Ultrasound Obstet Gynecol 2009; **33**: 76–84
Published online in Wiley InterScience (www.interscience.wiley.com). **DOI:** 10.1002/uog.6277

Ultrasound factors to predict the outcome of external cephalic version: a meta-analysis

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KEYWORDS: external cephalic version; meta-analysis; prediction; ultrasound

ABSTRACT

Objective *To systematically review the medical literature reporting on ultrasound factors that can be predictive for the outcome of an attempt at external cephalic version (ECV).*

Methods *MEDLINE, EMBASE and Cochrane Central Register of Controlled Trials were searched. Studies reporting on potential ultrasound prognosticators and ECV success rates that allowed construction of a 2 × 2 table were selected.*

Results *We selected 37 primary articles reporting on 7709 women. Posterior placental location (odds ratio (OR), 1.9; 95% CI, 1.5–2.4), complete breech position (OR, 2.3; 95% CI, 1.9–2.8) and an amniotic fluid index > 10 (OR, 1.8; 95% CI, 1.5–2.1) were predictors of successful ECV.*

Conclusion *Success of an ECV attempt is associated with ultrasound parameters such as fetal position, amniotic fluid and placental location. This knowledge can be used to develop a prognostic model to predict successful ECV.*

INTRODUCTION

Breech presentation occurs in 3–4% of all term pregnancies[1]. External cephalic version (ECV) can reduce the rate of non-cephalic presentations at term, and thus the number of Cesarean deliveries performed for breech presentation[2]. It is a safe procedure, carrying minimal risk for mother and child[3]. The high Cesarean delivery rate for breech presentation makes ECV an important obstetric intervention and it is therefore recommended by the Royal College of Obstetricians and Gynaecologists. Nevertheless, acceptance of both women and clinicians to attempt an ECV varies. Reported rates of maternal refusal of an ECV attempt range from 18% to 76%[4–6]. Conversely, the number of women potentially suitable for ECV who are not offered an attempt ranges from 4% to 33%[6–8]. Uncertainty about the chances of success of an ECV attempt might explain this at least in part. Therefore, individual prediction of the outcome of an ECV attempt could be important.

Various studies have reported on clinical and ultrasound factors that predict the outcome of an ECV attempt[9–15]. Ultrasound factors thought to be associated with successful ECV are placental location, amniotic fluid index (AFI) and type of breech. One systematic review evaluated the role of the AFI in the success of an ECV attempt[16], finding that an AFI < 10 may correlate with lower success rates for ECV, although the association was not statistically significant. This review did, however, report only on AFI and not on other ultrasound parameters. At present, a systematic review on all potential ultrasound factors is not available. The aim of this review, therefore, was to identify and quantify ultrasound factors that can predict successful outcome of an ECV attempt.

METHODS

Search strategy

We performed an electronic search to identify all studies reporting on the outcome of ECV in relation to potential ultrasound prognosticators. We searched the current Cochrane Central Register of Controlled Trials (CENTRAL, The Cochrane Library), MEDLINE (1953–2007) and EMBASE (1980–2007) using a search strategy with keywords: 'version, fetal', 'cephalic version', 'external version', 'predict', 'success' and/or 'rate'. The

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Accepted: 18 July 2008

complete electronic search strategy is available from the first author. Reference lists of review articles and eligible primary studies were checked to identify cited articles not captured by electronic searches. Reference manager 11.0 (Thomson ISI ResearchSoft, Philadelphia, PA, USA) was used to manage the results of all searches.

Study selection criteria

Studies were selected in a two-stage process. Firstly, three reviewers (M.K., L.G., B.M.) scrutinized the titles and abstracts of all references possibly reporting on potential ultrasound prognosticators and ECV success rates. Successful ECV was defined as the fetus being in cephalic position directly after the procedure. For all studies that were selected by at least one of the reviewers, full manuscripts were obtained. Secondly, final in-/exclusion decisions were made after independent and duplicate examination of the full manuscripts of selected references by two reviewers (M.K., L.G.). Studies were included if they reported on ECV from 36 weeks onwards with at least one potential ultrasound prognosticator related to ECV success rate. Language restrictions were not applied. For each included article, data on clinical and methodological study characteristics were extracted independently by two reviewers on piloted data-extraction forms. Any disagreements were resolved by consensus and, if necessary, by a third reviewer.

