Pre-Clinical Research Report

Journal of INTERNATIONAL MEDICAL RESEARCH

Journal of International Medical Research
48(6) 1–9

DOI: 10.1177/0300060520924275
journals.sagepub.com/home/imr
SAGE

Clinical effectiveness of position management and manual rotation of the fetal position with a U-shaped birth stool for vaginal delivery of a fetus in a persistent occiput posterior position

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Abstract

Objective: To examine the effects of position management, manual rotation of the fetal position, and using a U-shaped birth stool in primiparous women with a fetus in a persistent occiput posterior position.

Methods: This was a prospective pilot study of women who delivered at Gansu Provincial Maternity and Child-care Hospital between January and June 2018. The women were divided into the position management ([PM] position management, manual rotation of fetal position, use of a U-shaped birth stool at different stages, and routine nursing) and control groups (position selected by women and routine nursing).

Results: There were 196 women in the PM group and 188 in the control group. There were no significant differences in maternal age, gestational weeks, newborn weight, and the neonatal

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asphyxia rate between the PM and control groups. The duration of labor was shorter in the PM group than in the control group. Pain and blood loss 2 hours after delivery and the episiotomy rate were significantly lower in the PM group than in the control group.
Conclusion: Applying position management, manual rotation of the fetal position, and using a U-shaped birth stool should be considered for women with a fetus in a persistent occiput posterior position.

Keywords
Position management, manual rotation of fetal position, U-shaped birth stool, occiput posterior position, primipara, spontaneous delivery

Date received: 23 September 2019; accepted: 15 April 2020

Introduction

Abnormal fetal position during delivery is a frequent cause of dystocia.[1] The most common fetal malposition is the occiput posterior position, accounting for 33.3% of malpositions occurring in labor, and the rate of dystocia is as high as 93.5%.[2] Entering the pelvis in the occiput anterior position is normal for the fetus. Entering the pelvis in the occiput posterior position should not necessarily be considered as abnormal because most fetuses spontaneously rotate to the occiput anterior position.[3] However, spontaneous rotation cannot occur in some cases, and a persistent occiput posterior position occurs in approximately 5% of births.[4]

Early application of abdominal pressure can lead to cervical edema and fatigue of pregnant women, which in turn results in delayed or arrested labor. This situation increases the risks of caput succedaneum, scalp hematoma, and intrauterine distress of the fetus.[5] The result of increased difficulties with a fetus in the occiput posterior position is increased rates of assisted vaginal delivery and cesarean section. However, this can also lead to physical damage to the pregnant woman and poor neonatal outcomes.[4] Early discovery, diagnosis, and management of this position can reduce the risk of dystocia, decrease the rate of cesarean section, and increase the rate of spontaneous vaginal delivery.[6]

Manual rotation of the fetal position is the most effective method for treating the occiput posterior position.[7] The position of pregnant woman is a critical factor affecting manual rotation of the fetal position. When pregnant women are standing upright, the angle between the plane of the pelvic outlet and the ground is approximately 60°, which favors descent of the fetus into the pelvis. Additionally, a sitting position increases the pelvic space, which helps accelerate descending fetal presentation and rotation of the fetal head in the birth canal.[8] The gravity of the fetus and buoyancy of the amniotic fluid promote the fetus to rotate around its long axis downward.[9]

In our hospital, position management and manual rotation of the fetal position are applied in combination with use of a U-shaped birth stool for primiparous women with a fetus in a persistent occiput posterior position. We hypothesized that these procedures effectively shorten the birth process time, reduce pain, reduce rates of assisted delivery and cesarean

section, and increase the rate of spontaneous delivery. Therefore, we performed a pilot comparison study to examine the effects of position management and manual rotation of the fetal position in the first stage of labor, combined with using a U-shaped birth stool in the second stage of labor, on delivery in primiparous women with a fetus in a persistent occiput posterior position.

