CLINICAL ARTICLE

Probability of cesarean delivery after successful external cephalic version

Jorge Burgos [a,*], María Iglesias [a], José I. Pijoan [b,c], Leire Rodriguez [a],
Luis Fernández-Llebrez [a], Txantón Martínez-Astorquiza [a]

[a] Obstetrics and Gynecology Service, BioCruces Health Research Institute, Hospital Universitario Cruces (UPV/EHU), Barakaldo, Biscay, Spain
[b] Clinical Epidemiology Unit, BioCruces Health Research Institute, Hospital Universitario Cruces (UPV/EHU), Barakaldo, Biscay, Spain
[c] CIBER Epidemiología y Salud Pública, Biscay, Spain

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ABSTRACT

Objective: To identify factors associated with cesarean delivery following successful external cephalic version (ECV). *Methods:* In a prospective study, data were obtained for ECV procedures performed at Cruces University Hospital, Spain, between March 2002 and June 2012. Women with a singleton pregnancy who had a successful, uncomplicated ECV and whose delivery was assisted at the study hospital, with the fetus in cephalic presentation, were included. A multivariate model of risk factors of cesarean delivery was developed. *Results:* Among 627 women included, 92 (14.7%) delivered by cesarean. A cesarean was performed among 33 (8.5%) of 387 women with spontaneous labor versus 59 (24.6%) of 240 who were induced ($P < 0.001$). Multivariate analysis showed that higher BMI ($P = 0.006$), labor induction ($P = 0.001$), and prior cesarean ($P < 0.001$) were associated with cesarean. Time between ECV and delivery was inversely associated with probability of cesarean during the first 2 weeks. Thus, the probabilities of cesarean delivery on the first day were 0.53 (95% CI 0.35–0.71) and 0.34 (95% CI 0.18–0.51) following induced and spontaneous labor, respectively. On the seventh day, the probabilities were 0.23 (95% CI 0.15–0.32) and 0.12 (95% CI 0.07–0.18), respectively. *Conclusion:* Following ECV, induction of labor, an interval of less than 2 weeks to delivery, BMI, and previous cesarean were associated with an increased risk of cesarean.

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1. Introduction

The prevalence of breech presentation is about 3%–4% of singleton pregnancies at term [1]. In recent years, efforts have been made to reduce cesarean delivery rates through both the revitalization of breech delivery and external cephalic version (ECV). ECV aims to modify the fetal presentation from breech to cephalic shortly before labor, thus avoiding cesarean delivery.

In 2012, a Cochrane Collaboration systematic review based on seven randomized studies [2] established that ECV at term decreases the rates of breech presentation at delivery and of cesarean delivery in non-cephalic presentations. Furthermore, maternal or fetal complications during the procedure were rare. However, despite solid evidence supporting ECV, few studies have assessed pregnancy management following the procedure, particularly when successful and a cephalic fetal presentation was achieved.

The aim of the present study was to analyze the course of pregnancies after a successful ECV and to identify the factors associated with cesarean delivery despite a cephalic fetal presentation.

2. Materials and methods

In a prospective study, data were obtained for ECV procedures performed at Cruces University Hospital, Barakaldo, Spain, between March 1, 2002, and June 30, 2012. All women with a singleton pregnancy who had a successful, uncomplicated ECV and whose delivery was assisted at the study hospital, with the fetus in cephalic presentation, were included in the study. Women presenting with placenta previa, premature placental abruption, oligohydramnios (amniotic fluid index <5), evidence of fetal compromise, fetal death, severe malformations, multiple pregnancies, Rhesus incompatibility, coagulation disorders, and an indication for cesarean delivery unrelated to fetal presentation were excluded from the study. All patients were informed of the procedure and written informed consent for inclusion was obtained. This study was approved by the Clinical Research Ethics Committee of Cruces University Hospital (CEIC 09/06).

Data were obtained for body mass index (BMI; calculated as weight in kilograms divided by the square of height in meters), parity, previous cesarean delivery, time between ECV and delivery, length of pregnancy at delivery, indication for induction, and route of delivery.

