УДК 618.4/.5+618.6]-07
DOI: https://doi.org/10.17816/JOWD110888

Анатомическое и функциональное состояние мышц тазового дна после ассистированных вагинальных родов

В.Ф. Беженарь[1], Е.В. Фредерикс[2], М.Д. Леонова[2], А.Д. Жарук[2]

[1] Первый Санкт-Петербургский государственный медицинский университет им. акад. И.П. Павлова, Санкт-Петербург, Россия;
[2] Родильный дом № 13, Санкт-Петербург, Россия

Обоснование. Основной функцией мышц промежности является сохранение синтопии и топографии органов брюшной полости и малого таза. Клинически синдром несостоятельности мышц тазового дна проявляется различными группами симптомов, значительно ухудшающих качество жизни пациентки. В настоящее время одной из наиболее часто обсуждаемых причин развития пролапса тазовых органов остается акушерская травма.

Цель исследования — оценить анатомическое и функциональное состояния мышц тазового дна после физиологических родов и родов с применением акушерских щипцов.

Материалы и методы. Исследование проведено на базе Родильного дома № 13 в период с 2020 по 2021 г. с участием 137 пациенток, родоразрешенных через естественные родовые пути: 47 человек — с использованием акушерских щипцов (основная группа), 90 человек — без использования родоразрешающих инструментов (группа контроля), через 6 мес. после родов. Проведены комплексная оценка состояния мышц тазового дна с использованием валидированного опросника PFDI-20 и ультразвукового исследования структур тазового дна в покое, а также функциональная оценка состояния мышц тазового дна на тренажере Pneumatic Pelvic Muscle Trainer XFT-0010.

Результаты. Оценка жалоб по шкале-опроснику PFDI-20 по медиане составила в основной группе 6,00 ± 1,77 балла, в контрольной — 5,50 ± 1,29 балла (p = 0,8), отличия достоверно не значимы. По данным ультразвукового исследования, у пациенток обеих групп выявлены уменьшения толщины сухожильного центра промежности и *m. bulbocavernosus* без статистически значимой разницы между группами, а толщина *m. puborectalis* не отличалась от нормы и также не показала статистически значимой разницы между группами. В результате оценки функционального состояния мышц тазового дна не выявлено статистически значимых различий в группах.

Заключение. Результаты исследования демонстрируют безопасность применения акушерских щипцов для анатомической и функциональной состоятельности мышц тазового дна и не показывают значимых различий между естественными родами и родами с использованием родоразрешающих инструментов. Применение акушерских щипцов в практике врача акушера-гинеколога может быть надежным инструментом, не влияющим на качество жизни пациенток в отдаленной перспективе.

Ключевые слова: ассистированные вагинальные роды; недостаточность тазового дна; акушерские щипцы; трансперинеальная ультрасонография.

Как цитировать:
Беженарь В.Ф., Фредерикс Е.В., Леонова М.Д., Жарук А.Д. Анатомическое и функциональное состояние мышц тазового дна после ассистированных вагинальных родов // Журнал акушерства и женских болезней. 2022. Т. 71. № 5. С. 13–19. DOI: https://doi.org/10.17816/JOWD110888

Рукопись получена: 12.09.2022 **Рукопись одобрена:** 12.10.2022 **Опубликована:** 31.10.2022

ЭКО•ВЕКТОР

DOI: https://doi.org/10.17816/JOWD110888

Anatomical and functional conditions of the pelvic floor muscles after assisted vaginal delivery

Vitaly F. Bezhenar[1], Elena V. Frederiks[2], Margarita D. Leonova[2], Anastasia D. Zharuk[2]

[1] Academician I.P. Pavlov First St. Petersburg State Medical University, Saint Petersburg, Russia;
[2] Maternity Hospital No. 13, Saint Petersburg, Russia

BACKGROUND: The main function of the muscles of the perineum is to preserve the syntopy and topography of the organs of the abdominal cavity and small pelvis. Clinically, various groups of complaints that significantly worsen the patient's quality of life manifest pelvic floor muscle failure. Currently, one of the most commonly discussed causes of pelvic organ prolapse is still considered obstetric trauma.

AIM: The aim of this study was to assess the anatomical and functional conditions of the pelvic floor muscles after normal physiologic childbirth and childbirth with the use of obstetric forceps.

