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Higher Rates of Operative Delivery and Maternal and Neonatal Complications in Persistent Occiput Posterior Position with a Large Head Circumference: A Retrospective Cohort Study

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Keywords

Head circumference · Instrumental delivery · Occiput posterior position · Operative delivery · Prolonged second stage of labor

Abstract

Introduction: We investigated whether large head circumference (HC) combined with persistent occiput posterior (OP) position is associated with higher rates of operative delivery and obstetric and neonatal complications than OP deliveries without large HC or in occiput anterior (OA) position. ***Materials and Methods:*** Term singleton deliveries in our centers from January 2010 to December 2014, delivered in cephalic OA (n = 41,038) or OP position (n = 1,740), were assessed. We compared delivery modes, maternal and neonatal complications in OA versus OP deliveries, and HC ≥90th centile versus HC <90th centile in persistent OP position. ***Results:*** Persistent OP position combined with HC ≥90th centile was associated with higher rates of vacuum extraction and unplanned cesarean delivery than HC <90th centile in OP position (20.1 vs. 17.2%, OR 1.53 [95% CI 0.99–2.36], and 23.4 vs. 9.2%, OR 3.326 [95% CI 2.17–5.11], respectively). Rates of prolonged second stage of labor and neonatal intensive care unit admission were also increased compared to those in either OA position with HC ≥90th centile or OP position with HC <90th centile. ***Discussion:*** Large HC combined with OP position is associated with higher rates of operative delivery and prolonged second stage of labor compared to OP delivery with HC <90th centile. HC might be included with other measures to assess women in labor, as it is associated with fetal outcomes in OP deliveries.

Introduction

Persistent occiput posterior (OP) position is a common malposition of the fetal head in cephalic presentation. At term, approximately 15–20% of fetuses are in this position; at delivery, some 5% will remain so [1–4]. Risk factors [3, 5] for OP position at delivery described in the literature include nulliparity, maternal age, body habitus, ethnicity, decreased pelvic outlet dimensions, anterior placenta [6], gestational age ≥41 weeks, birth weight (BW) ≥4,000 g, epidural anesthesia [7, 8], and previous pregnancy with OP position [9]. Some investigators also identify labor induction as increasing the risk of OP position [3].

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OP position has been implicated in obstetric and neonatal complications [3–5, 10–16], including prolonged first and second stages [4, 5, 15] of labor or arrested second stage [15], and higher rates of operative delivery [11, 13, 17], as well as neonatal acidemia [12], 5-min Apgar score <7 [4, 12], neonatal intensive care unit (NICU) admission [12], meconium staining [12], birth trauma and shoulder dystocia [2, 4, 12], and intrapartum disruption of the maternal anal sphincter [10, 13, 14, 16]. The possible effect of a large head circumference (HC) combined with OP position at delivery on rates of obstetric outcomes has not been investigated.

Our recent study [18] comprising a cohort of over 26,000 deliveries showed that large neonatal HC was associated with higher rates of operative delivery and neonatal complications. HC ≥95th centile was more strongly associated with unplanned cesarean delivery (UCD) or instrumental delivery than BW ≥95th centile. For women delivering babies with HC ≥95th centile, the odds ratios (ORs) for UCD and instrumental delivery were 2.58 and 2.13, respectively, and among primiparae, OR for UCD was 3.5 and for instrumental delivery 2.29 [18].

In the present study, we sought to investigate whether a large HC combined with persistent OP position at delivery is associated with higher rates of operative delivery modes and various maternal and neonatal outcome parameters as compared with those observed both in fetuses with large HC in occiput anterior (OA) position and with HC <90th centile delivered in OP position.

