Sonographic Measurement of the Lower Uterine Segment Thickness in Women With Previous Caesarean Section

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Abstract

Objectives: To evaluate the accuracy of prenatal sonography in determining the lower uterine segment (LUS) thickness in women with previous Caesarean section and to assess the usefulness of measuring LUS thickness in predicting the risk of uterine rupture during a trial of vaginal birth.

Methods: Sonographic examination was performed in 102 pregnant women with one or more previous Caesarean sections at between 36 and 38 weeks' gestation to assess the LUS thickness, which was defined as the shortest distance between the urinary bladder wall-myometrium interface and the myometrium/chorioamniotic membrane-amniotic fluid interface. Of the 102 women examined, 91 (89.2%) had transabdominal sonography only, and 11 (10.8%) had both transabdominal and transvaginal examinations. The sonographic measurements were correlated with the delivery outcome and the intraoperative LUS appearance.

Results: The mean sonographic LUS thickness was 1.8 mm, standard deviation (SD) 1.1 mm. An intraoperatively diagnosed paper-thin or dehisced LUS, when compared with an LUS of normal thickness, had a significantly smaller sonographic LUS measurement (0.9 mm, SD 0.5 mm, vs. 2.0 mm, SD 0.8 mm, respectively; $P < 0.0001$). Two women had uterine dehiscence, both of whom had prenatal LUS thickness of < 1 mm. Thirty-two women (31.4%) had a successful vaginal delivery, with a mean LUS thickness of 1.9 mm, SD 1.5 mm; none had clinical uterine rupture. A sonographic LUS thickness of ≤ 1.5 mm had a sensitivity of 88.9%, a specificity of 59.5%, a positive predictive value of 32.0%, and a negative predictive value of 96.2% in predicting a paper-thin or dehisced LUS.

Conclusions: Sonography permits accurate assessment of the LUS thickness in women with previous Caesarean section and therefore can potentially be used to predict the risk of uterine rupture during trial of vaginal birth.

Résumé

Objectifs : Évaluer la précision de l'échographie prénatale aux fins du calcul de l'épaisseur du segment inférieur chez les femmes ayant déjà subi une césarienne, ainsi que l'utilité de mesurer l'épaisseur du segment inférieur en vue de prévoir le risque de rupture utérine pendant l'épreuve d'accouchement vaginal.

Méthodes : Un examen échographique a été effectué sur 102 femmes enceintes ayant déjà subi au moins une césarienne entre la 36e et la 38e semaine, en vue de mesurer l'épaisseur du segment inférieur. Cette épaisseur se définit comme étant la distance la plus courte entre l'interface paroi de la vessie-myomètre et l'interface myomètre/membrane chorioamniotique-liquide amniotique. Des 102 femmes examinées, 91 (89,2 %) ont subi une échographie transabdominale uniquement, et 11 (10,8 %) ont subi un examen transabdominal et un examen transvaginal. Les mesures obtenues par échographie ont été mises en corrélation avec l'issue de l'accouchement et l'apparence peropératoire du segment inférieur.

Résultats : L'épaisseur moyenne du segment inférieur, mesurée par échographie, était de 1,8 mm, avec un écart-type (ÉT) de 1,1 mm. Un segment inférieur déhiscent ou extrêmement mince, constaté pendant la période peropératoire, présentait une épaisseur de beaucoup inférieure à celle d'un segment inférieur d'épaisseur normale (0,9 mm, ÉT 0,5 mm, par rapport à 2,0 mm, ÉT 0,8 mm, respectivement; P < 0,0001). Deux femmes présentaient une déhiscence utérine; dans les deux cas, l'épaisseur prénatale du segment inférieur était < 1 mm. Trente-deux femmes (31,4 %) ont connu un accouchement vaginal réussi, avec un segment inférieur d'une épaisseur moyenne de 1,9 mm, ÉT 1,5 mm. Aucune des patientes n'a subi de rupture utérine clinique. Une mesure échographique ≤ 1,5 mm présentait une sensibilité de 88,9 %, une spécificité de 59,5 %, une valeur prédictive positive de 32,0 % et une valeur prédictive négative de 96,2 % relativement à l'établissement d'un diagnostic de segment inférieur déhiscent ou extrêmement mince.

Conclusions : L'échographie permet d'évaluer avec précision l'épaisseur du segment inférieur chez les femmes ayant déjà subi une césarienne, ce qui pourrait permettre de prévoir les risques de rupture utérine pendant l'épreuve d'accouchement vaginal.

