OBSTETRICS

Impact of uterine closure on residual myometrial thickness after cesarean: a randomized controlled trial

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BACKGROUND: Incomplete healing of uterine scar after cesarean has been associated with adverse gynecological and obstetrical outcomes. Several studies reported that uterine closure at cesarean influences the healing of uterine scar and the risk of uterine rupture at subsequent pregnancies: the commonly used locked single-layer suture including the decidua being associated with a 4-fold increased risk of uterine rupture. However, data from randomized trials are lacking.

OBJECTIVE: We sought to evaluate the impact of 3 techniques of uterine closure after cesarean delivery on uterine scar healing.

STUDY DESIGN: This was a 3-arm 1:1:1 randomized study in women with singleton pregnancies undergoing elective primary cesarean delivery at ≥38 weeks' gestation. Closure of the uterine scar was carried out by locked single layer including the decidua, double layer with locked first layer including the decidua, or double layer with unlocked first layer excluding the decidua. Primary outcome was residual myometrial thickness (RMT) at the site of the scar, measured by transvaginal ultrasound 6 months after delivery. Secondary outcome was the RMT as a percentage of the myometrial thickness above the scar (healing ratio). Intent-to-treat analyses using Student *t* test were performed to compare each double-layer technique to the single-layer closure, and $P < .025$ was considered significant.

RESULTS: Complete follow-up was obtained from 73 (90%) of the 81 participants. Compared to single-layer closure, double-layer closure with unlocked first layer was associated with thicker RMT (3.8 ± 1.6 mm vs 6.1 ± 2.2 mm; $P < .001$) and greater healing ratio (54 ± 20% vs 73 ± 23%; $P = .004$). In contrast, double-layer closure with locked first layer was not significantly different than single-layer closure in either RMT (4.8 ± 1.3; $P = .032$) or healing ratio (60 ± 21%; $P = .287$).

CONCLUSION: Double-layer closure with unlocked first layer is associated with better uterine scar healing than locked single layer.

Key words: cesarean, scar, uterine closure

Introduction

Cesarean delivery is carried out in approximately one fourth of all births in developed countries.[1-3] Incomplete healing of the uterine scar after cesarean is a side effect with potential long-term consequences, including thinning of the myometrium that occurs in 37-59% of cases.[4-6] This defect has been associated with major obstetrical complications, such as ectopic scar pregnancies, placenta accreta, and uterine rupture, as well as numerous gynecological problems, including postmenstrual spotting, dysmenorrhea, and pelvic pain.[7]

There is some evidence that the risk of uterine scar defect is related to number of previous cesarean deliveries and method of uterine closure.[5,8] Similarly, there is evidence from large retrospective studies that the risk of uterine rupture and placenta accreta is related to the method of uterine closure.[9,10] A meta-analysis including retrospective and prospective studies reported that locked single-layer closure, compared to double-layer closure, is associated with a 4-fold increase in risk of uterine rupture in a subsequent pregnancy.[9] Prospective studies using ultrasound evaluation of the scar favor an unlocked suture with exclusion of the decidua to optimize the approximation of the tissues and their healing.[9,11,12] However, at present, there is no consensus on the method of uterine closure following cesarean delivery in terms of use of 1 or 2 layers, locking or not of the first layer, and whether the decidua should be included or excluded.[13,14]

Transvaginal ultrasound is a validated tool to evaluate uterine scars.[15] Scar defects are reported as "niche," "isthmocele," or "wedge" and are related to gynecological symptoms and uterine rupture in subsequent pregnancies.[7] The severity of the defect is quantified by the measurement of the remaining myometrium thickness at the site of the uterine scar.[7,15] Such a tool offers the opportunity to evaluate the impact of uterine closure on scar healing.

The objective of this randomized study was to compare 2 types of double-layer closure with the most commonly used method of locked single-layer closure including the decidua.[16]

Materials and Methods

Study design and participants

We performed a double-blind randomized controlled trial to compare 3 types of uterine closure (ratio 1:1:1). The project was approved by the institutional review board of the hospital and registered at clinicaltrial.gov (NCT01860859). Participants were recruited from March 2013 through June 2014, in Quebec City, Quebec, Canada, during their preoperative appointment where they gave written informed consent. The study included women ≥18 years of age with singleton pregnancies undergoing an elective primary cesarean delivery at ≥38 weeks' gestation. Exclusion

