

Introduction of a dedicated team increases the success rate of external cephalic version: A prospective cohort study



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ABSTRACT

Objective: To investigate the influence of a dedicated team on the success rate of external cephalic version and mode of delivery.

Study design: This prospective cohort study included 673 women with a singleton fetus in breech presentation who underwent external cephalic version between January 2013 and December 2017 at Jeroen Bosch Hospital, 's-Hertogenbosch, The Netherlands. In January 2014, a dedicated team consisting of six gynaecologists and six midwives was introduced at the study clinic. The success rate of external cephalic version and mode of delivery were analysed. In addition, predictors for success were examined by logistic regression analysis. Successful external cephalic version was defined as fetal cephalic presentation immediately following the procedure.

Results: Following the introduction of a dedicated team in 2014, the success rate of external cephalic version increased from 39.8% in 2013 to 69.5% in 2017 ($p < 0.001$), with the greatest increase in nulliparous women (from 23.5% to 58.5%, $p = 0.002$). Over the 5-year study period, the vaginal delivery rate after external cephalic version increased from 43% in 2013 to 71% in 2017 ($p < 0.05$). The rate of caesarean section after external cephalic version decreased from 55% to 27% ($p < 0.05$). Anterior placenta [odds ratio (OR) 0.7, 95% confidence interval (CI) 0.48–0.97] and complete breech (OR 0.2, 95% CI 0.07–0.90) were significantly associated with a lower success rate.

Conclusions: This study showed that introduction of a dedicated team led to a significant increase in the success rate of external cephalic version, and a significant decrease in the rate of caesarean section for women presenting with breech in pregnancy.

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Introduction

Breech presentation occurs in 3–4% of all pregnant women at term [1]. Breech deliveries account for 5.8% (10 of 172 per year) of perinatal and neonatal mortality up to 28 days postpartum among term singleton deliveries in The Netherlands [2]. External cephalic version (ECV) is an important obstetric intervention to reduce breech presentation at delivery, which improves the woman's chance of having a vaginal cephalic birth [1,3]. ECV should be offered to all women with an uncomplicated breech pregnancy [4] as it is recommended as a safe and effective procedure with few contraindications [5–8]. Abnormal fetal heart rate traces occur in approximately 0.7–9% of cases. Performing an emergency caesarean section (CS) after ECV is uncommon [6,8,9]. Rosman et al. proposed a reduced list of contraindications based on evidence and clinical

experience – a history or signs of placental abruption, severe pre-eclampsia or HELLP syndrome, and signs of fetal distress – which makes the vast majority of women eligible for attempting ECV [7]. The reported success rate of ECV for breech presentation varies from 20% to 70% [6,8–17]. Numerous studies have attempted to elucidate factors that can predict the success of ECV, such as multiparity, increased fetal weight, high amniotic fluid, unengaged presenting part, easily palpable fetal head and low body mass index [12,14,15]. Only two studies have focused on the effect of ECV performance by a small group of trained gynaecologists and midwives, and investigated the effect of a dedicated team [16,17].

The aim of this study was to evaluate the effectiveness of the introduction of a dedicated ECV team compared with the traditional protocol at the study clinic.

Materials and methods

This prospective cohort study was conducted at Jeroen Bosch Hospital, 's-Hertogenbosch, The Netherlands between January 2013 and December 2017. Before 2014, ECVs at the study clinic

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were performed by all gynaecologists and all midwives or residents. The ECV attempt was performed by both a gynaecologist and a midwife or resident. In 2014, a dedicated ECV team consisting of six gynaecologists and six midwives was introduced at the study clinic to improve continuity of care. All six gynaecologists were subspecialized in obstetric care. All members of the ECV team had followed the ECV training course, and midwives also followed an ECV counselling course.

When the ECV team was introduced, standard information was developed for patients, consisting of a leaflet, a movie and an ECV checklist (including an informed consent form and risk counselling). In this way, uniform counselling was guaranteed. Absolute contraindications were multiple pregnancy, being in labour, indication for a planned CS, abnormal umbilical Doppler flow, Rhesus immunization, vaginal bleeding <7 days previously, placenta praevia, ruptured membranes, suboptimal fetal heart rate and congenital uterine abnormalities.

