ORIGINAL RESEARCH ARTICLE

Effects of analgesic delivery on pelvic floor function of primiparous women

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Abstract

This was an original article, and the objective of this study was to clarify the short-term effects of analgesic delivery on the pelvic floor function of primiparous women. Three hundred primiparas who delivered vaginally in The Affiliated Hospital of Kangda College of Nanjing Medical University from January 2022 to July 2022 were enrolled, and were divided into control and intervention groups. The control accepted traditional delivery without special analgesic intervention, while the intervention group accepted intraspinal block analgesia at the time of delivery. The results showed that related to the control group, the intervention group presented shorter first and second stages of labour, higher pelvic organ prolapse quantification (POP-Q) scores (0 and 1 degree) and hand-measured pelvic floor muscle strength scores, lower abnormal rate of muscle fatigue (class I and II), higher values of rapid contraction stage, tension contraction stage, and endurance contraction stage, lower values of pre-resting stage and post-resting stage, lower incidences of urinary retention and incontinence and higher VLQ and SSQ scores. We conclude that the implementation of analgesic delivery in primiparous women can effectively shorten the first and second stages of labor, suppress the damage to pelvic floor function, and elevate maternal satisfaction with sexual life.. *(Afr J Reprod Health 2024; 28 [11]: 152-159).*

Keywords: Spinal block; analgesic delivery; primipara; pelvic floor function; urinary retention

Résumé

Il s'agissait d'un article original et l'objectif de cette étude était de clarifier les effets à court terme de l'administration d'analgésiques sur la fonction du plancher pelvien des femmes primipares. Trois cents primipares ayant accouché par voie vaginale à l'hôpital affilié du Collège Kangda de l'Université médicale de Nanjing de janvier 2022 à juillet 2022 ont été inscrites et divisées en groupes de contrôle et d'intervention. Le groupe témoin a accepté l'accouchement traditionnel sans intervention analgésique spéciale, tandis que le groupe d'intervention a accepté l'analgésie par bloc intrarachidien au moment de l'accouchement. Les résultats ont montré que, par rapport au groupe témoin, le groupe d'intervention présentait des premier et deuxième stades de travail plus courts, des scores de quantification du prolapsus des organes pelviens (POP-Q) plus élevés (0 et 1 degré) et des scores de force musculaire du plancher pelvien mesurés à la main, plus faibles. taux anormal de fatigue musculaire (classes I et II), valeurs plus élevées du stade de contraction rapide, du stade de contraction de tension et du stade de contraction d'endurance, valeurs plus faibles du stade avant et après le repos, incidences plus faibles de rétention urinaire et d'incontinence et plus élevées Scores VLQ et SSQ. Nous concluons que la mise en œuvre de l'administration d'analgésiques chez les femmes primipares peut effectivement raccourcir les première et deuxième étapes du travail, supprimer les dommages à la fonction du plancher pelvien et accroître la satisfaction maternelle à l'égard de la vie sexuelle *(Afr J Reprod Health 2024; 28 [11]: 152-159).*

Mots-clés: Bloc spinal ; délivrance d'analgésiques; primipare; fonction du plancher pelvien ; rétention urinaire

Introduction

Pelvic floor muscles are the muscles that seal the pelvic floor. This muscle group acts as a "hanging net", by which organs containing the urethra, bladder, vagina, and the uterus along are tightly held together, keeping them in their normal position to enable them to perform their functions. Once the elasticity of the "net" becomes poor and the "lifting force" is insufficient, the organs in the "net" will not be able to maintain their normal position, resulting in corresponding dysfunction, such as

incontinence and pelvic organ prolapse. Therefore, pelvic floor muscles are closely related to sexual function and urination function[1,2].