Methods

Patients

Primiparous women with an occiput posterior fetal position who were awaiting childbirth in the delivery room of Gansu Provincial Maternity and Child-care Hospital between January 2018 and June 2018 were included in this pilot clinical trial. The inclusion criteria were as follows: 1) aged $\leq$35 years; 2) primiparous; 3) term pregnancy; 4) singleton; 5) persistent occiput posterior position, which was defined as a fetus that did not spontaneously rotate and was delivered in the occiput posterior position or would be delivered in the occiput posterior position when cervical dilatation was $\geq$3 cm;[4,10] and 6) the fetus was in good condition (no fetal malformation and class I traces on fetal heart rate monitoring).[11] The exclusion criteria were as follows: 1) pregnancy complications or obstetric complications; 2) intrauterine fetal distress; 3) uterine hyperkinesia; 4) evident edema or hematoma in the head of the fetus; 5) severe cervical edema; 6) severe perineal edema; and 7) low birth weight or large for gestational age.

This study was approved by the Ethics Committee of Gansu Provincial Maternity and Child-care Hospital. All pregnant women signed informed consent forms.

Strategy for therapy

As per routine practice at our center, the fetal position was tested by a midwife in the delivery room. Patients with the occiput posterior position of the fetus then received a bedside ultrasound scan by qualified obstetricians to eventually diagnose the position. Patients were allocated in a 1:1 ratio into the position management (PM) group and control group (see details below), using blocks of four women. Women in both groups were transferred to the delivery room to wait for delivery when cervical dilatation was 3 cm, with routine nursing and care. Epidural anesthesia was provided for women who volunteered to receive it. The self-made Scale of Assessing Risk Factors of Falling (Appendix 1) was applied to all women. All women were asked to empty their bladder to avoid influencing uterine contractions and descending fetal presentation. The midwife was asked to closely monitor the progression of labor and uterine contractions. Effective uterine contractions (3–5 within 10 minutes) were ensured throughout the labor process, and evaluated using an Avalon Fetal Monitor M2702A (Philips Medizin Systeme Boeblingen GmbH, Boeblingen, Germany). Regular fetal heart rate monitoring was also conducted using an Avalon Fetal Monitor M2702A (Philips Medizin Systeme Boeblingen GmbH). Regular fetal heart rate was defined as class I on fetal heart rate monitoring.[12]

For women in the PM group, position management, manual rotation of the fetal position, and a U-shaped birth stool were used. Position management was applied when cervical dilatation was 4 to 6 cm. When the fetal position was the left occiput posterior position, the woman was asked to lie in a right prone position, with the left leg bent close to the abdomen, the right leg stretched backward, the left shoulder

pressed downward, and the abdomen as close to the bed as possible. When the fetal position was the right occiput posterior position (ROP), the woman was asked to lie in a left prone position, with the right leg bent close to the abdomen, the left leg stretched backward, the right shoulder pressed downward, and the abdomen as close to the bed as possible. The women were asked to lie in such a position for at least 40 minutes.

For women with cervical dilatation of 6 to 8 cm, while the fetal position was still in the occiput posterior position after position management ($s = 0$ or $s = +1$), manual rotation of the fetal position was conducted. The external genital area was routinely disinfected and draped. The direction of the fetal head, size of the fetus, and dilation of the vagina were examined. The midwife placed her forefinger and middle finger into the vagina during intervals of uterine contractions to determine the position of the fetal head and avoid touching the fontanels. For a fetus in the left occiput posterior position, the fetal head was gently rotated in the counterclockwise direction. For a fetus in the right occiput posterior position, the fetal head was gently rotated in the clockwise direction. The angle of rotation was approximately 45° to 90°. After the fetal head was rotated to the occiput anterior position, the fetal position was fixed after two to three uterine contractions. The fetal head was induced to descend. During descent of the fetal head, the midwife ensured that there were no signs of prolapse of the umbilical cord, and her hand was only withdrawn after the conditions were normal. Moreover, the fetal heart rate was monitored closely during these processes, which were stopped immediately if there were any abnormalities. Sesarean section was conducted for cases of umbilical cord prolapse. After rotation of the fetal position succeeded and the fetal heart rate had been monitored for 5 to 10 minutes, the women were allowed to walk with the assistance of a delivery vehicle or to swing gently on a birth ball (monitoring of the women and fetus was conducted by the midwife). If the rotation failed, the women were still allowed to perform the same activities, or further position management was conducted.

