



MORPHOFUNCTIONAL FEATURES OF THE ABDOMINAL PRESS IN WOMEN OF REPRODUCTIVE AGE

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✓ *Resume*

Despite the emergence of new technologies in herniology, the problem of choosing a method and material for fixing meshprostheses remains unresolved and requires the search for new approaches to solve this problem.

Key words: hernia, hernioplasty, mesh, abdominal wall reconstruction, women of childbearing age.

МОРФОФУНКЦИОНАЛЬНЫЕ ОСОБЕННОСТИ БРЮШНОГО ПРЕССА У ЖЕНЩИН РЕПРОДУКТИВНОГО ВОЗРАСТА

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✓ *Резюме*

Несмотря на появление новых технологий в герниологии, проблема выбора способа и материала для фиксации сетчатых протезов у беременных женщин фертильного возраста остается до конца не решенной и требует поиска новых подходов для решения этой задачи.

Ключевые слова: грыжа, герниопластика, сетка, реконструкция брюшной стенки, женщины фертильного возраста.

РЕПРОДУКТИВ ЁШДАГИ АЁЛЛАРДА ҚОРИН ПРЕССИНИНГ МОРФОФУНКЦИОНАЛ ХУСУСИЯТЛАРИ

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✓ *Резюме*

Янги технологиялар пайдо бўлишига қарамай, герниология, тўрни аниқлаш учун усул ва материал танлаш муаммоси, фертил ёшдаги хомиладор аёлларда протез ҳал этилмасдан қолаётгани ва бу муаммони ҳал қилиш учун янги ёндашувларни қидиришни талаб қилади.

Калит сўзлар: чурра, герниопластика, тўр, қорин девори реконструкцияси, фертил ёшдаги аёллар.

Relevance

The achievements of modern herniology not only helped a significant number of patients to get rid of the disease or the consequences of surgery, but also gave rise to a number of problems [1,3,9].

Thus, the socially oriented direction in surgery that has appeared in modern conditions implies not only the solution of surgical issues, but also the choice of a number of conditions. For example, the technique of hernia section has been worked out in detail throughout the twentieth century, but still one of the significant problems remains the choice of the optimal method of hernioplasty [2,4,6].

The classical tactics of planned surgical treatment of hernias, based on plastic surgery with local tissues, has not satisfied most surgeons for a long time, therefore, modern surgical treatment of hernias of the anterior abdominal wall is increasingly based on the use of synthetic meshes for plastic defects. Currently, there are thousands of ways to treat hernias, and at least 10-15 new proposals are published annually [1,5,7].

However, non-tensioning plastic surgery does not solve all the problems in the treatment of hernias. The experience of alloplastic operations reveals problems related to the range and characteristics of prostheses, and the placement of endoprotheses is also debatable. One of the unresolved issues remains the choice of an adequate mesh prosthesis in size. That is, modern herniology is at the stage of understanding the accumulated experience in the use of prosthetic materials. There are a huge number of problems associated with the development of unsatisfactory treatment results, relapses, late and early complications, with a large number of techniques, operations, prostheses. For many years, the cause of failures in the treatment of hernias was considered to be technical miscalculations of the surgeon, incorrect choice of the operation option, comparison of heterogeneous tissues, etc. The issues of the body's reaction to the mesh implant, drainage of postoperative and recurrent hernias of the anterior abdominal wall are debatable, and in many cases requires a balanced decision. But at the same time, the introduction into practice of new and new methods, methods and modifications of hernioplasty requires a lot of information and analytical work. Therefore, the use of endoprotheses in a compromised area of intervention remains the subject of lively discussions in the herniological community, and the emergence of new methods necessitates the development of an algorithm for optimal treatment[1,2,8].

At the same time, the introduction of new advanced technologies sometimes occurs arbitrarily, when, according to the authors, multidirectional hernioplasty techniques are used in the same category of patients.

