

Issues and challenges in the surgical treatment of anterior abdominal wall hernias. Review

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The literature review discusses contentious issues and challenges that arise in the surgical treatment of anterior abdominal wall hernias. The author identified the causes of hernia formation and examined the dynamics of change in the pattern of hernia incidence. An analysis of the factors that contribute to the development of incisional ventral hernias was given special consideration. The causes of hernia recurrence were also studied. The entire spectrum of existing classifications of primary and incisional ventral hernias was reviewed, along with their advantages and disadvantages. Evaluation of current recommendations regarding the use of additional imaging methods for the examination of patients with ventral hernias was carried out. In the study, considerable attention was paid to surgical methods for hernia treatment. The advantages and disadvantages of “open” and minimally invasive laparoscopic hernioplasty techniques were critically evaluated. The difficulties in selecting an intervention method for certain types of hernias, including large ones, were highlighted, as was the importance of preventing hernia recurrence.

It has been established that there are still many unsolved problems in the surgical treatment of anterior abdominal wall hernias. The author justified the need for a standardized approach to determining the characteristics of anterior abdominal wall hernias and their further classification. It is necessary to study the effectiveness of using imaging methods (ultrasound, computed tomography) for ventral hernias, depending on their size and location. There is a need for wider implementation of laparoscopic hernioplasty techniques, and the degree of the hernial defect should be taken into account when determining the indications for surgical intervention. The possibility of using laparoscopic hernioplasty for large hernias, as well as for hernias associated with rectus abdominis diastasis, requires further investigation. Improving management strategies for patients with anterior abdominal wall hernias is critical in order to reduce the risk of hernia recurrence and complications.

KEYWORDS

ventral hernia, incisional hernia, hernioplasty, mesh.

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Anterior abdominal wall hernias are one of the most common pathologies in surgical practice. About a quarter of the global population is either born with a ventral hernia or may develop it during life [25, 26].

Etiology and epidemiology of anterior abdominal wall hernias

The reasons for hernia development include evolutionary anatomical weakness of certain areas of the abdominal wall (umbilical area, midline of the abdomen, inguinal areas), predisposition to the formation of a defect in the abdominal wall (operative interventions in the anamnesis), and increased intra-abdominal pressure [41]. However, such social factors as a decreased birth rate, a lack of physical activity, increased

life expectancy, and higher obesity rates can have an impact on the pattern of hernia incidence [35].

According to epidemiological studies, inguinal hernias (70–75 %) predominate among abdominal wall hernias [35, 56, 67]. And while 30 years ago femoral hernias were the second most prevalent (6–17 %), the situation has changed [56, 67]. According to N. Dabab et al., midline abdominal wall hernias became the most common among ventral hernias. Hernias of the umbilical area (umbilical and paraumbilical – 19 %) are currently the second most common, followed by midline abdominal wall hernias, including epigastric (8.6 %) and incisional (4.8 %) hernias, femoral hernias (2.6 %) and hernias of rare locations, including Spiegelian hernias (less than 1 %) [35]. However, the prevalence of incisional ventral hernias varies widely

(2–23%), according to various authors, and is dependent on the technique used to suture the surgical wound, the presence of concomitant diseases, wound infection, and other factors. Incisional hernias occur in 1–15% of patients operated on by the traditional «open» method for various types of abdominal pathology. Their frequency increases to 20% 10 years after surgery [16, 19, 21, 23, 29, 39, 53, 57, 63, 64, 68, 71, 80, 82]. At 12 months of follow-up, a meta-analysis based on 24 randomized controlled trials (a total of 3,490 patients) demonstrated a significant difference in the incidence of incisional ventral hernias after laparoscopic (4.3%) and open (10.1%) surgery [54]. Incisional hernias can occur in up to 69% of high-risk patients [59].

