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*Original Research*

# The Impact of Delivery Methods on the Delivery Outcomes of Women with a Prolonged Second Stage and a Fetus in the Occipital Posterior Position

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**Abstract**

**Background**: The objective was to explore the impact of different delivery methods on maternal and infant outcomes in women with a prolonged second stage of labor and a fetus with a persistent occipital posterior position. **Methods**: 60 women with a fetus in the occipital posterior position who underwent obstetric low forceps-assisted delivery were selected as the study group according to the order of delivery, and 40 women who underwent cesarean section during the same period were selected as study group 1 according to the order of delivery. We compared the maternal-related indicators and neonatal outcome-related indicators of the two groups. Then, we selected women in chronological order during the same period to be included in control group 2 (60 primiparous women with a fetus in the occipital anterior position who underwent low forceps-assisted delivery during the same period) for comparison with the study group. **Results**: The time of fetal head delivery, postpartum hemorrhage rate, hospitalization time, average hospitalization cost, and number of cases of postpartum infection in the group with a fetus in the occipital posterior position and low forceps-assisted delivery were significantly lower than those in the cesarean section group ($p < 0.05$). There was no statistically significant difference in the 1-minute Apgar score, umbilical artery blood gas pH value, or number of neonatal injuries between the cesarean section group and the group with a fetus in the occipital posterior position with forceps-assisted delivery ($p > 0.05$). There were also no statistically significant differences in the complication-related indicators between the group with a fetus in the occipital posterior position with forceps-assisted delivery and the group with a fetus in the occipital anterior position with forceps-assisted delivery. The two groups had second-degree lacerations, cervical lacerations, vaginal wall lacerations, and vaginal wall hematomas. There was no statistically significant difference in the comparison of urinary retention ($p > 0.05$), and there was no statistically significant difference between the group with a fetus in the occipital posterior position and forceps-assisted delivery and the group with a fetus in the occipital anterior position and forceps-assisted delivery in the comparison of related indicators of neonatal outcomes and pelvic floor reexamination at the Aa and Ap points 42 days after delivery ($p > 0.05$). **Conclusions**: The use of low forceps for women with a prolonged second stage of labor and a fetus in a persistent occipital posterior position can effectively shorten the time of fetal head delivery, reduce postpartum bleeding, reduce the incidence of postpartum infection, shorten the hospitalization time, and reduce average hospitalization costs and does not increase adverse neonatal outcomes.

**Keywords:** prolonged second stage of labor; occipital posterior position; low forceps; cesarean section; maternal and infant outcomes

## 1. Introduction

Abnormal fetal orientation is the main factor leading to dystocia. When the fetal head is in the occipital posterior position and the biparietal diameter of the fetal head reaches the middle pelvic plane, internal rotation is completed. After sufficient trial production, the occipital part of the fetal head cannot be turned forward and lies behind the maternal pelvis, resulting in difficulty in delivery. This is called persistent occipital posterior positioning and accounts for 5% [1] of all deliveries. It is an important factor that leads to the extension of the second stage of labor. In recent decades, the cesarean section rate (CSR) in China has remained high. In 2010, the World Health Organization (WHO) released a sampling survey report on delivery methods in nine Asian countries, stating that China's CSR reached 46.2%, ranking first in Asia. An excessively high cesarean section rate can increase maternal and fetal complications and mortality in the short and long term [2]. The proportion of women transitioning to cesarean section due to the extension of the second stage of labor is as high as 40% or more. Therefore, to reduce the rate of transition to cesarean section in the second stage of labor and ensure the safety of the mother and baby, it is particularly important to take safe and effective treatment measures for the extension of the second stage of labor due to occipital posterior positioning. This study analyzed the impact of a prolonged second stage of labor with persistent occipital posterior positioning using low forceps

