

Effectiveness and Safety of External Cephalic Version in Full-Term Breech Presentations: Retrospective Study

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Background: External cephalic version (ECV) is a pivotal intervention aimed at converting abnormal foetal presentations to cephalic in full-term pregnancies, thereby reducing cesarean delivery rates. This study evaluated the effectiveness of ECV and examined factors influencing its success.

Methods: We conducted single-centre retrospective observational study at the Fourth Hospital of Shijiazhuang, high-volume tertiary obstetric centre, from January 2018 to December 2023. Three hundred and sixty-five women with singleton-term pregnancies and breech, transverse, or oblique foetal presentation who underwent attempted ECV were included. Detailed clinical data, encompassing maternal characteristics, procedural variables, and delivery outcomes, were extracted from medical records. ECV success was defined as conversion to cephalic presentation confirmed by ultrasound without associated complications. Statistical analyses, including univariate and multivariate logistic regression, were performed to identify independent predictors of successful ECV.

Results: Among the study population, 237 patients achieved successful ECV, representing a 64.9% success rate. No major maternal or neonatal complications attributable to the ECV procedure were documented in the study cohort. Multivariate analysis revealed that management by specialized disease team (adjusted OR: 3.262, $p < 0.001$) and multiparity (adjusted OR: 2.374, $p = 0.001$) were significantly associated with higher success rates. Conversely, an anterior placental location significantly reduced the odds of successful ECV (adjusted OR: 0.495, $p = 0.004$). Maternal age and gestational age at the time of the procedure were not significant predictors.

Conclusion: Our findings underscore that specialized team management and favourable obstetric history are critical determinants of successful ECV, whereas an anterior placental location poses a significant impediment. These insights can inform clinical protocols and guide future research aimed at optimizing ECV outcomes.

Keywords: breech presentation, external cephalic version, placenta, pregnancy

Introduction

Breech presentation, where foetus is positioned with its buttocks or feet facing birth canal instead of head, is one of most common abnormal foetal presentations in obstetrics, affecting approximately 3–4% of full-term singleton pregnancies.¹ This malpresentation presents significant challenges in management of labour and delivery, primarily due to increased risks associated with vaginal breech delivery.¹ Complications such as difficulty in delivering foetal head, premature rupture of membranes, umbilical cord prolapse, and elevated risk of neonatal morbidity and mortality have historically led clinicians to favour caesarean sections as safer option for managing breech presentations.²

Breech presentation at term is associated with important clinical decision-making because it increases the likelihood of operative delivery and may be associated with adverse maternal and neonatal outcomes if not appropriately managed. Historically, concerns regarding the safety of vaginal breech birth contributed to a marked rise in planned caesarean delivery

for term breech presentation.^{3,4} Although this strategy reduced some intrapartum risks, it also increased exposure to the short- and long-term consequences of surgical birth, thereby sustaining interest in interventions that may safely reduce avoidable caesarean delivery. Although caesarean delivery may reduce selected intrapartum risks in breech presentation, it remains major surgical procedure with implications for maternal morbidity and future reproductive health.⁵⁻⁷ This has reinforced interest in approaches that may safely increase the likelihood of cephalic presentation and vaginal birth.

One such alternative is external cephalic version (ECV), procedure that involves manual manipulation of foetus through maternal abdomen with goal of converting a breech or non-cephalic presentation to cephalic (head-first) position.⁸ Typically performed after 36 weeks of gestation, ECV has gained recognition as a viable means to promote possibility of a vaginal delivery, thereby potentially mitigating risks associated with caesarean sections.⁹ Advances in foetal monitoring technologies such as real-time ultrasound guidance and non-stress tests have greatly enhanced safety profile of ECV, allowing clinicians to perform manoeuvre with a higher degree of confidence in monitoring foetal well-being during procedure.¹⁰

Cochrane Review concluded that attempting ECV at or near term increases vertex presentation at birth and reduces caesarean birth without clear evidence of long-term harm.⁹ In parallel, the Royal College of Obstetricians and Gynaecologists provides dedicated guidance for ECV and for intrapartum management of term breech,¹¹ emphasizing structured selection criteria, trained teams, and documented counselling. In United States, ACOG recommends that clinicians offer ECV to eligible patients and perform it in facilities with immediate caesarean capability; its Practice Bulletin further notes higher success with tocolysis and supports considering neuraxial analgesia in combination with tocolytic therapy.¹²

Decision to attempt an external cephalic version is complex and must balance potential benefits against risks. Although ECV is generally considered safe procedure, it is not entirely free of complication.¹³ Rare but serious adverse events such as transient foetal distress, placental abruption, or even need for an emergent caesarean delivery necessitate meticulous patient selection and strict adherence to established protocols.¹⁴ Thus, it becomes crucial for clinicians to understand not only success rates associated with ECV but also underlying factors that influence these outcomes.¹⁵

Reported success rates of external cephalic version vary considerably across settings, generally ranging from approximately 40% to 80% in the published literature, depending on case selection, operator experience, use of tocolysis or neuraxial analgesia, and institutional protocols.^{8,9} This variability is clinically important because it indicates that ECV outcomes are not determined solely by maternal or foetal characteristics, but also by service organization and procedural expertise. In China, this issue is particularly relevant given the persistently high caesarean section burden, evolving fertility policies that increase the importance of preserving reproductive potential, and the concentration of obstetric care in high-volume tertiary maternity units. However, data remain limited on how these service-level factors influence ECV success within routine Chinese clinical practice.

One service-level factor that may be especially important is the presence of a dedicated or specialized ECV team. In practice, such a model typically involves protocolized patient selection, coordinated input from senior obstetricians, anaesthesia support, ultrasound guidance, and trained nursing or midwifery staff. Although centre experience and operator expertise have been associated with better ECV outcomes, this type of structured team-based care has been less explicitly evaluated as an independent predictor in routine retrospective cohorts.

