

## WOMEN'S SEXUAL HEALTH

# Effect of Epidural Analgesia on Pelvic Floor Dysfunction at 6 Months Postpartum in Primiparous Women: A Prospective Cohort Study



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## ABSTRACT

**Introduction:** Epidural analgesia has become a universal intervention for relieving labor pain, and its effect on the pelvic floor is controversial.

**Aim:** To investigate the effect of epidural analgesia on pelvic floor dysfunction (PFD) in primiparous women at 6 months postpartum.

**Methods:** We performed a prospective cohort study involving 150 primiparous women in preparation for vaginal delivery, with 74 (49.3%) receiving epidural analgesia. Baseline demographic and intrapartum data were collected. At 6 months postpartum, PFD symptoms, including stress urinary incontinence, overactive bladder, defecation disorder, pelvic organ prolapse, and 4 kinds of sexual dysfunction (arousal disorder, low sexual desire, dyspareunia, and orgasm disorder), were evaluated. Pelvic floor muscle (PFM) function and postpartum depression were also assessed. Multivariate logistic regression was applied to identify factors associated with the PFD symptoms affected by epidural analgesia.

**Main outcome measure:** PFD symptoms and sexual dysfunction were evaluated through Pelvic Floor Distress Inventory-20 (PFDI-20) and Female Sexual Function Index (FSFI-12). PFM function was examined with palpation and surface electromyography (sEMG). Postpartum depression was assessed using Self-Rating Depression Scale (SDS).

**Results:** At 6 months postpartum, women who delivered with epidural analgesia had a higher incidence of dyspareunia (43.2% vs 26.3%,  $P < 0.05$ ) and longer first, second, and total stage of labor durations ( $P < 0.01$ ) than those who without. No significant difference in other PFD symptoms or PFM function was found between the 2 groups ( $P > 0.05$ ). Multivariate logistic regression revealed that epidural analgesia (OR = 3.056, 95% CI = 1.217-7.671) and SDS scores (OR = 1.066, 95% CI = 1.009-1.127) were independent risk factors for dyspareunia.

**Conclusion:** At 6 months postpartum in primiparous women, epidural analgesia was associated with an increased risk of postpartum dyspareunia and longer labor durations, which deserves attention for rehabilitation after delivery. Future studies with a larger sample size are needed to evaluate the impact of epidural analgesia on other PFD symptoms. **Du J, Ye J, Fei H, et al. Effect of Epidural Analgesia on Pelvic Floor Dysfunction at 6 Months Postpartum in Primiparous Women: A Prospective Cohort Study. Sex Med 2021;9:100417.**

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**Key Words:** epidural analgesia; pelvic floor dysfunction; sexual dysfunction; dyspareunia

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## INTRODUCTION

Pelvic floor dysfunction (PFD) is a universal problem faced by millions of women throughout the world and consists of a series of bothersome symptoms, such as stress urinary incontinence (SUI), overactive bladder (OAB), defecation disorder, pelvic organ prolapse (POP), and sexual dysfunction. It has been reported that PFD negatively influences quality of life, body image and daily activities in approximately 46% of women<sup>1</sup>. The etiopathology of PFD is multifactorial, and child birth, especially

vaginal delivery, is a crucial contributing factor acknowledged by numerous studies.<sup>2-4</sup> The structure of the pelvic floor is complex, with multiple layers of fascia, muscles, and ligaments covering and attaching the pelvic outlet, which play an essential role in pelvic floor function, including supporting, opening, closing, and sexual activities. Vaginal delivery can cause the structure to be overstretched and lead to irreversible anatomical and functional damage.<sup>5</sup> As the Prolapse and Incontinence Long-term (PROLONG) study<sup>6</sup> reported, vaginal delivery increase the odds of urinary incontinence by 50% and POP by 90% compared to cesarean delivery 12 years after index delivery, and the odds were even higher 20 years after first childbirth in the Swedish Pregnancy, Obesity, and Pelvic Floor (SWEPOP) study.<sup>7</sup>

In recent years, the utilization of epidural analgesia during vaginal delivery has increased to reduce labor pain.<sup>8</sup> From neuraxial techniques to patient-controlled epidural analgesia (PCEA) and programmed intermittent epidural boluses (PIEB), the safety and efficacy of epidural analgesia have improved to enhance women's satisfaction with the childbirth experience.<sup>9</sup> However, a growing number of studies have reported various adverse side effects of epidural analgesia on vaginal delivery, such as an increased risk of cesarean section, urinary retention, and hypotension.<sup>10</sup> As a Cochrane review in 2018 summarized, women receiving epidural analgesia had longer first and second stages of labor<sup>11</sup>, and a randomized controlled study<sup>12</sup> indicated that PCEA prolongs labor duration by inhibiting the activity of uterine and abdominal muscle and nerves.

As a longer second stage of delivery has a strong relationship with levator ani muscle injury (LAMI), which plays an important role in the negative effect of vaginal delivery on PFD,<sup>13</sup> would epidural analgesia contribute to PFD through muscle injury caused by prolonged labor duration? Studies on the effects of epidural analgesia on PFD are rare and usually cover just a few symptoms of PFD and show nonsignificant relationships between them.<sup>14,15</sup> The purpose of this study was to investigate whether the use of epidural analgesia was associated with a wider scale of PFD symptoms, including SUI, OAB, defecation disorder, POP, and 4 kinds of sexual dysfunction.