For women with a cervix at full dilatation, but the fetus was still in the occiput posterior position, manual rotation of fetal position could still be conducted, as above. When rotation remained impossible, despite all of the above-mentioned measures, a U-shaped birth stool could be used. During uterine contractions, the women were guided to lean forward, with their legs stretched apart and both feet on the ground, and both hands were holding the handles of the birth stool. The women were asked to take a deep inhalation and then push downward, holding their breath for as long as possible. This process was repeated immediately after exhalation until the uterine contraction stopped. The women were asked to rest and relax in the intervals of uterine contractions. When using the U-shaped birth stool, the midwife provided one-to-one guidance and observation. Fetal heart rate, uterine contractions, cervical dilatations, and descent of fetal presentation were closely monitored. When 3 to 4 cm of the fetal head appeared at the vaginal orifice during uterine contractions, women were transferred to the obstetric table. The women were then placed in the supine lithotomy position for delivery. For women with a normal fetal position, the U-shaped birth stool was used directly, as above. For women with more than five contractions in 10 minutes,[13] abnormal signs in fetal heart rate monitoring, or severe perineal edema, the birth stool was not used.

Women in the control group were allowed to select their position in the first stage of labor and were provided with routine nursing. The labor process was monitored. After full cervical dilatation,

the women felt anal expansion and pushed, while spontaneously holding their breath. The women were placed in the supine lithotomy position, with both hands holding both handles of the obstetric table tightly, and both feet against the footstools of the obstetric table. The women were asked to take a deep inhalation, and then hold their breath and push hard, with both hands pulling upward, and both feet stepping downward. The women were asked to rest and relax during intervals of uterine contractions. Food and water were provided for women to maintain their physical strength.

Clinical data collection

The delivery mode (spontaneous delivery, vacuum extraction, forceps delivery, and cesarean section), duration of the first and second stages of labor, pain score, volume of blood loss at 2 hours after delivery, perineal outcome, and the neonatal asphyxia rate in both groups were recorded. Neonatal asphyxia was defined as a 1-minute Apgar score $\leq$7 or 5-minute Apgar score $\leq$7, with an umbilical artery pH at birth of $\leq$7.20. Severe asphyxia was defined as a 1-minute Apgar score $\leq$3 or 5-minute Apgar score $\leq$5, with an umbilical artery pH at birth of $\leq$7.0.[14]

The visual analog scale method was used for assessing pain. The stage of perineal laceration was assessed according to the Royal College of Obstetricians and Gynaecologists (RCOG) criteria.[6] The volume of blood loss at 2 hours after delivery was measured by the volumetric method and gravimetric method.

Statistical analysis

SPSS 13.0 software (SPSS, Inc., Chicago, IL, USA) was used for statistical analysis. Continuous variables with a normal distribution are shown using mean and standard deviation, and were compared by the independent t-test. Non-normally distributed continuous variables are shown as median (range) and were compared using the Kruskal–Wallis test. Categorical variables are shown as percentages and were compared by the chi-square test or Fisher's exact test. $P<0.05$ was considered statistically significant.

Results

General characteristics

A total of 400 primiparous women with a fetus in a persistent occiput posterior position were included in this study. The women were divided into the PM and control groups, with 200 women in each group. Four women in the PM group and 12 in the control group underwent cesarean section. Therefore, analysis was performed in 196 women in the PM group and 188 in the control group (Figure 1). The characteristics of the study population are shown in Table 1. There were no significant differences in maternal age, gestational weeks, and newborn weight between the two groups.

Delivery mode and perineal outcome in the two groups

Table 2 shows the delivery modes in the two groups. A total of 185 (94.4%) women in the PM group and 169 (89.9%) in the control group had spontaneous delivery, with no significant difference in delivery mode between the two groups ($P = 0.07$). There was a significant difference in perineal outcome between the two groups (χ^2 test, $P = 0.04$) as follows. Women in the PM group had a higher frequency of first-degree laceration and a lower frequency of episiotomy compared with the control group.

