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Effects of Labor Analgesia on Pelvic Floor Function at 6 to 8 Weeks after Delivery: A Prospective Cohort Study

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Abstract

Objective The aim of the study is to determine whether the use of labor analgesia had a higher risk of pelvic floor functional problems after delivery.

Study Design All primiparas who delivered at our hospital between June 2019 and May 2020 were enrolled in the study. They were divided into two groups according to their choices: delivery with labor analgesia (analgesia group, $n = 76$), and delivery without labor analgesia (nonanalgesia group, $n = 78$). The primary outcome of the study was to test the pelvic floor function by electromyography (EMG) at postpartum 6 to 8 weeks. Participants also completed questionnaires including Pelvic Floor Distress Inventory (PFDI-20), International Consultation on Incontinent Questionnaire-Short Form (ICIQ-SF), and Overactive Bladder Symptom Score (OABSS) at postpartum 6 to 8 weeks.

Results Primiparas in the analgesia group experienced longer first and second stages of labor ($p < 0.05$), and had significantly higher PFDI-20 scores at postpartum 6 to 8 weeks ($p < 0.05$). But the differences in ICIQ-SF, OABSS scores, and Pelvic Organ Prolapse Quantification (POP-Q) system between the two groups were not significant ($p > 0.05$). No statistically significant difference was found in class II and class I muscles, scores of pretest resting baseline, and posttest resting baseline between primiparas with or without labor analgesia ($p > 0.05$).

Conclusion Our results strongly confirmed that labor analgesia did not increase the risk of pelvic floor dysfunction up to 6 to 8 weeks after delivery, although symptom burden might be increased after labor analgesia.

Keywords

- labor analgesia
- primiparas
- pelvic floor dysfunction
- postpartum
- vaginal delivery

Key Points

- Labor analgesia did not increase risk of pelvic floor muscle dysfunction after delivery.
- There are longer first and second stages of labor in primiparas with labor analgesia.
- Primiparas with labor analgesia had more obvious subjective symptoms of PFD.

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As a major public health concern after childbirth, pelvic floor dysfunction (PFD) seriously affects women's physical and mental health.[1] PFD could lead to dysfunction such as pelvic organ prolapse (POP), stress urinary incontinence, overactive bladder (OAB), and sexual dysfunction.[2,3] One-third of the world's women are estimated to suffer from PFD during their lifetime.[4] The injury of ligament, fascia, and muscle during labor has been considered as the main etiology of PFD.[3]

Vaginal delivery, advanced maternal age, prolonged second stage of labor, episiotomy are common risk factors for PFD.[5] Among them, vaginal delivery is implicated as the most common risk factor for postpartum PFD.[6] Vaginal delivery directly causes damage to pelvic floor structure and tissues and increases intra-abdominal pressure,[7] especially during the second stage of delivery.[8]

Labor analgesia is offered in modern obstetric wards, to decrease labor pain, labor complications, and maternal mortality.[3] Previous studies have revealed that labor analgesia plays a dual role in pelvic floor function. It could relax the pelvic floor muscles (PFMs) during labor, but it also lengthens the second stage of labor, increasing the strain on the PFMs.[9] Thus there remains a controversy about the influence of labor analgesia on pelvic floor function. For example, Sartore et al found that the use of labor analgesia in the form of epidural analgesia was not associated with symptoms related to PFM weakness.[10] Ruan et al revealed that labor analgesia had a protective effect on the PFMs during delivery.[3] However, other studies have reported that labor analgesia may increase the risk of PFD.[11,12] Therefore, the purpose of this study was to make clear the relationship between labor analgesia and pelvic floor function at 6 to 8 weeks after delivery.

Materials and Methods

Patients

Primiparas who had a vaginal delivery between June 2019 and May 2020 at the Beijing hospital and were also seen postpartum 6 to 8 weeks were included in this single-center, prospective cohort study. Women in this study self-selected their labor choices and were followed accordingly—analgesia or nonanalgesia group. No women underwent regular pelvic floor training within 6 to 8 weeks postpartum.

The inclusion criteria were as follows: (1) women who gave birth in the hospital; (2) women who were $\geq$18 years old; (3) women who gave birth by vaginal delivery to a live, single, mature fetus ($\geq$38, $\leq$40 weeks). Participants with the following conditions before delivery were excluded: (1) gestational diabetes mellitus; (2) neuromuscular diseases; and (3) chronic cough, constipation, POP, or history of urinary incontinence.[3] This study was approved by the Ethics Committee of the Beijing Hospital (2019BJYYEC-014–02). Written informed consent was obtained from all study participants.