The relevance of the problem of errors and complications in herniology has not decreased in the XXI century, despite the emergence of undeniably effective therapeutic and diagnostic methods and conceptions. Thus, many issues of herniology remain unresolved and controversial.

A significant breakthrough in practical herniology is possible only on the basis of fundamental research necessary to create a general theory of hernia formation explaining the etiology and pathogenesis of this disease. And the development of an adequate algorithm for surgical treatment based on an individual approach to a specific woman of fertile age during pregnancy will allow for the reconstruction of the abdominal wall and achieve the result of treatment.

The effectiveness of the treatment of such patients has increased significantly in recent years, mainly with the help of the development of new treatment methods, prosthetic techniques, high-tech transplants. Especially noticeable is the progress in the treatment of patients with extensive and giant ventral hernias, which allows them to perform plastic surgery without tension, thereby preventing various postoperative complications. Performing such operations, the surgeon is largely able to restore the anatomical integrity of the anterior abdominal wall. However, the possibilities of restoring the functions of the anterior abdominal wall have not yet been studied. Practically unexplored are the issues of allogenioplasty during pregnancy, especially in the second and third trimesters. This work is devoted to the study of this problem.

The aim of the study is to improve the results of surgical treatment of women of fertile age with hernias of the anterior abdominal wall by substantiating a differentiated approach to the choice of the method of allogenioplasty.

Material and methods

The distribution of patients by age categories was carried out in accordance with the officially revised classification of the World Health Organization from 2012. According to the new age classification, from 25 to 45 years is a young age. Body weight was measured with an accuracy of 100 g using floor scales in the morning on an empty stomach, after emptying the intestines and bladder. The determination of the body mass index (BMI), a value that shows the degree of correspondence between a person's weight and his height, is an indirect, but easy and affordable way to assess. The body mass index indicator was developed by the Belgian sociologist and statistician Adolf Ketele in (1869). The body mass index is calculated by the formula $I = m/h^2$, where m is body weight in kilograms, h is height in meters, and is measured in 170 g/m^2 .

Laparometric examination of women was performed by measuring the anterior abdominal wall according to V.N. Shevkunenko. When forming groups of patients according to abdominal shapes, the formula for determining the PJ (parameters of the abdominal index) according to V.M. Zhukov (1972) was used: $PJ = \text{distansia bicostarum} / \text{distansia bispinarum} \times 100$. According to this indicator, the analyzed women were distributed as follows. When the indicator fell into the range of 97,5 – 102,5 points, the shape of the abdomen was noted as ovoid. If it falls into the range of 97,4 and less, it expands downward, and at 102,68 and more, it expands upward.

When assessing the profile of the abdomen, the following were taken into account: convex, straight and sunken.

Ultrasound examination of the rectus abdominis muscles in 61 herniators and 31 women without hernia was carried out on the A1 ultrasound machine of the Rgo Sound SSD 4000 (Korea) with a linear sensor with a scanning frequency of 7,5 MHz in a supine position in a specially equipped office. Layered ultrasound scanning of the rectus abdominis area was performed above the navel at the level of 2-3 abdomen. As a rule, the second abdomen was taken from the right, since it subsequently served for EMG research. Initially, its position was determined, since it is difficult to find it palpationally in herniators with large subcutaneous fat and muscle diastasis.

To assess the presence of intraabdominal hypertension and compartment syndrome, which are consequences and complications of inadequate hernioplasty, 92 hernia carriers measured intra-abdominal pressure. The study of the latter was carried out before the operation. Before the study, information consent was taken from patients. Measurement of intra-abdominal pressure was carried out by catheterization in aseptic conditions of the bladder and the introduction of 100 ml of sterile saline solution into the latter. Foley's catheter was attached to a granular glass tube (Waldman apparatus), which was positioned vertically. The beginning of the countdown corresponded to the level of the symphysis. By the size of centimeters of the water column, converted into millimeters of mercury column using a coefficient of 0,74, the value of the IAP was judged. The volume of the injected saline solution into the bladder during the measurement of IAP was established on the basis of literature data, as well as experimentally during laparoscopic operations.

