OBSTETRICS

Is maternal posturing during labor efficient in preventing persistent occiput posterior position? A randomized controlled trial

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OBJECTIVE: We sought to evaluate the efficacy of maternal posturing during labor on the prevention of persistent occiput posterior (OP) position.

STUDY DESIGN: We conducted a randomized trial including 220 patients in labor with a single fetus in documented OP position. Main outcome was the proportion of anterior rotation from OP position.

RESULTS: The rates of anterior rotation were, respectively, 78.2% and 76.4% in the intervention group and the control group without significant difference ($P = .748$). Rates of instrumental and cesarean section deliveries were not significantly different between intervention and control groups (18.2% vs 19.1%, $P = .89$, and 19.1% vs 17.3%, $P = .73$, respectively). In intervention and control groups, persistent OP position rates were significantly higher among women who had cesarean section (71.4% and 89.5%, respectively) and an instrumental delivery (25% and 33.3%, respectively) than among women who achieved spontaneous vaginal birth (5.8% and 2.8%, respectively). In multivariable analysis, body mass index and parity were found to have significant and independent impact on the probability of fetal head rotation.

CONCLUSION: Our study failed to demonstrate any maternal or neonatal benefit to a policy of maternal posturing for the management of OP position during labor.

Key words: fetal malposition, persistent occiput posterior position, posture

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With an estimated prevalence ranging from 2-13% at delivery, persistent occiput posterior (OP) position is the most common malposition in labor[1-7] and is associated with maternal and neonatal morbidities. Thus it exposes not only to prolonged first and second stages of labor, use of epidural analgesia, postpartum hemorrhage, cesarean and operative vaginal delivery, third- and fourth-degree perineal lacerations, and chorioamnionitis[1,4-7] but also to low Apgar score, neonatal trauma, acidemic cord blood gas concentrations, admission to neonatal intensive care unit, and newborn encephalopathy.[5-9] Several studies based on ultrasound examination during labor have demonstrated that the vast majority of OP deliveries results from the failure of rotation from this position.[10-13] Thus, the rate of OP position has been estimated to be 30-40% at the early stage of active labor, 20-30% at 10-cm dilatation, and 5-10% at delivery.[10-13] Various methods have been considered to rotate an OP fetus: use of oxytocin, operative delivery, manual rotation, and maternal posturing before or during labor. But none of them had any proven efficacy in reducing persistent OP position. Maternal posturing is somewhat attractive because it is noninvasive and theoretically harmless for the fetus. In a recent Cochrane review,[14] only a single study about the efficacy of maternal posturing during labor was of sufficient quality to be included. This trial, using a single posture during labor (hands-and-knees), failed to demonstrate either any reduction of persistent OP at birth or improvement of maternal or neonatal outcomes.[15] Two Chinese trials (published in Chinese) have found an increased rate of anterior rotation of OP fetuses using lateral recumbent position during labor.[16,17] These last 2 studies were excluded from the Cochrane review[14]; no explanation was given about the reason for such exclusion. However, with only these 3 trials, the presumed benefit of maternal posturing during labor remains understudied and therefore widely debated. Nevertheless, there is in

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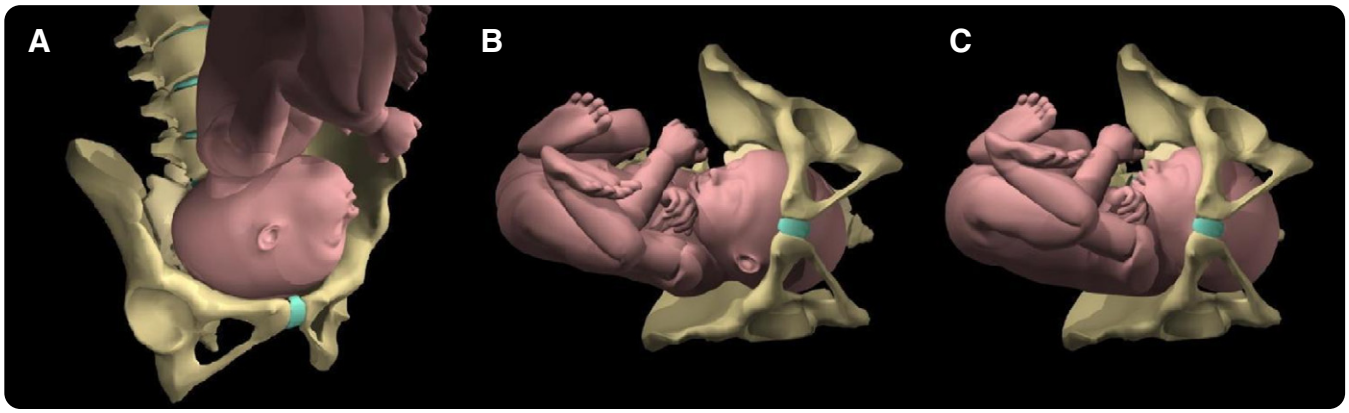
FIGURE 1
Three-dimensional computer simulation to analyze theoretical rotation mechanism of fetal head