Analgesia Protocol

Women in the analgesia group received analgesia during delivery. With a cervical opening of approximately 2 cm, an epidural catheter (puncture site: L2–3 or L3–4) was established. Then, lidocaine (1%) was intrathecally injected. Using the analgesia pump, a mixture of ropivacaine (0.143%) and sufentanil (0.3 μg/mL) was continuously infused until the cervix was fully dilated.

Women in the nonanalgesia group were not provided any analgesia or opioid during labor.

Pelvic Floor Function Test

According to the morphological characteristics of muscle, the PFM is divided into class I and class II fibers. Class I muscle fibers are the main components of deep PFMs, which are less fatigable and have a long contraction duration. The class II muscle fibers are easily fatigued and fast in contraction, playing an important role in controlling urine, defecation, and sexual function.[3] The PFM function was tested using electromyography (EMG) at postpartum 6 to 8 weeks. Vishee neuro muscle stimulator (MyoTrac Infiniti, model SA9800, Thought Technology Ltd., Montreal, Canada) was used to perform the EMG tests according to the Glazer protocols.[13] Examinations were performed in the lithotomy position. Then, a pear-shaped vaginal manometric probe (Nanjing Vishee Medical Technology, Ltd., China) was placed into the vagina. To monitor unwanted muscle activation, the electrode configurations were positioned on the hip adductors and on abdominal muscles. The strength of the class I muscle fibers was recorded during a contraction of 10 seconds. The strength of the class II muscle fibers was the mean value of five fast contractions. The resting PFM strength and the dynamic strength of the class II and class I muscles were evaluated.[14]

Subjective and Objective Evaluation

Participants completed questionnaires including Pelvic Floor Distress Inventory (PFDI-20), International Consultation on Incontinent Questionnaire-Short Form (ICIQ-SF), and Overactive Bladder Symptom Score (OABSS) at postpartum 6 to 8 weeks. PFDI-20 consists of three scales: the Pelvic Organ Prolapse Distress Inventory (POPDI-6), the Urogenital Distress Inventory, and the Colorectal-Anal Distress Inventory. The higher score indicates higher symptom burden.[15] ICIQ-SF is a questionnaire used to assess the frequency, severity, and impact on quality of life (QoL) of men and women with UI in both clinical trials and daily practice. A higher value means worse incontinence-related QoL.[16] The OABSS is an effective tool to assess the symptoms of OAB, which comprised of four test items including frequency of urination, nocturia, urgency urinary incontinence, and urgency episodes. Total score of OABSS ranges from 0 to 15, with scores of 3 to 5 indicating mild OAB, 6 to 11 indicating moderate OAB, and 12 to 15 indicating severe OAB.[17]

The Pelvic Organ Prolapse Quantification (POP-Q) scoring system was used to performed the objective evaluation of the patients at postpartum 6 to 8 weeks. Points Ba (B anterior), Bp (B posterior), and C can reflect the most serious degree of prolapse of the vaginal walls and uterus. Ba is the most dependent position of the anterior wall, Bp is the most dependent position of the posterior wall, and point C is

the cervix or cuff. Total vaginal length (TVL) reflects the total vaginal length.

Statistical Analysis

SPSS 23.0 (IBM, Armonk, NY) was used to perform the statistical analysis. The continuous data with normal distribution was presented as mean ± SD, and the comparison was analyzed by *t*-test. The continuous data without normal distribution was presented as median and interquartile range, and the comparison was performed by Mann–Whitney test. The categorical data was presented as percentage (%), the comparison between groups was conducted by $\chi 2$ test. $p < 0.05$ was considered as statistically significant.

Results

Baseline Characteristics

A total of 188 primiparas were enrolled in this study. Of these, 34 (18.09%) primiparas were excluded: 20 (10.64%) who underwent cesarean sections, eight (4.26%) who underwent their postpartum check-ups before 6 weeks postpartum or after 8 weeks postpartum, 6 (3.19%) who had multiple births, leaving 154 (81.91%) primiparas to constitute the study sample. Among the 154 primiparas, 76 self-selected labor analgesia (analgesia group) while 78 did not select labor analgesia (nonanalgesia group).

►Table 1 shows the demographic variables of the primiparas with and without analgesia. There were no significant differences in maternal age, prepregnancy weight, prepregnancy BMI, weight gain in pregnancy, weight at 6 weeks postpartum, newborn weight, postpartum hemorrhage, and ratios of episiotomy or forceps between the two groups. However, primiparas in the analgesia group had longer first and second stage of labor than those in the nonanalgesia group (412.50 [327.50–500.00] vs. 332.50 [270.00–420.00], $p = 0.023$ for first stage of labor; 65.00 [50.00–94.75] vs. 58.00 [33.50–89.50], $p = 0.046$ for second stage of labor).