S. G. Parker et al. identified 5 groups of important prognostic factors for the development of ventral hernia recurrence based on a meta-analysis of the results of the treatment of 12,423 patients. Female sex, age 65 years or less, a body mass index greater than 25 kg/m² (patient factors), as well as the presence of such concomitant diseases as diabetes, chronic obstructive pulmonary disease, III–IV ASA degree, smoking, and use of steroids, significantly increase the risk of hernia recurrence. Two factors associated with hernias (incisional/primary, recurrent/primary), six intraoperative factors (use of biological mesh, bridging, open vs. laparoscopic surgery, hernia suture vs. synthetic mesh, onlay mesh placement technique vs. retrorectus, intra-peritoneal mesh placement compared with retrorectus), and six postoperative factors (any complication, surgical-site occurrence, wound infection, seroma, hematoma, and wound opening) were also identified as important prognostic factors for hernia recurrence [62]. In the study, the authors aimed to determine the factors that influenced the risk of recurrence of ventral hernias but did not concentrate on assessing the importance of each of the factors. In a number of analyzed studies, for example, a body mass index greater than 25 kg/m² increased the rate of hernia recurrence, but the indicator of 30 kg/m² was the threshold for most studies. However, J. S. Jolissaint et al. noted that surgical site occurrences, not body mass index, increased the risk of ventral hernia recurrence in the long term [50].

After surgery, recurrences of small and large umbilical hernias are observed in 15–20% and 30–40% of cases, respectively [16]. The frequency of recurrence of incisional ventral hernias is on average 18–21% after 12 months of observation, but it can reach 37% after 48 months of observation [52]. At the same time, the difference in the data on the development of recurrence after laparoscopic and open hernioplasty is controversial.

Classification of anterior abdominal wall hernias

The goal of developing a hernia classification is to standardize an approach to identifying the type of hernia, processing and presenting statistical data, determining examination tactics, and selecting the type of surgical treatment based on the hernia's characteristics [38, 61]. The literature review demonstrates the absence of a single approach to the classification of anterior abdominal wall hernias. Primary ventral and incisional hernias are distinguished by different factors that contribute to their occurrence. Some authors propose categorizing them separately [33, 51, 61, 70, 78] based on different indicators, while others combine these types of hernias into a single classification [20, 38].

In 2000, J. P. Chevrel and A. M. Rath proposed the SWR classification of incisional hernias. They chose three criteria: the location of the hernia «S» (medially or laterally located, with further division into 4 subgroups according to the localization zone on the abdominal wall), the width of the defect «W» (4 subgroups with a step of 5 cm) and the number of hernia recurrences «R» [33]. However, the classification did not include the length of the hernial defect or the number of defects, and had shortcomings in the distribution according to the site of the defect, which made it difficult to determine surgical tactics.

V. Schumpelick proposed to divide incisional hernias into 5 classes, taking into account the maximum size of the hernial defect, the number of defects, their localization, symptoms, the presence of recurrence, and the reparability of the hernia. However, his classification was not widely used in surgical practice [61, 70].

In 2001, M. Korenkov et al. proposed their version of the classification of incisional hernias, modifying the Chevrel classification. They grouped hernias according to their location, which was defined as vertical, transverse, oblique, or combined. They also proposed to determine the size of the hernia not only by its width but also by its length, dividing it into three subgroups while leaving a step of 5 cm and defining a large hernia as a hernia with a width or length of more than 10 cm. M. Korenkov et al. focused on the need to determine the «real» size of the hernial defect by measuring the distance between the muscle-aponeurotic structures and not the edges of the scar tissue of the defect, which cannot serve as a frame when suturing the defect. It was proposed to take into account the presence of hernia symptoms and their reducibility [51]. However, the risk factors for the development of hernia recurrence and the number of defects were not taken into

consideration. Moreover, when assessing the size of the defect, the width and length were compared as equally important, which negatively affects the adequacy of the choice of surgical tactics. It is the width of the hernial defect that influences the degree of tissue tension after suturing and determines the need to separate the components of the abdominal wall in order to prevent compartment syndrome [22].

