



The association of skin-incision type at cesarean with maternal and neonatal morbidity for women with multiple prior cesarean deliveries[☆]

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ARTICLE INFO

Article history:

Received 29 April 2015

Accepted 3 June 2015

Keywords:

Maternal morbidity

Multiple cesarean deliveries

Skin incision

ABSTRACT

Objective: In women with multiple prior cesarean deliveries (CDs), vertical skin incisions are thought by some to result in better outcomes. The objective of this study was to compare maternal and neonatal outcomes according to the type of skin incisions among women with multiple prior CDs.

Study design: This was a secondary analysis of MFMU Cesarean Registry data. Women undergoing repeat CD with a viable singleton gestation and history of ≥ 2 prior CDs were included in this analysis. Women who had indications for urgent CD (e.g., cord prolapse) or suspected placenta accreta were excluded. Maternal and neonatal outcomes of women with 2, 3 and ≥ 4 prior CDs were compared by skin-incision type (transverse vs. vertical) using univariable and multivariable analyses.

Results: 5007 women met the inclusion criteria. In univariable analysis, women with 2 prior CDs who had a vertical skin incision had shorter incision-to-delivery intervals (12.9 min vs. 14.1 min, $p < 0.001$) but also higher rates of endometritis and composite adverse maternal outcomes (4.9% vs. 2.7%, $p = 0.001$, 16.1% vs. 13.4%, $p = 0.026$, respectively). Women with 3 prior CDs also had higher rates of composite adverse maternal outcomes (21.2% vs. 15.8%, $p = 0.042$). In women with ≥ 4 prior CDs, prolonged hospitalization, composite adverse maternal outcomes, NICU admission and composite adverse neonatal outcomes also were higher with vertical skin incision (23.2% vs. 9.3%, $p = 0.005$, 32.9% vs. 13.7%, $p = 0.001$, 32.1% vs. 19.6%, $p = 0.045$, 32.9% vs. 19.4%, $p = 0.024$, respectively). In multivariable analyses, vertical skin incision remained associated with prolonged hospitalization and composite adverse maternal outcome among women with ≥ 4 prior CDs (aOR 3.40, CI 1.11–10.38, aOR = 2.37, CI 1.02–5.55, respectively).

Conclusion: Vertical skin incision at the time of multiple repeat CD was not associated with better obstetric or perinatal outcomes and was associated among women with ≥ 4 prior CDs with a higher frequency of prolonged hospitalization and adverse maternal outcomes.

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Introduction

Women with multiple prior cesarean deliveries (CDs) consistently have been demonstrated to have a higher risk of maternal morbidity at the time of delivery [1–5]. Although a large portion of that risk is attributable to abnormal placentation [1,2], maternal complications related to dense adhesions encountered at the time of repeat CD also have been reported as a cause of significant

morbidity [4]. The frequency of severe adhesions, moreover, increases with the number of CDs [2–4,6,7].

In current practice, most women undergo repeat CD through a transverse skin incision, such as the Pfannenstiel or the Joel-Cohen, which provides better cosmetic results and carries a lower risk of incisional hernia [8]. Vertical skin incisions typically have been reserved for emergent situations necessitating expeditious delivery, or in settings when it is thought that greater exposure may be necessary (e.g., planning for cesarean hysterectomy) [8]. It is possible, however, that more routine use of vertical skin incisions may provide advantage for women who have had multiple prior CDs by enabling dense adhesions in the lower abdomen to be avoided more readily, by reducing blood loss, and by allowing greater ease for cephalad extension of the skin incision if more space is required for uterine and fetal access.

[☆] Presented in the poster format at the 35th Annual Meeting of the Society for Maternal–Fetal Medicine, San Diego, CA, February 2–7, 2015.

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A MEDLINE search for publications in English between January 1, 1980 and November 30, 2014, using the keywords “repeat cesarean delivery”, “higher-order cesarean delivery”, “multiple cesarean section” or “multiple cesarean delivery”, and “skin incision” or “skin incision type” or “abdominal skin incision”, yielded only three studies specifically concerned with the type of skin incision and obstetric morbidity [6,9,10] with one study being limited to emergent CDs [9], and two studies including both primary and repeat CDs [6,10]. Correspondingly, the skin incision type that minimizes operative morbidity for women who are having a CD after multiple prior CDs is uncertain. The aim of this study was to compare maternal and neonatal outcomes by skin incision type (transverse compared with vertical) in a large cohort of women with multiple prior CDs who were undergoing repeat CD.

Materials and methods

This was a secondary analysis of data from the Cesarean Registry of the Eunice Kennedy Shriver National Institute of Child Health and Human Development Maternal–Fetal Medicine Units Network. Complete details of that registry, which was the result of a 4-year multicenter observational study designed to address clinical issues related to cesarean childbirth, have been described previously [11]. Detailed information regarding maternal demographic characteristics, medical and obstetrical history, intrapartum course, postpartum complications and neonatal outcomes were abstracted directly from maternal and neonatal charts by specially trained and certified research nurses.