## METHOD

### Study Design

This is a prospective, observational cohort study conducted from May 1, 2019, to November 1, 2020 in the Pelvic Floor Disorder Center, the Seventh Affiliated Hospital of Sun Yat-sen University. Women with and without epidural analgesia during vaginal delivery were recruited, and the association between epidural analgesia and 8 PFD symptoms (SUI, OAB, defecation disorder, POP, and 4 kinds of sexual dysfunction including arousal disorder, low sexual desire, dyspareunia, and orgasm disorder) was analyzed. The study was approved by the Ethics Committee of the Seventh Affiliated Hospital of Sun Yat-sen University.

### Participants

Women included in the study were primiparas at 37-41 weeks gestation with singleton and cephalic presentation and were preparing to give birth vaginally in the delivery room. Exclusion criteria were a history of miscarriage or abortion, multiple pregnancies, preterm delivery, severe diseases of mother or child, a history of PFD symptoms before delivery, the presence of epidural analgesia contradictions including infectious diseases, spinal trauma, and other conditions unsuitable for epidural analgesia as judged by the anesthetists. The history of PFD symptoms was assessed to exclude those who already had PFD symptoms during or before pregnancy by PFDI-20, FSFI questionnaires, and several examinations, which would be stated in detail in the outcome measurements. They were informed of the purpose and process of our study. The decision to use epidural analgesia was made by each participant herself, and written consent was required to confirm participation in our study. Six months after delivery, they were asked to return to the hospital and their pelvic floor function was evaluated.

### General Data Collection

Before delivery, the participants' baseline data were collected verbally, including age, body mass index (BMI), gestational age, BMI change during pregnancy, and lactation status. Intrapartum data, including labor duration, amount of bleeding, and degree of perineal tears, and birth data, including neonatal head circumference and birth weight, were recorded from the obstetric journal.

### Protocol of Epidural Analgesia

Patient-controlled epidural analgesia (PCEA) was administered at the participants' request. For those who requested PCEA, epidural space puncture and catheterization were performed when the cervix was dilated 2-3 cm, while no puncture or any analgesics were applied to those who did not request epidural analgesia. Fetal heart monitoring was conducted in both groups, and uterine contractions, progress of labor, and vital signs were observed. For the PCEA group, the anesthetist placed the catheter at the L2-L3 intervertebral space after puncture, and it was moved toward the head 4 cm and then fixed. After a PCEA pump was connected to the catheter, an initial bolus of 10 mL of 0.075% ropivacaine with 240 mL sufentanil (0.4  $\mu\text{g}/\text{mL}$ ) was administered prior to the exclusion of total spinal anesthesia with the infusion of 1% lidocaine 3 ml as a test dose. The same solution of the mixture at 2 mL/h was used to maintain the analgesia, and an infusion of a 6-10 mL bolus sustained for 3 minutes was administered at 60 minutes intervals. The participants in the PCEA group were asked not to push the pump after the cervix was fully dilated while the background infusion persisted. If perineal suture was required after delivery of the placenta, the PCEA pump could be pressed, and postpartum analgesia was continued for 24 hours before the catheter was removed.

## Outcome Measurements

**Primary outcome.** The primary outcome at 6 months postpartum was the prevalence of the 8 PFD symptoms. The diagnosis of different PFD symptoms was in accordance with the latest guidelines and the questionnaires, including the validated Chinese versions of the Pelvic Floor Distress Inventory-20 (PFDI-20)<sup>16</sup> and the Female Sexual Function Index (FSFI).<sup>17</sup> The PFDI-20 is a currently widely used questionnaire recommended by the International Continence Society (ICS) that measures PFD symptoms and their impact on quality of life based on the widely acknowledged definitions of different PFD symptoms. In the present study, SUI was defined as a non-zero answer to question 17 “Do you usually experience urine leakage related to coughing, sneezing, or laughing?”, OAB as a positive answer to question 15 or 16 “frequent urination” or “urine leakage associated with a feeling of urgency”, defecation disorder as a positive answer to question 4 or 8 “the feeling of incomplete bowel emptying” or the need to “push on the vagina or around the rectum to have or complete a bowel movement”. The FSFI is a brief self-reported scale of female sexual function composed of 19 items separated into 6 subscales assessing sexual desire, orgasm, arousal, satisfaction, and dyspareunia, with each item given a score of 0-5 or 1-5. Sexual dysfunction of each domain consisting of low sexual desire, arousal disorder, dyspareunia, and orgasm disorder was defined as scores <65% of the maximum achievable scores in that domain.<sup>18</sup>

The Pelvic Organ Prolapse Quantification (POP-Q) System<sup>19</sup> was used to assess the stage of POP. The participants were asked to stay in the lithotomy position, and then the anatomic positions of six defined points, two on the anterior vaginal wall (Aa and Ba), two on the posterior vaginal wall (Ap and Bp), and two on the distal terminal of the uterus/fornix (C and D), were measured in centimeters with a ruler. According to the measurement results, the POP stages of the anterior vaginal wall, posterior vaginal wall, and uterus/fornix were graded from 0~4 and recorded.