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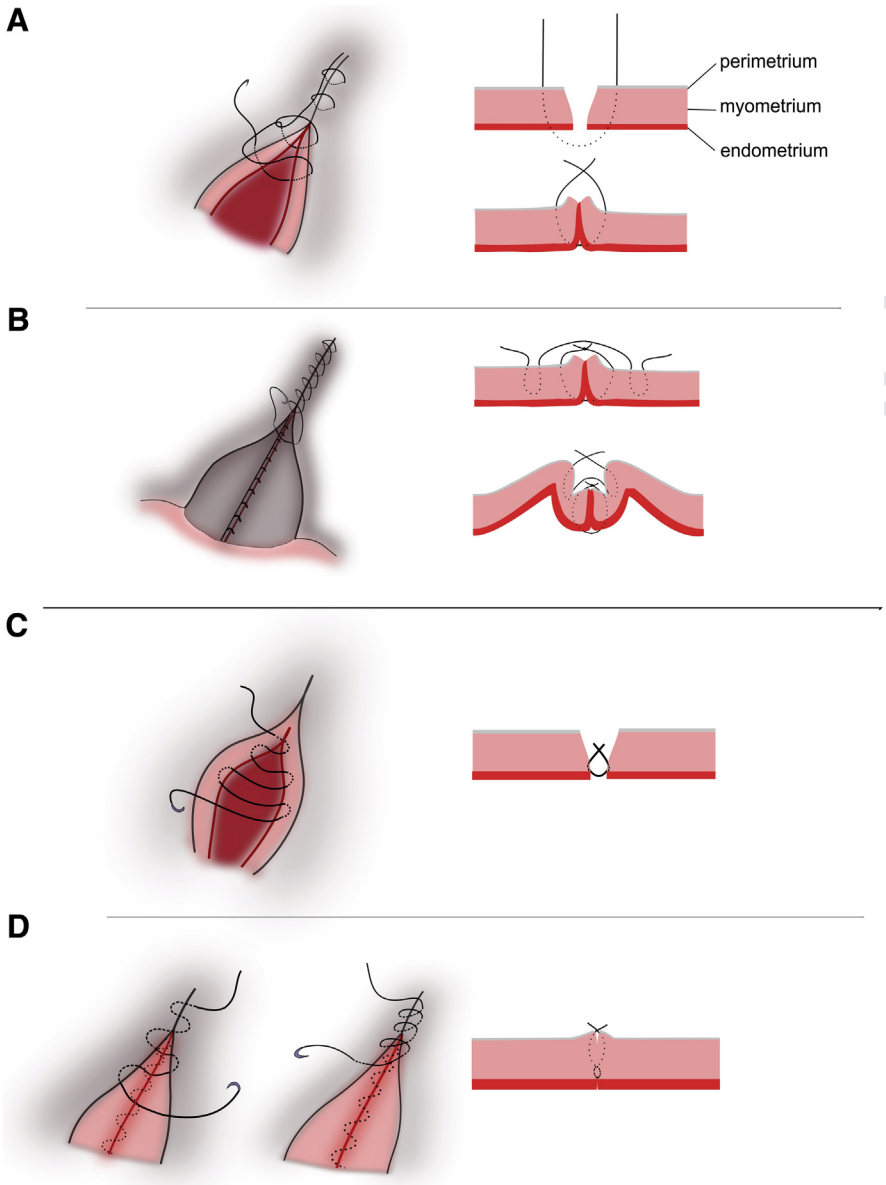
FIGURE 1
Types of uterine suture following cesarean delivery



A, Locked single-layer closure including decidua. **B**, Double-layer closure with first layer locked and second layer unlocked and imbricating first layer. **C**, Double layer with first layer unlocked, excluding decidua and including deeper part of myometrium. **D**, Second layer of double-layer closure, unlocked and taking remaining part of myometrium, either subcuticular or over, depending on deepness of suture.

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criteria were multiple pregnancies, thrombophilia, mullerian anomalies, previous cesarean or uterine scar, active labor (with regular uterine contractions and cervical dilatation ≥4 cm) at the time of cesarean, body mass index (BMI) ≥35 kg/m^2, placenta previa, or known chronic inflammatory disease.

Randomization and masking

Randomization was computer generated, supervised by a statistician using 3 blocks. At the time of the elective cesarean delivery, a research assistant gave the next sealed opaque and consecutively numerated envelope containing a description and an image of the suture technique to the surgeon (Figure 1). Women were allocated to 1 of [F1] the 3 groups: (1) single layer locked, including the decidua (controls)[16]; (2) double layer with the first layer locked including the decidua and the second layer unlocked and imbricating the first layer; and (3) double layer with the first layer unlocked, excluding the decidua and including the deep part of the myometrium, and the second layer unlocked including the remaining part of the myometrium. All sutures had to be continuous using synthetic absorbable thread (polyglycolic acid, size: 0). The participant, the research nurse who collected postpartum information, the sonographer who performed the ultrasound scan, the 2 external observers that analyzed the ultrasound images, and the person in charge of the database remained blinded to intervention allocation.

Follow-up

The following baseline characteristics were collected: maternal age, BMI, previous vaginal birth, gestational age at delivery, and reason for the cesarean delivery. A questionnaire was given to the surgeon after delivery for the following information: (1) need for additional suture; (2) whether or not the vesicouterine and parietal peritoneum were closed; and (3) duration of surgery. The following information was collected from the chart: birthweight, estimated blood loss, and postpartum endometritis.

Considering that uterine scar healing is complete after a minimum of 6 months following delivery, each participant was invited for an ultrasound examination of the uterine scar at between 6-12 months after the cesarean delivery.[17] At that appointment, she answered a questionnaire administered by a trained research nurse regarding potential postpartum complications. Thereafter, transvaginal ultrasound was performed by a trained sonographer to