In 2007, U. A. Dietz et al. proposed a classification of incisional hernias [37], which later received the name of the Wuerzburg classification of ventral and incisional hernias [38]. It is based on the determination of the patient's body type, localization (hernia morphology), and size of the hernia, the presence of previous attempts at hernioplasty, and risk factors for hernia recurrence [37, 38].

There were attempts to supplement the hernia classification with additional indicators, including the ratio of the area of the anterior abdominal wall to the area of the hernial defect. As the indicator of this ratio increases, the risk of high tension in the anterior abdominal wall and compartment syndrome increases [22].

All of these above-mentioned classifications have not been widely used in practice. For example, in 2008, a method for collecting statistical data on the basis of which hernias were classified was presented in the Swedish Register of Hernias of the Anterior Abdominal Wall. In addition to the generally defined parameters, including hernia localization, their number, and size, it was supposed to take into account additional preoperative indicators such as the patient's body mass index, causes of incisional hernia formation, the presence of a pre-installed mesh, and the type and location of the previous incision [61].

In order to develop a common language and create a practically oriented and widely supported classification of hernias, the European Hernia Society (EHS) formed a working group that included the authors of the above classifications. In 2009, they introduced the classification of primary and incisional hernias of the anterior abdominal wall. Primary hernias of the anterior abdominal wall are classified according to their location, with medial (epigastric, umbilical) and lateral (Spiegelian, lumbar) hernias distinguished, as well as their size, with small (less than 2 cm), medium (from 2 to 4 cm), and large (4 cm and more) hernias defined. Depending on their location, incisional hernias are classified as middle (subxiphoid M1, epigastric M2, umbilical M3, subumbilical M4, suprapubic M5) and lateral (subcostal L1, flank L2, iliac L3, lumbar L4). It is suggested that the length and width of the hernial defect be measured in centimeters and that the type of hernia be classified as W1 (<4 cm), W2 (from

4 to 10 cm), and W3 (10 cm and more). In addition, it is necessary to indicate whether the hernia is recurrent (yes/no). However, it is not necessary to indicate the number of hernial defects. In the case of their multiplicity, it is proposed to define the width as the distance between the lateral edges of the most laterally located defects and the length as the distance between the upper edge of the most cranially located defect and the lower edge of the most caudally located defect [61].

Despite the wide range of hernia characterization criteria and ease of use, the EHS classification is still criticized and competes for use with other developed classifications [20, 27, 30, 38, 44, 75]. Since one of the goals of developing a hernia classification was to facilitate the selection of surgical tactics and predict the risk of complications, the working group from the United States proposed a hernia grading system (hernia grading system: assessment of risk for surgical site occurrences) [78]. It is based on the determination of risk factors for postoperative wound healing (4 degrees), depending on the infection of the operative field or the presence of concomitant diseases that worsen the reparative processes. The use of this grading system assists in determining surgical tactics and selecting the type of mesh (synthetic or biological), but it is fundamentally different from the proposed EHS principles of stratification of hernias and is not a hernia classification [38, 78]. Another attempt was made to categorize ventral hernias into 4 degrees based on clinical manifestations and imaging results (ultrasound, computed tomography (CT), and magnetic resonance imaging (MRI)). However, this classification is also fundamentally different from the EHS classification, and the results of its implementation are still being studied [20].

As a result, the EHS classification of anterior abdominal wall hernias remains the most standardized and used [27, 49, 60], though it is subject to changes when different professional associations reach a consensus. Thus, the joint working group of EHS and the American Hernia Society (AHS) suggested changing the size parameters of umbilical and epigastric hernias, dividing them into small (0–1 cm), medium (1–4 cm), and large (more than 4 cm) [49]. It should be noted that all the above classifications do not take into account the association of hernias with rectus abdominis diastasis, which can significantly influence the choice of surgical tactics [28].

