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Original Article

A comparative study of epidural labor analgesia and natural delivery without analgesia

Deying Luo[1], Yuan Yuan[2], Le Guo[1], Zhugen Chen[3]

Departments of [1]Obstetrics and Gynecology, [2]Science and Education, Maternity and Child Care Center of Xinyu, Women and Children's Hospital of Xinyu, Xinyu, Jiangxi Province, China; [3]Department of General Surgery, Fourth Hospital of Xinyu, Xinyu, Jiangxi Province, China

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Abstract: Objective: To investigate the effects of epidural labor analgesia and natural delivery without analgesia on labor duration, pain, uterine continuous contraction time, abnormal labor process and complications. Methods: A total of 220 primiparas in our hospital were selected and divided into two groups according to whether they accepted epidural labor analgesia, including 146 cases in the study group and 74 cases in the blank group. Primiparas in the study group received epidural block analgesia, and those in the blank group received routine labor without analgesia. Duration of the first, second and third stages of labor was observed and recorded. The NRS pain score and uterine continuous contraction time were detected before and after the analgesia. The abnormal situation and complications of primiparas in the two groups were recorded. Results: Compared with those in the blank group, the duration of the first stage of labor and the amount of postpartum hemorrhage in the study group were decreased (all P<0.001). The primiparas' NRS score in the study group was lower than that in the blank group at 10 min, 15 min, 30 min, 60 min and 120 min after analgesia (all P<0.001). The duration of uterine contractions in the study group was lower than that in the blank group at 15 min, 30 min and 60 min after analgesia (all P<0.01). Compared with those in the blank group, primiparas in the study group had a higher probability of active phase arrest in the process of labor (P<0.05). Compared with the blank group, the probability of urinary retention in the study group increased (P<0.05). Conclusion: The effect of epidural labor analgesia is better, which is conducive to shorten the time of the first stage of labor, good analgesic effect, shorter duration of the uterine contraction and higher safety.

Keywords: Epidural block, labor analgesia, natural labor, pain score, complications

Introduction

Delivery is a complex physiological process for women. The fetus leaves the mother's body and appears as a new individual [1].

Women will experience severe labor pain in delivery and pain will run through the whole stage of delivery [2]. The central location of pain is the lower abdomen, which can involve the spine. The second stage of labor is the period of fetal abscission, and the puerpera will be accompanied by burning pain, which easily induces a series of stress reactions [3]. The labor process is divided into three stages. The second and the third stage of labor pain is more severe than that in the first stage. The second stage of labor pain results from nerve impulses and conducts through the body, while the contraction of the placenta causes the third stage of labor pain. Blocking S2-S4 stage upward conduction has an important role in reducing pain. The USA labor analgesia committee pointed out that labor pain has adverse effects on both the mothers and fetuses, so labor analgesia is significant in the process of delivery [4]. The ideal labor analgesia should have little effect on the mother and fetus and have an immediate effect. Epidural analgesia blocks the spinal nerve root with anesthetics, which can paralyze some areas [5]. The analgesic effect of an epidural block after local anesthesia is stable and continuous. Epidural labor analgesia is a safe and effective mode of labor analgesia because the required drug concentration is low and the inhibitory effect on motor nerve block is small [6]. However, some parturients and their families may worry about the impact of labor analgesia on maternal and neonatal outcomes and choose natural childbirth without analgesia.

Whether epidural labor analgesia can reduce maternal pain and stress response and reduce postpartum adverse reactions at the same time has been a difficult problem to solve in the medical field [7]. Whether epidural labor analgesia has adverse effects on the delivery process and outcomes has been controversial. At present, there is no precise data about the impact of epidural analgesia on primipara delivery in China. Therefore, this paper includes primiparas given epidural anesthesia in our hospital from June 2019 to September 2020 and observes the impact of epidural anesthesia on maternal labor analgesia, abnormal situations and delivery outcomes. This study provides a theoretical basis for epidural anesthesia in labor analgesia.

