Observation of Pelvic Floor Structure in Women Undergoing Second Natural Delivery Using Intelligent Pelvic Floor Ultrasound

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Abstract: Objective: To observe and study the pelvic floor structure of women undergoing second natural childbirth using intelligent pelvic floor ultrasound. Methods: Fifty pregnant women who completed second natural delivery in our hospital from April 2019 to April 2020 were selected as the experimental group, while 50 pregnant women who underwent first natural delivery during the same postpartum review were selected as the control group. Analyzing the test data of the two groups of patients, use two-dimensional ultrasound to observe whether there is pelvic floor organ prolapse and related parameter abnormalities in the two groups of pregnant women, and measure the movement of the bladder neck, urethral rotation angle, and posterior bladder angle of the pregnant women under Valsalva status; Real-time three-dimensional ultrasound was used to measure the area of the levator ani muscle hiatus under resting and Valsalva conditions, and to measure the pelvic floor muscle strength of the two groups of pregnant women. Results: There was no significant difference between the two groups in bladder neck movement, urethral rotation angle, and posterior bladder angle under Valsalva status ($P>0.05$). There was no statistically significant difference in the area of levator ani muscle hiatus between the two groups of parturients at rest [(14.00 ± 3.76) cm^2 vs (14.51 ± 3.60) cm^2] and Valsalva [(24.98 ± 326) cm^2 vs (25.53 ± 3.40) cm^2] ($P>0.05$); There was no significant difference in the incidence of pelvic floor organ prolapse and related abnormalities between the two groups ($P>0.05$); There was no statistically significant difference between the two groups in the unqualified rate of Class I (64.07% vs 69.00%) and Class II pelvic floor muscle strength (74.58% vs 78.00%) ($P>0.05$). Conclusion: The incidence of abnormal pelvic floor structure in women after second natural delivery is not significantly higher than that after first natural delivery, which provides imaging evidence for clinical guidance in selecting delivery methods and postpartum pelvic floor rehabilitation training for women after second natural delivery.

Keywords: Pelvic Floor; Pelvic Floor Dysfunction Disease; Levator Ani Muscle Hiatus; Ultrasound Examination

1. Data and Methods

1.1 Research object

A retrospective analysis was conducted of 100 pregnant women who gave birth in our hospital from April 2019 to April 2020, and 50 pregnant women who had a second natural delivery. They were selected as the experimental group, while 50 pregnant women who had a first natural delivery during the same postpartum review were selected as the control group. Inclusion criteria: 6-9 weeks postpartum; Both were first or second spontaneous vaginal delivery; Full term delivery; No extension of the second stage of labor; No macrosomia; No fetal head suction, forceps, and third degree perineal laceration were used during delivery; There were no severe internal surgical complications in the pregnant women; The first delivery history of the second delivery women met the above criteria, and the included women received intelligent pelvic floor ultrasound examination and pelvic floor muscle strength measurement at the same time. The difference between the two examinations was within 3 days. Exclusion criteria: Other pregnancy and childbirth histories other than those in this study, including those with vaginitis, urinary system infection, postpartum hemorrhage, and incomplete lochia, as well as a history of pelvic surgery. The 100 pregnant women were divided into a primipara group with 50 cases of first natural childbirth and a multipara group with 50 cases of second natural childbirth. The age of the control group was 21-36 years old, with an average of (27.34 ± 2.81) years old, and the average gestational week of delivery was (39.00 ± 0.97) weeks; The age of the experimental women group was 23-41 years old, with an average of (31.38 ± 4.12) years old, and the average gestational week of delivery was (39.61 ± 1.18) weeks. This study was approved by the hospital ethics approval committee, and all pregnant women had informed consent.

1.2 Instruments and methods

1.2.1 Pelvic floor ultrasound examination

Mindray Resona8s ultrasound diagnostic instrument, D8-4U probe, frequency 4~8MHz is used. After emptying the stool and defecation, the subject takes a bladder lithotomy position, initiates two-dimensional ultrasound examination to obtain a midsagittal section, instructs the pregnant woman to perform Valsalva maneuver, and observes whether there is any prolapse of pelvic floor organs. The intelligent pelvic floor measurement tool (SmartPelvic) - automatic anterior pelvic evaluation system is used to obtain the bladder neck movement, urethral rotation angle, and posterior bladder angle under Valsalva status; Start real-time three-dimensional ultrasound examination, and instruct the pregnant woman to perform Valsalva maneuver to observe the changes in the shape of levator ani muscle fissure under both states. Use the intelligent pelvic floor measurement tool (SmartPelvic) to measure the area of levator ani muscle fissure (HA) under resting state and Valsalva state, respectively.

