

Maternal and Neonatal Outcomes after Attempted External Cephalic Version among Women with One Previous Cesarean Delivery

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Am J Perinatol Rep 2018;8:e349–e354.

Abstract

Objective This study was aimed to evaluate success rates of (1) external cephalic version (ECV) among women with one prior cesarean delivery (CD) and (2) maternal and neonatal outcomes after ECV among women with prior CD.

Study Design Two linked studies using U.S. Natality Database were performed. First we performed a retrospective cohort comparing ECV success rates of women with prior CD and women without prior CD. Then we compared the outcomes of TOLACs (trial of labor after cesarean delivery) that occurred after ECV with those that occurred without ECV. Multivariable logistic regression analysis was used to estimate adverse outcomes.

Results A total of 715 women had ECV after 36 weeks with prior CD and 9,976 had ECV without prior scar. ECV success rate with scar was 80.6% and without scar was 86.4% ($p < 0.001$). Seven hundred and sixteen women underwent TOLAC after ECV attempt and 234,617 underwent TOLAC without a preceding attempt. Women with preceding version had increased risks of maternal transfusion (1 vs. 0.4%, adjusted OR [odds ratio]: 2.48 [95% CI (confidence interval): 1.17–5.23]), unplanned hysterectomy (0.4 vs. 0.06%, adjusted OR: 6.90 [95% CI: 2.19–21.78]), and low 5-minute Apgar's score (2.5 vs. 1.5%, adjusted OR: 1.76 [95% CI: 1.10–2.82]).

Conclusion Women with prior CD may have a decrease in the rate of successful ECV. While the absolute risks are low, ECV appears to increase risks of adverse maternal and neonatal outcomes among women undergoing a trial of labor.

Keywords

- ▶ blood transfusion
- ▶ cesarean delivery
- ▶ external cephalic version
- ▶ trial of labor after cesarean
- ▶ unplanned hysterectomy

Breech presentation at term occurs in 3 to 4% of all pregnancies.¹ The three main options of management for women with breech presentation at term are planned vaginal delivery, elective cesarean delivery, and external cephalic version (ECV). Since the results of the Term Breech Trial in 2,000 cesarean delivery (CD) for breech presentation has increased,² putting more emphasis on the option of version for those who want to avoid a CD. ECV is a procedure that involves applying pressure to the woman's abdomen to turn the fetus from breech to vertex with the goal to increase the chances of a vaginal delivery.³ Given a

low risk of complication and a decreased risk of CD among ECV attempts in a meta-analysis,⁴ the American College of Obstetricians and Gynecologists recommends that all women near term with breech presentations should be offered an ECV if they do not have a contraindication for trial of labor.³

The success and safety of ECV among women with one previous CD have been reported previously. Multiple studies have shown that the success rate of ECV among women with one previous CD is similar to women without a history of cesarean with a pooled success rate of 73.6% in 398 women

received
September 4, 2018
accepted after revision
October 16, 2018

DOI <https://doi.org/10.1055/s-0038-1676297>.
ISSN 2157-6998.

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with prior cesarean deliveries.^{5–12} In addition, they reported low complication rates without serious adverse maternal outcomes. However, none of these studies had enough power to detect rare but serious maternal and neonatal outcomes, such as uterine rupture which has a reported prevalence between 0.3–0.7% among women undergoing trial of labor with history of CD.^{13,14} There were two goals in this study. One goal was to evaluate the success rate of ECV in women with one prior CD. The second goal was to evaluate maternal and neonatal outcomes after ECV in women with one prior CD undergoing trial of labor.

Materials and Methods

We performed two linked studies using the U.S. Natality Database from 2014 to 2016 based on U.S. birth certificates. Study 1 was comprised of women who underwent ECV. Women with one prior CD constituted the study group, and women without a prior CD constituted the control group. Study 2 was comprised of women undergoing trials of labor after cesarean delivery (TOLAC). Women with a prior ECV constituted the study group, while women without a prior ECV constituted the control group. Data were obtained from the National Center for Health Statistics, Centers for Disease Control and Prevention. This dataset is publicly available and contains deidentified data; institutional review board approval was not required.

Analysis was limited to singleton, nonanomalous pregnancies among women who underwent ECV and who underwent a TOLAC. We excluded patients who delivered at less than 36 weeks of gestation, and those who had more than one prior CD.