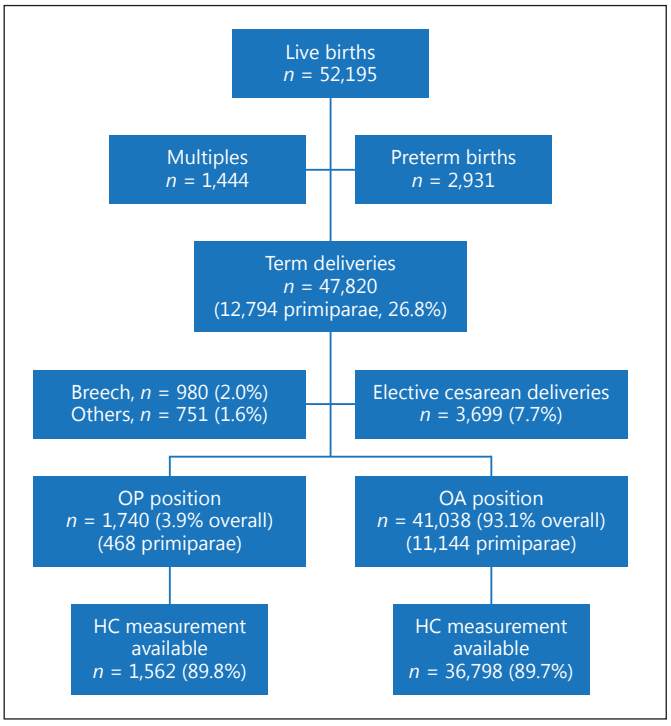

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Fig. 1. Selection flowchart of the study cohort. OP, occiput posterior; OA, occiput anterior; HC, head circumference.

Methods

Study Design

This is an electronic medical record (EMR)-based retrospective cohort study of gravidae delivering in the labor and delivery wards of the 2 campuses of a tertiary care center over the period January 2010 to December 2014 (local institutional review board approval was obtained: #0085-13-HMO, February 14, 2013, and #0632-15-HMO, December 30, 2015). Part of this cohort was included in an earlier study [18]. Data were entered prospectively at point of care and extracted for the study at the end of the study period. Clinical ward staff was not aware of the study at the time of data entry, and investigators involved in data extraction and analysis (O.Y., S.M.C., and M.L.) were not involved in clinical care. Term deliveries (37–42 weeks' gestation) of live singleton fetuses were included. Fetal position at delivery was recorded in the EMR in the labor ward. Fetuses in breech, face, or shoulder/transverse positions were excluded, as were twins and higher-order multiples, preterm deliveries, and all elective cesarean deliveries. Data collected included maternal background parameters, obstetric history, and labor and delivery parameters of the index pregnancy, including mode of delivery, labor induction, epidural administration, length of second stage of labor, and maternal hemorrhage. Mothers' files were cross-referenced with their infants' files; infant gender, neonatal HC, BW, 5-min Apgar scores, umbilical artery pH, and admission to NICU were extracted along with complications, such as intraventricular hemorrhage. However, owing to the very small number of cases in these term singleton deliveries, the latter was not included in final analyses. Prolonged second stage of labor was defined differentially according to parity and epidural anesthesia use [19, 20] (defined as prolonged if >3 h for primipara with epidural anesthesia and >2 h without epidural anesthesia; >2 h for multipara with epidural anesthesia and >1 h without epidural anesthesia). Maternal hemorrhage was defined differentially as >500 mL in vaginal deliveries and >1,000 mL in cesarean births. BW was recorded in the delivery room, and HC was measured in the newborn nursery 6–18 h after delivery, with a flexible non-shrink, non-stretch tape measure passed around the baby's head above the eyebrows anteriorly and at the posterior protuberance of the occipital bone posteriorly [21].

We first compared the study background and outcome parameters between fetuses delivered in OP position versus OA position. Further analyses focused on 3 subgroups: fetuses with an HC ≥90th centile that were delivered in OA position (group A); fetuses with an HC ≥90th centile that were delivered in OP position (group B); and fetuses that were delivered in OP position with an HC <90th centile (group C). Analyses tested whether rates of operative delivery and maternal and neonatal complications were increased in group B versus group A and in group B versus group C. Analyses were performed for the entire cohort and for primiparae and multiparae separately.