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**Table 1. Comparison of age, gestational age, body mass index, presentation, and newborn weight between the two groups of pregnant women.**

| Group | Number of patients | Age (years) | Pregnancy week (weeks) | Body mass index | Fetal presentation (cm) | Newborn weight (g) |
|---|---|---|---|---|---|---|
| Study group | 60 | 28.5 ± 3.79 | 39.69 ± 0.93 | 26.79 ± 3.10 | 2.7 ± 0.34 | 3316.0 ± 233.98 |
| Control group 1 | 40 | 28.7 ± 2.74 | 39.75 ± 1.05 | 27.87 ± 3.13 | 2.7 ± 0.37 | 3272.5 ± 310.13 |
| $t$ | | –0.20 | –0.23 | –1.21 | 0.00 | 0.57 |
| $p$ | | 0.84 | 0.82 | 0.23 | 1.00 | 0.58 |
| 1-$\beta$ | | 0.05 | 0.05 | 0.4 | 0.18 | 0.1 |

and cesarean section on relevant indicators of maternal and neonatal outcomes and explored the most suitable management method.

## 2. Materials and Methods

### *2.1 General Information*

A retrospective analysis of primiparous women who underwent vaginal delivery in our hospital (Longquan Hospital, West China Hospital, Sichuan University) from January 2017 to January 2023 was conducted. 60 women with a fetus in the occipital posterior position who underwent obstetric low forceps-assisted delivery were selected as the study group according to the order of delivery, and 40 women who underwent cesarean section during the same period were selected as study group 1 according to the order of delivery. Then, we selected women according to time sequence during the same period as control group 2 (60 primiparous women with a fetus in the occipital anterior position who underwent low forceps-assisted delivery during the same period). We conducted statistical analysis on the general data of three groups of women. To collect cases and controls we sorted the postpartum women within the specified time according to their delivery time duration and compared them in order according to the inclusion criteria of the study group, to reach the pre-determined 60 cases.

### *2.2 Inclusion and Exclusion Criteria*

The inclusion criteria were as follows: (1) primiparous women who were full term, had a singleton fetus, presentation, and planned to have a vaginal delivery; (2) women with a prolonged second stage of labor with a fetus in the persistent occipital posterior position; (3) women with indications for a low forceps-assisted delivery or cesarean section; and (4) women and their families who provided informed consent and signed an informed consent form.

The exclusion criteria were as follows: (1) contraindications to vaginal delivery; (2) deceased fetus or fetal malformation; and (3) contraindications for low forceps-assisted delivery or cesarean section.

### *2.3 Methods*

Postoccipital position obstetric low forceps-assisted delivery: the indications for vaginal midwifery were assessed, the patients were communicated with and adequately informed, preparations for neonatal resuscitation and shoulder dystocia were made, and postpartum bleeding was actively prevented. The postpartum woman adopted a bladder lithotomy position, and catheterization and bilateral perineal block anesthesia was performed. A vaginal examination was performed to verify that the fetus was in an occipital posterior position. The bone part of the fetal head was more than 2 cm below the ischial spine, and a left perineal lateral incision was made. All study subjects used Simpson forceps for delivery assistance. The method of placing the forceps was the same as that for the occipital anterior position. The two blades of the forceps were placed on both sides of the fetal head, with the difference being that the left lobe of the forceps was placed on the right side of the fetal head, and the right lobe of the forceps was placed on the left side of the fetal head. The traction direction was horizontal, upward, and downward [3]. First, parallel forward traction was applied until the forehead was exposed under the pubic arch, and then the obstetric forceps handle was gradually lifted to rotate the fetal head. After the occipital tuberosity crossed the perineum, the obstetric forceps handle was gradually pressed down to deliver the fetal forehead and face. The obstetric forceps were removed and the fetus was delivered [3].

