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INNOVATIVE ASPECTS OF OPEN INGUINAL HERNIA SURGERY: REDUCING COMPLICATIONS AND PREVENTING RECURRENCES

Summary

Inguinal hernias constitute a significant portion of surgical pathology and remain among the most common reasons for seeking surgical consultation. According to the World Health Organization, inguinal hernias occur in 4-5% of the adult population, with men being affected 7 to 10 times more frequently than women.

The aim of the study. *The present study is aimed at improving the effectiveness of treatment, reducing the frequency of relapses and complications, as well as improving long-term treatment outcomes.*

Research materials and methods. *This study is based on the diagnostic and treatment outcomes of patients with inguinal hernias who underwent surgical intervention at the surgical department of the multidisciplinary regional hospital in Samarkand between 2019 and 2024. A total of 196 male patients with various types of inguinal hernias were selected for retrospective and prospective analysis.*

The results of the study. *The study identified key risk factors for inguinal hernias, including hard physical work, increased intra-abdominal pressure and connective tissue dysplasia. The factor analysis of the causes of relapse and unsatisfactory results in patients in the comparison group, such as impaired sexual function and testicular atrophy on the operated side, showed positive long-term effect in patients in the main group. Among 79.6% of patients followed in the long-term period, no recurrence of the disease was observed. None of the patients reported a sensation of a foreign body in the operative area, although some patients of reproductive age reported sexual dysfunction. Quality-of-life assessment indicated that implementation of a differentiated algorithm for treatment strategy selection increased the proportion of «excellent» and «good» outcomes from 88.3% to 100.0%.*

Conclusion. *The developed algorithm for selecting the method of inguinal canal plastic surgery, and the improvement of surgical instruments has significantly reduced the incidence of early postoperative complications. The use of a modified preperitoneal alloplasty technique demonstrated excellent long-term results, decreasing recurrence rates and improving patients' quality of life.*

Keywords: *Inguinal Hernias; Preperitoneal Alloplasty; Connective Tissue Dysplasia; Surgical Complications; Quality of Life.*

Introduction

Inguinal hernias account for a significant proportion of surgical pathology and remain one of the most common causes of patients seeking medical help [1]. According to the World Health Organization, inguinal hernias occur in 4-5% of the adult population, and men are 7-10 times more likely to get sick than women [2, 3, 4]. The development of optimal treatment methods that minimize the risk of complications and relapses, as well as improve the quality of life of patients, is an urgent task of modern surgery [5, 6].

The contribution of authors from different countries highlights the global significance of the problem. Research by Uzbek surgeons (Y. B. Axmedovich et al., 2024) focuses on the importance of an individual approach to choosing a hernioplasty method that takes into account the morphological and anatomical characteristics of patients [7, 8]. Ukrainian researchers (V. Boyko et al, 2021) investigated the influence of body type on the development of inguinal hernias and assessed the effectiveness of various alloplasty techniques [9]. Belarusian researchers (R. M. Rudziankou, I. I. Pribushenya, 2016) emphasize the need to improve surgical instruments to prevent damage to the spermatic cord [10].

Ukrainian surgeons and researchers make a significant contribution to the study of inguinal hernias, with particular emphasis on the morphofunctional characteristics of tissues, the impact of comorbid conditions and the role of technical factors in surgical treatment. Studies by Ukrainian researchers, including L. S. Bilianskyi et al (2014), emphasize the importance of considering patients' constitutional characteristics – such as

congenital connective tissue dysplasia and a hypersthenic body type – as key risk factors for inguinal hernia development [11].

Ukrainian scientists emphasize the need to improve the methods of surgical plastic surgery of the inguinal canal. For example, studies by I. A. Krivoruchko and colleagues (2017) have confirmed that the use of preperitoneal alloplasty can achieve a lower recurrence rate in the treatment of inguinal hernias of medium and large size [12]. In addition, in the work of A. B. Klimenko et al. (2016) it is noted that the use of biomaterials with improved properties (mesh implants) helps to reduce the frequency of complications such as infiltrate, dropsy and testicular atrophy, especially in patients with severe concomitant pathology [13].

An important focus of Ukrainian research is the analysis of complications and recurrences. A. O. Dvorakevich, A. A. Pereyaslov (2015) emphasize the need to develop novel surgical instruments that minimize the risk of spermatic cord injury and enhance techniques for tension-free hernioplasty. These innovations have enabled Ukrainian surgeons to reduce early postoperative complications such as scrotal edema and infiltration, while also improving patient quality of life, as confirmed by studies employing internationally validated questionnaire scales. [14].

Thus, the work of Ukrainian surgeons emphasizes the importance of an individualized approach, technical advancements in surgical procedures, and the implementation of novel biomaterials. These studies contribute significantly to addressing the issue of inguinal hernias, highlighting the relevance of this topic both regionally and globally [15].

International studies confirm the relevance of the problem. In China (D. Xu et al., 2021), the focus is on the use of modern mesh implants and minimizing complications such as testicular dropsy and testicular atrophy. Japanese surgeons (T. Hori et al., 2021) have developed innovative approaches to tension-free hernioplasty in order to shorten the postoperative period. South Korean authors (M. S. Cho et al., 2019) studied the use of bioresorbable meshes, which reduced the incidence of chronic pain. Turkish researchers (M. B. Yıldırım et al., 2021) focused on improving preperitoneal alloplasty, which reduces relapses [16, 17, 18, 19].

Large-scale studies are being conducted in Western European countries (Italy, Portugal, Spain, France, Germany) aimed at standardizing approaches to the treatment of inguinal hernias. In particular, Italian surgeons (C. Stabilini et al., 2023) noted that using algorithms for choosing a treatment method allows achieving better long-term results. German specialists (A. Kohler et al., 2019) focused on morphological changes in aponeuroses in patients with inguinal hernias [20, 21].

In North America (USA, Canada, Mexico), the key areas of research are the introduction of advanced imaging techniques and biomaterials for mesh implants. American surgeons (A. Hatewar et al., 2024) confirm that the Lichtenstein technique remains the «gold standard», but requires modernization in terms of preventing relapses [22].

Analysis of domestic and foreign data, as well as the results of our own research, have shown that the introduction of developed algorithms and improved surgical instruments can significantly reduce the risk of complications such as

scrotal edema, infiltrates, dropsy and testicular atrophy, shorten the early postoperative period and improve the quality of life of patients [23].

