Intraspinal Block Anesthesia on Vaginal Delivery Parturients and Its Effect on Postpartum Pelvic Floor Muscle Strength and Immune Function

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Objective:At present, intramural block anesthesia is mostly used clinically for vaginal delivery, but it is unclear whether intraocular block anesthesia has an effect on postpartum pelvic floor muscles and immune function after vaginal delivery. Therefore, this study investigated the effect of intraspinal block anesthesia on vaginal delivery parturients and its effect on postpartum pelvic floor muscle strength and immune function.Patients and Methods:A total of 182 parturients with vaginal delivery were selected as the study subjects. They were admitted in our hospital from March 2015 to January 2017. Among them, 92 parturients receiving intraspinal block anesthesia were enrolled in the study group and 90 parturients without intraspinal block anesthesia in the control group. The pelvic floor muscle damage and muscle strength recovery in the two groups were measured 3 months after delivery. The peripheral blood T lymphocyte subsets of parturients at different time points in the two groups was detected to investigate the effect of intraspinal block anesthesia on pelvic floor muscle strength and immune function after vaginal delivery. Results: The pain degree during delivery in the study group was significantly lower than that in the control group ($p<0.05$). The pelvic floor muscle damage, pelvic organ prolapse, pelvic floor function damage and stress urinary incontinence in the study group were all lower than those in the control group ($p<0.05$). The recovery of postpartum pelvic floor muscle strength in the study group was significantly better than that in the control group($p< 0.05$). Both the first and second labor durations in the study group were significantly lower than those in the control group ($p<0.05$).Conclusion:Intraspinal block anesthesia has a better analgesic effect on the vaginal delivery parturients,can effectively shorten the labor. It also has a certain improvement effect on the recovery of postpartum pelvic floor muscle and immune function of parturients.

Keywords: intraspinal block anesthesia, vaginal delivery, pelvic floor muscle strength, immune function

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INTRODUCTION

Vaginal delivery is the best way for women's delivery. However, as the uterine contraction and the head of the fetus descends, the oppression on the pelvic floor will cause severe pain. It is easy to make the parturients' highly nervous and discomfort, resulting in a series of physiological changes that seriously threaten parturients and fetus (1). During maternal labor, due to severe pain and other reasons, the pelvic floor muscles will be damaged to varying degrees, and the contractile tension of the pelvic floor muscles will be reduced, so that the muscle fibers cannot return to the previous state. If the muscles are weak or too long, there would be pelvic floor dysfunction (PFD), such as stress urinary incontinence, bladder prolapse, anterior vaginal wall prolapse(2). The maternal cellular immune function in pregnancy is in a certain state of immunosuppression compared with non-pregnant women. CD4 + T lymphocytes

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are reduced in peripheral blood, CD8 + T lymphocytes are basically unchanged, and the ratio of CD4 + / CD8 + decreases (3). It is very important to take corresponding labor analgesia measures to relieve or eliminate pain during delivery (4). The best labor analgesia features fast onset and simple operation without adverse effects on labor, uterine contraction, mother-infant safety(5).

Intraspinal block anesthesia is now the most widely used drug-induced analgesia with reliable anesthetic effect, which is recognized by the anesthesia physicians (6). Intraspinal block anesthesia can effectively reduce the pain in the whole delivery process. Good analgesic effect can not only improve the internal environment of the parturient, but also improve the safety index of the newborn (7). A previous study has found that the analgesic effective rate of intraspinal block anesthesia is over 95% (8). This article mainly explores the damage of the pelvic floor muscles and the recovery of muscle strength in the two groups of women after delivery, and the levels of T lymphocyte subsets in the peripheral blood of the two groups of women at different time points to explore the effect of intraspinal block anesthesia on postpartum pelvic floor muscle strength and immune function after vaginal delivery.

MATERIALS AND METHODS

Baseline Data

A total of 182 parturients with vaginal delivery were selected as the study subjects. They were admitted in our hospital from March 2015 to January 2017. The parturients voluntarily chose whether to receive anesthesia. Among them, 92 parturients who received intraspinal block anesthesia were divided into the study group, and 90 parturients who did not receive intraspinal block anesthesia were divided into the control group.