Quality assessment

We assessed all manuscripts that met the selection criteria for study quality[17]. For this review, quality criteria considered to be associated with bias were retrospective data collection, non-consecutive patient enrolment, lack of blinding to the clinical factors and no report on number of clinicians assessing the ultrasound factors. All included manuscripts were assessed by at least two reviewers for quality of study and of reporting.

Statistics

For each study, we constructed a 2×2 table cross-classifying a potential ultrasound prognosticator against the outcome of the ECV attempt. The authors of studies from which it was not possible to construct 2×2 tables were contacted for additional data. From each 2×2 table an odds ratio (OR) and 95% CI was calculated[18]. When multiple cut-offs were present for one risk indicator, we constructed a 2×2 table for each cut-off level. We used forest plots to visualize the data. The I^2 test was used to assess homogeneity, using a P-value of 0.05 as the threshold[19]. When homogeneity could not be rejected, we used a fixed-effect model to calculate a common OR and 95% CI, whereas a random-effects model was used when homogeneity was rejected. Statistical analyses were performed using Stata/SE 9.0 (StataCorp, College Station, TX, USA).

RESULTS

Literature identification and study quality

The search detected 616 studies, of which 102 were retrieved for complete assessment (463 excluded after screening of titles and 51 after screening of abstracts). Of the 102 primary articles, 65 had to be excluded for the following reasons: from three studies 2×2 tables could not be derived; 60 studies did not report on ultrasound parameters; and for two studies, the original report could not be obtained. We asked the authors of the three studies from which we were unable to construct 2×2 tables to provide us with the relevant data for construction of these tables, but, while all authors responded, none could provide sufficient data for table construction. Thus, there remained 37 studies reporting on a total of 7709 women[9–11,13,14,20–51].

Study characteristics

The study characteristics of those included are shown in Figure 1. Data collection was prospective in 20 (54%) studies and sampling of patients was consecutive in 20 (54%) studies. There were 31 (84%) studies designed as cohort studies, three (8%) case control studies and three (8%) randomized controlled trials. In 27 studies, the patients received tocolysis prior to ECV (73%). None of the studies reported explicitly whether the clinicians performing the ECV were blinded to the ultrasound results.

Meta-analysis

The overall rate of ECV that resulted in a fetus in cephalic position after the procedure was 55%. Potential ultrasound prognosticators identified were: fetal position, placental location, AFI, estimated fetal weight (EFW) and position of the fetal spine.

Twenty studies reported on fetal position in relation to the outcome of ECV[10,13,25,27–34,35,38,39,43,48,49,51–53]. From the various descriptions in the articles, we distinguished eight different fetal positions: complete breech, extended legs, flexed breech, flexed legs, footling breech,

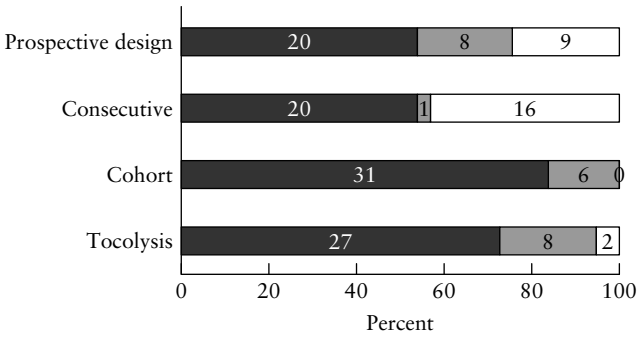

Figure 1 Methodological and reporting characteristics of studies included in the systematic review. Data are presented as 100% stacked bars; figures in stacks represent numbers of studies (■, yes; ■, no; □, not reported.

frank breech, incomplete breech and non-frank breech. None of the studies defined the fetal positions specifically. We categorized these eight fetal positions into four main categories: complete breech, frank breech, footling breech and transverse position. Complete breech was defined as buttocks down, with the legs folded at the knees and the feet near the buttocks. Positions in this category were complete breech, flexed breech, non-frank breech and flexed legs. Frank breech was defined as the fetal buttocks pointing down aimed toward the birth canal and the legs straight, in line with the front of the body, with the feet near the head. Positions in this category were frank breech and extended legs. Incomplete breech was defined as one or both of the fetus's feet pointing down. Positions in this category were footling breech and incomplete breech. Figure 2 shows the forest plot of ORs from the individual studies reporting on fetal position in relation to successful ECV. Homogeneity among the detected studies was rejected ($P < 0.005$). Frank breech was associated negatively with successful ECV (OR, 0.6; 95% CI, 0.5–0.7), whereas in women with complete breech, ECV was successful more often (OR, 2.3; 95% CI, 1.9–2.8). Incomplete breech was not associated with ECV outcome (OR, 1.0; 95% CI, 0.8–1.3), while transverse position was associated with successful ECV (OR, 8.2; 95% CI, 4.1–16).