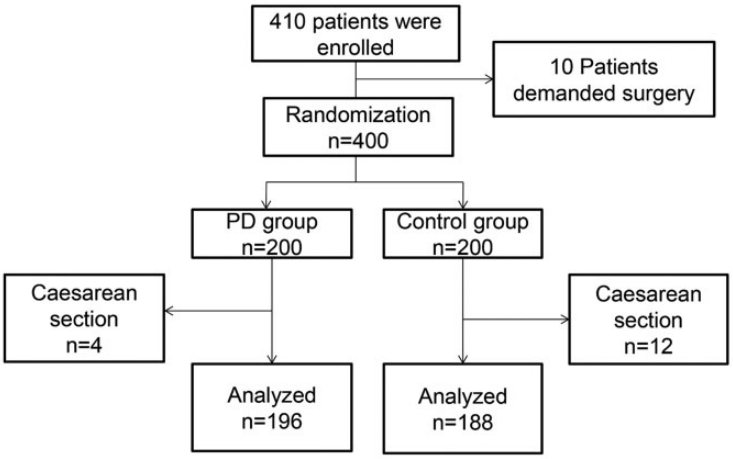

Figure 1. Inclusion process of the study participants. PM: position management.

Table 1. Baseline characteristics of the general study population.

	PM group	Control group	P
Number of patients	196	188	
Age (years)	27.9 ± 0.2	28.0 ± 0.2	0.77
BMI (kg/m^2)	26.1 ± 3.2	26.8 ± 3.2	0.83
Gestational week (weeks)	39.2 ± 1.0	39.3 ± 1.1	0.67
Birth weight (kg)	3.3 ± 0.3	3.2 ± 0.3	0.27

Values are mean ± standard deviation. PM: position management; BMI: body mass index.

Duration of labor, pain score, and volume of blood loss at 2 hours after delivery in the two groups

The first and second stages of labor were significantly shorter in the PM group than in the control group (both $P<0.05$), while the pain score was significantly lower in the PM group than in the control group ($P = 0.003$). The volume of blood loss at 2 hours after delivery was also significantly lower in the PM group than in the control group ($P<0.05$) (Table 2), but there was no significant difference in the frequency of women with blood loss >250 mL.

Neonatal asphyxia rate in the two groups

The rate of neonatal asphyxia was not significantly different between the two groups. No maternal or neonatal death occurred in both groups.

Discussion

This study investigated whether position management, manual rotation of the fetal position, and using a U-shaped birth stool improved delivery in primiparous women with a fetus in a persistent occiput posterior position compared with standard methods. There was no significant difference in delivery mode between the two groups, but the duration of labor was shorter in the PM group than in the control group.

Confirming the position of the fetal head using ultrasound is important for correct management of the delivery process. Indeed, Akmal et al.[15] reported a high failure rate of determining the fetal head

Table 2. Comparison of labor and outcomes between the two groups.

	PM group	Control group	P
Number of patients	196	188	
Delivery mode, n (%)			0.07
Spontaneous delivery	185 (94.4)	169 (89.9)	
Vacuum extraction	5 (2.5)	10 (5.3)	
Forceps delivery	6 (3.1)	9 (4.8)	
Duration of labor, mean ± SD			
First stage of labor (hours)	11.95 ± 3.57	13.70 ± 2.87	<0.05
Second stage of labor (minutes)	110.84 ± 16.70	119.28 ± 19.09	<0.05
Pain score, mean ± SD	4.79 ± 2.91	5.65 ± 2.40	0.003
Volume of blood loss at 2 hours after delivery (mL), mean ± SD	284.97 ± 117.21	364.26 ± 152.92	<0.05
Perineal outcome, n (%)			0.04
I° perineal laceration	95 (48.5)	68 (36.2)	
II° perineal laceration	25 (12.7)	19 (10.1)	
Episiotomy	76 (38.8)	101 (53.7)	
Neonatal asphyxia rate, n (%)	5 (2.6)	4 (2.1)	0.78

PM: position management; SD, standard deviation.

position by a clinical examination. Dupuis et al.[16] reported that the difference in fetal head position between a clinical examination and ultrasound could differ by >45° in 20% of the cases. Ultrasound is a simple, fast, inexpensive, and bedside method for determining the fetal head position. Inappropriate estimation of the fetal head position is associated with poor progress of labor, a higher rate of instrumental delivery and cesarean section, and a higher rate of morbidity for the mother and the newborn.[12,17,18]

