

Study on the Effect of Birthing Ball-Assisted Care on Pelvic Floor Muscle Function in Primiparas Undergoing Natural Childbirth

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Abstract: Objective: To explore the effect of birthing ball-assisted care on pelvic floor muscle function in primiparas undergoing natural childbirth. **Methods:** Ninety primiparas who underwent natural childbirth in the obstetrics department of our hospital from March 2022 to September 2024 were selected as the study subjects. They were divided into an observation group (45 cases) and a control group (45 cases) using a random number table method. The control group received routine intrapartum care, while the observation group received birthing ball-assisted care in addition to routine care. The progress of labor, delivery outcomes, and postpartum pelvic floor muscle function recovery were compared between the two groups. **Results:** All labor progression indicators in the observation group were superior to those in the control group, with significantly improved delivery quality and better postpartum pelvic floor muscle function recovery ($P < 0.05$). **Conclusion:** Birthing ball-assisted care can effectively shorten labor duration, reduce delivery complications, and promote the recovery of postpartum pelvic floor muscle function, making it worthy of promotion and application in clinical practice.

Keywords: Birthing ball-assisted care; Natural childbirth; Primipara; Pelvic floor muscle function; Effect

Introduction

With the transformation of modern medical models and the updating of nursing concepts, comfortable and humanized childbirth care has become an important direction in the development of obstetric nursing. As a new type of birthing aid, the birthing ball shows promising application prospects in improving maternal childbirth experience and promoting natural childbirth through its unique physical characteristics and movement

mechanisms^[1]. Pelvic floor muscle function, as an important factor affecting female reproductive health and quality of life, has attracted much attention regarding its changes during pregnancy and childbirth. Although traditional intrapartum care models can ensure basic medical safety, they still have shortcomings in promoting active maternal participation, alleviating pain perception, and protecting pelvic floor structures^[2]. Therefore, exploring more scientific and effective nursing interventions is of



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great significance for improving the quality of natural childbirth and maintaining maternal physical and mental health.

1. Data and Methods

1.1 General Information

Ninety primiparas who underwent natural childbirth in the obstetrics department of our hospital from March 2022 to September 2024 were selected. They were divided into an observation group and a control group, with 45 cases each, according to a random number table method. The observation group had an age range of 22-35 years, average (28.3±3.7) years; gestational age 37-42 weeks, average (39.2±1.1) weeks. The control group had an age range of 21-36 years, average (28.7±3.9) years; gestational age 37-42 weeks, average (39.0±1.3) weeks. There was no statistically significant difference in general data between the two groups ($P > 0.05$), indicating comparability. Inclusion criteria: Singleton term pregnancy (gestational age 37-42 weeks); no severe pregnancy complications or internal medical diseases. Exclusion criteria: Indications for cesarean section or high-risk pregnancy factors; abnormal fetal position or macrosomia; mental illness or cognitive impairment.

1.2 Nursing Methods

Control group: Received routine intrapartum care, including standardized nursing procedures such as admission assessment, vital signs monitoring, fetal heart rate monitoring, labor observation, pain management, and delivery guidance. Midwives provided corresponding nursing support based on labor progress, such as posture guidance, breathing exercises, and psychological comfort.

Observation group: Received birthing ball-assisted care in addition to routine care: (1) Birthing ball preparation: A professional medical birthing ball with a diameter of 65cm was selected, made of environmentally friendly TPU material with a load-bearing capacity ≥ 150 kg. It was cleaned and disinfected before use to ensure safety and hygiene. (2) Adaptive training: During the hospital admission waiting period, the parturient underwent adaptive training with the birthing ball under the guidance of a midwife. The parturient was assisted to sit on the birthing ball, maintain body balance, and perform gentle front-

back and left-right rocking, for 10-15 minutes each time, 2-3 times daily, until proficient. (3) Application during the first stage of labor: After cervical dilation reached 3cm, the parturient was guided to straddle and sit on the birthing ball, holding onto the bed rail or other fixed objects for balance. Rhythmic pelvic rocking movements were performed according to the contraction rhythm, including: Anterior-posterior tilting: Tilting the body forward and backward in coordination with contractions, utilizing gravity to promote fetal head descent; Left-right swaying: Gently swaying the pelvis left and right to assist fetal head rotation and internal rotation; Circular motion: Performing circular motions centered on the hip joint to enhance pelvic floor muscle elasticity. (4) Application during the second stage of labor: After full cervical dilation, the parturient could choose a kneeling or semi-squatting posture to use the birthing ball according to her own condition. The midwife stood beside the parturient to provide support and protection, guiding her to bear down during contractions and rest appropriately during intervals. (5) Precautions: Closely monitor changes in the parturient's vital signs during use; immediately stop use if symptoms such as dizziness or fatigue occur; strictly control usage time to avoid excessive fatigue; keep the birthing ball surface dry to prevent slipping accidents.

