

# Clinical effectiveness of various methods of inguinal hernia repair

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## ABSTRACT

**Aim:** To improve the results of surgical treatment of patients with inguinal hernias.

**Materials and Methods:** The paper analyzes the results of surgical treatment of 198 patients who underwent inguinal hernia repair in the period from 2018 to 2024. The study was conducted at the clinical base of the Department of General Surgery of Uzhgorod National University - KNP «Uzhgorod City Multidisciplinary Clinical Hospital» of the Uzhgorod City Council of the SE «Clinical Hospital of Planned Treatment» The study was a bidirectional (ambidirectional study), namely, it included: 1) retrospective analysis ("case-control", randomized multicenter analysis); 2) prospective observation and treatment. The inclusion criteria in the study were: the presence of acquired inguinal hernia, hernioplasty according to the Lichtenstein, Shouldis method, TAPP hernioplasty (transabdominal preperitoneal hernioplasty) and TAPP with suturing of the internal inguinal ring (TAPP with SIIR ) and TEP - total extraperitoneal allohernioplasty, which was performed in the preperitoneal space without entering the abdominal cavity.

**Results:** The smallest number of complications was recorded after laparoscopic TAPP and TAPP-SIIR hernioplasty, including in people with overweight and obesity. The results obtained were statistically processed with the inclusion of all possible risk factors that could affect the postoperative outcome of each specific patient. Based on the obtained values,  $\chi^2$  in all cases was equal to or greater than the value of 3.99, which exceeds the critical value of 3.84;  $p=0.05$ .

**Conclusions:** A comprehensive differentiated approach to preoperative preparation of patients with inguinal hernias with correction of comorbid pathology, body mass index and factors that increase intra-abdominal pressure significantly reduces the frequency of early postoperative complications compared with standard treatment tactics ( $\chi^2 > 3.84$ ;  $p \leq 0.05$ ).

**KEY WORDS:** inguinal hernias, «Trans Abdominal Pre-Peritoneal» – hernioplasty, «Total Extra Peritoneal» – allohernioplasty, Lichtenstein method, Shouldis method

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## INTRODUCTION

About 20 million hernia operations are performed annually in the world. Inguinal hernias (IG) account for about 75% of all abdominal wall hernias. The incidence of IG in adults increases with age, especially after 70 years. Prognostic calculation of the risks of developing IG indicates that this pathology can affect almost 25% of men and 2% of women in one way or another during their lives. At the same time, men account for almost 90% of all cases of the disease. The share of emergency surgical treatment of IG in developed countries is 2.5-7.7%, and in developing countries it can reach 76.9%. Mortality in emergency repair of inguinal hernia is from 1.7% to 7.0%, but in cases of necrosis and intestinal resection reaches 25%. The high frequency of recurrence of inguinal hernias only increases the urgency of the problem. For example, after autoplasmic methods of plastic surgery, recurrences range from 10% to 30%, and after plastic surgery according to Shouldice, recurrences reach 6% (on

average 3.6%); after prosthetic plastic surgery according to Lichtenstein - 2.4% (on average 0.8%) [1-4].

In some articles, the basis of research of which were hospitals specializing only in herniotomy, the frequency of recurrences for decades does not exceed 1%. Undoubtedly, the use of endoscopic methods of hernioplasty has allowed to reduce the number of recurrences. For example, in countries, the cumulative percentage of such complications, calculated for a 5-year period, is generally slightly more than 3.7%. The success of operations also depends on the presence or absence of various concomitant aggravating diseases: overweight (OB), hypertension, diabetes mellitus, obesity. At the same time, comparative studies on the influence of concomitant comorbid factors on the outcome after inguinal hernia repair are reported extremely rarely in the modern literature, which does not satisfy specialists and requires a comprehensive study of this issue, which necessitates a deeper study of this issue [5-8].

The modern stage of herniology development is characterized by the transition from tension techniques to alloplasty according to the "tension-free" principle, which has significantly reduced the frequency of recurrence of inguinal hernias. Open hernioplasty according to Lichtenstein has long remained the standard of treatment due to its technical simplicity and reliability of results. At the same time, laparoscopic techniques TAPP and TEP have become widely used, which provide preperitoneal placement of a mesh implant with overlapping of all potential hernial defects. Their use is associated with less intensity of postoperative pain, faster rehabilitation and the possibility of simultaneous correction of bilateral and recurrent hernias. The TEP technique has the additional advantage of being performed without entering the abdominal cavity, which reduces the risk of intra-abdominal complications [6,9-11].

