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Effect of Rotation on Perineal Lacerations in Forceps-Assisted Vaginal Deliveries

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Abstract

Objective—To determine the difference in the rates of severe perineal lacerations between forceps-assisted vaginal deliveries in the occiput-posterior (OP) position compared with forceps-assisted vaginal deliveries in which the fetal head was rotated to occiput anterior (OA) prior to delivery.

Methods—We studied a retrospective cohort of 148 women who had a forceps-assisted vaginal delivery from 2008–2011 at the University of Pittsburgh. Mild perineal lacerations were defined as first or second degree, and severe lacerations were defined as third or fourth degree. Chi-square and *t* tests were used for bivariate and logistic regression was used for multivariable analyses. $P<.05$ was considered statistically significant.

Results—Of 148 forceps-assisted deliveries, 81 delivered OA after either manual or forceps rotation, 10 delivered in the OP or occiput-transverse position after an unsuccessful rotation, and 57 delivered OP without attempted rotation. No significant differences were found between demographic, obstetric and neonatal characteristics of the groups. Overall, 86 (67.7%) women had mild lacerations and 41 (32.3%) had severe lacerations. A significantly greater rate of severe perineal lacerations were found in the OP nonrotated compared with the rotated group (43.4% compared with 24.3%; $P=.02$). In multivariable analyses, adjusted for age, race, insurance, body mass index, gestational age, parity, episiotomy and neonatal weight, forceps-assisted vaginal delivery in the OP position without rotation remained significantly more likely to be associated with severe lacerations (OR 3.67; 95% CI 1.42–9.47).

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Conclusion—Forceps-assisted vaginal delivery after rotation of an OP position to an OA position is associated with less severe maternal perineal trauma than forceps-assisted delivery in the OP position.

Introduction

Forceps-assisted vaginal delivery is a significant risk factor for maternal perineal lacerations, including anal sphincter injury.(1, 2) In retrospective studies, the incidence of third-degree and fourth-degree lacerations associated with forceps-assisted vaginal deliveries ranges from 10% to 35%. (3) Nevertheless, in appropriately chosen candidates, the use of obstetric forceps results in good maternal and neonatal outcomes and provides an important alternative to cesarean delivery. (4)

Among forceps-assisted vaginal deliveries, occiput posterior (OP) position has been consistently associated with a further increased risk of severe perineal lacerations. The increased maternal morbidity associated with forceps-assisted delivery in the OP position raises the question of the effect of fetal head rotation as an intervention to mitigate the effect of forceps-assisted delivery on perineal trauma.

While forceps-assisted delivery in the OP position has been shown to increase the risk of severe perineal lacerations, the effect of rotation to occiput anterior (OA) position prior to delivery has not been evaluated.(5, 6) As a result, the purpose of this study was to evaluate the difference in rates of severe perineal laceration between forceps-assisted vaginal deliveries in the OP position compared with forceps-assisted delivery in which the fetal head was rotated, either by manual or forceps rotation, prior to delivery. This analysis is intended to identify an intervention that will help obstetricians decrease the rate of severe perineal laceration associated with forceps-assisted vaginal delivery without incurring additional maternal and neonatal morbidity.

Materials and Methods

We performed a retrospective cohort study of all forceps-assisted vaginal deliveries from June 2008 to November 2011. *International Classification of Diseases, Ninth Revision* (ICD-9) codes for forceps-assisted vaginal delivery were used to identify the sample. From all forceps-assisted vaginal deliveries, we selected women who had a forceps-assisted delivery in the OP position without rotation and women who had a forceps-assisted delivery after either a manual or forceps rotation. Maternal demographics including age, parity, body mass index (BMI), race, and insurance type, obstetric characteristics including anesthesia type, the use of episiotomy, severity of perineal lacerations, fetal head position at time of delivery, type of forceps delivery, and neonatal characteristics including neonatal weight and neonatal Apgar scores were extracted from the medical record. Data extracted from the medical record was validated through a double entry process. Two researchers experienced in medical record extraction individually and separately extracted each variable from the medical record into two separate databases. These two datasets were then merged and analyzed for discrepancies between the entered data. Each discrepancy was reviewed and resolved by the primary author through a third review of the medical record. This study was approved by the University of Pittsburgh Institutional Review Board, IRB # PRO11120431.