1.3 Observation Indicators

(1) Labor-related indicators: Record the duration of the first stage, second stage, total labor duration, and amount of bleeding within 2 hours postpartum for both groups. (2) Natural childbirth success rate. (3) Pelvic floor muscle function indicators: A pelvic floor electromyography assessment device was used to measure three core functional indicators at 6 weeks postpartum: maximum contraction pressure of the pelvic floor muscles, sustained contraction time, and number of rapid contractions.

1.4 Statistical Methods

Data were processed using SPSS 26.0. Count data (represented by percentage (%)) and measurement data (conforming to normal distribution, represented by mean \pm standard deviation) were subjected to χ^2 test and *t*-test, respectively; $P < 0.05$ indicated a significant difference.

2. Results

2.1 Comparison of Labor Conditions Between the Two Groups

The labor durations in the observation group were

shorter than those in the control group, and the amount of bleeding within 2 hours postpartum was less than that in the control group ($P < 0.05$). See **Table 1**.

Table 1 Comparison of Labor Conditions ($\bar{x} \pm s$)

Group	<i>n</i>	First Stage (min)	Second Stage (min)	Total Labor (min)	Bleeding Volume (ml)
Observation	45	428.6±76.3	45.2±12.8	473.8±82.1	186.3±42.7
Control	45	512.4±89.7	62.7±18.3	575.1±95.4	248.9±58.6
<i>t</i> -value	-	5.124	5.387	5.621	5.892
<i>P</i> -value	-	< 0.001	< 0.001	< 0.001	< 0.001

2.2 Comparison of Delivery Outcomes Between the Two Groups

The natural childbirth success rate in the observation

group was higher than that in the control group ($P < 0.05$). See **Table 2**.

Table 2 Comparison of Delivery Outcomes [*n*(%)]

Group	<i>n</i>	Natural Childbirth
Observation	45	43(95.6)
Control	45	37(82.2)
χ^2	-	4.045
<i>P</i> -value	-	0.044

2.3 Comparison of Postpartum Pelvic Floor Muscle Function Recovery Between the Two Groups

At 6 weeks postpartum, the maximum contraction pressure of the pelvic floor muscles in the observation

group was higher than that in the control group, the sustained contraction time was better, and the number of rapid contractions was greater than those in the control group ($P < 0.05$). See **Table 3**.

Table 3 Comparison of Postpartum Pelvic Floor Muscle Function Recovery ($\bar{x} \pm s$)

Group	<i>n</i>	Max. Contraction Pressure (cmH ₂ O)	Sustained Contraction Time (s)	Rapid Contractions (times)
Observation	45	38.7±6.2	12.8±2.4	18.3±3.7
Control	45	32.4±5.8	9.6±2.1	14.2±3.1
<i>t</i> -value	-	4.987	6.521	5.743
<i>P</i> -value	-	< 0.001	< 0.001	< 0.001

3. Discussion

The pelvic floor muscle group is a complex structure composed of multiple layers of muscles and fascia, mainly including deep muscles such as the pubococcygeus, iliococcygeus, and ischiococcygeus, as well as superficial muscles such as the superficial transverse perineal muscle and bulbospongiosus muscle. These muscles together form the "hammock" structure at the bottom of the pelvic floor, undertaking important physiological functions such as supporting pelvic organs, maintaining urethral and anal sphincter functions, and participating in sexual function

regulation. Pregnancy and childbirth cause varying degrees of damage to the pelvic floor muscles. Particularly during vaginal delivery, the mechanical pressure and traction generated by the fetal head passing through the birth canal can easily lead to problems such as pelvic floor muscle fiber tearing and nerve damage, subsequently causing a series of pelvic floor dysfunction diseases, including stress urinary incontinence, pelvic organ prolapse, and sexual dysfunction^[3]. Primiparas, due to lack of childbirth experience and relatively poor elasticity and adaptability of pelvic floor muscles, are more

susceptible to damage during childbirth. Therefore, how to maximize the protection of pelvic floor muscle structural and functional integrity while ensuring maternal and infant safety has become an important issue in modern obstetric care. In recent years, non-surgical pelvic floor muscle rehabilitation interventions have gradually gained attention. Among them, birthing ball-assisted care, as a simple, easy-to-implement, cost-effective, and efficient physical therapy method, shows promising application prospects in improving childbirth experience and promoting pelvic floor muscle function recovery through its unique biomechanical principles and movement mechanisms^[4]. The application of the birthing ball not only helps the parturient find comfortable positions but also stimulates pelvic floor muscle contractions through rhythmic movements, enhancing muscle strength and coordination.

