

# Predicting success of external cephalic version

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**OBJECTIVE:** Many authors have identified prognostic factors for external cephalic version success, but there has not been an attempt to integrate these factors into a simple, quantitative scoring system for predicting version success. Nor have any prognostic factors been prospectively tested.

**STUDY DESIGN:** We examined the clinical characteristics of 108 consecutive breech versions performed between 1984 and 1986. These characteristics were evaluated by stepwise linear regression and discriminate analysis to identify those factors associated with success. Five factors explained the majority of the variability in outcome (parity, placental location, dilation, station, and estimated fetal weight). A model was developed to incorporate the trends identified among these five variables to create a scoring system similar to that of Bishop. This scoring system was then applied to 286 women undergoing external cephalic version since October 1986.

**RESULTS:** There was a positive relationship between a rising version score and the likelihood of successful breech version. No versions were successful with a score  $\leq 2$ , and all breech versions were successful with a score of 9 or 10. The results of the version score may have significantly altered physician recommendations in more than one third of cases.

**CONCLUSION:** We believe that this simple, quantifiable scoring system is a refinement in our ability to predict the likelihood of external cephalic version success. (AM J OBSTET GYNECOL 1993;169:245-50.)

**Key words:** External cephalic version, breech presentation

External cephalic version has been described in the medical literature since the writings of Hippocrates and was a commonly performed obstetric procedure earlier in this century. This procedure, however, fell from favor because of unacceptably high complication rates and failure to improve on the relatively high spontaneous version rate. During the last decade external cephalic version at term was resurrected with success rates reported from various institutions of 60% to 70% with parallel reductions in the incidence of breech presentation in labor and subsequent cesarean delivery.<sup>1-5</sup>

A number of attempts have been made to identify either maternal or fetal variables influential in the success or failure of external cephalic version. Most reports have emphasized a single variable thought to be prognostically important. However, these reports have frequently been contradictory. A few authors have reviewed multiple variables with statistical methods designed to determine the contribution of various factors

to the probability of successful external cephalic version.<sup>6-8</sup> None of these reports offer a simple clinical tool for predicting the likely success of external cephalic version, nor were the prognostic factors identified in these reports ever prospectively tested.

The objective of this study was to review external cephalic versions performed at the Medical University of South Carolina between 1984 and 1986 to identify maternal and fetal variables that influence the outcome of this procedure. This retrospective analysis was used to develop a prognostic scoring system, which was then prospectively tested on the women admitted for external cephalic version between October 1986 and October 1992.

## Material and methods

The initial data base consisted of 108 women with singleton gestations having undergone external cephalic version at the Medical University of South Carolina between 1984 and 1986. Maternal and fetal data regarding external cephalic version in this group were collected retrospectively. All external cephalic versions were carried out in the labor and delivery unit at term after the method of Saling and Muller-Holve.<sup>9</sup> In brief, those patients admitted to labor and delivery underwent a real-time ultrasonographic examination, a non-stress test, and a pelvic examination. The ultrasonographic examination was to confirm a nonvertex presentation, the adequacy of the amniotic fluid volume

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*Presented at the Fifty-fifth Annual Meeting of the South Atlantic Association of Obstetricians and Gynecologists, Hot Springs, Virginia, January 31–February 3, 1993.*

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0002-9378/93 \$1.00 + .20 6/6/47757*

(pocket  $\geq 2$  cm in vertical diameter), fetal measurements consistent with a term gestation, and estimated fetal weight. Ultrasonography was also used to confirm the absence of any gross fetal anomalies and to identify placental location. Placental location was described as being anterior, posterior, fundal, or lateral. After obtaining a reactive nonstress test or negative contraction stress test, an intravenous line was established for infusion of ritodrine hydrochloride at 100  $\mu\text{g}/\text{min}$ . In the latter years of the investigation a 250  $\mu\text{g}$  subcutaneous injection of terbutaline sulfate was substituted for the intravenous ritodrine hydrochloride. In five patients with insulin-requiring diabetes magnesium sulfate was used intravenously for tocolysis.

