

How to Cite:

Omarov, N. B., Mendybaev, A. A., Fursov, A. B., Volchkova, I. S., Kuspaev, E. N., & Akhmetzhanova, D. O. (2022). Hernioplasty of inguinal hernias and the role of laparoscopic interventions. *International Journal of Health Sciences*, 6(S7), 3066–3086. <https://doi.org/10.53730/ijhs.v6nS7.12114>

Hernioplasty of inguinal hernias and the role of laparoscopic interventions

Omarov N. B.

Email: omarov.n83@mail.ru

Mendybaev A. A.

Email: Koshakan_888@mail.ru

Fursov A. B.

Email: fabcom2@yandex.ru

Volchkova I. S.

Email: Volchkovais@mail.ru

Kuspaev E. N.

Email: onco_ezh@mail.ru

Akhmetzhanova D. O.

Email: edina.0483@mail.ru

Abstract---Among surgical diseases, hernias of various localization still play an important role. Despite certain changes in the structure of risk factors, the frequency of their development and surgical treatment remains high in all countries of the world. Plastic surgery of inguinal hernias is the most common operation in surgical hospitals. Every year, more than 20 million patients are exposed to these interventions worldwide. There are many different methods of performing inguinal hernia surgery, which are presented in this review as a comparative characteristic.

Keywords---inguinal hernia, laparoscopy, hernioplasty,
Objective: to study the literature on the diagnosis and surgical treatment of inguinal hernias.

Introduction

Hernias are still one of the most frequent surgical diseases [1,2]. Those of them, which are localized on the anterior abdominal wall, primarily inguinal, most often develop in the elderly people [3]. This is determined by the progressive atrophy of

the muscles in the inguinal canal zone, a decrease in the elasticity of aponeuroses, the formation of pathophysiological changes in the elderly, leading to an increase in intra-abdominal pressure. The problem of surgical treatment of inguinal hernias, which account for about 70-80% of abdominal wall hernias, is still relevant to date. The importance of the problem is due to the high prevalence of this pathology (3-7% of the male able-bodied population) and dissatisfaction with the results of operations, since, despite the large number of proposed methods of operations, the rapid progress of herniology, many surgical issues, especially those related to inguinal canal plastic surgery and a decrease in the number of relapses of the disease, remain not fully resolved.

According to the data provided by various authors, the frequency of relapses after herniation for mild forms of inguinal hernias ranges from 3-6.9%. On average, relapse is observed in every tenth operated patient. At the same time, in clinics where qualified individualization of surgical methods is carried out, the frequency of this complication is no more than 6%.

The most important causes of recurrent inguinal hernias, according to most authors, is a template approach to inguinal canal plastic surgery and the standard use of traditional surgical methods, without taking into account the pathogenetic significance of the condition of the posterior wall of the inguinal canal in the formation of hernias, the causes and mechanism of relapses. All this leads to the fact that intraoperatively, most surgeons do not perform a full-fledged revision of the posterior wall of the canal, much less the restoration of both it and the destroyed inner inguinal ring. According to the All-Union questionnaire conducted by M.N. Gorelik (1974), out of 55 surgical clinics, only one performs suturing of the internal inguinal opening during operations for oblique inguinal hernia, although this is a prerequisite for radical surgery, dedicated to the narrowing of the deep inguinal ring, as the main preventive measure of recurrence of oblique inguinal hernias. But all the authors mentioned stitched only on the edges of the ring, that is, on the fascial tissue representing the transverse fascia in its medial part. Such sutures are not reliable enough and, in addition, increase the risk of damage to the lower epigastric vessels. All this encourages surgeons to develop new and improve existing methods of plastic surgery of the internal inguinal opening and transverse fascia.

With a significant flow of surgical interventions in medical institutions, various ways of strengthening the inguinal canal are used, depending on the views of certain surgeons and schools. Some surgical schools, in order to improve the immediate and long-term results of surgical treatment of inguinal hernias, promote one of the currently existing or newly developed and, in their opinion, a more advanced method of surgery. But this approach to solving the problem in most cases, unfortunately, is not always justified.