Cesarean section: indications for cesarean section were assessed, the patients were communicated with and adequately informed, preparations were made for neonatal resuscitation and measures were taken to prevent postpartum hemorrhage and infection, and an intravenous infusion of 1 g calcium gluconate was given. Routine lumbar epidural anesthesia was used, and a transverse arc incision was made at the two transverse fingers above the pubic symphysis. The skin, subcutaneous adipose tissue, anterior sheath of rectus abdominis, and peritoneum were sequentially incised. A transverse incision was made in the upper third of the lower segment of the uterus, blunt separation was performed, and the uterine incision was opened. Due to the deep depression of the fetal head, to avoid soft birth canal tears, the delivery method was chosen according to the situation, such as foot traction or upward pushing of the fetal shoulder and upward pushing of the fetal head inside the vagina. Routine disposal of the placenta, closure of the uterine incision, and layer-by-layer closure of the abdomen were performed [4].


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**Table 2. Comparison of age, gestational age, body mass index, presentation, and newborn weight between the two groups of pregnant women with forceps-assisted delivery.**

| Group | Number of patients | Age (years) | Pregnancy week (weeks) | Body mass index | Fetal presentation (cm) | Newborn weight (g) |
|---|---|---|---|---|---|---|
| Study group | 60 | 28.50 ± 3.79 | 39.69 ± 0.93 | 26.79 ± 3.10 | 2.7 ± 0.34 | 3316.0 ± 233.98 |
| Control group 2 | 60 | 28.47 ± 3.19 | 39.65 ± 1.02 | 27.40 ± 3.52 | 2.7 ± 0.36 | 3285.0 ± 297.45 |
| $t$ | | 0.04 | 0.15 | –0.71 | 0.00 | 0.45 |
| $p$ | | 0.97 | 0.88 | 0.48 | 1.00 | 0.66 |
| 1-$\beta$ | | 0.03 | 0.04 | 0.17 | 0.18 | 0.09 |

**Table 3. Comparison of fetal head delivery time, postpartum bleeding volume, postpartum infection, average hospitalization cost, and hospitalization time in the 2 groups.**

| Group | Number of patients | Delivery time of fetal head (minutes), P (M25, M75) | Postpartum bleeding volume (mL) | Puerperal infection (number of cases) | Average hospitalization cost (RMB*) | Hospitalization time (days) |
|---|---|---|---|---|---|---|
| Study group | 60 | 3 (2.75, 5) | 240 ± 31.73 | 2 (3.3%) | 4636 ± 1001.51 | 4.07 ± 0.87 |
| Control group 1 | 40 | 39 (27.75, 45.75) | 499 ± 53.53 | 7 (17.5%) | 11,677.5 ± 936.99 | 6.40 ± 1.10 |
| $t/z/\chi^2$ | | –5.98 | –21.45 | 4.28 | –24.98 | –8.38 |
| $p$ | | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 |
| 1-$\beta$ | | 1 | 1 | 0.67 | 1 | 1 |

* 1 USD = 7.20 RMB.

### *2.4 Outcome Measures*

(1) The relevant indicators of postpartum women in the study group and control group 1 (fetal head delivery time, postpartum bleeding volume, number of cases of postpartum infection, average hospital expenses, and hospital stay) were compared. (2) The relevant indicators of neonatal outcomes (1-minute Apgar score, umbilical artery blood gas pH value, and number of neonatal birth injuries) between the study group and control group 1 were compared. (3) We compared the complications of the puerperae in the study group and control group 2 (second-degree lacerations, cervical lacerations, vaginal wall lacerations, vaginal wall hematoma, urinary retention) and compared the pelvic floor Aa point (the middle line of the front vaginal wall 3 cm away from the external opening of the urethra) and Ap point (the middle line of the back vaginal wall 3 cm away from the hymen) in the two groups 42 days after delivery.