Childbirth is a vital cause of abnormal pelvic floor function, but this factor can be improved by medical intervention, including shortening the labour process and reducing perineal injury.[3]. Among them, shortening the labour process can reduce the time for the fetal head to compress the pelvic floor muscles, suppress the damage to the pelvic fascia, ligaments, and nerves, while reducing perineal injury can protect the anatomical integrity of the pelvic floor muscles, and effectively alleviate the damage to pelvic floor function. Thus, it is urgent to find medical interventions that can improve this factor[4]. Due to the lack of relevant experience in childbirth, primiparas will increase the psychological burden resulting from their own fear during childbirth, and negative emotions will increase the pain, which will have a direct impact on uterine contractions, resulting in prolonged production and affecting maternal pelvic floor function[5]. Recently, China's fertility rate has been declining, most of which are due to the fear of childbearing among women of childbearing age. Thus, alleviating labor pain and reducing the damage to pelvic floor function have positive significance for the improvement of women's postpartum quality of life[6]. Analgesic labour can relax the pelvic floor muscles to a certain extent, which is conducive to the opening of the cervix and effectively shortens the labor process. Furthermore, it can relax the perineum vagina, increase its extensibility and elasticity during childbirth, and reduce the lateral incision and tear of the perineum, but there is a lack of clinical literature support and evidence[7]. The methods of analgesic labour include non-pharmacological analgesia, drug-induced labour analgesia, and intraspinal nerve block anaesthesia[8]. Intraspinal nerve block anaesthesia is the most reliable, widely used, and feasible analgesic method recognized by the domestic and foreign anesthesia community at present. Intraspinal injection of analgesic or anesthetic drugs can attenuate sensory nerve excitation induced by nerve conduction and block spinal nerve conduction function, thereby relieving pain[9].

However, the role of analgesic delivery on pelvic floor function in primipara remains unclear. Therefore, the objective of this study was to clarify short-term impact of analgesic delivery on the pelvic floor function of primipara. The novelty of our study was that the implementation of analgesic delivery in primiparous women can effectively shorten the first and second stages of labor, suppress the damage to pelvic floor function, and elevate maternal satisfaction with sexual life, which might provide a clinical guidance for analgesic delivery in primiparous women.

Methods

Materials

This was an original study. A total of 300 primiparas who delivered vaginally in The Affiliated Hospital of Kangda College of Nanjing Medical University from January 2022 to July 2022 were enrolled, and randomly allocated into the control group and intervention group using the random number table. No signidicance was seen in the general information between 2 groups, indicating comparable (P > 0.05, Table 1). The study inclusion criteria were as follows: 1) primiparas with vaginal delivery; 2) maternal signed informed consent; and 3) those with barrier-free mental, consciousness and communication skills. The exclusion criteria were: 1) high risk factors for pregnancy; 2) contraindications to analgesics; 3) history of pelvic floor dysfunction; and 4) serious dysfunction of the heart, kidneys along with other organs.

Table 1: General data of patients in 2 groups

Groups		Age (years)	Gestational age (weeks)
Control group	150	27.0 ± 2.5	39.4 ± 0.4
Intervention group	50	26.5 ± 3.0	39.5 ± 0.5
T	/	1.6	1.9
P	/	0.1	0.1

Methods

Both groups were given prenatal health education, including psychological counseling, breathing, and exertion during delivery, and routine nursing after delivery.

Both groups entered the labour room when the cervix was opened to 3 cm and the uterine

contractions were regular. While the control group underwent traditional labor without special analgesic intervention during labor, the intervention group was given intravertebral block analgesia. The women in the intervention group were instructed to lie in the left lateral position, to hold their legs with both hands to bend the body and keep still. Under local anesthesia with lidocaine (2%, Jiangsu Aipeng Medical Devices, China), the L2-3 lumbar space was punctured until the epidural was reached. Four ml of 1% lidocaine was given, and the extension tube was connected and fixed. After 5 min of no abnormality, an epidural injection of 12 ml of 0.08% ropivacaine (Jiangsu Aipeng Medical Devices, China) + 0.4 μg/ml sufentanil (Jiangsu Aipeng Medical Devices, China) was performed, and then the analgesic solution was continuously pumped at 10 ml/h.

The primiparas were observed for 2 h after delivery, and analgesia was terminated after no abnormalities were observed.

Observed indicators

The following indicators were measured and compared between the cases and intervention groups at 6 weeks postpartum.

1) Comparison of labour stages, including the first and second stages of labour.

2) Pelvic floor muscle strength was assessed through PHENIX series neuromuscular stimulation therapeutic apparatus[10], including class I and class II muscle fiber muscle strength grading.

