Effects of pelvic floor myofascial manipulation intervention on primiparas and neonates during the second stage of vaginal delivery

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Abstract. A prolonged second stage of vaginal delivery increases the risk of shoulder dystocia, unnecessary episiotomies and cesarean sections. However, no standardized method has been proposed to tackle this issue. The effects of pelvic floor myofascial manipulation intervention during the second stage of labor in primiparas and its prognostic value in neonatal postpartum outcomes remain unknown. In the present study, a total of 60 primiparas who were expecting a vaginal delivery in the Second Affiliated Hospital of Hainan Medical College (Haikou, China) between October 2021 and January 2022 were selected. These women were randomly assigned to a control group (standard intrapartum care) or an experimental group (pelvic floor myofascial manipulation for 15-20 min during the second stage of labor along with standard intrapartum care) using a random number table, with 28 patients in each group. There was no significant difference in age, gestational time or body mass index between the two groups before delivery, indicating that the baseline data were comparable. The second stage of labor duration, forced breath-holding time and postpartum hemorrhage volume in the experimental group were significantly lower than those in the control group. The pain visual analog scale scores, fatigue scores and neonatal Apgar scores in the experimental group were also significantly lower than those in the control group. The rate of episiotomy in the experimental group was lower than that in the control group, but the difference was not statistically significant. In conclusion, pelvic floor myofascial manipulation intervention during the second stage of labor for primiparas with vaginal delivery can reduce the duration of the second stage of labor, the amount of bleeding during labor and the pain during labor. Meanwhile, it has the potential to improve neonatal outcomes.

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Introduction

Vaginal delivery is the natural delivery process after the pregnancy period, and is the preferred mode of delivery for most mothers (1-3). However, the pain during childbirth and the long labor duration causes not only physical fatigue of the puerpera but also many adverse psychological emotions, such as fear and anxiety of a potential perineum tear, thereby affecting the normal force of the puerpera during labor, prolonging the labor duration and increasing the amount of labor bleeding (4). The continuous exertion of the mother during the second stage of labor puts pressure on the perineal body locally. If the labor process is prolonged or the fetus is stuck during the delivery after entering the pelvis, the risk of episiotomy or tearing of the perineum will be increased, and even worse, there is an increased risk of suffocation and dystocia for the newborn (5).

The pelvic myofascia is subjected to orthostatic pressure for several months during pregnancy. During labor, persistent tension and contraction of pelvic floor muscle fibers cause spasms, and the fascial matrix transmits the tension produced by the muscle, resulting in increased fascial tension and ischemia (6). For increased pelvic muscle tone, physical therapy has been the first-line treatment, and trigger point injections have been employed to release the myofascial tension (7,8). During vaginal delivery, the injections can be challenging due to the danger of injuring the surrounding tissue or possibly the fetus. Thus further research into a non-invasive way to decrease myofascial tension during labor is required.

Thiele massage is a maneuver to lessen pain during childbirth by massaging posterior pelvic floor muscles via the rectum (7), which has been shown to benefit women who have interstitial cystitis and increased pelvic muscle tone (9). A previous study explored transvaginal pelvic floor fascia manipulation and revealed that this method increases the pain threshold of myofascial receptors, while reducing the sensitivity to pain (10). Additionally, Li (11) reported that

it can improve the physical and mental adaptability of the puerpera to painless delivery, thereby reducing the labor time and the rate of cesarean section (12). However, its effects on other delivery-related issues and neonatal outcomes remain unknown. Thus, the present study aimed to investigate the effect of pelvic floor myofascial manipulation on primiparas and neonates during the second stage of vaginal delivery.

Patients and methods

Patient selection. A total of 60 primiparas who were expecting to deliver at the Department Obstetrics, The Second Affiliated Hospital of Hainan Medical College (Haikou, China) between October 2021 and January 2022 were enrolled. The inclusion criteria were as follows: i) Women at full-term pregnancy admitted for vaginal delivery; ii) women without gestational hypertension or diabetes (the diseases increasing the risk of delivery complications); and iii) women without pelvic bony or anatomical abnormalities that could influence manual therapy. The exclusion criteria were as follows: i) Breech or transverse fetal positions, which significantly increased delivery complications; ii) abnormal fetal heart rate or spontaneous rupture of the fetal membrane, which increased the likelihood of cesarean section delivery; iii) women who needed emergent cesarean section delivery after failure of vaginal delivery; iv) women who had major depression or a psychotic episode and did not cooperate with therapy instructions; and v) women who dropped out due to personal choices or other emergencies.