**Secondary outcome.** The strength of pelvic floor muscle (PFM) and surface electromyography (sEMG) were measured at the follow-up, and a Chinese version of the Self-Rating Depression Scale<sup>20</sup> was used for the assessment of depression.

To examine the strength of PFM, the participants were placed in a supine position with the index finger placed inside the vagina and forcing moderate pressure over the muscle to help induce appropriate contractions. As a maximal voluntary contraction (MVC) was reached, the strength of PFM could be evaluated and recorded. Referring to the Oxford grading system, the strength of PFM was graded from 0 to 5 (0 = no contraction, 1 = flicker, 2 = weak contraction, 3 = moderate contraction, 4 = good contraction, and 5 = strong contraction).<sup>21</sup>

The sEMG was conducted through a Glazer protocol.<sup>22</sup> The participants in a supine position with their bladders emptied were asked to flex their hips and knees while their legs were

supported to keep them relaxed. Then, a probe with a tiny diameter was inserted into the vagina, and the sensor was positioned on the lateral vaginal wall. The average mean amplitude ( $\mu v$ ) of pre-baseline rest, type I (slow) and type II (fast) muscle contraction, and post-baseline rest were recorded.

The Self-Rating Depression Scale (SDS) is a form with a series of questions assessing both psychological and somatic symptoms of depression and is often used for primary screening of depression. A higher score reflects more severe symptoms of postpartum depression.

## Statistical Analysis

The sample size calculation was based on the prevalence of dyspareunia at 6 months postpartum (37.5%), which was the highest among the 8 PFD symptoms according to the available literature<sup>23-25</sup> and the data of our institution, considering a lack of referential examples evaluating the effect of epidural analgesia on the 8 symptoms. We estimated that 78 participants per group would be required to detect a 22% increase or decrease in the rate of dyspareunia for the intervention of epidural analgesia using two-tailed  $\alpha = 0.05$  and power = 0.80. The target sample size was enlarged to 100 per group to account for possible dropouts and patient loss.

Continuous variables with a normal distribution are presented as the mean  $\pm$  standard deviation (SD), and those with a nonnormal distribution are presented as the median (interquartile range). Categorical variables are presented as numbers (percentages). Continuous outcomes were compared using independent sample t test or Mann-Whitney U test if they were not normally distributed, and categorical data were compared with the  $\chi^2$  test or Fisher exact test. Logistic regression was used to adjust for possible covariates that were published in previous literature, including age, BMI, gestational age, BMI change during pregnancy, first and second labor durations, amount of bleeding, degree of perineal tears, neonatal head circumference, and birth weight.<sup>26,27</sup>

## RESULT

### Population and Characteristic

A total of 256 primiparous women who met the inclusion criteria initially approached enrollment, while 208 of them provided written informed consent. During delivery, 19 enrolled women with indications were transferred to the operating theater for cesarean section, and 4 had forceps application; therefore, data from these women were excluded. Thirty-five enrolled women could not complete the 6-month follow-up, and at the end, 150 were included in the final analysis, of which 74 (49.3%) delivered with epidural analgesia and 76 (50.7%) without epidural analgesia (Figure 1). The characteristics of the participants who completed the study are shown in Table 1. There was no difference in the baseline information between those who received epidural analgesia and those who did not.