In addition, interest in reducing unnecessary primary caesarean delivery has increased in many settings, including high-volume tertiary obstetric units, making ECV an important component of contemporary breech management.¹⁶⁻¹⁸ Several studies have also attempted to predict the likelihood of successful ECV using clinical scoring systems and multivariable prediction models, including models based on parity, placental location, amniotic fluid volume, engagement of the breech, and estimated foetal weight.^{19,20} These tools, including commonly cited predictive approaches such as the Kok model, highlight that ECV success is multifactorial. Nevertheless, the performance and applicability of such models may vary across institutions and populations, particularly where procedural protocols, anaesthesia use, and operator structure differ. For this reason, evaluating predictors in local practice remains necessary even when prior models already exist.

Despite the availability of international evidence on ECV and several reported predictors of success, important gaps remain regarding how patient-level and service-level factors interact in real-world Chinese tertiary obstetric settings. In particular, limited data are available on the influence of structured specialized-team management on ECV success, and the extent to which established predictors from prior scoring systems apply in high-volume local practice is uncertain.

Therefore, this study was undertaken to assess the success rate of ECV in full-term pregnancies with breech, transverse, or oblique foetal presentations, and to identify maternal, foetal, and procedural predictors of success in our setting.

Materials and Methods

Study Design and Setting

This retrospective observational study was conducted at Fourth Hospital of Shijiazhuang over period extending from January 2018 to December 2023. Study involved detailed review of medical records for parturient who received antenatal care and delivered at our institution during this time period. Primary objective was to evaluate effectiveness of ECV in full-term pregnancies with abnormal foetal presentations. Study design was carefully structured to capture all relevant clinical data and ensure that ethical guidelines were strictly followed throughout research process. Institutional approval was obtained, and all aspects of study were conducted in accordance with established protocols to ensure reliability and reproducibility of findings.

Although our institution conducts >20,000 births annually, not all term breech presentations were eligible for or offered ECV during the study period. Consistent with guideline-based practice, ECV was systematically considered for singleton, non-anomalous foetuses at $\geq 36+0$ weeks with reassuring foetal status and no contraindication to vaginal birth. Common reasons not to attempt ECV included: presentation late in active labour or with ruptured membranes; placenta praevia or antepartum haemorrhage; non-reassuring foetal testing; major foetal anomaly or growth restriction with abnormal Dopplers; oligohydramnios; suspected uterine anomaly; multiple gestation; and (per contemporaneous institutional policy in the early years of the cohort) prior uterine scar. In addition, logistical constraints (out-of-hours presentation, operator/unavailable ultrasound/anaesthesia cover) and patient preference (electing planned caesarean after counselling) further reduced the number of attempts. The present cohort therefore represents all documented ECV attempts among women who met eligibility and consented; women who were ineligible, presented intrapartum, declined ECV, or were seen when ECV services were unavailable were not included.

ECV was delivered in scheduled clinic sessions under a standardized protocol and checklist, with a senior consultant present at each session. Trainee attempts occurred only under direct supervision; when coded for analysis, operator role was captured as consultant vs trainee-supervised to reflect experience at the point of care.

Participant Selection

This retrospective cohort comprised all consecutive eligible women who underwent documented ECV at our institution between January 2018 and December 2023 and met the study inclusion criteria.

Research Subjects

Three hundred and sixty-five parturients who met study criteria were selected based on their delivery records at Fourth Hospital of Shijiazhuang. All patients included in study had expressed strong desire for vaginal delivery and, after receiving thorough counselling regarding procedure and its potential risks and benefits, voluntarily consented to undergo ECV. Detailed informed consent was obtained from each participant, ensuring that they were fully aware of procedural details and any associated complications.

We reviewed the completeness of the medical records for all included cases before analysis. Among the 365 women included in the study, data for the variables entered into the descriptive comparison and multivariable logistic regression analyses were available for all cases (365/365, 100%). Therefore, no included participant was excluded from the final analysis because of missing data in the analysed variables. However, some secondary details, particularly certain operator-level and procedural nuances, were not consistently documented in the retrospective records and could therefore not be analysed in a standardized manner across the full cohort.

Inclusion Criteria

Inclusion criteria for study were designed to ensure homogeneous patient population suitable for evaluation of ECV outcomes. Only those parturient with gestational age of 36 weeks or more were included, ensuring that the study focused on full-term pregnancies. Additionally, study was restricted to singleton pregnancies in which the foetus was identified as being in breech, transverse, or oblique position.

Exclusion Criteria

To minimize potential confounding factors and enhance patient safety, stringent exclusion criteria were applied. Patients with history of scarred uterus were excluded due to increased risks associated with surgical intervention. Other exclusion criteria included presence of oligohydramnios, rupture of membranes, and cases in which pregnant woman had RH negative blood type. Rh-negative status was considered an exclusion criterion according to local institutional practice during the study period. Although ECV can be safely performed in unsensitized RhD-negative women with appropriate anti-D prophylaxis in many settings, our centre did not have a uniformly embedded retrospective workflow ensuring standardized documentation and timely administration of anti-D prophylaxis for all such cases across the full study period. To maintain procedural consistency and avoid heterogeneity related to prophylaxis logistics, these patients were excluded from the present cohort.

Moreover, any parturient experiencing vaginal bleeding within one week prior to procedure, or those in active labour accompanied by abnormal foetal heart rate monitoring or placental abruption, was excluded from study. Additionally, severe maternal complications such as hypertensive disorders or thromboembolic diseases, as well as significant foetal/uterine abnormalities including foetal hydrocephalus, untreated foetal anaemia or oedema, abnormal Doppler blood flow values, foetal growth restriction (FGR), macrosomia, septate uterus, or unicornuate uterus resulted in exclusion from study.

Rh-Negative Status

During the study period, unsensitized RhD-negative women were excluded from ECV at our centre to avoid any risk of unrecognized fetomaternal haemorrhage without guaranteed, contemporaneous documentation of anti-D prophylaxis. Standard pathways (group and screen, post-procedure anti-D within 72 h, and dose adjustment if fetomaternal haemorrhage testing indicates) were not uniformly embedded in our retrospective ECV workflow; therefore these patients were not offered ECV and are not represented in this cohort.

