



REVIEW ARTICLE

A meta-analysis of reverse breech extraction to deliver a deeply impacted head during cesarean delivery

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ABSTRACT

Background: During cesarean delivery, extracting a deeply impacted head is a real challenge for obstetricians. **Objectives:** To compare selected maternal and fetal outcome indicators of the “pull” (reverse breech extraction) and “push” methods for impacted fetal head extraction during cesarean delivery. **Search strategy:** A computer-based search of the Medline, Cochrane library, and HINARI databases. **Selection criteria:** Studies that compared the maternal and perinatal outcomes of the push and pull methods for impacted fetal head extraction during cesarean delivery were included. **Data collection and analysis:** A meta-analysis of Mantel–Haenszel odds ratios and standardized mean differences from 11 randomized comparative and retrospective cohort studies was performed. **Main results:** In the pooled analysis, the risk of uterine incision extension was more than 8 times higher with the push method than with the pull method. Blood loss and operation time were also increased with the push method, and this method was associated with more perinatal deaths and admissions to the neonatal intensive care unit. The risk of wound infection was not significantly different between the 2 methods. **Conclusions:** The present meta-analysis demonstrated marked reductions in uterine incision extension, blood loss, and operation time with reverse breech extraction.

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1. Introduction

The exact incidence of deeply impacted head encountered during cesarean delivery is not known but it is estimated to be a quarter of all emergency cesarean deliveries [1]. Impaction of the fetal head is considered when the station is below the ischial spines and it is usually a consequence of a prolonged second stage of labor [2,3]. Multiple factors can contribute to impaction of the fetal head, including reluctance to intervene during a prolonged second stage, use of epidural anesthesia, trial of instrumental delivery, and fetal head malposition [2,4–6]. Whatever the cause, extracting a deeply impacted head is a real challenge and associated with several complications (trauma to the fetus, increased risk of infection, uterine incision extension, and excess blood loss) [4,5,7,8].

To ease the challenges, several methods have been applied: pushing the wedged fetal head from below by an assistant [2]; making a low vertical uterine incision and extracting the infant by the feet and legs [9]; pushing the head from below with a device called Fetal Disimpacting System [1]; extracting the head first with a Murless head extractor (a method that has been practiced since 1948) [10]; bimanual version of

the “push” method, with 1 hand of the surgeon in the vagina and the other hand in the uterus [11]; and reverse breech extraction [3,12–21].

Although pushing the wedged fetal head from below by an assistant (abdominovaginal delivery or “push” method) was first described in the literature during the 1960s [22], it is probably the oldest technique and has been practiced for approximately a century [23]. The 2 major complications when pushing the head from below are extension of the uterine incision (downward and lateral) and contamination of the operation field by the pushing hand, which increases the risk of postoperative infections [9,11]. Disengagement of the impacted head is also associated with a significant delay between uterine incision and fetal extraction [24].

By contrast, reverse breech extraction (“pull” method) technically means grasping the fetal feet through an incision made high in the overstretched lower uterine segment and performing a semi-version to deliver the fetus by total breech extraction [18]. Unlike the push method, reverse breech extractions are a safe and easy alternative to the more uncommon approach of extending the uterine incision laterally and downward [2,9] and are associated with less blood loss [12,16]. However, reports on the risk of postoperative infections and perinatal morbidity and mortality are inconsistent.

The objective of the present meta-analysis was to compare selected intraoperative and postoperative maternal and fetal outcome indicators for impacted fetal head extraction by either the pull or the push method during cesarean delivery.

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2. Materials and methods

2.1. Search strategy

A computer-based search for published articles on the delivery of a deeply impacted fetal head during cesarean delivery was performed using the Medline, Cochrane library, and HINARI databases. The HINARI literature search included the websites of major publishers (Elsevier Science [ScienceDirect], Nature Publishing Group, Oxford University Press, PsycARTICLES, Science, and Wiley–Blackwell). The search was further strengthened by using the Google Scholar search engine and by searching the reference lists of retrieved articles for relevant publications. The search terms included: “reverse breech extraction,” “pull method,” “push method,” “cesarean section,” “delivery of wedged head,” “prolonged second stage,” “obstructed labor,” “uterine incision extension,” “birth trauma during cesarean section,” “blood loss during cesarean section,” “blood transfusion during and after cesarean section,” and “delivery of the impacted head.” During the search, the search terms were combined using the Boolean operators “and” and “or.”

2.2. Inclusion criteria and study selection

The present meta-analysis included studies that: (1) compared the maternal and perinatal outcomes in relation to the push and pull methods for impacted fetal head extraction during cesarean delivery; (2) were performed between January 1, 2000, and April 30, 2013; and (3) were published in English. The analysis included randomized comparative studies and retrospective cohort studies. The studies compared 1 pull method with 1 push method, with the exception of Chopra et al. [17], who compared 3 push methods with 1 pull method. Two articles [9,20] included in the present analysis described the Patwardhan technique from India. This method involves pulling the trunk first and then the feet and is technically similar to reverse breech extraction (pull method) because it is practically impossible during reverse breech extraction to pull the breech without some simultaneous pulling of the trunk.