Materials and methods

General information

This prospective study selected 220 primiparas delivered in our hospital from June 2019 to September 2020 and met the inclusion and exclusion criteria. Inclusive criteria: (1) parturients who required vaginal delivery; (2) parturients with first-time delivery; (3) singleton; (4) parturients aged 18-35 years old; (5) parturients with no indication of cesarean section; (6) parturients with ASA grade I-II; (7) parturients without contraindication of epidural anesthesia; (8) parturients who voluntarily participated in the study. Exclusion criteria: (1) parturients who are unable to give birth vaginally; (2) pregnant women with acute labor; (3) parturients who are complicated with uterus scars, placental abruption after placenta previa; (4) parturients who have mental illness; (5) parturients who quit the experiment without reasons. Parturients were divided into two groups according to whether they accept epidural labor analgesia. One hundred and forty-six cases in the study group voluntarily chose epidural labor analgesia, while seventy-four cases in the blank group chose natural labor without analgesia. The two groups of maternal and family members were aware of the experiment's content and signed informed consent. The study was approved by the Ethics Committee of our hospital.

Analgesic methods of epidural anesthesia

Routine guidance of natural childbirth without any analgesic intervention is given to parturients in the control group. Parturients received prenatal knowledge popularization of childbirth, the guidance of correct breathing methods during childbirth and psychological decompression, etc. In the study group, when the uterine orifice opening is more than 2 cm, parturients are kept in the left lateral position. Both hands of parturients are put around the knees. Parturients bent their head to the chest so that the back presents a posterior arch. After skin disinfection, L3-L4 space was selected as the puncture point for epidural puncture. After the puncture point was selected successfully, the epidural catheter was inserted and fixed on the parturients' back. The initial experimental dose was 3 mL of 2% lidocaine (China, Xi'an disai bio Pharmaceutical Co., Ltd.). Five minutes later, if no adverse reactions occurred, an initial dose of 0.08-0.1% ropivacaine (China, Hebei Yipin Pharmaceutical Co., Ltd.) and 5 mL sufentanil citrate (Germany, IDT biologika) mixed solution was given. Then the patient-controlled analgesia pump was connected to the epidural catheter. The dose was 5-7 mL/h, while the intravenous dose was 5 ml. The locking time was 15 min, and the upper limit dose was 30 mL/h. Real-time monitoring of maternal ECG was given before and after medication. The medication was stopped when the uterine orifice was fully open, and the catheter was pulled out 2 hours after the delivery.

Primary outcome measures

Duration of labor and amount of bleeding: The duration of labor (the first, second and third) in the study group and the blank group were recorded, and the amount of bleeding in 24 hours was observed.

NRS score before and after the analgesia: Labor pain was evaluated by the NRS score [8]. Time: before analgesia, 10 min after analgesia, 15 min after analgesia, 30 min after analgesia, 60 min after analgesia and 120 min after analgesia. The scale adopted 10 points. 0 points was painless; 1-3 points were mild pain (no pain in the supine position, mild pain in deep breathing); 4-6 points were moderate pain (persistent pain in supine position); 7-10 points were severe pain (unbearable pain in supine position). The higher the NRS score is, the more severe the pain is.

Duration of uterine contraction before and after analgesia: Y-61 tilted micro-manometer

Table 1. Comparison of general information of the two groups of women

Group	Study group	Blank group	t	*P* value
n	146	74		
Average age (years)	26.8±3.1	27.2±3.2	0.804	0.422
Pregnancy times (times)	1.42±0.66	1.39±0.71	0.311	0.756
Average gestational week (weeks)	39.36±0.89	39.47±0.91	0.860	0.391
Height (cm)	162.01±4.51	161.66±4.38	0.549	0.584
Body weight (Kg)	65.84±7.55	66.20±7.41	0.336	0.737
Body mass index	25.15±2.66	25.18±3.02	0.075	0.940

Table 2. Comparison of labor duration and postpartum hemorrhage between the two groups ($\bar{x}$ ± sd)

Group	n	The first stage of labor (min)	The second stage of labor (min)	The third stage of labor (min)	Postpartum bleeding (mL)
Study group	146	151.3±22.6	81.0±20.5	7.3±1.5	196.0±26.6
Blank group	74	223.2±41.5	78.9±23.8	7.1±1.8	254.1±33.4
t		16.640	0.680	0.872	14.010
P value		<0.001	0.498	0.384	<0.001

(Shanghai Yemao Instrument Co., Ltd., China) was used to measure uterine contraction duration when the intrauterine pressure was more than 40 mmHg. The uterine contraction duration was evaluated before analgesia, 15 min, 30 min, 60 min and 120 min after analgesia.