Various methods have been used to improve the birth process in women who present with a fetus in a persistent occiput posterior position. At the beginning of labor, a popular approach is to use maternal postures that might facilitate flexion of the fetal head and favor its rotation into the occiput anterior position, but there is no consensus on the best position.[5,12,19,20] In this study, women with the left occiput posterior position were asked to lie in a right prone position, while women with the right occiput posterior position were asked to lie in a left prone position. Previous studies have suggested that manual rotation reduces the rate of operative delivery, but it might not be used often.[21,22] The fetal head should not be pushed too far upward during manual rotation of the fetal position to avoid inducing umbilical cord prolapse. The third intervention performed in the PM group was provision of a birthing stool during the second stage of labor. The supine lithotomy position is generally used for parturition in China. In this position, labor and fetal heart rate are easily monitored, and delivery is easy to conduct. However, this position is not in agreement with the physiological position of regular parturition because expansion of the sacrococcygeal joint is difficult and the pelvic outlet is narrow. Furthermore, a supine position could allow the uterus to press the abdominal aorta and inferior vena cava, and, therefore, increase the risk of fetal hypoxia.[23] In contrast, delivery in the sitting position is better in agreement with physiological features of the birth canal.[24] Previous studies have shown that when

women are in the sitting position, more endorphin is secreted.[25] In this study, the second stage of labor was shorter in the PM group than in the control group, and this may have been due to the option of using a sitting position and a birthing stool for these women. Women who give birth in a supine position are also more likely to have an episiotomy than those who give birth in a sitting position.[26]

This study has some limitations. The study was undertaken in one maternity unit. Therefore, the sample size was relatively small in both groups. Consequently, the women were not representative of the general or Chinese population. Therefore, our findings need to be generalized with caution, and our study was considered a pilot study. A larger study would provide more evidence for these results. Women who finally underwent cesarean section were excluded from the analysis. Indeed, this study aimed to examine the effects of position management, manual rotation of the fetal position, and use of a U-shaped birth stool in primiparous women with a fetus in a persistent occiput posterior position. Finally, the PM group was managed using a combination of methods, and we cannot determine which method contributed the most to the outcomes. Nevertheless, the strength of this study was its randomized design.

In conclusion, adjusting an abnormal fetal position is critical for reducing dystocia of cephalic presentation and increasing the quality of vaginal delivery.[27] Applying position management in the first stage of labor, rotation of the fetal position, and use of a U-shaped birth stool in the second stage of labor to change the occiput posterior position to the occiput anterior position effectively shorten labor, and decrease pain and blood loss in women. Therefore, these methods are worth considering for women with a fetus in a persistent occiput posterior position.

Declaration of conflicting interest

The authors declare that there is no conflict of interest.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

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Appendix 1. Scale of assessing risk factors of falling.

Modified scale to evaluate the risk factors for falling	
Risk factors	Detailed descriptions
History of falling	History of falling with unknown reasons within 1 year☐ History of bilateral lower extremity injuries☐ History of pelvic injuries☐
General conditions	Twins or more☐ Fetal macrosomia☐ Short in stature☐ Weak☐ Hypertension☐ Others☐
Feelings	Dizziness☐ Vertigo☐ Orthostatic hypotension☐ Weakness☐ Numbness in both lower limbs☐ Contraction pain☐ Restlessness☐
Activities	Struggling with movement☐ Mobility impairment☐ Gait instability
Cognition	Unwilling to move☐ Unable to move☐ Anxiety☐
Diet/physical conditions	No/little food consumption☐ No/little water consumption☐ Weak☐
Excretion	Diarrhea☐ Frequent urination☐ Strong urge to urinate☐
Activity tools	Birth ball☐ Wheelchair☐ Supported by family members☐
Anesthetic methods and drug treatment	Spinal anesthetics☐ Epidural anesthesia☐ Magnesium sulfate☐

Application of the scale: After the pregnant woman enters the delivery room, the scale can be applied (excluding those with absolute indications to be in bed) throughout the entire delivery process. Please check the boxes after the corresponding descriptions.

The scale has a total score of 34 and each check represents 1 point

1. If the score falls between 0 and 5, the risk of falling is low and the nurse in charge should provide general care.
2. If the score falls between 6 and 10, the risk of falling increases and the nurse in charge should provide one-on-one care.
3. If the score falls between 10 and 15, the risk of falling is relatively high and the nurse in charge should report to the doctor in charge for further evaluation. If getting out of bed is essential to promote delivery, the nurse in charge should provide sufficient notification and education in addition to one-on-one care. Proper activity tools should be selected.
4. If the score is >15, the risk of falling is high and the patient is not suggested to be out of bed. The nurse in charge should provide explanations and corresponding care with high quality.