After the study and control groups were established, the data were reviewed to record maternal age, prepregnancy body mass index (BMI), gestational age at delivery, birth weight, fetal presentation at birth, and mode of delivery. Adverse maternal outcomes included blood transfusion, uterine rupture, postpartum hysterectomy, and intensive care unit admission. Adverse neonatal outcomes included 5-minute Apgar's scores less than 7, immediate assisted ventilation, assisted ventilation greater than 6 hours, neonatal seizures, and neonatal intensive care unit admission.

Sample size calculation was based on a reported prevalence of uterine rupture risk of 0.7% among trial of labors with an unscarred uterus.¹³ Assuming a prevalence of uterine rupture risk of 4% in the study group and 0.7% in the control group, a minimum of 702 patients per group was needed with an α error of 0.005 and β error of 0.10. Assuming a prevalence of 2% of TOLAC among all births, a reported prevalence of 3% of breech presentation at term,¹ a reported prevalence of 25% not offered ECV,¹⁵ and 30% declining ECV,¹⁶ a total of 2,228,571 births would need to be reviewed. Assuming the average number of births per year in the U.S. is 4 million, a total of one year of national data was needed. However, in 2016, there were only 279 attempted ECVs after exclusion criteria were applied. Therefore additional 2 years of national data was added to meet the minimum number of subjects required.

Maternal and labor characteristics were compared between the groups in both analyses. Student *t*-test was used for continuous variables and Chi-square test was used with categorical variables. Statistical significance was defined as $p < 0.005$. Among women who underwent TOLAC, multivariable logistic regression analyses were performed to predict adverse maternal and neonatal outcomes controlling for potential confounding variables. The main exposure of risk was a prior ECV. Adverse maternal outcomes included any blood transfusion, uterine rupture, unplanned hysterectomy, and intensive care unit admission. The potential confounding variables used for maternal outcomes included maternal age, maternal BMI, and CD. Adverse neonatal outcomes included 5-minute Apgar's score less than 7, immediate need of assisted ventilation, assisted ventilation for more than 6 hours, neonatal seizures, and neonatal intensive care unit admission. The potential confounding variables used for neonatal outcomes included maternal BMI, gestational age at delivery, and birth weight. All analyses were performed on StataCorp LLC Stata 15.1 (College Station, Texas).

Results

There were 155,332 multiparous women who underwent an ECV identified among 11,943,020 births (1.3%) between 2014 and 2016. After exclusions, the final cohort for study 1 included 10,691 women (►Fig. 1). There were 715 women with one previous CD and 9,976 women without a prior CD. Maternal and obstetrical characteristics were similar between groups (►Table 1).

A univariate, unadjusted comparison of success rates and mode of delivery of women with one prior cesarean and without prior cesarean was performed (►Table 2). The success rate of ECV was higher in women without CD compared with women with a prior cesarean (86.4 and 80.6%, respectively; $p < 0.001$).

For study 2, after exclusions, 235,463 women undergoing trial of labor after one cesarean constituted the final cohort (►Fig. 2). There were 716 women undergoing a TOLAC with a preceding version and 234,617 women without a preceding version. Maternal and obstetrical characteristics were similar (►Table 3).

We performed an unadjusted comparison of mode of delivery of women undergoing TOLAC with a preceding version and those without a version (►Table 4). Mode of delivery was similar between groups (vaginal, $p = 0.096$; operative, $p = 0.042$; cesarean, $p = 0.494$). Vaginal birth after cesarean occurred in 74.9% of women undergoing TOLAC after a preceding version, and 73.6% in women without a preceding version ($p = 0.494$).

Finally, we performed an adjusted comparison of the maternal and neonatal outcomes of the study and control groups (►Table 5). There was no report of a uterine rupture among the women undergoing TOLAC after a preceding version. However, they had an increased risk of maternal blood transfusion (adjusted OR [odds ratio]: 2.48 [95% CI (confidence interval): 1.17–5.23]), unplanned hysterectomy (adjusted OR: 6.90 [95% CI: 2.19–21.78]), and 5-minute Apgar's score of 7 (adjusted OR: 1.76 [95% CI: 1.10–2.82]).

