

COMPARATIVE ASSESSMENT OF TRADITIONAL AND MINI INVASIVE
SURGICAL METHODS IN DIAPHRAGM RELAXATION

Tursunov Nasritdin Toshovich¹

Polvonniyozov Khumoyun Gayratjon ogli²

Babajanova Shokhista Bakhtiyarovna²

State Institution «Republican Specialized Scientific and Practical Medical Center for Surgery
named after academician V.Vahidov», Uzbekistan, Tashkent¹
Tashkent State Medical University, Uzbekistan, Tashkent²

Abstract. The diaphragm is the main respiratory muscle and is one of the most important members of the abdominal press. Wieting was the first to directly describe a pathological condition accompanied by anatomical changes not characteristic of a hernia in the diaphragm, and at the same time proposed the term “relaxation” for this condition. To date, there is no stable definition of the concept of diaphragm relaxation, and all existing interpretations are aimed at the most accurate description of the pathological condition that occurs, which implies a violation of the muscle tone of the diaphragm dome for a number of reasons. Clinical manifestations of diaphragm relaxation are very diverse. Treatment of diaphragm relaxation depends primarily on the etiology and clinical signs of the disease.

Keywords: diaphragm; diaphragm relaxation; diaphragm nerve stimulation; invasive treatment of diaphragm relaxation.

The diaphragm is the main respiratory muscle and is one of the most important members of the abdominal press. It is second only to the heart in terms of importance for the functioning of the body. The role of the diaphragm in the normal functioning of the body is extremely important. Stable oxygen access to organs and tissues is provided by synchronous and cyclic functioning of the respiratory muscles, in the process of which the diaphragm performs the main task [1].

Surgical treatment of diaphragm relaxation (DR) was first described by D.Morley in 1920. After detecting a thinned and elevated diaphragm, he cut off and sutured its edge parts.

To date, there is no stable definition of the concept of DR, and all existing interpretations are aimed at the most accurate description of the pathological condition that occurred, which implies a violation of the muscle tone of the diaphragm dome for a number of reasons. The most common definition of DR is presented as a pathological process that develops against the background of a violation of the innervation of the diaphragm and is characterized by a decrease in tone and loss of elastic properties, but without compromising its integrity [2].

In clinical practice, the separation of DR into congenital and acquired types has been adopted [2, 3]. As a result of the loss of tone of the diaphragm, under the influence of the internal pressure of the abdomen and the sum of the retractive force of the lungs, the dome shifts upwards. Often such deviations are manifested at an early age and are often diagnosed in the next age category due to the adaptation possibilities of the child's body. From this, in many ways, the temporary features of the manifestation of clinical symptoms of DR and the duration of surgical correction depend.

Speaking about the physiological deviations that cause the displacement of the diaphragm Dome, it should also be mentioned the rise (elevation) of the barrier separating the chest and abdomen, which is observed in cases such as ascites, peritonitis, enlarged spleen (splenomegaly) and

pregnancy. In such patients, there are no dystrophic changes in the diaphragm, and after the elimination of abdominal problems, the functioning of the organ is fully restored [4].

Acquired DR is of great interest, since in this case significant atrophic and dystrophic changes are observed in the diaphragm, which are initially unchanged in structure. The etiological factors that contribute to the emergence of changes are very diverse. Initially, traumatic damage to the dome was considered as the main cause [2]. As the problem was studied, the list of causative factors expanded, but various etiological factors triggered a common pathogenetic mechanism associated with damage to the diaphragm nerve [5]. Currently, factors such as inflammatory processes in the pleural space, including viral origin, damage to the central nervous system, demyelination diseases of the nerves, diseases of the diaphragm motor nuclei and neuromuscular synapses (myasthenia, hyena-Barre syndrome, lateral amyotrophic sclerosis) are being considered [2].

Thus, the action of any aggressive factor on the diaphragm nerve can lead to secondary neurotic muscular dystrophy. In this, the diaphragm sharply thins, stretches and loses not only its breathing, but also its separation function. The appearance of additional factors that contribute to a significant increase in the internal pressure of the abdomen accelerates the upward displacement of the diaphragm and abdominal organs, and the relaxation of the chest-abdominal barrier leads to the manifestation of clinical signs.

The clinical manifestations of DR are very diverse. However, in most cases, the authors note that the disease proceeds without any symptoms, and the pathological change in the diaphragm dome is detected only as a result of an X-ray examination [2, 3].

Complete relaxation of the right Dome of the diaphragm is thought to be less common. Damage to the right dome is often of limited character and is divided into front-internal, central and back-External. In right-sided damage, the right segment of the liver undergoes transposition, so in such patients, functional disorders are less pronounced and are mainly associated with cardiopulmonary disorders [6].

Recently, articles have been published in foreign literature about the effectiveness of ultrasound in the diagnosis of DR. The authors note the simplicity and popularity of ultrasound examination, as well as the possibility of assessing the movement (excursion) and strength of the Dome in real time.