MATERIALS AND METHODS: The study was conducted in Maternity Hospital No. 13 (Saint Petersburg, Russia) in 2020–2021, which involved 137 patients who delivered through the natural birth canal with the use of obstetric forceps (main group, $n = 47$) or without the use of delivery instruments (control group, $n = 90$) six months after delivery. A comprehensive assessment of the condition of the pelvic floor muscles was carried out using the validated PFDI-20 questionnaire and ultrasound examination of the pelvic floor structures at rest. A functional assessment of the condition was carried out using the Pneumatic Pelvic Muscle Trainer XFT-0010.

RESULTS: Evaluating complaints using the PFDI-20 scale revealed that the median was 6.00 ± 1.77 points in the main group and 5.50 ± 1.29 points in the control group, the differences being not significant ($p = 0.8$). The ultrasound examination showed no significant difference in decreases in the thickness of the tendon center of the perineum and *m. bulbocavernosus* between the study groups; *m. puborectalis* thickness in the main group did not differ significantly from the norm either. The assessment of the functional condition of the pelvic floor muscles revealed no significant differences between the patients of the study groups.

CONCLUSIONS: The data obtained demonstrate the safety of the use of obstetric forceps for the anatomical and functional viabilities of the pelvic floor muscles and do not have significant differences compared to childbirth performed without the use of delivery instruments. However, the use of obstetric forceps in the practice of obstetricians and gynecologists can be a reliable tool that does not affect the quality of life of patients in the long term.

Keywords: assisted vaginal delivery; pelvic floor insufficiency; obstetric forceps; transperineal ultrasonography.

To cite this article:
Bezhenar VF, Frederiks EV, Leonova MD, Zharuk AD. Anatomical and functional conditions of the pelvic floor muscles after assisted vaginal delivery. *Journal of Obstetrics and Women's Diseases.* 2022;71(5):13–19. DOI: https://doi.org/10.17816/JOWD110888

Received: 12.09.2022 **Accepted:** 12.10.2022 **Published:** 31.10.2022

BACKGROUND

Pelvic floor insufficiency is a collective term that includes urinary incontinence, pelvic organ prolapse, anal (fecal) incontinence, sexual dysfunction, and pelvic pain that is unrelated to the organic and inflammatory changes of the pelvic organs [1–3]. The main function of the perineal muscles is to preserve the syntopy and topography of the abdominal and pelvic organs. Clinically, pelvic floor muscle failure manifests as several groups of symptoms: urological (urinary incontinence or difficulties), gynecological (dyspareunia and genital prolapse), coloproctological (fecal and gas incontinence, constipation, and rectal prolapse), general (chronic pelvic pain syndrome), and sexual dysfunction [4, 5].

Risk factors for the development of pelvic floor insufficiency are usually the patient's age, excessive body weight (in particular, obesity), genetic predisposition, childbirth parity, maternal delivery mode and obstetric trauma, menopausal period, chronic cough, chronic constipation, connective tissue dysplasia (Ehlers–Danlos or Marfan syndrome) [5–7]. Obstetric trauma remains one of the most frequently discussed causes of pelvic organ prolapses. Handa et al. reported that 10%–30% of natural childbirths end with *m. levatorani* trauma [8]. Blomquist et al. published data on the occurrence of pelvic floor muscle failure 5–10 years after delivery. The authors showed that surgical abdominal delivery was associated with a lower risk of genital prolapse than natural childbirths [9].

The use of obstetric forceps is the greatest concern in the study of pelvic floor muscle failure syndrome. Gurol-Urganci et al. published data from a cohort study including 1,035,253 primiparous women who delivered through the natural birth canal from 2000 to 2012. The incidence of anal sphincter injuries during delivery using obstetric forceps was 22.7% without episiotomy and 6.1% with episiotomy; that during vacuum-extraction deliveries was 4% without episiotomy and 2.3% with episiotomy; and that during normal vaginal deliveries was 3.4% without episiotomy and 2.2% with episiotomy [10].

The opposite results were obtained in a study conducted in 2015–2017 in China. Wan et al. observed that no long term maternal complications were associated with birth with obstetric forceps relative to natural childbirth. In this study, no statistically significant differences in the frequency of postpartum hemorrhage, anal sphincter injuries, vaginal hematomas, and perineal suture discrepancies were observed between groups, and neither did the frequency of distant effects (dyspareunia, urinary incontinence, and fecal and gas incontinence) differ significantly in groups. However, the authors stressed the need for a perineal protection aid [11].