Pregnant women with a singleton fetus in breech presentation who did not have contraindications for ECV were eligible for this study. Type of breech, amniotic fluid volume, placental location and fetal growth were assessed before attempting ECV. Each ECV was performed by two members of the ECV team (one gynaecologist and one midwife), on a fixed day of the week. An abdominal examination, an orientating ultrasound scan and 30 min of cardiotocography were performed prior to ECV. Uterine relaxation was obtained by continuous infusion with ritodrine iv at 4.0 ml/h (50 µg ritodrine in 11 mL glucose 5%), started 15–30 min before the ECV attempt. Ultrasound scanning was used to monitor fetal heart rate during the procedure and afterwards to assess success. Cardiotocography was carried out for 30 min, and Rhesus-

negative women received anti-D immunoglobulin (1000 IU intramuscularly) following the procedure. When ECV failed, a new attempt was made at the study clinic when possible.

The following parameters were collected in the database: maternal age, gestational age, body mass index, parity (nulliparous vs multiparous), type of breech (frank, complete, incomplete or transversal), placental location (anterior vs non-anterior) and amount of amniotic fluid. The amniotic fluid index (AFI) was measured, resulting in oligohydramnios (AFI < 5 cm), normal fluid (AFI 5–25 cm) or polyhydramnios (AFI > 25 cm). In the database, the amniotic fluid volume was noted as oligohydramnios vs normal/polyhydramnios. The primary outcome of the study was the success of ECV. Successful ECV was defined as the fetus having a cephalic presentation immediately after the procedure. Secondary outcomes were mode of delivery and factors contributing to the success of ECV.

Statistical analysis

All statistical analyses were performed using SPSS Version 25.0 (IBM Corp., Armonk, NY, USA). A *p*-value <0.05 was considered to indicate statistical significance. Categorical variables are described using absolute and relative frequencies, and univariate comparisons between 2013 and 2014–2017 were performed using Chi-squared tests. Continuous variables with a normal distribution are described using means and standard deviations. Univariate comparisons were performed using *t*-tests. Continuous variables without a normal distribution are described using medians and ranges. Univariate comparisons were performed using Mann-Whitney *U*-tests. Logistic regression analysis was performed to assess the factors contributing to the success of ECV.

Table 1
Characteristics of women who underwent external cephalic version (ECV).

Characteristics	Total n=673	2013 n=83	2014–2017 n=590	<i>p</i> -value
Maternal age	31.9 (±4.4)	31.8 (±4.9)	32.0 (±4.4)	<i>p</i> = 0.75 ^a
Missing	8 (1.2)	1 (1.2)	7 (1.2)	
Body mass index	23.0 (17–48)	23.0 (17–41)	23.0 (17–48)	<i>p</i> = 0.51 ^b
Missing	34 (5.1)	7 (8.4)	27 (4.6)	
Gestational age at ECV (weeks)	36.0 (34.1–41.9)	36.3 (35.1–39.0)	36.0 (34.1–41.9)	<i>p</i> < 0.001^b
Missing	3 (0.4)	0	3 (0.5)	
Gestational age at ECV (weeks)				
<37	579 (86.0)	75 (90.4)	504 (85.4)	<i>p</i> = 0.26 ^c
≥37	91 (13.5)	8 (9.6)	83 (14.1)	
Missing	3 (0.4)	0	3 (0.5)	
Parity				
Nulliparous	375 (55.7)	51 (61.4)	324 (54.9)	<i>p</i> = 0.27 ^c
Multiparous	297 (44.1)	32 (38.6)	265 (44.9)	
Missing	1 (0.1)	0	1 (0.2)	
Placental location				
Anterior	281 (41.8)	35 (42.2)	246 (41.7)	<i>p</i> = 0.92 ^c
Non-anterior	385 (57.2)	47 (56.6)	338 (57.3)	
Missing	7 (1.0)	1 (1.2)	6 (1.0)	
Type of breech				
Complete	95 (14.1)	11 (13.3)	84 (14.2)	<i>p</i> = 0.95 ^c
Incomplete	38 (5.6)	5 (6.0)	33 (5.6)	
Frank	495 (73.6)	60 (72.3)	435 (73.7)	
Transversal	33 (4.9)	5 (6.0)	28 (4.7)	
Missing	12 (1.8)	2 (2.4)	10 (1.7)	
Amniotic fluid volume				
Normal/polyhydramnios	653 (97.0)	81 (97.6)	572 (96.9)	<i>p</i> = 0.99 ^c
Oligohydramnios	16 (2.4)	2 (2.4)	14 (2.4)	
Missing	4 (0.6)	0	4 (0.7)	
Tocolytic use				
Yes	545 (81.0)	77 (92.8)	468 (79.3)	<i>p</i> < 0.001^c
No	121 (18.0)	3 (3.6)	118 (20.0)	
Missing	7 (1.0)	3 (3.6)	4 (0.7)	

Data presented as *n* (%), mean (±standard deviation) or median (range).

^a *t*-test.