Inclusion criteria: accompanied by family members on admission; complete clinical data and good compliance; voluntary cooperation with follow-up survey; with an age of 22 to 40 years old; no vaginitis or urinary system infection; the American Society of Anesthesiologists (ASA) grade Ⅰ - Ⅱ. Exclusion criteria: patients with a history of mental illness or a family history of mental illness; patients with defect in the autoimmune system; patients with a history of severe organ disease; patients with a history of drug dependence; patients with communication disorder due to aphasia, irritability, and unconsciousness.

The study was approved by the ethics committee of our hospital. The patients and their families were informed in advance and a complete informed consent was signed.

Methods

Anesthesia methods

In the study group, patients underwent intraspinal block anesthesia - combined spinal-epidural anaesthesia. Parturients entered the delivery room to establish a venous transfusion. The parturient waited in the lateral position. When the uterus cervix was opened in 1-2 cm, the puncture was performed in the L3-L4 gap. Then 5 μg of sufentanil (Yichang Humanwell Pharmaceutical Co., Ltd., SFDA Approval No. H20054172) (Dilute to 1ml with cerebrospinal fluid)was injected to the subarachnoid (9), and it was found that cerebrospinal fluid flowed from the needle. Insert the epidural catheter through the epidural puncture needle (3cm through the needle mouth), withdraw the epidural puncture needle, cover the puncture point with sterile gauze and connect the fixed catheter with the micro injection analgesia pump. After helping the parturient to turn over and lying on her back, block level by spinal anesthesia was measured.

The analgesic pump was initiated when maternity VAS score was ≥ 3 points. 0.3 μg/ml of sufentanil and 0.143% 1.48mg/ml ropivacaine mixed with analgesic solution were sequentially injected through the epidural space. The maintenance dose was 4ml / h, the load was 5ml, the self-controlled analgesic dose was 7ml, the analgesic level was controlled below T10, and the time was lockedto 20min. In the control group, patients were treated with local anesthesia. Bladder lithotomy position of the parturient was taken. One hand touch the ischial spine and sacrospinous ligament through vagina and cut off the contact between the presenting part and the vaginal wall in this side. The needle was inserted from the middle point between the ischial tuberosity and the anus with an elongated needle. After intradermal injection, it passes through the sacrospinous ligament about 1 cm to the side of the ischial spine under the guidance of another fingers entry into the vagina. There was no blood return by after suction the failure. Then 10 ml ropivacaine was injected (Shanghai yuanye biotechnology co., LTD., item No.: S68348). The needle was removed to subcutaneous tissue and 10ml of 0.375% ropivacaine was injected along the side-cut suture path.

Collecting method of amount of postpartum hemorrhage

The weighing method was used to accurately measure the amount of postpartum hemorrhage at each period from the perineum incision to 24 hoursafter delivery by professionals, Then, the amount of postpartum hemorrhage was converted into volume according to the blood specific gravity:

blood volume (ml) = blood weight (g) ÷ 1.05.

Collection and detection of blood

In the two groups, elbow venous blood (3ml) of parturients was collected and put into heparin anticoagulant tubes at uterine orifice dilation 2-3cm(T), fetus passage (T1) and after delivery (T2) for 24h. Flow cytometry (Beijing Image Trading Co., Ltd., item No.: AMG0002051) was used to detect T cell subsets CD3, CD4, CD8 and CD4/CD8 (kit, Shanghai youyu biotechnology co., LTD., item No.: JM596). Specific steps: the flow cytometer gas threshold was turned on and the pressure was adjusted to obtain a suitable liquid flow velocity. Then the light source was turned on and system was cooled. Deionized water was added to the sample tube and the nozzle system of the flow was rinse. The calibration standard sample was used to adjust instrument so that the fluorescence intensity of 0 and 90 scattering was the strongest based on the laser power, photomultiplier voltage and amplifier circuit gain setting and the coefficient of variation was required to be minimal. The flow rate was selected. The number of cells and parameters were measured. The sample was measured under the same conditions. After the sample has been measured, the liquid fluid system was rinsed with deionized water. Computer was used for data processing.

