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ABSTRACT

of the dissertation for the degree of Doctor of Philosophy

**THE ROLE OF A NEW RECONSTRUCTIVE HERNIA
ALLOPLASTIC SURGICAL TREATMENT WITH THE
TRABUCCO METHOD FOR INGUINAL HERNIA**

Specialty: **3213.01 – Surgery**

Field of science: **Medicine**

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The dissertation work was conducted at the I and II surgical Departments of Republican Clinical Hospital named after academician M.A. Mirgasimov and at the Educational-Surgical Clinic of Azerbaijan Medical University.

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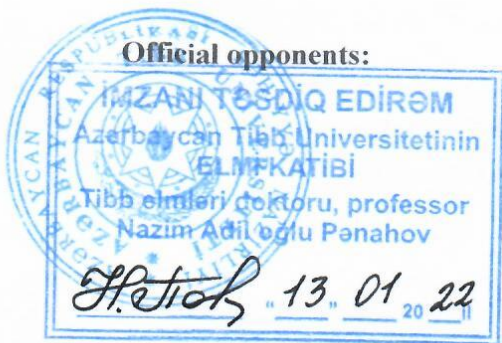
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GENERAL CHARACTERISTICS OF THE RESEARCH

Relevance of the problem: Since the beginning of the XXI century, an inguinal hernia has been one of the most common diseases, and among the planned surgeries, operations for this pathology it occupies the first place. Planned hernia surgeries usually do not result in lethality, but after emergency and urgent surgeries, this indicator varies from 6% to 35% ¹. After direct inguinal hernia operations, the frequency of recurrences reaches 10%, and after operations for aggravated (strangulated) hernias it reaches 20-30% ^{2,3,4}.

There are currently 3 main surgical treatments for inguinal hernias that achieve good results and minimal recurrence: by positioning the seminal vesicle under the skin with the posterior wall of the inguinal canal using local tissues (Bassini, Shouldice) and by placing the outer groin hole up and outside (according to Postempsky). Besides, the frequency of inflammatory changes in the wound during plastic surgery with a polypropylene prosthesis by the Lichtenstein method decreased from 0.3% to 1%, and the recurrence of hernias decreased from 0.7% to 1.4%. Intensive pain syndrome in the early postoperative period is associated with suturing of nerve stumps (n. ilioinguinalis and n. genitofemoralis) or compression of them to bulky masses (hematoma, seroma) ⁵.

After the hernia sac is cut or straightened into the abdomen during Trabucco surgery, “Hertra” mesh of the Italian company “Herniamesh” is positioned in the space between the posterior wall of the inguinal canal without suturing and the aponeurosis of the external oblique muscle i.e. kept in an anatomically closed area.

1. Crovella F., Bartone G., Fei L. Incisional Hernia/ Springer-Verlag.: Italia, 2012.- 298p.
2. Nəsirov M.Y., Məhərrəmov T.A., Şərifov E.Y. Qasıq yırtığının müalicəsində alloplastika probleminin müasir vəziyyəti //Sağlamlıq. - 2015. - № 2. –S. 14-20.
3. Raimxanov A. D. , Aymaqambetov M. J., Yoşixiro Noso, Aujanov D. B., Auenov M. A., Jaqniev J. E. Rezulğtati xirurqıçeskoqo leçeniə reüidivnıx i bolğsıx paxovo-moşonoçnıx qrıj // Nauka i Zdravooxranenie (Kazaxstan). – 2016. - №1. -C.89 -97.
4. Schumpelick V., Klinge U., Junge K., Stumpf M. Incisional abdominal hernia: the open mesh repair // Langenbecks Arch. Surg. - 2014. - Vol. 389,№1.-P. 1-5.
5. Şirinov Z.T., Xankişişiyev N.H. Lichtenstein üsulu ilə qasıq yırtıqlarının allohernioplastikası bizim kliniki təcrübəmizdə //Sağlamlıq. -2015.- №2. -S.50-56.

This prosthesis has an ideal stiffness and a flat state shape memory form. Therefore, it does not twist, wrinkle or move. In the postoperative period, connective tissue fills the pores of the mesh, a homogeneous barrier is formed, and recurrence of the disease is prevented. This technique ensures minimal contact of the mesh with the seminal vesicle and, of course, the ejaculatory duct in men minimizes the risk of damage to the nerves and blood vessels of the latter (duct) ^{6,7}.

The modern prosthetics methods of Lichtenstein, Trabucco, I. Rutkow, and other authors are more reliable in terms of non-recurrence, the frequency of relapses after these operations is less than 1%.

However, these methods have one common drawback: a foreign matter - a non-absorbable synthetic endoprosthesis - remains in the body for life. Specifically, in the surgery for inguinal hernias, mesh polypropylene endoprostheses are used. A chronic slow reaction to the foreign matter begins in the area of their placement and does not cease for years, resulting mostly in pathological conditions called endoprosthesis-related complications (up to 25%) ⁸.

Under modern conditions and with existing needs, the effectiveness of a particular treatment, including a surgery method, is considered and evaluated not only in terms of reliability but also in terms of its impact on patients' quality of life.