^b Mann-Whitney *U*-test.

^c Chi-squared test.

Results

In total, 787 women were referred to the study clinic for an ECV attempt. Sixty-two (7.9%) women underwent two or more attempts. Only the last attempt was analysed. Fifty-two (6.6%) women were excluded, mainly because of spontaneous cephalic presentation or refusal by the woman herself. In total, 673 (85.5%) ECV attempts were analysed. Of these, 375 women were nulliparous (56%) and 297 (44%) women were multiparous. Baseline characteristics are depicted in Table 1. Baseline characteristics were comparable for 2013 and 2014–2017, except for use of ritodrine and gestational age at ECV. However, when dividing gestational age into two groups (preterm vs term), there was no significant difference between 2013 and 2014–2017. The overall ECV success rate was 57% (385/673). ECV outcomes and obstetric outcomes by year are shown in Table 2. After introduction of the dedicated team in 2014, the number of ECV attempts per year increased from 85 in 2013 to 173 in 2017, and the success rate of ECV increased from 39.8% in 2013 to 69.5% in 2017 (Fig. 1). The greatest increase in the success rate of ECV was seen in nulliparous women (from 23.5% to 58.5%, $p=0.002$) (Fig. 1). After successful ECV, 13 women showed breech presentation at birth, of which three (23%) women had a spontaneous vaginal delivery and 10 (77%) women had a planned CS.

The total spontaneous vaginal delivery rate (cephalic and breech) after ECV increased from 43% in 2013 to 71% in 2017 ($p<0.05$) with a relative risk of 1.7 (95% confidence interval (CI) 1.3–2.2). The number needed to treat was four, meaning that four ECVs performed by the dedicated ECV team led to one additional vaginal delivery in comparison with ECVs performed by the general team.

In 2013, 57.8% (48/83) of women showed a fetus in breech presentation at birth, of which 14.6% had a spontaneous vaginal delivery. There was a significant decline in breech presentation at birth (28%). Notably, more women opted for vaginal breech delivery when the fetus was in breech presentation at birth. In 2017, the rate of breech presentation at birth was 29.9% (46/154), and 32.6% of these women had a spontaneous vaginal breech delivery. This represented an increase in vaginal breech deliveries (18%). However, the overall vaginal breech delivery rate after ECV remained stable throughout the study period (mean 9.2%). Uniform counselling by the same gynaecologists and use of the information leaflet may have given women more confidence in vaginal breech delivery.

Table 2

External cephalic version (ECV) and obstetric outcome by year.

Variable	2013 <i>n</i> =83	2014 <i>n</i> =139	2015 <i>n</i> =131	2016 <i>n</i> =166	2017 <i>n</i> =154
Result of ECV					
Successful	33 (39.8)	71 (51.1)	73 (55.7)	101 (60.8)	107 (69.5)
Failed	50 (60.2)	68 (48.9)	58 (44.3)	65 (39.2)	47 (30.5)
Fetal position at birth					
Breech	48 (57.8)	68 (48.9)	52 (39.7)	61 (36.7)	46 (29.9)
Cephalic	33 (39.8)	67 (48.2)	71 (54.2)	101 (60.8)	105 (68.2)
Transverse	1 (1.2)	0	1 (0.8)	0	0
Missing	1 (1.2)	4 (2.9)	7 (5.3)	4 (2.4)	3 (1.9)
Mode of delivery					
Vaginal	36 (43.4)	66 (47.5)	75 (57.3)	105 (63.3)	110 (71.4)
Spontaneous	34	60	71	96	98
Assisted	2	6	4	9	12
Caesarean section	46 (55.4)	69 (49.6)	49 (37.4)	57 (34.3)	41 (26.6)
Planned	41	48	38	39	29
Unplanned	5	21	11	18	12
Missing	1 (1.2)	4 (2.9)	7 (5.3)	4 (2.4)	3 (1.9)

Data presented as *n* (%).

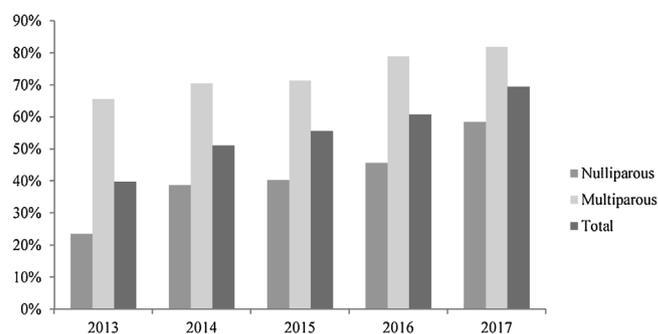


Fig. 1. Success rate of external cephalic version for nulliparous, multiparous and total women.