Confrontation of fetal head with maternal pelvis and spine at different levels of fetal head station; **A,** between -5 and -3; **B,** between -2 and 0; **C,** >0.
Desbriere. Is maternal posturing during labor efficient in preventing persistent occiput posterior position? Am J Obstet Gynecol 2013.

France a growing interest in and use for maternal positioning during labor that is supported more on empirical knowledge than on evidence-based medicine. The aim of this study was to test the efficacy of maternal posture options during labor on prevention of persistent OP position in order to reduce their maternal and neonatal morbidities.

Materials and Methods

This randomized controlled trial took place in a tertiary care center maternity unit (Hôpital Nord, Marseille, France) from Jan. 5, 2009, through Jan. 25, 2011. Ethical approval was obtained from the Committee for the Protection of Persons "Sud Méditérranée I." Written informed consent was obtained from each participant before randomization. Eligible patients were adult pregnant women (age ≥18 years) in labor at ≥36 weeks of gestation, with cervical dilatation of ≥3 cm and ruptured membranes, and with a single fetus in cephalic OP position confirmed by ultrasound examination. Gestational age calculation was based on the participant's reported last menstrual period and fetal biometry at first-trimester systematic ultrasound scan. After inclusion, participants were randomly assigned to the intervention or the control group. The randomization was made in permutated blocks of 4.