Electromyography Outcomes

As shown in ►Table 2, primiparas in the analgesia group had similar pelvic floor function test scores to those in the nonanalgesia group. And the class II or class I muscles between the two groups were not significant. The scores of pretest resting baseline and posttest resting baseline between the two groups were not significantly different either.

Subjective and Objective Symptom Scores

As shown in ►Table 3, primiparas in the analgesia group had significantly higher PFDI-20 scores at postpartum 6 to 8 weeks than those in the nonanalgesia (50.00 [25.00–75.00] vs. 25.00 [0–75.00], $p = 0.006$). But the difference in ICIQ-SF and OABSS scores between the two groups was not significant. The indicator points in the POP scoring system were compared

Table 1 Demographic and clinical characteristics of the study sample

	Nonanalgesia group ($n = 76$)	Analgesia group ($n = 78$)	*p*-Value
Maternal age (year, median [range])	30.50 (29.00–32.25)	31.00 (29.00–33.00)	0.713[a]
Prepregnancy weight (kg, median [range])	55.00 (51.00–60.00)	55.00 (50.00–62.00)	0.900[a]
Prepregnancy BMI (kg/m^2, median [range])	20.96 (19.93–22.76)	20.70 (19.51–23.32)	0.434
Weight gain in pregnancy (kg, median [range])	13.00 (10.00–15.50)	12.00 (9.00–15.00)	0.054[a]
Weight at 6 wk postpartum (kg, median [range])	60.00 (56.00–66.00)	60.00 (54.75–65.00)	0.172
First stage of labor (min, median [range])	332.50 (270.00–420.00)	412.50 (327.50–500.00)	0.023[a]
Second stage of labor (min, median [range])	58.00 (33.50–89.50)	65.00 (50.00–94.75)	0.046[a]
Newborn weight (g, median [range])	3,400.00 (3,050.00–3,665.00)	3,235.00 (3,000.00–3,500.00)	0.781[a]
Postpartum hemorrhage (mL, median [range])	200.00 (150.00–300.00)	200.00 (150.00–250.00)	0.502[a]
With episiotomy, *n* (%, median [range])	23.00 (30.26)	26.00 (33.33)	0.683[b]
With forceps assistance, *n* (%)	7 (9.21)	4 (5.13)	0.325

Abbreviation: BMI, body mass index.
[a]Mann-Whitney *U*-tests.
[b]Chi-square tests.

Table 2 Comparison of pelvic floor muscle scores between primiparas with and without analgesia

	Nonanalgesia group ($n = 76$)	Analgesia group ($n = 78$)	*p*-Value
The class II muscles (median [range])	74.00 (49.25–82.75)	71.00 (55.75–84.00)	0.996[a]
The class I muscles (median [range])	55.50 (40.00–70.00)	57.50 (40.25–70.00)	0.637[a]
Pretest resting baseline (median [range])	78.00 (48.25–88.00)	80.00 (63.75–86.00)	0.931[a]
Posttest resting baseline (median [range])	84.50 (57.00–89.00)	84.50 (69.75–89.00)	0.389[a]
Total score (median [range])	63.25 (49.69–55.48)	66.91 (55.48–73.94)	0.480[a]

[a]Mann-Whitney U tests.

Table 3 Comparison of subjective symptom scores between primiparas with and without analgesia

	Nonanalgesia group ($n = 76$)	Analgesia group ($n = 78$)	p-Value
PFDI-20 (median [range])	25.00 (0–75.00)	50.00 (25.00–75.00)	0.006[a]
ICIQ-SF (median [range])	0 (0–1.75)	0 (0–1.00)	0.838[a]
OABSS (median [range])	0.50 (0–1.00)	1.00 (0–1.00)	0.457[a]

Abbreviations: ICIQ-SF, Incontinent Questionnaire-Short Form; OABSS, Overactive Bladder Symptom Score; PFDI-20, Pelvic Floor Distress Inventory-20.
[a]Mann-Whitney U tests.

Table 4 Comparison of POP-Q scores between primiparas with and without analgesia

	Nonanalgesia group ($n = 76$)	Analgesia group ($n = 78$)	p-Value
Ba (cm, mean ± SD)	−2.61 ± 0.60	−2.51 ± 0.83	0.369[a]
Bp (cm, mean ± SD)	−2.97 ± 0.15	−2.98 ± 0.10	0.500[a]
C (cm, mean ± SD)	−5.39 ± 1.11	−5.27 ± 1.10	0.502[a]
TVL (cm, mean ± SD)	9.14 ± 1.03	9.24 ± 0.74	0.494[a]

Abbreviations: Ba, B anterior; Bp, B posterior; POP-Q, Pelvic Organ Prolapse Quantification; SD, standard deviation; TVL, total vaginal length.
[a]Independent sample t-tests.

between the analgesia group and the nonanalgesia group. Our results showed that the differences in AP, BP, C, and TVL between the two groups were not significant (►Table 4).