In the present analysis, we included all women from the Registry who had a history of at least two prior CDs and were undergoing non-urgent repeat CD. Exclusion criteria were urgent CDs that were performed for the diagnosis of umbilical cord prolapse, placental abruption, uterine rupture and conditions that overtly would affect both the decision regarding the type of skin incision and the probability of adverse outcome (i.e. presence of placenta previa or placenta accreta). Women undergoing repeat CD were divided into three groups based on their number of prior CDs: 2 prior CDs, 3 prior CDs and at least 4 prior CDs. In each group, outcomes of women undergoing vertical skin incisions were compared to those of women undergoing transverse skin incisions.

The primary maternal outcome pre-specified for this analysis was a composite adverse maternal outcome that included all of the following: blood product transfusion, intraoperative complications (cystotomy, ureteral injury, bowel injury), postoperative ileus, endometritis, wound complications (infection, dehiscence), maternal hospital stay greater than 4 days, hysterectomy, intensive care unit (ICU) admission and death. Endometritis was defined as clinical diagnosis of puerperal infection in the absence of findings suggestive a nonuterine source of infection. Secondary outcomes included the incision-to-delivery interval, a composite neonatal adverse outcome (transient tachypnea of the newborn, respiratory distress syndrome, seizure, necrotizing enterocolitis, sepsis, prolonged hypotonicity >24 h, mechanical ventilation, hypoxic-ischemic encephalopathy (HIE), or death), as well as immediate neonatal outcomes including Apgar score less than 5 at 5 min, injuries at the time of delivery, and neonatal ICU (NICU) admission.

All analyses were performed with Stata version 12.0 (StataCorp College Station, TX). Univariable comparisons were performed using Pearson's chi-square test for categorical data and the student *t*-test for continuous measures. The Wilcoxon rank-sum test was used to compare incision-to-delivery intervals. Additionally, multivariable logistic regression and Cox proportional hazard regression were performed to adjust for potential confounding variables for categorical and time-to-event variables, respectively, for the outcomes that were significantly different at a

$p < 0.05$ level, in univariable analysis. Potential confounding variables were entered into the regression equation if they differed between groups in univariable analysis at a level of $p < 0.05$. Odds ratios (OR) and hazard ratios (HR) with 95% confidence intervals (CI) were estimated from the regressions. This study used publically available de-identified data and was considered exempt by the Institutional Review Board at Northwestern University.

Results

Five thousand and seven women met inclusion criteria, of whom 3841, 945 and 221 had 2, 3 or at least 4 prior CDs, respectively. Among women with at least 4 prior CDs, 159 women had 4 prior CDs, 44 women had 5 prior CDs, 12 women had 6 prior CDs, 5 women had 7 prior CDs and 1 woman had 9 prior CDs. Maternal and neonatal characteristics of the study population according to the number of prior CDs and the type of skin incision are depicted in Table 1. In general, women who underwent transverse incisions differed in several ways from those who underwent vertical incisions. For example, the former had an older mean age, were more likely to be Non-Hispanic white, and were less likely to have had a prior classical uterine incision. Body mass indices overall were similar regardless of the type of cesarean incision undertaken, although women with 2 prior cesareans who had a vertical skin incision had a slightly higher mean BMI than those who underwent a transverse skin incision.

Maternal and neonatal outcomes are depicted in Table 2. Incision-to-delivery time was relatively similar regardless of the type of skin incision, although women with 2 prior CDs with a transverse incision had a time-to-delivery that was statistically longer than those who had a vertical skin incision (14.1 min vs. 12.9 min, $p < 0.001$). In terms of clinical outcomes, vertical skin incisions were associated with higher rates of endometritis among women with 2 prior CDs (4.9% vs 2.7%, $p = 0.001$), and higher rates of prolonged hospitalization among women with at least 4 prior CDs (23.2% vs. 9.3%, $p = 0.005$). In addition, vertical skin incisions were associated with a higher chance of the composite adverse maternal outcome across all three groups (16.1% vs. 13.4%, $p = 0.026$, 21.2% vs. 15.8%, $p = 0.042$, 32.9% vs. 13.7%, $p = 0.001$). That was driven mainly by prolonged hospitalization among women with vertical skin incision. Neonatal outcomes were different only among women with at least 4 prior CDs, with vertical skin incision being associated with higher rates of NICU admission and the composite adverse neonatal outcome (32.1% vs. 19.6%, $p = 0.045$, 32.9% vs. 19.4%, $p = 0.024$, respectively).

To assess the potential for confounding, Cox and logistic regressions were performed for those outcomes that had been significantly different based on incision type in univariable analysis. These results are presented in Table 3. Vertical skin incisions remained to be associated with a slightly shorter incision-to-delivery interval among women with 2 prior CDs (aHR = 1.37, CI 1.26–1.49) but no other difference in clinical outcomes. Among maternal outcomes, a vertical skin incision remained associated with a greater odds of a prolonged hospital stay and composite adverse maternal outcome for women with at least 4 prior CDs (aOR = 3.40, CI 1.11–10.38, aOR = 2.37, CI 1.02–5.55).

Comment

In this analysis we sought to evaluate maternal and neonatal outcomes according to skin-incision type in women undergoing repeat CD after multiple prior CDs. We were unable to find any clear benefit from the use of a vertical skin incision. Although vertical skin incisions were associated with a shortened incision-to-delivery interval in women with 2 prior CDs, the absolute time difference was small and did not translate to any observable

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