After 20 minutes the external cephalic version was attempted by two operators. The "forward roll" technique was usually attempted if the fetal head crossed the maternal midline. The "back flip" was used if the initial method failed or occasionally as the initial technique if the fetus did not cross the midline. Version attempts were discontinued for excessive patient discomfort, for a persistently abnormal fetal heart rate tracing, or after multiple failed attempts. Real-time ultrasonography confirmed version outcome before discontinuation of tocolytic therapy. For Rh-negative, unsensitized patients Rh immune globulin was administered after version. After the procedure fetal heart rate monitoring was continued until a reactive nonstress test was obtained. Anesthesia and immediate operative facilities were available throughout the external cephalic version.

There were few absolute contraindications to external cephalic version, but these included abruptio placentae, placenta previa, premature rupture of the membranes, or evidence of fetal compromise during preliminary fetal heart rate monitoring. Transverse lie, prior uterine scar, or maternal weight  $\geq 200$  pounds were not considered contraindications to external cephalic version.

On the basis of experience and previous reports in the literature, 10 potentially influential maternal and fetal variables were selected for analysis as prognostic factors. These factors were (1) maternal weight, (2) parity, (3) gestational age, (4) type of breech (frank, complete, incomplete, or transverse lie), (5) amniotic fluid volume (oligohydramnios, average, or polyhydramnios), (6) placental location (anterior, posterior, lateral, or fundal), (7) cervical dilatation, (8) cervical effacement, (9) station of presenting part, and (10) the estimated fetal weight at the time of the external cephalic version. By means of these 10 variables, an initial stepwise linear regression analysis was performed on the 108 women who had undergone external cephalic version to determine those variables correlating best with procedure success.

The stepwise linear regression analysis revealed that

five of the 10 variables explained the majority of variability between success or failure. These five variables were (1) parity, (2) placental location, (3) cervical dilatation, (4) station, and (5) estimated fetal weight. Discriminate analysis was applied to these five variables to identify trends regarding outcome. These trends were then used to create, by a statistical model, a simple scoring system similar to that of Bishop for predicting external cephalic version success. This scoring system is shown in Fig. 1.

This scoring system was subsequently applied to all 286 external cephalic version candidates before undergoing this procedure at the Medical University of South Carolina between October 1986 and October 1992. This test population was not part of the initial study group, and these procedures were performed after the evaluation of the initial study group. The application of the external cephalic version scoring system was performed independently of the physicians involved in the procedure, and there were no significant changes in the external cephalic version technique between the two study periods.

Data are presented as means  $\pm$  SD. Statistical analysis was performed by Student *t* test for unpaired variables and  $\chi^2$  analysis for differences among proportions. Significance was established at a *p* value of  $\leq 0.05$ .

## Results

During the prospective application of the scoring system 286 external cephalic versions were performed at the Medical University of South Carolina. Twenty of these procedures involved the cephalic version of a transverse lie; they will be discussed separately. The scoring system was thus applied to the 266 breech presentations undergoing external cephalic version.