Our primary outcome was severe perineal lacerations. Severe perineal lacerations were defined as either a third-degree or fourth-degree vaginal laceration and mild perineal lacerations were defined as either a first-degree or second-degree vaginal laceration. The degree of perineal laceration, fetal head position at the time of delivery and the type of forceps delivery were determined by the delivery physician at the time of the delivery. Rotation was defined as either a manual or forceps-assisted rotation immediately prior to the forceps-assisted delivery. Tucker-McLane, Elliot, Simpson or Lauffe forceps were used for forceps-assisted deliveries. Kjelland-Barton or Kjelland forceps were used for forceps-assisted rotations. The University of Pittsburgh is a teaching institution and all forceps-assisted vaginal deliveries are performed by either an attending physician or by a senior-level resident under the supervision of an attending physician. Episiotomy was defined as either a medial or mediolateral episiotomy. Sulcal tears were defined as either unilateral or bilateral sulcal tears. Intrapartum complications included the presence of at least one of the following complications: vaginal wall hematoma, postpartum hemorrhage, fetal trauma or shoulder dystocia. Body mass index (BMI, in kg/m^2) was dichotomized into 30 or more and less than 30. Neonatal Apgar scores at 1 and 5 minutes were dichotomized into either 7 or less or greater than 7. The neonatal Apgar scores were assigned by pediatricians who are present during all operative vaginal deliveries at the University of Pittsburgh. Missing values were excluded from the analysis.

We used descriptive statistics to report demographic characteristics for the study population. Chi-square and *t* test analyses were conducted to assess for significant differences between the sample of women who had a forceps-assisted delivery after rotation and the sample of women who had a forceps-assisted delivery in the OP position without rotation. Chi-square analyses were also conducted to assess for significant differences between the samples of women who had a manual rotation compared with a forceps-assisted rotation. Bivariate and multivariable logistic regression analyses were conducted to determine the relationship between fetal head position with and without rotation and severe perineal laceration while adjusting for age, race, gestational age, parity, insurance status at the time of delivery, episiotomy, neonatal weight and maternal weight. Logistic regression models were evaluated for collinearity and variance inflation factor values were less than 2.0 for all independent variables. All analyses were conducted with STATA 12 (StataCorp, College Station, TX). $P<.05$ was considered statistically significant.

Results

In 2011, there were at total of 9,022 obstetric deliveries at our institution. Of these deliveries, 6,063 (67.2%) were vaginal deliveries, 2,466 (27.3%) were cesarean deliveries, 364 (4%) were vacuum-assisted vaginal deliveries and 129 (1.4%) were forceps-assisted vaginal deliveries. Our cohort was composed of the 562 forceps-assisted vaginal deliveries that took place between June 2008 and November 2011. Within this cohort, a total of 99 rotations were identified, 64 of which were rotated manually and 35 of which were rotated using rotational forceps. Of 99 rotations, 81 were successfully rotated to OA position prior to delivery, 10 had unsuccessful rotations and delivered in the OP position (nine cases) or the occiput transverse (OT) position (one case). Fetal head position at the time of delivery was missing for eight rotations and these rotations were excluded from our sample. Also within this sample, 57 patients who had a forceps delivery in the OP position without attempted rotation were also identified. Therefore, our final sample consisted of 148 forceps-assisted vaginal deliveries: 91 rotations (81 who delivered in the OA position after successful rotation and 10 unsuccessful rotations who delivered in the OP position [nine cases] and OT position [one case]) and 57 who delivered in the OP position without attempted rotation. Within this sample, 86 (67.7%) women had mild lacerations and 41 (32.3%) had severe lacerations.

Maternal demographic data, obstetric and neonatal characteristics of both samples are compared in Table 1. Although there were no significant demographic, obstetric or neonatal differences between the two groups, women who had a forceps-assisted vaginal delivery in the OP position without rotation were significantly more likely to have a severe perineal laceration (43.4% compared with 24.3%; $P=.02$). Most patients were nulliparous, Caucasian women who had private insurance, had epidural anesthesia and did not have an episiotomy. Only 12 patients had an intrapartum complication.

To assess for possible differences between the samples of women who received a manual rotation compared with a forceps-assisted rotation, we conducted a subanalysis of these two groups (Table 2). Importantly, there was no significant difference in the rate of severe perineal lacerations (20.4% compared with 32.0%; *P*=.27) between the manual and forceps-assisted rotation groups. The forceps-assisted and manual rotation groups were also similar with regards to the rate of sulcal tears (26.7% compared with 38.7%; *P*=.24), intrapartum complications (8.3% compared with 12.9%; *P*=.49), 1-minute neonatal Apgar score 7 or less (18.6% compared with 29.0%; *P*=.26) and 5-minute neonatal Apgar score 7 or less (6.8% compared with 6.5%; *P*=.95). Because we did not find any significant differences between our manual compared with forceps-assisted rotation groups, we combined these two groups in our bivariate and multivariable analysis.