ECV was offered to women with singleton pregnancies with breech fetal presentation. Before ECV, fetal well-being was confirmed by cardiotocography. Intravenous ritodrine (Prepar; Reig Jofre SA, Barcelona, Spain) was used as a tocolytic, administered through a continuous 200-μg

* Corresponding author at: Obstetrics and Gynecology Service, BioCruces Health Research Institute, Hospital Universitario Cruces, C/Plaza de Cruces 12, 48903, Barakaldo, Biscay, Spain. Tel.: +34 94 6006000; fax: +34 94 6006076.

E-mail address: jburgoss@sego.es (J. Burgos).

infusion pump 30 minutes before ECV and maintained during the maneuver. In the event of contraindications to this drug, 6.75 mg atosiban (Tractocile; Ferring SA, Madrid, Spain) was administered as an intravenous bolus 2 minutes before ECV.

ECV was performed following previously published guidelines [3]. The procedure was considered successful when the breech was converted to a cephalic presentation. Following the ECV attempt, cardiotocography was performed to assess fetal status and any possible adverse effects; anti-D was administered when indicated. If no further complications arose, women were discharged and monitored until delivery.

Induction of labor was considered when there was an obstetric indication for termination of pregnancy and the cervix was unripe (Bishop score ≤6). Delivery was induced at 42^{+0} weeks in the study institution until July 2009, after which delivery was generally induced at 41^{+5} weeks. In cases of premature rupture of membranes, induction was initiated in the absence of uterine contractions. Vaginal birth after cesarean delivery is standard practice at the study hospital and is attempted when there are no contraindications (≥1 previous classic cesarean, previous uterine surgery accessing the uterine cavity, previous uterine rupture, contraindications for vaginal birth, or >3 cesareans). Induction was performed on the basis of obstetric or maternal indications. The prespecified time for induction was 37 weeks among women with intrahepatic cholestasis, small-for-gestational-age fetuses (estimated fetal weight <2 standard deviation scores), or pre-eclampsia; 38 weeks among those with gestational diabetes and a macrosomic fetus; and 40 weeks among those with gestational diabetes and receiving insulin treatment, or late intrauterine growth restriction (estimated fetal weight <10th percentile, umbilical artery pulsatility index >95th percentile, or middle cerebral artery pulsatility index <5th percentile).

Labor induction was performed using oxytocin (Syntocinon; Defiante Farmacéutica SA, Funchal, Portugal) or a sustained-release prostaglandin E2 insert (Propess; Ferring SA), according to the discretion of the obstetrician in charge (the study institution's protocol includes both methods). Oxytocin is generally used for patients with a Bishop score near 6, whereas prostaglandin is used for those with a higher score.

Binary logistic regression models with one variable were fitted for each potential explanatory factor to assess the risk factors associated with eventual cesarean delivery. A multivariate logistic model was then built with all variables with a *P* value lower than 0.25, followed by a manual, systematic backward selection procedure [4]. The shape of the relationship between continuous covariates and outcome was modelled using polynomials where appropriate. Odds ratios with 95% confidence intervals (CIs) were used to evaluate the magnitude and direction of association of each factor with occurrence of cesarean delivery. The Hosmer-Lemeshow test was used to test the overall goodness-of-fit of the final model and the area under the receiver operating characteristic (ROC) curve to describe its overall predictive performance. To aid the interpretation of the estimated effect of selected explanatory variables, the predictive margins (expected probability of cesarean delivery under alternative values of the explanatory variable of interest, at specified values of certain continuous covariates [e.g. BMI and days since ECV], while keeping the remaining variables at their observed values) were estimated and plotted [5,6].

Statistical analyses were performed using SPSS version 22.0 (IBM, Armonk, NY, USA) and Stata version 12 (StataCorp, College Station, TX, USA). A two-sided *P* value of less than 0.05 was deemed significant.