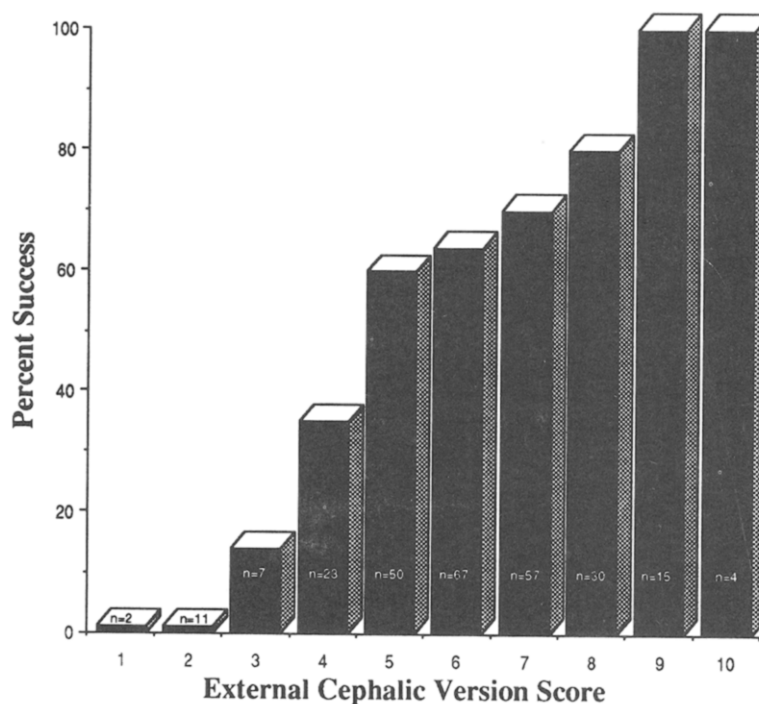
External cephalic version was successful in 166 of the breech presentations (62.4%). The mean version score for the successful procedures was  $6.6 \pm 1.5$ , whereas the mean score for unsuccessful procedures was  $5.1 \pm 1.8$  ( $p < 0.05$ ). These external cephalic versions were performed at a mean gestational age of  $37.8 \pm 1.4$  weeks' gestation.

Fig. 2 illustrates the application of the scoring system to the 266 breeches undergoing external cephalic version during the prospective trial. None of the 13 patients with a version score of  $\leq 2$  had a successful version. Forty-three women (16%) undergoing external cephalic version had version scores of  $\leq 4$ , predicting a likelihood of procedure success (21%) significantly less than for the entire group ( $p < 0.05$ ).

All 19 women with a version score of 9 or 10 had a successful version. Forty-nine women (19%) undergoing external cephalic version had breech version scores of  $\geq 8$ , predicting a likelihood of procedure success (88%) significantly better than for the entire group ( $p < 0.05$ ).

|                      | 0         | 1              | 2              |
|----------------------|-----------|----------------|----------------|
| <b>Parity</b>        | 0         | 1              | ≥ 2            |
| <b>Dilatation</b>    | ≥ 3 cm    | 1 - 2 cm       | 0 cm           |
| <b>Estimated Wt.</b> | < 2500 gm | 2500 - 3500 gm | > 3500 gm      |
| <b>Placenta</b>      | anterior  | posterior      | lateral/fundal |
| <b>Station</b>       | ≥ -1      | -2             | ≤ -3           |

**Fig. 1.** Proposed external cephalic version scoring system for estimating likelihood of successful breech version.



**Fig. 2.** Predicting success of external cephalic version. Relative percentages of successful breech versions in various score categories among women ( $N = 266$ ) in prospective test group. ECV, External cephalic version.

The 174 women (65%) with version scores of 5, 6, or 7 had an overall success rate (65%) that was not significantly different than for the entire group.

The components of the external cephalic version scoring system were also evaluated individually to determine their relationship to procedure success or failure (Table I). In general, none of the individual components were as effective as the combined external cephalic version scoring system in predicting the likelihood of procedure success. However, a parity of two or more was usually associated with success (87%), and there were no successful versions when the fetal breech had descended to a  $-1$  station or lower.

In addition to the external cephalic version scoring system, several other evaluations were performed. There were 35 women who weighed  $>200$  pounds at the time of their version attempt; 22 were successful (63%). This was not different than the success rate for the remaining women who weighed  $<200$  pounds (62%). Operator experience also did not affect version success. In those cases where the senior operator was an obstetric resident, the version was successful in 78 of 118 cases (66%). In those cases where a faculty member participated, success was achieved in 87 of 148 cases (59%). The choice of tocolytic therapy was also an unimportant variable. Exactly 62% of the external ce-