Intervention

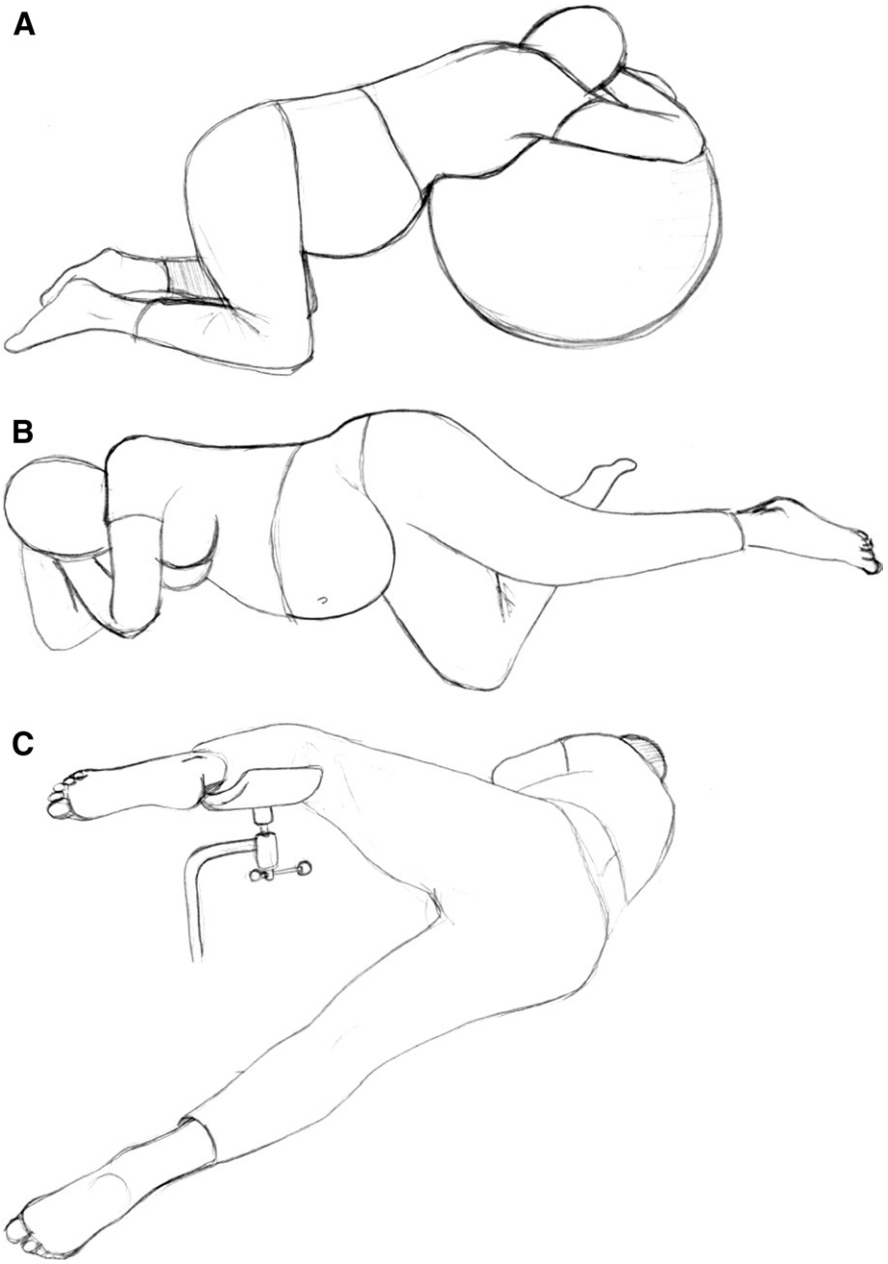
While randomized patients in the control group adopted dorsal recumbent position during labor, those in the intervention group had to adopt postures depending on the station of the fetal head. In both groups, if medically indicated (severe fetal heart rate abnormalities or maternal hypotension), patients were transiently placed in lateral recumbent position for a short delay (<10 minutes) and immediately returned to their designated posture. Because pressures applied to the fetal head change as it progresses into the pelvis, we postulated that maternal position should be adjusted to the different stages of labor. Three different maternal postures were chosen after 3-dimensional computer simulation and analysis of theoretical rotation mechanism by one of the authors (J.-P.R.) using 3-dimensional simulation software (Carrara 7 Pro; DAZ 3D Editor, Inc. Draper, Lake City, UT) (Figure 1). Posture 1 was used in patients with fetal head station between -5 and -3 (Figure 2, A) and corresponded to hands-and-knees posture with possible support on a balloon at shoulder level. The expected goal of this posture was to move the fetus away from the maternal spine to facilitate its global rotation, assuming that the physical confrontation of fetal spine with maternal spine convexity and psoas muscle in maternal recumbent position restricts its flexion (Figure 1, A). Patients with fetal head station between -2 and 0 were positioned in posture 2 (Figure 2, B). Thus, patients were positioned in strict lateral recumbent position on the same side of the fetal spine (eg, left maternal lateral position for left fetal spine) with folded inferior leg and upper leg positioned in the axis of the body. In this position, the maternal pelvic inlet was oblique with the highest iliac crest located on the lower side (ie, the side of the patient that is lying on the bed). The aim of this posture was to induce the flexion of the fetal head by confronting the fetal occiput to the maternal sacro-iliac joint and delay contact of the forehead with the contralateral pubis allowing for complete flexion and thus provoke anterior rotation (Figure 1, B). Finally, posture 3 was used in patients with fetal head station >0 (Figure 2, C). It consisted of a lateral recumbent position on the same side of the fetal spine, with the inferior leg lying in the axis of the body and the other leg folded at an approximately 90-degree angle with the use of a leg support. In this position, the maternal pelvic inlet was orientated in the exact opposite direction than in posture 2. The aim was to confront the fetal forehead with the levator ani and to therefore induce the flexion of the fetal head, supposing that the rotation of the fetal head would lead to the anterior rotation of fetal shoulders and trunk (Figure 1, C).