Study Procedures

Admission and Pre-Procedure Evaluation

Upon reaching gestational age of 36 weeks or more, each parturient was admitted to hospital for further evaluation and management. At admission, comprehensive pre-procedural evaluation was performed to confirm suitability of patient for ECV. This evaluation included detailed ultrasound examination to assess foetal position, amniotic fluid volume, and other vital parameters, as well as non-stress test (NST) to monitor uterine contractions and foetal well-being. During this period, patients were provided with extensive information about the procedure, and after all their queries were addressed, they signed informed consent forms.

Pre-Procedure Medication

Prior to initiation of external cephalic version, patients were administered specific pre-procedural medication protocol designed to optimize uterine environment. Each patient received 4 mg of Salbutamol Sulfate Tablets orally approximately 1–2 hours before procedure. Purpose of administering Salbutamol was to inhibit uterine contractions, thereby creating a more relaxed and favourable uterine environment for external manipulation of foetus. This medication was given only after thorough clinical assessment to exclude any contraindications to its use, ensuring that only those patients who were safe candidates for uterine relaxation received drug.

ECV Procedure

ECV procedure was conducted in fully equipped operating room under strict medical supervision. Following the administration of spinal anaesthesia, which was used to ensure maternal comfort and to minimize risk of procedural complications, the procedure commenced under continuous ultrasound monitoring. This ultrasound guidance was critical, as it allowed for real-time assessment of the foetal heart rate, amniotic fluid volume, umbilical blood flow, and presence of any umbilical cord entanglement. Placental position was also evaluated prior to manoeuvre to avoid any interference during procedure. The ECV was attempted up to three times, with each attempt strictly limited to duration of 10 minutes to reduce potential stress on foetus. Throughout procedure, intermittent ultrasound scans were performed to monitor the progress of the foetal repositioning. Once foetus was successfully turned to cephalic presentation, immediate post-procedure ultrasound was conducted to verify foetal heart rate and umbilical blood flow. Following confirmation of a successful version, abdominal binder was

applied to secure foetal position, and the patient was subsequently transferred back to inpatient ward where continuous NST monitoring was maintained in preparation for natural labour.

ECV attempts were performed either by a senior consultant or by a trainee under direct consultant supervision, in accordance with institutional practice. The intended maximum number of attempts was the same irrespective of operator category (up to three attempts per procedure session). However, because individual operator case volumes and detailed attempt-level documentation were not consistently available for all cases in the retrospective record, we were unable to formally compare learning-curve effects, exact manipulation characteristics, or attempt-by-attempt differences between consultant-led and trainee-supervised procedures.

All ECV procedures were performed according to a standardized institutional protocol that remained broadly consistent throughout the study period with respect to eligibility assessment, pre-procedural ultrasound and fetal monitoring, use of tocolysis, neuraxial anaesthesia support, ultrasound-guided manipulation, and post-procedure monitoring. Minor operational refinements may have occurred over time as team experience accumulated, but there were no major protocol changes in the core procedural pathway.

Anaesthesia Protocol

For scheduled ECV sessions, we used a standardized single-shot spinal anaesthetic to optimize maternal comfort and abdominal wall relaxation. After IV access and standard monitors (ECG, non-invasive blood pressure, pulse oximetry), spinal anaesthesia was performed in the sitting position at the L3–L4 or L4–L5 interspace with a 25G pencil-point needle. The intrathecal solution comprised hyperbaric bupivacaine 0.5% (6–8 mg) combined with fentanyl (10–20 µg) according to anaesthetist discretion within predefined dose bands, targeting a bilateral sensory block to approximately T10 prior to manipulation. Left uterine displacement was maintained throughout. The rationale for neuraxial use was to (i) improve maternal comfort and tolerance of sustained fundal pressure, (ii) facilitate uterine/abdominal wall relaxation that may increase ECV success, and (iii) allow immediate conversion to caesarean delivery if urgent delivery became necessary (with theatre/obstetric team on standby). Supplemental oxygen was provided as needed. Maternal haemodynamics were supported with crystalloid co-loading and vasopressors per institutional protocol.

Dose, level of block, need for vasopressors, and any adverse events (hypotension, desaturation, high block, post-dural puncture headache) were prospectively recorded in the anaesthesia record and abstracted for this study. Fetal status was assessed by cardiotocography immediately pre-procedure and continuously during manipulation; any non-reassuring pattern prompted cessation of attempts and obstetric escalation per protocol.

Tocolysis

As per institutional protocol during the study period, women received oral salbutamol 4 mg with a sip of water 30–60 minutes before the ECV attempt, unless contraindicated (baseline tachyarrhythmia, poorly controlled hyperthyroidism, insulin-treated diabetes with labile control, or significant cardiac disease). Maternal heart rate and blood pressure were checked pre-dose and immediately pre-procedure; tremor or palpitations were documented when present.

Other tocolytics (eg, subcutaneous terbutaline 0.25 mg single dose or oral nifedipine 10 mg immediate-release 30 minutes pre-attempt) were not used routinely; they were considered only when salbutamol was contraindicated or unavailable, at the treating clinician's discretion. Because alternative agents were used infrequently and non-randomly (policy-driven, contraindication-based), the study was not powered for a head-to-head comparison of tocolytic classes. For transparency, we recorded the agent, dose, timing, and any adverse effects in the case record form.

Management of Unsuccessful ECV

In situations where external cephalic version was unsuccessful or if complications arose during procedure, predetermined management protocol was followed. If procedure resulted in complications such as premature rupture of membranes (PROM), placental abruption, or abnormal foetal heart rate, immediate caesarean section was performed to ensure safety of both mother and foetus. In this study, PROM denotes spontaneous rupture of membranes before labour during the delivery admission after ECV; all ECVs were performed with intact membranes and no procedural ROM occurred. We

have therefore re-presented PROM under delivery/intrapartum outcomes (antenatal PPRM cases were ineligible for ECV and not counted as events).