6. Fyodorov İ.V., Ramazanov E.M., Vəliyev N.Y. Trabukkoya görə tor hernioplastikası //Azərbaycan Tibb Jurnalı. 2013. № 1. –s. 148-151

7. Suxinina İ. V. Qrjeseçenie pri paxovıx qrıjax po metodike Trabucco: Kand. dissert. – Moskva,2010. - 107 s.\

8. Bessa SS, Abdel-Fattah MR, Al-Sayes IA, Korayem IT Results of prosthetic mesh repair in the emergency management of the acutely incarcerated and/or strangulated groin hernias: a 10-year study //Hernia. - 2015 Dec;19(6):909-14. doi: 10.1007/s10029-015-1360-y. Epub 2015 Mar 3. PMID: 25731947 DOI: 10.1007/s10029015-1360-y

In other words, improving the quality of life of patients after surgery for primary inguinal hernias is one of the important surgical problems^{9,10}.

To date, the general principles of disruption of arterial and venous blood flow in the tissue of the gonads on the side of the hernia before surgery have been adequately described.

However, in the short and long periods after operations with various hernioplasty methods, changes in the blood supply of the testicles, and their reproductive functions are not sufficiently studied, and the available scarce literature data are contradictory^{11,12}.

One of the main parameters characterizing the reproductive function of men is the level of testosterone in the blood, which is determined by various factors, including the state of blood circulation in the testicles, which is also influenced by the type of hernia gate plasticity in inguinal hernias.

While analyzing recent literature, including medical internet sources about the impact of surgery for inguinal hernias on quality of life, we come across a few publications describing the problem. Thus, the unfavorable results of traditional plastic surgery techniques for the inguinal canal, currently used with the application of local tissues and plastic materials, as well as the insufficient study of the clinical efficacy of alloplasty with the Trabucco method in patients with inguinal hernias highlight the relevance of the study and determine its goals and objectives.

9. AYTEKOVA F. M.-P. Vlienie metodov qrijeseçeniä na kaçestvo jizni i reproduktivnuö funküü u bolğnix s paxovimi qrijami: Kand. dissert. – Maxaçkala, 2015 - 137 s.

10. Astraxanüev A.F., Aristarxov V.Q., Solovğev A. A i dr. Osobennosti qemodinamiki aıçek u bolğnix s paxovimi qrijami // Androloqiä i qenitalğnaä xirurgiä. - 2012. - № 1. - S. 33-38

11. Omarov İ.M., Minkailov G.K., Qadjiev M.Ş. i dr. Qemodinamiçeskie izmeneniä orqanov moşonki pri paxovix qrijax // Vestnik novix mediüinskix texnoloqiy. - 2012. - T. XV, №3. - S. 212-213.

12. Polivkan M.İ. Pokazateli qemodinamiki i strukturnie izmeneniä v aıçke v usloviäx kosoy paxovoy qriji. // Vestnik RUDN, seriä Mediüina. – 2014. - №1. – S. 40-44.

The purpose of the research. Study of the effects of new reconstructive plastic surgery of the posterior wall of the inguinal canal with the Trabucco method on the short-term and long-term outcomes of surgical treatment, the blood supply to the testicles, reproductive health, and quality of life in patients with various clinical forms of inguinal hernias.

Tasks:

1. To study the short- and long-term outcomes of plastic surgery of the anterior (Girard method) and posterior (Postempsky method) walls of the inguinal canal at the expense of local tissues by traditional tension methods in patients with different clinical forms of inguinal hernias;
2. Assessment of the short- and long-term outcomes of posterior wall alloplasty of the inguinal canal using the I.L. Lichtenstein method in patients having various clinical forms of inguinal hernias;
3. Introduction and application of a method of alloplasty of the posterior wall of the inguinal canal according to Trabucco in patients with various clinical forms of inguinal hernias;
4. To study the course of the wound process and the dynamics of the blood circulation state in the inguinal canal using USM and color Doppler before and after the application of various hernioplasty methods in adult men;
5. To study the effect of different types of inguinal hernias and hernioplasty methods on the reproductive function of the testicles by determining the level of testosterone in the blood of adult men;
6. Comparative study of the results of plastic surgery of inguinal canal by different methods (autoplasty by the Lichtenstein and Trabucco methods) in patients with various forms of inguinal hernias. Based on the results of the comparison, assessment of the effect of the “Hertra” prosthesis of the “Herniamesh” firm (Italy) on the short-term and long-term outcomes and life quality of the patients.

Research methods: The research was conducted based on the results of treatment of 126 patients who underwent inguinal hernia surgery in the surgical departments of the Republican Clinical Hospital in 2013-2017. The level of testosterone in the blood, condition of blood circulation in the inguinal canal, and the course of the disease were studied in 60 patients using the Color Dopplerography.