Twenty-seven studies reported on placental location in relation to ECV outcome[9,10,13,14,20,22,24–26,28–32,34,35,37–39,41–45,47,48,50]. From the various descriptions in the articles, we distinguished four different locations: anterior, posterior, fundal and lateral. Anterior position was associated with less successful ECV (OR, 0.6; 95% CI, 0.5–0.8), whereas in women with posterior placenta, ECV was successful more often (OR, 1.9; 95% CI, 1.5–2.4) (Figure 3). Fundal and lateral placental locations were not associated with ECV outcome (OR, 1.1; 95% CI, 0.8–1.5 and OR, 1.3; 95% CI, 0.9–1.8, respectively). Except for lateral placental location ($P = 0.91$) homogeneity among the detected studies was rejected.

Thirteen studies reported on amniotic fluid in relation to ECV outcome[9–11,20,21,23,31,35,41–44,51]. Amniotic fluid was either quantified by the AFI, or only described in terms of oligohydramnios or decreased amniotic fluid. Studies reporting on AFI used different cut-off points to describe the relation with ECV outcome. We used a cut-off level of 10 to pool the studies. An AFI > 10 was associated with successful ECV (OR, 1.8; 95% CI, 1.5–2.1) (Figure 4). When the amniotic fluid was not quantified, there was no apparent relation with ECV outcome (OR, 1.2; 95% CI, 0.90–1.6). Homogeneity among the detected studies was rejected ($P < 0.05$).

Five studies reported on EFW in relation to ECV outcome[9,10,14,34,38]. The weight categories reported were too heterogeneous to pool results (Figure 5).

Eleven studies reported on position of the fetal spine in relation to ECV outcome[9,11,13,24,25,28,29,31,34,37,42]. From the various descriptions in the articles, we distinguished four different categories: spine anterior, posterior, lateral or central. Anterior location tended to be associated with successful ECV (OR, 4.0; 95% CI, 0.9–18.5) (Figure 6). Only one study reported on central spine in relation to ECV outcome; it was associated with successful ECV outcome (OR, 18.2; 95% CI, 0.9–353.6). Lateral and posterior spine were not associated with ECV outcome (OR, 1.1; 95% CI, 0.6–1.9 and OR, 0.9; 95% CI, 0.3–2.7, respectively). Except for posterior spine position ($P = 0.94$), homogeneity among the detected studies was rejected.

DISCUSSION

We have summarized the available evidence on potential ultrasound prognosticators for the outcome of ECV. Our systematic review has shown posterior placental location, AFI > 10 cm and complete breech position to be associated with successful ECV.

In this meta-analysis, we used ORs to quantify clinical factors that might predict successful outcome of an ECV attempt. Both ORs and likelihood ratios are considered important tools in the interpretation of diagnostic tests in clinical practice, although there is no consensus on whether likelihood ratios should be used in meta-analysis. Recently, strong arguments against the pooling of likelihood ratios have been raised[54]. Estimating summary receiver–operating characteristics curves when the number of studies is limited and when tests have fixed cut-off levels, for example, for engagement and uterine relaxation, is possible, although the usefulness is debatable. The aim of our review, however, was not primarily to generate data to be used for risk estimation in clinical practice, but to identify potential sonographic prognosticators for the outcome of ECV. Our finding that posterior placental location, normal amniotic fluid and complete breech position are associated with the outcome of an ECV attempt should be explored when prediction models and diagnostic prediction rules are developed.

This study has several important strengths. We conducted this review with a comprehensive search strategy, using a prospective protocol, and we made a concerted effort to find all available evidence. We scrutinized the selected studies for their quality. Methodological issues that may overestimate accuracy, such as case–control design, retrospective design and non-consecutive studies, were present in fewer than 50% of the studies investigated.