The study selection process included 2 steps. First, the retrieved articles were reviewed and classified as “likely” and “unlikely” based on their titles and abstracts. Second, the whole content of articles classified as “likely” was reviewed before a decision was made on whether to include them. The 2 authors (Y.B. and A.B.) of the present article selected the studies independently from each other. Discrepancies were resolved by discussion and reviewing the article in question in detail.

2.3. Data extraction

Once a common data frame had been established, data extraction was conducted individually using standard Excel (Microsoft, Redmond, WA, USA) spreadsheets. The following information was abstracted: authors, year of publication, number of cases with fetal head impaction where the fetus was extracted with the “pushing from below” method during cesarean delivery, number of cases with fetal head impaction where the fetus was extracted with the reverse breech extraction method during cesarean delivery, mean operation time, extension of the uterine incision, mean blood loss, blood transfusion, wound infection, 5-minute Apgar score, and duration of hospital stay.

2.4. Operational definitions

Reverse breech extraction (pull method) means that a fetus with cephalic presentation is first extracted by the breech. With this technique, the uterine incision is made in the lower segment, using a high transverse or a low vertical approach. Pushing from below is technically the same as the traditional cephalic extraction of fetuses with cephalic presentation, but it is assisted from below by another person who is not part of the operating team. In the present article, the terms “reverse

breech extraction” and “pull method” are used interchangeably, as are the terms “pushing from below” and “push method.”

2.5. Statistical analysis

The selected maternal and neonatal outcome indicators in relation to the push and pull methods for impacted fetal head extraction during cesarean delivery were assessed by calculating odds ratios (ORs) and standard mean differences (SMDs). The overall ORs and 95% confidence intervals (CIs) for extension of the uterine incision, blood transfusion, and wound infection were determined by the Mantel–Haenszel method. The overall SMDs and the 95% CIs for blood loss, 5-minute Apgar score, operation time, and duration of hospital stay were computed using the inverse variance method. Results were considered statistically significant if the CIs of odds ratios did not include the value 1.0, the CIs of SMDs did not include the value 0.0, or $P < 0.05$.

To assess the heterogeneity of the studies included in the meta-analysis, the χ^2 , I^2 , and P values were computed. If the I^2 value of was greater than or equal to 50%, the heterogeneity was considered to be statistically significant. Because the included studies had different designs and were conducted in different settings, the random-effects model was used for all meta-analyses. Sensitivity analyses were also conducted to assess the stability of the pooled values by excluding 1 study at a time. Publication/disclosure biases were assessed with funnel plots. All statistical analyses and plots were generated using Meta-Analyst 3.13 beta (Tufts Medical Center, Boston, MA, USA) for the calculation of ORs and RevMan 5.1 (Cochrane Collaboration, Oxford, UK) for the calculation of SMDs.

3. Results

3.1. Characteristics of the included studies

The literature search for the selected search terms initially identified 1131 citations (Fig. 1). Following a review of the titles for their relevance to the objective of the present analysis, 135 citations were selected. After screening the abstracts, 32 articles were retrieved for a detailed review. In total, 11 articles [3,12–21] met the inclusion criteria for the present meta-analysis (Table 1). In these studies, there were no significant differences between the pull and push methods in terms of maternal age, pregnancy duration, and parity.

3.2. Analysis of the pooled data

The risk of lateral or downward extension of the uterine incision was approximately 8 times higher with the push method (OR 7.8; 95% CI, 5.01–12.25) than with the pull method [3,12–18,20,21] (Fig. 2). The reduced risk of incision extension with the pull method was consistent in all studies, and heterogeneity testing did not show any significant variation between the studies ($I^2 = 17.1\%$). Furthermore, the sensitivity analysis demonstrated stability of the pooled ORs; when excluding one study at a time, the pooled ORs ranged from 7.58 to 8.75. Some authors [13,14] investigated lateral and downward incisions separately and found that lateral extensions were more common than vaginal extensions if the push method was used.

Of the assessed postoperative maternal complications, febrile morbidity [12,13], urinary tract infection [13], and endometritis [14,16] were more prevalent among women in the push group than among those in the pull group. None of the included studies demonstrated a statistically significant association of wound infection with either method [3,12–18], and there was no heterogeneity between the studies ($I^2 = 0.0\%$) (Fig. 3). However, wound infection was more common in the push group [13,15–17].

Blood transfusion and/or mean blood loss were used as indicators of the degree of bleeding associated with the 2 fetal extraction techniques. In the studies that reported on blood transfusion [3,13,15–18,20,21], the

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