Thus, the development and implementation of optimized approaches to an open method of surgical treatment of patients with inguinal hernias is of great importance for surgical practice.

The aim of the study. The present study is aimed at improving the effectiveness of treatment, reducing the frequency of relapses and complications, as well as improving long-term treatment outcomes.

Research materials and methods

This study was based on data from the diagnosis and surgical treatment of patients with inguinal hernias treated at the surgical department of the multidisciplinary regional hospital in Samarkand between 2019 and 2024. A total of 196 male patients with various types of inguinal hernias were included for retrospective and prospective analysis.

The primary objective of the study was to optimize surgical approaches aimed at reducing the incidence of early postoperative complications, lowering the risk of recurrence, and preserving reproductive function in men of childbearing age – thereby improving overall quality of life. For this reason, female patients were not included in the study cohort.

Patients underwent both elective and emergency surgeries. Based on the chosen treatment strategy, they were divided into two comparison groups (Fig. 1).

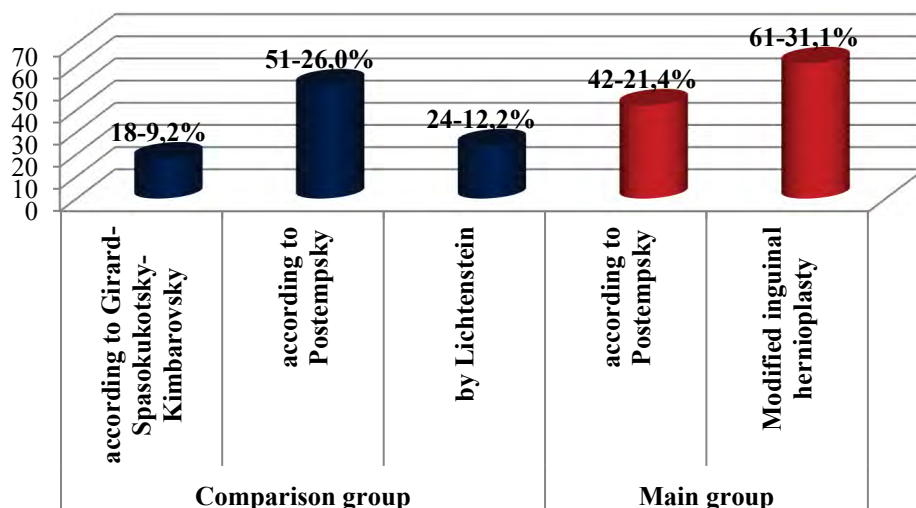


Fig. 1. Distribution of patients by study groups (n=196)

Surgical interventions were performed in both planned and in emergency cases. The patients were divided into two groups depending on the treatment method used. The first group, consisting of 93 people (47.4%), underwent treatment using traditional hernioautoplasty (69 patients, 74.2%) and inguinal hernioalloplasty using the Lichtenstein method (24 patients, 25.8%). The second group included 103 patients (52.6%) who underwent modified inguinal hernioalloplasty (61 patients, 59.2%) and Postemsky hernioautoplasty (42 patients, 40.8%).

The mean age of participants varied. In the main group, it was 47.1 ± 0.3 years, compared to 44.7 ± 1.0 years

in the control group ($p > 0.05$). All patients underwent anthropometric measurements performed using standard methods.

In the anamnesis, repeated infringements were noted in 22 patients of the main group (21.3%) and in 17 people in the comparison group (18.3%). Of all patients who underwent surgery, 134 patients (68.4%) had elective procedures, while 62 patients (31.6%) required emergency intervention due to inguinal hernia injury. Hernioautoplasty was performed 3.5 times more frequently in cases of incarcerated hernias (79.0%), whereas hernioalloplasty was more commonly used for uncomplicated hernias (53.7%).

The distribution of hernia types in the study groups, performed according to the classification of L. M. Nyhus, is shown in Table 1. Among all patients, oblique hernias accounted for 149 cases (76.0%). Hernias of type IIIA

(direct) were detected in 43 patients (21.9%), and recurrent hernias in 9 cases (4.6%). According to the statistical analysis, there are no differences between the groups according to the type of hernias. ($p > 0,05$).

Table 1

Distribution of inguinal hernias according to L. M. Nyhus hernia classification

Study groups		Types of hernias						Total hernias
		I type	II type	III type		IV type		
				IIIA	IIIB	IVA	IVB	
Comparison Group	by Girard-Spasokukotsky-Kimbarovsky	15	3	-	-	-	-	18
	by the Postemsky		21	13	15	1	1	51
	by Lichtenstein		13	6	5	-	-	24
Main group	by Postemsky		19	12	9	1	1	42
	Modified inguinal hernioalloplasty		26	12	18	2	3	61
Total		15	82	43	47	4	5	196
%		7.6	41.8	21.9	23.9	2.0	2.5	100

Anthropometric assessments were performed under standardized conditions in a well-lit room maintained at a minimum ambient temperature of 20 °C, on a flat, warm floor surface. Measurements were predominantly conducted in the morning and completed within 10 minutes. Body weight was recorded in the fasting state using calibrated medical-grade scales. Given the stability of the position of the inguinal canal in adults, anthropometric analysis focused on skeletal dimensions to classify somatotype in accordance with the method described by V. N. Shevkunenko.

Laboratory evaluation included complete blood count, urinalysis, determination of blood group and Rh factor, screening for HIV infection, hepatitis B and C viruses, and test for Wassermann reaction. Biochemical analyses comprised measurement of total serum protein (with protein fractionation

when indicated), bilirubin, transaminases, urea, creatinine, and serum electrolytes. Hemostatic assessment included evaluation of platelet count, fibrinogen concentration, international normalized ratio (INR), clotting time, and bleeding time. When clinically indicated, an extended coagulation profile (coagulogram) was additionally performed.

Duplex ultrasound scanning of spermatic cord elements was used to study blood flow in the testicles. Peak systolic blood flow velocity in the intratesticular artery was measured in 30 patients with inguinal hernias before, during, and one month after surgery. The sensor was placed on the skin of the scrotum above the testicle, scanning was performed in real time in the longitudinal and transverse planes. The results were recorded in the protocol and supplemented with photographic materials (Fig. 2-3).