Main points presented to the defense of the dissertation:

- A recurrent inguinal hernia causes the greatest reduction in the linear velocity of blood flow in the testicular artery of the hernia side (13.6%; $p < 0.05$), and the direct hernia causes the least reduction (4.8%; $p > 0.05$);
- Hernia autoplasty with the Postempsky method causes the highest linear velocity of blood flow in the testicular artery (17.5%; $p < 0.01$), while in hernia alloplasty with the Trabucco method this parameter is lowest (0.5%; $p > 0.05$);
- On the side of the inguinal hernia, the germinative function of the testicle is reduced in all types of hernia, and the hernia operation itself, both auto- and alloplastic methods have an additional negative effect on the functional state of the testicle;
- Auto-hernioplasty by the Postempsky method is the most traumatic operation, reliably ($p < 0.05-0.01$) inhibits the germinative testicular function in men with inguinal hernias; Allohernioplasty with the Trabucco method is the least traumatic. After its application, the germinative function, on the contrary, increases unreliably ($p > 0.05$).
- Hernia alloplasty with the Trabucco method is an effective and safe method of treatment of patients with inguinal hernias. Thus, alloplasty with the Lichtenstein method reliably reduces the frequency of short-term (2 times; $p < 0.01$) and long-term (4 and 3.4 times; $p < 0.01$) postoperative complications compared to autoplasty with Girard and Postempsky methods, improves the quality of life, as well as eliminates the risk of relapses;

- Hernia alloplasty with the Lichtenstein and Trabucco methods using different plastic materials reliably reduces the probability of recurrence in the long-term postoperative period (2 times; $p < 0.01$) compared to tension auto-hernioplasty with the Girard and Postempsky methods;

Scientific novelty of the research:

1. The effect of different methods of inguinal canal plasticity (traditional autoplasty, alloplasty according to Lichtenstein and Trabucco) on the direct and long-term outcomes of treatment, the quality of life of patients with various inguinal hernias has been studied
2. Statistical analysis has proved that hernia alloplasty with the Trabucco method is a more reliable method with greater clinical efficacy compared to traditional autoplasty and Lichtenstein methods of the posterior wall of the inguinal canal in various inguinal hernias;
3. The advantages of Trabucco hernia alloplasty compared to other plastic methods in terms of postoperative mood, activity, and satisfaction have been proven;
4. New data have been obtained about the effect of surgical treatment of inguinal hernias using different types of endoprotheses on seminal vesicle and synthesis of the sex hormone testosterone;
5. The incidence frequency of endoprosthesis-related complications, in adult men, the degree of the negative effects on blood circulation in the seminal vesicle and the production of the sex hormone testosterone after traditional autoplasty (according to Girard and Postempsky) and alloplasty (according to I.L. Lichtenstein and E. Trabucco) in various inguinal hernias have been studied;
6. In men with inguinal hernias, the most traumatic inhibitory effect on blood circulation and germinative function of the testicles was found to belong to autohernioplasty by the Postempsky method, and the least to hernioalloplasty by the Trabucco method.

Practical significance of the research:

1. Performing hernioplasty with the Trabucco method reliably reduces the risk of recurrence of the disease in the first place, as well as the frequency of complications in the seminal vesicle, scrotum, and testicles;
2. Comparison of inguinal hernioplasty of the I.L.Trabucco method with the Lichtenstein surgery shows that the former is simple to perform, does not require the installation of fixative sutures around the perimeter of the prosthesis, and is performed in a short time;
3. This method of hernia alloplasty allows reducing pain immediately after surgery and the number of chronic pain incidences in long term;
4. Hernioplasty with the Trabucco method provides a reliable reconstruction of the inguinal canal and restores the normal topographic anatomy of the inguinal region in complicated and recurrent hernias. As a result, the frequency of postoperative complications and relapses decreases, as well as the length of the stationary period of patients is shortened;
5. The short- and long-term outcomes of operative treatment of inguinal hernias with the use of different types of endoprotheses, as well as the effect of inguinal hernia on the quality of life of patients in the long term have been studied;
6. Based on the analysis of traditional treatment criteria and assessment of the quality of life in patients with inguinal hernia, the advantages of tension-free plastics of the inguinal canal using the Trabucco method over tension muscle-aponeurotic methods and tension-free hernioalloplasty with the Lichtenstein method have been proven.

Approbation of dissertation materials. Fragments of the dissertation were presented at the 8th International Correspondence Scientific and Practical Conference "Modern innovations in the era of globalization: theory, methodology, practice" (Moscow, 2018) and at the scientific-practical conference dedicated to the 92nd anniversary of National Leader H.A. Aliyev (Baku, 2015).

Preliminary discussion of the work was held on February 21, 2019, at the Educational-Surgical Clinic of Azerbaijan Medical University, at the 6th joint scientific meeting of the surgical profile departments of the Azerbaijan Medical University and the scientific seminar of the Dissertation Council ED 2.06 (10.06.2021; protocol No3).

Application of the results. Results of the research are applied in daily practical activity of the I and II surgical Departments of Republican Clinical Hospital named after academician M.A. Mirgasimov. The main points of the dissertation are taught during lectures and practical classes at the III Department of Surgical Diseases of Azerbaijan Medical University.

Organization where the dissertation was performed. The dissertation work was conducted at the I and II surgical Departments of Republican Clinical Hospital named after academician M.A. Mirgasimov and at the Educational-Surgical Clinic of Azerbaijan Medical University.

Publications. The main points of the dissertation were presented in 8 scientific articles and 4 theses, 7 of which were published in our country and 5 abroad.

Structure and volume of the dissertation. The dissertation consists of 159 pages typed on the computer and is illustrated with 24 tables and 27 figures (207,439 characters). It contains the introductory part (2,044 characters), Chapter I covering the literature review (43,347), description of research materials and methods (33,760 characters), 3 chapters on the personal research (16,792+25,406+24,834 characters), conclusion, results, practical recommendations (44,202 characters) and bibliography. The bibliography covers 256 sources (18 – local and 238 - foreign).