Evaluation Indexs

Visual analogue scale VAS

VAS uses a total of 11 numbers from 0 to 10 to indicate the degree of pain. Point 0 means painlessness, increasing in turn and 10 means the most severe pain. The patient chose one of the 11 numbers to represent their own degree of pain. VAS pain score standard: 0 point was painlessness; 3 points or less was mild pain and patients can bear it; 4 points - 6 points was moderate pain, patients'sleep will be affected and patients can still tolerate; 7 points -10 points was severe pain which will affect appetite and sleep, patients can not tolerate pain (10).

Detection of pelvic floor muscle strength grading

According to the internationally universal muscle strength test method (11), the pelvic floor muscle strength is divided into 6 levels, 0, I, II, III, IV, V, and the pelvic floor muscle strength > III is normal.

Criteria for stress urinary incontinence, pelvic organ prolapse and impaired pelvic floor function

The pelvic organ prolapse index method (12) was referred as the diagnostic criteria for stress urinary incontinence and pelvic organ prolapse. Patients with pelvic floor muscle strength below grade III or those with stress urinary incontinence and pelvic organ prolapse were diagnosed as pelvic floor function impaired.

Observation Indicators

The degree of pain during delivery and the total blood loss at 2h and 24 postpartum were observed in the two groups. The damage of the pelvic floor muscles was detected 3 months after delivery. The expression levels of T-cell subsets in peripheral venous blood, the Apgar scores 1 and 5 minutes after birth, and the time of delivery in the two groups were recorded. The results of clinical trials were in line with CONSORT 2010 guidelines.

Statistical Analysis

SPSS20.0 (IBM Corp, Armonk, NY, USA) was used for all statistical analyses of the experimental results. All graphical results were plotted by using GraphPad Prism 7 (San Diego Graphpad Software, Inc.). The count data were represented by [n(%)]. The chi-square test was used for comparison between groups. The measurement data were represented by (x±s). The two groups were compared by paired t-test. The comparison of multiple time points was performed by using repeated measures analysis of variance. The post hoc test was performed by using LSD-t. The difference was statistically significant with $p<0.05$.

RESULTS

Comparison of Clinical Baseline Data

General clinical data of age, weight, height, gestational age and neonatal weight, presence or absence of delivery history and ASA grade were collected from the study group and the control group (shown in Table I). There was no difference between the two groups in general clinical data ($p>0.05$).

Table I
Comparison of the baseline data of patients in both groups ($\bar{x}$±sd)/n[%]

	Study group (n=92)	Control group (n=90)	X^2/t	*p*
Average age/year(s) old	31.52±6.25	30.45±6.51	1.13	0.26
Average weight/KG	61.14±9.58	60.82±9.86	0.22	0.82

Average heigh/cm	168.23±5.21	167.28±5.95	1.15	0.25
Average gestational age/week(s)	39.50±2.30	39.20±1.80	0.98	0.33
Neonatal weight/g	3215.00±247.00	3254.00±212.00	1.14	0.26
Delivery history/cases			0.26	0.61
Yes	18 (19.57)	15 (16.67)		
No	74 (80.43)	75 (83.33)		
ASA grade/cases			0.00	0.99
I	50 (54.35)	49 (54.44)		
II	42 (45.65)	41 (45.56)		

Note: ASA, American Society of Anesthesiologists，

Comparison of Pain Degree of Parturients between Two Groups During Delivery

Comparison of pain degree of parturients between two groups during delivery was shown in Table II. Compared with the control group, the pain degree in the study group was significantly lower and painlessness was significantly higher(p<0.05). There was no significant difference in mild pain between the two groups (p>0.05), while the numbers of cases with moderate and severe pain were significantly larger than those in the control group (p<0.05).