Given that no absolute evidence suggests that a high risk of maternal injuries exists when obstetric forceps are utilized and the indications for vacuum extractor use have several significant limitations, such as invasive procedures on the fetal head and fetal head location above the narrow pelvic cavity, an objective assessment of the outcomes of surgical vaginal deliveries with obstetric forceps for the mother is important.

The aim of the study is to assess the anatomical and functional status of the pelvic floor muscles after natural childbirth and childbirth with the use of obstetric forceps.

MATERIALS AND METHODS

The study was conducted in Maternity Hospital No. 13 in 2020–2021. It involved 137 patients 6 months after delivery through the natural birth canal with the use of obstetric forceps (main group, $n = 47$) or without the use of delivery instruments (control group, $n = 90$). Mediolateral episiotomy was performed on all patients of the main group, whereas mediolateral episiotomy was not performed on 28% of the cases in the control group.

Inclusion criteria were age 18–40 years, singleton pregnancy, gestational age by the time of delivery of 37–41 6/7 weeks, occipital insertion of the fetal head, no contraindications to natural childbirth, and signed informed consent to participate in the study. Additional criteria for inclusion in the main group included indications for surgical abdominal delivery and signed informed consent for surgical delivery. Exclusion criteria were bone pelvic anomalies, placental abnormalities, and signs of acute bacterial and viral diseases of the urogenital tract that complicate delivery.

A comprehensive assessment of the pelvic floor muscles was performed by using the validated Pelvic Floor Distress Inventory (PFDI-20), which consisted of three separate scales, including the Pelvic Organ Prolapse Distress Inventory 6, Colorectal-Anal Distress Inventory 8, and Urinary Distress Inventory 6, and resting pelvic floor structure ultrasound on a Voluson E6 Gm Healthcare Austria GmbH&CoOG (Austria) device with a RIC 5-9-D 4–6 MHz transducer in B-mode. The measurement was taken vertically from the upper edge of the anal sphincter to the vaginal mucosa without pressure from the transducer on the vaginal wall. The thicknesses of the pelvic floor muscles, the perineal tendon center, *m. bulbocavernosus*, and *m. puborectalis*; the integrity of the external and internal anal sphincters; and the presence of diastasis (measured at the upper edge of the external anal sphincter, perpendicular to the muscle bundle) were determined. The following thicknesses were considered normal: perineal tendon center thickness of 10–15 mm, *m. puborectalis* thickness >7 cm, and *m. bulbocavernosus* thickness >7 mm [12]. The functional assessment of the pelvic floor muscles was performed by using a Pneumatic Pelvic Muscle Trainer XFT-0010 (China) with a 9-point scale in accordance with the results of two training modes.

DOI: https://doi.org/10.17816/JOWD110888

Statistical data processing was conducted by applying for Microsoft Excel 2013 and Statistica 8.0 programs with the calculation of mean indices (*M*) and errors of standard deviation (*m*). The statistical significance of differences between quantitative criteria was assessed by using Student's *t*-test. Differences between the compared values were considered statistically significant at $p < 0.05$. Multiple correlation analysis with the calculation of the Spearman correlation coefficient (*k*) was performed to determine the relationship between indices.

RESULTS

The mean age of patients in the main group (29.72 ± 4.88 years) and the control group (30.36 ± 3.99 years) did not significantly differ ($p > 0.05$). The body mass indices of the main and control groups were 29.31 ± 4.91 and 27.91 ± 4.1, respectively, and did not significantly differ ($p > 0.05$). The proportion of primiparous women was 81% (38 women) in the main group and 55% (50 women) in the control group. No differences were found in the gestational age at delivery, i.e., 39.71 ± 1.15 weeks in the main group and 39.84 ± 1.04 weeks in the control group ($p > 0.05$). Newborn body weight was 3258.8 ± 877.0 g in the main group and 3630.4 ± 482.1 g in the control group ($p > 0.05$).

In both groups, no grade III–IV perineal tears were observed. However, two cases of vaginal wound prolongation after episiotomy were recorded in the main group, and one case was recorded in the control group.

Complaint scores on the PFDI-20 scale were 6.00 ± 1.77 for the main group and 5.5 ± 1.29 for the control group ($p = 0.8$) without significant differences.