MATERIALS AND METHODS.

This research was carried out at the surgical department of Republican Clinical Hospital named after academician M.A. Mirgasimov on the basis of the III Department of Surgical Diseases of AMU of the Ministry of Health of the Azerbaijan Republic. The results

of surgical treatment of 126 male patients for various types of inguinal hernias from 2013 to 2017 were included in the research.

The results of the research were processed on a personal computer using statistical analysis methods based on the Student's (t) criterion. Differences in groups were considered reliable when $p < 0.05$.

The age of the patients ranged from 18 to 82, and the mean age was 48.5 ± 10.4 years.

All patients were divided into 3 groups according to the surgical treatment methods used: Group I – control group, 63 patients who underwent traditional tension hernioplasty with local tissues of the anterior and posterior walls of the inguinal canal for various inguinal hernias (29 patients - IA subgroup by the Girard method and 34 patients - IB subgroup by the Postempsky method); Group II - comparison group, using the I.L. Lichtenstein method, tension-free plastic surgery with the prolene mesh was performed in the posterior wall of the inguinal canal of 32 patients; Group III - main group, 31 patients underwent tension-free alloplasty of the posterior wall of the inguinal canal using the Trabucco method: implantation of a rigid polypropylene prosthesis in the form of memory and suturing the aponeurosis of the abdominal external oblique muscle under the seminal vesicle.

Main parameters of all treatment subgroups and groups, such as age, complaints, duration of hernias, causes of hernias, main (type, stage, and size of the hernia), and concomitant diseases, data from objective examinations, etc., matched each other.

Thus, according to the Nyhus classification (1993), the frequency of hernias in subgroups and groups was approximately the same and did not differ reliably from each other ($p > 0.05$) (Table 1).

Before surgery, patients underwent routine tests (general analysis of blood and urine, blood glucose), analysis for infections (hepatitis AIDS, Wasserman's test), and according to the instructions, instrumental (summary radioscopy, USM, US Dopplerography, CT), special examinations of accompanying somatic diseases and their severity rates were found.

To assess the functional status of the blood supply to the testicles, the degree of impact of inguinal hernia and various

hernioplasty methods on the testicles, Ultrasound Dopplerography was performed in 82 patients aged 18-60 years (80.3%) (IA (19 patients), IB-(22) control subgroups, II (21) and III (20) groups) before surgery, as well as 1, 6 and 12 months after surgery to study the linear velocity of blood flow in the testicular artery (a. testicularis) from the external ring site in the seminal vesicle. Data from the hernia side (surgery) were compared with data from the intact side. The concentration of the male sex hormone testosterone was determined in the peripheral venous blood of these patients before surgery as well as 6 and 12 months after surgery. This examination was performed also after a long time (1-3 years after surgery) in 65 patients (51.2%).

Table 1
Types of hernias according to the Nyhus classification (1993)

Types of hernias	Patient subgroups and groups							
	IA (n=29)		IB (n=34)		II (n=32)		III (n=31)	
	Abs.	%	Abs.	%	Abs.	%	Abs.	%
I	1	3.5	1	2.9	1	3.1	-	-
II	25	86	22	64.7	18	56.3	21	67.7
IIIA	1	3.5	5	14.7	5	15.6	4	12.9
IIIB	1	3.5	4	11.8	5	15.6	4	12.9
IVA	-	-	1	2.9	1	3.1	1	3.2
IVB	1	3.5	1	2.9	2	6.2	1	3.2

Note: I – oblique intracanalicular hernias; II - oblique inguinal hernias; IIIA – direct inguinal hernia; IIIB – oblique inguinal-testicular and sliding hernias; IVA – recurrent direct inguinal hernias; IVB - recurrent oblique inguinal hernias

During the alloplasty operation using the Lichtenstein method, we used polypropylene monofilament endoprostheses - Ethicon (Johnson & Johnson, USA) and ESFIL (Lintex, St. Petersburg, Russia), Surgipro (USSC, USA), as well as

polytetrafluoroethylene (PTFE) prostheses of the Mycromesh firm (Gore-Tex, USA).

We used the following prostheses for hernioplasty using the Trabucco method:

1. "Hertra 1" and "Hertra 2" (semi-rigid and rigid endoprotheses) - produced in the size of 5x10 cm with a pre-drilled hole with a diameter of 1 cm for the insertion to the seminal vesicle. This prosthesis is placed in the projection of the posterior wall of the inguinal canal;

2. "T4 Herniamesh" is a prosthesis of 5 cm in size having an eccentric hole with a 1 cm diameter. It is placed in the preperitoneal space in the projection of the inner inguinal ring around the seminal vesicle.

The short-term outcomes of hernioplasty were studied by comparing the duration of surgery, the intensity, and duration of early postoperative pain, the frequency of early postoperative complications (wound complications, etc.), as well as the duration of stationary treatment.

The long-term outcomes of surgical treatment of inguinal hernia gates with various plastic methods, including assessment of the quality of life, have been studied by questioning, surveys, and patient follow-up from 6 months to 3 years after surgery. Patients were examined for the availability of complications of the genitourinary system (hydropsy of the testicular membranes, atrophy of the testicles, cysts of the seminal vesicle, orchitis, defferentitis, epididymitis), and ischemic complications of compression (postoperative neuritis - neuralgia, pain in the scar area, inguinal-genital neuropathy).