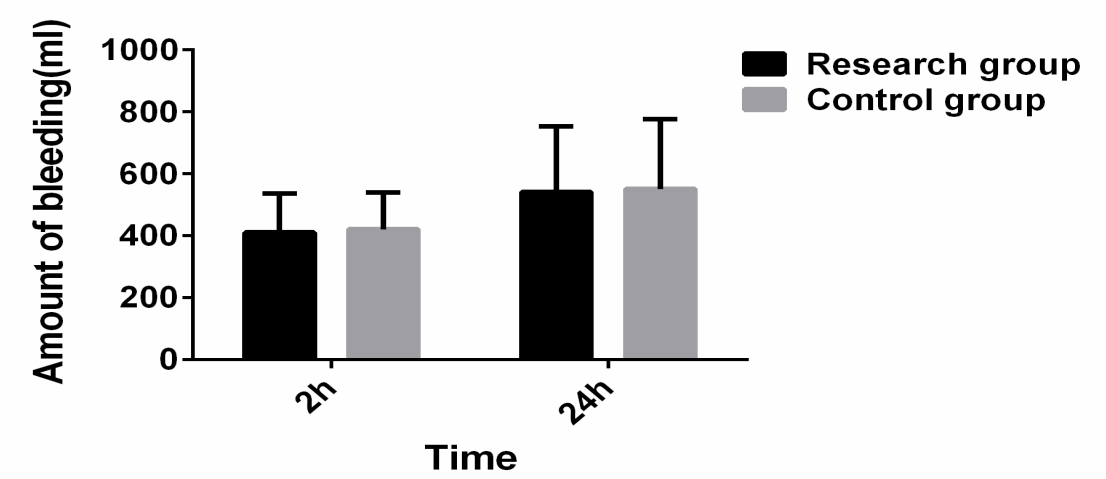
Table II
Comparison of pain degree of parturients between two groups during delivery n[%]

	Painlessness	Mild pain	Moderate pain	Severe pain
Study group (n=92)	64(69.57)	21(22.83)	7(7.60)	0(0.00)
Control group (n=90)	0(0.00)	19(21.11)	41(45.56)	30(33.33)
X^2	96.57	0.08	33.74	36.72
p	0.00	0.78	0.00	0.00

Comparison of Total Amount of Bleeding in Parturients between the Two Groups at Different Time Points after Delivery

Comparison of total amount of bleeding in parturients between the two groups at different time points after delivery was shown in Figure 1. There was no significant difference in total amount of bleeding after delivery for 2h (411.25±125.68ml) and 24h (542.10±212.05ml) between the study group and the control group (421.05±118.75ml, 551.448±225.63ml) (P_{2h}=0.59，P_{24h}=0.77,p>0.05).

Figure 1
Comparison of total amount of bleeding in parturients between the two groups at different time points after delivery



There was no significant difference in total amount of bleeding in the study group after delivery for 2h and 24h compared with the control group (p>0.05).

Comparison of Postpartum Pelvic Floor Muscle Damage of Parturients in Two Groups

Comparison of pelvic floor muscle damage of parturients in two groups after delivery for 3 months was shown in Table III. The pelvic floor muscle damage in the study group was significantly lower than that in the control group. The pelvic organ prolapse, pelvic floor function damage and stress urinary incontinence in the study group were lower than those in the control group (p<0.05).

Table III
Comparison of postpartum pelvic floor muscle damage of parturients in two groups n[%]

	Stress urinary incontinence	Pelvic floor function damage	Pelvic organ prolapse
Study group (n=92)	1 (1.09)	21 (22.83)	18 (19.57)
Control group (n=90)	8 (8.89)	44 (48.89)	35 (38.89)
X^2	5.89	13.46	8.23
p	0.02	0.00	0.00

The Recovery of Postpartum Pelvic Floor Muscle Strength

Comparison of pelvic floor muscle strength of parturients in the two groups after delivery for 3 months was shown in Table IV. The recovery of postpartum pelvic floor muscle strength in the study group was significantly better than that in the control group (p<0.05). The number of patients with Grade IV-V in the study group was significantly higher than that in the control group (p<0.05), while patients with Grade 0-III in the study group was less than those in the control group (p<0.05).

Table IV
Comparison of maternity pelvic floor muscle strength between the two groups n[%]

	Grade 0-III	Grade IV-V
Study group (n=92)	35 (38.04)	57 (61.96)
Control group (n=90)	56 (62.22)	34 (37.78)
X^2	10.64	10.64
p	0.00	0.00

Comparison of T Cell Subsets in Peripheral Venous Blood of Parturients in the Two Groups

Comparison of T cell subsets in peripheral venous blood of parturients in the two groups was shown in Table V. The CD3+, CD4+ and CD4+/CD8+ in the two groups at T2 were significantly lower than those at T and T1 and compared with the study group, the control group decreased significantly (p<0.05). There was no significant change of maternity CD8 + in the two groups.