Secondary outcome measures

Abnormal conditions during labor: The abnormal labor process (active phase arrest, prolonged active phase, the prolonged second stage of labor, abnormal fetal position and oxytocin use) of the two groups was compared.

Complications: The occurrence of gastrointestinal reaction (vomiting), nerve reaction (dizziness), postpartum urinary retention, pruritus and postpartum hemorrhage were observed during and after childbirth. The incidence of neonatal amniotic fluid color change and neonatal asphyxia were observed and calculated.

Statistical analysis

SPSS 23.0 software was used in this study. The duration of labor, pain score and duration of uterine contractions in the two groups were expressed by $\bar{x}$ ± sd and t-test analysis was performed. Independent sample t-test was used between groups and paired sample t-test was used within groups. The abnormal conditions and complications in labor were expressed by n (%) and a chi-square test was performed. The difference was statistically significant when P<0.05.

Results

Comparison of general data between the two groups

The age, pregnancy times, gestational weeks, height, weight and body mass index of the blank group and the study group were comparable (all P>0.05). See **Table 1**.

Comparison of labor duration and postpartum hemorrhage between two groups

Compared with the blank group, the duration of the first stage of labor and the amount of postpartum hemorrhage in the study group were decreased (all P<0.001). There was no significant difference in the duration of other labor stages between the study group and the blank group (all P>0.05). See **Table 2**.

Comparison of NRS scores before and after analgesia between the two groups

There was no significant difference in the NRS score between the study group and the blank group before analgesia (P>0.05). The study group's NRS score was lower than that of the blank group at 10 min, 15 min, 30 min, 60 min and 120 min after analgesia (all P<0.001). See **Table 3** and **Figure 1**.

Table 3. Comparison of NRS scores before and after analgesia between the two groups ($\bar{x} \pm sd$)

Groups	n	Before analgesia (scores)	10 min after analgesia (scores)	15 min after analgesia (scores)	30 min after analgesia (scores)	60 min after analgesia (scores)	120 min after analgesia (scores)
Study group	146	9.15±0.33	4.84±2.10###	3.77±1.56###	3.53±1.62###	3.66±1.31###	3.70±1.14###
Blank group	74	9.10±0.29	9.25±0.63	9.33±0.60	9.45±0.50	9.24±0.57	9.07±0.80
t		1.105	17.650	29.540	30.670	34.970	36.230
P value		0.270	<0.001	<0.001	<0.001	<0.001	<0.001

Note: Compared with those before analgesia in the same group ###P<0.001.

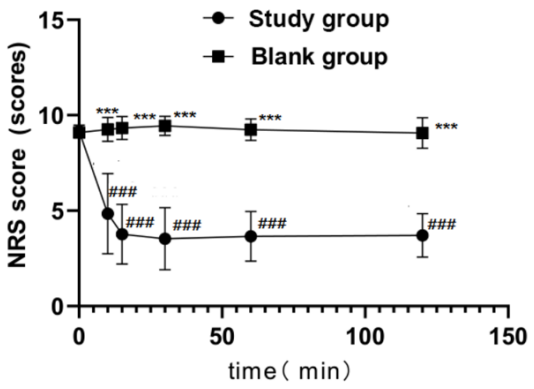

Figure 1. Comparison of NRS scores before and after analgesia between the two groups. Compared with those before analgesia in the same group, ###P<0.001; compared with those in the study group, ***P<0.001.

Comparison of uterine continuous contraction time between two groups before and after analgesia

There was no significant difference in the duration of uterine continuous contraction between the study group and the blank group before and 120 min after analgesia (all P>0.05). Compared with the blank group, the duration of uterine contraction in the study group decreased 15 min, 30 min and 60 min after analgesia (all P<0.01). See **Table 4** and **Figure 2**.

Comparison of an abnormal situation in the process of labor between the two groups

Compared with the blank group, primiparas in the study group had a higher probability of active phase arrest during labor (P<0.05). There was no significant difference in the extension of the active period, the extension of the second stage of labor and the incidence of abnormal fetal position (all P>0.05). See **Table 5**.

Comparison of maternal and neonatal complications between the two groups

Compared with the blank group, the incidence of maternal urinary retention in the study group was higher (P<0.05). There was no significant difference in the incidence of vomiting, dizziness, pruritus, postpartum hemorrhage, neonatal amniotic fluid color change and neonatal asphyxia between the two groups (all P>0.05). See **Table 6**.