A simplified and illustrated protocol with a flow chart and detailed descriptions was available in the labor ward to help caregivers. Regardless of the timing of inclusion, the posture was maintained as long as the fetal occiput remained posterior and the patient tolerated it. The maternal posture was subsequently adapted to the evolution of the fetal head station. Because ultrasonography has been demonstrated to be the gold standard for the diagnosis of fetal presentation,[10-12,18,19] an ultrasonographic control of the fetal presentation was performed every hour throughout the labor until anterior rotation of the fetal occiput was achieved. Patients who had achieved anterior rotation were then asked to adopt dorsal recumbent position.

Outcome measures

We considered that the primary outcomes had to be: (1) fetal head position at delivery for spontaneous deliveries; and (2) fetal head position immediately before instrumental delivery or cesarean section for operative deliveries. For all patients who achieved vaginal spontaneous delivery, the midwife or the obstetrician in charge of the delivery systematically recorded the exact type of fetal head presentation observed at the time of vaginal delivery. In cases of operative delivery, the fetal head position was recorded by means of ultrasonography immediately before the instruments (either spatulas or vacuum) were applied. If a cesarean delivery was performed, the fetal head presentation was confirmed by ultrasonography immediately before cesarean section. As secondary outcomes, length of labor, length of pushing, operative deliveries, cesarean sections, perineal lacerations (Anglo-Saxon classification), and neonatal morbidity (5- and 10-minute Apgar scores, umbilical arterial pH) were systematically recorded. Maternal characteristics were collected to verify the comparability of the 2 groups: age, parity, gestational age, height, and initial and final weight. Finally, factors that could have had an impact on head presentation were also recorded for analysis: analgesia, position of placenta, spontaneous or induced labor, and oxytocin use.

FIGURE 2
Postures used during the trial



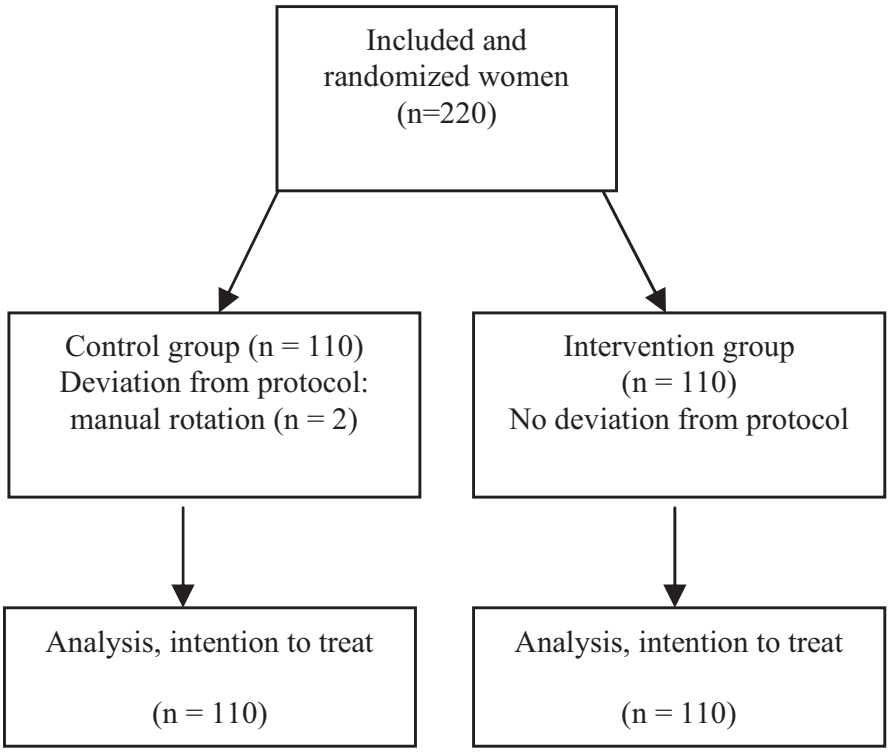
A, Postures used in patients with fetal head station; **A,** between -5 and -3; **B,** between -2 and 0; **C,** >0.

Desbriere. Is maternal posturing during labor efficient in preventing persistent occiput posterior position? Am J Obstet Gynecol 2013.