1.2.2 PFD ultrasound diagnostic criteria

PFD was diagnosed using the criteria in "Practical Pelvic Floor Ultrasonography", and all parameters were measured at the maximum Valsalva state.

1.2.3 Pelvic floor muscle strength testing methods and evaluation standards

The pelvic floor muscle strength (class I and class II) of the two groups of pregnant women was monitored using the PHENIX U4 therapeutic instrument. Class I and Class II muscle strength are both 0-5 levels, with muscle strength ≥ 3 being qualified, and muscle strength<3 being unqualified. One experienced physician completed the pelvic floor ultrasound examination and pelvic floor muscle strength measurement using a blind method, and the two physicians were unaware of the examination results.

1.3 Statistical analysis

Using SPSS22.0 software, the measurement data conforming to the normal distribution were expressed in x ± s, and the independent sample t-test was used for inter group comparison. The counting data were compared between groups using χ In the 2-test, P<0.05 indicates a statistically significant difference.

2. Results

2.1 General information

Compared with the primipara group, the menopausal women group had significant differences in age, high pre pregnancy body mass index (BMI), and low proportion of painless labor (P<0.05); There was no statistically significant difference between the two groups in terms of the second stage of labor time, the proportion of lateral episiotomy/first and second degree perineal laceration, neonatal body mass, and neonatal head circumference (P>0.05). 2.2 Intelligent pelvic floor ultrasound results

When comparing Valsalva's movements, two-dimensional ultrasound observation showed that various organs of the pelvic floor moved towards the dorsal and caudal side of the human body, and real-time three-dimensional ultrasound observation showed that the area of the levator ani muscle fissure increased. Compared with the primipara group, the area of levator ani muscle hiatus, bladder neck movement, and urethral rotation angle were larger in the multiparous group under resting and Valsalva conditions, while the posterior bladder angle was smaller, with no statistically significant difference ($P>0.05$); The incidence of pelvic floor organ prolapse (uterine prolapse, anterior rectal wall prolapse, excessive movement of the perineal body) and related parameter abnormalities (such as increased bladder neck movement, opening of the posterior horn of the bladder, increased area of the levator ani fissure, and funnel-shaped opening of the inner orifice of the urethra) was higher in the postmenopausal women group, while the incidence of cystocele and increased urethral rotation angle was lower, with no statistically significant difference ($P>0.05$).

3. Discussion

Pregnancy and childbirth are independent risk factors for PFD in women, especially vaginal delivery, which can affect the pelvic floor support structure of women. Pelvic floor muscles are an important component of the pelvic floor support structure. During natural vaginal delivery, due to the pressure and extreme stretching of the fetal head on the pelvic floor muscles and their innervating nerves, changes in the morphology of the pelvic floor muscles exceed their damage threshold, resulting in myogenic and neurogenic changes in the pelvic floor muscles, This can lead to decreased pelvic floor muscle strength after childbirth. The muscle fibers of the pelvic floor muscles are divided into two types. Type I muscle fibers, also known as slow fibers, provide constant support for pelvic floor organs in a resting state; Class II muscle fibers, also known as fast fibers, mainly prevent stress reactions such as urinary incontinence or fecal incontinence when abdominal pressure increases. Therefore, when pelvic floor muscle strength decreases, long-term compression of pelvic floor muscles by abdominal and pelvic organs can lead to an increase in the area of the levator ani muscle fissure and pelvic floor organ prolapse. When pelvic floor muscles are unable to resist a sharp increase in abdominal pressure during stress reactions, it can lead to stress urinary incontinence and fecal incontinence. Two-dimensional ultrasound can observe the presence or absence of pelvic floor organ prolapse during Valsalva maneuver. In addition, the possibility of stress urinary incontinence can be evaluated by measuring indicators closely related to it, such as bladder neck movement, urethral rotation angle, and posterior bladder angle; Real-time three-dimensional ultrasound can display the coronal plane of the pelvic floor, visually observe the shape of the levator ani muscle fissure, and measure its area, anteroposterior diameter, left and right diameter, etc. It has the advantages of intuition, high resolution, and economy; Currently, pelvic floor ultrasound has achieved intelligent identification of pelvic floor structures and automatic measurement of relevant parameters. If only a few important anatomical points need to be selected, automatic measurement of relevant data can be achieved. Its advantages are that it can reduce subjective errors caused by different professional levels and human operations, and shorten measurement time. However, due to the high image quality requirements of this technology, when the image quality is poor or the shape of the levator ani muscle fissure is irregular, manual adjustment of the trace contour is required, which may require a relatively long time.

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