Currently, more and more surgeons agree that it is necessary to use various methods of hernioplasty. The choice of the operation method should be determined by the type of inguinal hernia, the age of the patient, the presence of concomitant pathology and, most importantly, the degree of pathological changes in the anatomical structures of the inguinal canal, especially its posterior wall.

Inguinal hernias develop much more often than other abdominal hernias. According to various authors, patients with this pathology account for 8-18% of the total number of hospitalized surgical patients. At the same time, the percentage of patients with inguinal hernias is up to 75-80% [4]. Thus, according to various researchers, inguinal hernias develop in 73.5% of cases in men and 20.3% in women [5]. According to the analysis of statistical studies, the ratio of men and women with inguinal hernias is 10:3 [6].

In the frequency structure of all surgical interventions, hernia sections occupy the 2nd place (after appendicitis operations), and the first place in the proportion of elderly and senile patients [7].

With prolonged presence, inguinal hernias lead to atrophy of the aponeurotic and muscular components of the inguinal canal, a decrease in elasticity due to thickening of collagen and a decrease in the number of elastic fibers and the replacement of fibrous structures with less stable fatty and loose connective tissue. This leads to an increase in the inguinal gap, destruction of the transverse fascia, inguinal ligament fibrillation and an increase in the diameter of the inner inguinal ring [8,9]. The number of hernia cases increases with increasing age. In particular, according to a number of authors, the proportion of hernia carriers among people over 50 years old can reach 54-65% [10-12]. In addition, among this category of patients, the frequency of strangulated and recurrent hernias reaches 68% [13,14].

More than 400 methods of hernia repair and their modifications have been proposed for surgical practice, which indicates that this problem is not fully solved, and that each of the proposed approaches has certain disadvantages and limitations [15].

Important predictors of complications in patients with inguinal hernias are elderly and senile age, the presence of concomitant pathology, functional insufficiency of organs and systems, potential errors in performing surgical intervention, leading to exceeding the maximum degree of negative impact on the body [16,17]. Therefore, the choice of the treatment method and the scope of the operation should be carried out strictly individually, taking into account the presence and severity of concomitant diseases, clinical and pathophysiological factors affecting the general condition of the patient and determining the level of operational risk [18-20].

Laparoscopic methods are the most promising, since they have minimal invasiveness [21,22].

Etiological factors and pathogenesis of inguinal hernias

A wide range of factors contributing to the development of abdominal hernias, including inguinal hernias, is known.

The formation of hernias is favored by both obesity and exhaustion due to various diseases. With obesity, atrophy of the abdominal wall muscles usually develops. Obesity is most often detected in patients with inguinal hernias. A number of

authors point to excessive fat deposition in a quarter-half of cases of inguinal hernias, especially in people over 60 years of age [23,24]. In addition, postoperative complications develop more often in overweight patients than in patients with normal and reduced BMI.

The process of hernia formation during exhaustion is determined by a decrease in the content of adipose tissue in anatomical formations, which gives an increase in the size of those holes in the abdominal wall that were previously filled with it. As a result, the resistance of "weak spots" to the action of intra-abdominal pressure decreases and favorable conditions for the occurrence of hernia are formed [25,26].

The choice of the surgical method at the present stage of the development of surgical treatment of inguinal hernias depends not only on the variant, but also on the pathogenetic mechanisms of herniation [27].

The optimal choice of surgical tactics for inguinal hernias in patients with risk factors is particularly difficult [28].

The mechanism of hernia formation is complex and diverse. In addition to local predisposing factors, which are based on changes in the topographic and anatomical location or physico-mechanical properties of the tissues of the area where the hernia occurred, general factors also contribute to the appearance of a hernia. The general factors of hernia formation are usually divided into two fundamentally different groups: predisposing and producing.

Predisposing factors include: hereditary (genetic predisposition to hernia formation), anatomical (body type, sexual differences), as well as age-related (involutional changes in tissues) [29,30].