The included women were given 5-digit random numbers. An online random number table was used to randomly allocate the women to an experimental group and a control group. During the intervention period, a total of 4 cases dropped out, 2 from each group. Finally, 28 cases were included in each group. This study was approved by the Ethics Committee of the Second Affiliated Hospital of Hainan Medical College (approval no. H20171201-1), and all participants/their guardians provided written informed consent.

General labor care. Women in the control group received standard care. Primiparas were continuously monitored for fetal heart rate during labor. All women included were in active labor. During the first stage of labor, primiparas were encouraged to ambulate more. Furthermore, birthing appliances, such as rocking chairs, birthing balls and birthing stools, were suggested to assist in labor to promote the descent of the fetal head and relieve pain. The second stage of labor was defined as the period from the beginning of complete dilation and erasure of the cervix to the end of the baby's delivery. The labor evaluation included the determination of the fetus's cephalic position and a cervical check using a bedside ultrasound, both of which were performed by a junior and a senior attending obstetrician. After entering the second stage of labor, primiparas were given low-flow oxygen inhalation and instructed to perform breathing exercises during uterine contractions, and their fetal heart rates and amniotic fluid conditions were closely monitored. Upon the complete dilation of the cervix, the primiparas were instructed to grab the bedpost with both hands, stirrup the feet on the delivery bed, inhale deeply to hold a breath and then force this held breath downward as if relieving a bowel movement. The primiparas were placed in a semi-recumbent position on a bed, with their feet apart and on the pedals, while their legs were abducted and flexed to the sides of the abdomen. During the contractions, primiparas were instructed to hold their legs with both hands, lift their heads slightly, tighten their chins, keep their eyes on the navel and hold their breath downwards. Notably, they were allowed to relax in the interval between contractions. The perinea of the primiparas were protected when the fetal heads were exposed at 3 to 4 cm dilation. The midwives placed themselves in a semi-squat position and used their left hand to properly depress the occiput of the fetal head when instructing the mother to exert force, so that the biparietal diameter of the fetal head was slowly delivered. When the occiput of the fetal head was exposed on the pubic arch, the mother was instructed to direct her held breath slightly downwards during the interval between contractions, and the midwife assisted the fetal head to stretch up with her left hand to ensure the slow delivery. In the next contraction, the midwife used the thenar muscle of the right hand to hold the perineum and the left hand to pull the fetal neck down. The first shoulder was thus delivered. The midwife then dragged the baby's neck up and over the second shoulder. Finally, the midwife relaxed her right hand and used both hands to assist in delivering the fetus.

Pelvic floor myofascial manipulation. Women in the experimental group received pelvic floor myofascial manipulation during the second stage of labor along with the standard care. This intervention was performed by the senior attending obstetrician to ensure consistency. At first, gentle pressure was applied externally to the pubic symphysis and perineum muscles and tendons (superficial transverse perineal muscle, central perineal tendon, bulbocavernosus muscle and ischiocavernosus muscle). Later, a sterile gloved index or middle finger was placed in the vagina to palpate the boney structures (sacrum and coccyx) and identify pelvic floor muscles and tendons (iliococcygeus, ischicoccygeus, obturator internus and levator ani tendon), as well as trigger points. At last, gentle pressure was given to massage the trigger points and muscles at each spot to reduce muscle tension and alleviate pain for 15-20 min.

Evaluation indicators. The duration of the second stage of labor, the forced breath-holding time and the postpartum hemorrhage volume in 2 h for both groups were evaluated.

The pain level in the second stage of labor was assessed using the Pain Visual Analogue Scale (VAS) (13). The survey data were collected 30 min after delivery. The pain level was marked on a scale of 1 to 10, with 0 indicating no pain and 10 indicating intolerable, extreme pain.