To assess the aesthetic effect and quality of life, patients were also asked to answer the questionnaire freely. To this end, we developed and used a questionnaire consisting of 13 questions on 4 scales (physical, social, emotional, and functional well-being). The results up to 19 points were assessed as insufficient, from 19 to 34 - sufficient and from 34 to 54 - good.

Statistical processing of the material obtained as a result of the research process was carried out by standard methods of

mathematical statistics: Student's t criterion, Kolmogorov-Smirnov's non-parametric criterion, and Wilcoxon's double criteria. Statistical processing of the obtained results was carried out on a personal computer, using Microsoft Office 2003® Access® and Excel® programs.

Results and Discussion

In all subgroups and groups, the level of pain intensity was studied primarily in the immediate postoperative period. Pain intensity levels were determined by scoring based on the Verbal Rating Scale (VRS): in group III, mild pain (1 point) was observed in 26 patients (20.6%) on the first postoperative day, moderate pain (2 points) was detected in 95 (75.4%) patients, and severe pain (3 points) was observed only in 4 patients (3.2%) in groups I and II.

The results for the subgroups and groups were as follows: mild pain was observed in 6 (17.6) patients in subgroup IA, in 6 (2.19%) patients in the II group, and 8 (25.8%) patients in the III group; Moderate pain- in 22 (75.9) patients in subgroup IA, 26 (76.5%) in subgroup IB, 24 (75.0%) in group II, 23 (74.2%) in group III; Severe pain was observed in 1 (3.4%) patient in group IA, 2 (5.9%) patients in IB subgroup, and 1 patient (3.1%) in group II. As a rule, the latter patients underwent surgery for recurrence (2) and large inguinal hernia (2). No severe pain was observed in the immediate postoperative period in patients who underwent Trabucco hernioplasty. This operation technique is easy to perform due to the lack of additional manipulations. There was no statistically significant difference in pain intensity depending on the type of hernioplasty ($p > 0.05$).

In the III group, pain at the wound site on the day of surgery was mostly slight or mild: no pain was noted due to localization, intensity, and irradiation. Postoperative analgesia was usually performed with non-narcotic painkillers. Narcotic preparations were used only in 4 patients who underwent surgery for recurrent or inguinal hernia with severe pain.

In most patients, the duration of analgesia lasted an average of 2-3 days. Statistically significant reduction was not observed in

requirements for postoperative analgesia in subgroups and groups ($p > 0.05$).

Practically, after hernioplasty surgery, all patients were activated on the 1st day of surgery without any serious difficulties associated with pain in the surgical site. Patients of the III group were activated earlier. 5-6 hours after the operation, they moved freely in the ward. In these patients, pain syndrome was minimal in the early postoperative period. As a result, they did not even need non-narcotic painkillers.

In the surgical site, endoprosthesis cases such as discomfort and foreign body sensation were observed only in 5 patients (4.0%), specifically in 3 patients of group II (9.3%) and 2 patients of group III (6.5%). In 1 of the last 2 patients, the foreign body sensation disappeared 6 months after surgery.

The list of early postoperative complications included subcutaneous adipose tissue seroma, testicular edema, hematoma of the seminal vesicle, infiltration of the surgical wound, suppuration, and ligature fistula. Subcutaneous adipose tissue seroma was found only in 4 patients (3.2%): in IB subgroup - 1 (2.9%), in group II - 2 (6.2%) patients, and in group III - 1 patient (3.2%). This complication was not observed after plastic surgery of the anterior wall of the inguinal canal using the Girard method. This complication was 3 times more common in patients who underwent alloplasty than in autoplasty. This complication emerges due to the local irritating effect of the implant (polypropylene mesh) on the surrounding tissues, especially adipose tissue. That is, exudation occurs around the implant and tissue fluid stores. To minimize the formation of seroma, a special vacuum silicone drain(s) was(were) placed in the subcutaneous area, which was connected to a hemovac or electric vacuum sucker, dynamic USM was performed in suspected patients, and collected fluid (seroma) was punctured under USM supervision based on a prescription.

Edema of the testicles was observed in 4 patients (3.2%): in 1 (3.4%) patient in subgroup IA, in 2 (5.9%) in subgroup IB, and in 1 patient (3.1%) in group II. This complication was 3 times more common in patients with auto-hernioplasty. After traditional tension

plastic surgery of the inguinal canal, this complication develops because of the disruption of venous blood and lymph flow due to excessive narrowing of the deep ring of the inguinal canal, i.e. compression of the seminal vesicle. During allohernioplasty by the Lichtenstein method, due to compression of the seminal vesicle, especially its veins, including, mechanical irritation of surrounding tissues and seminal vesicle caused by polypropylene mesh fixed to the posterior wall of the inguinal canal with intermittent sutures, venous blood, and lymph flow may be disturbed if a narrow hole is formed in the prosthetic mesh. In plastic surgery using the Trabucco method, no complication was observed in this group of patients after surgery, as the frequency of the processes described above was minimized due to the standard anatomical hole in the endoprosthesis for comfortable, the uncompressed passage of the seminal vesicle. Postoperative wound hematoma was 1.5 times less common after allohernioplasty than autoplasty. This is attributed to the traumatism of autoplasty operations, extreme mobilization, and traumatization of the seminal vesicles, as well as the difficulty of performing reliable hemostasis. In the postoperative period, hematoma developed mainly in patients with large, giant, recurrent, and irreversible hernias, as well as frequent strangulations. In this category of patients, there is a high risk of damage to the elements of the seminal vesicles due to multiple intimate adhesions during the separation of the hernia sac. As a result, with the continuation of bleeding, edema of the testicles develops due to thrombosis of small testicular vessels. In addition, after the removal of large and giant hernias, a large and extremely large cavity (area) remains in the testicles and groin area. In the early stages, serous-hemorrhagic fluid accumulates in this cavity (area). Subcutaneous hematomas were removed by slightly opening the edges of the wound, placing a rubber band, or puncturing with or without USM control. In other patients, small and medium-sized hematomas were absorbed after conservative, including physiotherapeutic treatment. No purulence of hematoma was observed.