Discussion

The natural delivery process takes a long time. During the delivery of the fetus from the uterus through the birth canal, the parturient will feel severe pain, accompanied by a certain degree of anxiety, panic and other negative emotions, which further stimulate the sympathetic nerve, reduce prolactin secretion, and can have a negative impact on the parturient and the newborn [8, 9]. Labor analgesia is to use a variety of methods to reduce or even eliminate the pain during delivery. Epidural labor analgesia is a commonly used method for maternal labor analgesia. Generally, experimental drugs are injected when the uterine orifice is opened to 3 cm-4 cm. Continuous analgesia or patient-controlled analgesia are mostly used to improve maternal labor pain [10, 11].

Epidural anesthesia can shorten the first stage of labor, improve the pain of delivery, help the puerpera maintain physical strength and ensure a smooth delivery. Braga et al. confirmed that compared with natural childbirth without analgesia, the epidural block can improve vaginal and pelvic floor muscle relaxation, reduce the delivery time of the first stage of labor, and improve delivery efficiency via reducing pain [12]. Epidural analgesia for primiparas can significantly reduce the psycho-

Table 4. Comparison of the duration of uterine contraction before and after analgesia between the two groups ($\bar{x}$ ± sd)

Groups	n	Before analgesia (min)	15 min after analgesia (min)	30 min after analgesia (min)	60 min after analgesia (min)	120 min after analgesia (min)
Study group	146	32.05±6.33	28.44±6.64##	28.56±6.27##	29.15±6.21##	38.47±6.22
Blank group	74	31.58±7.04	32.01±7.99	32.28±6.05	34.53±6.34	39.11±4.55
t		0.501	3.513	4.207	6.029	0.785
P value		0.617	0.001	0.001	<0.001	0.433

Note: Compared with those before analgesia in the same group, ##P<0.01.

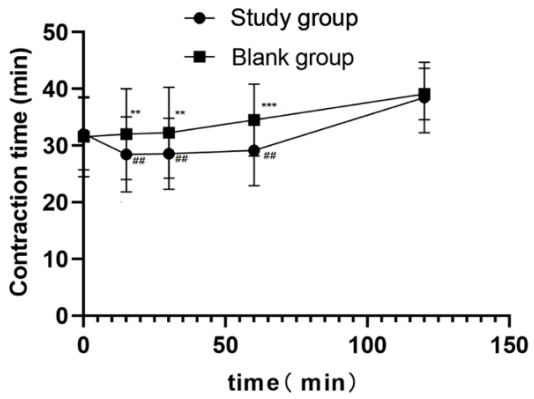

Figure 2. Comparison of the duration of uterine contraction before and after analgesia between the two groups. Compared with that before analgesia in the same group, ##P<0.01; compared with that in the study group, **P<0.01, ***P<0.01.

logical stress caused by pain, reduce the activity of nervous substances, increase the degree of cervical softening, improve the ability of fetal head decline, improve the ability of cervical dilatation, and reduce the time of labor and postpartum hemorrhage [13]. Zhang Guanglan et al. showed that the block of pain perception by epidural anesthesia delays when pregnant women are willing to exert themselves due to the reflection of pelvic floor tissue compressed by the fetal head [14]. The relaxation effect of analgesia on skeletal muscle causes a decrease in the labor force. The relaxation of pelvic floor tissue makes the fetal head unable to smoothly complete the internal rotation, which affects the decline of the fetal head and prolongs the second stage of labor. The results of this paper are different from those of the above study. The duration of the first stage of labor and the amount of postpartum hemorrhage in the study group are lower than those in the blank group. There is no statistical difference in the duration of other stages of labor between the two groups. The results show that epidural anesthesia can reduce the first stage of labor and will not prolong the second and third stages of labor. The difference of results between this study and the above study may be related to the baseline conditions of the included patients, such as age, body mass and the number of subjects.