The results of this study showed that the durations of the first stage, second stage, and total labor in the observation group were significantly shorter than those in the control group. The birthing ball-assisted care effectively shortened labor mainly based on the following mechanisms: First, the unstable support surface provided by the birthing ball forces the parturient to constantly adjust her body's center of gravity. This dynamic balance state activates more core muscle groups, including the deep pelvic floor muscles. Continuous muscle contraction activity helps cervical dilation and fetal head descent, thereby accelerating labor progress. From an anatomical perspective, when the parturient rides and sits on the birthing ball performing anterior-posterior tilting movements, the angle of the pelvic inlet plane changes, facilitating better fetal head engagement and descent. Second, postural changes assisted by the birthing ball break the limitations of the traditional supine position, allowing the parturient to fully exert her own strength under the action of gravity. Research indicates that upright or semi-sitting positions, compared to the supine position, can increase the effective length of pelvic diameters, creating more favorable conditions for the fetus to pass through the birth canal. Especially during the active phase of the first stage of labor, appropriate postural changes can promote fetal head rotation and internal rotation, reducing the incidence of dystocia. Third, the soft and elastic nature of the birthing ball provides good cushioning and support for the parturient, reducing

fatigue and discomfort caused by maintaining the same posture for a long time. A psychologically relaxed state helps the secretion of endogenous oxytocin, further promoting the coordination and effectiveness of uterine contractions^[5]. The significantly reduced postpartum bleeding volume in the observation group in this study may be closely related to this. It is worth noting that the natural childbirth success rate in the observation group was significantly higher than that in the control group, suggesting that birthing ball-assisted care also has a certain positive effect in reducing cesarean section rates. The reasons may be that, on one hand, the use of the birthing ball enhances the parturient's confidence and sense of control over natural childbirth; on the other hand, effective labor management reduces unnecessary medical interventions, lowering the risk of conversion to cesarean section.

The most core and important finding of this study is the significant promoting effect of birthing ball-assisted care on postpartum pelvic floor muscle function recovery. The observation group was significantly superior to the control group in three key indicators: maximum contraction pressure, sustained contraction time, and number of rapid contractions of the pelvic floor muscles, and this advantage further expanded over time. Maximum contraction pressure reflects the muscle's maximum contraction capacity and is a core indicator for evaluating pelvic floor muscle strength. At 6 weeks postpartum, this indicator in the observation group reached 38.7 ± 6.2 cmH₂O, significantly higher than the control group. This degree of improvement has important clinical significance. From a physiological perspective, the regular muscle contraction activity assisted by the birthing ball is similar to a targeted strength training, effectively activating fast-twitch muscle fibers and promoting muscle fiber thickening and strength enhancement. Sustained contraction time reflects the endurance level of the pelvic floor muscles, which is crucial for maintaining long-term stability of pelvic organs. At 6 weeks postpartum, the sustained contraction time in the observation group reached 12.8 ± 2.4 seconds, significantly better than the 9.6 ± 2.1 seconds in the control group. This improvement in endurance may stem from two aspects: first, the pelvic floor muscles received moderate exercise rather than excessive fatigue during childbirth; second, birthing ball-assisted care promoted local

blood circulation, facilitating the removal of muscle metabolic waste and the supply of nutrients. The number of rapid contractions reflects the reaction speed and coordination of the pelvic floor muscles, which is important for coping with sudden increases in intra-abdominal pressure (such as coughing, sneezing)^[6]. At 6 weeks postpartum, the number of rapid contractions in the observation group reached 18.3 ± 3.7 times, significantly higher than the 14.2 ± 3.1 times in the control group. This improvement indicates that birthing ball-assisted care not only enhances the strength of the pelvic floor muscles but also improves their functional flexibility and adaptability.

In summary, as an innovative intrapartum nursing intervention, birthing ball-assisted care can effectively shorten labor duration, reduce delivery complications, increase the natural childbirth success rate, and significantly promote the recovery of postpartum pelvic floor muscle function. Its mechanism of action is scientifically sound, its clinical effect is definite, and its safety profile is good, giving it important clinical promotion value. It is recommended that medical institutions at all levels actively introduce and promote the application of birthing ball-assisted care to provide higher quality and more humanized nursing services for pregnant women and make positive contributions to promoting female reproductive health.

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