Our study also has limitations. First, none of the studies reported blinding of the clinicians who performed ECV to the ultrasound results. This could lead to overestimation of associations, as clinicians may make a second attempt in women with potential favorable findings at ultrasound, or give up earlier in cases with poor prospects of success based on ultrasound findings. Second, there was considerable variation with respect to how studies reported fetal position and amniotic fluid. For amniotic fluid, we tried to solve this problem by distinguishing between studies quantifying it by AFI and those giving only a description of the amount of amniotic fluid. This made clear that quantifying amniotic fluid enables prediction of ECV outcome.

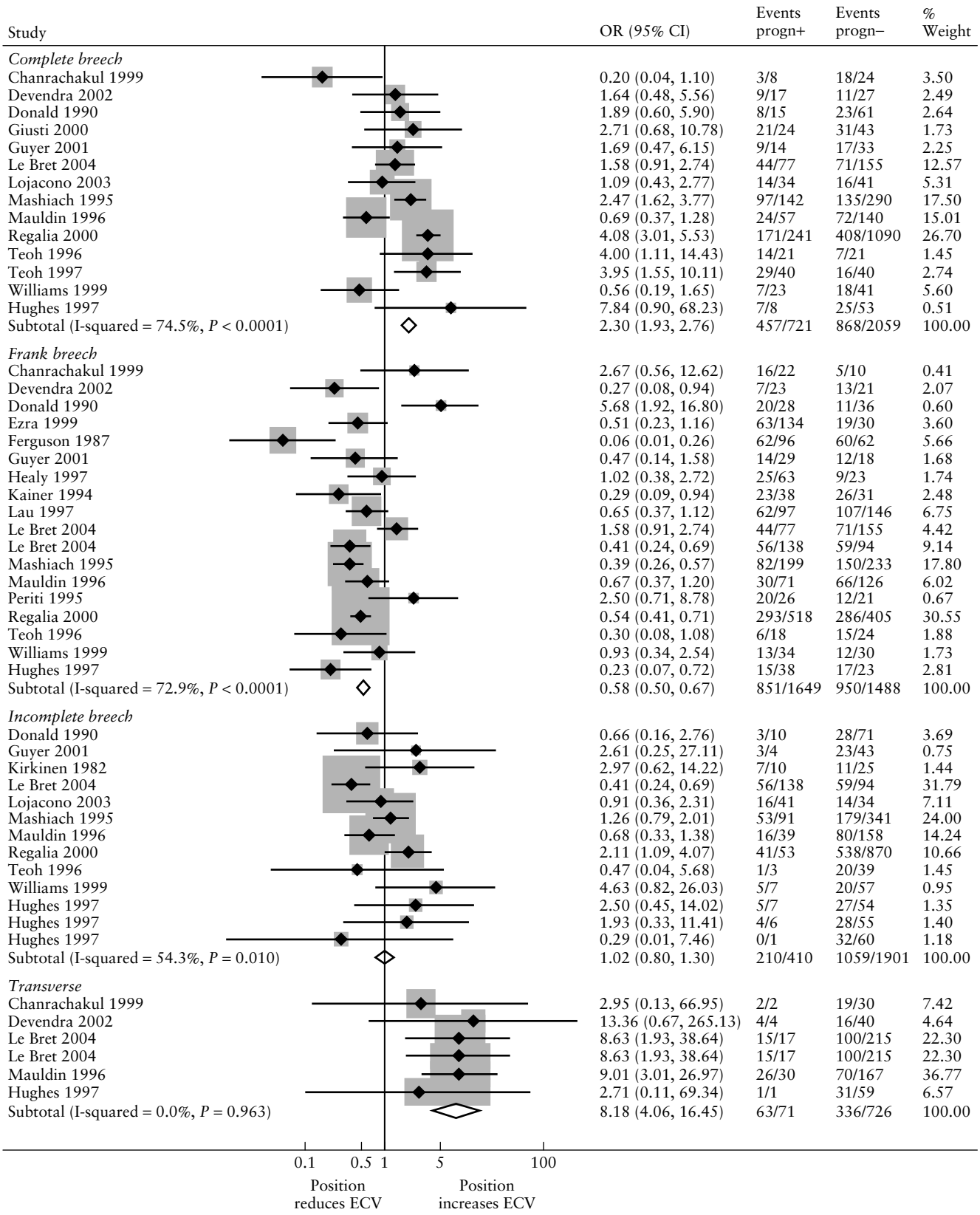

Figure 2 Forest plot of odds ratios (OR) from individual studies reporting on fetal position in relation to successful external cephalic version (ECV). Events progn+, proportion of cases in which ECV was successful when trait was present; Events progn−, proportion of cases in which ECV was successful when trait was not present.