In cases where the ECV did not successfully convert the foetal presentation, yet the foetal heart rate remained stable and no other adverse conditions were present, the decision regarding subsequent management was made in consultation with the patient. In these instances, based on informed preference of patient and clinical judgment, caesarean section was either scheduled for later time or performed immediately. This approach ensured that any potential risks were managed promptly while respecting the patient wishes and clinical circumstances.

Outcome Measures

Observation Indicators

The success of the external cephalic version was defined as the conversion of the foetal position to cephalic as confirmed by ultrasound, with no associated adverse maternal or foetal conditions. For analytical purposes, the study population was divided into two distinct groups: success group, where ECV was successful, and failure group, where procedure did not yield cephalic presentation or was accompanied by complications. A broad spectrum of clinical data was collected from each participant, including demographic and baseline characteristics such as age, height, pre-pregnancy BMI, BMI prior to the procedure, and parity. In addition, specific gestational parameters were documented, including the gestational age at time of procedure and at delivery. Detailed foetal characteristics were also recorded, such as foetal position (categorized as frank breech, complete breech, transverse, or oblique), estimated foetal weight obtained via ultrasound, and ratio of estimated foetal weight in grams to the maternal height in centimeters.

Foetal-Weight-to-Maternal-Height Ratio (FW/MH)

Because both estimated foetal weight (EFW) and maternal anthropometry have been associated with ECV success or intrapartum mechanics, we created a simple proportionality index a priori to capture foetal size relative to maternal stature. Maternal height (meters) was abstracted from the first antenatal booking visit. EFW (kilograms) was obtained from the ultrasound performed within ≤ 7 days of the ECV attempt and calculated using the Hadlock model that combines head circumference, abdominal circumference, and femur length (Hadlock-3/4 family) as per unit protocol. The ratio was defined as:

$$\text{FW/MH} = \text{EFW (kg)} / \text{Maternal height (m)}$$

We also verified that an alternative scaling (grams/centimeter) is mathematically equivalent up to a constant, yielding identical model fit; we report kg/m to preserve common clinical units and avoid very small numbers. The Hadlock approach is a widely used and validated method for EFW estimation.

Study also captured procedural variables such as the placental position and whether the procedure was performed by specialized disease team. In our context, “specialized” denotes a structured ECV program: dedicated clinics, standardized protocols, and operators with sustained experience (several years and high annual ECV volume under audit). Specialized disease team’ denotes a scheduled ECV clinic staffed, at minimum, by a senior obstetric consultant (lead manipulator), an anesthetist (neuraxial/monitoring), a sonographer (pre-/post-scan, real-time guidance), and a midwife/OR nurse (positioning, fetal surveillance, documentation). Clinics followed a common checklist/protocol; trainee attempts occurred only under direct consultant supervision. Outside these clinics, ad-hoc attempts on the labour ward (without the full named team) were coded as non-specialized. These elements are reproducible in smaller centers via protocolization, brief focused training/simulation, and supervised starts or regional referral/mentorship, rather than relying on unique tertiary-center resources. Maternal outcomes, including mode of delivery, occurrence of postpartum haemorrhage, placental abruption, umbilical cord prolapse, intrauterine foetal death, and fetomaternal transfusion, were meticulously documented. Neonatal outcomes were equally scrutinized, with particular emphasis on 5-minute Apgar score and the length of neonatal admission to the neonatology department.

Prior ECV literature has examined EFW and maternal anthropometrics (height/weight/BMI) individually as predictors of success, while broader obstetric literature suggests that anthropometric ratios (eg, maternal-height-to-infant-weight or fetal-head-to-maternal-height) better reflect fetopelvic proportionality and the biomechanics of manipulation and descent.^{14–18} Building on these insights, we evaluated FW/MH as a parsimonious, reproducible proxy of proportionality for ECV.

Statistical Analysis

All data collected during the study were systematically analysed using SPSS version 25.0 software. Normality of continuous variables was assessed using visual inspection of histograms and Q–Q plots together with the Shapiro–Wilk test. Variables judged to be approximately normally distributed are presented as mean \pm standard deviation and were compared using the independent-samples *t* test, whereas skewed variables are presented as median (interquartile range) and were compared using the Wilcoxon rank-sum test. Enumeration data were analysed using chi-square test to evaluate categorical variables.

Because this was a retrospective study including all eligible documented ECV attempts during the study period, no formal a priori sample size or power calculation was performed. The study should therefore be interpreted as an observational analysis of the available cohort rather than a prospectively powered hypothesis-testing study.

Model and Variable Selection

We modelled ECV success (yes/no) using multivariable logistic regression. Candidate predictors were prespecified from clinical relevance and prior literature: parity (nulliparous vs multiparous), gestational age at attempt (weeks), amniotic fluid index (AFI; cm), placental location, estimated fetal weight (EFW; kg), maternal height (m) (or the FW/MH ratio in exploratory models), tocolysis given (yes/no), neuraxial anaesthesia used (yes/no), and operator (consultant vs trainee-supervised).

Operator and Calendar Time

To partially account for provider experience, we included operator category (consultant-led vs trainee-supervised) as a service-level covariate rather than individual operator identifiers, because operator-specific case volumes and identifiers were not consistently available across the retrospective study period. Accordingly, residual operator-level variability may not have been fully captured. We did not include calendar year in the final model because the available sample size and events-per-variable did not support adding multiple time parameters without risking overfitting; however, we acknowledge that changes in practice patterns, team experience, and procedural organization across the 6-year study period may have contributed to unmeasured heterogeneity.