Table 1. Background and obstetric parameters of the study cohort (n = 42,778) in occiput anterior and occiput posterior position

Background parameters	Total cohort	Occiput anterior (n = 41,038)	Occiput posterior (n = 1,740)	p value
Maternal age, years	29.4±5.5	29.4±5.5	29.6±5.4	0.1
Primipara status	11,612 (27.2)	11,144 (27.2)	468 (26.9)	0.82
Smoking status	1,430 (3.4)	1,376 (3.4)	54 (3.2)	0.32
Maternal diabetes	975 (2.3)	942 (2.3)	33 (1.9)	0.33
Gestational age at delivery, weeks	39.4±1.2	39.4±1.2	39.5±1.1	0.03
Induction of labor	7,077 (16.5)	6,779 (16.5)	298 (17.1)	0.082
Epidural anesthesia	22,791 (53.3)	21,778 (53.1)	1,003 (57.6)	<0.001
Male gender	21,898 (51.2)	21,033 (51.3)	865 (49.7)	0.21
HC, cm	34.3±1.2	34.3±1.2	34.2±1.2	<0.001
BW, g	3,314±422	3,314±423	3,327±411	0.2
HC ≤10th centile	3,599 (9.4)	3,419 (9.3)	180 (11.5)	0.003
BW ≤10th centile	3,961 (9.3)	3,815 (9.3)	146 (8.4)	0.22
HC ≥90th centile	4,159 (10.8)	4,005 (10.9)	154 (9.9)	0.2
BW ≥90th centile	4,512 (10.6)	4,329 (10.6)	183 (10.5)	0.99

Values are means ± standard deviations or n (%). Dichotomous variables were compared with the χ^2 or Fisher exact test as appropriate; continuous variables were compared with ANOVA. HC, head circumference; BW, birth weight.

Statistical Analysis

Statistical analysis was performed using IBM SPSS 20 for Windows (Chicago, IL, USA) and Microsoft Excel 2012 (Seattle, WA, USA). Dichotomous variables were compared with the Pearson χ^2 test and the Fisher exact test as appropriate. ANOVA was applied to analyze between-group differences in continuous variables. Multinomial multivariable regression was performed to model the association of persistent OP position and significant variables with mode of delivery. ORs and adjusted ORs (aORs) were determined for the primary outcomes, where OA position and spontaneous vaginal delivery were the reference categories.

Results

Background and Study Cohort

During the study period, there were 52,195 live births in our delivery wards; Figure 1 summarizes the cohort selection. There were 47,820 term singleton deliveries (12,794 primiparae, 26.8%). The 90th centiles for HC and BW were 36 cm and 3,850 g, respectively. A cephalic OA delivery was recorded in 41,038 and a cephalic OP delivery in 1,740 (3.9% overall). Among primiparae, 11,144 delivered in OA position and 468 in persistent OP position. Breech and other presentations were noted in 2.0 and 1.6% of cases, respectively. HC measurements were available for 36,798 OA and 1,562 OP infants. Table 1 summarizes the background parameters of the cohort and compares the OA and OP deliveries. Contrary to the literature, primipara status was not significantly associated with persistent OP position, nor was induction of labor or fetal macrosomia (BW ≥90th centile, 3,850 g or 95th centile, 4,023 g). Indeed, we observed that infants with HC ≤10th (32.9 cm) centile were delivered significantly more often in OP position than expected (11.5%, p = 0.003), while rates of HC ≥90th centile (36 cm) and BW ≤10th centile (2,772 g) among fetuses delivered in OP position did not significantly differ from the rate in the cohort. The rate of epidural anesthesia administration was higher among women who delivered babies in persistent OP position.

Table 2 summarizes the obstetric and neonatal outcome parameters studied and their associations with delivery in OP position as compared to OA position. Consistent with the literature, persistent OP position was associated with longer second stage of labor (in min) and the rate of prolonged second stage of labor, higher rates of operative delivery, maternal hemorrhage, Apgar ≤7 at 5 min, and neonatal umbilical artery pH ≤7.1.