We feel that this study is important for two reasons. First, knowledge about ultrasound factors that are associated with the success rate of an ECV attempt can be useful in the counseling of affected women. Women who refuse an ECV attempt may be persuaded if they know there are some favorable factors which enhance

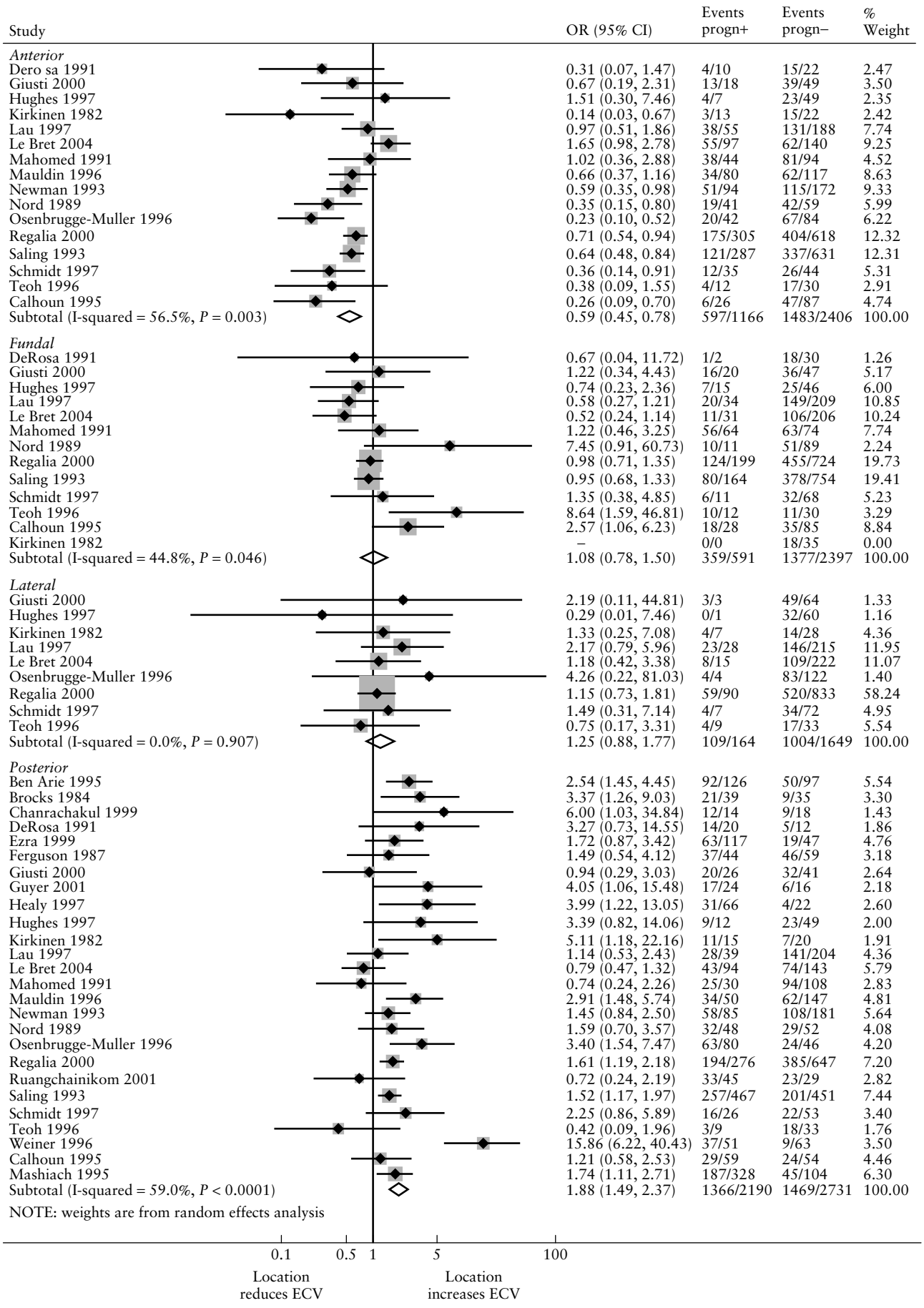

Figure 3 Forest plot of odds ratios (OR) from individual studies reporting on placenta location in relation to successful external cephalic version (ECV). Events progn+, proportion of cases in which ECV was successful when trait was present; Events progn−, proportion of cases in which ECV was successful when trait was not present.