Discussion

In the current study, we performed a small-scale prospective cohort study evaluating postpartum pelvic floor function in primiparas who gave birth vaginally with or without analgesia. The primary objective of the study was to compare the pelvic floor function at postpartum 6 to 8 weeks in primiparas with or without labor analgesia. Our results strongly confirmed that labor analgesia did not increase risk of PFM dysfunction up to 6 to 8 weeks after delivery, although primiparas with labor analgesia had higher PFDI-20 scores.

Early postpartum (6 weeks to 3 months of postpartum) is reported to be the most vulnerable period for the woman. But it is also the best period for rehabilitation.[3] Thus, we chose postpartum 6 to 8 weeks as the time point to measure the pelvic floor function.

The methods usually used for labor analgesia include epidural analgesia and combined spinal-epidural analgesia (CSEA). The method used in our hospital for labor analgesia is epidural anesthesia. In previous studies, the relationship between epidural analgesia and a prolonged second stage of labor is well determined.[18] In this study, we also observed longer first and second stages of labor in primiparas with labor analgesia compared with those without analgesia. Previous studies have found that the duration of the second stage of labor has an effect on postpartum PFD symptoms.[19,20]

In this study, primiparas in the analgesia group had significantly higher PFDI-20 scores at postpartum 6 to 8 weeks than those in the nonanalgesia group. The PFDI-20 is a questionnaire to measure QoL and the extent of PFD.[19] The higher score of PFDI-20 indicates higher symptom burden. Our results indicated that primiparas with labor analgesia had more obvious subjective symptoms of PFD. Previous studies reported that prolonged second stage of labor is consistent with the trend of improvement in all components of the PFDI-20.[19,21] Thus, higher PFDI-20 score obtained in the analgesia group may be due to the prolonged duration of the second stage of labor. However, other subjective and objective tools (POP-Q, ICIQ-SF, and OABSS) used to measure PFD in this study did not acquire similar results. Lack of enough sample size may contribute to this situation.

EMG analysis did not demonstrate a significant difference in the postpartum pelvic floor function scores (including total score, pretest resting baseline score, posttest resting baseline score, class II muscle score and class I muscle score) between the two groups. Our findings are in line with that of a matched retrospective cohort study conducted by Ruan et al, which found that the use of patient-controlled epidural analgesia was not related to PFM weakness.[3] A previous study conducted by Wang et al used manometry to evaluate PFM endurance and strength in primiparous women with or without epidural analgesia.[9] They found that PFM endurance or strength at 6 weeks postpartum between the two groups was no statistically different.[9] Although we used a different method to measure PFM function, our findings also essentially agree with those of the study conducted by Wang et al. Another Chinese study conducted by Xing et al demonstrated that CSEA did not increase the risk of postpartum PFD in primiparous women.[22] According to the results of our study and the studies mentioned above, it is possible that neither epidural analgesia nor CSEA has any negative effect on postpartum PFM function. But this conclusion should be confirmed by the large, prospective studies.

Limitations

The small sample size is the main limitation of this study. In this study, we observed a prolonged second stage of labor and higher PFDI-20 scores in primiparas with labor analgesia.

But these changes were not associated with reduced PFM function. Lack of enough sample size and observation time may contribute to this situation. Furthermore, primiparas in this study had higher episiotomy rate compared with other areas, and lower BMI compared with other populations. These factors may limit the application of this study.

Conclusion

In conclusion, our results showed that the patient's choice of analgesia during the delivery did not have a higher risk of pelvic floor functional problems after delivery, but the results should be confirmed by studies with larger sample sizes and longer observations.

Ethical Approval

This study was conducted in accordance with the Declaration of Helsinki and approved by the ethics committee of Beijing Hospital. Ethical certificate number: 2019BJYYEC-014–02.

Informed Consent

All participants informed and consent to participate in this study.

Authors' Contributions

L.A. and L.M. contributed toward conception and design. L. J. and G.T. did the data acquisition. F.Q., D.W., and W.S. analyzed and interpreted the data. F.Q., D.W., and W.S. drafted the manuscript. All authors read and approved the final manuscript.

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Conflict of Interest

None declared.

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