Collinearity, Coding, and Diagnostics

Continuous predictors were checked for linearity in the logit using restricted cubic splines (3 knots at the 10th/50th/90th percentiles); if non-linearity was not supported (overall spline $p > 0.05$), variables were modelled linearly and scaled to clinically interpretable units (eg, per 1 cm AFI, per 0.1 kg EFW, per 0.5 kg/m FW/MH). We assessed multicollinearity via variance inflation factors (VIF), targeting $VIF < 5$ for all retained covariates; when two variables were highly correlated (eg, FW/MH with its components), we did not include both simultaneously and prioritized the prespecified primary representation. Placental location was encoded as anterior vs non-anterior (posterior/fundal/lateral) based on prior evidence that anterior placenta reduces success.

Multivariable Model Selection and Reporting

Multivariable model was restricted to candidate predictors considered clinically relevant and available before the ECV outcome was known. Variables were considered for multivariable analysis if they were clinically prespecified based on prior literature and biological plausibility and/or showed an association with ECV success at $p < 0.20$ in univariable analysis. Variables that were clearly downstream outcomes of ECV success or failure, such as mode of delivery, gestational age at delivery, neonatal birth weight, PROM, Apgar score, and neonatal admission, were not included as predictors in the multivariable model because they do not precede the ECV outcome and would not be appropriate explanatory variables.

We then performed backward elimination with the Akaike Information Criterion (AIC) as the stopping rule, retaining variables that minimized AIC; we report the final model with two-sided $p < 0.05$ considered statistically significant and provide adjusted odds ratios (aORs) with 95% CIs. Formal goodness-of-fit and calibration diagnostics were not included in the original analysis and are acknowledged as a methodological limitation. However, we minimized overfitting by

restricting the number of covariates in relation to the sample size, assessing collinearity, and using clinically prespecified variables with AIC-guided model refinement.

Results

Figure 1 shows the flowchart depicting the outcome of the patients. Table 1 summarizes the clinical characteristics of patients undergoing ECV stratified by procedure outcome (successful, $n=237$; failed, $n=128$). Patients in the successful group were significantly older (31.1 ± 3.9 years) compared to those in the failed group (29.8 ± 3.6 years; $p=0.001$). Although body mass index was similar between groups (21.7 ± 3.6 vs. 21.5 ± 2.9 kg/m^2 ; $p=0.629$), the gestational age at which ECV was attempted was slightly lower in the successful group (38.0 ± 0.8 weeks) relative to the failed group (38.2 ± 0.9 weeks; $p=0.012$). Foetal weight at the time of ECV did not differ significantly (3050 ± 304 vs. 3010 ± 265 grams; $p=0.213$).

Delivery outcomes showed significant differences: the successful group had a later gestational age at delivery (39.3 ± 1.0 vs. 38.3 ± 0.8 weeks; $p<0.001$) and higher neonatal birth weights (3274 ± 343 vs. 3050 ± 312 grams; $p<0.001$). A significantly greater proportion of patients in the successful group were managed by a specialized disease team (67.1% vs. 38.3% ; $p<0.001$) and were multiparous (62.0% vs. 39.8% ; $p<0.001$). Although the overall distribution of foetal positions (single breech, complete breech, and transverse) did not differ significantly between the groups ($p=0.220$), there was a significantly higher incidence of anterior placental location in the failed group (51.6% vs. 34.2% ; $p=0.002$).

Notably, all patients in the failed group underwent cesarean section compared to only 13.5% in the successful group ($p<0.001$). There were no significant differences in newborn gender distribution ($p=0.576$) or 5-minute Apgar scores (both groups medians of 10; $p=0.359$). Finally, premature rupture of membranes occurred significantly more frequently in the successful group (33.3% vs. 3.9% ; $p<0.001$), while the rate of neonatal admissions to the Department of Neonatology was similar (6.8% vs. 9.4% ; $p=0.412$). This difference in PROM should be interpreted cautiously. At our centre, women with failed ECV were generally managed by planned caesarean delivery before labour, whereas women with successful ECV usually continued expectant management awaiting labour. Accordingly, the higher PROM proportion observed in the successful ECV group likely reflects differential post-procedure management pathways and longer exposure to labour-related events rather than a direct adverse effect of successful ECV itself.

