Sonographic Lower Uterine Segment Thickness and Risk of Uterine Scar Defect: A Systematic Review

Nicole Jastrow, MD,[1] Nils Chaillet, PhD,[1] Stéphanie Roberge, BSc,[2,3] Anne-Maude Morency, MD,[4] Yves Lacasse, MD, MSc,[5] Emmanuel Bujold, MD, MSc, FRCSC[1,2,3]

[1]Department of Obstetrics and Gynaecology, Centre Hospitalier Universitaire Sainte-Justine, Faculty of Medicine, Université de Montréal, Montreal QC

[2]Department of Social and Preventive Medicine, Faculty of Medicine, Université Laval, Quebec QC

[3]Department of Obstetrics and Gynaecology, Centre de recherche du Centre Hospitalier Universitaire de Québec (CRCHUQ), Faculty of Medicine, Université Laval, Quebec QC

[4]Department of Obstetrics and Gynaecology, Faculty of Medicine, McGill University, Montreal QC

[5]Institut Universitaire de Cardiologie et de Pneumologie, Hôpital Laval, Faculty of Medicine, Université Laval, Quebec (Quebec)

Abstract

Objective: To study the diagnostic accuracy of sonographic measurements of the lower uterine segment (LUS) thickness near term in predicting uterine scar defects in women with prior Caesarean section (CS).

Data Sources: PubMed, Embase, and Cochrane Library (1965–2009).

Methods of Study Selection: Studies of populations of women with previous low transverse CS who underwent third-trimester evaluation of LUS thickness were selected. We retrieved articles in which number of patients, sensitivity, and specificity to predict a uterine scar defect were available.

Data Synthesis: Twelve eligible studies including 1834 women were identified. Uterine scar defect was reported in a total of 121 cases (6.6%). Seven studies examined the full LUS thickness only, four examined the myometrial layer specifically, and one examined both measurements. Weighted mean differences in LUS thickness and associated 95% confidence intervals between women with and without uterine scar defect were calculated. Summary receiver operating characteristic (SROC) analysis and summary diagnostic odds ratios (DOR) were used to evaluate and compare the area under the curve (AUC) and the association between LUS thickness and uterine scar defect. Women with a uterine scar defect had thinner full LUS and thinner myometrial layer (weighted mean difference of 0.98 mm; 95% CI 0.37 to 1.59, $P = 0.002$; and 1.13 mm; 95% CI 0.32 to 1.94 mm, $P = 0.006$, respectively). SROC analysis showed a stronger association between full LUS thickness and uterine scar defect (AUC: 0.84 ± 0.03, $P < 0.001$) than between myometrial layer and scar defect (AUC: 0.75 ± 0.05, $P < 0.01$). The optimal cut-off value varied from 2.0 to 3.5 mm for full LUS thickness and from 1.4 to 2.0 for myometrial layer.

Conclusion: Sonographic LUS thickness is a strong predictor for uterine scar defect in women with prior Caesarean section. However, because of the heterogeneity of the studies we analyzed, no ideal cut-off value can yet be recommended, which underlines the need for more standardized measurement techniques in future studies.

Key Words: Pregnancy, Caesarean section, uterine rupture, ultrasound

Competing Interests: None declared.

Received on October 23, 2009

Accepted on December 17, 2009

Résumé

Objectif : Étudier la précision diagnostique des mesures échographiques de l'épaisseur du segment inférieur utérin (SIU) à l'approche du terme pour ce qui est de prédire les anomalies de la cicatrice utérine chez les femmes ayant déjà subi une césarienne (CS).

Sources de données : PubMed, Embase et Cochrane Library (1965–2009).

Méthodes de sélection des études : Les études portant sur des populations de femmes ayant déjà subi une CS transversale basse qui ont été soumises à une évaluation de l'épaisseur du SIU au cours du troisième trimestre ont été sélectionnées. Nous avons extrait les articles dans lesquels la sensibilité et la spécificité de la mesure visant à prédire une anomalie de la cicatrice utérine et le nombre de patientes étaient disponibles.

Synthèse des données : Douze études admissibles portant sur 1 834 femmes ont été identifiées. Une anomalie de la cicatrice utérine a été signalée dans 121 cas en tout (6,6 %). Sept études ont examiné l'épaisseur du SIU dans sa totalité; quatre études ont étudié la mesure du myomètre uniquement; et une étude a examiné ces deux mesures. Les différences moyennes pondérées en matière d'épaisseur du SIU et les intervalles de confiance à 95 % connexes entre les femmes avec et sans anomalie de la cicatrice utérine ont été calculés. L'analyse des courbes *summary receiver operating characteristic* (SROC) et *summary diagnostic odds ratios* (DOR) a été utilisée pour évaluer et comparer l'aire sous la courbe (ASC) et l'association entre l'épaisseur du SIU et l'anomalie de la cicatrice utérine. Chez les femmes présentant une anomalie de la cicatrice utérine, le SIU dans sa totalité et la couche myométriale étaient plus minces (différence moyenne pondérée de 0,98 mm; IC à 95 %, 0,37 – 1,59, P = 0,002; et de 1,13 mm; IC à 95 %, 0,32 – 1,94 mm, P = 0,006, respectivement). L'analyse SROC a indiqué une plus forte association entre totale épaisseur du SIU et l'anomalie de la cicatrice utérine (ASC : 0,84 ± 0,03, P < 0,001) qu'entre la couche myométriale et l'anomalie de la cicatrice utérine (ASC : 0,75 ± 0,05, P < 0,01). La valeur seuil optimale variait entre 2,0 et 3,5 mm, pour ce qui