Predisposing factors do not carry the a priori inevitability of hernia formation. For the occurrence of a hernia, the action of any of the producing factors is necessary [31].

Producing factors are factors that contribute to an increase in intra-abdominal pressure or its sharp fluctuations: heavy physical labor, cough in chronic lung diseases, prolonged constipation, difficulty urinating with prostate adenoma or narrowing of the urethra, difficult childbirth [32].

Inguinal hernias classification

According to the time of occurrence, inguinal hernias are divided into primary congenital, primary acquired, recurrent.

Anatomically, they are divided into straight, oblique, supravesical, scrotal, sliding.

According to the clinical state of the contents of the hernial sac, there are adjustable, unrecoverable, infringed [33].

Abroad (mainly in the USA), the classification of the American surgeon Lloyd M. Nyhus is widespread. This one is often used in modern scientific developments and articles that compare the results of open and laparoscopic methods of inguinal hernia repair.

According to the classification of L.M. Nyhus (1995), all hernias are divided into 4 types:

Type I – oblique inguinal hernias, occurring mainly in children, adolescents, young people. In this type, the inner inguinal ring, as a rule, is not expanded, and hernial protrusion extends from the inner inguinal ring to the middle third of the inguinal canal. (In the Russian literature, this type of hernia is called “channel inguinal hernias”).

Type II – oblique inguinal hernias with a significantly expanded inner inguinal ring. In this type, the hernial sac does not descend into the scrotum, however, when straining, the hernial protrusion is determined under the skin in the groin area.

Type III – is divided into: a) straight, b) oblique inguinal and c) femoral hernias.

Type III a – all types of direct inguinal hernias. With these hernias, there is weakness and stretching of the transverse fascia, which leads to a violation of the structure of the posterior wall of the inguinal canal.

Type III b – oblique inguinal hernias of large size, usually inguinal-scrotal. In this type, there is a defect in both the anterior and posterior walls of the inguinal canal. The inner inguinal ring is usually significantly expanded. Sliding hernias are often observed. There may be both straight and oblique inguinal hernias, which in foreign literature is called “pantaloon hernia” [34].

Type III c – femoral hernias.

Type IV – recurrent hernias:

type IV a – recurrent direct inguinal hernias.

Type IV b – recurrent oblique inguinal hernias.

Type IV c – recurrent femoral hernias.

Type IV d is a combination of recurrent rectus, oblique inguinal and femoral hernias [35].

The classification of L.M. Nyhus makes it possible to determine the type of hernias fairly accurately and, when studying various types of hernioplasty, objectively assess the advantages and disadvantages of each method depending on the type of hernias.

Inguinal hernias diagnosis

The main approaches to the diagnosis of inguinal hernias were developed more than 100 years ago and are now quite routine [36].

Depending on the place of exit of the hernial sac in relation to the lower epigastric vessels, there are direct and oblique inguinal hernias. With a direct hernia, the hernial gates are located inside of these vessels, and with an oblique one – outwards. During a clinical examination of a patient, this difference can be detected only when the epigastric artery is clearly felt.

However, in obese patients, as well as in patients with a thickened spermatic cord from a hernia, this is rarely possible to do and therefore has no practical significance. In addition, an oblique hernia forms a scrotal hernia more often than a straight one [37].

Uncomplicated hernia is manifested by pulling pain in the groin area or in the lower abdomen, which increases when walking and lifting weights [38]. Often a hernia is discovered accidentally during a medical examination or the appearance of a protrusion, forcing you to consult a doctor [39]. In some cases, the detection of hernia is assisted by ultrasound data [40].

In elderly patients, a hernia may first appear due to increased intra-abdominal pressure with prostate adenoma, chronic bronchitis, prolonged constipation. During the examination, the hernia is detected by comparison with the opposite side. On palpation, the presence of a hernia is confirmed by the symptom of a cough push – when coughing, the hernial sac hits the finger inserted into the inguinal canal. The consistency of hernial protrusion, the possibility of its reduction into the abdominal cavity, the size of the hernial gate are also determined [41].