Fig. 2. Ultrasound of patient A., 57 years old, I/b No.8592/736. Recurrent inguinal hernia after Lichtenstein surgery. The prosthesis is shown, under the aponeurosis



Fig. 3. Ultrasound of patient P., 64 years old, I/b No. 1843/103. The defect of the prosthesis is shown in the area of the exit of the spermatic cord through the Cook window

Occupational history revealed that more than half of the patients (58.7%) were engaged in heavy physical labor. This observation suggests that sustained physical exertion may represent a contributing factor in the development of primary hernias and/or their recurrence (Fig. 4).

The majority of patients were overweight and exhibited a hypersthenic body type. Less frequently, individuals presented with comorbid conditions associated with

elevated intra-abdominal pressure or reported a family history of hernias. A number of patients had several concurrent signs (Fig. 5). To assess for features suggestive of systemic connective tissue involvement beyond the presence of an inguinal hernia, a detailed analysis of comorbidities was conducted. This analysis focused on identifying clinical indicators of generalized connective tissue pathology.

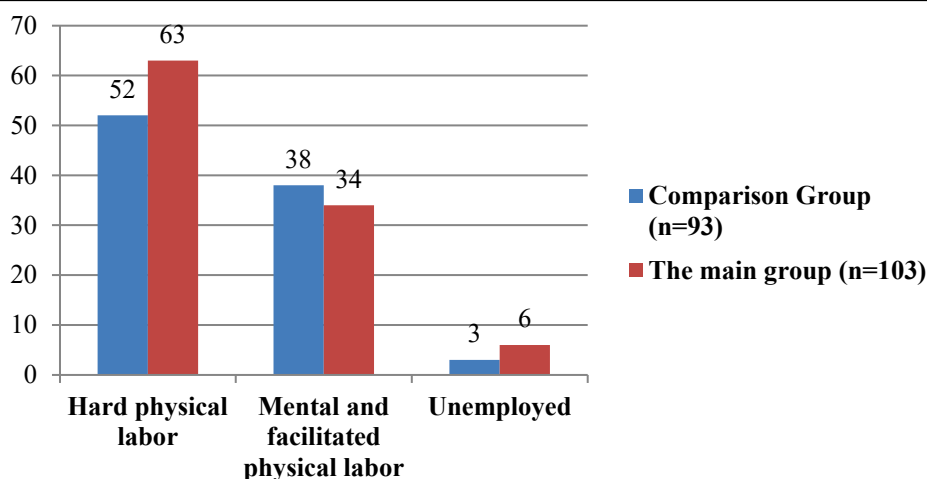


Fig. 4. The distribution of patients depends on the nature of their work (n=196).

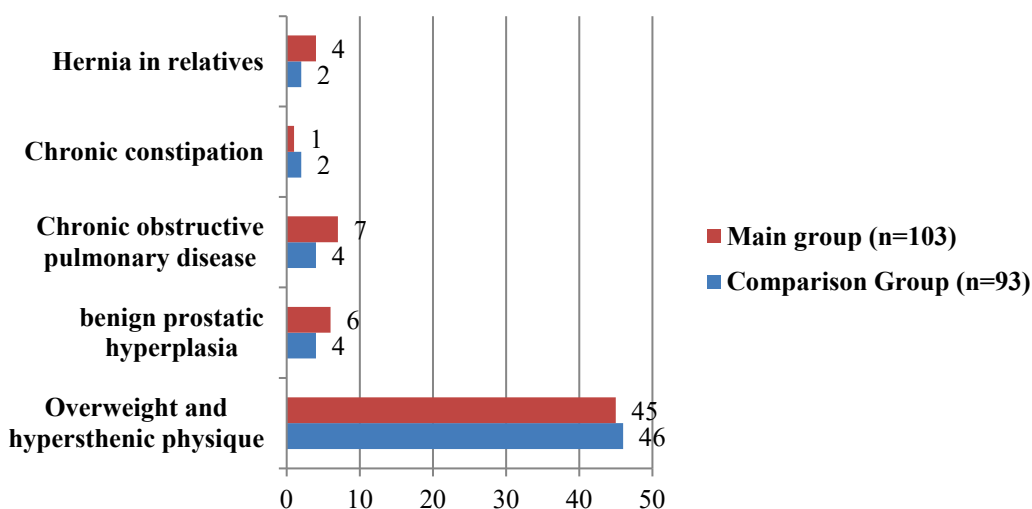


Fig. 5. Characteristics of concomitant diseases accompanied by increased intra-abdominal pressure in patients of the studied groups (n=196).

During the study, morphological changes in the tissues of the inguinal canal wall were examined. Patients with obesity and a hypersthenic body habitus demonstrated significant structural abnormalities of the musculoaponeurotic wall. The

characteristics of these changes, including disorganization of collagen fiber arrangement, suggests that they represent the main reason for the decrease in the strength of aponeurosis (Fig. 6-7).

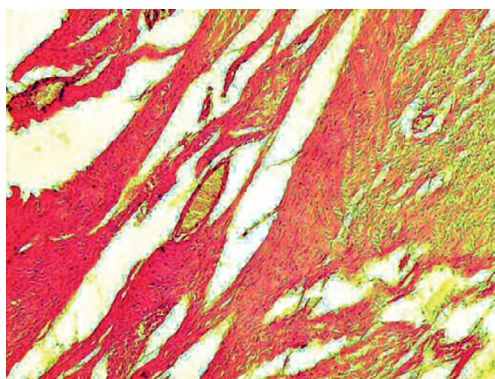


Fig. 6. The muscle tissue of the upper wall of the inguinal canal in a patient with hypersthenic physique. Wide gaps between muscle bundles («structureless» zones). Vessels with dilated lumens and accumulated red blood cells. Patient K. is 35 years old (№ . 15232/1031). G-E. 10×10.

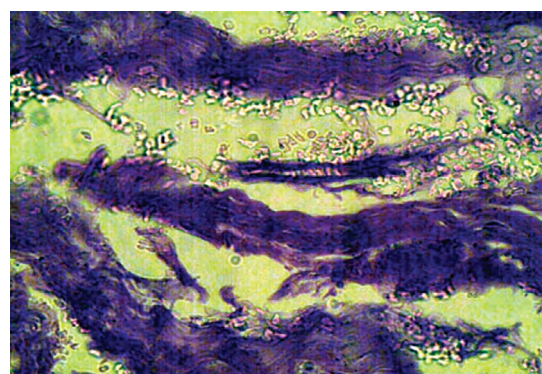


Fig. 7. Aponeurosis of patient K. 45 years old (№ . 15232/1031) with a hypersthenic build. Large gaps between bundles of fibers with red blood cells in them. G-E. 10×40.