3) Fatigue: using pelvic floor electrophysiological examination, 0% was normal rate, less than 0% was abnormal, including class I and II muscles; pelvic floor function evaluation: using the international pelvic organ prolapse quantification (POP-Q) system examination[11], the subjects emptied urine, took the bladder lithotomy position, and patients were instructed to hold their breath to perform Valsalva maneuvers to measure the pelvic floor muscle strength score by hand. The subjects emptied their urine and exposed the perineum in a supine position. The doctor applied manual examination, lightly pressing the abdomen with one hand, and instructing them to contract the vagina according to the command after the middle and index fingers entered the vagina and then felt the strength of the vagina, with a score of 0-5 points. The higher scores suggested the better muscle strength.

4) Pelvic floor muscle surface myopotential values were assessed using a biostimulatory feedback device[12]. The surface muscle potential of pelvic floor muscle was evaluated by Glazer. First of all, the patient was educated on the theory of pelvic floor structure and surface electromyography, and the patient was trained in muscle perception and instructed in urination through the method of urinary interruption. The patient was placed in lithotomy position, with the feet facing outward to prevent irrelevant interference of the internal obturator muscle on the measurement of the pelvic floor muscle, and the surface muscle signals of the pelvic floor muscle were collected from the left and right pelvic floor muscles by electrodes. The potentials of pre-resting stage, rapid contraction stage, tension contraction stage, endurance contraction stage and post-resting stage were measured respectively.

5) Comparison of vaginal laxity and sexual satisfaction. Vaginal laxity was assessed by the Vaginal Laxity Questionnaire (VLQ)[13], with a score of 1-7 points, and less than 4 points could be diagnosed as vaginal laxity. Sexual life satisfaction was assessed by the female Sexual Satisfaction Questionnaire (SSQ)[14], with a score of 0-150 points, with higher scores indicating higher satisfaction. The incidences of urinary retention and urinary incontinence were also recorded in two groups.

Statistical analysis

The data obtained in this study were input into SPSS 22.0 software for statistics. Measurement data were in line with normal distribution and exhibited as mean ± standard deviation ($\bar{x} \pm s$), and tested by t test. The count data were subjected to the X^2 test, and the rank count data were subjected to the rank sum test. $P < 0.05$ meant the difference was statistically significant.

Ethical considerations

All patients and their families knew the purpose and method of this study, and voluntarily signed the informed consent. This study was approved by the Ethics Committee of The Affiliated Hospital of

Kangda College of Nanjing Medical University in December 2021.

Results

Comparative results of labor process

The first stage of labour in control group was (689.5 ± 73.8) min, and the second stage of labour was (53.1 ± 8.4) min. The first stage of labour in intervention group was (450.8 ± 48.3) min, and the second stage of labour was (29.1 ± 6.1) min. In comparison with the control group, the intervention group had shorter first and second stages of labour ($P < 0.05$, Table 2).

Table 2: Timing of labour process in the two groups

Groups	N	First stage of labor (min)	Second stage of labor (min)
Control group	150	689.5 ± 73.8	53.1 ± 8.4
Intervention group	150	450.8 ± 48.3	29.1 ± 6.1
T	/	33.1	28.2
P	/	< 0.05	< 0.05

Comparative results of pelvic floor muscle strength

The proportions of class I and class II muscle fiber muscle strength grades ≥ grade III in the intervention group was higher relative to the control group ($P < 0.05$, Table 3).

Comparative results of fatigue, POP-Q scores, and hand-measured pelvic floor muscle strength scores

POP-Q score scale (0-degree, 1 degree) and hand-measured pelvic floor muscle strength scores were higher in the intervention while abnormal rate of muscle fatigue (class I, class II) were lower in the intervention group when compared to the control group. Similarly, the POP-Q score (2 degree) in the intervention group was lower than that in the control group ($P < 0.05$, Table 4).

Comparative result of pelvic floor muscle surface myopotential values

Relative to the control group, the intervention group had higher values of rapid contraction stage, tension contraction stage, and endurance contraction stage, as well as lower values of pre-resting stage and post-resting stage ($P < 0.05$, Table 5).

Comparative result of postpartum urinary retention, urinary incontinence, vaginal laxity, and sexual satisfaction

After delivery, in control group, there were 12 cases (8.0%) of urinary retention and 21 cases (14.0%) of urinary incontinence; VLQ scores (3.3 ± 0.4) and SSQ scores (90.5 ± 7.1) were observed. In the intervention group, there were 5 cases (3.3%) of urinary retention as well as 7 cases of urinary incontinence (4.7%); VLQ scores (6.1 ± 0.6) and SSQ scores (141.7 ± 4.9) were observed. The incidences of urinary retention and incontinence were lower and VLQ scores and SSQ scores were higher in the intervention group relative to the control group ($P < 0.05$, Table 6)..