Differential diagnosis is carried out with inguinal lymphadenitis, femoral hernia, oncological pathology.

Surgical treatment of inguinal hernias

The only radical method of treating abdominal wall hernias is surgery. Wearing bandages of various designs does not prevent the development of the disease, does not exclude the possibility of infringement. In addition, aseptic inflammation in the hernial sac and in the area of the hernial gate leads to the development of cicatricial perivisceritis, which creates additional intraoperative technical difficulties, increases the likelihood of complications of the operation [42,43].

The age of the patient is currently not an absolute contraindication to hernia surgery. The severity of concomitant pathology is of much greater importance in determining indications and contraindications to surgery [44,45]. Considering the high probability of infringement with the development of deadly complications (necrosis of the infringed organ, peritonitis) in elderly herniators, more active surgical tactics should be applied to this group of patients [46].

The existing standard method of inguinal hernia plastic surgery, proposed by E. Bassini more than 110 years ago and S.I. Girard and improved by A.A. Bobrov (1892), S.I. Spasokukotsky (1902), I. Roux (1899), M.A. Kimbarovsky (1928) and others, has stopped satisfying many surgeons, since after it there is a high the percentage of relapses [47,48]. Thus, when using classical methods of hernia repair, relapse of the disease develops in 10-35% of cases [49]. With recurrent hernia repair, this indicator reaches 45.5-63.7% [50].

There is a known pattern in the recurrence of certain types of hernias. In patients with direct hernias, relapses occur in 12-13% of cases, with large hernias – in more than 20% [51]. Relapses occur less often after interventions undertaken for oblique hernias, here their number ranges from 3-9% [52]. The frequency of relapses after surgery performed for strangulated hernias turns out to be even higher than after planned hernias [53]. This is due to the fact that plastic surgery of the anterior abdominal wall is carried out under conditions of increased intra-abdominal pressure due to intestinal obstruction phenomena.

It should be noted that the absence or low numbers of hernia complications (1-2%) are currently obtained only in specialized herniological centers [52], while in general surgical hospitals, according to various authors, the number of complications after open operations (recurrence of hernia, suppuration of the surgical wound, damage to the spermatic cord, etc.) reaches 7-10%, and with repeated interventions – 30% or more [54].

Modern herniology has dozens of methods of hernia surgery. The greatest attention has recently been paid to the use of so-called tension (excluding tension) methods of hernia defect plastic surgery [55,56]. Biochemical studies show that the reaction of connective tissue to tension is a violation of collagen synthesis [57,58]. As a result, there is no formation of a full-fledged scar in the area of a hernial defect. Atrophic degeneration of sutured tissues develops, a recurrence of hernia occurs [59].

The basic principle of surgical treatment of abdominal hernias is an individual, differentiated approach to the choice of herniation method [60]. When solving this problem, it is necessary to take into account the shape of the hernia, its pathogenesis, the condition of the tissues of the anterior abdominal wall and the size of the hernial sac [61].

In recent years, the so-called complex forms of inguinal hernias have been persistently singled out in domestic and foreign literature [62,63]. These include, first of all, hernias of large and very large sizes, unrecoverable, sliding, recurrent and repeatedly recurrent. This group of inguinal hernias is distinguished by a more severe clinical course, a tendency to complications and recurrence, including the development of other variants of hernias of the anterior abdominal wall. Thus, calling such hernias “complex”, one should keep in mind not only the purely technical side of the issue, but also the occurrence of complex clinical situations that determine the specifics of choosing the method of anesthesia and surgery, the volume of preoperative preparation and therapy in the postoperative period [64].

Hernia surgery should be as simple as possible and least traumatic. This principle, however, should be based on the confidence that the chosen intervention will provide radical treatment. If the bulk of uncomplicated inguinal hernias can achieve good results using fairly simple methods of herniation, then with complex hernias (recurrent, giant, repeatedly recurrent) surgical treatment is often a difficult task [65,66].