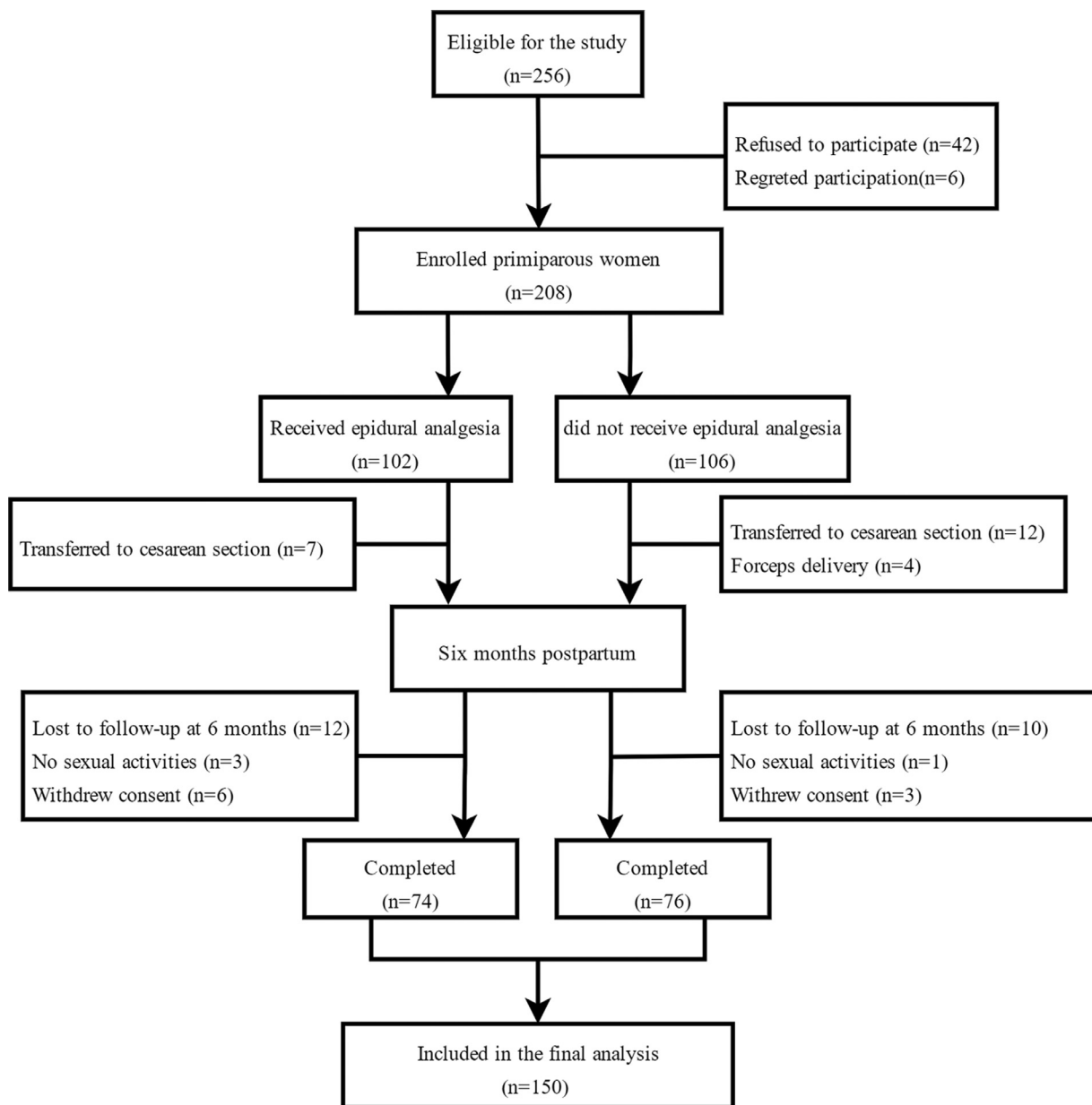


Figure 1. Flow chart of the study

### Effect of Epidural Analgesia on Intrapartum and Birth Events

The use of epidural analgesia was associated with the first, second, and total stage of labor durations, which were significantly longer than those without using epidural analgesia (Table 2,  $P < 0.01$ ). There was no significant difference in other intrapartum and neonatal results, such as the third labor stage duration, degree of perineal tears, amount of bleeding, neonatal head circumference, or birth weight.

### Effect of Epidural Analgesia on PFD and Depression Outcomes

At 6 months postpartum, participants who received epidural analgesia had similar incidences of SUI (23.0%), defecation

disorder (28.4%), OAB (35.1%), arousal disorder (4.1%), low sexual desire (27.0%), and orgasm disorder (17.6%) as those who did not (28.9%, 30.3%, 31.6%, 11.8%, 32.9%, 17.1%, respectively), without any significant difference ( $P > 0.05$ ). Among those who received epidural analgesia, 32 (43.2%) had dyspareunia, and this rate was significantly higher than in those who did not receive epidural analgesia (20, 26.3%;  $P < 0.05$ ). No significant difference was identified when comparing the POP stage, strength of pelvic floor muscle, and sEMG and SDS scores between the two groups. Table 3 presents the comparison of PFD rates, pelvic floor measurements, and SDS scores between women using/not using epidural analgesia.

Noticing the effect of epidural analgesia on dyspareunia, we carried out an adjusted logistic regression model to identify other

**Table 1.** Baseline information of the participants having completed the study

Variable	Total (n = 150)	No epidural analgesia (n = 76)	Epidural analgesia (n = 74)	Z/ $\chi^2$	P
Age at inclusion (years)				1.912	0.384
<25	25 (16.7%)	14 (18.4%)	11 (14.9%)		
25-29	82 (54.7%)	44 (57.9%)	38 (51.4%)		
$\geq 30$	43 (28.7%)	18 (23.7%)	25 (33.8%)		
Gestational age (days)	277 (272, 282)	276 (272, 281)	278 (272, 284)	0.920	0.358
Lactation					
6 weeks	137 (91.3%)	72 (94.7%)	65 (87.8%)	2.254	0.133
6 months	121 (80.7%)	65 (85.5%)	56 (75.7%)		
BMI at inclusion (kg/m <sup>2</sup> )				0.082	0.960
<25.0	82 (54.7%)	41 (53.9%)	41 (55.4%)		
25.0-29.9	57 (38.0%)	29 (38.2%)	28 (37.8%)		
$\geq 30.0$	11 (7.3%)	6 (7.9%)	5 (6.8%)		
BMI change during pregnancy (kg/m <sup>2</sup> )				2.221	0.329
<4.0	25 (16.7%)	15 (19.7%)	10 (13.5%)		
4.0-5.9	78 (52.0%)	41 (53.9%)	37 (50.0%)		
$\geq 6.0$	47 (31.3%)	20 (26.3%)	27 (36.5%)		