**Table I.** Breech version success rates associated with individual components of the breech version scoring system

| Component                   | Success | Failure | Success rate (%) |
|-----------------------------|---------|---------|------------------|
| Parity                      |         |         |                  |
| Nulliparous                 | 46      | 56      | 45               |
| Para 1                      | 61      | 34      | 64               |
| Para $\geq 2$               | 60      | 9       | 87               |
| Dilatation (cm)             |         |         |                  |
| $\geq 3$                    | 14      | 14      | 50               |
| 1-2                         | 66      | 54      | 55               |
| 0                           | 86      | 32      | 73               |
| Estimated fetal weight (gm) |         |         |                  |
| <2500                       | 13      | 16      | 45               |
| 2500-3500                   | 118     | 75      | 61               |
| >3500                       | 35      | 9       | 80               |
| Placenta                    |         |         |                  |
| Anterior                    | 51      | 43      | 54               |
| Posterior                   | 58      | 27      | 68               |
| Lateral or fundal           | 57      | 30      | 66               |
| Station                     |         |         |                  |
| $\geq -1$                   | 0       | 14      | 0                |
| -2                          | 16      | 13      | 55               |
| $\leq -3$                   | 148     | 75      | 66               |

phalic versions were successful for both the 214 women receiving intravenous ritodrine hydrochloride and the 47 women receiving subcutaneous terbutaline sulfate. External cephalic version was also successful in four of five women with insulin-requiring diabetes who received magnesium sulfate for tocolysis.

Although not included in the data analysis, the 20 women with a transverse lie had a mean version score of  $6.3 \pm 1.3$ . Eighteen of these 20 versions were successful (90%).

### Comment

In the current investigation we have attempted to present a simple, quantifiable scoring system that can be used to predict successful outcome for external cephalic version procedures. Multiple clinical variables were retrospectively assessed on 108 external cephalic versions and subjected to a stepwise linear regression and discriminate analysis to determine those clinical factors most closely associated with external cephalic version success. By means of these clinical factors a predictive scoring system was developed and prospectively tested on 286 external cephalic versions performed between October 1986 and October 1992.

The clinical variables identified as important by the current investigation have all been evaluated previously for their prognostic significance. Both VanDorsten et al.<sup>1</sup> and Ferguson et al.<sup>6</sup> found significantly improved success rates among parous women, whereas other investigators have not found the nulliparous women to be at a comparative disadvantage.<sup>3, 4, 7</sup>

Neither Stine et al.<sup>3</sup> nor Fortunato et al.<sup>7</sup> could relate

birth weight to the success or failure of the version attempt. Ferguson et al.<sup>6</sup> found that the likelihood of success could not be related to an estimated fetal weight of either greater or less than 3500 gm. However, they did find that successful version was unlikely when the fetal abdominal circumference was below the 5 percentile. Kirkinen and Ylostalo<sup>10</sup> found, as we did, that increasing fetal weight is associated with greater success, presumably because of an improved ability to manipulate the fetus. Estimation of fetal weight will be the most difficult variable to determine in the scoring system. However, with the increasing use of ultrasonography an acceptable margin of error should be achieved, especially considering the wide birth weight categories. Obviously, a patient who would not be a candidate for vaginal delivery because of gross macrosomia may need to be reconsidered as a version candidate.

The effect of placental location on the success of external cephalic version has probably been the most controversial. Brocks et al.<sup>11</sup> has reported an increased failure rate with an anterior placental location, whereas both Hofmeyr<sup>12</sup> and Ferguson et al.<sup>6</sup> found higher failure rates with cornual implantations. Neither Fortunato et al.,<sup>7</sup> Morrison et al.,<sup>2</sup> or Donald and Barton<sup>8</sup> could find any relationship between placental location and procedure success. In the current investigation posterior, lateral, and fundal placentas were more frequently associated with success than were anterior placentas. In our institution cornual implantations would be considered as either fundal or lateral depending on the predominant location.

In the original paper by VanDorsten et al.<sup>1</sup> in 1981, they noted an improved success rate with an undilated cervix or a high presenting part. Many reviews have not included an assessment of the cervical status; however, Fortunato et al.<sup>7</sup> did report in 1988 an increased failure rate with descent of the breech into the pelvis past the  $-3$  station. In the prospective application of our scoring system, we had no successes in cases where descent of the breech into the pelvis reached a  $-1$  station or lower.