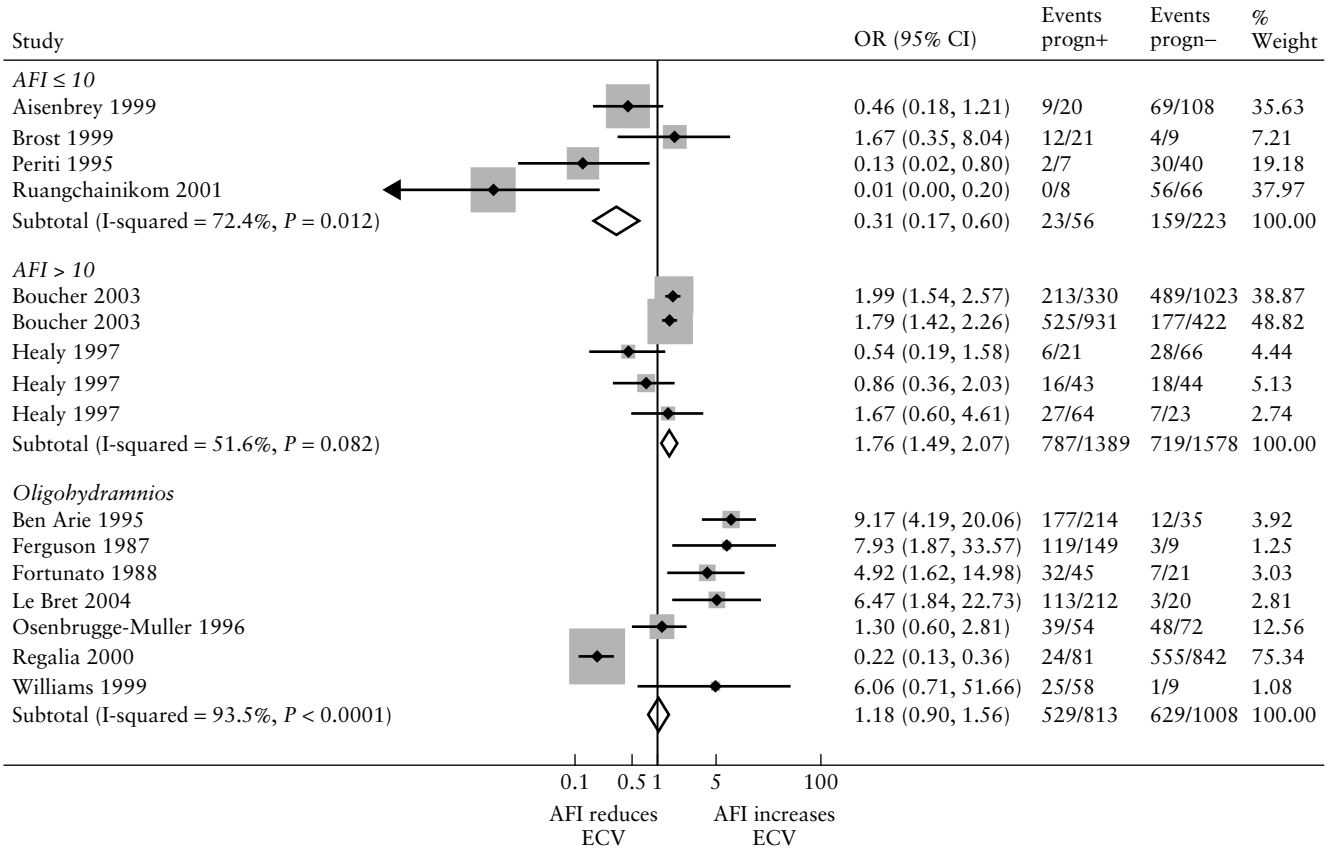

Figure 4 Forest plot of odds ratios (OR) from individual studies reporting on amniotic fluid in relation to successful external cephalic version (ECV). AFI, amniotic fluid index; Events progn+, proportion of cases in which ECV was successful when trait was present; Events progn−, proportion of cases in which ECV was successful when trait was not present.