est de totale épaisseur du SIU, et entre 1,4 et 2,0, pour ce qui est de la couche myométriale.

Conclusion : La mesure échographique de l'épaisseur du SIU est un fort facteur prédictif de l'anomalie de la cicatrice utérine chez les femmes ayant déjà subi une césarienne. Cependant, en raison de l'hétérogénéité des études que nous avons analysées, aucune valeur seuil idéale ne peut encore être recommandée, ce qui souligne la nécessité d'adopter des techniques de mesure mieux standardisées dans le cadre des études à venir.

J Obstet Gynaecol Can 2010;32(4):321–327

INTRODUCTION

Uterine rupture is an uncommon but potentially catastrophic complication of a trial of VBAC.[1,2] Several studies have reported the perinatal risks of failed trial of labour and uterine rupture in women attempting VBAC.[1–6] Partly because of concerns about this complication, the rate of VBAC deliveries continues to fall in developed countries, with an inverse increase in CSs. However, multiple CSs are associated with a greater risk of complications during surgery and abnormal placentation (previa, accreta).[7] Because in the last two decades the choice between elective repeat CS and TOL has been largely left to the patients' preferences, few tools have been made available to help in decision making.

To better assess the risk of uterine rupture, some authors have proposed sonographic measurement of lower uterine segment thickness near term, assuming that there is an inverse correlation between LUS thickness and the risk of uterine scar defect.[8,9] Therefore, this assessment for the management of women with prior CS may increase safety during labour by selecting women with the lowest risk of uterine rupture. However, while a large prospective study demonstrated that a full LUS thickness of under 3.5 mm had a strong negative predictive value, the best cut-off values and the best measuring technique remain controversial.[10,11]

The main objective of the current study was to assess the strength of the association between sonographic measurement of the LUS in women with prior CS and uterine scar defect at delivery. Second, we aimed to ascertain the best cut-off values for predicting uterine rupture.

ABBREVIATIONS

AUC	area under the curve
CS	Caesarean section
DOR	diagnostic odds ratios
LUS	lower uterine segment
SROC	summary receiver operating characteristic
TOL	trial of labour
VBAC	vaginal birth after Caesarean section

METHODS

Sources

We searched PubMed, Embase, and the Cochrane Library for articles published between 1965 and 2009 in any language with various combinations of the following terms: lower uterine segment, uterine rupture, uterine scar, thickness, and ultrasound.

Study Selection

Populations of pregnant women with prior low transverse CS who underwent third-trimester evaluation of LUS thickness were selected. We retrieved articles for which sensitivity and specificity to predict uterine scar defect, as well as the number of patients, were available. The number of patients and mean LUS thickness for women with and without uterine scar defect were collected. The outcome of interest was uterine rupture during TOL (defined as complete separation of the uterine scar, resulting in communication between the uterine and peritoneal cavities) or uterine scar defect (defined as either uterine rupture or uterine scar dehiscence, which was also called "window"). LUS thickness data were collected considering the different layers included (full thickness, myometrial layer alone, or both). Full LUS thickness was defined as the smallest measurement between the amniotic fluid and urine in the maternal bladder.[9] The myometrial layer was defined as the smallest hypoechoic portion of the LUS.[12] Analyses were stratified according to specific measurements (full thickness or myometrial layer) and according to available cut-off values. The quality of our study was assessed according to (STAndards for Reporting of Diagnostic accuracy).[13]

Weighted mean differences of full LUS and myometrial thicknesses and their associated 95% confidence intervals between women with and without uterine scar defect were calculated using Cochrane Review Manager software (version 4.2.8). Individual and pooled odds ratio, as well as associated 95% confidence interval were computed. Summary receiver operating characteristic curve analysis was undertaken to evaluate the association between full LUS thickness or myometrial layer and uterine scar defect.[14] Because the number, training, and expertise of the persons executing and reading the tests can vary across studies, a Dersimonian and Laird (random effects) model was adopted. Summary sensitivity and specificity, summary estimates of diagnostic odds ratios, and SROC analyses for full LUS thickness and myometrial layer were generated by Meta-DiSc software (version 1.4). Summary DOR value was used to represent the test's accuracy against the reference standard.[15] To handle studies with no false negatives or false positives, 0.5 was added to all their cells with zero. Heterogeneity was assessed for each summary estimate according to the Cochran-Q test.[16]