Overall, the rate of CS after ECV decreased from 55% to 27% ($p<0.05$). The unplanned CS rate was comparable over the years (mean 9.9%). Elective CS for breech presentation decreased from 48.2% to 18.2%.

Multivariable logistic regression analysis showed that multiparity ($p<0.001$) was significantly associated with the success of ECV. Use of ritodrine ($p=0.001$), complete breech ($p=0.03$) and anterior placenta ($p=0.03$) were significantly associated with a lower success rate of ECV. Normal fluid/polyhydramnios ($p=0.09$) and gestational age >37 weeks ($p=0.05$) were associated with the success of ECV, but the results were not significant (Table 3).

Over the 5-year period, nine (1.3%) complications occurred, all within 48 h of ECV. There was one (0.1%) major complication; an ECV attempt was performed at 39^{0/7} weeks of gestation with subsequent induction of labour. Due to umbilical cord prolapse, after artificial rupture of membranes, an emergency CS was performed with good neonatal outcome. There were eight (1.2%) minor complications. There were two cases of preterm rupture of membranes, both of which resulted in preterm birth. Another two preterm deliveries occurred. In all four cases, fetal outcome was good. One woman underwent ECV and showed a lot of blood loss and contractions the next day, and delivered at 36^{0/7} weeks of gestation. Another woman was admitted because of vaginal bleeding during the procedure, and two women experienced preterm contractions. The latter three cases did not lead to preterm birth.

Discussion

Since the introduction of a dedicated team in 2014, the success rate of ECV has increased by 30% to a rate of 69.5% in 2017. Using an experienced group of obstetricians to perform ECV led to an increase in the success rate and a significant decrease in the CS rate overall.

Several prediction models for the success of ECV have been developed, but none of them included experience of the operator as a potential predictor for success [10,15,18]. Kim et al. underlined the potential importance of operator experience by developing a learning curve for ECV. To achieve an expected success rate of 50% in nulliparous women, approximately 57 ECV attempts are needed, and for a 70% success rate, approximately 130 attempts are needed. In multiparous women, only eight to 10 cases would be necessary for an expected success rate of 50% and 70%, respectively [19]. Bogner et al. showed that operator experience had a significant effect on the success rate of ECV [20]. The fact that the success rate of ECV in this study continued to increase in the years after introduction of the dedicated team, without a change in team members, also indicates the development of a learning curve. Two previous studies have focused on

Table 3
Logistic regression analysis to determine predictors of successful external cephalic version.

Variable	Univariable OR (95% CI), <i>p</i> -value	Multivariable OR (95% CI), <i>p</i> -value
Amniotic fluid volume		
Oligohydramnios	1	1
Normal/polyhydramnios	3.0 (1.0–8.7), <i>p</i> =0.04	3.1 (0.85–11), <i>p</i> =0.086
Placenta location		
Non-anterior	1	1
Anterior	0.8 (0.6–1.0), <i>p</i> =0.073	0.7 (0.48–0.97), <i>p</i>=0.032
Tocolytic use		
No	1	1
Yes	0.17 (0.1–0.3), <i>p</i> <0.001	0.3 (0.19–0.64), <i>p</i>=0.001
Type of breech		
Frank	1	1
Complete	0.11 (0.03–0.35), <i>p</i> <0.001	0.2 (0.07–0.90), <i>p</i>=0.034
Incomplete	0.22 (0.06–0.77), <i>p</i> =0.018	0.5 (0.12–1.88), <i>p</i> =0.292
Transversal	0.25 (0.06–0.97), <i>p</i> =0.046	0.5 (0.11–2.1), <i>p</i> =0.326
Gestational age (weeks)		
<37	1	1
≥37	4.5 (2.5–8.1), <i>p</i> <0.001	1.9 (0.99–3.77), <i>p</i> =0.054
Parity		
Nulliparous	1	1
Multiparous	4.0 (2.9–5.6), <i>p</i> <0.001	2.7 (1.9–3.9), <i>p</i><0.001
Body mass index (kg/m ²)		
<30	1	1
≥30	1.1 (0.64–1.75), <i>p</i> =0.84	0.7 (0.42–1.3), <i>p</i> =0.30

OR, odds ratio; CI, confidence interval.

the effect of a dedicated team [16,17], but the present study demonstrated a greater increase in the success rate of ECV after introduction of a dedicated team compared with these studies. Hickland et al. [16] replaced their fortnightly ECV clinic by a weekly breech clinic, and showed an increase in the success rate of ECV from 32.6% to 41.9% over a 3-year period. Vaginal deliveries after ECV increased and the annual number of CSs decreased, as demonstrated in the present study. Kuppens et al. also showed an increase in the success rate (from 47% to 61%) after a change in ECV protocol in 2007 [17].