Discussion

Pelvic floor dysfunction is a series of diseases that occur due to the abnormal function and physiological state of pelvic organs caused by damage to the pelvic floor supporting structure, which can cause pelvic organ prolapse, urinary incontinence, chronic pelvic pain, sexual dysfunction as well as other symptoms. Pelvic floor dysfunction is a social health problem for women around the world, which seriously affects women's normal life and work[15]. According to clinical analysis, the main causes of pelvic floor dysfunction caused by childbirth are as follows: (1) the gravitational influence of the fetus and appendages during pregnancy; (2) excessive stretch of the pelvic floor caused by uterine contractions and prolonged labour during childbirth; and (3) damage to the pelvic floor tissue caused by lateral episiotomy during childbirth.

Table 3: Pelvic floor muscle strength in two groups

Groups	N	Class I muscle fiber strength grading						Class II muscle fiber strength grading					
		0	I	II	III	IV-V	≥ III	0	I	II	III	IV-V	≥ III
Control group	150	12	51	58	21	8	29 (19.3)	20	56	51	17	6	23 (15.3)
Intervention group	150	5	35	52	39	19	58 (38.7)	9	38	54	36	13	49 (32.7)
X^2	/	/	/	/	/	/	5.8						5.0
P	/	/	/	/	/	/	< 0.05	/	/	/	/	/	< 0.05

Table 4: Three indicators in two groups

Groups	N	Abnormal fatigue		POP-Q score scale			Hand-measured pelvic floor muscle strength score (points)
		Class I	Class II	0	1	2	
Control group	150	77 (51.3)	58 (38.7)	42 (28.0)	37 (24.7)	71 (47.3)	1.0 ± 0.2
Intervention group	150	58 (38.7)	40 (26.7)	63 (42.0)	78 (52.0)	9 (6.0)	3.6 ± 0.6
T/X^2	/	6.1	5.1	4.9	5.1	6.7	20.3
P	/	< 0.05	< 0.05	< 0. 05	< 0.05	< 0.05	< 0.05

Table 5: Pelvic floor muscle surface myopotential values in two groups (μV)

Groups	**N**	**Pre-resting stage**	**Rapid contraction stage**	**Tension contraction stage**	**Endurance contraction stage**	**Post-resting stage**
Control group	150	5.9 ± 1.6	29.7 ± 5.3	19.6 ± 3.9	17.1 ± 3.1	4.7 ± 1.3
Intervention group	150	4.2 ± 1.0	37.0 ± 6.2	22.8 ± 4.3	22.1 ± 4.8	4.1± 1.1
T	/	19.9	20.5	21.2	18.8	20.6
P	/	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05

Table 6: Postpartum urinary retention, urinary incontinence, vaginal laxity, and sexual satisfaction in two groups

Groups	**N**	**Urinary retention**	**Urinary incontinence**	**VLQ scores (points)**	**SSQ scores (points)**
Control group	150	12 (8.0)	21 (14.0)	3.3 ± 0.4	90.5 ± 7.1
Intervention group	150	5 (3.3)	7 (4.7)	6.1 ± 0.6	141.7 ± 4.9
T/X^2	/	4.3	5.7	49.9	73.3
P	/	< 0.05	< 0.05	< 0.05	< 0.05

Among them, there is no other effective intervention method for the first reason other than weight control during pregnancy, but medical intervention can be used for the other two explanations during childbirth[16-18].

The purpose of analgesic childbirth is to reduce the degree of maternal pain through professional medical means (including drugs and equipment) during the labour process. The principle of analgesia is to block or paralyze the sympathetic nerves and reduce the sensitivity of body to pain. At present, the most commonly used method in clinical practice is intraspinal block anesthetic analgesia[19]. Ropivacaine can block the flow of sodium ions into the membrane of nerve fibers, thereby reversibly blocking their impulse conduction to nerve fibers. Large doses can exert surgical anesthesia effect, while small doses can exert sensory blockade (analgesic) effect[20]. Herein, continuous pumping of low-dose ropivacaine + sufentanil during delivery can effectively ensure the continuity of anesthesia and the efficacy of anesthesia.