The choice of the optimal method of hernioplasty should be based on an individualized approach, taking into account the patient's clinical characteristics and risk factors [12-15].

## AIM

To improve the results of surgical treatment of patients with inguinal hernias.

## MATERIALS AND METHODS

The paper analyzes the results of surgical treatment of 198 patients who underwent inguinal hernia repair in the period from 2018 to 2024. The study was conducted at the clinical base of the Department of General Surgery of Uzhhorod National University - KNP «Uzhgorod City Multidisciplinary Clinical Hospital» of the Uzhgorod City Council of the SE «Clinical Hospital of Planned Treatment» The study was a bidirectional (ambidirectional study), namely, it included: 1) retrospective analysis ("case-control", randomized multicenter analysis); 2) prospective observation and treatment. The inclusion criteria in the study were: the presence of acquired inguinal hernia, hernioplasty according to the Lichtenstein, Shouldis method, TAPP hernioplasty (transabdominal preperitoneal hernioplasty) and TAPP with suturing of the internal inguinal ring (TAPP with SIIR) and TEP - total extraperitoneal allohernioplasty, which was performed in the preperitoneal space without entering the abdominal cavity.

The following were considered indications for TEP:

- primary unilateral and bilateral inguinal hernias
- absence of entrapment
- absence of pronounced adhesions after previous operations on the abdominal organs.

When performing TEP, a mesh polypropylene implant of at least 10×15 cm in size was used with the overlap of all potential hernial defects of the myopectineal foramen. Ranking of patients by body weight was performed based on the WHO classification, while calculating the body mass index (BMI) in kg/m<sup>2</sup>. According to the Asian overweight classification, patients were considered underweight if their BMI was <18.5; normal weight (18.5 BMI<23); overweight (23≤BMI<25); obese (if BMI≥25) and severely obese (if BMI≥30 kg/m<sup>2</sup>). Statistical analysis was performed using Statistica 10.0 and SPSS ver. 10.0.

## FRAMEWORK

The work was carried out in the framework of research work 0124U002167 «Monitoring of traumatic disease against the background of chronic stress».

## RESULTS

The study involved 33 (16%) women, 165 (84%) men. Patients were divided into two groups: group B (study) 97 patients (49%), for whom the proposed treatment complex was used, and group A (control) 101 patients (51%) - for whom the proposed algorithm was not used. There were 139 (70.0%) patients with normal BMI, 41 (21%) with overweight, 18 (9%) with obesity. The age composition of the operated patients ranged from 18 to 78 years. The average age of all patients was 59.2±10.6 years. There were 34 (17%) young people, according to the WHO classification «from 18 to 44 years». Almost all of them were overweight (BMI≥23) or engaged in heavy physical labor.

Among the older age group, patients with normal weight and the presence of one or more concomitant aggravating diseases prevailed. 156 patients were operated on in a planned manner, which is 79%. Emergency surgery was performed in 42 people, or 21% of patients. Hernias were more often located on the right - in 57.0% of patients, on the left - in 43.0%, including bilateral hernias observed in 8 (4%) people. Among the patients of the study group with concomitant aggravating factors, who underwent surgical intervention in a planned manner, preoperative preparation was carried out in cooperation with related specialists in order to correct indicators of glycemia, hypertension, spirometry, heart function, body weight. At the same time, necessary measures were taken to minimize factors contributing to increased intra-abdominal pressure: treatment of benign prostatic hyperplasia, combating constipation, etc. The choice of anesthetic care depended on the surgical technique. In laparoscopic hernioplasty, general anesthesia was used, in open surgical

**Table 1.** General characteristics of surgical interventions in both groups

Hernioplasty method	Number of patients, n = 198	
	Group A	Group B
TAPP	25 (25%)	15 (15.5%)
TAPP with SIIR	3 (2%)	30 (30.9%)
TEP	22 (22%)	24 (24.7%)
Lichtenstein method	30 (30%)	22 (22.7%)
Shouldis method	8 (8%)	6 (6.2%)
Autohernioplasty	13 (13%)	0
Total	101	97

