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An Improved Method of Non-Tension Hernioplasty for Inguinal Hernias

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Abstract The study included the results of surgical treatment of 85 patients who underwent hernioplasty for inguinal hernia. To study the effectiveness of the proposed method of inguinal hernia hernioplasty, the results of treatment in two groups were compared. For the first group, for control comparison, in 24 patients, hernioplasty was performed using the Lichtenstein method, in 61 patients, the developed method of inguinal hernia alloplasty was used. The presented technique for reconstructing the inguinal canal, aimed at reducing trauma and reducing the time of intervention, can be used in wide practice.

Keywords Inguinal hernia, Non-tension, Hernioalloplasty

1. Introduction

The “non-tensioning” technique of inguinal hernioalloplasty according to Lichtenstein has shown a number of obvious advantages over traditional types of inguinal hernioplasty. The operation takes a little time, is easy to perform and is quite acceptable at cost [3,8,11].

However, often the inguinal ligament is so loose that it can hardly be a reliable place to fix the prosthesis. There is a need for its additional fixation. Using the Cooper ligament for this, as many authors recommend, only partially solves the problem, and Kozlov's methods with the formation of an artificial inguinal ligament and Fletching using a "three-layer mesh" are technically difficult [3,5,9].

In addition, it is not always possible to observe the principle of "no tension" with the Lichtenstein method. The weakness of the inguinal ligament encountered makes it necessary to resort to grabbing into a continuous seam and part of the aponeurosis of the external oblique abdominal muscle for a more durable fixation of the prosthesis. In addition, the capture of the Cooper ligament into the seam shifts the inguinal ligament downwards. As a result, stitching the flaps of the aponeurosis of the external oblique abdominal muscle is impossible without tension. Even a slight swelling of the tissues that occurs in the postoperative period leads to even greater tension of the anterior wall of the inguinal canal. Incomplete restoration of the integrity of the anterior wall of the inguinal canal with the abandonment of a large external inguinal ring leads to straightening of the inguinal canal and violation of its valve function [2,7,10].

It should also be noted that exudation resulting from surgical trauma and in response to the prosthesis, as a foreign body, can lead to fluid accumulation in the inguinal canal cavity, edema of the spermatic cord and testicle. The use of various types of drains frees from hematomas and effusion fluid often only subcutaneous tissue, while the effusion remains in the inguinal canal [1,4,6,14].

Another important thing is that the posterior wall of the inguinal canal is strengthened only by a weakened transverse fascia and a mesh implant. The mechanical load immediately falls on the graft. There is a need to use dense "heavy" nets, because the use of lightweight and semi-absorbable nets with an increase in intra-abdominal pressure leads to the separation or rupture of the mesh and, as a consequence, the recurrence of hernia. But also transplants made of "heavy" polypropylene are reduced in size by 30% during the year, which also contributes to relapse [5,9,13]. Also, a pre-cut graft with a hole for the spermatic cord is fixed to the tissues with the formation of folds, because it does not take into account the individual characteristics of the inguinal space. In addition, fixation of the upper edge of the graft to the surface of the internal oblique abdominal muscle leads to a number of negative consequences: to the eruption of sutures and migration of the mesh implant due to the low mechanical strength of muscle tissue; to the danger of injury to muscle vessels, and in conditions of early loading - to the formation of intermuscular hematomas, suppuration of the postoperative wound; to the formation of a rough rigid scar on the site of the formed folds [6,10,12].

In general, the described changes show that after implantation of a synthetic prosthesis by the Lichtenstein method in the tissues of the inguinal region, processes occur

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that predispose to the development of a possible recurrence of hernia.

The aim of the study is to optimize non-tensioning herniplasty in inguinal hernias by introducing a new method of alloplasty.

2. Materials and Methods of Research

The study is based on the results of examination and treatment of patients with inguinal hernias who were operated in the surgical department of the multidisciplinary regional hospital of Bukhara in the period from 2018 to 2023. 85 patients with inguinal hernias were selected for a prospective dynamic active study. These were male patients with inguinal hernias of various types. The patients were operated on both as planned and as an emergency, and depending on the choice of treatment tactics, the patients were divided into two groups. The first group, the comparison group, consisted of 24 (28.2%) patients with inguinal hernias who underwent hernioalloplasty using the Lichtenstein method. The second, main group consisted of 61 (71.8%) patients who underwent inguinal hernioalloplasty according to our modified method.