Contrary to earlier studies [5, 13], the rate of OP position at delivery was not significantly increased among primiparae: 4.03 versus 4.08% in multiparae (p = 0.82). However, the clinical impact on obstetric and neonatal outcome parameters was considerable. Particularly marked was the increase in operative deliveries in the

Table 2. Maternal and fetal outcome parameters of the study cohort ($n = 42,778$) in occiput anterior and persistent occiput posterior position

Outcome parameters	Total cohort	Occiput anterior ($n = 41,038$)	Occiput posterior ($n = 1,740$)	p value
Mode of delivery				
SVD	35,700 (83.5)	34,458 (84)	1,242 (71.4)	<0.001
Vacuum extraction	3,519 (8.2)	3,210 (7.8)	309 (17.8)	<0.001
Unplanned cesarean delivery	3,559 (8.3)	3,370 (8.2)	189 (10.9)	<0.001
Length of second stage of labor, min	41±53	40±53	60±62	<0.001
Rate of prolonged second stage	2,477 (5.8)	2,240 (5.5)	237 (8)	<0.001
Maternal hemorrhage[a]	2,866 (6.7)	2,727 (6.6)	139 (8)	<0.010
Apgar ≤7 at 5 min	185 (0.4)	166 (0.4)	19 (1.1)	<0.001
Umbilical arterial pH ≤7.1 ($n = 29,184$)	307 (1.1)	274 (1)	33 (2.6)	<0.001
NICU admission	356 (0.8)	341 (0.8)	15 (0.9)	0.9

Values are means ± standard deviations or n (%). Dichotomous variables were compared with the χ^2 or Fisher exact test as appropriate; continuous variables were compared with ANOVA. SVD, spontaneous vaginal delivery; NICU, neonatal intensive care unit. [a] Hemorrhage was differentially defined as >500 mL in vaginal deliveries and >1,000 mL in cesarean deliveries.

context of OP position in primiparae, which accounted for 62% of births, as opposed to 16.3% among multiparae.

Infant Anthropometry

In concurrence with the literature [5, 13], we observed increased operative deliveries and maternal and neonatal complications in infants delivered in OP position as compared to OA position.

Comparing infants with a large HC (≥36 cm), significant differences were observed between those delivered in OP position (group B) versus those delivered in OA position (group A) in the rate of prolonged second stage of labor and vacuum extraction or UCD, as well as in the rate of umbilical artery pH ≤7.1 (Table 3, columns A and B). A comparison of infants with a large HC (≥36 cm) delivered in OP position with infants with HC <36 cm delivered in OP position (Table 3, columns B and C) showed that babies with a large HC who were delivered in OP position had significantly higher rates of epidural anesthesia administration, prolonged second stage of labor, UCD, and admission to the NICU (though numbers were very small). The rate of vacuum delivery was not significantly increased.

Table 4 compares the rates and ORs for modes of delivery and outcome parameters in OP deliveries of infants with an HC ≥90th centile versus those with an HC <90th centile in primiparae and multiparae. Though numbers are very small in some categories, it is of note that 60.5% of primiparae with a fetus in persistent OP position and an HC ≥90th centile delivered via UCD versus 24.3% of primiparae with a fetus in persistent OP position and an HC <90th centile (OR 9.81, 95%CI 3.29–29.26). The OR in multiparae was 3.73 (95% CI 1.9–7.29). Odds of vacuum extraction were significantly increased among multiparae (OR 1.88, 95% CI 1.13–3.18) but not primiparae (OR 2.43, 95% CI 0.73–9.29).

We examined the rates and ORs of operative delivery and maternal and neonatal complications in OA versus OP deliveries of infants with BW ≥90th centile, as well as OP deliveries of infants with BW above versus below the 90th centile. High-BW babies in OP position were significantly less often born to primiparae (16.9 vs. 28%, OR 0.52, 95% CI 0.35–0.78; $p < 0.001$) and significantly less often delivered by vacuum extraction (11.5 vs. 18.5%, OR 0.57, 95% CI 0.35–0.92; $p < 0.02$) than cases with a BW <90th centile. They had a significantly higher rate of prolonged second stage of labor (21.6 vs. 14.1%, OR 1.68, 95% CI 1.14–2.5; $p = 0.01$) and maternal hemorrhage (15.3 vs. 8.4%, OR 2.48, 95% CI 1.58–3.91; $p < 0.001$). Rates of UCD and epidural anesthesia administration were not significantly increased.