Sample size

The sample size calculation was based on a previous nonrandomized pilot study performed in our maternity ward (data not published) and relied on the assumption that 60% of the control group would rotate from OP to occiput anterior[13] vs 85% in the intervention group. To achieve a 90% powered study with set at 0.001, we calculated that 202 patients were required to be included and randomized. To compensate for any secondary exclusion, we arbitrarily increased this number by 10%; inclusion

FIGURE 3
Flow of participants through various stages of trial



Desbriere. Is maternal posturing during labor efficient in preventing persistent occiput posterior position? Am J Obstet Gynecol 2013.

and randomization of 220 patients was therefore required.

Statistical analysis

Statistical analysis was performed using software (PASW Statistics, version 17.0.2; IBM Corp, Armonk, NY). Data are expressed as mean ± SEM or median with interquartile interval. Groups were compared using the χ^2 or Fisher exact test for categorical characteristics, and using the Student *t* test or Mann-Whitney *U* test for continuous ones, as appropriate. A multivariate analysis was performed using a logistic regression model to estimate risk factors for persistent OP position. Variables that were found to be significantly associated with outcome or to be marginally significant ($P < .10$) in univariate analysis, or that had clinical relevance, were included in the logistic regression model. Calibration was assessed using the Hosmer-Lemeshow goodness-of–fit test to evaluate the discrepancy between observed and expected values. A 2-sided *P* value $< .05$ was considered statistically significant. Main outcome measure was analyzed according to the intention-to-treat principle.

RESULTS

Patients

Over 2 years, 220 women were prospectively included and randomized, of whom 110 were assigned to the intervention group and 110 to the control group. Figure 3 shows the flow of participants throughout the trial. No patient was secondarily excluded from the study. Two patients in the control group underwent successful manual rotation immediately before instrumental delivery and–therefore considered as having persistent OP position–they were not excluded from the study because we chose an intention-to-treat protocol. No deviation of protocol occurred in the intervention group. Table 1 summarizes the baseline characteristics of the 2 groups. Except for cervical dilatation at the time of inclusion, the groups were comparable for gestational age, initial and final body mass index (BMI), parity, placental insertion, use of induction of labor and of epidural analgesia, and neonatal weight. In the intervention group, the majority of patients (86/110; 78.2%) were included when the fetal head station was between -2 and 0 cm, and then were recommended to adopt posture 2. Postures 1 and 3 were used in 13.6% (15/110) and 8.2% (9/110), respectively. No patient had to adopt all 3 positions, as all women who adopted posture 1 had their fetuses rotate from OP to occipitoanterior before they had to adopt posture 3. No statistically significant differences were observed between the intervention and control groups regarding the mode of delivery (Table 2). Operative delivery was performed in 41 cases: 26 spatulas[20] and 15 vacuums. Indications for operative delivery were inadequate expulsive efforts in 22 cases, nonreassuring fetal heart tracing in 18 cases, and maternal contraindications to expulsive efforts in 1 case. Forty patients underwent a cesarean section. Indications for cesarean section were: failure to progress before complete dilatation in 24 cases (21 associated with persistent OP), failure to progress at full dilatation in 9 cases (6 associated with persistent OP), nonreassuring fetal heart tracing in 6 cases, and brow presentation in 1 case. Indications for operative delivery or cesarean section were not statistically different between the 2 groups.

Main outcome

In the intervention group, 24 (21.8%) patients were diagnosed with persistent OP position compared to 26 (23.6%) in the control group ($P = .75$) (Table 3). When considering each mode of delivery, no statistical difference between the 2 groups regarding fetal head position at birth or immediately before operative delivery or cesarean section was observed (Table 2). In the control group, compared to spontaneous deliveries, persistent OP position was significantly more often observed immediately before operative delivery: 2 (2.8%) vs 7 (33.3%), respectively ($P < .001$), and was also more often observed immediately before cesarean section than immediately before operative delivery: 17