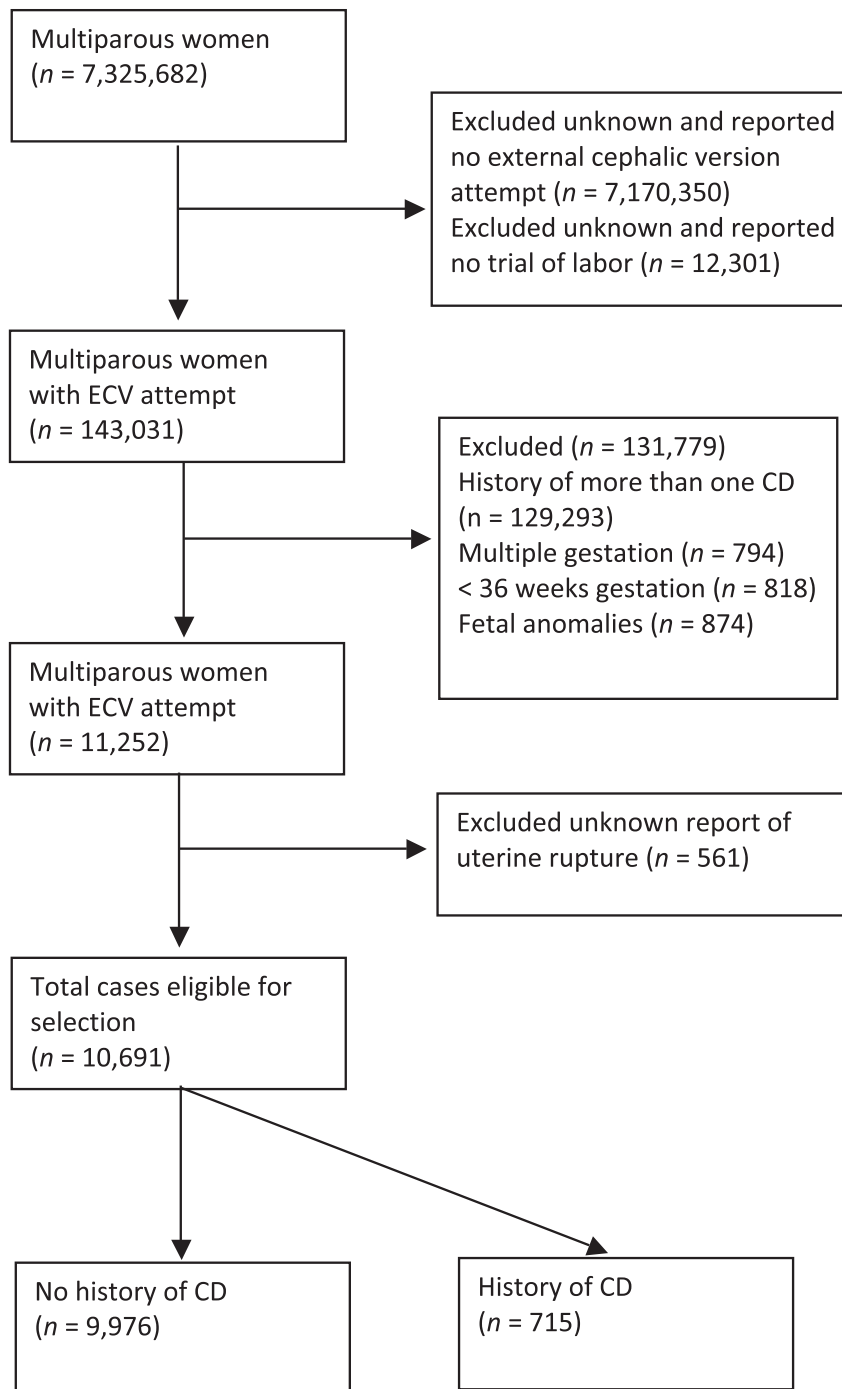


Fig. 1 Cohort selection flow diagram of multiparous women undergoing ECV attempt, study 1. CD, cesarean delivery; ECV, external cephalic version.