In bivariate analysis, OP position without rotation, maternal age, race, insurance, gestational age, neonatal weight, nulliparity and episiotomy were significantly associated with an increased odds of severe perineal laceration when compared with rotation to OA position prior to forceps-assisted vaginal delivery. However, in multivariable logistic regression analysis, only OP position without rotation (OR 3.67; 95% CI 1.42–9.47) and nulliparity (OR 6.47; 95% CI 1.13–37.01) remained significantly associated with an increased odds of severe perineal laceration after adjusting for age, race, gestational age, insurance type, episiotomy, neonatal weight and maternal BMI 30 or more (Table 3).

Overall, 10 women had an unsuccessful rotation defined as an attempted rotation followed by fetal head position at the time of delivery in either the OP (nine cases) or OT (one case) position. These unsuccessful or “failed” rotations accounted for only 6.7% of our rotation sample. To mitigate the potential confounding effect of OP and OT fetal head position associated with these failed rotations on the odds of severe perineal laceration, we excluded failed rotations from the analysis in Table 3. However, including failed rotations in the analysis resulted in a comparable OR of 2.39 (95% CI 1.12–5.10).

Discussion

Operative vaginal deliveries and OP position have been shown to be independent risk factors for severe perineal lacerations. (1, 5, 6) Given that the average suboccipitobregmatic diameter is 9.5 cm and the average occipital-frontal diameter is 11.5 cm, increased rates of severe perineal trauma associated with OP presentation are not unexpected. In our analysis, OP position was also found to be significantly associated with severe perineal lacerations. In a previous evaluation of the effect of fetal head position on perineal lacerations in forceps-assisted vaginal deliveries, Benavides et al did not find a significant association between rotational forceps and severe lacerations. However, this analysis did not directly compare rates of perineal lacerations between rotated and nonrotated groups and did not include manual rotations. (6) The results of our analysis indicate that rotation of fetal head position from OP to OA prior to forceps-assisted vaginal delivery may be protective for severe perineal lacerations and does not incur significant maternal and neonatal trauma.

There were no significant differences in the rate of severe perineal lacerations, demographic, obstetric and neonatal outcomes between the forceps-assisted and manual rotation groups. Although the limited sample size of the manual and forceps rotation groups may have limited our ability to detect a difference between the groups, our sample size is appropriate to other published evaluations of rotation at the time of forceps-assisted delivery. (7) Additional characteristics of our sample are also consistent with that of other published studies of operative vaginal delivery. (5, 7) In our sample, the rate of severe vaginal lacerations was approximately 32% which is comparable to other reported rates of 20–50%. (8, 9) In addition, the rate of severe vaginal lacerations associated with forceps-assisted vaginal delivery in OP position was approximately 43% which is also consistent with previously reported rates. (10)

Our study must be interpreted in light of certain limitations. Our study was retrospective in nature and our data were based on and subject to the limitations of a retrospective review of medical record documentation. We were unable to determine the length of the second stage of labor as this information was not uniformly recorded in the medical record. Prolonged second stage of labor has been associated with an increased risk of severe anal sphincter injuries and could affect the rate of severe perineal laceration.(5) While previous evaluations of rotational deliveries have shown that advanced degrees of forceps rotations do not result in a clinically significant increase in infant or maternal morbidity, we were unable to determine the degree of rotation performed during rotational deliveries.(11) We were also unable to determine which member of the delivery team (attending compared with resident) ultimately successfully applied and pulled the forceps to facilitate delivery based on a retrospective review of the medical record. Importantly, the ability to rotate a fetus from OP to OA prior to delivery can be a complex process dependent on multiple fetal and maternal factors, provider training and provider comfort level with the rotation procedure and we were unable to standardize these factors. Finally, while our sample size is comparable with that of previous evaluations of rotation during forceps-assisted delivery, the absence of a statistically significant difference in maternal and neonatal morbidity between the manual and forceps-assisted rotation subgroups may have been affected by our sample size. (7, 12)

In summary, our study found that forceps-assisted vaginal deliveries in the OA position after rotation are associated with less maternal morbidity than forceps-assisted vaginal deliveries in the OP position. These findings suggest that when considering an assisted delivery in patients with an OP presentation, clinicians should attempt to rotate the fetal head to decrease the rate of anal sphincter injury. It is imperative that we continue to elucidate factors that may confer increased risk to maternal and neonatal outcomes to help guide current obstetric practices.