Ultrasound findings revealed a reduction in the thickness of the perineal tendon center and *m. bulbocavernosus* without statistically significant differences in both groups, whereas the thickness of *m. puborectalis* did not differ from normal and showed no statistically significant differences between groups (Table 1).

In addition, correlation analysis was performed on the main transperineal ultrasound findings and the median PFDI-20 scores ($p < 0.05$) of the study groups (Table 2).

No statistically significant correlation between the main parameters of transperineal ultrasound and the median PFDI-20 scores was observed.

The assessment of the functional status of the pelvic floor muscles by using the Pneumatic Pelvic Muscle Trainer XFT-0010 revealed no statistically significant differences between the study groups. The median scores in the main and control groups were 4.025 ± 1.33 and 4.015 ± 1.05, respectively ($p = 0.75$).

DISCUSSION

This study found no statistically significant differences between the groups in perineal muscle thickness (according to transperineal ultrasound) and the assessment of complaints according to the PFDI-20 scale and the functional status of the pelvic floor muscles evaluated by using the Pneumatic Pelvic Muscle Trainer XFT-0010. This finding indicates that surgical vaginal delivery with the use of obstetrical forceps does not show a higher incidence of pelvic floor dysfunction than natural childbirth without the use of delivery instruments.

The data obtained in this work contradict the results of several studies. Muraca et al. showed that compared with

Table 1. Comparison of transperineal ultrasound parameters between groups

Таблица 1. Сравнение показателей трансперинеального ультразвукового исследования между группами

Parameters	Main group ($n = 47$)	Control group ($n = 90$)	Statistical significance
Thickness of the perineal tendon center ($M \pm m$), cm	0.8 ± 0.06	0.76 ± 0.05	$p = 0.61$
Thickness of *m. puborectalis* ($M \pm m$), cm	0.965 ± 0.08	0.9 ± 0.06	$p = 0.87$
Thickness of *m. bulbocavernosus* ($M \pm m$), cm	0.945 ± 0.05	0.9 ± 0.04	$p = 0.87$

Table 2. Analysis of the correlation between main transperineal ultrasound parameters and median PFDI-20 scores in groups ($p < 0.05$)

Таблица 2. Корреляционный анализ основных показателей трансперинеального ультразвукового исследования и медианы баллов по шкале-опроснику PFDI-20 в группах ($p < 0,05$)

Transperineal ultrasound parameters	Coefficient of correlation between the index and the median score according to the PFDI-20 scale PFDI-20 (*k*)	
	Main group ($n = 47$)	Control group ($n = 90$)
Thickness of the perineal tendon center	–0.094	0.107
Thickness of *m. puborectalis*	0.225	0.079
Thickness of *m. bulbocavernosus*	0.130	0.015

cesarean section, the use of obstetrical forceps is associated with a greater risk of bleeding due to the high incidence of grade III–IV perineal tears [13]. Notably, the risk of technical failures, such as slipping of the vacuum extractor cup, is 21%–34%; meanwhile, the combined use of a vacuum extractor and obstetric forceps increases the risk of developing deep perineal tears by 8.1 times [14]. However, the authors of these studies did not specify whether episiotomy was performed during surgical vaginal delivery. In our study, a mediolateral episiotomy was performed in 100% of cases when obstetrical forceps were applied. This approach may be the reason for fewer deep perineal tears.

MacLennan et al. reported that pelvic floor muscle dysfunction is correlated with age, childbirth parity, and surgical vaginal delivery. However, surgical abdominal delivery does not prevent the development of pelvic floor muscle failure in the long term [15]. The present study noted a decrease in two ultrasound indices in both groups and concluded that the change in pelvic floor structure was not due to the mode of delivery and may have occurred during pregnancy. Several independent studies demonstrated that pregnancy itself is a significant risk factor for pelvic floor muscle failure and that the method of delivery has no effect on the rate of the development of this pathological process. In the long term, no significant differences in the formation of pelvic floor insufficiency were found depending on the method of delivery [16, 17]. Moreover, the patient's subjective assessment of their condition did not correlate with the severity of anatomical changes (according to ultrasound) and did not depend on the method of delivery. Similar observations were reported by several other studies [18], proving the importance of an objective assessment of the pelvic floor by using instrumental techniques.