Multinomial Regression Modeling

Observations of associations, described above, revealed differential patterns of prevalence and clinical impact of persistent OP position with or without large HC. Multinomial regression modeling was applied to assess the different associations of parity and anthropometry

Table 3. Rates and ORs for outcome measures in cases of HC ≥90th centile (≥36 cm) in OA versus OP position (column A vs. column B) and OP position with large HC versus OP with HC <90th centile (column B vs. column C)

	A: OA HC ≥90th centile (*n* = 4,005)	B: OP HC ≥90th centile (*n* = 154)	OR (95% CI)	*p* value	C: OP HC <90th centile (*n* = 1,408)	OR (95% CI)	*p* value
Primipara status	1,061 (26.5)	38 (24.7)	0.9 (0.63–1.32)	0.71	378 (26.8)	0.89 (0.58–1.22)	0.631
Epidural anesthesia	2,505 (62.5)	104 (67.5)	1.25 (0.88–1.76)	0.24	795 (56.5)	1.60 (1.13–2.28)	0.010
Prolonged second stage of labor	399 (11.2)	35 (25.7)	2.74 (1.84–4.07)	<0.001	174 (13.5)	2.22 (1.47–3.37)	<0.001
Mode of delivery							
SVD	2,996 (74.8)	87 (56.5)	1		1,037 (73.7)	1	
Vacuum delivery	510 (12.7)	31 (20.1)	2.09 (1.38–3.19)	0.001	242 (17.2)	1.53 (0.99–2.36)	0.068
Unplanned cesarean delivery	499 (12.5)	36 (23.4)	2.48 (1.66–3.7)	<0.001	129 (9.2)	3.33 (2.17–5.11)	<0.001
Maternal and neonatal complications							
Maternal hemorrhage[a]	417 (12.4)	15 (13.4)	1.09 (0.63–1.89)	0.77	109 (9)	1.57 (0.88–2.8)	0.127
Apgar ≤7 at 5 min	24 (0.6)	2 (1.3)	2.18 (0.51–9.31)	0.25	8 (0.6)	2.30 (0.49–10.94)	0.258
Umbilical arterial pH ≤7.1 (*n* = 2,938)	34 (1.2)	5 (4.5)	3.84 (1.47–10.01)	0.02	26 (2.6)	1.776 (0.67–4.72)	0.225
NICU admission	20 (0.5)	2 (1.3)	2.62 (0.6–11.32)	0.19	1 (0.1)	18.51 (1.67–205.36)	0.027

Values are *n* (%). OR, odds ratio; HC, head circumference; OA, occiput anterior; OP, occiput posterior; CI, confidence interval; SVD, spontaneous vaginal delivery (reference category for delivery mode); NICU, neonatal intensive care unit. [a] Hemorrhage was differentially defined as >500 mL in vaginal deliveries and >1,000 mL in cesarean deliveries.

Table 4. Rates and ORs of modes of delivery and maternal and neonatal complications in primiparae and multiparae, with the fetus in occiput posterior position and a HC ≥90th centile versus <90th centile (*n* = 1,562)