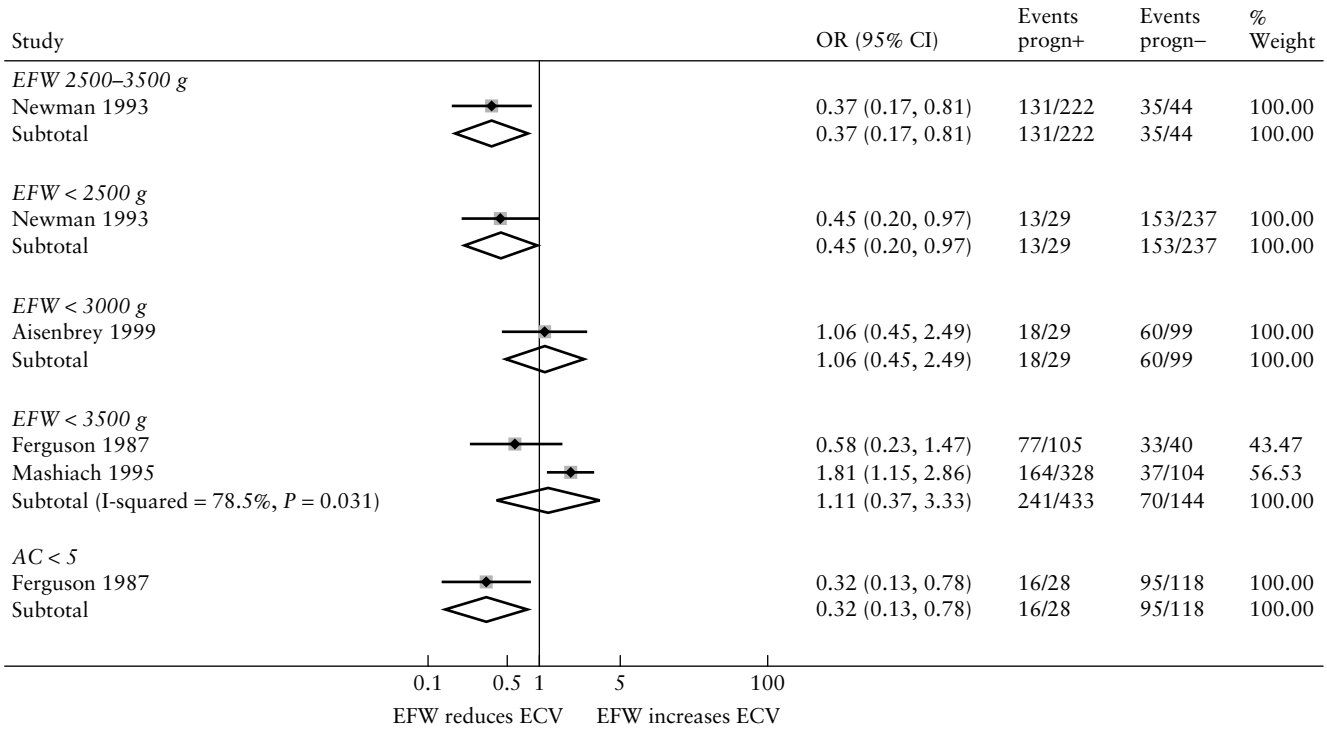

Figure 5 Forest plot of odds ratios (OR) from individual studies reporting on estimated fetal weight (EFW) in relation to successful external cephalic version (ECV). The weight categories reported were too heterogeneous to pool results. AC, abdominal circumference; Events progn+, proportion of cases in which ECV was successful when trait was present; Events progn−, proportion of cases in which ECV was successful when trait was not present.