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INTRODUCTION

Uterine rupture is a recognized complication of a trial of vaginal birth after previous Caesarean section (VBAC). It has a reported incidence of 0.2% to 1.5% in women who attempt labour after a previous transverse lower uterine segment (LUS) incision.[1] However, the maternal and fetal consequences associated with uterine

rupture can be serious and potentially life threatening.[2,3] In a recent review that examined 142 075 trials of labour, the overall rate of uterine rupture was 0.62%, with a maternal death rate of 0.002%, a hysterectomy rate of 0.09%, and a transfusion rate of 0.18%.[4]

In a recent guideline on VBAC, the Society of Obstetricians and Gynaecologists of Canada recommended that, in the absence of any contraindications, a woman with one previous transverse lower segment Caesarean section should be offered a trial of labour with appropriate discussion of maternal and perinatal risks and benefits.[1] Presently, there are no reliable methods for predicting the risk of uterine rupture in women attempting VBAC. It is generally accepted that a uterus with a thinner LUS is more likely to rupture during attempted VBAC than is a uterus with a normal LUS.[5,6] The value of applying sonographic LUS thickness measurement in the management of VBAC remains unclear, although 16% of obstetricians in Canada currently use LUS thickness measured by sonography at or near term to determine which women are good candidates for VBAC.[7]

Sonographically, the LUS appears as a 2-layered structure that consists of the echogenic muscularis and mucosa of the bladder wall, including part of the visceral-parietal peritoneum, and the relatively hypoechoic myometrial layer (Figure 1).[5,8] In late pregnancy, the chorioamniotic membrane and the decidualized endometrial layer usually cannot be seen separate from the myometrium. If the fetus is presenting as a vertex, the presenting part may be firmly applied against the LUS with no amniotic fluid visible between these 2 structures.

Since the completion of our preliminary study,[9] which demonstrated that sonographic evaluation of the LUS was potentially capable of diagnosing a uterine defect and determining the degree of LUS thinning, we have been convinced that sonographic LUS measurement is a valuable tool for estimating the risk of uterine rupture, and we have continued to examine the LUS of women with previous Caesarean section. This report describes our 2-year experience with use of prenatal sonographic LUS thickness measurement in women with a previous Caesarean section. The objectives of this study were to assess the accuracy of prenatal sonography in diagnosing an extremely thin LUS and to determine a threshold LUS thickness to identify women with potentially higher risk of uterine rupture during attempted VBAC.

METHODS

This study was a continuation of our previously reported study.[9] We obtained approval from the Research Ethics Committee at North York General Hospital. During the study period, from January 2003 to December 2004, 102 pregnant women (53 from the previous study[9] and 49 additional women recruited in this study) with one or more previous Caesarean sections underwent sonographic assessment. All sonographic examinations were performed at 36 to 38 weeks' gestation. We calculated gestational age using the date of the last menstrual period and measurements from first- or second-trimester sonography. None of the women were in labour at the time of scanning. Because the uterine thickness might be affected by abnormal intrauterine volume, women with multiple gestations and abnormal amniotic fluid volumes were excluded from the study, as were women with placenta previa in whom the LUS might not be clearly identifiable.

All women underwent transabdominal sonographic examination. Beginning in September 2004, transvaginal examination was also performed in 11 women (10.8%) to allow better visualization of the LUS near the pericervical area (Figure 2). Both examinations were carried out with a full urinary bladder (to the extent that the patient had the urge to void) to allow good imaging of the LUS. The LUS was examined longitudinally and transversely to identify any areas of obvious dehiscence or rupture. The thinnest zone of the lower segment was identified visually at the midsagittal plane along the cervical canal. This area was magnified at least to the extent that any movement of the caliper would produce a change in measurement of not more than 0.1 mm. The measurement was taken with the calipers at the urinary bladder wall-myometrium interface and the myometrium/chorioamniotic membrane-amniotic fluid interface (Figure 3).[10] At least 2 measurements were made, and the lowest value obtained from either transabdominal or transvaginal examination was taken as the LUS thickness. All examinations were performed with an Aloka SSD 5000 or Toshiba SSH-140A ultrasound machine with a 3.5- or 5.0-MHz convex transabdominal transducer or a 5.0- or 7.5-MHz transvaginal transducer, and all examinations were performed by a single sonographer (V.Y.T.C). The referring physicians were aware of the sonographic findings.

The patients' labour and delivery outcomes were reviewed. After a vaginal delivery, routine manual palpation of the LUS was not performed. Following a repeat Caesarean section, the obstetrician who performed the surgery was asked to assign the appearance of the LUS to one of the following categories (modified from those of Michaels et al.[8] and Fukuda et al.[11]): (a) normal thickness, similar to that seen with primary Caesarean section; (b) evidence of rupture (represented by complete separation of the uterine scar of any length, resulting in communication between the uterine and peritoneal cavities)[5] or dehiscence (represented by