OBSTETRICS

Management of fetal malposition in the second stage of labor: a propensity score analysis

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OBJECTIVE: We sought to determine the factors associated with selection of rotational instrumental vs cesarean delivery to manage persistent fetal malposition, and to assess differences in adverse neonatal and maternal outcomes following delivery by rotational instruments vs cesarean delivery.

STUDY DESIGN: We conducted a retrospective cohort study over a 5-year period in a tertiary United Kingdom obstetrics center. In all, 868 women with vertex-presenting, single, liveborn infants at term with persistent malposition in the second stage of labor were included. Propensity score stratification was used to control for selection bias: the possibility that obstetricians may systematically select more difficult cases for cesarean delivery. Linear and logistic regression models were used to compare maternal and neonatal outcomes for delivery by rotational forceps or ventouse vs cesarean delivery, adjusting for propensity scores.

RESULTS: Increased likelihood of rotational instrumental delivery was associated with lower maternal age (odds ratio [OR], 0.95; $P < .01$), lower body mass index (OR, 0.94; $P < .001$), lower birthweight (OR, 0.95; $P < .01$), no evidence of fetal compromise at the time of delivery (OR, 0.31; $P < .001$), delivery during the daytime (OR, 1.45; $P < .05$), and delivery by a more experienced obstetrician (OR, 7.21; $P < .001$). Following propensity score stratification, there was no difference by delivery method in the rates of delayed neonatal respiration, reported critical incidents, or low fetal arterial pH. Maternal blood loss was higher in the cesarean group (295.8 $\pm$ 48 mL, $P < .001$).

CONCLUSION: Rotational instrumental delivery is often regarded as unsafe. However, we find that neonatal outcomes are no worse once selection bias is accounted for, and that the likelihood of severe obstetric hemorrhage is reduced. More widespread training of obstetricians in rotational instrumental delivery should be considered, particularly in light of rising cesarean delivery rates.

Key words: cesarean delivery, delivery, fetal malposition, intrapartum care, operative vaginal delivery

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Fetal head malposition in the second stage of labor is a significant risk factor for adverse maternal and neonatal outcomes, and is associated with high rates of both instrumental delivery and cesarean delivery.[1] While some women will spontaneously deliver a malpositioned fetus, most require obstetric intervention.[2] In cases of persistent malposition, the obstetrician must choose between a potentially difficult rotational instrumental delivery and a second-stage cesarean delivery.

Instrumental rotation of the fetal head has fallen out of favor in modern obstetric practice in much of the world, despite data showing low complication rates.[3,4] It has recently been demonstrated that, while the majority of obstetricians considered rotation of the fetal head to be an acceptable intervention (97%), less than half (41%) had performed it within the previous year.[5] Second-stage cesarean delivery is an increasingly common alternative,[6] but carries a significant burden of maternal morbidity.[7,8]

A small number of studies have compared the morbidity associated with different instruments used to effect

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rotational delivery, and have found low prevalence of adverse maternal and neonatal outcomes, as well as increased risk of some adverse events with emergency cesarean delivery.[9-11] However, any comparison of delivery outcomes by rotational instruments vs second-stage cesarean delivery must confront the possibility that obstetricians systematically select more difficult cases for cesarean delivery, thereby introducing a selection bias. This study has 2 main objectives: first, to illuminate the factors that make an attempt at rotational instrumental delivery more likely, by modeling the obstetrician's decision-making process; and second, to use propensity score stratification to create comparable groups that allow differences in maternal and fetal outcomes by delivery type to be tested reliably.

Materials and Methods

A cohort of 25,886 women with vertex-presenting, single, liveborn infants at term (37-42 completed weeks of gestation), aiming for vaginal delivery was identified over a 5-year period (January 2008 through October 2013) in a single tertiary obstetrics center in the United Kingdom. A subcohort of 868 women was identified with a confirmed cephalic fetal malposition in the second stage of labor. Of these, 833 underwent either cesarean delivery (n = 534) or successful instrumental delivery (n = 299), and 35 underwent failed instrumental delivery, followed by second-stage cesarean delivery.