There were cases of spontaneous reversion to breech presentation after successful ECV. However, these were rare. Overall, in 13 of 385 (3.4%) women with successful ECV, the fetus reverted to breech presentation. The rate of reversion to breech after successful ECV observed in this study is comparable with rates of 2.2–8.1% reported in the literature [6,16,17,20,21]. Previous studies have tried to elucidate fetal and maternal factors that can predict the success of ECV [10–12,15,17,18,22]. Normal to high amniotic fluid volume, multiparity and increased fetal weight have been shown to be predictive of the success of ECV in several studies [11,15,17]. The present study also found that multiparity and normal to high amniotic fluid volume were associated with the success of ECV. However, the association between the success of ECV and amniotic fluid volume did not reach significance, probably due to the small number of women with oligohydramnios (2.4%). The type of breech also influences the success rate of ECV. Burgos et al. found that double footling [odds ratio (OR) 2.8] and complete breech (OR 1.8) were positive predictors of success [22]. Other studies have shown non-frank breech to be positively associated with the success of ECV, but the results were not significant [12,15]. Of note, the present study found that complete breech was a negative predictor for the success of ECV (OR 0.2, 95% CI 0.07–0.9, *p*=0.034). Hutton et al. considered palpability of the fetal head and descent of presenting part, and found that easy palpability of the fetal head and a floating or dipping presenting part were predictive of successful ECV [12]. It is presumed that the predictive value of fetal position might depend on or interact with other fetal parameters as mentioned above.

Strengths and limitations

A strength of this study is the fact that it is the first prospective cohort study to assess the influence of a dedicated team on the success rate of ECV. Furthermore, it is the largest study on this topic to date, with a long-term follow-up. In the years following introduction of the dedicated team, the success rate continued to increase. The team continued to improve their skills by performing more ECV attempts per operator and gaining additional experience over the years. There were no significant differences in patient and obstetric characteristics, except for the use of ritodrine, between consecutive years, making bias less likely.

This study has some limitations. First, all women who underwent ECV attempts were included. This resulted in a large spread of gestational ages, between 34⁺¹ and 41⁺⁶ weeks (median 36⁺⁰ weeks). Compared with ECV after 37 weeks, performing ECV between 34 and 36 weeks decreases the rate of non-cephalic presentation and risk of vaginal breech birth. However, early ECV is associated with increased risk of preterm birth [3]. Overall, 84% of women underwent ECV at 35–37 weeks of gestation, which is the clinic's standard protocol as it reduces the risk of preterm birth and has a good chance of success. Fifteen women (2.2%) underwent ECV before 35 weeks of gestation, but none of them had a preterm birth. Nowadays, the protocol is followed more strictly, and ECV is no longer performed prior to 35 weeks. Velzel et al. showed gestational age at ECV from 37 weeks onwards to be a negative predictor for the success of ECV [18]. The present study did not find a significant effect of gestational age before or after 37 weeks on the success of ECV. However, gestational age of more than 37 weeks was associated with a higher success rate of ECV (OR 1.9, 95% CI 0.99–3.77, *p*=0.054). A possible explanation for this association is the high number of multiparous women in this group (74%, 67/91).

Finally, 121 of 673 (18%) women did not receive tocolysis prior to ECV. More individualized care after introduction of the dedicated team in 2014 led to less use of ritodrine, with 77 women (93%) receiving ritodrine in 2013 compared with 468 (79%) in 2014–2017 (*p*<0.001). The vast majority of published studies compared different tocolytic agents, instead of comparing tocolysis

with placebo. B2-sympathomimetics, such as ritodrine or fenoterol, seem better than atosiban as a tocolytic agent prior to ECV [18,23,24]. One randomized controlled trial studied the effect of ritodrine tocolysis compared with placebo, and found an improved success rate of ECV in nulliparous women receiving ritodrine [25]. In this study, ritodrine was a contributing factor to a lower success rate of ECV, which is a remarkable finding. One hundred of 121 women (83%) without ritodrine tocolysis were multiparous. Since 86% of women who did not receive ritodrine had a successful ECV, it is presumed that the omission of tocolysis will not have affected the results. This may also explain the negative association between the use of ritodrine and the success of ECV.

Conclusions

This study demonstrated that ECV performance by a dedicated team, consisting of experienced obstetricians, leads to an increased success rate and fewer CSs.

Conflict of interests

None declared.

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None.

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