Table 1 Maternal and obstetrical characteristics among women with an external cephalic version attempt

Characteristic	No history of cesarean delivery	History of cesarean delivery	p-Value
<i>n</i>	9,976	715	
Maternal age (y)	30.6 +/- 5.5	30.7 +/- 5.2	0.474
BMI	26.4 +/- 6.2 (9,707)	26.8 +/- 6.2 (704)	0.052
Gestational age (wk)	39.2 +/- 1.6 (9,971)	39.3 +/- 1.6	0.051
Birth weight (g)	3,407.5 +/- 478.1 (9,974)	3,436.0 +/- 487.8 (714)	0.124

Abbreviation: BMI, body mass index.

Note: Data are mean or % unless otherwise specified, (+/- SD [standard deviation];N, if missing data).

Table 2 Success rate among women with ECV attempt

Characteristic	No history of cesarean delivery	History of Cesarean delivery	p-Value
<i>n</i>	9,976	715	
ECV success rate	86.4	80.6	< 0.001
^a Fetal presentation at birth			
Vertex	97.2 (8,523)	94.4 (567)	< 0.001
Breech	1.3 (8,523)	3.5 (567)	< 0.001
Other	1.4 (8,523)	2.1 (567)	0.181

Abbreviations: ECV, external cephalic version; TOLAC, trial of labor after cesarean.

^aSuccessful ECV; *n* = 8,616 and 576, respectively.

Note: Data are % unless otherwise specified (N, if missing data).