Table V
Comparison of T cell subsets in peripheral venous blood of parturients in the two groups ($\bar{x}\pm s$)

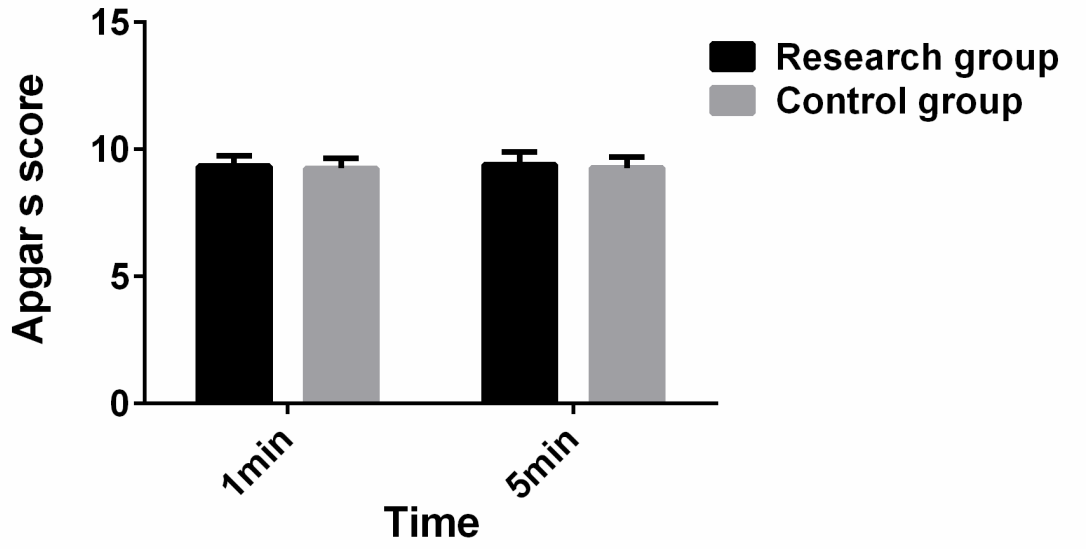
	$CD3^+$（%）	$CD4^+$（%）	$CD8^+$（%）	$CD4^+/CD8^+$
Study group (n=92)				
T	58.66±3.33	43.21±8.45	32.54±5.12	1.43±0.55
T1	57.68±5.17	43.18±8.14	32.45±4.34	1.42±0.46
T2	51.34±5.41ab	36.78±7.88ab	31.81±4.12	1.14±0.24ab
Control group (n=90)				
T	59.21±3.45	42.87±8.62	32.87±5.68	1.45±0.41
T1	58.74±4.51	42.58±8.11	32.58±4.59	1.42±0.39
T2	47.54±5.12abc	31.67±7.89abc	31.48±4.25	0.91±0.24abc

Note: a indicates the comparison with T, [a]p<0.05; b indicates the comparison with T1, [b]p<0.05; c indicates the comparison with with the study group, [c]p<0.05.

Neonatal Apgar Score of The Two Groups

The neonatal Apgar scores of the two groups was shown in Figure 2. There was no significant difference in the neonatal Apgar score between the study group (9.34±0.41, 9.39±0.51) and the control group (9.25±0.39, 9.27±0.43) at 1 min and 5 min (P>0.05). There was no significant difference at the same group at 1 min and 5 min (P_{1min}=0.13,P_{5min}=0.09,p>0.05).

Figure 2
The neonatal Apgar scores of the two groups



There was no significant difference between the study group and the control group at 1 min and 5 min (p>0.05). There was no significant difference at the same group at 1 min and 5 min (p>0.05).

Comparison of Maternity Labor Time between the Two Groups

Comparison of maternity labor time between the two groups was shown in Table VI. In the study group, labor time can effectively shortened the labor process. The first labor time and the second labor time in the study group were significantly lower than those in the control group (p<0.05).There was no significant difference in the

third labor time (p>0.05).