TABLE 1
Patient characteristics

Characteristic	Intervention group (n = 110)	Control group (n = 110)	*P* value
Maternal age, y	27.8 ± 0.64	28.9 ± 0.51	.180
BMI			
Initial	23.7 ± 0.47	24.1 ± 0.49	.482
At time of delivery	28.6 ± 0.57	28.2 ± 0.75	.680
Parity			
Nullipara	69 (62.7)	62 (56.4)	.579
1	23 (20.9)	29 (26.4)	
≥2	18 (16.4)	19 (17.3)	
Gestational age, wk	39.4 ± 0.10	39.4 ± 0.10	.950
Placental insertion			
Anterior	49 (44.5)	61 (55.4)	.367
Posterior	47 (42.8)	39 (35.5)	
Others	14 (12.7)	10 (9.1)	
Labor			
Spontaneous	82 (74.5)	81 (73.6)	.878
Induced	28 (25.5)	29 (26.4)	
Median cervical dilatation at time of inclusion, cm	6.26	5.68	.046
Epidural analgesia	103 (93.6)	105 (95.5)	.553
Birthweight, g	3466.2 ± 41.29	3403.13 ± 44.56	.300

Data are expressed as mean ± SEM or n (%).
BMI, body mass index.

Desbriere. Is maternal posturing during labor efficient in preventing persistent occiput posterior position? Am J Obstet Gynecol 2013.

(89.5%) vs 7 (33.3%), respectively (P = .003). The same differences were observed in the intervention group: 4 (5.8%) vs 5 (25%), respectively (P = .004), and 15 (71.4%) vs 5 (25%), respectively (P < .03).

Factors identified with significant and independent impact on the anterior rotation of the fetal head

In multivariable analysis, maternal BMI and parity were found to be independent factors significantly associated with anterior rotation of the fetal head during labor. For BMI, the adjusted odds ratio (AOR) was 0.94; 95% confidence interval (CI), 0.88–0.998; P = .045 (Table 4). Our results showed that a 1-U increase in BMI was associated with a 6% decrease of the probability of an anterior rotation of fetal head. For women with parity ≥2, the AOR was 11.73; 95% CI, 1.48–92.81; P = .02, when compared to nulliparas (Table 4).

Obstetrical and neonatal outcomes

Both groups were comparable in terms of duration of first and second stage of labor, oxytocin use, cervical dilatation or station of fetal head at epidural placement, duration of maternal pushing, rates of episiotomy or perineal tears, and neonatal morbidity (Table 5). Only 1 neonatal trauma (a scalp injury after vacuum-assisted delivery) was reported in the control group.

COMMENT

In France, interest for maternal positioning during labor has been growing over the last decade. However, because of the lack of genuine evidence, such management only relies on personal beliefs and empirical practice. In a recent Cochrane review, authors estimated that only 1 study evaluating this intervention during labor was of sufficient methodological quality to be included.[14] This study, using a single type of posture during labor (hands-and-knees), failed to demonstrate any benefit in the reduction of persistent OP at birth or any improvement of maternal or neonatal outcomes.[15] Accordingly, the Cochrane review concluded that further randomized trials were required to determine whether encouraging postures during labor had any effect on the progress and/or outcome of labor. The authors added that outcomes to be evaluated should be the measure of pain experienced during labor, duration of labor, method of delivery, baby's condition, and maternal satisfaction, and that the assessment of fetal position by ultrasound would enhance the reliability of these results.[14] Our randomized controlled trial provides an answer to the Cochrane concerns regarding clinical research on that specific topic.

Results from this prospective randomized trial showed that a policy of maternal posturing for fetal OP position during labor had no significant effect on the fetal head rotation to the anterior position (P = .75) and whatsoever the mode of delivery (Table 2). Such finding is of major clinical interest, as identification of interventions currently used in practice that do not have a beneficial effect on outcome is important. Thus, for spontaneous delivery the rate of persistent OP was 5.8% in the intervention group vs 2.8% in the control group (P = .44). For assisted delivery the rate of persistent OP was 10% in the intervention group vs 14.3% in the control group (P = 1). Moreover, no significant difference was observed between the intervention and control groups regarding the mode of delivery, duration of labor, use of oxytocin, induction of labor, use of epidural analgesia, cervical dilatation at epidural placement, duration of pushing, episiotomy, perineal tear, Apgar score, neonatal acidemic cord blood gas concentrations, or admission to neonatal intensive care unit (Table 5). One could consider that