Depending on the method of hernioplasty in the analysis of the general results of surgical treatment in patients with inguinal

hernias, 8 (27.6%) early complications were observed in the control subgroup IA (wound complications - 5, hyperthermia - 3), 15 (44.1%) in the control subgroup IB (wound complications - 9, hyperthermia - 5 and acute urinary retention - 1), 16 in group II (50%) (wound complications - 8, hyperthermia - 4, acute urinary retention - 1 and foreign body sensation -3), and in group III only in 7 patients (22.6%) (wound complications - 3, hyperthermia - 2 and foreign body sensation - 2) (Table 2).

Table 2

Short-term outcomes of hernioplasty

Indicators		Subgroups and groups							
		IA (n=29)		IB (n=34)		II (n=32)		III (n=31)	
		Abs.	%	Abs.	%	Abs.	%	Abs.	%
Pain intensity (points)	1 (weak)	6	20.7	6	17.6	6	21.9	8	25.8
	2 (moderate)	22	75.9	26	76.5	24	75.0	23	74.2
	3 (strong)	1	3.4	2	5.9	1	3.1	-	-
Foreign body sensation (discomfort in the surgical area)		-	-	-	-	3	9.3	2	6.5
Wound complications	Seroma	-	-	1	2.9	2	6.2	1	3.2
	Scrotal edema	1	3.4	2	5.9	1	3.1	-	-
	Hematoma of seminal vesicle	1	3.4	2	5.9	1	3.1	1	3.2
	Wound infiltrate	1	3.4	2	5.9	2	6.2	1	3.2
	Wound purulence	1	3.4	1	2.9	1	3.1	-	-
	Ligature fistula	1	3.4	1	2.9	1	3.1	-	-
Acute urinary retention		-	-	1	2.9	1	3.1	-	-
Hyperthermia		3	10.2	5	14.7	4	12.4	2	6.4
Bed-day		5.1±2.2		5.7±2.1		6.5±1.9		6.1±2.0	

Thus, the incidence of early postoperative complications in patients of the main group III was approximately 2 times less than in patients of the control subgroup IB and group II and statistically significant ($p < 0.01$)

Long-term complications of the genitourinary system, pathological conditions such as hydrops of the testicles, atrophy of the testicles, cysts of the seminal vesicle, orchitis, deferentitis, and epididymitis occurred. Complications were more common in the IB subgroup (5 patients, 14.7%) and the least in the comparison group II (2 patients, 6.3%). This was 2.3 times less than in the patients of the IB subgroup and significant ($p < 0.01$) (Table 3).

In group III (hernioplasty by the method of Trabucco) there were no long-term postoperative complications of the genitourinary system.

Compression-ischemic complications, including postoperative neuritis (neuralgia), pain in the surgery scar area, and inguinal-genital neuropathy were observed. These complications occurred in 8 patients (6.3%) of groups I and II: 2 (6.9%) in subgroup IA, 4 (11.8%) in subgroup IB, and 2 (6.2%) in comparison group II. They were not observed in group III.

Long-term different complications occurred in 23 patients (18.3%) after the application of various methods of hernioplasty: 5 in the IA subgroup (17.2%), 9 in the IB subgroup (26.5%), 7 in the II comparison group (21.9%), 2 in group III (6.5%). Thus, the frequency of long-term complications was highest in patients of subgroup IB and lowest in group III. The frequency of long-term complications in patients of group III was 4 times less than in subgroup IB and was statistically significant ($p < 0.01$); It was 3.4 times less compared to comparison group II and 2.6 times less common than in the IA subgroup and statistically significant.

The best indicators of quality of life were recorded in group III, i.e. in patients who underwent hernioplasty by the method of Trabucco. Thus, these patients had no recurrence of the hernia, good quality of life (16 patients, 18%) was more than satisfactory and unsatisfactory indicators, in contrast to other subgroups and groups, satisfactory indicators were 2-4 times less.