### *2.5 Statistics*

Statistical analysis was conducted using SPSS 26.0 software (IBM Corp., Armonk, NY, USA). The measurement data in accordance with a normal distribution are represented by $\bar{X} \pm s$, and a $t$ test was used for comparison. The measurement data with a nonnormal distribution are represented by the median M (P25, P75), and the rank sum test was used for comparison. Count data comparison was performed using the $\chi^2$ test or Fisher's exact test (when the number of cells with a theoretical frequency less than 1 or a theoretical frequency less than 5 exceeded 1/5). Using ClinCalc's post power calculator to calculate verification efficiency (1-$\beta$). $p < 0.05$ indicated a statistically significant difference.

## 3. Results

There was no statistically significant difference ($p > 0.05$) between control group 1 and the study group or between control group 2 and the study group in terms of the general data (age, gestational age, prenatal body mass index, presentation, and neonatal weight), indicating comparability, as shown in Tables 1,2.

Compared with control group 1, the study group showed a significantly shorter delivery time and hospital stay, lower average hospital expenses, significantly reduced postpartum bleeding, and a reduced number of postpartum infections. The differences were statistically significant ($p < 0.05$), as shown in Table 3.

There was no statistically significant difference ($p > 0.05$) in the 1-minute Apgar score, umbilical artery blood gas pH value, or number of neonatal birth injuries between control group 1 and the study group, as shown in Table 4.

There was no statistically significant difference between the study group and control group 2 in terms of related indicators of maternal complications, such as second-degree or above lacerations, cervical lacerations, vaginal wall lacerations, vaginal wall hematoma, and urinary retention ($p > 0.05$), as shown in Table 5.

There was no statistically significant difference ($p > 0.05$) in the relevant indicators of neonatal outcomes between the study group and control group 2, as well as the Aa and Ap points in the pelvic floor examination of postpartum women on the 42nd day after delivery, as shown in Table 6.

**Table 4. Comparison of the 1-minute Apgar score, umbilical artery pH value, and neonatal birth injury rate of newborns in the two groups.**

| Group | Number of patients | 1-minute Apgar score | Umbilical artery pH value | Neonatal birth injury (Number of cases) |
|---|---|---|---|---|
| Study group | 60 | 9.5 ± 0.63 | 7.24 ± 0.04 | 6 (10%) |
| Control group 1 | 40 | 9.35 ± 0.67 | 7.25 ± 0.034 | 5 (12.5%) |
| $t/\chi^2$ | | 0.80 | –1.48 | 0.00 |
| $p$ | | 0.43 | 0.15 | 0.95 |
| 1-$\beta$ | | 0.2 | 0.27 | 0.06 |

**Table 5. Comparison of two groups of pregnant women with perineum lacerations above grade II, cervical lacerations, vaginal wall lacerations, vaginal wall hematoma, and urinary retention.**

| Group | Number of patients | Perineum laceration above grade II | Cervical laceration | Vaginal wall laceration | Vaginal wall hematoma | Urinary retention |
|---|---|---|---|---|---|---|
| Study group | 60 | 9 (15%) | 2 (3.3%) | 10 (16.7%) | 3 (5%) | 1 (1.7%) |
| Control group 2 | 60 | 8 (13.3%) | 3 (5.0%) | 12 (20%) | 2 (3.3%) | 2 (3.3%) |
| $\chi^2$ | | 0.07 | Fisher test | 0.22 | Fisher test | Fisher test |
| $p$ | | 0.79 | 1.0 | 0.64 | 1.0 | 1.0 |
| 1-$\beta$ | | 0.04 | 0.07 | 0.06 | 0.05 | 0.09 |