Source: compiled by the authors of this study

methods, spinal anesthesia. In rare cases, with a high risk of infarction, thromboembolism, etc. in elderly patients with severe concomitant pathology of the cardiovascular and respiratory systems, local infiltration anesthesia was used. In the study group, surgical treatment was primarily based on the latest guidelines of the international «Hernia Surgery Group». In all cases, a mesh graft was used, and the posterior wall of the inguinal canal was plasticized. The operations were performed by open methods (according to Lichtenstein, Shouldice) and laparoscopically (according to the TAPP method). TAPP surgery was performed in two versions: a) TAPP without suturing the internal inguinal ring; b) TAPP with suturing the internal inguinal ring. Videolaparoscopic hernioplasty was not used for incarcerated inguinal hernias. In young individuals, in order to preserve the spermatic cord membranes and prevent adverse effects on testicular function and spermatogenesis, surgical interventions were performed using the TAPP or Shouldice method. The distribution of surgical intervention methods in the control and study groups is presented in Table 1.

In terms of the frequency of early postoperative complications, TEP was comparable to TAPP and was characterized by less trauma compared to open methods of hernioplasty. In the algorithm of management of patients with inguinal hernias proposed by us, one of the leading links is the correction of concomitant complicating factors in cooperation with therapists, cardiologists, endocrinologists and dietitians.

Thus, all the studied patients of group B with diabetes mellitus achieved a preoperative glycemia level of no higher than 8.5 mmol/l, except for one patient who was operated on urgently due to pinching (glycemia level 11.4 mmol/l).

Patients with concomitant arterial hypertension were selected for conservative treatment in order to reduce blood pressure to no higher than 150/90 mmHg.

Patients with concomitant heart failure were treated conservatively to maintain an ejection fraction of no lower than 55%, diuretics were used to eliminate edema.

A few months before the surgical treatment of patients with obesity of the I-II degree, in cooperation with a dietician, it was possible to include patients with excess body weight in the group. And patients who did not fall into this category according to the BMI index within the allotted time, had their surgical intervention postponed until the target weight indicators were achieved. body.

To prevent and reduce the severity of inguinal pain in all patients of group B, a TAP block and the administration of analgesics were performed before surgery according to the pain control scheme proposed by the European Herniology Association. The severity of pain was assessed 6 hours after surgical treatment using the VAS scale.

In patients of the study group, endoprostheses made of bioinert monofilament polypropylene were used for allohernioplasty, with a surface density of 34 g/m<sup>2</sup>, not less than 6x11 cm in size. Based on the statement of modern authors that any inguinal hernia is a consequence of stretching or the occurrence of a defect in the transverse fascia, in all cases of Lichtenstein plastic surgery, the internal inguinal ring was formed by applying a continuous suture (or knotted sutures) to the transverse fascia according to Joffe.

Considering that with the laparoscopic TAPP technique, the internal inguinal ring is the site of formation of recurrent hernias, in order to reduce the risk of recurrence, the study group underwent intracorporeal suturing of this ring, after which a mesh implant was applied and fixed.

Laparoscopic methods of surgical treatment were not used for incarcerated hernias. In emergency cases, Shouldis inguinal canal repair was preferred. Large, inguinal-scrotal incarcerated hernias without signs of hernial sac inflammation were operated on using the Lichtenstein method under the cover of antibacterial therapy.

Analysis of the frequency and nature of postoperative complications shows that complications are most often

**Table 2.** Complications of different hernioplasty methods

Complications	Shouldis method		Lichtenstein method		TAPP		TEP		Autohernioplasty	
	A	B	A	B	A	B	A	B	A	B
Group										
Scrotal swelling	1	0	6	1	3	1	1	0	8	-
Infiltrate	2	1	5	2	2	0	1	0	10	-
Seroma	0	0	3	4	2	1	1	0	6	-
Purulent complications	0	0	1	0	1	0	0	0	3	-
Acute urinary retention	1	1	2	1	0	0	1	1	4	-
Total	4	2	17	8	8	2	4	1	31	

Source: compiled by the authors of this study

**Table 3.** Results of different hernioplasty methods

Complications	Shouldis method		Lichtenstein method		TAPP		TEP		Autohernioplasty	
	A	B	A	B	A	B	A	B	A	B
Pain severity (Visual Analogue Scale)	5.1	4.2	5.4	4.4	4.6	3.5	3.9	3.1	6.7	-
Average hospital stay (days)	6.1	4.4	5.4	3.9	3.1	2.9	2.5	2.3	9.4	-
Recurrence of the disease (after a year)	0	0	1	0	2	0	0	0	3	-

Source: compiled by the authors of this study

recorded after open methods of hernioplasty (Table 2).