Result and discussion

In herniated carriers, the shape and profile of the abdomen can occur in different combinations, but still the median localization of the ventral defect is interrelated with the convex profile ($r_{sp}=0,889$; $p>0,205$). Thus, among women with ventral hernia, having the shape of the abdomen expanding upwards, 79 (85,7%) women had a convex profile, and 13 (14,3%) had a straight profile. With the ovoid shape of the abdomen, a convex profile was also more common: it was noted in 61 (66,3%) women, and straight and hollow - in 11 (11,9%) and 2 (2,2%), respectively. The convex profile prevailed also in herniated carriers with the form of the abdomen expanding downwards: out of 41 observations, it was registered in 29 (31,5%), straight - in 13 (14,1%), and sunken - in 1 (1,1%).

A normal body mass index was observed in three (17,8%) herniated carriers with a sunken abdomen. Also, 13 (31,7%) women with a straight belly and 7 (17%) with a convex had a normal body mass index. Overweight women in 28 (52,1%) cases had a belly with a straight profile and in 37 (6,3%) - with a convex one. At the same time, 68 women with grade 1 ($n=33$ women), grade 2 ($n=21$ women) and grade 3 obesity ($n=14$ women) had a convex abdominal profile.

This fact seems to be related to the fact that among herniated carriers with a normal body mass index, including 8 (15,6%) women engaged in heavy physical labor and 34 (84,4%) not engaged in it, the average level of intra-abdominal pressure was equal to $4,501 \pm 0,891$ In herniated carriers with excess body weight, the proportion of those engaged in physical labor decreased to 27.9% (31 women), and in non-employed - increased to 69.3% (41 women), however, the value of IAP practically did not change and averaged $4,614 \pm 1,378$ mm.water.st. ($t_{st}=0,521$; $p>0,05$). In women with obesity of the 1st degree, the frequency of those engaged in physical labor decreased to 31,9% (23 women), and those who were not employed increased to 68,1% (49 women), but at the same time, a statistically insignificant increase in the level of IAP was recorded on average to $5,899 \pm 1,891$ mm of water ($t_{st}=0,899$; $p>0,05$).

All hernia carriers of women with obesity of 2 and 3 degrees were not related to hard physical labor, and the average level of IAP in them increased to $8,898 \pm 0,469$ mm. water.st. and $12,349 \pm 1,799$ mm.water.st. respectively. That is, there is no difference in the amount of intra-abdominal pressure between hernia carriers of women of fertile age engaged in heavy physical labor and not involved in it. At the same time, the level of IBD in herniated carriers increases relative to the body mass index ($r=1,101$; $p>0,05$), and also affects the size of hernial protrusion ($r=0,479$; $p>0,05$). At the same time, the electrical potential of the basal tone (the level of electrical activity) of the muscle during the period of functional rest in herniated carriers is in the range of 3,21-155 mv. At the same time, in the bulk of hernia carriers, the biopotential fell into the range of 27,8-52,4 mv, whereas in persons without a ventral hernial defect, the latitude of the range was less ($t_{st}=1,276$; $p>0,05$), since it corresponded to 3-32 MV, and more often - 5,5-8,5 mv.

In other words, herniated carriers of women of fertile age have a constant tension of the rectus muscle, the presence of muscle contracture is also likely, which can be explained by the constant pain syndrome in herniated carriers. This can be regarded as an adaptive mechanism that compensates for the dystrophic functions of the altered muscles to perform an adequate contraction during their work, which is not required by a person with normal morphology of the rectus abdominis muscle. At the same time, the values of the biopotential under conditional tension of the rectus abdominis muscle in herniated carriers correspond to the heterogeneity of its morphology, since they vary widely from 29 MV to 7899 MV, even though most values are at the level of 199-1381 MV. This can be attributed to the presence of a certain psychological barrier in the carriers of hernia formation, discomfort associated with pain, fear of infringement of the hernia when changing the position of the body in space.