Factors contributing to overgrowth of the aponeurosis tissue, such as obesity and recurrent inguinal hernias, regardless of the age of patients, lead to the development of dystrophic changes in the musculoaponeurotic layer, which in turn reduces its strength (Fig. 8-9).

Structural changes as described above reduce the adaptive capacity of the inguinal canal wall to mechanical

stress, thereby contributing to the development of inguinal hernia.

These morphological alterations are characteristic not only of elderly patients but also of those with factors that promote aponeurotic tissue overgrowth. This finding supports the use of synthetic grafts to reinforce the posterior wall of the inguinal canal during hernioplasty.

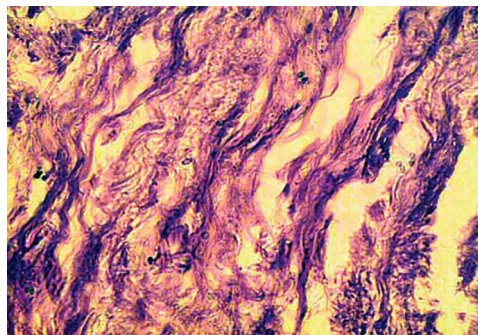


Fig. 8. Aponeurosis of a 77-year-old patient (№ .2912/2011). A chaotic arrangement of disparate fibers with expanded spaces between them, without pronounced bundle formation. G-E. 10×40.

Based on the analysis, patients with inguinal hernia were found to have between one and four risk factors for its development. The most prevalent included heavy physical labor (58.7%), the presence of comorbidities associated with increased intra-abdominal pressure (58.7%), and signs of congenital connective tissue dysplasia (28.1%). These factors contribute both to primary inguinal hernia formation and its recurrence, and should be considered when selecting a treatment strategy.

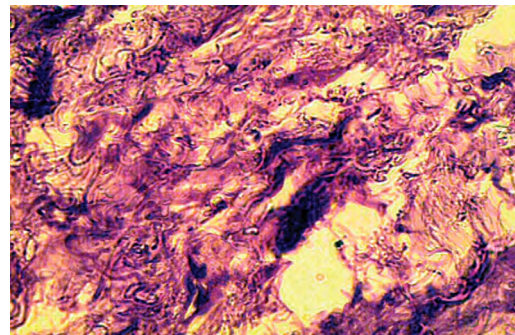


Fig. 9. Aponeurosis of patient X. 78 years old with a normosthenic physique. (№ 6254/443). A chaotic arrangement of disparate fibers with expanded spaces between them, without forming bundles. G-E. 10×40.

The results of the study. Of the 93 patients in the comparison group, 84 (90.3%) experienced an uneventful immediate postoperative period. A total of 15 postoperative complications (16.1%) occurred in 9 patients (9.7%). Reported complications included wound suppuration (n = 1), inguinal infiltration (n = 1), scrotal edema (n = 2), testicular hydrocele (n = 1), inguinal hematoma (n = 1), genitourinary tract infection (n = 1), and acute urinary retention (n = 4) (Table 2).

Table 2

Immediate results of surgical treatment of patients with inguinal hernia in the comparison group

Complications		Type of operation						Total	
		by Girard-Spasokukotsky-Kimbarovsky		by the Postemsky		by Lichtenstein			
		abs.	%	abs.	%	abs.	%	abs.	%
		18	100	51	100	24	100	93	100
In the area of the postoperative wound	Suppuration of the wound	-	-	1	1,96	-	-	1	1,1
	Infiltration	-	-	1	1,96	-	-	1	1,1
	Swelling of the scrotum	1	5,5	1	1,96	-	-	2	2,1
	hydrocele	-	-	1	1,96	-	-	1	1,1
	Hematoma of the postoperative area	1	5,5	-	-	-	-	1	1,1
	Postoperative wound seroma	-	-	-	-	4	16,7	4	4,3
Others	Acute urinary retention	-	-	3	5,9	1	4,2	4	4,3
	Infection of the genitourinary tract	-	-	1	1,96	-	-	1	1,1
Total complications:		2	11,1	8	15,7	5	20,8	15	16,1
Total patients:		2	11,1	4	7,8	3	12,5	9	9,7

One patient developed a hematoma of the spermatic cord, and another with testicular hydrocele underwent multiple aspirations over a period of 3 to 4 weeks. In cases of wound infiltration and scrotal edema, compresses were applied. One patient with wound suppuration experienced secondary intention healing. In 4 patients (4.3%), complications not directly related to the surgical wound or urinary catheter were observed. These included acute urinary retention in 3 patients (3.2%) and urinary tract infection in 1 patient (1.1%). These cases primarily involved elderly men.

The treatment outcomes of 24 patients with inguinal hernia who underwent hernioplasty with various mesh implants were analyzed. In the early postoperative period, 4 patients developed postoperative wound seroma, which was managed by aspiration. Acute urinary retention occurred in 1 patient. Among the 9 patients (37.5%) who underwent surgery using the Lichtenstein technique, all reported a sensation of a foreign body in the groin area at discharge; 3 of these patients (33.3%) experienced inguinal neuralgia.

Complications were more frequently observed in patients who received heavy-weight mesh implants (25.0%), which was attributed to irritation of the inguinal nerves (16.7%) (Fisher's exact test, $\phi < 0.01$).

At 6-month follow-up, 90 patients (96.8%) were re-evaluated. In 6 patients (6.7%) who had undergone

Lichtenstein repair, a persistent sensation of a foreign body was reported. Chronic, dull inguinal pain not requiring analgesics was noted in 5 patients (5.5%): 2 following Postempsky repair and 3 following Lichtenstein repair. Testicular atrophy was observed in 3 patients (3.3%) after Postempsky repair (Fig. 10).

