Ultrasound Assessment of Lower Uterine Segment Thickness During Pregnancy, Labour, and the Postpartum Period

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Abstract

Objectives: To evaluate the normal ranges of lower uterine segment (LUS) thickness throughout pregnancy in women without a previous cesarean and to evaluate the relationship between ultrasound and intraoperative LUS thickness.

Methods: We assessed LUS thickness using transabdominal and transperineal longitudinal scan at each week of gestation, during labour, and in the postpartum period in 1000 pregnant women without previous CS. Secondly, we assessed LUS thickness immediately before CS (using ultrasound) and intraoperatively (using ophthalmic calipers) immediately before delivery of the fetus in 35 women with a previous CS and 29 women without previous CS undergoing elective CS before labour.

Results: We performed 20 307 LUS thickness measurements in between 119 and 944 women at each week of gestation, in 944 women during labour, and in 936 women after delivery. We observed a strong relationship between transabdominal and transperineal ultrasound ($P < 0.001$) and an inverse correlation between LUS thickness and gestational age ($P < 0.001$), with a mean thickness of 5.1 ± 1.4 mm at 20 weeks, 3.6 ± 1.3 mm at 30 weeks, and 2.3 ± 0.6 mm at 40 weeks of gestation. In women undergoing elective CS, we observed a strong relationship between antepartum and intraoperative transperineal LUS thickness ($P < 0.001$), with mean thicknesses of 2.2 ± 0.7 in 28 women without thinning of LUS; 0.8 ± 0.1 mm in four women with grade II uterine scar dehiscence; and 0.4 ± 0.1 mm in three women with grade III dehiscence. A LUS myometrial thickness less than 1.2 mm could have predicted all grade II and grade III uterine scar dehiscences without false-positive cases.

Conclusion: LUS thickness decreases with gestational age and correlates strongly with the intraoperative LUS thickness in women with a previous CS.

Key Words: Lower uterine segment, LUS, uterine scar, Caesarean, pregnancy, labour, postpartum, ultrasound

Competing Interests: None declared.

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Résumé

Objectifs: Évaluer les plages normales en ce qui concerne l'épaisseur du segment utérin inférieur (SUI) tout au long de la grossesse chez les femmes chez les femmes sans césarienne antérieure ainsi qu'évaluer la relation entre l'épaisseur du SUI mesurée par échographie et celle qui est établie pendant l'intervention.

Méthodes: Nous avons évalué l'épaisseur du SUI au moyen de balayages longitudinaux transabdominaux et transpérinéaux à chacune des semaines de gestation, pendant le travail et pendant la période postpartum chez 1 000 femmes enceintes n'ayant jamais subi de césariennes. Dans un deuxième temps, nous avons évalué l'épaisseur du SUI immédiatement avant la tenue d'une césarienne (par échographie) et pendant cette intervention (au moyen de compas ophtalmiques, immédiatement avant l'accouchement du foetus) chez 35 femmes qui avaient déjà subi une césarienne et chez 29 femmes n'ayant jamais subi de césariennes, et qui devaient toutes subir une césarienne planifiée avant le travail.

Résultats: Nous avons mené 20 307 mesures de l'épaisseur du SUI chez de 119 à 944 femmes à chacune des semaines de gestation, chez 944 femmes pendant le travail et chez 936 femmes après l'accouchement. Nous avons constaté une forte relation entre les échographies transabdominales et transpérinéales ($P < 0{,}001$) et une corrélation inverse entre l'épaisseur du SUI et l'âge gestationnel ($P < 0{,}001$), l'épaisseur moyenne ayant été de $5{,}1 \pm 1{,}4$ mm à 20 semaines, de $3{,}6 \pm 1{,}3$ mm à 30 semaines et de $2{,}3 \pm 0{,}6$ mm à 40 semaines de gestation. Chez les femmes qui devaient subir une césarienne planifiée, nous avons constaté une forte relation entre les épaisseurs antepartum et peropératoire du SUI ($P < 0{,}001$), les moyennes établies ayant été de $2{,}2 \pm 0{,}7$ chez 28 femmes sans amincissement du SUI, de $0{,}8 \pm 0{,}1$ mm chez quatre femmes présentant une déhiscence de la cicatrice utérine de grade II et de $0{,}4 \pm 0{,}1$ mm chez trois femmes présentant une déhiscence de grade III. La constatation d'une épaisseur myométriale de SUI se situant en deçà de 1,2 mm aurait pu permettre de prédire tous les cas de déhiscence de la cicatrice utérine de grade II et de grade III, sans faux positifs.