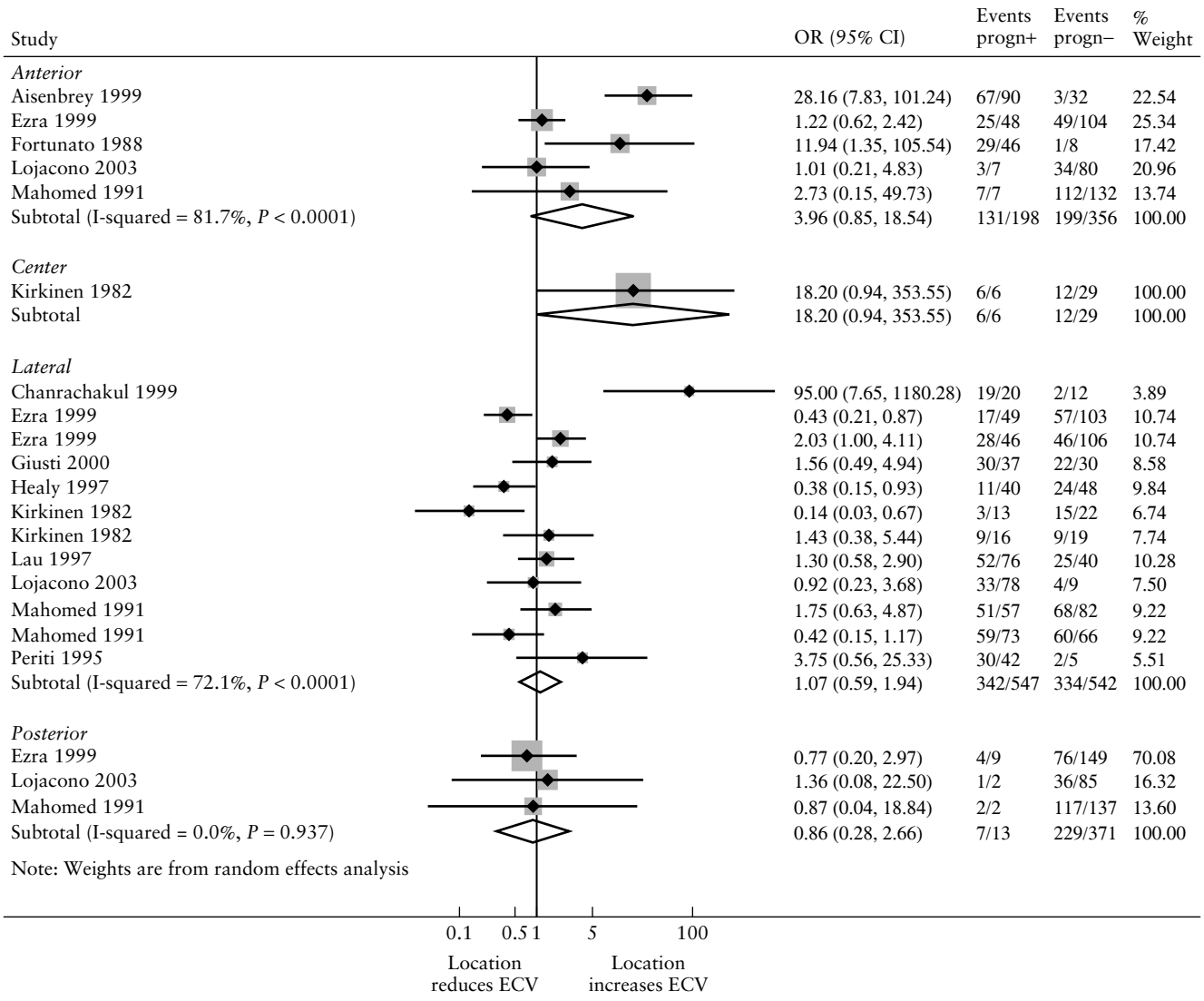

Figure 6 Forest plot of odds ratios (OR) from individual studies reporting on position of the fetal spine in relation to successful external cephalic version (ECV). Events progn+, proportion of cases in which ECV was successful when trait was present; Events progn−, proportion of cases in which ECV was successful when trait was not present.

their chance of success. Similarly, clinicians who are reluctant to offer ECV may be more inclined to do so when there are, for instance, one or more favorable factors enhancing the chances of success of an ECV attempt. Second, the results of this meta-analysis formalize what has been unofficially 'known' for some time in the literature, namely that there is some predictive ability regarding the success of ECV from ultrasound factors available before the procedure. The next step is to design a prospective study to quantify the relationship of each individual clinical factor with a successful version attempt, thus creating a prognostic model. So far, five studies have assessed the prognostic value of ultrasound indicators in a multivariate approach[9,11,13–15], the results of which are consistent with those of our meta-analysis. Two of these studies used prognostic indicators to develop a scoring system[14,15]; both were two-phase studies, in which the first phase was used to develop a scoring system from 53 and 108 versions, respectively, while the second phase was used to verify this scoring system by application to 88 and 286 versions, respectively. However, the two studies used different predictors and did not include all predictors that we assessed in this meta-analysis. The results of our study can be used to design a prospective cohort study to build a model which incorporates all relevant ultrasound predictors.

In conclusion, this study has demonstrated that success of an ECV attempt is associated with ultrasound parameters of fetal position, amniotic fluid and placental location. This knowledge can be used to develop a prognostic model to predict successful ECV.

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