TABLE 2
Mode of delivery and fetal head position, according to study group

Variable	Intervention group (n = 110)	Control group (n = 110)	*P* value
Spontaneous deliveries	69 (62.7)	70 (63.6)	.889
OA	65 (94.2)	68 (97.1)	.441
OP	4 (5.8)	2 (2.8)	
Operative vaginal deliveries	20 (18.2)	21 (19.1)	.965
Fetal head position before operative delivery			
OA	15 (75)	14 (66.7)	.558
OP	5 (25)	7 (33.3)	
Fetal head position at birth			
OA	18 (90)	18 (85.7)	1
OP	2 (10)	3 (14.3)	
CS deliveries	21 (19.1)	19 (17.3)	.727
Fetal head position before CS			
OA	6 (28.6)	2 (10.5)	.241
OP	15 (71.4)	17 (89.5)	

Data are expressed as n (%).
CS, cesarean section; *OA*, occipito anterior; *OP*, occipito posterior.

Desbriere. Is maternal posturing during labor efficient in preventing persistent occiput posterior position? Am J Obstet Gynecol 2013.

the difference reported in the mean value of the cervical dilatation observed between the 2 groups at the time of patients' inclusion could have potentially biased our results (Table 1). However, we believe such statistical difference is not clinically relevant and results only from the subjectivity and variability of clinical evaluation of cervical dilatation. Finally, our results are consistent with the only other randomized controlled trial that has been published to date. Using a single hands-and-knees position during labor, this previous trial failed to demonstrate any significant difference on maternal and neonatal outcomes between the intervention and control groups.[15]

In our study, the rate of epidural analgesia was not significantly different between the intervention and control groups (93.6% vs 95.5%, $P = .55$), but these rates were higher than the one observed among all patients managed in our maternity during the same period (72%). The finding of a higher rate of epidural use in women with the fetal OP position has been documented in other studies.[4,5] Currently, data are not sufficient to definitely conclude whether epidural analgesia may contribute to persistent OP position, or whether women with OP position experience more pain during labor and therefore request the use of epidural analgesia more often.[21-23] However, we may wonder about the epidural and persistent OP causality issue. In a prospective cohort study of 1562 nulliparous women in labor, Lieberman et al[22] found that epidural analgesia was associated with a 4-fold increase in the risk of OP at delivery (AOR, 4.0; 95% CI, 1.4–11.1) by means of a logistic regression analysis. The same authors also found that women with an OP fetus at delivery did not report more painful labors at enrollment (mean pain score 4.9 [±2.8] for OP at delivery vs 5.2 [±2.6] for not OP at delivery, $P = .2$).[22] In our study, we were not able to test if epidural analgesia was specifically associated with an increase in fetal OP position at delivery since only 12 patients of 220 did not receive epidural analgesia for pain relief during labor. Nevertheless, our results showed that cervical dilatation at epidural placement was not associated with anterior rotation of the fetal head during labor (AOR, 1.14; 95% CI, 0.89–1.47; $P = .295$) (Table 4). This finding is somewhat consistent with the fact that, for women in labor, early epidural analgesia is not accompanied by an increased rate of cesarean or instrumental vaginal deliveries.[24] Interestingly, when comparing to patients who had delivered spontaneously, we observed a progressive and significant increase of persistent OP position among patients who underwent operative deliveries and particularly among those who had a cesarean section (Table 2). These findings strengthen the theory that malrotation of fetal head is associated with increased maternal morbidity.[4-6,8]

In multivariable analysis, only maternal BMI and parity were found to be independent factors associated with anterior rotation of the fetal head during labor. A similar finding has been previously reported by Ponkey et al.[5] In their cohort study, the proportion of women with persistent OP position at delivery was nearly 2 times higher among nulliparas (7.2%) than among multiparas (4%) ($P < .001$).[5] To our knowledge, we are the first to show an effect of BMI on the rotation of fetal head during labor.

TABLE 3
Primary outcome according to study group

Variable	Intervention group (n = 110)	Control group (n = 110)	*P* value
Anterior rotation	86 (78.2)	84 (76.4)	.748
Persistent posterior position	24 (21.8)	26 (23.6)	

Data are expressed as n (%).