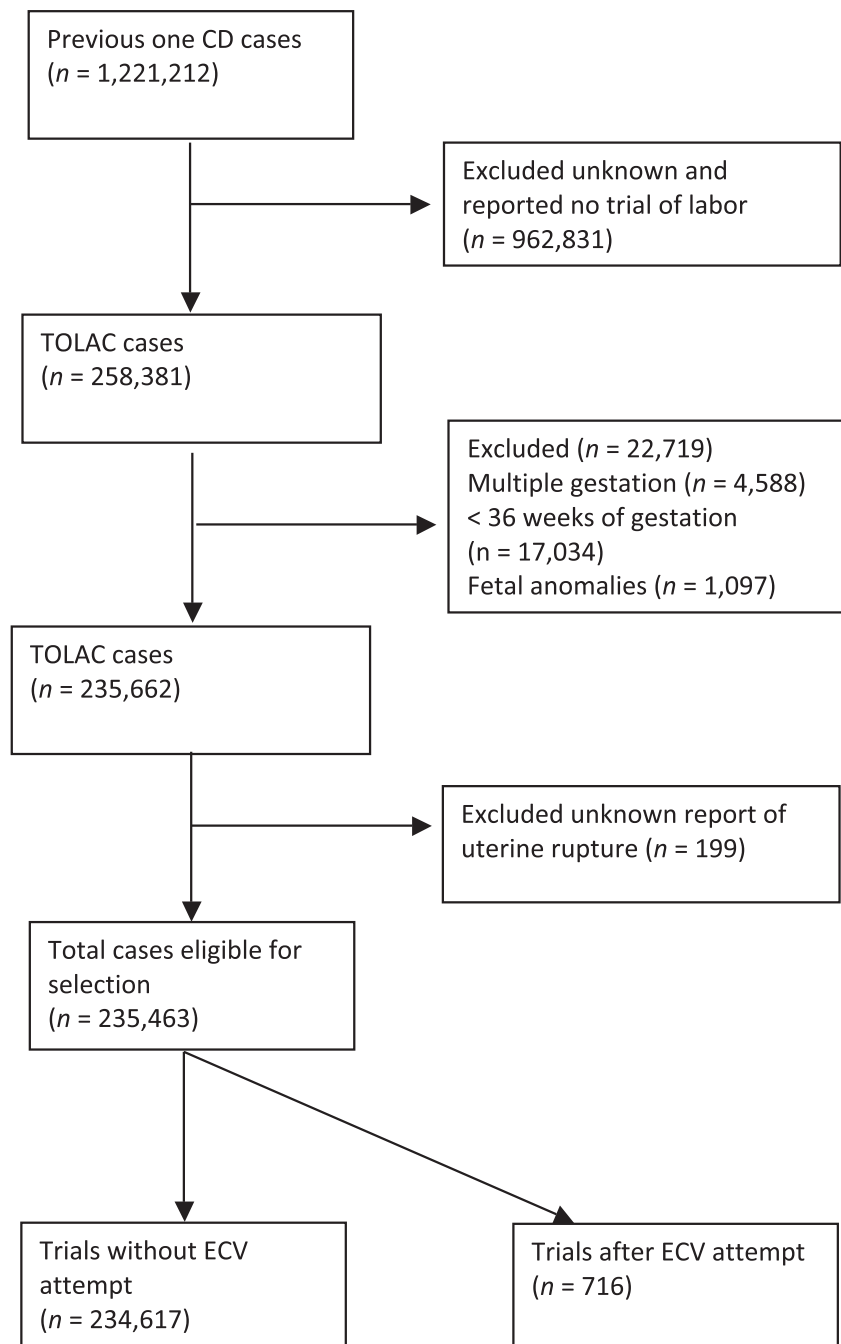


Fig. 2 Cohort selection flow diagram of study 2. CD, cesarean delivery; ECV, external cephalic version; TOLAC, trial of labor after cesarean delivery.

Table 3 Maternal and obstetrical characteristics among women with one previous cesarean delivery

Characteristic	TOLAC without ECV attempt	TOLAC after ECV attempt	p-Value
n	234,617	716	
Maternal age (y)	30.3 +/- 5.2	30.7 +/- 5.2	0.049
BMI	27.1 +/- 6.5	26.8 +/- 6.2	0.390
Gestational age (wk)	39.2 +/- 1.6	39.3 +/- 1.6	0.065
Birth weight (g)	3,391.9 +/- 480.4	3,436.6 +/- 487.7	0.013

Abbreviations: BMI, body mass index; ECV, external cephalic version; TOLAC, trial of labor after cesarean.

Note: Data are mean unless otherwise specified, (+/- SD [standard deviation]).

Table 4 Mode of delivery among TOLAC after ECV attempts

Characteristic	TOLAC without ECV attempt	TOLAC after ECV attempt	p-Value
n	234,617	716	
ECV success rate	–	80.6	
^a Mode of delivery			
Vaginal	68.5	67.9	0.096
Operative	5.1	6.9	0.042
Cesarean	26.4	25.1	0.494

Abbreviations: ECV, external cephalic version, TOLAC, trial of labor after cesarean.

^aSuccessful ECV; n = 577.

Note: Data are % unless otherwise specified.

Table 5 Risks of maternal and neonatal complications among TOLACs

	TOLAC without ECV attempt (n = 234,617)	TOLAC after ECV attempt (n = 716)	Unadjusted OR (95% CI)	^a Adjusted OR (95% CI)
Maternal complications				
Blood transfusion	914 (0.39)	7 (0.98)	2.52 (1.01–5.25)	2.48 (1.17–5.23)
Uterine rupture	532 (0.23)	–	–	–
Hysterectomy	134 (0.06)	3 (0.42)	7.36 (1.50–22.06)	6.90 (2.19–21.78)
ICU admission	336 (0.14)	1 (0.14)	0.98 (0.25–5.49)	0.92 (0.13–6.57)
Neonatal complications				
5-min Apgar's score < 7	3,516 (1.5) [233,874]	18 (2.5) [714]	1.69 (0.10–2.7)	1.76 (1.10–2.82)
Immediate assisted ventilation	6,944 (3.0) [234,399]	28 (3.9)	1.33 (0.88–1.95)	1.37 (0.94–2.01)
Assisted ventilation for > 6 h	1,426 (0.6) [234,399]	8 (1.1)	1.85 (0.79–3.67)	1.97 (0.98–3.96)
Neonatal seizure	99 (0.04) [234,399]	–	–	–
NICU admission	12,838 (5.5) [234,399]	42 (5.9)	1.08 (0.77–1.47)	1.16 (0.85–1.59)

Abbreviations: MBI, body mass index; CI, confidence intervals; ECV, external cephalic version, ICU, intensive care unit; NICU, neonatal intensive care unit; OR, odds ratio; TOLAC, trial of labor after cesarean.

^aNeonatal outcomes adjusted for maternal BMI, gestational age at delivery and birth weight. Maternal outcomes adjusted for age, maternal BMI, cesarean delivery.

Note: Data are n (%) (N, if there are missing data), unless otherwise stated.