In Ukraine, there is no single approach to the classification of anterior abdominal wall hernias. K. D. Toskin and V. V. Zhebrovskiy (1984) proposed a classification of abdominal hernias that takes into

account the location, size of the defect, and clinical signs of the hernia. But excessive detailing and a lack of clearly defined criteria for the size of the defect contributed to the limitation of its implementation in surgical practice. The leading hernia centers in Ukraine have used the EHS classification in publications to present the results of their research [15, 17, 18], but it is still not widely used among herniological surgeons. Some authors use domestic and foreign classifications of previous years [6, 12, 14] or do not describe the hernia's characteristics at all [10]. Implementing a unified approach to ventral hernia classification will allow us to develop an optimal treatment algorithm, compare comparable treatment results, and evaluate them in the distant postoperative period, regardless of the place of surgical treatment.

Diagnosis of anterior abdominal wall hernias

The clinical examination of the patient (examination, palpation, percussion, auscultation of the abdomen and areas of localization of the hernial defect) allows for the assessment of the location, size, and contents of the hernial sac. In most cases, a clinical examination is sufficient to diagnose an anterior abdominal wall hernia [49]. According to S. Halligan et al., preoperative methods of hernia visualization are used in only 12% of cases, while in the postoperative period this indicator increases to 29% [48], which may be due to the need for timely diagnosis of complications in the early postoperative period. CT is preferred over ultrasound as a procedure for hernia visualization. MRI and other X-ray imaging methods (herniography, abdominal X-ray) are very rarely or never used [48].

Although ultrasound examination of the anterior abdominal wall has long been used to detect hernias [73], it is not a required routine practice. If the clinical examination is complicated by obesity or severe pain syndrome, ultrasound is a non-invasive, accurate, reliable, relatively inexpensive, and easily accessible method for diagnosing hernias in patients [83]. Ultrasound is also recommended for excluding, confirming, or measuring rectus abdominis diastasis [27].

In the guidelines for surgical treatment of primary ventral and incisional hernias, data on imaging and instrumental diagnostics are either absent [30] or represented by limited recommendations based on insufficient evidence (grade D, level 4, level 5) to draw any conclusions regarding the use of CT and MRI in special cases [27, 29]. Thus, according to the 2014 ENS guidelines, CT and MRI are

recommended for the diagnosis of ventral hernias in patients who are obese, as well as in cases of giant (loss of domain), post-traumatic, lumbar, or Spiegelian hernias [29]. A small number of publications support the use of CT for the diagnosis of rare types of ventral hernias [46, 47, 66, 72]. In order to better plan the surgical strategy and inform the patient, the 2019 EHS guidelines recommend considering CT in patients with large or incarcerated hernias (Grade D) [27]. CT can help predict wound complications and anterior abdominal wall tension caused by the use of separation techniques in the treatment of patients with large ventral hernias [27, 43]. There is a need to define radiological criteria for the detection of hernia recurrence because there are inconsistencies in the findings regarding the detection of ventral hernias when a CT scan is performed in the postoperative period [27].

According to D. V. Cherla et al., there is a moderate correlation between the results of a clinical examination, a CT scan, and an intraoperative laparoscopic assessment when evaluating the extent of ventral hernia defects. However, differences in measurements can have an impact on the hernia classification and the choice of mesh size in 58% and 56% of cases, respectively [32].

According to the EHS and AHS guidelines, umbilical and linea alba hernias should be diagnosed clinically. Ultrasound or CT are recommended when the diagnosis is unclear [49].

The limited use of imaging methods for detecting anterior abdominal wall hernias can result in an underestimation of the hernia's characteristics, an increased risk of recurrence [48], and an irrational selection of the surgical procedure. More research into the effectiveness of ultrasound and CT in hernia patients is required.

Types of surgical treatment of hernias and their features

Prior to the development of modern minimally invasive technologies and meshes, the only surgical treatment option for anterior abdominal wall hernias was «open» suturing of the hernial defect, which included the formation of various types of aponeurotic duplications to strengthen the suturing zone and prevent recurrence. However, this technique had a high risk of complications and relapses, which significantly increased with large hernial defects [29]. The situation changed with the introduction of minimally invasive technologies and meshes. Their use in surgical practice when performing various types of hernioplasty significantly improved hernia treatment outcomes [27, 29]. J. W. Burger et al.

discovered that suturing an incisional ventral hernia up to 6 cm in size with a mesh reduced the rate of recurrence from 63% to 32% [31]. And, while the use of a mesh reduces the rate of recurrence by three times when compared to autoplasty, the location of the mesh does not allow for a significant reduction in the frequency of recurrence, but does affect the overall rate of complications [24, 77, 79]. According to the EHS and AHS recommendations, a mesh should be placed for ventral hernias larger than 1 cm to prevent recurrence of the disease [27, 49].