The application of epidural labor analgesia can greatly shorten the latency of labor and reduce perineal tear and pelvic floor muscle damage, ffectively improving pregnancy outcomes[21]. In this study, the first and second stages of labour in the intervention group were shorter than those in control group, suggesting that analgesic delivery could effectively shorten the first and second stages of labour, which was consistent with the conclusions of multiple clinical experiments[22].

The early injury of pelvic floor function is only manifested in the biochemical and electrophysiological changes of the pelvic floor supporting tissue structure. Thus, a simple postpartum perineum examination cannot effectively judge the degree of pelvic floor injury. Nevertheless, the detection of pelvic floor muscle strength, fatigue, pelvic floor muscle surface myopotential values, etc., through the detector can effectively and accurately assess whether there is pelvic floor muscle nerve injury[23]. In this study, the POP-Q score scale (0 degree, 1 degree) and the hand-measured pelvic floor muscle strength scores were higher n and the abnormal rate of muscle fatigue (class I, class II) were lower in the intervention group relative to the control group. The values of rapid contraction stage, tension contraction stage, and endurance contraction stage were higher as well as the values pre-resting stage and post-resting stage were lower in the intervention group relative to the control group. We believe that analgesic delivery could effectively reduce the damage to the pelvic floor muscles caused by delivery, due to the shortening of labour. Previous studies have shown that labour analgesia did not elevate the risk of pelvic floor dysfunction up to 6-8 weeks after delivery[24]. Pelvic floor muscle damage may be linked to the shortening of labour. Moreover, analgesic labour can relax the pelvic floor muscles, and the reduction of pain can weaken the stimulation of the central nervous system, to a large extent, block the role of sympathetic nerve in regulating uterine contraction, and effectively improve the maternal contractile force, which is conducive to cesarean section[25].Our study show that comparing with the control group, the intervention group had lowe incidence of urinary retention and incontinence and higher VLQ and SSQ scores, implying that analgesic delivery could reduce vaginal relaxation, suppress the occurrence of postpartum urinary retention and incontinence, and reduce the negative impact on sexual life.

Intraspinal block anesthetic analgesia is currently recognized as the most reliable and feasible method for analgesia in the field of surgical anesthesia. It has the following advantages: (1) It can achieve completely painless effect, and has high analgesic efficacy, which has a positive influence on puerperia with severe labor pain. (2) It can keep the puerperia's awake, does not hinder eating and water intake, and can effectively cooperate with the midwife to complete the delivery. (3) It will not block the movement, and primiparas can walk properly after the anesthesia. (4) Anesthesia is flexible. For primiparas who need forceps, their anesthesia needs can be flexibly adjusted and the time of labour can be effectively controlled. (5) Analgesia for childbirth is mild anesthesia, which meets the physiological requirements and can suppress the vasoconstriction symptoms induced by catecholamines elevation due to labor pain. Moreover, it can also achieve the influence of reducing pelvic floor damage. (6) Ropivacaine has little negative influences on mother and child along with labor process, and has a higher analgesic efficacy. Nevertheless, it should be noted that analgesic delivery is also an anesthesia, the dose of anesthesia should be controlled reasonably, and changes in the vital signs of the mother and the fetus should be closely observed during delivery to ensure drug administration safety[26]. However, due to the samples of our study were small, the effects of intraspinal nerve block anesthesia on mother and fetus require further larger-sample trials.

Strength and weakness

The strength of this study was that it is a randomized controlled trial investigating the effect of analgesic delivery in reducing the damage to pelvic floor function and in primiparas. The limitation of our study was the small samples. Our study might provide a clinical guidance for analgesic delivery in primiparous women.

Conclusion

The implementation of analgesic delivery in primiparas has achieved ideal results, which can effectively shorten the first and second stages of

labor, reduce the damage to pelvic floor function, and elevate maternal satisfaction with sexual life, which is worthy of clinical application.

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Author contributions

Zhang YH, Wang HH and Chen JQ: conceived the study, collected data, and drafted the initial manuscript. Zhang LY and Liu QC: checked data and performed data analysis. Wang YF and Yao WL assisted in data analysis, revised the manuscript, drew figures and helped revise the manuscript, as well as supervised the project. All authors mentioned in the article approved the manuscript.

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