Table 3

Long-term outcomes of hernioplasty methods

Indicators		Complications		Subgroups and groups of the patients							
				IA (n=29)		IB (n=34)		II (n=32)		III (n=31)	
				Abs.	%	Abs.	%	Abs.	%	Abs.	%
Genitourinary system	Hydrops	1	3.4	1	2.9	1	3.1	-	-		
	Atrophy of the testicles	1	3.4	1	2.9	-	-	-	-		
	Cysts of the seminal vesicle	-	-	1	2.9	-	-	-	-		
	Orchitis, deferentitis, epididymitis	1	3.4	2	5.9	1	3.1	-	-		
Compression-ischemic	Postoperative neuritis (neuralgia)	1	3.4	2	5.9	1	3.1	-	-		
	Inguinal-genital neuropathy	1	3.4	2	5.9	1	3.1	-	-		
Cosmetic effect	Excellent	4	13.8	5	14.7	6	18.8	9	29.0		
	Good	20	69.0	23	67.6	19	59.4	16	51.6		
	Satisfactory	4	13.8	7	20.6	6	18.8	6	19.4		
	Unsatisfactory	1	3.4	1	2.9	1	3.1	-	-		
Assessment of quality of life	Good	24	82.8	28	82.3	29	90.7	30	96.8		
	Satisfactory	4	13.8	5	14.8	2	6.2	1	3.2		
	Unsatisfactory (relapse)	1	3.4	1	2.9	1	3.1	-	-		

Recurrence of inguinal hernias was detected during control examinations only in 3 patients (2.4%). Recurrence was recorded in 2 (3.2%) patients of control group I (subgroup IA - 1, subgroup IB -

1), and in 1 patient (1.6%) of group II. There were no recurrences in the third group. Thus, in the long-term period after surgery with plastic materials, the frequency of relapses decreased by 2 times ($p < 0.01$) (Table 4). All 3 patients underwent repeated hernioalloplasty using the Trabucco method, after which no recurrence occurred.

To study the effect of hernioplasty methods (auto and alloplasty) on the blood supply to the testicle, the starting value of the linear velocity of blood flow at the level of the external inguinal hole in the testicular artery (*a. testicularis*) of the seminal vesicle was determined in subgroups and groups, in 82 patients with inguinal hernia. Thus, this value amounted to $19.9 \pm 1.6 - 20.4 \pm 1.7$ cm / sec on the healthy side and $18.6 \pm 1.8 - 19.4 \pm 1.4$ cm / sec on the hernia side ($1.0 \pm 0.3 - 1.6 \pm 0.4$ cm / sec or $4.9 \pm 1.5 - 7.9 \pm 2.0\%$ difference), without significant difference (In the IA subgroup $t = 2.52$; In the IB subgroup, $t = 2.44$; In group II, $t = 2.45$; In group III, $t = 2.48$; $p > 0.05$) but it was always lower compared to the healthy side. This is due to the negative impact (chronic compression) of the hernia contents and postoperative scar changes on the local blood circulation in the inguinal canal and scrotum.

Table 4

**Dynamics of the development of relapses
after hernioplasty**

Subgroups and groups	Postoperative period		
	6-12 months	1-2 years	2-3 years
IA (n=29)	1	-	-
IB (n=34)	-	-	1
II (n=32)	-	1	-
III (n=31)	-	-	-

We also examined the dynamics of patients in all study subgroups and groups over a period of 1 year and studied comparative changes in *a. testicularis* of Linear Blood Flow Velocity (LBFV) of the operated side (Table 5). The most statistically

significant ($p < 0.01$) decrease (within 17.5%) in *a. testicularis* of (LBFV) was in the IB subgroup patients who underwent autoplasty of the posterior wall of the inguinal canal by the Postempsky method, and the least (within 0.5%; $p > 0.05$) in patients of the III main treatment group who underwent Trabucco alloplasty.

The second place in the dynamic reduction of LBFV belonged to patients of the IA subgroup, who underwent autoplasty by the Girard method (statistically significant decrease in LBFV within 14.9%; $p < 0.01$). In patients of the II group, who underwent alloplasty by the Lichtenstein method, the decrease in LBFV (within 2.7%) was not statistically significant ($p > 0.05$). In the patients who underwent Trabucco alloplasty, LBFV remained almost the same throughout the one-year follow-up, and only a slight ($p > 0.05$) significant reduction (within 0.5%) was observed at the end of the year (Table 5).

Table 5

Changes in LBFV of *a. testicularis* of the hernia side in the patients during a year after surgery (M±m)

Indicators Subgroups and groups	LBFV in <i>A. testicularis</i> , (cm/sec)			
	Before surgery	1 month after surgery	6 months after surgery	12 months after surgery
IA (n=19)	18.8±1.8	19.0±1.7	16.1±2.1**	16.0±1.8**
t	-	2.25	2.46	2.47
p	-	>0.05	<0.01	<0.01
IB (n=22)	19.4±1.4	19.7±1.5	16.4±1.4**	16.0±1.5**
t	-	2.22	2.37	2.35
p	-	>0.05	<0.01	<0.01
II (n=21)	18.8±1.5	18.7±1.6	18.4±1.2	18.3±1.3
t	-	2.13	2.16	2.14
p	-	>0.05	>0.05	>0.05
III (n=20)	18.6±1.8	18.9±1.6	18.6±1.5	18.5±1.6
t	-	2.14	2.12	2.19
p	-	>0.05	>0.05	>0.05

Note: $p < 0.05$; $p < 0.01$ – significance of differences compared to initial values

We studied the effect of different hernioplasty methods on the hormonal background (testosterone levels) in all subgroups and groups of patients with inguinal hernia - the dynamic of the concentration of the hormone in the venous blood. In this case, compared to the norm, the decrease in the level was statistically insignificant ($p > 0.05$) in all subgroups and groups, but no statistically significant differences between groups ($p > 0.05$) were identified (Table 6).