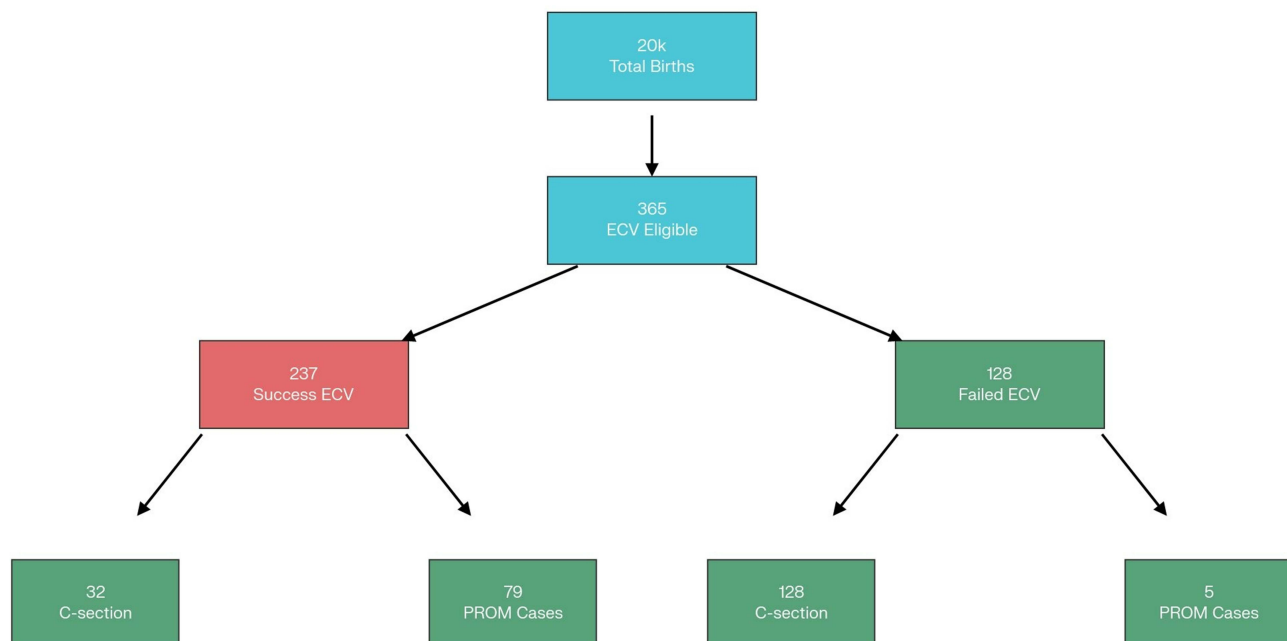


Figure 1 STROBE flow diagram illustrates the participant flow in the study. It starts from the annual 20,000 births at the hospital, narrowing down to 365 eligible external cephalic version (ECV) candidates included in the analysis. It then shows the division into 237 successful and 128 failed ECV attempts, with cesarean delivery outcomes and premature rupture of membranes (PROM) distributed accordingly.

Table 1 Comparison of Clinical Characteristics Between Successful Group and Failed Group of ECV (N=365)

Clinical Characteristics	ECV Successful Group (n=237)	ECV Failed Group (n=128)	p-value
Age (y)	31.1±3.9	29.8±3.6	0.001
BMI (Kg/m ²)	21.7±3.6	21.5±2.9	0.629
ECV gestational week(s)	38±0.8	38.2±0.9	0.012
ECV foetal weight	3050±304	3010±265	0.213
Gestational week at delivery	39.3±1.0	38.3±0.8	<0.001
Neonatal birth weight	3274±343	3050±312	<0.001
Specialized disease team	159 (67.1)	49 (38.3)	<0.001
Multipara	147 (62)	51 (39.8)	<0.001
Foetal position			0.220
Single breech presentation	111 (46.8)	54 (42.2)	
Complete breech presentation	111 (46.8)	70 (54.7)	
Transverse position	15 (6.3)	4 (3.1)	
Anterior wall of the placenta	81 (34.2)	66 (51.6)	0.002
Cesarean section	32 (13.5)	128 (100)	<0.001
Gender of newborn			0.576
Male	97 (40.9)	48 (37.5)	
Female	140 (59.1)	80 (62.5)	
Premature rupture of membranes (PROM)	79 (33.3)	5 (3.9)	<0.001
5-minute Apgar score of the newborn	10 (10,10)	10 (10,10)	0.359
Admission to the Department of Neonatology	16 (6.8)	12 (9.4)	0.412

Abbreviations: BMI, Body mass index; ECV, External cephalic version;

No major maternal or neonatal complications directly attributable to the ECV procedure, including placental abruption, umbilical cord prolapse, intrauterine foetal death, or clinically significant fetomaternal transfusion, were documented among the included participants.

Table 2 and Figure 2 displays the results of a multivariate logistic regression analysis conducted to identify independent predictors of successful ECV among 365 participants. In this analysis, management by a specialized disease team was strongly associated with success, with an adjusted OR of 3.262 (95% CI, 1.935–5.498; $p < 0.001$), indicating that patients managed by such teams were over three times more likely to have a successful ECV. Similarly, multiparity was significantly linked to higher success rates (adjusted OR 2.374, 95% CI, 1.415–3.981; $p = 0.001$).

Conversely, an anterior wall of the placenta was associated with reduced odds of success (adjusted OR 0.495, 95% CI, 0.308–0.793; $p = 0.004$), suggesting that this placental location may impede the effectiveness of the procedure. The analysis did not find age (adjusted OR 0.949, 95% CI, 0.887–1.016; $p = 0.133$) or the gestational week at which the foetal version was attempted (adjusted OR 1.008, 95% CI, 0.740–1.373; $p = 0.959$) to be significant predictors of ECV outcome.

Table 2 Multivariate Logistic Regression Showing the Factors Associated with Successful ECV Amongst Study Participants (N=365)

Clinical Characteristics	Adjusted OR	95% CI	p-value
Age	0.949	0.887–1.016	0.133
Gestational week of foetal version	1.008	0.740–1.373	0.959
Anterior wall of the placenta	0.495	0.308–0.793	0.004
Specialized disease team	3.262	1.935–5.498	<0.001
Multipara	2.374	1.415–3.981	0.001

Notes: Variables entered into the candidate multivariable pool were selected based on clinical relevance, literature support, and/or univariable association with ECV success; outcome variables occurring after ECV were not eligible for inclusion in the regression model.

Abbreviations: OR, Odds Ratio; CI, Confidence interval; ECV, External cephalic version.

Discussion

The present study showed that ECV achieved a success rate of 64.9% in term pregnancies with non-cephalic presentation, and that success was independently associated with management within a structured specialized team pathway and with multiparity, whereas an anterior placental location reduced the likelihood of success.^{21,22} The novel aspect of our findings lies less in identifying entirely new obstetric predictors and more in demonstrating, within a real-world tertiary-care cohort, that service-level organization, particularly management within a structured specialized team pathway was independently associated with ECV success alongside established clinical predictors such as multiparity and placental location.

Our centre followed a failed-ECV → planned pre-labor caesarean policy; accordingly, secondary outcomes that depend on entering labour (eg, PROM, mode of delivery, induction) are pathway-dependent and should be interpreted in that context rather than as effects of ECV success per se. Another key observation from study is the role of parity in predicting ECV success. Multiparous women were found to have higher odds of successful ECV compared to their nulliparous counterparts. This relationship might be reflective of the differences in uterine compliance and the prior history of vaginal deliveries, which may favour the mechanical aspects of foetal repositioning.²³