This study was not designed to assess and analyze the impact of epidural anesthesia on the anatomical integrity of pelvic floor structures. However, many factors affecting the likelihood of perineal trauma during surgical vaginal delivery are described in the literature. In a study published in 2019, Urbankova et al. observed that the use of epidural anesthesia in labor reduced the likelihood of a grade III–IV perineal tear. The authors associated this phenomenon with the relaxing effect of anesthesia on the perineal muscles and their increased ability to stretch [19]. However, this effect requires further study and analysis.

CONCLUSIONS

The results demonstrated the safety of the use of obstetrical forceps for the anatomical and functional status of the pelvic floor muscles. The effect on the pelvic floor muscles shown by this technique does not differ significantly from that of childbirth without the use of delivery instruments. The application of obstetrical forceps in the practice of obstetricians and gynecologists can be a reliable tool that does not affect the quality of life of patients in the long term.

ДОПОЛНИТЕЛЬНАЯ ИНФОРМАЦИЯ

Источник финансирования. Исследование выполнено без использования спонсорских средств и финансового обеспечения.

Конфликт интересов. Авторы декларируют отсутствие явных и потенциальных конфликтов интересов, связанных с публикацией настоящей статьи.

Вклад авторов. *В.Ф. Беженарь* — концепция и дизайн исследования; *Е.В. Фредерикс, М.Д. Леонова, А.Д. Жарук* — сбор и обработка материала; *М.Д. Леонова, А.Д. Жарук* — статистическая обработка данных; *Е.В. Фредерикс, М.Д. Леонова, А.Д. Жарук* — написание текста; *В.Ф. Беженарь* — редактирование.

Все авторы внесли существенный вклад в проведение исследования и подготовку статьи, прочли и одобрили финальную версию перед публикацией.

ADDITIONAL INFORMATION

Funding. The study had no external funding.

Conflict of interest. The authors declare no conflict of interest.

Authors contribution. *V.F. Bezhenar* — study concept and design; *E.V. Frederiks, M.D. Leonova, A.D. Zharuk* — collection and processing of material; *M.D. Leonova, A.D. Zharuk* — statistical data processing; *E.V. Frederiks, M.D. Leonova, A.D. Zharuk* — writing the text; *V.F. Bezhenar* — editing.

All authors made a significant contribution to the study and the article preparation, as well as read and approved the final version before its publication.

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AUTHORS INFO

Vitaly F. Bezhenar, MD, Dr. Sci. (Med.), Professor;
ORCID: https://orcid.org/0000-0002-7807-4929;
ResearcherID: R-7055-2017;
Scopus Author ID: 57191963583;
RSCI AuthorID: 271233;
eLibrary SPIN: 8626-7555;
e-mail: bez-vitaly@yandex.ru

Elena V. Frederiks, MD;
ORCID: https://orcid.org/0000-0002-2513-6209;
eLibrary SPIN: 1174-9903;
e-mail: evfrederiks@gmail.com

*** Margarita D. Leonova**, MD;
address: 4 Kostromskaya St., Saint Petersburg, 191124, Russia;
ORCID: https://orcid.org/0000-0002-3813-2995;
e-mail: _margarita_@bk.ru

Anastasia D. Zharuk, MD;
ORCID: https://orcid.org/0000-0002-3854-9563;
e-mail: zharukanastasia@gmail.com

ОБ АВТОРАХ

Виталий Федорович Беженарь, д-р мед. наук, профессор;
ORCID: https://orcid.org/0000-0002-7807-4929;
ResearcherID: R-7055-2017;
Scopus Author ID: 57191963583;
RSCI AuthorID: 271233;
eLibrary SPIN: 8626-7555;
e-mail: bez-vitaly@yandex.ru

Елена Вадимовна Фредерикс;
ORCID: https://orcid.org/0000-0002-2513-6209;
eLibrary SPIN: 1174-9903;
e-mail: evfrederiks@gmail.com

*** Маргарита Дмитриевна Леонова**;
адресс: Россия, 191124, Санкт-Петербург, ул. Костромская, д. 4;
ORCID: https://orcid.org/0000-0002-3813-2995;
e-mail: _margarita_@bk.ru

Анастасия Дмитриевна Жарук;
ORCID: https://orcid.org/0000-0002-3854-9563;
e-mail: zharukanastasia@gmail.com

* Corresponding author / Автор, ответственный за переписку