The most important principle of hernia surgery is its impeccable technical performance. Poor surgical technique, according to the apt expression of V.I. Dobrotvorsky (1998), “can discredit any, even the best way”. Herniation in mild cases does not require the pinnacles of operational skill and many years of experience. However, it is here that the surgeon's ability to take care of tissues, clearly navigate the topographic-anatomical relationships, ensure maximum asepticism of the operation and thorough hemostasis is manifested [67,68].

For the surgical treatment of inguinal hernias, many methods have been proposed that can be divided into two groups: traditional (suturing of tissues with tension) and modern (the use of mesh endoprotheses – suturing of tissues without tension) [69]. The main disadvantages of traditional hernioplasty include: intraoperative complications (damage to the elements of the spermatic cord and nerves, injury to the bladder, intestinal wall), complications from the postoperative wound, a long period of rehabilitation and disability. In this regard, the search for new alternative methods of hernioplasty remains relevant. In the last decade, the technique of reconstruction of the inguinal canal using synthetic materials, developed by I.L. Lichtenstein [70], has become widely popular.

When using this method, the posterior wall of the inguinal canal is strengthened by tissue-germinated mesh grafts placed anteriorly from the transverse fascia without tension and comparison of dissimilar tissues, which contributes to the biological patterns of wound healing [71].

According to the principles of preferential use of certain abdominal wall tissues, all methods of hernia surgery can be divided into 5 main types [34]:

- 1) fascial-aponeurotic;
- 2) muscular-aponeurotic [72];
- 3) muscle;
- 4) plastic with the help of additional biological or synthetic materials (alloplasty, xenoplasty, explantation) [73];
- 4) combined (the use of auto-tissues and foreign tissues) [74].

The first three methods are combined into autoplasmic, the other two are commonly called alloplastic [75]. Each plastic surgery method has been studied in detail. On their basis, many methods of operation have been proposed. If the choice of the herniation method is determined by the pathogenetic nature of the

hernia, then the choice of the operation method should ensure its reliability in terms of long-term results [76].

Currently, plastic is widely used with the help of additional biological and synthetic materials [77]. Transplants, depending on their origin, are divided into:

- a) autologous (taken within the same organism);
- b) allogeneic (taken in the body of the same species as the recipient's body;
- c) xenogenic (taken in the body of another species);
- d) explants (non-biological tissues);
- e) combined transplants (a combination of biological, more often autologous and non-biological tissue).

Indications for the use of plastic materials according to domestic and foreign studies [78], in inguinal hernias are:

- 1) recurrent, especially multiple recurrent hernias;
- 2) large primary hernias with a flabby abdominal wall due to muscle atrophy, fascia and aponeurosis;
- 3) postoperative hernias with multiple hernial gates, when suturing the hernial gates with local woven ones does not give full confidence in their viability;
- 4) "complex" inguinal hernias – large straight, oblique with a straight channel, sliding and combined with pronounced muscle atrophy, fibrosis of aponeurosis, hypoplasia of ligaments.

All plastic materials used in reconstructive surgery of the anterior abdominal wall have certain advantages and disadvantages. The analysis of individual results indicates that with the help of transplants it is possible to sharply reduce the number of relapses [79].

The age of the patient, the severity of concomitant diseases themselves can already serve as a restriction to the use of a particular type of hernioplasty. So the age of the operated person under 25 years is a contraindication for plastic surgery with an allograft. On the contrary, in patients of older age groups, the use of traditional autoplasty techniques should be considered unjustified, due, as a rule, to the functional failure of their own tissues in the area of the postoperative scar [80].

The widespread introduction into clinical practice of modern foreign and domestic synthetic materials, such as non-assembled synthetic atraumatic suture material, biologically inert polypropylene mesh, has significantly reduced the number of unsatisfactory results of operations. Thus, E. Shouldice's technique for the treatment of inguinal hernias, implying the use of atraumatic monofilament synthetic thread Surqipro 2-0, 3-0, the Lichtenstein method based on the use of polypropylene mesh, cause better immediate and long-term results (1-2% of

relapses in primary and 2.5-3.8% in recurrent inguinal hernias, a more favorable postoperative period) [81], compared with by traditional methods of plastic surgery of the posterior wall of the inguinal canal E. Bassini, N.I. Kukudzhanova, etc.