## 4. Discussion

The second stage of labor (also known as the fetal delivery period) refers to the entire process from the opening of the uterus to the delivery of the fetus by the mother. The extension of the second stage of labor refers to a period of over 3 hours for primiparous women and over 2 hours for multiparous women (in the case of labor analgesia, over 4 hours for primiparous women and over 3 hours for multiparous women). The correct evaluation and management of the second stage of labor directly affect maternal and infant outcomes. A prolonged second stage of labor can lead to adverse maternal and infant outcomes, including postpartum hemorrhage, puerperal infection, soft birth canal tears, neonatal asphyxia, low Apgar scores, and neonatal birth injury. Therefore, in the event of a prolonged second stage of labor, the maternal and fetal conditions should be actively evaluated and promptly addressed. The guidelines for normal delivery in China clearly state that the use of uterine floor pressure to assist in fetal delivery in the second stage of labor should be avoided. For women with a prolonged second stage of labor, cesarean section or vaginal delivery should be determined based on specific situations [5]. According to literature reports, 37% of women who undergo cesarean sections are transitioned from vaginal delivery, and a prolonged second stage of labor is an important factor leading to the transition to cesarean section [6]. Vaginal-assisted delivery refers to the use of forceps or vacuum to directly pull the fetal head during the second stage of labor to accelerate or achieve vaginal delivery of the fetus [7]. It is also an important operational method for handling the extension of the second stage of labor. The lower the position of the fetal head, the smaller the rotation angle, the lower the risk of vaginal delivery, and the less harm to the mother and fetus [8].

In this study, the presentation of fetuses in each group was above 2 cm below the ischial spine. The results showed that low-position forceps can significantly shorten the delivery time of the fetal head, reduce postpartum bleeding, and reduce the incidence of postpartum infection. Moreover, the comparison between the two groups did not increase adverse neonatal outcomes. As a reminder, compared to cesarean section, obstetric low position forceps-assisted delivery for occipital posterior positioning has more advantages in handling the prolonged second stage of labor, especially in cases of fetal distress. When the second stage of labor is prolonged, the bone part of the fetal head is usually 2 cm below the ischial spine, and the lower segment of the uterus is significantly elongated and thinner. At this time, a cesarean section should be performed. Because the fetal head is deeply embedded in the pelvis, it is difficult to deliver the fetus, which may lead to neonatal birth injury and soft birth canal tears, increasing the risk of postpartum bleeding. Based on the operator's experience, the fetus should be delivered by foot traction, pushing the fetal shoulder up, or pushing the fetal head up inside the vagina, mainly through foot traction. In this study, 5 cases of neonatal birth injuries occurred in the cesarean section group, of which 3 cases involved skin ecchymosis (caused by poor anesthesia during surgery, poor relaxation of the uterine smooth muscle, and difficulty in traction); special treatment was not provided and the condition spontaneously resolved after 2 days. Two cases of skull fractures (caused by pushing the fetal head upward) healed spontaneously without special treatment. In the group of women with a fetus in the occipital posterior position and forceps-assisted delivery, there were 6 cases of neonatal birth injuries, 4 cases of facial skin damage, and 2 cases of intracranial hemorrhage in the newborns, all of whom did not receive special treat-

**Table 6. 1-minute Apgar score, umbilical artery pH value, neonatal injury, and maternal Aa and Ap points at 42 days postpartum in the two groups.**

| Group | Number of cases | 1-minute Apgar score | Umbilical artery pH value | Neonatal birth injury | Maternal Aa point | Maternal Ap point |
|---|---|---|---|---|---|---|
| Study group | 60 | 9.5 ± 0.63 | 7.24 ± 0.04 | 6 (10%) | 0.54 ± 0.33 | 1.82 ± 0.29 |
| Control group 2 | 60 | 9.4 ± 0.62 | 7.24 ± 0.04 | 5 (8.3%) | 0.57 ± 0.30 | 1.90 ± 0.32 |
| $t/\chi^2$ | | 0.62 | –0.28 | 0.00 | –0.41 | 1.06 |
| $p$ | | 0.54 | 0.78 | 1.0 | 0.69 | 0.30 |
| 1-$\beta$ | | 0.14 | 0.07 | 0.05 | 0.08 | 0.3 |

ment and healed spontaneously. Therefore, there is a risk of neonatal birth injury when transitioning to cesarean section or low forceps-assisted delivery during the second stage of labor. Regardless of the treatment method, it is necessary to communicate and plan with pregnant women and their families to improve the prognosis of the mother and child. Similar conclusions were also drawn in the studies of Giacchino *et al*. [9] and Tempest *et al*. [10].