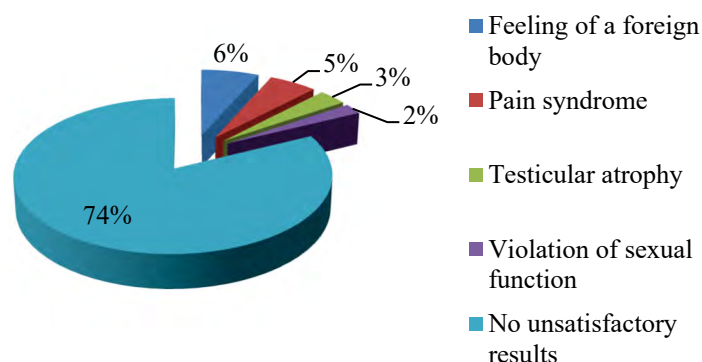


Fig. 10. Characteristics of unsatisfactory results in the first 6 months after surgery in patients of the comparison group

At 3 years postoperatively, 77 patients (82.8%) were available for follow-up. Testicular atrophy was identified in 3 patients (3.9%), and recurrent inguinal hernia was observed in 4 patients (5.2%). Among these, 1 patient had previously undergone hernioplasty using the Girard-Spasokukotsky-Kimbarovsky technique, 2 had Postempsky repair, and 1 had Lichtenstein repair (Table 3).

In summary, reinforcement of the anterior wall of the inguinal canal was associated with a recurrence rate

of 7.7%. Recurrences occurred less frequently (4.4%) following tension-based repair of the posterior wall; however, 6.7% of patients in this group developed testicular atrophy secondary to compromised testicular blood supply. Repair using the Lichtenstein technique was characterized by relative technical simplicity, with a mean operative time of 52.3 ± 11.2 minutes. Nonetheless, this method was not universally effective, as recurrence was observed in 1 patient (5.3%).

Table 3

Frequency of recurrence of inguinal hernia after surgery in patients in the comparison group

Long-term results	Type of operation						Total	
	by Girard-Spasokukotsky-Kimbarovsky		by the Postemsky		by Lichtenstein			
	abs.	%	abs.	%	abs.	%	abs.	%
	13	100	45	100	19	100	77	100
Relapse	1	7,7	2	4,4	1	5,3	4	5,2
Testicular atrophy	-	-	3	6.7	-	-	3	3.9

Factor analysis of recurrence etiology and treatment outcomes facilitated the development of a clinical decision-making algorithm for selecting the optimal method of inguinal canal reconstruction (Fig. 11).

Since 2020, the selection of the appropriate method for inguinal canal repair has been determined by the condition of the tissues within the inguinal triangle, the extent of destruction of the canal's posterior wall, the status of the internal inguinal ring, and the degree of laxity of the inguinal ligament and the aponeurosis of the external oblique abdominal muscle. Additional considerations include the patient's age, body habitus, and the presence of comorbid conditions. Among these factors, the integrity of the posterior wall remains the principal determinant influencing hernia recurrence. In cases with significant anatomical changes – such as large indirect, direct, or recurrent hernias – alloplastic repair with modification is considered the optimal approach.

For all patients undergoing surgical treatment for inguinal hernia, the standardized preoperative algorithm includes the following components: 1. Detailed medical history, with emphasis on occupational and familial risk factors, as well

as associated comorbidities; 2. Comprehensive clinical and laboratory evaluation aimed at identifying signs of connective tissue dysplasia and conditions contributing to elevated intra-abdominal pressure; 3. Anthropometric assessment to determine somatotype.

In the primary treatment group, Postempsky tension-based hernioautoplasty was performed in 42 patients (40.8%). The incidence of unfavorable outcomes – scrotal edema (1.96%), testicular hydrocele (1.96%), postoperative infiltrate (1.96%), and testicular atrophy (3.3%)—necessitated the development of revised technical strategies to improve surgical efficacy and reduce complications.

To prevent infringement of the spermatic cord in the area of the deep inguinal ring, a special tool was created and patented (patent No. IAP 7593, 12/29/2023).

To move/isolate the spermatic cord during plastic surgery of the posterior wall of the inguinal canal, a surgical instrument was used (Fig. 12), which contains two closing semi-cylinders (1) 5 cm long, 3.5 mm deep, and 1 mm thick, which, when brought together, are able to hold the spermatic cord as a whole without traumatizing its elements.

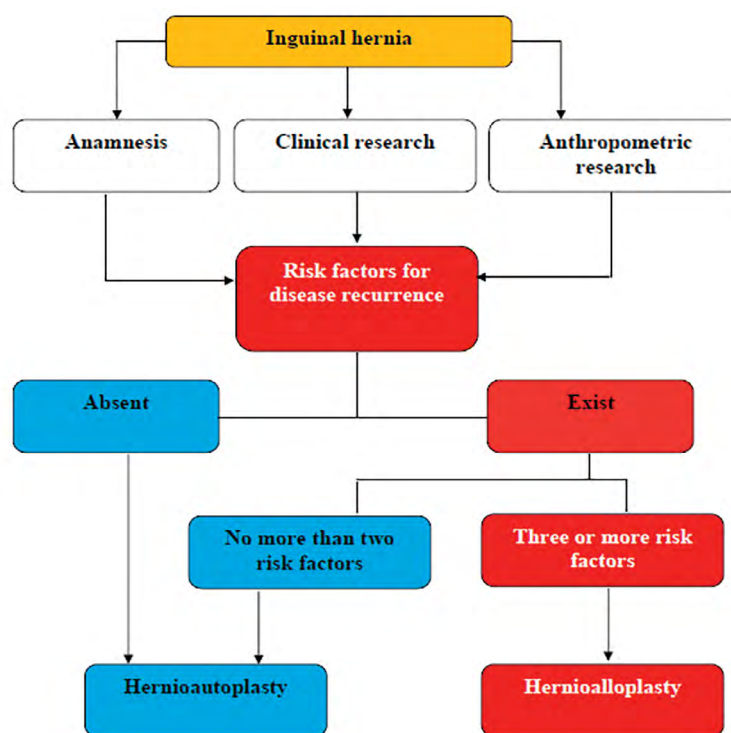


Fig. 11. Algorithm of tactics for choosing hernioplasty for inguinal hernias



Fig. 12. A developed tool to prevent infringement of the spermatic cord: 1. Two oblong collapsible hemispheres; 2. Handle with two pivotally connected branches; 3. Handle rings; 4. Lock; 5. Working part for wedging into the inguinal ring.