Data are presented as number (percentage), or median (range).  
BMI, Body mass index.

factors associated with dyspareunia. In the univariate analysis (Table 4), epidural analgesia and SDS scores were associated with dyspareunia ( $P < 0.05$ ). The multivariate model (Table 5) showed that both epidural analgesia (OR = 3.056, 95% CI = 1.217-7.671,  $P < 0.05$ ) and SDS scores (OR = 1.066, 95% CI = 1.009-1.127) were independently associated with an increased risk of dyspareunia, which was adjusted for age, BMI, gestational age, BMI change during pregnancy, first and second labor stage durations, amount of bleeding, degree of perineal tears, episiotomy, neonatal head circumference, birth weight, depression, and lactation.

## Other Findings

Women who underwent episiotomy had a longer second stage of labor duration than those who did not (median, 89.5; interquartile range [IQR], 56.5-145.75 vs median, 53.5; IQR, 28.5-84.5,  $P < 0.001$ ).

## DISCUSSION

In this prospective study evaluating the effect of epidural analgesia on PFD at 6 months postpartum among primiparous women who delivered vaginally, we found that epidural analgesia was associated with an increased risk of dyspareunia, and the participants using epidural analgesia had longer first, second, and total labor stage durations. Other PFD symptoms we investigated were not associated with epidural analgesia.

Postpartum PFD has been confirmed to be correlated with several gestational and intrapartum factors, such as maternal age, BMI, vaginal delivery, parity, and perineal tears.<sup>1,28,29</sup> Few studies have investigated the effects of epidural analgesia on postpartum PFD, and most of them focused on urinary incontinence, POP, and pelvic floor anatomic and physiological

changes,<sup>14,15,30-32</sup> with a weak association found between SUI and epidural analgesia (OR = 1.2, 95% CI = 1.0-1.5)<sup>33</sup> which was not significant among primiparous women. Therefore, we believe our study is innovative and provides important information. It is worth noting that women who used epidural analgesia were 16.9% more likely to have dyspareunia than those who did not, which was a novel finding.

Consistent with a systemic review<sup>34</sup> that reported the prevalence of dyspareunia as 43% at 2-6 months postpartum and 22% at 6-12 months postpartum, 34.7% of the primiparous women had dyspareunia in the present study. The type of delivery, episiotomy, perineal lacerations, lactation, and depression have been regarded as risk factors for dyspareunia.<sup>34,35</sup> Several studies have investigated the effect of perineal tears and episiotomy on dyspareunia and concluded that the incidence of dyspareunia develops with progressive perineal tears and episiotomy.<sup>35,36</sup> Moreover, perineal lacerations and episiotomy were found to be associated with a longer second stage of labor duration.<sup>37</sup> Due to the routine usage of episiotomy once the perineum tended to have severe laceration in our institution, there were no women with spontaneous perineal tears higher than first-degree in the present study. Both first-degree tears and episiotomy required sutures to repair the laceration or incision. In our study, women who used epidural analgesia had longer first, second, and total stages of labor durations than those who did not, and a longer second stage of labor duration was associated with episiotomy. However, dyspareunia bore no relationship to labor durations or episiotomy. In addition, all of our episiotomy practice was equivalent to second-degree laceration, consistent with a prospective study among primiparous women 12 months postpartum<sup>35</sup> which found that second-degree laceration or episiotomy parallel to it is not a risk factor for dyspareunia.



**Table 2.** Intrapartum and neonatal results according to the use/not use of epidural analgesia.

Variable	Total (n = 150)	No epidural analgesia (n = 76)	Epidural analgesia (n = 74)	Z/t/ $\chi^2$	P
First stage duration (min)*				4.06	<0.001
<360	31 (20.7%)	24 (31.6%)	7 (9.5%)		
360-719	61 (40.7%)	34 (44.7%)	27 (36.5%)		
720-1079	39 (26.0%)	11 (14.5%)	28 (37.8%)		
≥1080	19 (12.7%)	7 (9.2%)	12 (16.2%)		
Second stage duration (min)				-2.741	<0.01
<60	62 (41.3%)	40 (52.6%)	22 (29.7%)		
60-119	49 (32.7%)	20 (26.3%)	29 (39.2%)		
120-179	26 (17.3%)	13 (17.1%)	13 (17.6%)		
≥180	13 (8.7%)	3 (3.9%)	10 (13.5%)		
Third stage duration (min)				0.899	0.688
<10	117 (78.0%)	61 (80.3%)	56 (75.7%)		
10-19	27 (18.0%)	13 (17.1%)	14 (18.9%)		
≥20	6 (4.0%)	2 (2.6%)	4 (5.4%)		
Total duration of labor (min)				3.636	<0.001
<360	20 (13.3%)	16 (21.1%)	4 (5.4%)		
360-719	54 (36.0%)	32 (42.1%)	22 (29.7%)		
720-1079	50 (33.3%)	19 (25.0%)	31 (41.9%)		
≥1080	26 (17.3%)	9 (11.8%)	17 (23.0%)		
Degree of tear				0.029	0.865
No/ First	72 (48.0%)	37 (48.7%)	35 (47.3%)		
Second (episiotomy <sup>†</sup> )	78 (52.0%)	39 (51.3%)	39 (52.7%)		
Amount of bleeding (ml)				0.507	0.876
<250	87 (58.0%)	46 (60.5%)	41 (55.4%)		
250-499	57 (38.0%)	27 (35.5%)	30 (40.5%)		
≥500	6 (4.0%)	3 (3.9%)	3 (4.1%)		
Neonatal head circumference (cm)				2.651	0.266
<34	79 (52.7%)	45 (59.2%)	34 (45.9%)		
34	57 (38.0%)	25 (32.9%)	32 (43.2%)		
≥35	14 (9.3%)	6 (7.9%)	8 (10.8%)		
Birth weight (g)				4.794	0.187
<2999	35 (23.3%)	23 (30.3%)	12 (16.2%)		
3000-3499	83 (55.3%)	39 (51.3%)	44 (59.5%)		
3500-3999	28 (18.7%)	13 (17.1%)	15 (20.3%)		
≥4000	4 (2.7%)	1 (1.3%)	3 (4.1%)		