When studying the level of testosterone in the peripheral blood after surgery, we found that the most traumatic plastic surgery for inguinal hernias in men, which has an inhibitory effect on the germinative function of the testicles, is autoplasty of the posterior canal wall with the Postempsky method. Hormone production decreased progressively in the short time after this operation, continued to decline in all subsequent follow-up periods, decreased by 3% ($p < 0.05$) after 6 months compared to the initial indicator, and by 6.8% after 12 months ($p < 0.01$).

Table 6

Effect of hernioplasty methods on dynamic levels of testosterone in the blood ($M \pm m$) (nmol/l)

Study periods / Subgroups and groups	Before surgery	6 months after surgery	12 months after surgery
IA (n=19)	6.44±0.19	5.95±0.22	5.86±0.19
T	-	1.57	1.95
P	-	<0.05	<0.05
IB (n=22)	6.6±0.18	6.1±0.2	5.9±0.22
T	-	1.66	2.23
P	-	<0.05	<0.01
II (n=21)	5.8±0.16	5.4±0.10	5.3±0.22
T	-	2.13	1.71
P	-	>0.05	<0.05
III (n=20)	6.28±0.21	6.29±0.21	6.31±0.20
T	-	2.75	2.80
P	-	>0.05	>0.05

Note: $p < 0.05$; $p < 0.01$ –significance of differences compared to initial values

Girard autoplasty of the anterior wall of the inguinal canal was the second most damaging negative effect on the elements of the seminal vesicle and the reproductive function of the testicles. After this operation, testosterone levels decreased gradually, which was statistically significant ($p < 0.05$), after 6 months the decrease was 3% compared to the initial indicator, and after 12 months it reached 4.3%.

Plastic surgery of the posterior wall of the inguinal canal with polypropylene mesh using the I.L. Lichtenstein method ranked third in terms of its effect on testicular germinative function, i.e. a statistically unreliable ($p > 0.05$), 1.7% decrease in the hormone concentration was observed 6 months after the operation and 12 months later a statistically significant ($p < 0.05$) decrease of 3.4% was identified.

Among the existing auto- and alloplastic operations for inguinal hernias, the least traumatic, minimally retarding the germinative function of the testicles was alloplasty performed with the Trabucco method. No reduction in testosterone levels in peripheral venous blood was observed after the application of this method., on the contrary, hormone production increased statistically insignificantly ($p > 0.05$) by 0.2% after 6 months and by 0.5% after 12 months.

Conclusions

1. The worst unfavorable result (82.8%) was observed after autoplasty in patients with various clinical forms of inguinal hernias using the traditional tension methods of Girard and Postempsky (82,8%). Recurrence occurred in 3.2% of patients [1,3].
2. All types of inguinal hernias in men, damage the germinative function of the testicle on the side of the hernia, and the operation of the hernia gate by both auto- and alloplastic methods, as a rule, adversely affects its functional status (germinative function) [2,5,8].
3. The largest (14.9% and 17.5%) statistically significant ($p < 0.01$) decrease in the linear velocity of blood flow in the testicular

artery was observed after auto-hernioplasty operations by the Girard and Postempsky methods, and the smallest after the surgery by the Lichtenstein (2.7%; $p > 0.05$) and Trabucco (0.5%; $p > 0.05$) methods [2,5,8] .

4. Alloplasty with the Trabucco method for inguinal hernias statistically reduced the frequency of short-term (2 times; $p < 0.01$) and long-term (4 and 3.4 times; $p < 0.01$) postoperative complications, improved quality of life of patients, prevented recurrences of hernias contrary to the traditional tension auto methods as well as the Lichtenstein alloplasty method [6,9,10].
5. As a result of a dynamic USDG examination, the most statistically significant ($p < 0.05$) decrease in the linear velocity of blood flow in the testicular artery of the hernia side (3 ± 1.3 cm/sec or $13.6 \pm 4.0\%$) was identified in the recurrent, and the least in the direct inguinal hernias [4,11,12] .
6. Unlike other study groups, only after allohernioplasty by the Trabucco method (group III), the concentration of testosterone in the peripheral blood of patients remained at the initial level throughout the study, even after 6-12 months, an increase in its production was statistically insignificant ($p < 0.05$) [7,11,12] .

Practical recommendations

1. For the diagnosis and differentiation of inguinal hernias, non-invasive control of reparative processes in the prosthetic area, and early diagnosis of endoprosthesis-associated and other complications, more active and widespread use of various ultrasound diagnostic methods is recommended in the practice of surgical hospitals.
2. It is desirable to avoid incision of the hernia sac for reducing the likelihood of postoperative complications, especially neuralgia, during inguinal hernioplasty; it is recommended to insert it into the abdomen, to avoid early postoperative severe pain.
3. To reduce the incidence of recurrence and complications associated with endoprosthesis, it is recommended a wider

application of prosthetic hernia removal operations, especially in patients with complex shapes (Types III-IV according to Nyhus classification) and severe obesity with large posterior wall defects. For this purpose, it is recommended to use Hertra 1, ready-made Hertra T4 in medium and large inguinal hernias, and in other cases, Hertra 2 prostheses using the Trabucco method without fixative suture.

4. Activation of patients who underwent hernioplasty according to Trabucco is recommended 2-3 hours after surgery.

List of published scientific works on the topic of the dissertation

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