The degree of perineal laceration was classified as perineal integrity (without laceration), I°, II°, III° and IV° lacerations. Perineal integrity refers to the integrity of the perineal skin and vaginal mucosa without laceration. I° laceration refers to the tear of the perineal skin and vaginal entrance mucosa, with little bleeding. II° laceration indicates that the laceration has reached the fascia and muscular layer of the perineal body, involving the mucosa of the posterior vaginal wall, extending to the grooves on both sides of the posterior vaginal wall and

Table I. Comparison of general data between two groups.

Characteristic	Control group (n=28)	Experimental group (n=28)	P-value
Age, years	27.32±4.24	27.14±3.52	0.860
Gestational time, days	273.07±12.12	273.32±9.49	0.940
Body mass index, kg/m^2	25.29±2.63	25.57±2.65	0.588

Values are expressed as the mean ± standard deviation, and the comparison between groups was performed using the independent samples t-test.

Table II. Comparison of the stage of labor between the two groups.

Indicators	Control group (n=28)	Experimental group (n=28)
Duration of the second stage of labor, min	64.80±16.11	54.77±14.41[a]
Forced breath-holding time, min	28.67±7.98	24.57±7.21[a]
Postpartum hemorrhage volume in 2 h, ml	50.77±28.37	36.03±23.06[a]

Values were expressed as the mean ± standard deviation, and the comparison between groups was performed using the independent samples t-test. [a]P<0.05 vs. control group.

tearing upwards. The anatomical structure is difficult to identify, and there is a lot of bleeding. III˚ laceration refers to the laceration extending deep into the perineum, with rupture of the external anal sphincter, but an intact rectal mucosa. IV˚ laceration refers to complete penetration of the anus, rectum and vagina, exposure of the rectal lumen and severe tissue damage, with possibly some bleeding.

Fatigue degree of the primipara was assessed using the Multi-Dimensional Fatigue Inventory (MFI-20), which consists of five dimensions, namely mental, activity, overall, motivatio and physical, each with four entries. For a Likert 5-point scale, 1 point denotes complete compliance and 5 points mean complete non-compliance. The total score ranges from 20 to 100 points, with higher scores representing higher fatigue degree in primiparas (14).

Neonatal outcome indicators included fetal distress, abnormal umbilical cord, abnormal amniotic fluid and neonatal asphyxia. Data collection was performed within 1 h of delivery. The neonatal outcomes were also assessed by the Apgar score. Evaluation criteria were as follows: 1 min after birth, the newborns were scored from five aspects: Heart rate, respiration, muscle tone, laryngeal reflex and skin color, with a score of 0-2 out of 10 for each item. A score of 8-10 points represents normal newborns, 4-7 points represents mild neonatal asphyxia and 0-3 points represents severe asphyxia.

Statistical analysis. Categorical variables of the included women were expressed as frequencies, and these data were analyzed using the χ^2 test or Fisher's exact test. Continuous variables with normal distribution were expressed as the mean ± standard deviation and the comparison between groups was performed using the independent samples t-test. All statistical analyses were performed using IBM SPSS Version 26 (IBM Corp.), and a two-sided P-value of <0.05 was considered to indicate a statistically significant difference.

Results

Demographics. A total of 56 women were finally included in this study, with 28 patients each in the control and experimental groups. Women in the control group were aged between 16 and 34 years, with a mean age of 27.32 years. Women in the experimental group were aged between 21 and 34 years, with a mean age of 27.14 years. Comparing the age, gestational time and body mass index of the patients in the two groups, no significant differences were found (P>0.05), as shown in Table I.

Comparison of the stage of labor between the two groups. As shown in Table II, the duration of the second stage of labor, the forced breath-holding time and the postpartum hemorrhage volume in 2 h in the experimental group were lower than those in the control group, and the differences were statistically significant (P<0.05).

Comparison of the laceration rate and episiotomy rate between the two groups. In the control group, there were 13 women with I˚ vaginal tears and 5 with II˚ vaginal tears. In the experimental group, there were 13 women with first-degree vaginal tears and one with II˚ vaginal tears. The laceration ratio in the experimental group was 50.00%, which was lower than that in the control group (64.29%), but the difference was not significant different (P>0.05). One woman from the experimental group and four women from the control group required an episiotomy, as shown in Table III.