According to the types of hernias (classification of L.M. Nyhus), the distribution in the groups is shown in Table 1. The total number of oblique hernias in patients was 62 (72.9%). The number of type III hernias (direct hernias) was 18 (21.2%), recurrent inguinal hernias were found in 5 (5.9%) cases. Based on the statistical analysis carried out by the type of hernias in the studied groups, they can be considered homogeneous ($p\chi 2 > 0{,}05$).

The results of surgical treatment of 24 patients of the comparison group who were operated by the I.L.Lichtenstein method were analyzed. In the early postoperative period, seroma of the postoperative wound occurred in 4 (16.7%) patients, which was eliminated by the puncture method. Acute urinary retention was observed in 1 (4.2%) patient. 9 (37.5%) of I.L.Lichtenstein operated patients, at the time of discharge, indicated a feeling of a foreign body in the inguinal region, of which inguinal neuralgia occurred in 3 (33.3%) patients.

The number of complications prevailed in patients who had a "heavy" implant (25.0%), and due to complications associated with irritation of the nerves of the inguinal region (16.7%) (Fisher angular criterion $\varphi<0.01$).

12 months after the operation, it was possible to examine 23 (93.5%) (out of 24 patients in the comparison group) operated on, 1 (4.3%) elderly men with benign prostatic hyperplasia operated on for a hernia with a defect of 3 sizes and an inguinal gap of more than 3 cm, a relapse was detected after surgery using the I.L.Lichtenstein method. hernias.

Taking into account all the above disadvantages and possible complications in the postoperative period, we have developed and put into practice a modified inguinal hernioalloplasty.

The objective of the proposed method in developing a safe and effective method of surgical treatment of inguinal hernias was to strengthen the posterior walls of the inguinal canal by preperitoneal fixation of the mesh implant, prevention of relapses and reduction of postoperative complications, early activation and rehabilitation of patients.

The modified inguinal hernioalloplasty developed by us was carried out as follows. After opening the inguinal canal, taking the spermatic cord on the holder, the type of inguinal hernia was determined. Before dissection of the transverse fascia, in order to prevent damage to the bladder wall, the bladder was filled with furacilin solution through a urethral catheter. Then the transverse fascia was dissected and the peritoneum was peeled off. With a free direct inguinal hernia, the hernial sac is not opened, and the contents are not examined. The refusal to revise the contents of the hernial sac greatly simplifies the operation, reduces its time, and avoids iatrogenism. For a wider detachment of the peritoneum, a large napkin was inserted into the preperitoneal space, which further added convenience during the operation.

After removing the napkin, a long branch of a large Farabef hook was inserted into the opening of the transverse fascia. Next, the muscles of the abdominal wall and inguinal ligament were stitched with threads at four points. The first point was located laterally and 2 cm higher from the deep inguinal ring to the inner oblique abdominal muscle. The second point is laterally 2 cm from the deep inguinal ring on the inguinal ligament.

Table 1. Distribution of inguinal hernias according to the 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 Lichtenstein	-	13	6	5	-	-	24
Main group	Modified inguinal hernioalloplasty	-	26	12	18	2	3	61
Total		-	39	18	23	2	3	85
%		-	45,9	21,2	27,0	2,3	3,5	100

After passing the threads through these points, pulling them up, the mesh implant was placed under the punctures and fixed by stitching the tissues. The third point was located at the outer edge of the rectus abdominis muscle at the level of the first point. The thread at the third point was passed through the thickness of the aponeuroses of the broad abdominal muscles. The fourth point is located in the area of the pubic tubercle. In cases where the hernial defect is 3 sizes and the inguinal gap is more than 3 cm, there was a need for additional fixation of the implant at the 5th point to the inguinal ligament (in the middle between the 2nd and 4th).

Pulling up the threads, the implant was wound into the preperitoneal place, its folds were straightened with a finger and fixed at the specified points. Retreating from the lower edge of the mesh implant 1.5-2 cm, in the area of the deep inguinal ring, the latter was fixed with a polypropylene thread to the inguinal ligament from the side of the preperitoneal space (Figure 1).