	Primiparae (*n* = 416)				Multiparae (*n* = 1,146)			
	HC <90th centile (*n* = 378)	HC ≥90th centile (*n* = 38)	OR (95% CI)	*p* value	HC <90th centile (*n* = 1,030)	HC ≥90th centile (*n* = 116)	OR (95% CI)	*p* value
Length of second stage of labor, min[a]	125±66	159±69	–	0.01	35±37	53±50	–	<0.001
Prolonged second stage of labor	101 (26.7)	14 (37)	2.22 (1.02–4.82)	0.06	73 (7.6)	21 (18.1)	2.94 (1.73–5.03)	<0.001
Mode of delivery								
SVD (reference category)	157 (41.5)	5 (13.1)	1	1	880 (85.4)	83 (71.6)	1	1
Vacuum delivery	129 (34.1)	10 (26.4)	2.43 (0.73–9.29)	0.12	113 (11)	20 (17.2)	1.88 (1.1–3.18)	0.03
Unplanned cesarean delivery	92 (24.3)	23 (60.5)	9.81 (3.29–29.26)	<0.001	37 (3.6)	13 (11.2)	3.73 (1.9–7.29)	<0.001
Maternal and neonatal complications								
Maternal hemorrhage[b]	37 (13.8)	4 (10.5)	2.09 (0.64–6.83)	0.26	72 (7.6)	11 (9.5)	1.57 (0.8–3.08)	0.23
Apgar ≤7 at 5 min	6 (1.6)	1 (2.6)	1.68 (0.2–14.3)	0.49	2 (0.2)	1 (0.9)	4.47 (0.4–49.67)	0.27
Umbilical arterial pH ≤7.1 (*n* = 1,126)	14 (4.5)	2 (6.1)	1.36 (0.29–6.26)	0.66	12 (1.7)	3 (3.8)	2.28 (0.63–8.26)	0.19
NICU admission	0	1 (2.6)	–	–	1 (0.1)	1 (0.9)	8.95 (0.56-144)	0.19

Values are means ± standard deviations or *n* (%). OR, odds ratio; HC, head circumference; CI, confidence interval; SVD, spontaneous vaginal delivery; NICU, neonatal intensive care unit. [a] Analyzed with ANOVA. [b] Maternal hemorrhage was differentially defined as >500 mL in vaginal deliveries and >1,000 mL in cesarean deliveries.

Table 5. Multinomial multivariable regression modeling shows aORs of interventional delivery modes when the fetus is in occiput posterior position in primiparae (n = 9,085) and multiparae (n = 25,654)

	aOR vacuum delivery (95% CI)	p value	aOR unplanned cesarean delivery (95% CI)	p value
Primiparae				
Occiput posterior	3.01 (2.38–3.81)	<0.001	3.15 (2.46–4.04)	<0.001
HC ≥90th centile	2.45 (2.08–2.88)	<0.001	2.15 (1.80–2.56)	<0.001
BW ≥90th centile	0.49 (0.39–0.63)	<0.001	1.34 (1.09–1.64)	0.006
Multiparae				
Occiput posterior	3.50 (2.88–4.26)	<0.001	0.9 (0.67–1.20)	0.47
HC ≥90th centile	3.13 (2.65–3.71)	<0.001	2.01 (1.71–2.35)	<0.001
BW ≥90th centile	0.35 (0.27–0.45)	<0.001	0.94 (0.8–1.11)	0.48

Normal vaginal delivery is the reference category. Controlling for epidural anesthesia. aOR, adjusted odds ratio; HC, head circumference; BW, birth weight.

parameters with delivery mode of fetuses in OP position. aORs were obtained for vacuum extraction or UCD (with spontaneous vaginal delivery as reference category) (Table 5).

Multinomial regression modeling in primiparae showed that an HC ≥90th centile was associated with UCD (aOR 2.15) and vacuum delivery (aOR 2.45); a BW ≥90th centile was significantly negatively associated with vacuum delivery but positively associated with UCD (aOR 1.34).

Among multiparae, multinomial regression modeling showed that persistent OP position contributed an aOR of 3.5 for vacuum extraction but did not contribute significantly to UCD (aOR 0.9, not significant). An HC ≥90th centile, however, was associated with vacuum delivery (aOR 3.13) and with UCD (aOR 2.01). This was the only parameter studied to remain significantly associated with UCD in this context. A BW ≥90th centile was significantly negatively associated with vacuum delivery (aOR 0.35) in agreement with our earlier study [18].