«Open» hernioplasty with mesh placement in the thickness of the anterior abdominal wall (sublay, onlay, or inlay) is still one of the most common surgical treatments for ventral hernias of various localizations [16, 79]. This technique is used to treat both small umbilical (mainly sublay mesh placement) and large incisional ventral hernias [4, 16, 27, 34]. The technique of surgical intervention involves wide dissection of tissues for adequate placement of the implant, which causes a large intraoperative trauma, the development of a pronounced pain syndrome in the postoperative period, a long period of rehabilitation, and the social adaptation of patients [36]. And, if these open surgery methods are justified for the treatment of giant incisional hernias with the need to model the anterior abdominal wall, their use for small ventral hernias becomes debatable.

Open, non-tension surgery using mesh and the sublay technique has taken the lead in the surgical treatment of umbilical hernias in Ukraine. There is a 2% to 16.9% recurrence rate when using this technique [16]. However, even small umbilical hernias require extensive mobilization of soft tissues, which, when associated with rectus abdominis diastasis, causes significant traumatization of anterior abdominal wall tissues, contributing to prolonged surgical wound healing and patient rehabilitation. As a result, there is no consensus on the criteria for selecting the best surgical intervention technique for umbilical hernias associated with rectus abdominis diastasis.

Laparoscopic technologies for the treatment of hernias are currently in the implementation stage in Ukraine. They are primarily used in specialized medical centers and clinics of university surgical departments [1, 2, 4, 5, 7–9, 13, 15, 16]. The use of an intraperitoneal mesh (IPOM) during laparoscopic hernioplasty prevents tissue trauma and eliminates the need for abdominal wall component separation [29, 76]. Laparoscopic hernioplasty can decrease the rate of postoperative complications, reduce the length of stay, and promote rehabilitation [27, 29, 40, 58, 81]. The IPOM technique is the most widely used and researched method of ventral hernioplasty.

Other laparoscopic hernioplasty methods with mesh placement preperitoneally, retrorectally, or retromuscularly are still being studied and are technically more traumatic [28].

The requirement for specialized equipment and surgeon skills, the high cost of modern mesh implants, and the lack of a clear diagnostic and treatment algorithm all make it difficult to incorporate minimally invasive technologies into general surgical practice [55]. Treatment strategies are frequently determined by the surgeon's personal preferences for one type of surgical intervention or another, the clinic's capabilities, and the patient's requests. Laparoscopic hernioplasty is the optimal treatment option for the hernial defects up to 10 cm in size [29]. If the size of the hernial defect is more than 10 cm, it can be challenging to suture the defect in the anterior abdominal wall without tension. In such cases, «open» hernioplasty with various modifications of the Ramirez technique is preferred. This is a traumatic procedure that increases the risk of developing postoperative complications, including complications in the area of the postoperative wound [16, 42].

Laparoscopic surgery does not always involve suturing the hernial defect. In their study, K. Suwa et al. indicate the availability of a limited number of publications that compare the results of IPOM with and without suturing of the hernial defect before mesh placement. Suturing the hernial defect prior to IPOM yields better results [74]. However, A. M. Gonzalez et al. presented the research, which included 134 patients. The study's findings revealed a higher recurrence rate of 7.5% in the group that did not have hernial defect suturing prior to IPOM, compared to 1.5% in the group that had hernial defect suturing [45]. The availability of the results of mostly comparative studies and a limited sample of patients do not allow determining the reliability of performing IPOM without hernial defect suturing with a high degree of certainty.