Comparison of VAS scores, multidimensional fatigue scale scores and Apgar scores between the two groups. As shown in Table IV, the pain VAS scores, multidimensional fatigue scale scores and Apgar scores of the experimental group were significantly lower than those of the control group, and the differences were all statistically significant (P<0.05).

Table III. Comparison of the laceration ratio and sidecut ratio in the primipara of the two groups.

		Degree of perineal laceration, n				
Groups	N	I°	II°	Episiotomy, n	Laceration ratio, %	Sidecut ratio, %
Control group	28	13	5	4	64.29	14.29
Experimental group	28	13	1	1	50.00[a]	3.57[a]

Values are presented as n or % and analyzed using the χ^2 test or Fisher's exact test. [a]P>0.05 vs. control group.

Table IV. Comparison of visual analog scale scores, multidimensional fatigue scale scores, and Apgar scores between the two groups.

Indicators	Control group (n=28)	Experimental group (n=28)
Pain visual analog scale score	8.00±1.19	6.28±1.36[a]
Multidimensional fatigue scale score	62.36±10.73	48.71±8.51[a]
Apgar score	9.93±0.26	9.25±1.00[a]

Values are expressed as the mean ± standard deviation, and the comparison of groups was performed using the independent samples t-test. [a]P<0.05 vs. control group.

Table V. Comparison of neonatal outcomes between the two groups.

Groups	n	Fetal distress	Umbilical cord abnormalities	Abnormal amniotic fluid	Neonatal asphyxia	Total incidence
Control group	28	1 (3.57)	1 (3.57)	0 (0.00)	1 (3.57)	3 (10.71)
Experimental group	28	0 (0.00)	1 (3.57)	0 (0.00)	0 (0.00)	1 (3.57)[a]

Values are expressed as n (%) and total incidence was analyzed using the Fisher's exact test. [a]P<0.05 vs. control group.

Comparison of neonatal outcomes between the two groups. The experimental group exhibited a much lower incidence of neonatal adverse outcomes compared with the control group, and the difference between total incidence rates was statistically significant (3.57 vs. 10.71%; P<0.05; Table V).

Discussion

Pelvic floor myofascial manipulation has been reported to effectively reduce postpartum hemorrhage volume, avoid the need for a blood transfusion and help the mother's body to recover quickly (15). The procedure also shortens the duration of the second stage of labor, reduces the incidence of urinary incontinence and improves pelvic floor symptoms (16). In the present study, it was found that after pelvic floor myofascial manipulation intervention, the duration of the second stage of labor, the forced breath-holding time and the bleeding volume at 2 h postpartum were significantly lower in primiparas in the experimental group compared with those in control group. In some parturients, the fetal head enters the pelvic cavity and is stuck close to the pubic symphysis. Pelvic floor myofascial manipulation, which releases tight muscles and fascia and expands the pelvic cavity, means that the fetal head of the fetus can smoothly descend and the stage of labor is shortened. Accordingly, pelvic floor myofascial manipulation can adjust the fetal position to a certain extent, reduce the risk of dystocia, and benefit both the mother and the newborn.

Pelvic floor muscle tension will increase for a variety of reasons (such as pregnancy, childbirth and inflammation), and muscle hypertonia will not be relieved immediately. Therefore, perineal damage can easily occur during childbirth, increasing the probability of lateral cutting or tearing (17). In the present study, the proportion and degree of episiotomies or tears were decreased by pelvic floor myofascial manipulation during the second stage of labor. However, these indications showed no significant difference with those in the control group, which may be related to the small sample size. In addition, the intervention of pelvic floor myofascial manipulation can help mothers to speed up blood flow, reduce the release of pain-causing factors from related tissues and ultimately reduce the sensitivity of the mothers to pain (18), thereby reducing the pain, helping the fetal head descend and shortening the time of the second stage of labor (19,20). The present study also found

that the pain VAS and fatigue scores of the pregnant women in the experimental group were significantly lower than those in the control group.