E. Shouldice's technique is now increasingly called the "gold standard" of inguinal herniation. Using a large amount of material, the author of the technique managed to reduce the number of relapses to 2%. In other clinics, good results were also obtained, relapses did not exceed 5%, mainly in direct hernias. Synthetic polypropylene mesh has found application in large and giant inguinal hernias, recurrent hernias and endoscopic hernioplasty [82].

The possibilities of modern endoscopic surgery today allow performing operations for abdominal wall hernias. Some authors consider endoscopic herniation to be the most appropriate in cases of recurrent inguinal hernias. The disadvantages of the method include the need for anesthesia, the high cost of the equipment used, consumables and plastic materials, longer duration of surgical intervention. However, due to a shorter hospital stay, shorter rehabilitation periods and return to work, the overall health care costs for the treatment of patients with inguinal hernias are reduced. According to various authors, the number of early relapses (15-20%) after endoscopic herniotomy is quite high. Currently, the question of the widespread use of the endoscopic method of herniation remains debatable.

In recent decades, the practice of outpatient herniation has been actively introduced in developed countries [46].

The introduction of this technology looks especially attractive against the background of a decrease in the bed stock of surgical hospitals of domestic clinics. According to the National Outpatient Hernia Institute (USA), the use of modern hernioplasty techniques (E. Shouldice, Moran operations) in combination with modern drugs for local anesthesia and sufficient experience of the surgeon currently allows for operations with primary inguinal and other types of hernias on an outpatient basis, with postoperative observation of patients for 2-4 hours in the hospital and subsequent outpatient dressings. The short duration of the patient's stay in a medical institution practically excludes the possibility of an attack of hospital infection. This significantly reduces the likelihood of wound complications in the postoperative period. The number of postoperative complications and relapses of the disease using this technology was reduced to 0.3% [30].

The choice of the method of inguinal hernioplasty should be determined, first of all, by the degree of destruction of the posterior wall of the inguinal canal and the inner inguinal ring [83].

Older patients often have severe concomitant diseases (obesity, diabetes mellitus, post-infarction atherosclerosis, hypertension, etc.), their own tissues are unsuitable for reliable plastic surgery, which should be taken into account when choosing anesthesia and the method of plastic surgery. Many of them decide to undergo surgery in order to be able to continue to work actively.

In conclusion, it should be noted that at present the dispute about the advantages of any of the methods of herniation has not been finally resolved. Some authors consider it justified to perform the E. Shouldice operation in all cases [84], others consider the optimal use of synthetic materials as a defect-substituting material [85]. Some consider it necessary to use only endoscopic techniques for recurrent inguinal hernias [86]. However, in the end, not one of the existing hernioplasty methods by itself does not provide an absolute guarantee against recurrence of hernias. Only a differentiated approach to the choice of the operation method can significantly improve its immediate and long-term results.

Therefore, at present, the choice of the hernioplasty method should not be based solely on the considerations of the surgical school. The surgeon is obliged to master various types of effective operations, so that, assessing various aspects related to the treatment of a particular person, he must be able to competently choose the optimal method of plastic surgery in each case.

Thus, the analysis of domestic and foreign literature shows that the issues of inguinal hernia treatment in patients with risk factors remain relevant and debatable.

Laparoscopic technologies in the surgical treatment of inguinal hernias.