Data are presented as number (percentage).

\*Definition of the labor duration, first stage: begins with labor onset and ends with full cervical dilation to 10 cm; second stage: starts with complete cervical dilation to and ends with the neonatal birth; third stage: starts when the fetus is delivered and ends with the delivery of the placenta.

†Definition of episiotomy, a surgical incision of the vagina and perineum to enlarge the vaginal opening during the birth process. There were no spontaneous tears higher than first-degree in our study. Our episiotomy practice was equivalent to second-degree.

Previous studies exploring the effect of epidural analgesia on postpartum depression have reached polarizing conclusions. In a prospective study containing 214 parturients, Ding et al.<sup>38</sup> identified epidural analgesia as a protective factor for postpartum depression, whereas a meta-analysis of observational studies<sup>39</sup> suggested that epidural analgesia did not confer protection against developing postpartum depression. It is widely acknowledged that women with postpartum depression have an increased risk of dyspareunia.<sup>36</sup> In our study, more severe depression symptoms were also associated with a higher risk of dyspareunia, but epidural analgesia did not influence the outcome of

depression. We are cautious about our results because depression symptoms were evaluated using SDS in our study, instead of the Edinburgh postnatal depression scale (EPDS) which was used in most of previous studies<sup>39</sup> and may be more sensitive; further, the simultaneous evaluation of dyspareunia and depression couldn't exclude the depression caused by dyspareunia itself or other sexual problems. In addition, lactation was regarded as a risk factor for postpartum dyspareunia,<sup>36</sup> and the dyspareunia rate was also reported to be decreased among primiparous women using epidural analgesia.<sup>40</sup> In our study, women who used epidural analgesia and those who had dyspareunia had a

**Table 3.** Comparison of PFD and depression outcomes and depression between women using/not using epidural analgesia.

Variable	Total (n = 150)	No epidural analgesia (n = 76)	Epidural analgesia (n = 74)	Z/t/x2	P
SUI	39 (26.0%)	22 (28.9%)	17 (23.0%)	0.696	0.404
Defecation disorder	44 (29.3%)	23 (30.3%)	21 (28.4%)	0.064	0.800
OAB	50 (33.3%)	24 (31.6%)	26 (35.1%)	0.213	0.644
Sexual dysfunction					
Arousal disorder	12 (8.0%)	9 (11.8%)	3 (4.1%)	3.09	0.079
Low sexual desire	45 (30.0%)	25 (32.9%)	20 (27.0%)	0.615	0.433
Dyspareunia	52 (34.7%)	20 (26.3%)	32 (43.2%)	4.743	0.029
Orgasm disorder	26 (17.3%)	13 (17.1%)	13 (17.6%)	0.006	0.94
POP stage					
Anterior vaginal wall				0.803	0.249
No	8 (5.3%)	3 (3.9%)	5 (6.8%)		
Stage I	133 (88.7%)	70 (92.1%)	63 (85.1%)		
Stage II	9 (6.0%)	3 (3.9%)	6 (8.1%)		
Uterus/fornix				0.751	0.439
No	6 (4%)	2 (2.6%)	4 (5.4%)		
Stage I	144 (96%)	74 (97.4%)	70 (94.6%)		
Posterior vaginal wall				0.41	1.000
No	34 (22.7%)	17 (22.4%)	17 (23.0%)		
Stage I	113 (75.3%)	57 (75.0%)	56 (75.7%)		
Stage II	3 (2.0%)	2 (2.6%)	1 (1.4%)		
Strength of PFM					
Type I muscle				0.931	0.352
0	4 (2.7%)	3 (3.9%)	1 (1.4%)		
1	84 (56.0%)	39 (51.3%)	45 (61.8%)		
2	38 (25.3%)	19 (25.0%)	19 (25.7%)		
3	17 (11.3%)	9 (11.8%)	8 (10.8%)		
4	7 (4.7%)	6 (7.9%)	1 (1.4%)		
Type II muscle				0.359	0.719
0	4 (2.7%)	3 (3.9%)	1 (1.4%)		
1	25 (16.7%)	14 (18.4%)	11 (14.9%)		
2	69 (46%)	30 (39.5%)	39 (52.7%)		
3	32 (21.3%)	16 (21.1%)	16 (21.6%)		
4	16 (10.7%)	10 (13.2%)	6 (8.1%)		
5	4 (2.7%)	3 (3.9%)	1 (1.4%)		
sEMG ( $\mu$ v)					
Pre-baseline rest	6.53 (4.32, 9.07)	6.65 (4.67, 9.05)	6.53 (4.17, 9.11)	0.556	0.578
Type I muscle	19.60 (13.36, 27.98)	21.39 (13.94, 31.37)	18.36 (13.00, 24.77)	1.716	0.086
Type II muscle	33.29 (24.02, 46.63)	35.64 (25.89, 55.99)	31.43 (23.51, 39.36)	1.861	0.063
Post-baseline rest	7.02 (4.60, 10.07)	7.18 (4.71, 10.55)	6.56 (3.88, 9.27)	1.492	0.136
SDS score	28.50 (24.00, 35.00)	30.00 (24.25, 35.75)	27.00 (24.00, 34.00)	-0.723	0.470

