Table 4: Intraoperative LUS Appearance Compared to Sonographic Measurements

	Sonographic LUS measurements			
LUS Appearance	<1 mm (n=7)	1-2 mm (n=34)	>2 mm (n=19)	P-value
Class I (n=44)	0	25 (41.7%)	19 (31.7%)	<0.05
Class II (n=12)	3 (5%)	9 (15%)	0	<0.05
Class III (n=2)	2 (3.3%)	0	0	<0.05
Class IV (n=2)	2 (3.3%)	0	0	<0.05

LUS=Lower Uterine Segment, P-value<0.05 is significant, **Class I**=Well developed LUS,
Class II=Thin LUS but uterine contents are not visible, **Class III**=Translucent LUS and uterine contents are visible, **Class IV** = well-circumscribed defect, either rupture or dehiscence in the lower segment

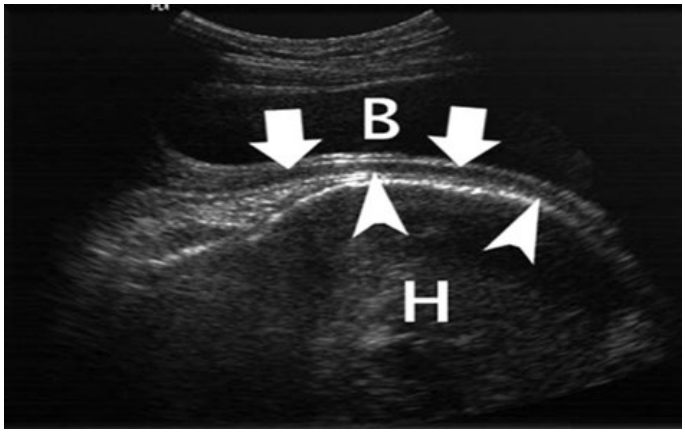

Figure 1: Transvaginal Ultrasound of the LUS from Control Patient Showing Bladder Wall-myometrium Interface (Arrows) and the Myometrium/Chorionic Membrane (Arrowheads) Indicating Symmetrical Thickness of Myometrium. B (Bladder), H (Fetal Head)

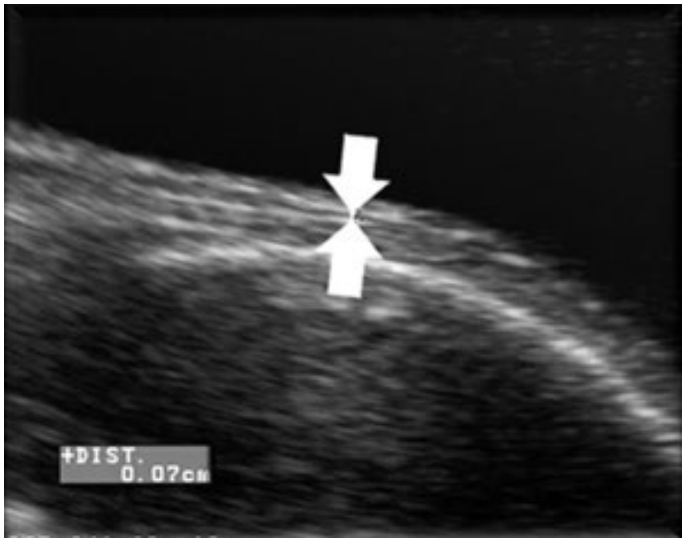

Figure 2: Ultrasound of the LUS Shows Extremely Thin Transparent LUS (between Arrows, 0.7 mm). The LUS was Confirmed to be Paper-thin with Visible Uterine Content (Scalp Hair) during Cesarean Section

DISCUSSION

A study used a cut off value for the thickness of the LUS at less than 3.5 mm at 36 to 38 weeks gestation[7]. Other studies used transabdominal sonography without clearly defining the site of measurement; they concluded that a wall thickness of 2 mm or less can be a sign of uterine defect[2-3]. A study found that using transvaginal sonography 74% of women with LUS less than 2.0 mm had an incomplete uterine rupture[8] (Figure 1). Another study described the sonographic appearance of the LUS by its symmetry, thickness, movement, ballooning, and the presence of a wedge defect and divided these findings into 3 classes to identify uterine defects instead of only measuring the thickness of the LUS[10] (Figure 2). However, one study found that measurement of the myometrial layer was more representative of the LUS thickness[14].

In our study, there was a statistically significant difference in LUS thickness between the cesarean and control group; this was similar to another study, which showed that LUS was thinner in women with previous cesarean delivery compared to the control group[8]. Thinning of the LUS is considered to be a result of stretching in a portion of LUS caused by gestation itself, which does not occur in the scarred tissue as it is rigid and not stretched[7]. The healing process of the uterine wound might affect the regeneration of the isthmus of the uterus in such a way that it would become thinner. Due to enlargement, the thinning part could lead to a thinner LUS in subsequent pregnancies[7]. Our findings show that there was a statistically significant decrease in the LUS thickness with the increased number of previous scars. However, another study did not find any significant difference between the number of previous scars and the thickness of the lower segment[13].

Uterine dehiscence could occur before the onset of labor. In our study, uterine dehiscence was found after repeated section and before the onset of labor. Our result was similar to other studies with regards to intraoperative diagnoses (paper-thin or dehisced LUS)[15,16]. One study reported that uterine dehiscence is a high-risk condition for uterine rupture; therefore, abdominal and vaginal ultrasound examination permits an accurate assessment of LUS thickness in patients with previous cesarean section[17]. Measurement of the lower uterine segment before the onset of labor may have clinical significance if it can identify uterine dehiscence.

In our study, the uterine scar tissue was difficult to be observed with ultrasonography. This finding was confirmed by a study which found that the previous cesarean scar could not always be demonstrated by the use of transvaginal or transabdominal sonography[18]. In healed cases, the LUS was found well-developed during the operation. Another study found that as time passes, the quality of the uterine wound improves progressively.

CONCLUSION

The lower uterine segment was thinner in women with previous cesarean delivery compared to women with an unscarred uterus. There was a progressive decrease in the LUS thickness with an increase in the number of previous cesarean scars. The sonographic evaluation of LUS could be helpful in diagnosing thinning or defective LUS, which could be a risk for rupture scarred uterus.

Author Contribution: The corresponding author made the whole effort contribution towards (1) conception and design, acquisition, analysis and interpretation of data; (2) drafting the article and revising it critically for important intellectual content, and (3) final approval of the manuscript version to be published. Yes.

Potential Conflicts of Interest: None.

Competing Interest: None.

Sponsorship: None.

Acceptance Date: 15 December 2020

Ethical Approval: Approved by the Research Ethical Committee, Maternity and Children Hospital, KSA.

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