Discussion

Main Findings

To the best of our knowledge, this is the first study to examine the combination of HC and persistent OP position at delivery and the varying associated rates of operative delivery and maternal and fetal complications. In contrast to the literature [3, 5], in our large cohort we did not find an increased prevalence of persistent OP position in "big babies," i.e., those with a BW ≥90th or 95th centile, or among primiparae [3–5, 13], nor was the rate of OP position increased in cases of labor induction [3, 13] or maternal diabetes; the observed difference in gestational age at delivery was not clinically significant. However, we did find that persistent OP position was more prevalent among infants with an HC ≤10th centile than in the cohort as a whole, but not more prevalent among babies with an HC ≥90th centile or a BW ≤10th centile.

We compared delivery modes and maternal and neonatal outcomes between those delivered in OA versus OP position, with HC above or below the 90th centile. OP position was consistently associated with 3-fold rates of prolonged second stage of labor and vacuum extraction and increased rates of UCD. Umbilical artery pH ≤7.1 was likewise increased in all subgroups.

In order to isolate the association of persistent OP position combined with a large HC we analyzed outcomes of infants delivered in OP position separately, comparing those with HC ≥90th centile to those with HC <90th centile: rates of prolonged second stage of labor, UCD, and admission to the NICU were increased in large-HC deliveries in OP position. When an HC ≥90th centile was combined with OP position, spontaneous vaginal delivery was achieved by only 56.5% of women, and among primiparae by only 13.1%.

Multivariable multinomial regression modeling showed that, similar to our earlier findings [18], a large HC increased the probability of vacuum delivery and UCD 2- to 3-fold, while a high BW reduced the odds of vacuum delivery significantly among both primiparae and multiparae and increased UCD in primiparae. These rates may partly be explained by physician reluctance to attempt vacuum

extraction in suspected "big babies." Persistent OP position contributed an aOR >3 for vacuum delivery in all women but increased the odds of UCD only in primiparae.

Strengths and Limitations

The present study has several strengths and limitations. It is a very large cohort based on closely monitored EMRs. This system allowed us to capture all deliveries in our center. To the best of our knowledge, this is the largest series of persistent OP position at delivery published to date. Approximately 10% of neonates lacked HC measurement; however, these neonates and their mothers did not differ from the rest of the study cohort in any of the other studied parameters. The study is retrospective in nature with its inherent biases; however, the prospective nature of data collection into the EMR, the size of the cohort, and the separation between caregivers entering data at point of care and those extracting and analyzing data should attenuate their effect.

Interpretation

The present study highlights the effects of HC on delivery mode and maternal and neonatal complications in fetuses delivered in persistent OP position. When persistent OP position is combined with a large HC, the rates of operative delivery are very high, particularly among primiparae.

One of the aims of obstetric research is to determine which parameters are most strongly associated with complicated outcomes in order to allow a more specific evaluation of risks in these situations. Persistent OP position is one such situation. As is well known and our results concur, persistent OP position poses increased risks of obstetric complications as compared to OA delivery. We demonstrate here that fetuses in persistent OP position fall into 2 groups according to their head dimensions, depending on whether HC is above or below the 90th centile. Our results show that a large HC combined with persistent OP position further increases the likelihood of operative delivery and maternal and neonatal complications.

We found that prenatal ultrasound and postnatal measurements of HC correlated strongly [18] and are associated with labor and delivery outcomes. These results concur with other work that examined fetal head dimensions and labor outcomes [22, 23]. Fetal HC is an accessible measurement that can be obtained reliably before delivery and might add an additional layer to prelabor and intrapartum assessment.

Conclusions

The present study shows the association of fetal head dimensions and delivery outcomes in cases of persistent OP position at delivery. Women with a large-HC baby in persistent OP position achieve spontaneous vaginal delivery in only about half of the cases, and these mothers have twice the rate of a prolonged second stage of labor. Fetal HC is an accessible measure and might be included with other parameters in labor assessment and management as it impacts the overall effect of persistent OP position on obstetric and neonatal outcomes, more than BW. Prospective studies, based on prenatal measurement of HC obtained in the labor ward or close to delivery, are needed to evaluate its usefulness in delivery management.

Disclosure Statement

All authors declare that they are not the beneficiaries of any sponsorship or funding arrangements relating to this research; all authors declare that they have no possible conflicts of interest.

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