Data are presented as number (percentage), or median (range).

SUI, stress urinary incontinence; OAB, overactive bladder; POP, pelvic floor organ prolapse; PFM, pelvic floor muscle; sEMG, surface electromyography.

higher lactation rate, but these relationships showed no statistical significance, perhaps due to the small sample size or a considerable lactation rate of over 80% after our routine encouragement of breastfeeding.

The role of epidural analgesia in postpartum PFM function is controversial. Ruan et al.<sup>14</sup> found that epidural analgesia increased the pre-rest and post-rest muscle tone of the pelvic floor, indicating higher tension of pelvic floor muscles at 6 weeks postpartum in a retrospective study containing 506 primiparas. Several studies

observed the effect of epidural analgesia on PFM strength, endurance, and other indicators at 2 to 10 months but found no associations between them.<sup>15,30,31</sup> No significant difference was found between the current study groups with regard to PFM strength and sEMG. Therefore, there is uncertainty regarding whether epidural analgesia has an effect on PFM function.

Although epidural analgesia was found to be associated with dyspareunia and longer labor durations at 6 months postpartum, the other PFD symptoms did not seem to be affected by epidural

**Table 4.** Univariate analysis of factors associated with dyspareunia

Variable	Total (n = 150)	Not dyspareunia (n = 98)	Dyspareunia (n = 52)	Z/t/x <sup>2</sup>	P
Age at inclusion (years)				1.201	0.230
<25	25 (16.7%)	19 (19.4%)	6 (11.5%)		
25-29	82 (54.7%)	53 (54.1%)	29 (55.8%)		
≥30	43 (28.7%)	26 (26.5%)	17 (32.7%)		
Gestational age (days)	277 (272, 282)	276.5 (272, 281.5)	278 (272, 284)		
Lactation					
6 weeks	137 (91.3%)	89 (90.8%)	48 (92.3%)	0.095	0.757
6 months	121 (80.7%)	78 (79.6%)	43 (82.7%)	0.209	0.647
BMI at inclusion (kg/m <sup>2</sup> )				-1.074	0.283
<25	82 (54.7%)	51 (52.0%)	31 (59.6%)		
25-29.9	57 (38.0%)	38 (38.8%)	19 (36.5%)		
≥30	11 (7.3)	9 (9.2%)	2 (3.8%)		
BMI change during pregnancy (kg/m <sup>2</sup> )				-1.018	0.309
<4	25 (16.7%)	17 (17.3%)	8 (15.4%)		
4-5.9	78 (52.0%)	46 (46.9%)	32 (61.5%)		
≥6	47 (31.3%)	35 (35.7%)	12 (23.1%)		
Epidural analgesia	74 (49.3%)	42 (42.9%)	32 (61.5%)	4.743	0.029
First stage duration (min)				0.947	0.344
<360	31 (20.7%)	19 (19.4%)	12 (23.1%)		
360-719	61 (40.7%)	46 (46.9%)	15 (28.8%)		
720-1079	39 (26.0%)	22 (22.4%)	17 (32.7%)		
≥1080	19 (12.7%)	11 (11.2%)	8 (15.4%)		
Second stage duration (min)				1.619	0.105
<60	62 (41.3%)	47 (48.0%)	15 (28.8%)		
60-119	49 (32.7%)	27 (27.6%)	22 (42.3%)		
120-179	26 (17.3%)	14 (14.3%)	12 (32.1%)		
≥180	13 (8.7%)	10 (10.2%)	3 (5.8%)		
Third stage duration (min)				1.003	0.316
<10	117 (78.0%)	79 (80.6%)	38 (73.1%)		
10-19	27 (18.0%)	15 (15.3%)	12 (23.1%)		
≥20	6 (4.0%)	4 (4.1%)	2 (3.8%)		
Total stage duration (min)				0.874	0.382
<360	20 (13.3%)	13 (13.3%)	7 (13.5%)		
360-719	54 (36.0%)	38 (38.8%)	16 (30.8%)		
720-1079	50 (33.3%)	32 (32.7%)	18 (34.6%)		
≥1080	26 (17.3%)	15 (15.3%)	11 (21.2%)		
Degree of tear				0.453	0.501
No/ First	72 (48.0%)	49 (50.0%)	23 (44.2%)		
Second (Episiotomy)	78 (52.0%)	49 (50.0%)	29 (55.8%)		
Amount of bleeding (ml)				0.369	0.712
<250	87 (58.0%)	58 (59.2%)	29 (55.8%)		
250-499	57 (38.0%)	36 (36.7%)	21 (40.4%)		
≥500	6 (4.0%)	4 (4.1%)	2 (3.8%)		
Neonatal head circumference (cm)				0.283	0.777
<34	79 (52.7%)	53 (54.1%)	26 (50.0%)		
34	57 (38.0%)	35 (35.7%)	22 (42.3%)		
≥35	14 (9.3%)	10 (10.2%)	4 (7.7%)		
Birth weight (g)				-0.572	0.567
<2999	35 (23.3%)	23 (23.5%)	12 (23.1%)		
3000-3499	83 (55.3%)	52 (53.1%)	31 (59.6%)		
3500-3999	28 (18.7%)	19 (19.4%)	9 (17.3%)		
≥4000	4 (2.7%)	4 (4.1%)	0		
SDS score	28.50 (24.00, 35.00)	27.00 (23.00, 33.00)	32.00 (25.00, 37.75)	2.384	0.017