Labor pain is a medical pain with a high pain index, which is mainly caused by factors such as uterine paroxysmal contractions, fetal compression of the birth canal and the body's neuroendocrine response (21). Labor pain can promote the secretion of catecholamines and other stress products in the maternal body, increase the blood pressure and heart rate, slow down uterine contractions, decrease placental blood flow and prolong cervix dilation time, all of which affect the entire delivery process and raise the risk of adverse maternal and infant damage (22). After the intervention of pelvic floor myofascial manipulation in the second stage of labor, the parturient experienced reduced pain and fatigue, a somewhat improved mood and maintained physical strength. This contributed to a shorter duration of labor and enhanced delivery outcomes. At the same time, it is also conducive to stabilizing the fetal heart rate, lowering the risk of neonatal asphyxia, reducing the poor prognosis of neonates and achieving a good neonatal outcome (23). As an important manifestation of neonatal outcome, neonatal asphyxia primarily results from ischemia and hypoxia or acidosis due to the failure of the normal respiratory function of newborns during delivery. In severe cases, it can lead to systemic organ damage and significantly increase neonatal disability or mortality (24). Disturbances in gas exchange or blood circulation between the mother and the fetus can result in fetal distress and fetal asphyxia. The fetal distress may be transformed into intrapartum asphyxia or postpartum asphyxia, which poses a serious threat to the quality of life or safety of the newborns (25). A prolonged labor is primarily to blame for adverse outcomes such as urinary retention and neonatal asphyxia in mothers and infants (26). In this study, newborns were scored 1 min after birth in terms of five aspects (heart rate, respiration, muscle tone, laryngeal reflexes and skin color) and umbilical artery blood. One of the newborns in the control group presented with a heart rate <100/min, a weak cry, slightly flexed limbs and umbilical artery blood pH <7.1, so it was assessed as mild asphyxia (27). However, whether the experimental group in this study did not have the aforementioned problems due to the intervention performed, and whether the control group had other causes of prolonged labor leading to mild asphyxia, needs to be verified in future clinical trials with larger samples and more data. The present findings indicated that pelvic floor myofascial manipulation could shorten the duration of the second stage of labor, relieve the pain, and decrease the amount of bleeding during delivery. Additionally, the intervention assists the parturient in passing through the second stage of labor in a better mental and physical state. However, when performing the intervention, the force and the stimulation should not be excessive, and the course of action should vary depending on the state of the maternal pelvic floor. The stimulation time should also not be excessively prolonged. More importantly, surgery should intervene promptly if the fetal position cannot be adjusted during the process or there is an indication for cesarean section.

There are still several limitations to the present study: i) The study was conducted in only one hospital in China with a relatively small sample size; ii) the manipulation is hard to standardize; iii) whether pelvic floor myofascial manipulation will benefit pregnant women with hypertensive disorder and diabetes remains to be explored; and iv) follow-up information (e.g. the health of mothers and babies) after delivery is lacking. In our future study, a large sample randomized clinical trial with an improved blinding and randomization process will be conducted to provide more reliable evidence for peripartum care.

In conclusion, pelvic floor myofascial manipulation during the second stage of labor for primipara undergoing vaginal delivery can shorten the duration of the second stage of labor and reduce blood loss during labor. For neonates, this intervention helps lower the incidence of neonatal adverse outcomes. In light of these effects, pelvic floor myofascial manipulation can be a potential adjuvant therapy during labor for better maternal and neonatal outcomes. Standardization of this technique and future clinical trials to further evaluate the effects of this non-invasive manual therapy are needed.

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Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Authors' contributions

YQC, ZWW and HYJ conceived and designed the study. HCL, JW, JZQ, JHL and DQW were responsible for provision of the study materials or patients. HCL, JW, JZQ, JHL and DQW collected and assembled the data. Data analysis and interpretation was performed by HYJ. YQC, ZWW and HYJ confirm the authenticity of all the raw data. All authors helped write the manuscript. All authors have read and approved the manuscript.

Ethics approval and consent to participate

This study was approved by the Ethics Committee of the Second Affiliated Hospital of Hainan Medical College (Haikou, China; approval no. H20171201-1), and all patients/their guardians provided written informed consent.

Patient consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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