Discussion

This study demonstrated that women, with one CD, who underwent a TOLAC with a preceding ECV (ECV), had an increased risk of maternal transfusion, an unplanned hysterectomy, and low Apgar's scores compared with women who underwent TOLAC without a preceding ECV. These results differ from prior investigations.

Flamm et al reported no serious maternal or fetal outcomes among 56 patients with previous CD who underwent ECV.⁵ In addition, de Meeus et al reported only transient vaginal bleeding as a complication among 38 women with previous CD after ECV.⁷ Recently, Weill and Pollack reported no significant complications among 158 patients with and without previous CD in a retrospective study of a prospective cohort of ECV attempts.⁹ These findings may differ from ours due to the low prevalence of adverse maternal and neonatal outcomes and inadequately powered prior studies. We found an increased risk of maternal blood transfusion and an unplanned hysterectomy compared with women without a preceding ECV. A known complication of ECV is placenta abruption which was demonstrated to occur in 0.18% of ECV in a meta-analysis.⁴ Thus, a possible explanation for the increased risk of maternal blood transfusion and peripartum hysterectomy in women with a preceding ECV may be due to a higher prevalence of abruption in this group. Friedman et al. demonstrated that abruption had an adjusted OR of 2.98 (95% CI: 2.52–3.2) for peripartum hysterectomy in a population-based study.¹⁷

The success rate of ECV among multiparous women with previous CD in our study (80.6%) was slightly higher than the reported pooled rate in the literature (73.6%),^{5–12} possibly because all patients in our cohort were multiparous. The success rate may have been smaller in women with a prior scar due to decreased effort in the procedure from providers

because of fear of uterine rupture. Although the success rate among women with a prior CD was significantly smaller than that of multiparous women without a previous CD, the mode of delivery was similar between the groups. Thus, we believe the absolute difference is too small to require any modification of standard preprocedure counseling to patients. The rate of vaginal birth, after cesarean, after successful ECV (74.9%) was similar to a previously reported rate of vaginal birth after cesarean of 79% among 195 women, after successful ECV.^{5,9,12}

The limitations of our study must be acknowledged. The cohorts were derived from large administrative databases which may include data entry errors and miscoding. We attempted to minimize such errors by excluding incomplete records from analyses. Also, we were limited to the variables that were collected in the original dataset. These sorts of datasets do not permit consideration of all potentially interesting confounders. We did adjust for maternal BMI, gestational age at delivery, and birth weight for adverse neonatal outcomes in women undergoing TOLAC with and without preceding ECV attempt. In regard to adverse maternal outcomes, we adjusted for maternal age, maternal BMI, and CD. Further, there is no reason to suspect that there is a systemic bias whereby one group or the other is different in regard to some of the things we could not measure, for example, amniotic fluid index (AFI). The ability to assess a large number of participants acts as a counterweight to this limitation. Also, we were not able to evaluate other known complications of ECV, such as placenta abruption. However, we have surrogates for such complications (e.g., blood transfusion for placental abruption). Finally, we are unable to know the timing of the ECV in relation to the unplanned hysterectomy, thus we cannot evaluate the risk of uterine rupture at time of ECV. However, we found no cases of uterine rupture in women with preceding ECV in this cohort, so the risk of rupture is not more than the risk of rupture during a trial of labor without ECV.

There are strengths to this study. We were able to include large number of external cephalic attempts among women with one previous CD ($n = 716$) among a contemporaneous obstetrical cohort, allowing us to perform analyses to evaluate serious adverse outcomes that have low prevalence. We also were not limited to data from a single site which might limit the generalizability of results. In addition, we were able to confirm the efficacy of ECV with one prior cesarean, reported in smaller prior studies, with larger numbers.

In conclusion, we found that the success rate of ECV in multiparous women with one prior CD was significantly smaller than without prior CD. However, vaginal birth after cesarean delivery (VBAC) after ECV in women with one prior CD was similar to what is reported in the literature and the absolute difference in success rates seen was small, and thus should not discourage providers from offering ECV to eligible women with one prior CD. We also found an increased risk of maternal blood transfusion, unplanned hysterectomy, and

low Apgar's scores among women who underwent TOLAC preceding an ECV attempt. While the absolute risks of these morbidities are low, caution should be undertaken among women undergoing TOLAC after ECV.

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