The tool also consists of a 7 cm long handle with two pivotally connected branches (2) with a thickness of 2 mm, a handle ring (3), a 3 cm retainer (4) and a working part up to half cylinders with a length of 10 cm (5), while the working part of the half cylinders (5) is wedged into the inguinal ring, then, holding the rings of the handle (3), the handles (2) rusted together, the spermatic cord was captured and placed in a cylinder formed when the semi-cylinders (1) were closed, the cylinder was held in the closed position by a lock (4), to plasticize the posterior wall of the inguinal canal, the upper flap of the aponeurosis of the external oblique abdominal muscle was sewn to the inguinal ligament, starting from the pubic tubercle to the deep inguinal ring close to the tubular part of the specified surgical instrument, then a duplicate of the aponeurosis of the external oblique abdominal muscle was created by stitching its lower flap to its upper flap, then, opening the semicylinders (1), the seminal the rope was being released.

After isolating the spermatic cord, it was taken onto an instrument developed by us (Fig. 13) with lateral-upward traction. After suturing and excision of the hernial sac at the neck, the aponeurosis was prepared for plastic surgery. In order to exclude infringement of the spermatic cord and impaired blood flow in the testicle, ultrasound Dopplerography of the scrotum was performed intraoperatively (Fig. 14).

The Lichtenstein method of non-tensioning hernioalloplasty has demonstrated significant advantages over traditional methods of inguinal hernia repair. It is characterized by a short duration of the operation, ease of execution and affordable cost.

However, in some cases, the condition of the inguinal ligament, which can be severely weakened, makes it an unreliable basis for fixing the prosthesis. This requires additional measures. Using Cooper's bundle, as many experts suggest, only partially solves the problem. Alternative approaches, such as the Kozlov method with the creation of an artificial inguinal ligament and the Fletcher method using a three-layer mesh, are technically difficult to implement.

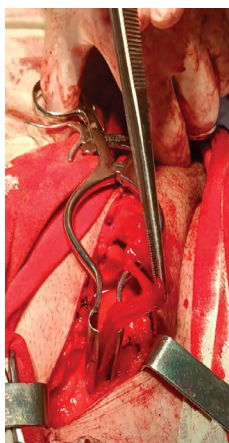


Fig. 13. Isolation of the spermatic cord and taking on a tool developed by us.

An analysis of the causes of inguinal hernia recurrence after the Lichtenstein method revealed that one of the 19 patients (5.3%) relapsed a long time after surgery. This patient with a hypersthenic build and high intra-abdominal pressure had fibrotic muscle aponeurotic tissue, incision of sutures and displacement of the mesh implant under mechanical stress.

These changes indicate processes in the issues of the inguinal region what occurs after implantation of a synthetic prosthesis, which may contribute to the recurrence of a hernia.

Taking into account the identified shortcomings and complications, we have developed and implemented an improved method of inguinal hernioplasty. This approach is patented in the Agency for Intellectual Property of the Republic of Uzbekistan (patent No. IAP 7588 dated 02.02.2024, «Method of inguinal hernia alloplasty»).

The modified alloplasty method for inguinal hernias consisted of the following steps:

1. The skin incision is 2 cm above and parallel to the inguinal ligament;
2. dissection of the aponeurosis of the external oblique abdominal muscle from the external inguinal ring parallel to the inguinal ligament;
3. there is a hernial sac in the thickness of the spermatic cord;



Fig. 14. Intraoperative ultrasound dopplerography of the scrotum.

4. excision of the hernial sac from the cervix;
5. taking the spermatic cord on the holder;
6. the bladder is filled with antiseptic through a urinary catheter;
7. A transverse incision is made on the transverse fascia (fig. 15);
8. A pocket is created between the transverse fascia and the peritoneum before and laterally to the spermatic cord (Fig. 16);
9. the graft with the formation of equal-width branches and a hole for the spermatic cord at 6 points is pre-stitched with II-shaped sutures (Fig. 17);
10. the graft is inserted into the preperitoneal pocket behind the transverse fascia;
11. with pre-applied II-shaped sutures, the graft is fixed to the transverse fascia, the periosteum of the pubic tubercle using a Deschamps needle;
12. the integrity of the transverse fascia is restored (fig. 18);
13. laying the spermatic cord on the newly restored transverse fascia;
14. restoration of the integrity of the anterior wall of the inguinal canal with nodular sutures (Fig. 19);
15. stitches on the skin.

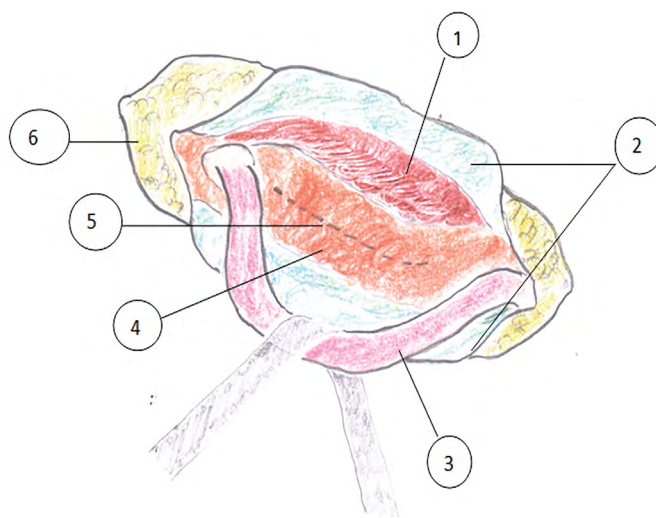


Fig. 15. Dissection of the transverse fascia of the abdomen: 1 – internal oblique and transverse muscles, 2 – aponeurosis of the external oblique abdominal muscle, 3 – the spermatic cord, 4 – the transverse fascia, 5 – the incision line of the transverse fascia, 6 – subcutaneous fat.