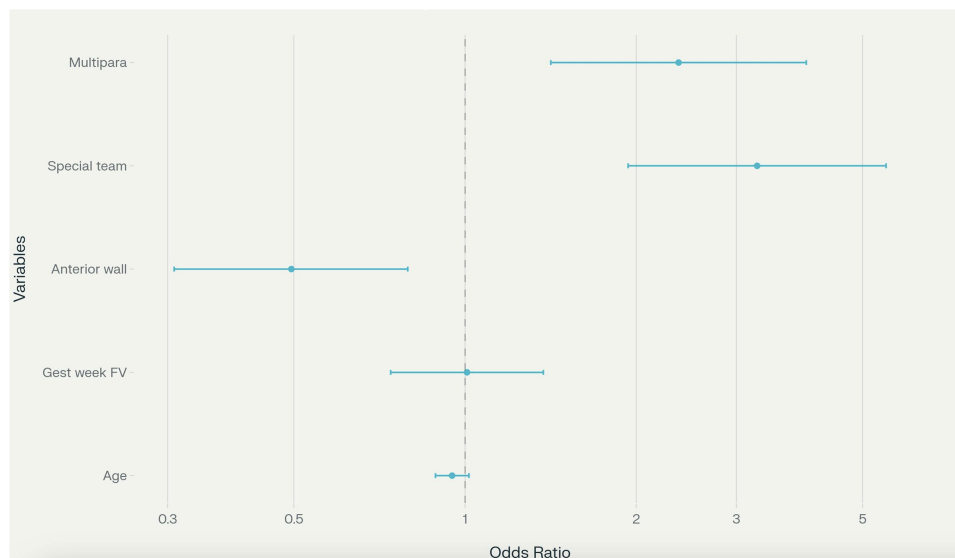


Figure 2 Forest plot presents the adjusted effects from your multivariate logistic regression analysis. It shows adjusted odds ratios with 95% confidence intervals for key predictors of successful ECV: age, gestational week of foetal version, anterior placental location (which reduces success odds), management by a specialized disease team, and multiparity (both strongly increasing success odds).

The study also highlighted the negative impact of an anterior placental location on ECV outcomes. Presence of the placenta along the anterior uterine wall was associated with a reduction in the likelihood of a successful version. This could be explained by the mechanical interference the placenta may pose during the manoeuvre, potentially limiting the ease with which the foetus can be rotated into a cephalic position.²⁴ Several mechanisms may explain this association. An anterior placenta may reduce the space over the anterior uterine wall available for effective manual pressure, thereby limiting the operator's ability to apply sustained and well-directed force during the version manoeuvre. An anterior placenta may also be associated with less favourable palpation of foetal poles and reduced manoeuvrability during ultrasound-guided rotation. Therefore, the lower success rate observed in these cases is likely to reflect both mechanical and operator-behavioural factors rather than placental location acting as an isolated biological determinant. Additionally, procedural outcomes extend to delivery and neonatal parameters, with successful ECV being linked to a later gestational age at delivery and higher neonatal birth weights. The significant reduction in caesarean sections among the successful group further reinforces the clinical importance of achieving a cephalic presentation before delivery, as it appears to contribute to more favourable maternal and neonatal outcomes.²⁵

The overall ECV success rate in our cohort was 64.9%, which lies within the broadly reported international range of approximately 40% to 80%. This positioning is clinically informative because it suggests that our results are neither unusually low nor exceptionally high, but rather consistent with outcomes achieved in well-organized contemporary practice. Global variation in ECV success likely reflects differences in case selection, parity distribution, placental location, amniotic fluid volume, gestational age at attempt, use of tocolysis or neuraxial analgesia, operator experience, and the degree of protocolization within institutions.

The higher crude PROM proportion in the success group should be interpreted as a pathway effect: successful ECV transitions most patients to expectant intrapartum management, increasing exposure time for PROM to manifest, whereas failed ECV commonly results in scheduled pre-labor caesarean, truncating the risk period. This finding should not be interpreted as evidence that successful ECV biologically increases PROM risk. Rather, it most likely reflects the fact that women with successful ECV remained under ongoing pregnancy and labour management, whereas failed ECV cases in our centre frequently proceeded to planned pre-labour caesarean delivery, thereby truncating the opportunity for PROM to occur.

The study findings align with several prior reports, but the broader literature is not entirely uniform and deserves more balanced interpretation. Substantial evidence supports multiparity and non-anterior placental location as favourable predictors of ECV success, and our findings are consistent with those observations.^{19,20,25–31} Cohort studies such as those by Burgos et al and long-term programmatic experience reported by Impey's group have also highlighted the contribution of structured clinical pathways and accumulated operator expertise.^{26,31} Likewise, Cochrane reviews support the effectiveness of ECV at or near term in increasing cephalic presentation at birth and reducing caesarean delivery.⁹ However, not all large cohorts have identified the same magnitude or pattern of predictors, and some have reported weaker or non-significant effects for variables such as maternal age, placental location, or timing of the procedure after multivariable adjustment. Differences across studies likely reflect heterogeneity in eligibility criteria, operator training, institutional pathways, analgesia and tocolysis use, and the baseline obstetric profile of the population studied.

Similarly, association between the involvement of specialized disease team and ECV outcomes is in line with recent trends in clinical practice where multidisciplinary approaches have become increasingly valued. Previous studies have indicated that centers with dedicated protocols and teams experienced in managing abnormal foetal presentations tend to report higher success rates.³² In contrast, the impact of maternal age on ECV outcomes has been a subject of debate in the literature. Some earlier studies suggested that advanced maternal age might be associated with lower success rates, possibly due to reduced uterine tone or other age-related physiological changes.³³ However, subsequent research, including the present study, has shown that age may not be as influential a factor as once thought when other variables are controlled.³⁴

The influence of placental location on the outcome of ECV is another aspect that has received varied attention in prior research. Some investigators have proposed that an anterior placenta could serve as a physical barrier during the manoeuvre, thereby reducing the chances of success, a hypothesis that finds support in the current study's results. However, the literature also reflects instances where the placental position did not significantly affect outcomes, highlighting the possibility of heterogeneity in patient populations or procedural techniques across different studies.³⁵ The present study contributes to this

ongoing discussion by providing evidence that an anterior placental location is indeed a significant impediment to successful ECV, thereby advocating for its consideration during pre-procedural evaluation.