A number of authors report a higher rate of hernia recurrence after minimally invasive laparoscopic procedures when compared to «open» techniques. However, the rate of recurrence varies significantly depending on the length of the postoperative observation period [40, 81]. According to S. Olmi et al., after 24 months of follow-up, hernia recurrence was found in 2.3% of patients after laparoscopic surgery and in 1.1% of patients after «open» hernioplasty in a prospective randomized study of 170 cases [81]. In a multicenter randomized controlled study including 206 patients, H. H. Eker et al. noted that after 35 months of observation, the frequency of hernia recurrence in the group after

laparoscopic surgery was 18%, while in the group after open surgery it was 14% [40]. Y. Zhang et al. found no significant difference in the frequency of hernia recurrence after laparoscopic and open hernioplasty for ventral hernias in their systematic review and meta-analysis of the results of 11 randomized controlled trials, including 1,003 patients [84]. The study, however, had several limitations, including the heterogeneity of the data collected and the hernioplasty techniques used. The analysis of 10 randomized controlled trials, which included 880 patients, shows that there is no significant difference in the frequency of hernia recurrence after laparoscopic and «open» hernioplasty [69].

The lack of a single systematic approach to selecting a method of treatment for anterior abdominal wall hernias results in a high frequency of complications and relapses of the disease with an unjustified preference for one of the treatment methods [3, 11].

Conclusions

Evaluation of the effectiveness of surgical treatment for anterior abdominal wall hernias requires a standardized method for recording hernia incidence and consensus on a classification approach.

The issue of introducing laparoscopic operations in herniology is extremely relevant and promising. The problem of preventing hernia recurrence after surgery and the use of minimally invasive technologies in the treatment of large hernias require special attention.

The optimization of the diagnostic and treatment algorithms for patients with anterior abdominal wall hernias will be possible through the investigation and analysis of current techniques for treating ventral hernias, the frequency and structure of post-operative complications, and the recurrence rate.

DECLARATION OF INTERESTS

The author has no conflicts of interest to declare.

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Проблемні питання в хірургічному лікуванні гриж передньої черевної стінки. Огляд

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Розглянуті дискусійні питання, які виникають при хірургічному лікуванні гриж передньої черевної стінки. Висвітлено чинники розвитку гриж. Проаналізовано динаміку зміни структури захворюваності на грижі. Особливу увагу приділено аналізу причин розвитку післяопераційних вентральних гриж. Також проаналізовано причини рецидиву гриж. Наведено класифікації первинних та післяопераційних вентральних гриж. Проаналізовано їхні переваги та недоліки. Проведено оцінку актуальних рекомендацій щодо застосування додаткових візуалізаційних методів обстеження у пацієнтів з вентральними грижами. Велику увагу приділено хірургічним методам лікування гриж. Критично оцінено переваги та недоліки «відкритих» та малоінвазивних лапароскопічних технік герніопластики. Наголошено на складності вибору методу втручання при окремих видах гриж, зокрема великих, і важливості профілактики рецидиву грижі.

Установлено, що в хірургічному лікуванні гриж передньої черевної стінки є багато невирішених питань. Обґрунтовано потребу в стандартизованому підході до визначення характеристик гриж передньої черевної стінки та вдосконаленні їхньої класифікації, зокрема в Україні. Необхідно вивчити ефективність застосування візуалізаційних методів (ультразвуку, комп'ютерної томографії) при вентральних грижах різного розміру та локалізації. Є потреба у ширшому впровадженні лапароскопічних методів герніопластики, визначенні показань до оперативного втручання залежно від розміру грижового дефекту. Потребує оцінки можливості використання лапароскопічної герніопластики при грижах великого розміру, а також при поєднанні гриж із діастазом прямих м'язів живота. Нагальною є потреба у вдосконаленні тактики ведення пацієнтів з грижами передньої черевної стінки для мінімізації ризику появи рецидивів та ускладнень.

Ключові слова: вентральна грижа, післяопераційна грижа, герніопластика, сітка.

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