Table VI
Comparison of maternity labor time between the two groups ($\bar{x}$±sd)

	The first labor time (h)	The second labor time (min)	The third labor time (min)
Study group (n=92)	6.20±2.54	49.57±18.64	6.34±2.11
Control group (n=90)	8.65±4.21	57.62±21.08	6.58±2.32
t	4.77	2.73	0.73
p	0.00	0.01	0.47

DISCUSSION

Delivery has a great impact on the physical and mental state of parturients. Therefore, it is particularly important to find better labor analgesia measures. Some literature shows that intraspinal block anesthesia in the delivery not only effectively relieves pain, but also reduces the lateral episiotomy rate of the parturient and reduce vaginal laceration(13,14). It will effectively reduce the incidence of pelvic floor dysfunction (15,16), better protect the structure of pelvic floor.

At present, intraspinal analgesia is widely used and ropivacaine combined with fentanyl of low concentration for labor analgesia is considered to be one of the exact methods of analgesia effect (17,18). The maternity pain degree was significantly lower in the study group; the number of painlessness in the study group was higher than that of the control group; the number of patients with moderate and severe pain were significantly lower than those of the control group. The results were the same with the results by author MA (19), indicating that intraspinal block anesthesia has a better analgesic effect for women undergoing vaginal delivery.

This study also concluded that there was no significant difference in the total amount of postpartum bleeding 2h and 24h after delivery between the study group and the control group. It was similar to the results of Jie et al (20). It indicated that intraspinal block anesthesia has less effect on postpartum hemorrhage. This study also concluded that the maternal pelvic floor muscle damage in the study group was significantly lower than that in the control group. The maternal pelvic organ prolapse, pelvic floor function impairment and stress urinary incontinence in the study group were all lower than those in the control group, so it can be speculated thatinternal block anesthesia and analgesia can improve the postpartum pelvic floor muscle strength. Therefore, this study further examined the recovery of muscle strength in the two groups, and concluded that the recovery of pelvic floor muscle strength in the study group was significantly better than that in the control group. The number of people with grade IV-V was significantly higher, andthe number of people with grade III was significantly lower than those of the control group, which has certain association with intraspinal block anesthesia. This result is consistent with the study of H et al(21), indicating that intraspinal block anesthesia and analgesia can improve the recovery of postpartum pelvic floor muscle strength.

A study showed that maternity cellular immune function during pregnancy is immunosuppressed (3). T lymphocytes are mainly responsible for the cellular immunity of the body. T lymphocytes are not a single cell, but a multi-functional cell population (22). T lymphocytes participate in cellular immunity, which is the main force in eliminating intracellular pathogen infection and antitumor immunity (23). T cells are the main parameters reflecting the body's immune regulation ability, while the cellular immunity hubs are CD3+, CD4+ and CD8+. Among them, the CD4+/CD8+ ratio can best reflect the immune function of the body (24, 25).In the study, the CD3+, CD4+, CD4+/CD8+ were significantly reduced in the study group and control group at T2 compared with those at T and T1, but the control group was significantly lower than the study group. There was no significant change in CD8+ of the two groups. Combined with recent studies, when people suffer from trauma, surgery, psychological and other stress reactions, the body will show a decrease in T cell subsets and immune function will be suppressed (26,27), indicating that intraspinal block anesthesia and analgesia can repair the immune function of parturients.

In this study, the neonatal Apgar scores of the two groups were not significantly different between the study group and the control group at 1 min and 5 min. There was no significant difference between the same group at 1 min and 5 min. Combined with the results of Gupta (28), it is speculated that, there will be no adverse effects of neonatal health

and nervous system development, no matter local anesthesia or simple epidural anesthesia or lumbar epidural anesthesia in the delivery. The study also concluded that the time of the first and second labor process in the study group was significantly shorter than that in the control group. In combination with the result of J (29), intraspinal block anesthesia can effectively shorten the labor process, indicating that intraspinal block anesthesia for vaginal delivery of the parturient can effectively reduce the labor process.

This study explored the effects of intraspinal block anesthesia on postpartum pelvic muscle strength and immune function in women undergoing vaginal delivery by observing the damage of the pelvic floor and the expression levels of T cell subsets in the two groups. However, long-term follow-up were not carried out, and maternal recovery were not observed, which brought certain limitations. In future research, more complete experiments would be carried out to obtain better experimental results.

In summary, intravaginal block anesthesia could effectively relieve pain for women undergoing vaginal delivery, and promote the recovery of postpartum pelvic floor function and immune function.

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