Moreover, among people with overweight and obesity, these complications were more common.

It is characteristic that seroma was detected when using a mesh implant (according to the Lichtenstein method) in both groups. This is explained by the rather high traumatic nature of this surgical intervention. However, this figure is much lower in patients who underwent outpatient preparation for surgical treatment in group B.

The smallest number of complications was recorded after laparoscopic TAPP and TAPP-SIIR hernioplasty, including in people with overweight and obesity (Table 3)

The use of laparoscopic hernioplasty techniques is accompanied by less intensity of postoperative pain syndrome, a shorter hospitalization period, and a lower incidence of local complications compared to open plastic surgery methods.

The results obtained were statistically processed with the inclusion of all possible risk factors that could affect the postoperative outcome of each specific patient. Based on the obtained  $\chi^2$  values, the presence of a statistical relationship between the risk factors under study and the outcome was confirmed at the appropriate level of significance (the chi-square criterion in all cases was equal to or exceeded the value of 3.99, which is greater than the critical value of 3.84;  $p=0.05$ ).

## DISCUSSION

Throughout the history of herniology, a large number of surgical methods for the treatment of hernias have been proposed. Today, there are 80–350 methods for

plastic surgery of the inguinal canal with local tissues. Most surgeons for all forms of inguinal hernias prefer operations aimed at strengthening the posterior wall of the inguinal canal. They consider it a significant prospect in improving treatment results to give preference to “non-tension” methods of hernioplasty compared to “tension” ones.

The most popular in the world has become the multilayer deep plastic surgery of the posterior wall of the inguinal canal, proposed by E. Shouldice. The method is recommended as the best when it is impossible to use a mesh in hernioplasty [1-4].

Over the past 30 years, the main method for the treatment of inguinal hernias has been and is the Lichtenstein operation [6]. With the development of laparoscopic techniques, hernioplasty methods using laparoscopic techniques (TAPP and TEP) are gaining increasing popularity among both patients and surgeons. The technique of laparoscopic hernioplasty without mesh endoprosthesis fixation helps to reduce the severity of postoperative pain. The laparoscopic method of inguinal hernia repair has a number of advantages, such as a lower incidence of postoperative complications, less severe postoperative pain, reduced hospitalization time, reduced costs for patient treatment and the duration of his disability. The most popular technique for surgical treatment of inguinal hernias today has become laparoscopic extraperitoneal hernioplasty [8].

The inclusion of the TEP technique in the range of laparoscopic interventions allowed:

- to avoid contact with the abdominal organs;
- to reduce the risk of intra-abdominal complications;
- to reduce the intensity of postoperative pain;
- to reduce the duration of hospitalization.

## CONCLUSIONS

1. A comprehensive differentiated approach to preoperative preparation of patients with inguinal hernias with correction of comorbid pathology, body mass index and factors that increase intra-abdominal pressure significantly reduces the frequency of early postoperative complications compared to standard treatment tactics ( $\chi^2 > 3.84$ ;  $p \leq 0.05$ ).
2. The use of laparoscopic hernioplasty techniques (TAPP and TEP) is accompanied by a lower intensity of postoperative pain syndrome, a shorter hospitalization period and a lower frequency of local complications compared to open methods of plastic surgery.
3. Intracorporeal suturing of the internal inguinal ring when performing TAPP reduces the risk of pseudorecurrence and recurrent inguinal hernias.
4. The highest frequency of postoperative complications and the longest period of inpatient treatment are noted after autohernioplasty, which limits the feasibility of its use in modern surgical practice.

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## CONFLICT OF INTEREST

The Authors declare no conflict of interest

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