Spirography is also an important examination in the diagnosis of Dr. Although the results of spirography do not have specific symptoms, DR sufferers are almost always diagnosed with impaired external respiratory function, including a decrease in the vital capacity of the lungs and the volume of forced breathing in the 1st second. This method, along with irradiation methods, provides a good indication of changes in the condition before and after treatment [3].

Patients who often go without any symptoms and only have damage on one side do not need treatment. In these cases, it is advisable to eliminate aggravating factors such as obesity, respiratory and cardiovascular disease, as they can exacerbate the symptoms of relaxation [6].

In cases of exacerbation of clinical symptoms, in particular Hanseatic and pain syndrome, absolute indications for the correction of the disease are prescribed [7]. Invasive treatment options for DR are aimed at improving or restoring the permeability of the diaphragm nerve, as well as reducing the size of the relapsed Dome.

According to a number of researchers, giving electric current to the diaphragm nerve is not only a way to stimulate it, but also provides an opportunity to determine the mechanical function of the dome by measuring the pressure generated by the contraction of the nerve [8]. One of the main advantages of this method is the possibility of studying the function of the diaphragm

separately from other respiratory muscles by recording transdiaphragmal pressure. For measurement, two catheters with latex balloons are used at the end, which are placed in the stomach and the lower part of the esophagus. Stimulation of the diaphragm nerve is carried out from the neck area, on the affected side or on both sides without cutting the skin, while the pressure difference in the balloons is noted. But this method is not widely used by patients due to its poor reception and technical complexity. In addition, in obese patients or those with anatomical changes, the indicators of DR are not fully reflected [7, 9].

When the diaphragm nerve is stimulated, electromyographic activity of the diaphragm is recorded, which makes it possible to measure the latency of the diaphragm nerve and the strength of the contraction potentials. In some diseases, such as demyelinating polyneuropathies, the passage of momentum through the diaphragm nerve slows down (in a healthy person, this figure is 6-8 ms). In traumatic injuries, the strength of muscle potentials can be reduced (the average in a healthy person is 500-800 mB).

Despite the promising nature of the described method, reconstructive operations on the diaphragm nerve were not widely used. This is due to the fact that technical complexity and long-term results are questionable. Our foreign colleagues have been more successful in this direction, but similar operations are being carried out among our domestic surgeons.

References:

1. Борзых, А. А. Диафрагма: связь регуляции кровоснабжения с особенностями сократительной функции / А.А. Борзых, О. Л. Виноградова, О.С. Тарасова // Вестник Московского университета. Серия 16: Биология. – 2020. – Т. 7, № 2. – С. 55–64.
2. Grigorchuk AY, Bazarov DV, Vyzhigina MA, Kavochkin AA, Kabakov DG. Khirurgiia relaksatsii diafragmy: so vremen B.V. Petrovskogo do nashikh dnei [Diaphragm relaxation surgery: since B.V. Petrovsky to the present day]. *Khirurgiia (Mosk)*. 2018;(7):60-66. Russian. doi: 10.17116/hirurgia2018760. PMID: 29992929.
3. Agarwal AK, Lone NA. Diaphragm Eventration. 2024 Aug 11. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. PMID: 32809332.
4. Yakubov F.R., Sapaev D.S., Allaberganov K.B., & Matkurbonov N.O. (2023). Modern Approach to Effective Drainage of Postoperative Injury in Large and Complex Ventral Hernias. *Journal of Intellectual Property and Human Rights*, 2(5), 32-34. <http://journals.academiczone.net/index.php/jiphr/article/view/797>
5. Гайворонский, И. В. Нормальная анатомия человека: учеб. для мед. вузов / И. В. Гайворонский. – 2-е изд., испр. и доп. – СПб. : Спец. Лит, 2001 – Т. 1. – 560 с.
6. Бугаевский, К. А. История анатомии и хирургии в отражении средств коллекционирования / К. А. Бугаевский, М. В. Пешикова, О. В. Пешиков // Непрерывное медицинское образование и наука. – 2021. – Т. 16, № 3. – С. 25–30.
7. Паршин, В. Д. Хирургия релаксациидиафрагмы / В.Д. Паршин, М.А. Хетагуров // Хирургия. Журнал им. Н. И. Пирогова. – 2018. – № 3-2. – С. 4–14. DOI 10.17116/hirurgia2018324-14
8. Systematic classification of morbidity and mortality after thoracic surgery / J. E. Seely, J. Ivanovic, J. Threder [et al.] // *Ann. Thorac. Surg.* – 2010. – Vol. 90, N 3. – P. 936–942. DOI 10.1016/j.athoracsur.2010.05.014
9. Yakubov, F., Sapaev, D., Allaberganov, K., & Matkurbonov, N. (2023). Results of effective postoperative wound drainage in large and complex ventral hernia. *European journal of modern medicine and practice*, 3(4), 30–32. <http://www.inovatus.es/index.php/ejmmp/article/view/1632>