3. Results

A total of 1426 ECV procedures were performed during the study period, 708 (49.6%) of which were successful. Among the 708 women with a successful ECV, 627 were included in the present analysis (Fig. 1). During follow-up of the 643 women who had undergone a successful ECV and later gave birth at the study institution, 16 (2.5%) experienced reversal.
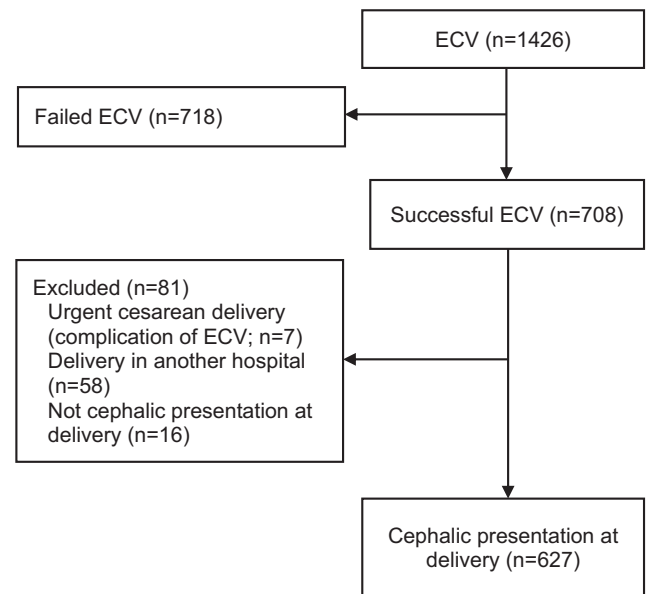

Fig. 1. Flow of patients through the study.

The mean age of the included women was 33.3 ± 4.3 years and mean BMI was 28.1 ± 4.1. Overall, 364 (58.1%) women were primiparous and 43 (6.9%) had undergone a previous cesarean delivery. ECV had been performed at 36 weeks of pregnancy for 34 (5.4%) women, at 37 weeks of pregnancy for 451 (71.9%), at 38 weeks among 79 (12.6%), and at 39 weeks or later for 61 (9.7%; data missing for two women). Labor was induced for 240 (38.3%) women, with the main indication being prelabor membrane rupture (125 [52.1%] women) followed by prolonged pregnancy (59 [24.6%]). Furthermore, 179 (74.6%) of the induced pregnancies were induced with a prostaglandin E2 sustained-release device and 61 (25.4%) with oxytocin.

The median time from ECV to delivery was 18 days (range 0–38). Fig. 2 shows the distribution of days from ECV to delivery following induction and spontaneous labor. There were no significant differences between the distributions (*P* = 0.58). Overall, 92 (14.7%) women underwent cesarean, with 33 (8.5%) of the 387 women with spontaneous labor and 59 (24.6%) of the 240 who were induced delivering by cesarean (*P* < 0.001). Cesareans were performed for 24 (19.2%) of the 125 women induced because of prelabor rupture of membranes and 15 (25.4%) of the 59 induced because of prolonged pregnancy.

The univariate analysis showed that a higher BMI, induced labor, previous cesarean delivery, and fewer days between ECV and delivery were potentially associated with a higher risk of cesarean delivery (Table 1). Conversely, multiparity and weeks of pregnancy at delivery were not significantly associated with a lower risk of cesarean delivery (Table 1). In the multivariate model, significant associations were noted for BMI, induced labor, previous cesarean, days between ECV and delivery, and multiparity (Table 2). When length of pregnancy at delivery was introduced into the multivariate analysis, no significant association was recorded (odds ratio 1.24, 95% CI 0.95–1.63; *P* = 0.11). This model showed a good global fit and a moderate predictive ability (area under the ROC curve 0.728). The multivariate analysis was performed over 534 cases because the values for explanatory variables were missing for some women.

An increase in the risk of cesarean delivery was observed in women with a BMI above 25; the risk was even higher when BMI was over 30 (data not shown). The time from ECV to delivery was inversely associated with an increased risk of cesarean delivery during the first 2 weeks after ECV (Fig. 3). Accordingly, the probability of cesarean delivery estimated through the multivariate logistic model for the first day was 0.53 (95% CI 0.35–0.71) and 0.34 (95% CI 0.18–0.51) for induced and spontaneous labor, respectively. On the seventh day, the