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Table 1

Sample Characteristics

	Forceps-Assisted Vaginal Delivery Without Rotation * (n=57)	Forceps-Assisted Vaginal Delivery With Rotation † (n=91)	*P*
Maternal demographic characteristics			
Age, y	27.1 (±4.8)	27.6 (±6.2)	0.60
Race			
Caucasian	38 (69.1)	63 (70.8)	0.88
African American	12 (21.8)	20 (22.5)	
Other	5 (9.1))	6 (6.7)	
Body mass index 30 or more kg/m^2	30 (52.6)	46 (50.6)	0.81
Gestational age, wk	38.4 (±2.8)	38.7 (±1.75)	0.35
Nulliparous	45 (79.0)	71 (78.0)	0.89
Insurance			
Private	35 (61.4)	42 (46.2)	0.07
Medicaid	22 (38.6)	49 (53.9)	
Obstetric and neonatal characteristics			
Epidural	53 (93.0)	80 (89.9)	0.69
Episiotomy			
Midline	7 (12.3)	8 (8.8)	0.30
Mediolateral	5 (8.8)	17 (18.7)	
Type of forceps			
Outlet	15 (26.3)	19 (21.0)	0.38
Low	39 (68.4)	60 (65.9)	
Mid	1 (1.8)	7 (7.7)	
Neonatal weight, g	3250.2 (±683.9)	3214.2 (±534.8)	0.72
1-minute neonatal Apgar 7 or less	14 (24.6)	20 (22.2)	0.74
5-minute neonatal Apgar 7 or less	4 (7.0)	6 (6.7)	0.93
Intrapartum complication	3 (5.3)	9 (9.9)	0.32
Sulcal tear	16 (28.1)	28 (30.8)	0.73
Severe perineal laceration	23 (43.4)	18 (24.3)	**0.02**

Data are n (%) or mean (± SD) unless otherwise specified.

Less than 5% missing data for all variables except severe perineal laceration with 8.6% missing data.

*Delivery position was occiput posterior for all cases.

† Delivery position was occiput anterior (81 cases), occiput posterior (9 cases) and occiput transverse (1 case).

Table 2

Characteristics of Manual Compared With Forceps-Assisted Rotation

	Manual Rotation (n=60)	Forceps-Assisted Rotation (n=31)	*P*
Maternal Demographics			
Age, y	26.9 (±6.08)	28.9 (±6.29)	0.17
Race			
Caucasian	40 (67.8)	23 (76.7)	0.27
African American	16 (27.1)	4 (13.3)	
Other	3 (5.1)	3 (10.0)	
Body mass index 30 or more kg/m^2	31 (51.7)	15 (48.4)	0.77
Insurance			
Private	25 (41.7)	17 (54.8)	0.23
Medicaid	35 (58.3)	14 (45.2)	
Nulliparous	47 (78.3)	24 (77.4)	0.92
Gestational age, wk	38.7 (±1.69)	38.9 (±1.89)	0.57
Obstetric and Neonatal Characteristics			
Epidural	53 (89.8)	27 (90.0)	0.52
Episiotomy			
Midline	6 (10.0)	2 (6.45)	0.28
Mediolateral	8 (13.3)	9 (29.0)	
Neonatal weight, g	3180.2 (±540.9)	3279.9 (±525.3)	0.40
1-minute neonatal Apgar 7 or less	11 (18.6)	9 (29.0)	0.26
5-minute neonatal Apgar 7 or less	4 (6.8)	2 (6.5)	0.95
Intrapartum complication	5 (8.3)	4 (12.9)	0.49
Sulcal tear	16 (26.7)	12 (38.7)	0.24
Severe perineal laceration	10 (20.4)	8 (32.0)	0.27

Data are n (%) or mean (± SD) unless otherwise specified.

Table 3

Odds Ratio For Severe Perineal Laceration

Characteristic	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
OP position without rotation	2.79 (1.25–6.23)	3.67 (1.42–9.47)
Age	1.04 (1.01–1.08)	1.02 (0.92–1.14)
Race		
Caucasian	ref	ref
African American	0.44 (0.22–0.88)	0.58 (0.12–2.86)
Other	2.71 (1.51–4.89)	3.44 (0.60–19.78)
Insurance		
Medicaid	0.27 (0.17–0.41)	0.53 (0.16–1.70)
BMI 30 or more kg/m^2	0.84 (0.57–1.23)	1.06 (0.40–2.81)
Gestational age	1.19 (1.06–1.34)	0.98 (0.72–1.35)
Nulliparity	2.49 (1.32–4.70)	6.47 (1.13–37.01)
Episiotomy	2.5 (1.67–3.84)	0.93 (0.33–2.66)
Neonatal weight	1.00 (1.00–1.00)	1.00 (0.99–1.00)

OR, odds ratio; CI, confidence interval; OP, occiput posterior; BMI, body mass index.