In synthesizing these comparisons, it becomes evident that the current study not only reaffirms several established predictors of ECV success but also clarifies the relative importance of different clinical variables. The confirmation of multiparity and specialized team management as strong predictors underscores the need for clinicians to prioritize these factors during patient counselling and procedural planning.²⁶

Evidence suggests neuraxial anesthesia plus tocolysis can yield ~75% success, whereas our 64.9% likely reflects centre-specific factors such as case-mix, stricter eligibility, anterior-placenta prevalence, operator mix, timing of attempts, and broader institutional workflow rather than technique alone. More generally, these same factors help explain why ECV success rates vary internationally across the 40–80% range reported in the literature.

Our finding that multiparity strongly predicts ECV success aligns with multiple prospective and retrospective series, where prior vaginal birth likely reflects greater abdominal wall compliance and lower uterine tone, facilitating manipulation.^{19,20,27–30} In a prospective cohort, Burgos et al identified parity, higher amniotic fluid, and non-anterior placenta as independent predictors of success.²⁷ Subsequent multivariable analyses and prediction studies have repeatedly confirmed the parity effect. In addition, operator experience appears to influence outcomes: single-operator series^{19,20} and centres with dedicated ECV teams report higher success and fewer abandoned attempts, and long-running cohort experience from Impey's group supports the value of structured programmes and expertise development.³¹

Training data spanning simulation curricula and supervised early clinical series suggest that structured instruction with mentored starts can achieve 50–75% ECV success once basic proficiency is reached³⁶ consistent with higher rates reported from long-running, single-operator/structured programs.

The study has several notable strengths that enhance credibility and clinical relevance of its findings. One of the primary strengths is its higher sample size drawn from single institution over an extended period of six years. This extended timeframe allowed for collection of comprehensive clinical data, which increases the statistical power of the analysis and helps in detecting significant associations. In addition, utilization of multivariate logistic regression model enabled researchers to control for multiple factors simultaneously, thereby isolating the independent effects of key variables such as specialized team management, multiparity, and placental location.

Despite these strengths, the study is not without limitations. First, the inclusion proportion was low relative to the total number of annual births and the expected number of term non-cephalic presentations, reflecting eligibility restrictions, patient preference, and service-availability constraints. As a result, the findings may not be fully generalizable to broader obstetric populations or to centres with different referral pathways, case selection practices, or service structures. Second, the single-centre retrospective design limits external validity. In addition, unsensitized RhD-negative women were excluded according to local practice logistics during the study period, whereas many centres perform ECV with anti-D prophylaxis pathways in place. Therefore, our results may be most applicable to institutions with similar eligibility criteria, procedural protocols, and service organization. The sample size reflected the full eligible retrospective cohort rather than a prospectively powered sample, and the findings should therefore be interpreted as observational associations within the available institutional dataset. Although a common procedural pathway was used across the study period, gradual evolution in team experience and service organization over six years may have introduced unmeasured heterogeneity. Operator-level variability could only be partially addressed because detailed individual case-volume data and attempt-level procedural metrics were not consistently available in the retrospective records.

These findings also have particular relevance in the Chinese obstetric context. In a setting where caesarean reduction remains an important health-system priority and fertility encouragement policies have increased attention to the long-term reproductive implications of primary caesarean birth, improving access to safe and effective ECV may have value beyond the index pregnancy.

This study carry significant implications for clinical practice, particularly in the context of managing abnormal foetal presentations at term. The strong association between specialized team management and successful ECV outcomes suggests that healthcare institutions should consider developing dedicated multidisciplinary teams to manage these cases. Such teams, equipped with specialized training and experience, can optimize patient selection, implement standardized pre-procedural protocols, and provide continuous monitoring during the procedure, ultimately enhancing the likelihood

of a favourable outcome. This approach not only has the potential to increase the success rates of ECV but may also reduce the incidence of cesarean deliveries, thereby improving maternal and neonatal outcomes.^{37,38}

While the present study offers valuable insights, several avenues for future research remain open to further validate and extend these findings. Prospective, multicentre studies are warranted to confirm the observed associations in a more diverse patient population and across various healthcare settings. Such studies would help to address the limitations related to the single-center design and enhance the external validity of the results. Additionally, randomized controlled trials could provide more definitive evidence regarding the causal impact of specialized team management on ECV success, as well as the relative benefits of various pre-procedural protocols and techniques.

Conclusion

This retrospective single-centre study showed that ECV achieved a success rate of 64.9% in term pregnancies with breech, transverse, or oblique presentation, placing our findings within the internationally reported range for contemporary ECV practice. Successful ECV was independently associated with management within a structured specialized team pathway and with multiparity, whereas an anterior placental location was associated with lower odds of success. These findings suggest that ECV outcomes are influenced not only by patient characteristics but also by the organization and expertise of the service delivering the procedure. From a clinical perspective, the results support offering ECV within protocolized care pathways that include careful pre-procedural assessment, experienced operators, ultrasound-guided monitoring, and appropriate anaesthesia/tocolysis support. In counselling patients, clinicians should consider parity and placental location as practical factors when discussing the likelihood of success, while also recognizing that a meaningful proportion of women can still benefit from an attempted version under well-organized care. Future multicentre prospective studies should validate these predictors in broader populations, examine operator-level and service-level determinants more directly, and evaluate whether structured ECV programs can improve success rates and reduce avoidable primary caesarean delivery at the health-system level.

Data Sharing Statement

Data will be made available upon reasonable request from corresponding author.

Ethics Approval and Consent to Participate

This study was approved by Medical Ethics Committee of the Fourth Hospital of Shijiazhuang City with approval number 20230022. Informed consent was obtained from all the study participants. The study was carried out on in compliance with the Helsinki Declaration.

Author Contributions

Qianqian He and Fuchun Cui contributed equally to the work as co-first authors. Yanlei Xu and Qian Wang contributed equally to the work as co-corresponding authors. All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors report no conflicts of interest in this work.

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