Conclusion: L'épaisseur du SUI est inversement proportionnelle à l'âge gestationnel. Chez les femmes qui ont déjà subi une césarienne, l'épaisseur du SUI mesurée par échographie avant

et pendant le travail est également en forte corrélation avec l'épaisseur du SUI établie pendant l'intervention.

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INTRODUCTION

During the last decade, rates of VBAC have been decreasing, mainly because of concerns about the risk of uterine rupture during the trial of labour (TOL) and its related perinatal morbidity.[1] Even though several risk factors have been reported, it remains very difficult to predict uterine rupture to allow for a safe TOL in women contemplating VBAC.[2,3] However, ultrasonographic evaluation of the uterine scar and measurement of the thickness of the lower uterine segment (LUS) potentially could become efficient tools to predict and prevent uterine rupture. In 1988, Fukuda et al. reported that ultrasound examination could detect thinning of the LUS and predict women with uterine scar dehiscence at repeat CS.[4] After that publication, several small and moderate-sized studies confirmed these findings, including two studies that reported an association between LUS thickness and uterine rupture during TOL.[5,6] Systematic reviews and meta-analyses support the strong association between LUS thickness and the risk of uterine scar defect but call for a standardized method of measurement.[7,8]

Several techniques for evaluating measurement of LUS thickness during pregnancy have been reported. Using a single approach (transabdominal or transvaginal scan only), many authors reported an association between LUS thickness and uterine scar dehiscence[9–22] but also reported a relatively high rate of uterine scar dehiscence at CS with normal LUS thickness. On the other hand, data from studies combining both ultrasound approaches (transabdominal and transperineal or transvaginal) suggest that the combination of both approaches could help reduce the false-negative rate.[23–26] Even though most studies have reported the relationship between LUS thickness measured in the third trimester and uterine scar dehiscence, there is increasing interest in measurement of LUS thickness in early pregnancy; this could be used as a decision-aid tool to help women with previous CS in their delivery plans.[27]

This study aimed to evaluate the normal range of LUS thickness throughout pregnancy in women without a uterine scar, using both ultrasound approaches (transabdominal and transperineal).

METHODS

We performed a prospective cohort study of LUS thickness in pregnant women with no previous CS. All eligible participants were invited to undergo periodic ultrasound measurement of LUS from 16 weeks' gestation onward, during delivery, and immediately after delivery. We used an SSA 250A or SSA 340A-CX Toshiba scanner with a 3.75, 6.0, or 7.5 MHz linear (convex) probe for transabdominal and transperineal scans and an SSA 250A or SSA 340A-CX Toshiba scanner with a 5 or 7 MHz convex vaginal probe or a Sonovista CS or EX Mochida scanner with 5.0, 6.0, and 7.5 MHz mechanical sector vaginal probes for transvaginal scans.

LUS measurements using ultrasound were made at a higher magnification with the bladder half-full to full. The procedure consisted of a transabdominal longitudinal scan followed by a transperineal (and/or transvaginal) longitudinal scan (Figure 1). Transvaginal ultrasound assessment was performed in only a small number of examinations (less than 10%) when images obtained with transperineal scanning were not optimal for measurement of LUS thickness. These methods have been described previously in detail.[23] For each scan, we assessed the myometrial thickness (hypoechogenic part excluding the bladder wall) over the fetal head and used the thinnest measurement as our primary outcome (Figure 2). Assessment of LUS after vaginal delivery was achieved by sandwiching the LUS between the examiner's fingers inside the uterus and the transabdominal probe outside, sliding from the upper to the lower part of the LUS, as shown in Figure 3.

Women undergoing elective CS before labour also were invited to participate in the study. After informed consent and immediately before beginning the CS, ultrasound measurements of the LUS were performed. In these

Figure 1. Procedure used for transabdominal and transperineal lower uterine segment measurements