The great controversy in the literature regarding prognostic factors suggests that no one variable will optimally predict procedure success. In fact, when the individual components of the external cephalic version scoring system and other clinical factors not included in the scoring system were evaluated in the 266 breech presentations tested prospectively, no single factor really stood out other than deep descent of the breech into the pelvis and maternal parity of two or more. It is noted that the individual components of the external cephalic version scoring system demonstrated the same trends in the prospectively tested group that was predicted by the retrospective analysis. It would seem reasonable that the simultaneous assessment of several

variables may provide greater accuracy and reliability in predicting external cephalic version success. It would also seem reasonable that all the variables should be equally weighted, because none have clearly demonstrated their predominance. Obviously, other variables may play a role in version outcome. The proposed scoring system is not all inclusive; rather, it addresses clinical variables that can be easily evaluated on every external cephalic version candidate.

The predictive accuracy of any scoring system will be best for those patients from which it was derived. Much like the confirmation of the Zatuchni-Andros score in predicting the likelihood of successful vaginal breech delivery at term, the true value of any scoring system is found in its prospective application.<sup>13, 14</sup> We were pleased by the performance of this predictive scoring system when it was applied prospectively to the next 266 women with breech presentations undergoing external cephalic version. There was a positive relationship between a rising version score and the likelihood of procedure success. There were no successful versions with a score  $\leq 2$ , and all breech versions were successful with a score of 9 or 10. Approximately 35% of the women in the prospective trial had a version score of  $\leq 4$  or  $\geq 8$  where the likelihood of success was either significantly worse or better than for the remainder of the study group.

The women with transverse lies were excluded because the retrospective evaluation was specifically designed to predict the success of external breech version and because the overall success rate for external version of the transverse lie is generally higher, ranging from 80% to 90%.<sup>15</sup> In this investigation 90% of the transverse lies undergoing external cephalic version were successful.

On the basis of the prospective of evaluation of this external cephalic version scoring system, the women scoring  $\leq 4$  may simply not be candidates for external cephalic version. Appropriate delivery plans should be made and a costly and futile attempt at version avoided. Alternatively, those women with favorable scores of  $\geq 8$  would appear to be optimal candidates, with success rates significantly greater than those generally quoted. We would urge the use of the version score in the evaluation of external cephalic version candidates with breech presentations. This scoring system is an easily applicable and quantifiable tool that can improve both physician selection of version candidates and patient informed consent in over one third of breech presentations undergoing external cephalic version.

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## Discussion

**DR. ARTHUR T. EVANS**, Norfolk, Virginia. The authors asked a simple clinical question: is there a group of measurable maternal and fetal parameters that will accurately predict the success or failure of a breech version attempt? Not only did they answer this affirmatively, but they did so in a way that is a model for good clinical research.

The authors began with 10 of the maternal and fetal variables that have been identified in the literature to be linked to the success or failure of external version. By retrospective analysis of 108 patients who previously had an attempted external version, they determined the five variables that were statistically most predictive of external version outcome. From these they created a scoring system using a value of 0 to 2 for each of the five variables and then applied the scoring system prospectively to 266 women undergoing breech version at the University of South Carolina. The use of statistical modeling to develop and score this group of variables is a correct approach and unique in the external version literature.

The study used VanDorsten's well-accepted version technique involving two operators and tocolysis (see reference 1 of article). Their overall success rate of 62.4% conversion to vertex presentation is comparable to other studies. The data presented by the authors clearly demonstrate that this scoring system is particu-

larly predictive for patients at the two extremes of the scoring spectrum. Those with very low scores ( $\leq 2$ ) had no successful versions. Those with very high scores (9 to 10) had a 100% success rate. Although only 12% (32/266) of their prospective patients were in either of these two groups, the ability to definitively predict failure or success should significantly alter how we counsel and manage women with such scores. Most term patients with a breech fetus will have scores that fall in between the two extremes. This scoring system provides them a better understanding of the possibility of successful version. When the score is between 2 and 4, the success rate is only 18%, whereas 80% of women with a score of 8 had a successful version. Although 65% of the study patients had scores of 5 to 7 (174/266), the finding of a 65% probability of their having a successful version still provides more precise counseling and better informed consent.