Data are presented as number (percentage), or median (range).



**Table 5.** Multivariate analysis of dyspareunia\*

Variable	Adjusted Odds ratio (95% CI)	P
SDS score	1.066 (1.009, 1.127)	0.017
Epidural analgesia	3.056 (1.217, 7.671)	0.022

SDS, Self-rating depression scale.

\*Adjusted for age, BMI, gestation age, BMI change during pregnancy, the first and second labor durations, amount of bleeding, degree of perineal tears, episiotomy, neonatal head circumference, birth weight and depression, lactation.

analgesia. The prevalence of dyspareunia decreased over time due to self-rehabilitation of pelvic floor muscle, hormone regulation, and adaptation to postpartum conditions.<sup>34</sup> Therefore, epidural analgesia is still worth recommending in view of its considerable benefit of relieving labor pain. Effect of epidural analgesia on dyspareunia should be noted and managed.

### Strength and Limitation

One of the strengths of this study is its prospective cohort design, which better measures predictors and outcomes and controls confounding variables. Furthermore, there was wide coverage of PFD symptoms, including sexual dysfunctions, in our study, and this is the first time that dyspareunia was found to be associated with epidural analgesia among primiparous women. Moreover, the follow-up period was relatively longer than that in similar studies, which generally evaluated pelvic floor outcomes at a postpartum period of less than 3 months.<sup>14,15,31</sup>

We acknowledge several limitations of this study. One of the major limitations is the restricted sample size. There may be more positive findings if the sample size is enlarged. The examinations were performed by different examiners, and they were not blinded to the participants' information, which may amplify misclassification bias. However, all examinations were conducted by no more than 2 professionally trained physicians, which reduced the measurement error of the examination results to some extent. In addition, as the participants were all Chinese, some policies, such as the usage of episiotomy, varied in different countries. However, this would not influence our results, as a Cochrane review comparing trials from different countries showed that there is little or no difference in long-term dyspareunia, urinary incontinence, or genital prolapse between the selective use and routine use of episiotomy.<sup>41</sup> We used SDS as a screening instrument for postpartum depression; however, SDS was designed for the general population and may be less sensitive for women after delivery. The time point of depression screening should also be advanced to the resumption of sexual behavior so that depression caused by sexual problems can be excluded. As we observed the association between epidural analgesia and 8 PFD symptoms, details of each symptom were neglected to some extent; for example, the severity of dyspareunia was not assessed. Several recognized factors associated with epidural analgesia or dyspareunia, such as relationship status and educational

qualification,<sup>36,40</sup> were not included in the analysis. The number of women resuming physical activities after delivery, especially for PFM exercise, was unknown. Nonetheless, postpartum PFM exercise education is routine for all parturients in our institution. Finally, a randomized controlled trial is needed to confirm the causation between epidural analgesia and dyspareunia and to explore the effect of epidural analgesia on other PFD diseases.

### CONCLUSION

In conclusion, our study in a primiparous cohort showed that epidural analgesia was associated with an increased risk of dyspareunia at 6 months postpartum. Furthermore, women who delivered with epidural analgesia had longer first, second, and total labor stage durations than those who did not. Future studies with larger samples should be planned to investigate the relationship between epidural analgesia and other PFD symptoms at a longer postpartum follow-up. More quantifiable measurements are needed to evaluate the severity of pain symptoms. The time point and instrument for screening postpartum depression should be more rigorous. Regarding the preliminary knowledge about the association between epidural analgesia and dyspareunia, we should pay more attention to the postpartum sexual function of primiparous women using epidural analgesia and improve the postpartum rehabilitation system for them.

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## SUPPLEMENTARY MATERIALS

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