Both low forceps-assisted delivery and cesarean section have corresponding risks. This study found that there was no statistically significant difference in the 1-minute Apgar score, acidosis rate, or neonatal birth injury rate between the two groups who underwent low forceps-assisted delivery and cesarean section due to a prolonged second stage of labor. However, the use of low forceps significantly shortened the time for fetal head delivery and reduced the risk of neonatal asphyxia and low Apgar scores. From the comparison between the women with fetuses in the occipital anterior and occipital posterior positions who underwent forceps-assisted delivery in this study, the incidence of maternal complications and neonatal outcome indicators were not statistically significant, indicating that the implementation of forceps-assisted delivery for occipital posterior positioning did not increase the incidence of maternal and neonatal complications if the operator had rich experience in vaginal delivery and mastered occipital posterior delivery techniques. There was no statistically significant difference in the measurement of Aa and Ap points on the 42nd day postpartum, indicating that there was no significant difference in the impact of forceps-assisted delivery on pelvic floor organ prolapse between the two groups. A study have shown that there is no significant difference in the effects of cesarean section, natural delivery, and forceps-assisted delivery on the pelvic floor morphology and sexual function of primiparous women in the later stages of childbirth [11]. There is relatively little research on the long-term outcomes of vaginal delivery in fetuses, but there is also a study indicating that there is no significant difference in the learning, attention, and neurological effects of vaginal delivery compared to natural delivery [12].

It is necessary to acknowledge the limitations of this work, because this study aimed to investigate a rare abnormal labor process in a specific population, we had access to a limited sample size, which may have affected the generalizability of this work. In the future, we will continue to collect cases of such pregnant women in order to conduct larger scale studies and improve the accuracy and credibility of the research.

## 5. Conclusions

In summary, the implementation of low forceps-assisted delivery in women with a prolonged second stage of labor and a fetus in the persistent occipital posterior position can effectively shorten the delivery time of the fetus, shorten the average hospitalization stay, reduce hospitalization costs, reduce the incidence of maternal complications, reduce the conversion rate to cesarean section and reduce the incidence of postpartum infections and does not increase adverse outcomes for newborns. Therefore, as obstetric medical staff, we need to make correct evaluations and provide treatments for a prolonged second stage of labor. In addition to focusing on the time limit, we should also focus on electronic monitoring of the fetal heart rate, uterine contractions, fetal orientation, decreased fetal presentation, and the general situation of the mother. Strictly grasping the indications for a prolonged second stage of labor, balancing the advantages and disadvantages of cesarean section and vaginal delivery for the mother and child, carefully selecting the treatment plan, mastering the techniques of cesarean section and forceps-assisted delivery for fetuses in the occipital posterior position and deep fetal head, and improving the surgical level are crucial for ensuring the safety of the mother and child.

## Availability of Data and Materials

The data in this manuscript is sourced from the medical record database of Longquanyi District People's Hospital. As it involves hospital regulations and patient privacy, it is necessary to obtain the consent of Longquanyi District People's Hospital before obtaining the data.

## Author Contributions

JZ and SYM designed the research study. ZPZ, CXL, JLin, JT, JLing, LXY, ZJJ and DDW performed the research. JZ provided help and advice on research methods. SYM and JLin analyzed the data. JZ, SYM and JLin wrote

the manuscript. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript.

## Ethics Approval and Consent to Participate

Written informed consent was obtained from the subject and/or guardian. This research project has been approved by the Ethics Committee of the First People's Hospital of Longquanyi District, Chengdu City, Sichuan Province (AF-KY-2023025).


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## Conflict of Interest

The authors declare no conflict of interest.

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