For the first time, the concept of "laparoscopic transabdominal preperitoneal hernioplasty" (TAPP) was introduced in May 1991. Surgeons from Indianapolis (USA) M. Arregui and R. Nagan proposed laparoscopically, after opening the peritoneum and thorough dissection of the posterior wall of the inguinal region, to place a mesh implant preperitoneal to cover all "weak" places, fix the mesh around the perimeter with paper clips and suture the peritoneum above mesh (peritonization). The technique of "total extraperitoneal hernioplasty" (TEP) was proposed in 1991 by Prof. J. Dulucq (France). In order to exclude possible damage to internal organs and complications associated with the introduction of instruments into the abdominal cavity and manipulations in it, the surgeon suggested the idea of a completely extraperitoneal method of treating inguinal hernias using laparoscopic instruments. At the same time, he proposed the insufflation of CO₂ into the preperitoneal space for adequate exposure, as well as the fixation of a synthetic prosthesis only to the Cooper ligament by a herniator [87].

Thus, in fact, only two methods of endoscopic hernioplasty have found practical application:

1. Transabdominal preperitoneal hernioplasty (TAPP) [88].
2. Total extraperitoneal (TEP) [89].

A comparative study of the methods described above to identify the most effective method was conducted in the form of numerous controlled randomized trials. For instance, in 1994, a multicenter retrospective analysis of 1514 hernioplasty operations performed [90], complications and relapses associated with TAPP and

TEP methods was carried out. The result of the study was the identification of the fact that a huge percentage of complications is associated with the period of mastering the techniques. With the acquisition of experience in performing operations, the number of complications and relapses decreased significantly [91].

Back in 1995, E. L. Felix, C. A. Michas et al. A study was performed where 733 TAPP and 382 TEP operations were compared. The results showed the advantage of the TEP method [92].

In the same year the works of L. Krähenbühl, M. Schäfer et al. revealed an absence of advantages in the postoperative period of any specific endoscopic plastic surgery of the inguinal canal was revealed. Preference was given to the TAPP method as easier to learn [93].

In 1998, a number of works were published comparing hernioplasty with TAPP and TEP methods. For example, P. Sayad, A. Hallak et al. when analyzing complications and relapses, 11222 hernioplasty revealed that TEP has a better result, but TAPP is performed more widely [94].

In 1998, J. Cueto et al. presented a review of the literature “Intestinal obstruction in the postoperative period after laparoscopic hernioplasty”, according to the results of which it is proposed to use TAPP only if it is impossible to perform TAP [95].

In 1999, a multicenter prospective analysis of 1605 hernioplasty by TEP was published in 29 Swiss clinics (P. Aeberhard., C. Klaibe et al), which has revealed that TEP is more suitable for primary hernias, and patients note a high level of quality of life in the postoperative period [96].

In 2002, an article was published by C. G. Schmedt, R. Bittner, presenting a systematic review of 33 published studies comparing endoscopic hernioplasty methods (TAPP and TEP) with the methods of Shouldice and Lichtenstein. As a result, only one study showed the advantage of the Lichtenstein hernioplasty method. In 22 studies, there were no statistically significant differences between TAPP, TAP and Lichtenstein hernioplasty [97].

The first long-term studies over a period of at least 5 years show the advantage of endoscopic methods. Even with careful interpretation of the data, it becomes obvious that endoscopic hernioplasty methods are the most convenient for patients.

In 2003, A. Czechowski and A. Schafmayer conducted a retrospective analysis for 5 years after TAP – 352, and after TAP – 324 hernioplasty performed by four surgeons. As a result, the number of complications and relapses in both groups did not differ. Relapses occurred on average in the TAPP group after 45 months, and in the TAP group after 36 months [98].

In the same year, P. Lal et al. A randomized controlled trial of TEP and Lichtenstein methods was conducted. In this study, complications, surgery time, postoperative pain, duration of stay and time of return to work were compared. As a result, taking into account complications and short-term relapse, it was noted

that the methods of TAPP and Lichtenstein are comparable. The severity of the pain syndrome after the TEP method is lower, the time to return to work is shorter, the cosmetic result is better [99].

In the same year, the work of P. K. Chowbey et al. is published, which presents the materials and results of a retrospective study of 1193 hernioplasty by the TEP method in the period from 1996 to 2001 in order to identify the causes of relapse. As a result, it was found that the cause of relapses was the displacement of the mesh due to inadequate proximal mobilization of the peritoneum from the spermatic cord [100].

