



Review

Prediction models for successful external cephalic version: a systematic review



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ABSTRACT

To provide an overview of existing prediction models for successful ECV, and to assess their quality, development and performance. We searched MEDLINE, EMBASE and the Cochrane Library to identify all articles reporting on prediction models for successful ECV published from inception to January 2015. We extracted information on study design, sample size, model-building strategies and validation. We evaluated the phases of model development and summarized their performance in terms of discrimination, calibration and clinical usefulness. We collected different predictor variables together with their defined significance, in order to identify important predictor variables for successful ECV. We identified eight articles reporting on seven prediction models. All models were subjected to internal validation. Only one model was also validated in an external cohort. Two prediction models had a low overall risk of bias, of which only one showed promising predictive performance at internal validation. This model also completed the phase of external validation. For none of the models their impact on clinical practice was evaluated. The most important predictor variables for successful ECV described in the selected articles were parity, placental location, breech engagement and the fetal head being palpable. One model was assessed using discrimination and calibration using internal (AUC 0.71) and external validation (AUC 0.64), while two other models were assessed with discrimination and calibration, respectively. We found one prediction model for breech presentation that was validated in an external cohort and had acceptable predictive performance. This model should be used to counsel women considering ECV.

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Contents

Introduction	161
Methods	161
Study identification	161
Study selection	161
Study quality assessment	161
Predictor variables	161
Model development assessment	162
Model performance	162
Results	162
Study identification and selection	162
Study characteristics	162

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Study quality	162
Predictor variables	162
Phases of model development	164
Performance of the prediction models	166
Discussion	166
Conflicts of interest	166
Funding source	166
Acknowledgements	166
References	167

Introduction

Breech presentation occurs in 3–4% of all term pregnancies [1,2]. Vaginal delivery of a fetus in breech position is associated with higher rates of neonatal morbidity and mortality compared to a planned caesarean delivery [3]. Consequently, worldwide the rate of term vaginal breech deliveries has declined substantially [4,5]. However, caesarean delivery is associated with short and long-term consequences for maternal and neonatal health [6,7]. External cephalic version (ECV) is a safe and effective procedure to reduce the number of breech presentations at term and consequently the caesarean delivery rate for this indication [8–12]. Considering the worldwide general rise in caesarean delivery rate in the last decade [13–15] and the urgency to put a hold to this rise [6,7], ECV is an important intervention that can contribute to this goal.

Even though procedure related complications rarely occur, concerns about safety of the procedure can be a reason for women not to accept an ECV attempt [16,17]. Additionally, knowledge about the effectiveness of ECV also influences acceptance of ECV [16,17]. The success rate of ECV varies from approximately 35% up to 86% in the literature with an average of 50–60% [4,18]. Thus, a reliable more precise and individualized prediction of successful ECV could be useful to counsel women for an ECV attempt. Previous studies have shown that clinical and ultrasound characteristics are associated with success or failure of an ECV procedure [19,20]. There are several prediction models that enable individualized prediction of the outcome of an ECV attempt. However, since the use of poor-quality prediction models could have a negative effect on decision-making [21], careful evaluation is needed before these models can be implemented in clinical practice.

Therefore, the aim of this review is to give an overview of existing prediction models for successful ECV, to evaluate their quality, development and performance and to identify important predictor variables described in the selected articles.

Methods

Study identification

We performed a computerized MEDLINE, EMBASE and Cochrane databases search to identify all studies reporting on prediction models for successful ECV published from inception to April 2015. Language restrictions were not applied. Together with a clinical librarian we developed a search strategy including all known synonyms for the term ‘external cephalic version’ and we performed a search filter for prediction models. References from selected publications were manually searched for additional relevant articles not identified by the computerized search.

Study selection

This review focused on articles that reported on a prediction model to predict the outcome of an ECV attempt. A prediction model was defined as a multivariable model that expressed the chance of successful ECV as a function of at least two predictor variables. In order to be eligible and selected, the articles had to report on a prediction model sufficient to make predictions for individual cases. Two independently working reviewers (JV and FM) selected articles by assessing titles and abstracts. When there were any doubts about the eligibility after reading title and abstract, the article was included for full text reading to make sure no potential eligible article was missed. Any disagreements were resolved by consensus and, if necessary, by a third reviewer (MK).

Study quality assessment

A framework was developed based on the recommended guideline of Hayden et al. [22] in combination with recommendations derived from the Quality In Prognosis Studies tool [23], in order to adequately operationalize items for assessing bias and study quality of the selected articles. The framework was divided into four sections: study participation, predictor variables/prognostic factor measurement, outcome measurement and analysis.

As recommended by Hayden et al., we assessed our four potential bias domains in two steps. During the first step, we assessed the fully operationalized relevant quality items which were scored with ‘yes’, ‘no’, ‘partly’ or ‘unclear’. During the second step, we used these item responses to judge each of the four potential bias domains. Each of these domains was rated as having high, moderate or low risk of bias. This approach to quality appraisal follows a method that has been described by Wortman [24] as ‘mixed-criteria’ quality assessment.

Additionally, we assessed the overall risk of bias and therefore the overall study quality for each study by combining the ratings of the four bias domains of our framework. We took into account the importance of each individual bias domain, with ‘analysis’ and ‘predictor variables’ being the most important domains, which were determined a priori.

Predictor variables

We collected all predictor variables used in the selected articles together with their defined significance, in order to identify the most important predictor variables for successful ECV. Predictor variables are the potential predictors, which were tested both during model development and in the final model. The most important predictor variables were those described as statistically significant input variables in both univariable and multivariable regression analysis in three or more studies. When a predictor variable was only tested in two studies, and not in the other

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