NRS score is a digital intuitive expression form of the VAS score. Compared with the VAS score, the NRS score can more directly express the body's pain intensity and it is easier for pregnant women to understand and express. NRS score adopts a 10 point system. The higher the score is, the more severe the pain is [15]. This paper confirmed that the study group's epidural analgesia could significantly reduce the NRS score, indicating that epidural block can improve labor pain. Epidural analgesia mostly uses the LCP mode (i.e., loading dose + continuous dose + PCA dose) injection. Blood drug concentration is maintained in effective analgesia through a certain degree of a loading dose of drugs and continuous medication, enhancing the clinical effect and reducing complications. Epidural catheterization directly infuses narcotic analgesics into the epidural plexus to contact nerve roots, hindering the pain conduction of nerve roots, thus inhibiting the generation of pain sensation. Epidural block can play an analgesic role without reducing uterine contraction ability [16]. Epidural anesthesia can block pain signal transduction and significantly inhibit severe pain induced by the painful substances. This study confirmed that the study group's epidural analgesia could significantly reduce the NRS score, indicating that epidural block could improve labor pain, which is similar to the results of Wang C H et al. [17].

Adequate labor analgesia can relieve the pain of the parturient and at the same time have little impact on motor nerves. In particular, good labor analgesia should have no inhibitory effect on the contractility of uterine muscle, abdomi-

Table 5. Comparison of the incidence of abnormal situation in the two groups of women during labor (n, %)

Groups	n	Active phase arrest	Prolonged active phase	Prolonged second stage of labor	Abnormal fetal position
Study group	146	9 (6.16)	3 (2.05)	7 (4.80)	18 (12.33)
Blank group	74	2 (2.78)	1 (1.35)	5 (6.76)	6 (8.11)
χ^2		3.967	0.144	0.332	0.871
P value		0.046	0.704	0.564	0.351

Table 6. Comparison of maternal and neonatal complications between the two groups (n, %)

Groups	Study group	Blank group	χ^2	*P* value
n	146	74		
Maternal complications				
Vomiting	10 (6.85)	6 (8.11)	0.106	0.745
Dizziness	20 (13.70)	8 (10.81)	0.341	0.559
Itchy skin	3 (2.05)	2 (2.70)	0.089	0.765
Postpartum hemorrhage	5 (3.42)	2 (2.70)	0.085	0.771
Urinary retention during delivery	69 (47.26)	20 (27.03)	5.509	0.019
Neonatal complications				
Amniotic fluid color changes	6 (4.11)	1 (1.35)	1.395	0.238
Neonatal asphyxia	6 (4.11)	2 (2.70)	0.292	0.589

nal muscle and levator anal muscle. International literature has confirmed that epidural block has little effect on motor and sensory nerves. Liang et al. indicated that epidural anesthesia could regulate the uterine contraction receptor, up-regulate the level of oxytocin, stimulate the release of PGE2 and PGE2a, induce regular and coordinated uterine contraction and accelerate fetal delivery [18]. This paper shows that the duration of uterine contraction in the study group at 10 min, 30 min and 60 min after analgesia is lower than that in the blank group, indicating that epidural analgesia can block the sympathetic nervous system and have a regulatory effect on uterine contraction. The mechanism is that epidural anesthesia blocks the sympathetic nervous system and can release norepinephrine voluntarily to control and regulate uterine activity [19, 20]. This study shows that the incidence of active phase arrest and the number of oxytocin users in the study group were higher than those in the blank group, which may be related to the rate of uterine orifice dilatation after epidural analgesia. This study shows that the incidence of urinary retention in the study group is higher than that in the blank group. The reason may be that epidural block accelerated the rate of bladder relaxation. The tension of the urethral sphincter is increased when the sympathetic nerve is blocked by epidural analgesia. Besides, the incidence of urinary retention is increased when primiparas keep the supine position. This is similar to the results of Ojo et al. [21, 22].

Due to limited time and small sample size, the experimental results are from a single center. Later, our group will cooperate with other research groups and increase the sample size. We will further refine the experimental content and provide a reference for selecting of analgesic methods for clinical parturients.

In conclusion, epidural labor analgesia has a good effect, which is conduciveto shortening the first stage of labor. Epidural labor analgesia has a good analgesic effect and high safety and can reduce the duration of uterine contractions.

Disclosure of conflict of interest

None.

Address correspondence to: Zhugen Chen, Department of General Surgery, Fourth Hospital of Xinyu, No. 46 Xianlai East Avenue, Xinyu 338000, Jiangxi Province, China. Tel: +86-18007908988; E-mail: chenzhugen5u8o@163.com

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