Desbriere. Is maternal posturing during labor efficient in preventing persistent occiput posterior position? Am J Obstet Gynecol 2013.

TABLE 4
Multivariable analysis: factors associated with anterior rotation of fetal head

Variable	AOR	95% CI	*P* value
Age	1.046	0.979–1.117	.187
BMI	0.936	0.877–0.998	.045
Labor (spontaneous vs induced)	0.501	0.240–1.045	.065
Cervical dilatation at epidural placement	1.144	0.889–1.470	.295
Parity = 0	1	—	—
Parity = 1	0.979	0.445–2.154	.957
Parity ≥2	11.726	1.481–92.806	.020

AOR, adjusted odds ratio; *BMI*, body mass index; *CI*, confidence interval.

Desbriere. Is maternal posturing during labor efficient in preventing persistent occiput posterior position? Am J Obstet Gynecol 2013.

TABLE 5
Obstetric and neonatal outcomes according to study group

Variable	Intervention group (n = 110)	Control group (n = 110)	*P* value
Duration of labor, h			
First stage	3.0 (1.425-4.70)	3.0 (1.5-4.0)	.435
Second stage	1.0 (0.17-2.0)	0.8 (0.32-2.30)	.666
Oxytocin use	96 (87.3)	103 (93.6)	.108
Mean maximal dosage, mL/h	67.84	73.95	.267
Epidural analgesia			
Cervical dilatation at placement	3.82 ± 0.13	3.64 ± 0.12	.317
Length of pushing, min	16.35 ± 1.29	15.98 ± 1.17	.830
Perineal tears			
No tears	18 (20.2)	21 (23.1)	.757
Episiotomy	27 (30.3)	28 (30.7)	
Lacerations	44 (49.5)	42 (46.2)	
First degree	32	30	.532
Second degree	12	10	
Third degree	0	1	
Fourth degree	0	1	
Apgar score			
5 min	9.69 ± 0.78	9.84 ± 0.65	.121
10 min	9.90 ± 0.37	9.95 ± 0.28	.309
Umbilical arterial pH	7.278 ± 0.075	7.279 ± 0.067	.886
Hospitalization in NICU	6 (5.4)	3 (2.7)	.498

Data are expressed as mean ± SEM except for duration of labor expressed as median with interquartile range or n (%).
NICU, neonatal intensive care unit.

Desbriere. Is maternal posturing during labor efficient in preventing persistent occiput posterior position? Am J Obstet Gynecol 2013.

According to our findings, a 1-U increase in BMI is associated with a 6% decrease of the probability of an anterior rotation of fetal head. This finding is not consistent with any other retrospective or cohort studies on this subject, and must be confirmed by other studies.

In conclusion, our study failed to demonstrate any maternal or neonatal benefit to a policy of maternal posturing during labor for OP position. We believe that such posture should not be imposed on women having an OP position during labor and that epidural analgesia should not be delayed in nulliparous patients in labor as its placement timing has no effect on fetal head rotation or maternal and neonatal morbidities. As highlighted by Kariminia et al,[25] identification of interventions currently used in practice that do not have a beneficial effect on outcome is important. Women who are advised to adopt postures during labor may feel a sense of failure or shame if they do not follow that advice and may also find their confidence in their caregiver diminished if fetal head failed to rotate despite properly following recommendations. Identification of a technique that could effectively reduce the rate of operative delivery by correcting the fetal malpresentation and allowing for normal descent and delivery of the fetus remains a challenge because it would have the potential to reduce maternal and neonatal morbidity and mortality. Recently, a protocol from the Cochrane Database[26] was published with the objective of assessing the effect of prophylactic manual rotation for women with malposition in labor on the mode of delivery and maternal and neonatal outcomes. We believe that this procedure is worth considering and evaluating by means of randomized controlled trials.

Clinical implications

This study proposed an evaluation of a posturing method to treat persistent OP position, which is the most common malposition during labor and is associated with maternal and neonatal morbidities. In all, 220 patients were randomized in 2 groups (postured or not) and the primary outcome was fetal

head position at delivery. A policy of maternal posturing for the management of OP position during labor did not lead to maternal or neonatal benefit. We believed that no posture should be imposed on women with OP position during labor. ■

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