Fetal malposition was defined as any cephalic position >45 degrees from direct occipito-anterior,[12] and was diagnosed by digital examination. The rate of malpositions delivered by each method did not vary significantly across the study years. Deliveries where the obstetrician performed manual rotation of the fetal head followed by direct instrumental delivery were not considered to be cases of persistent fetal malposition, and were not included in the analysis. The indications and procedures for instrumental delivery in our center are defined in the operative vaginal delivery guidance from the Royal College of Obstetricians and Gynaecologists (RCOG), United Kingdom.[12] The classification of and indications for operative vaginal delivery are materially identical to the American Congress of Obstetricians and Gynecologists Practice Bulletin number 17 on operative vaginal delivery.[13]

Rotational instrumental delivery was carried out with either Kjelland forceps or ventouse. Ventouse devices available in the unit include posterior and rotational metal cups, Silastic cups (Dow Corning Corp, Hemlock, MI), and Kiwi Omnicups (Clinical Innovations, Murray, UT). Of the 334 successful instrumental deliveries, 62.0% (n = 207) were conducted with Kjelland forceps and 38.0% (n = 127) using ventouse.

Data regarding each woman's pregnancy, labor, and delivery were recorded by midwives shortly after birth, and were subsequently obtained from the hospital's data-recording system. The database is regularly validated by a rolling program of audits where the original case notes are checked against the information recorded in the database. No patient-identifiable data were accessed during this research, which was performed as part of a provision-of-service study for the obstetrics center. Individual medical records were not accessed at any stage. Institutional review board approval was therefore not required.

Characteristics of the maternal-fetal dyad were extracted from the database, including maternal age (at time of delivery), body mass index (BMI) (at first-trimester prenatal booking), parity (prior to delivery), ethnicity, and birthweight to the nearest gram. Also recorded were the time between diagnosis of second stage and delivery (time fully dilated), and the instrument selected. Gestational age (measured by crown-rump length at first-trimester ultrasound) was recorded to the nearest week. Only cases where birth occurred within the interval 37-42 weeks' completed gestation were included. No adjustment was made for infants found to be small or large for gestational age. The indication for delivery was also classified into those where there was evidence of fetal compromise (including pathological fetal-heart tracing, abnormal fetal-blood sampling result, evidence of sepsis) and those where delivery was undertaken on other grounds (including failure to progress in second stage and maternal exhaustion). Deliveries were conducted under regional anesthesia (epidural or spinal), excepting a small number who required general anesthetic because of time constraints or failure of regional anesthesia during the procedure.

The level of experience of the obstetrician attempting delivery and the time at which the delivery took place were also recorded. Obstetricians were classified into 3 types using years of training as a proxy for experience. Type-1 and -2 obstetricians have 3-5 years and 5-10 years of obstetric training, respectively. Type-3 obstetricians typically have >10 years of clinical obstetric experience. Our study was conducted in a unit where 2 obstetricians are available to perform instrumental deliveries or cesarean deliveries at any time. The first is typically a type-1 obstetrician, and is always supported by an immediately available doctor with >5 years obstetric training: a type-3 obstetrician during the day, or type-2 overnight. All obstetricians had training in at least 1 method of rotational instrumental delivery, in line with RCOG training requirements.

Delay in neonatal respiration was recorded where spontaneous respiration was not achieved within 1 minute of delivery. Umbilical cord blood was obtained immediately following delivery, and the arterial pH recorded. Correlation between arterial and venous pH was checked to confirm accuracy of the measurements. Arterial pH was categorized as ≥7.1 or <7.1.[14] A critical-incident form was generated at delivery in the case of any obstetric or neonatal emergency, including neonatal resuscitation, postpartum hemorrhage, shoulder dystocia, severe perineal trauma, maternal visceral injury, or any other event generating an obstetric emergency call. Maternal blood loss was measured by operating-room staff immediately after delivery, using suction blood collection and weighing of swabs and other pads. Blood loss was treated as a numerical variable to the nearest milliliter, and also categorized as minor