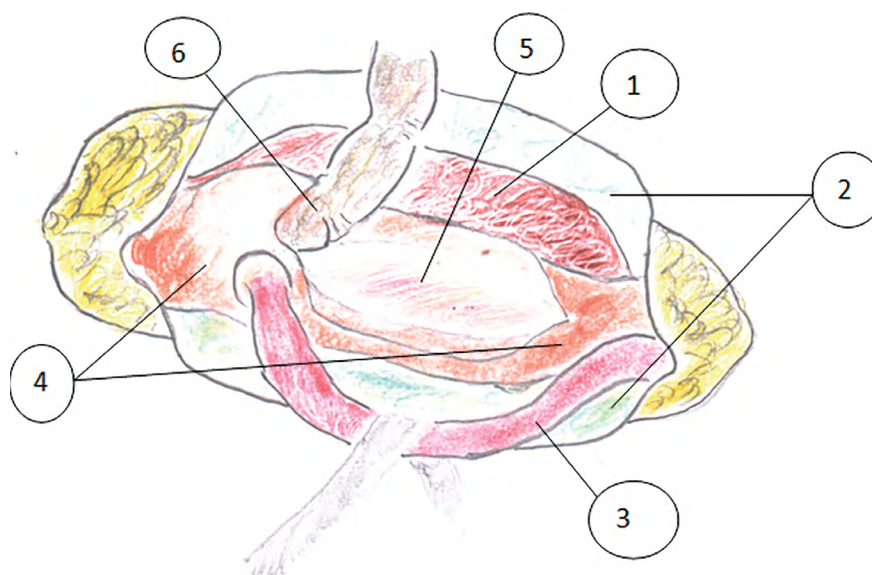


Fig. 16. Creating a bed in the preperitoneal space for the implant:
1 – internal oblique and transverse muscles, 2 – aponeurosis of the external oblique abdominal muscle, 3 – spermatic cord, 4 – transverse fascia, 5 – peritoneum, 6 – creating a pocket between the transverse fascia and the peritoneum with the surgeon's finger.

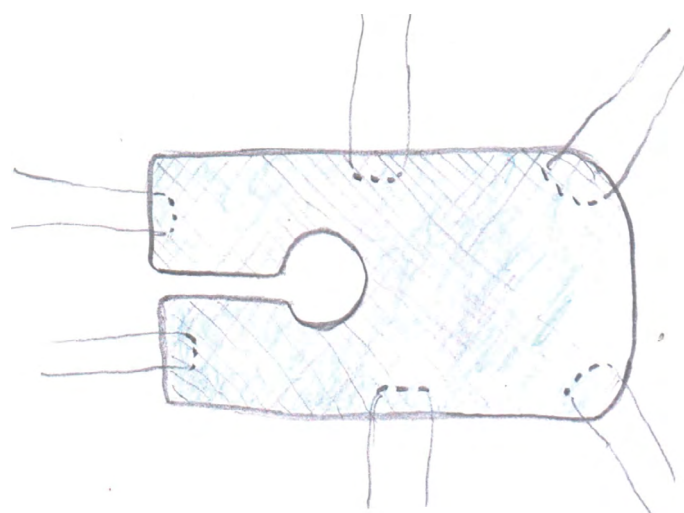


Fig. 17. Polypropylene mesh (allograft) with the formation of equal-width branches and a hole for the spermatic cord at 6 points is pre-stitched with П-shaped seams.

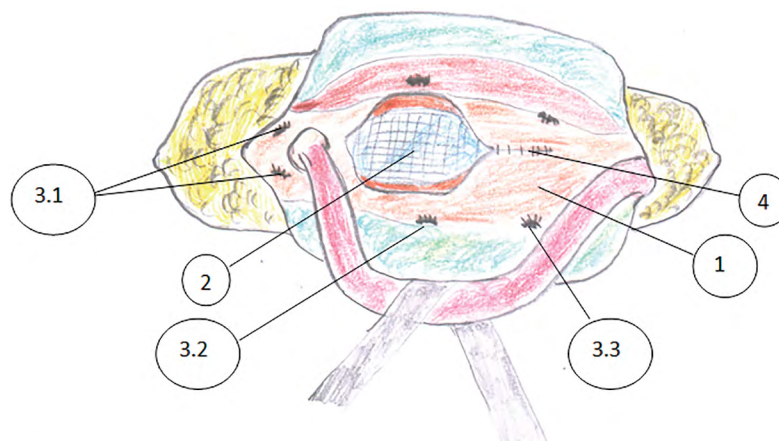


Fig. 18. Allograft fixation points: 1 – transverse fascia, 2 is the allograft (preperitoneal location), 3 is the fixation points of the allograft to the transverse fascia (3.1), to the umbilical ligament (3.2) and to the periosteum of the pubic tubercle (3.3) with pre-applied П-shaped sutures, 4 is the suture line restoring the integrity of the transverse fascia.

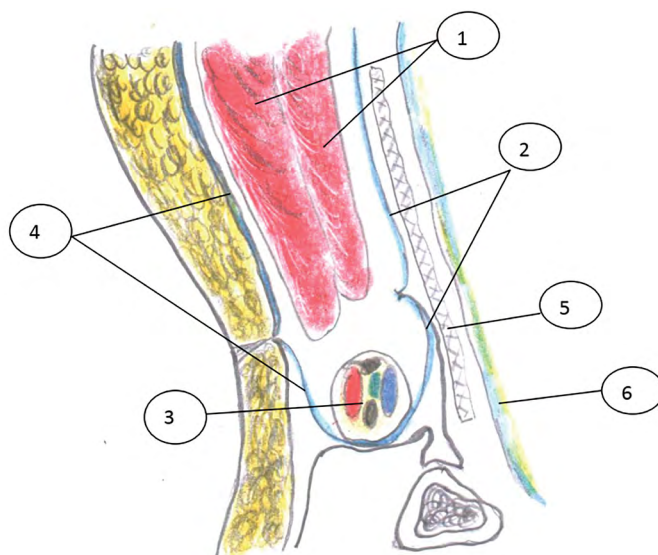


Fig. 19. Operation scheme: 1 – internal oblique and transverse muscle, 2 – transverse fascia, 3 – spermatic cord, 4 – aponeurosis of the external oblique abdominal muscle, 5 – allograft (preperitoneal location), 6 – peritoneum.

The proposed method of inguinal hernia hernioalloplasty addresses several critical surgical objectives simultaneously. It provides reliable fixation of the graft to the walls of the inguinal canal, facilitating tissue approximation in a direction parallel to the horizontal plane. This technique reinforces the posterior wall of the inguinal canal, protects the spermatic cord from potential external trauma, and prevents excessive connective tissue proliferation between the prosthesis and the cord.

In addition, this approach minimizes the risk of adhesive changes in the vas deferens in patients of reproductive age, reduces venous congestion within the spermatic cord, and prevents scrotal edema in the postoperative period. As

a result, a robust posterior wall is formed, comprising both muscle tissue and a mesh implant. This structural integrity allows for the safe use of lightweight or partially absorbable meshes with lower mechanical strength – an important consideration during the early postoperative phase, prior to the development of mature scar tissue in the implant zone.