As can be seen from the above, the TEP technique, despite the complexity of its development, is gaining popularity. Already in 2004, an article was published by G. Ferzli et al., which presents 11 cases of treatment of pinched inguinal hernias by the TEP method. At the same time, the duration of the operation averaged 59 minutes, hospital stay – 5.4 days. In one case, an injury to the cecum occurred. Thus, the TEP technique is acceptable in the treatment of a pinched inguinal hernia [101].

In 2005, B. L. Wake and McCormack processed all published and unpublished studies comparing TAPP and TEP hernioplasty methods. As a result, they came to the conclusion that there is insufficient data to allow conclusions to be drawn about the relative effectiveness of TEP compared to TAPP [102].

In the same year, B. J. Leibl et al. conducted studies comparing TAPP and TEP using studies of Medline literature sources. As a result, there were no statistically significant differences between TAPP and TEP in the postoperative period. The only difference was that the learning curve for TAPP is shorter [103].

When comparing TAPP and TEP, it is necessary to note an important advantage of the TAPP method – the possibility of performing diagnostic laparoscopy of the abdominal cavity. At the XVIII EAES Congress in Geneva, 100 specialists were interviewed and asked 19 questions. All surgeons answered and as a result, 82% of surgeons prefer an individual approach. Endoscopic methods are used more often in open bilateral (93% vs. 7%) and recurrent (81% vs. 19%) inguinal hernias. While for unilateral inguinal hernia, all methods were used almost the same (TAPP – 39%, TAPP – 29%, open – 32%). TAPP was used much more often than TAP, even for those surgeons who are experts in TAP for herniation of complex hernias.

Surgeons are also inclined to perform the open method in patients with hematological diseases (58%) and in patients with a history of laparotomy (59%) [104]. In addition, at the end of 2012 M. Gass et al. we completed randomized studies comparing TAPP and TEP methods, where we participated: TEP=3457 and TAPP=1095. As a result of the analysis, according to the authors, TEP hernioplasty has a greater number of complications and conversions. Therefore, the TAPP method is the operation of choice in patients with unilateral inguinal hernia [105].

In 2014, the work of X. Chen, J. W. Li et al. was published. about the treatment of 213 patients with recurrent inguinal hernias who were operated by TAPP, TEP and open method. According to the authors, the TAPP method is the most optimal in the treatment of recurrent inguinal hernia [106]. In the same year, A. Pisanu, M. Podda et al. We have completed a meta-analysis comparing the laparoscopic method and the Lichtenstein method in the treatment of recurrent inguinal hernia. The study included 647 patients. According to the authors, laparoscopic methods have shown a reduction in chronic pain and an early return to work [107].

In the Russian literature, there are also works on the study of the use of the TARR method in the treatment of recurrent hernias [108], as well as its use after previously performed TAP-plastic surgery, the so-called Re-TARR [109] with good postoperative results. Thus, it is already safe to say that endovideosurgical methods of inguinal hernia treatment are the future. Despite the existing experience of minimally invasive treatment of inguinal hernias, developed methods of prevention, diagnosis and treatment of postoperative complications, the results of treatment still do not satisfy surgeons [100].

Summarizing all of the above, we can say that the work on comparing endoscopic methods of inguinal hernia treatment carried out at different stages of the development of the technique does not give unambiguous answers and is sometimes very contradictory.

Results: a total of 24,394 sources were found, 110 of them were analyzed.

Search strategy: to conduct a systematic search for scientific information and to achieve this goal, an analysis of scientific publications in evidence-based medicine databases (PubMed), using specialized search engines (Google Scholar) and in electronic scientific libraries (CyberLeninka, e-library) was conducted from 1990 to 2020.

Inclusion criteria: studies of high methodological quality: meta-analysis, systematic review, and cohort studies, as well as publications with clearly formulated and statistically proven conclusions in English and Russian.

Exclusion criteria: summary of reports, reports in the form of abstracts, advertising articles.

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