In healthy women with conditional tension of the rectus muscle, the results of EMG were also diverse and were observed in the range from 119 mv to 8009 mv, but still most of the values fit into a smaller range – from 611 to 1317 mv ($t_{st}=1,329$; $p>0,05$). In the group of women without a hernial defect with conditional reduction, the lower limit of the biopotential was higher than in hernia carriers, the indicators are 29 MV and 119 MV, respectively. In most women without hernia, the biopotentials of conditional contraction of the rectus muscle were in a narrower range (from 611 to 1299 MV) than in herniated carriers (199-1379 mv). A more powerful contraction of the rectus abdominis muscle during its operation in people without a ventral hernial defect is indicated by the fact that the lower limit of biopotentials was at the level of 612 MV, compared with 199 MV in herniated carriers ($t_{st}=3,829$; $p>0,05$). In herniated carriers, the spread of values of such an integral EMG indicator as a change in the biopotential of the calm state of the rectus muscle and its conditional contraction corresponds to 7-59 mv. In the absence of a hernial defect, the spread reached the boundaries of 25 MV - 329 mv. At the same time, in herniated carriers, the biopotential increased more often by 19-28 MV, whereas in women without a hernia, it usually increased by 101-179 MV ($t_{st}=0,681$; $p>0,05$).

To exclude the subjective limitation of the abdominal muscles, we checked the spread of EMG biopotentials with unconditional tension (cough push) of the rectus muscles. In herniated carriers, it reached the following limits: the minimum value was registered at the level of 12 MV, and the maximum value was at the level of 2129 MV. And in women without hernia, the range had a smaller amplitude and corresponded to 261 MV and 1139 mv ($t_{st}=1,699$; $p>0,05$). Just as with the conditional reduction, the main part of the hernia carriers had a greater spread of EMG readings, which fell in the range of 329-695 MV. With a healthy abdominal wall, it was equal to 528-779 mv.

The lower level of biopotentials in herniated carriers (329-695 mv) was significantly lower ($t_{st}=0,127$; $p>0,05$) than in persons without hernia (528-779 mv). This suggests that in herniated carriers, with unconditional contraction, the abdominal muscles are not capable of fully performing the function. At the same time, herniated carriers had patients with biopotentials of rectus muscles with an unconditional contraction of 2131 MV, which significantly exceeded the biopotential in people without hernia (1141 MV). This indicates an overstrain of the muscles of herniated carriers at rest and the risk of inadequate excessive contraction of them, which can lead to infringement of hernial protrusion.

Conclusions

Thus, when choosing surgical tactics for hernia carriers of women of fertile age, it is necessary to take into account the following.

1. In hernia carriers of women of fertile age with median localization of the ventral defect, a convex profile is more common with the shape of the abdomen expanding upwards - in 90,3%, with the ovoid shape - in 81,5%, with the shape of the abdomen expanding downwards - in 65,1%.

2. The profile of the abdomen is affected by obesity. At the same time, the level of IBD in herniated carriers increases relative to the body mass index, but does not exceed the limits of the norm, since it is compensated due to the size of the hernial protrusion. At the same time, in herniated carriers of women of fertile age, abdominal muscles against the background of dystrophy and fatty dysplasia have a reduced level of biopotentials, both basal tone and the potential for conditional and unconditional contraction. This is a consequence of an increase in intra-abdominal pressure and leads to a violation of the mechanism of protection of the weak points of the abdominal wall, thereby contributing to an increase in the size of the hernial defect, sacrificing the functionality of the abdominal muscles.

3. The umbilical ring is a separate structural element of the abdominal wall, it does not participate in biomechanics and has its own properties, expressed by rigidity and strength of shape. Their changes are not associated with muscle dysfunction, but with the severity of connective tissue dysplasia.

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Entered 09.03.2022