The intraoperative use of Doppler ultrasonography enabled the prevention of complications such as scrotal edema and hydrocele, completely avoiding disruptions in testicular blood flow. When compared with outcomes from 2018 to 2020, the incidence of early postoperative complications decreased from 16.1% to 4.8% (table 4).

Table 4

Immediate results of surgical treatment of patients with inguinal hernia in the main group

Complications		Type of operation				Total	
		by the Postemsky		according to the modified hernioalloplasty method			
		abc.	%	abc.	%	abc.	%
		42	100	61	100	103	100
In the area of the postoperative wound	Suppuration of the wound	-	-	-	-		
	Infiltration	-	-	-	-		
	Swelling of the scrotum	-	-	-	-		
	hydrocele	-	-	-	-		
	Hematoma of the postoperative area	1	2,4	1	1,6	2	1,9
	Postoperative wound seroma	-	-	1	1,6	1	0,97
Others	Acute urinary etention	1	2,4	1	1,6	2	1,9
Total complications:		2	4,8	3	4,9	5	4,8
Total patients:		1	2,4	2	3,3	3	2,9

During hernioplasty in the main study group, the implementation of the proposed technical innovations did not adversely affect the duration of the surgical procedure. On the contrary, operative time was reduced by approximately 50% compared with the comparison group. The mean duration of postoperative hospitalization decreased from 8.2 ± 1.2 days to 4.9 ± 0.3 days.

Factor analysis of the causes of recurrence and unsatisfactory outcomes in the comparison group – such as

impaired sexual function and testicular atrophy on the operative side – demonstrated favorable long-term effects in patients in the main group. Among the 82 patients (79.6%) available for long-term follow-up, no cases of hernia recurrence were reported. None of the patients complained of a foreign body sensation at the surgical site, and no complaints of sexual dysfunction were recorded among those of reproductive age. Follow-up Doppler ultrasonography revealed no cases of testicular atrophy or impaired testicular blood flow.

Analysis of patient-reported quality of life demonstrated that implementation of a differentiated algorithm for selecting the optimal surgical strategy significantly improved outcomes. The proportion of «excellent» and «good» results increased from 88.3% (68 of 77 patients in the comparison group) to 100.0% (82 patients in the main group) ($p = .030$).

Conclusion

Between one and four risk factors for inguinal hernia development were identified in affected patients. The most prevalent included heavy physical activity (58.7%), comorbid conditions associated with increased intra-abdominal pressure (58.7%), and clinical signs of congenital connective tissue dysplasia (28.1%). Inguinal hernias were most frequently observed in patients with a hypersthenic body type (65.8%), in whom histomorphological analysis revealed progressive structural degradation of the aponeurosis of the abdominal wall muscles. The developed treatment algorithm facilitated individualized selection of the most appropriate technique

for inguinal canal reconstruction based on risk stratification. Introduction of an improved surgical instrument that prevents compression of the spermatic cord significantly reduced the incidence of early postoperative complications – including scrotal edema, testicular hydrocele, postoperative infiltrate, and testicular atrophy – from 16.1% to 4.8%.

Comparison of surgical techniques revealed that the I. L. Lichtenstein procedure, while technically straightforward, was associated with a recurrence rate of 5.3%. In contrast, modified preperitoneal alloplasty proved to be a reliable alternative, particularly for moderate to large hernias and recurrent cases. This approach demonstrated zero recurrence and a low complication rate ($p < 0.05$), regardless of the type of mesh implant used. The use of a differentiated treatment strategy significantly increased the proportion of favorable outcomes («excellent» and «good») from 88.3% to 100% ($p = .030$) and led to substantial improvements in both physical and psychological well-being following low-tension hernioalloplasty ($p < .05$).

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ІННОВАЦІЙНІ АСПЕКТИ ХІРУРГІЧНОГО ЛІКУВАННЯ ВІДКРИТОЇ ПАХОВОЇ ГРИЖІ: ЗМЕНШЕННЯ КОМПЛІКАЦІЙ ТА ЗАПОБІГАННЯ РЕЦИДИВАМ

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Резюме.

Пахові грижі становлять значну частину хірургічної патології і залишаються однією з найпоширеніших причин звернення за хірургічною консультацією. За даними Всесвітньої організації охорони здоров'я, пахові грижі зустрічаються у 4-5% дорослого населення, причому чоловіки страждають на них у 7-10 разів частіше, ніж жінки.

Мета дослідження. Дане дослідження має на меті підвищення ефективності лікування, зменшення частоти рецидивів і ускладнень, а також поліпшення довгострокових результатів лікування.

Матеріали та методи дослідження. Дослідження базується на результатах діагностики та лікування пацієнтів з паховими грижами, які пройшли хірургічне втручання в хірургічному відділенні багатопрофільної обласної лікарні в Самарканді в період з 2019 по 2024 рік. Для ретроспективного та проспективного аналізу було відібрано 196 пацієнтів чоловічої статі з різними типами пахових гриж.

Результати дослідження. Дослідженням було виявлено ключові фактори ризику розвитку пахових гриж, серед яких важка фізична праця, підвищений внутрішньочеревний тиск та дисплазія сполучної тканини. Факторний аналіз причин рецидивів та незадовільних результатів у пацієнтів порівняльної групи, таких як порушення статевої функції та атрофія яєчка з боку операції, показав позитивний довгостроковий ефект у пацієнтів основної групи. У 79,6% пацієнтів, які спостерігалися в довгостроковому періоді, рецидиву захворювання не спостерігалось. Жоден з пацієнтів не повідомляв про відчуття стороннього тіла в області операції, хоча деякі пацієнти репродуктивного віку повідомляли про сексуальну дисфункцію. Оцінка якості життя показала, що впровадження диференційованого алгоритму вибору стратегії лікування збільшило частку «відмінних» і «добрих» результатів з 88,3% до 100,0%.

Висновок. Розроблений алгоритм вибору методу пластичної хірургії пахового каналу та вдосконалення хірургічних інструментів значно зменшили частоту ранніх післяопераційних ускладнень. Застосування модифікованої техніки преперитонеальної алопластики продемонструвало відмінні довгострокові результати, зменшивши частоту рецидивів та покращивши якість життя пацієнтів.

Ключові слова: пахові грижі; преперитонеальна алопластика; дисплазія сполучної тканини; хірургічні ускладнення; якість життя.

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