It is important to keep the limitations of this study in mind. Other studies have suggested that posterior positioning of the fetal spine and hyperextension of the fetal head decrease the success of external version. Neither of these two variable factors were evaluated in of this scoring system. It would be of interest to know if the authors have any data on either of these two variables. The authors do not provide any information on the eventual outcome of these pregnancies. This leaves a number of important questions unanswered. How many of the successful versions spontaneously reverted to breech before delivery? Was there a difference in the rate of spontaneous reversion to breech in the women with extremely high scores versus those with average scores? What complications were associated with the procedure itself, and did the complication rates differ between patients on the basis of their numeric scores? Was the procedure perceived to be less difficult or painful by women on the basis of their score? It would be interesting to project the savings from avoiding the cost of failed external versions in women with low scores and assuring that all women with high scores have external version rather than cesarean section. These are questions that should be addressed in future studies. I would ask Dr. Newman if he has an opinion about whether women with scores of 9 or 10 could have external version attempted without tocolysis?

The unanswered questions that I have raised do not detract from the importance of this study. It is the first article on external cephalic version to provide an objective, quantifiable method to predict the likelihood of success. This should serve to enhance and refine our use of the procedure. I congratulate the authors for having the perseverance to continue the study over the course of 6 years to enroll an adequate number of patients at a single institution. Ultimately, this information should help to improve the acceptance of external

breech version and in doing so, positively influence current obstetric practice.

**DR. EDGAR O. HORGER III**, Columbia, South Carolina. I received a copy of this manuscript about 8 weeks ago, and since then I have kept a record of the score of the seven version attempts I have performed. I had four successes and three failures. The three failures involved patients whose scores were 2, 4, and 7. The failure in the patient with a score of 7 was very disappointing except for the fact that the fetal spine was directly anterior. I think I recall VanDorsten teaching me not to try versions when the spine was directly anterior, but this finding was not included in your appraisal.

**DR. NEWMAN** (Closing). The relationship of the fetal to maternal spine was not assessed in our retrospective review because the data sheets used at the time did not include that information. We do feel that anterior positioning of the fetal spine is a deterrent to success. On occasion we have not attempted versions in fetuses with directly anterior fetal spines. The posterior fetal spine is something with which we have less familiarity. The paper does not include information on outcome. We do not have outcome information on infants involved in the prospective trial. In the retrospective trial the patients had a 5% incidence of reverting to a breech presentation. I cannot characterize that in terms of their score. Complications were extremely infrequent. I personally am unaware of any emergency cesarean sections that we had to perform. Fetal bradycardia after the version attempt, successful or unsuccessful, is not infrequent but usually resolves with maternal positioning and a minute or two of time. Again, I cannot comment on the likelihood of complications on the basis of a specific score. We have not looked at that information. I would agree that the patients with the higher scores of 9 or 10 do seem to be those who have easier procedures and less maternal discomfort. Whether those procedures could be effectively performed without tocolytic therapy is unknown. I expect they could, but I have no direct information about that. There are papers in the literature that have looked at version without tocolytic therapy. I think that the best candidates for version without tocolytic therapy would be those with the highest scores.

The issue of savings is a very critical one. I was surprised when I spoke with some of our business people about the charges for external cephalic version. When the costs of ultrasonography, nonstress testing, the procedure and hospitalization in the labor and delivery suite for about half a day are considered, it comes to about \$1700 per patient. There may also be some charges that I have overlooked. Therefore, when we are able to determine which patients are the best candidates for external cephalic version, there is the possibility of significant cost savings to some patients.