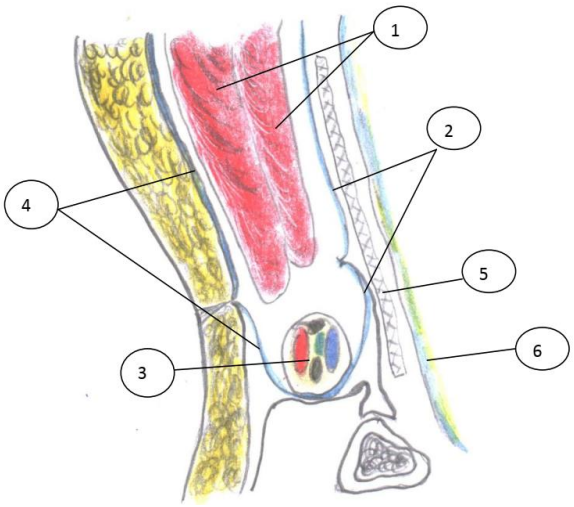

Figure 1. Operation diagram. 1 – internal oblique and transverse muscle, 2 – transverse fascia, 3 – spermatic cord, 4 – aponeurosis of the external oblique abdominal muscle, 5 – allograft (preperitoneal location), 6 – peritoneum

Preperitoneal alloplastic of the inguinal canal makes it possible to strengthen the posterior wall of the inguinal canal using a mesh implant without stretching the tissues and without drawing anatomical structures of the inguinal cord into the scar process. It was noticed that it was technically easier to install a mesh implant through the groin gap in the projection of the medial inguinal fossa.

3. The Results of the Study

A reduction in the traumatic nature of surgical access with early activation of operated patients, the possibility of strengthening the posterior wall of the inguinal canal with polypropylene mesh with preperitoneal fixation contributed to a twofold reduction in the duration of postoperative fever, i.e., seroma secretion decreased from 16.7% to 1.6%.

After alloplastic, changes in the inguinal canal were studied by ultrasound. In the course of the study, in order to study the constituent tissues of the inguinal canal, the thickness of the rectus abdominis muscle, the internal oblique and transverse abdominal muscles, the height of the inguinal gap at rest and under tension (leg lift by 15°) was measured in patients who underwent alloplasty of a hernial defect 1 month after surgery in 47 (77.0%) and 19 (79.2%) patients of the main group and in the comparison group, respectively (Table 2).

After alloplasty (after 1 month), during ultrasonography of the inguinal area, the mesh implant behind the spermatic cord is well traced, regardless of whether the plastic was performed according to the I.L.Lichtenstein technique or preperitoneal alloplasty in the modification we proposed. The transverse fascia is not always possible to visualize.

Under stress, regardless of the type of alloplasty, there was a significant ($p>0.05$) increase in the thickness of the rectus abdominis muscle, the internal oblique and transverse abdominal muscles, and the thickness of the inguinal canal. The height of the inguinal space decreased slightly ($p>0.05$). This indicates that changes in the inguinal region in patients after alloplasty (according to the I.L. Lichtenstein technique or preperitoneal aloplasty of a hernial defect in the proposed modification) at rest and under load are identical (Table 2).

Table 2. The dimensions of the individual components of the inguinal canal tissues after alloplasty of the hernial defect of the inguinal hernia at rest and under stress

Parameters	Type of plastic					
	Способ I.L. Lichtenstein (n=19)			Modified method of inguinal hernioalloplasty (n=47)		
	At rest	Under tension	p	At rest	Under tension	p
Thickness of the rectus abdominis muscle above the womb (mm)	13.2±1,22	14,43±1,63	<0,05	12,98± 1,41	14,44± 1,77	<0,01
Thickness of the internal oblique and transverse abdominal muscles 1 cm above the inguinal ligament (mm)	11,65±2,32	13,31±2,44	<0,05	10,86± 1,53	12,31± 1,8	<0,01
Thickness of the inguinal canal (mm)	12,58±1,25	13,95±1,23	<0,05	12,67± 1,02	13,66± 1,45	<0,05
Height of the inguinal gap (mm)	19,32±6,32	16,94±3,69	>0,05	20,12± 7,5	18,26± 5,84	>0,05

Thus, during tension, the thickness of the inguinal canal significantly increases, which means that these operations do not violate the comfortable mechanism of the inguinal canal for the spermatic cord, which prevents possible disruption of blood flow in the spermatic cord and testicle.

The latter was studied by examining the peak systolic blood flow rate in the intratesticular artery.

The sensor was placed on the skin of the scrotum above the testicle. Scanning was performed in real time in the longitudinal and transverse directions to establish changes in testicular blood flow on the hernia side and on the healthy side.

Intratesticular blood flow was studied in 66 patients with inguinal hernia. The data obtained from the testicle on the side without hernia was taken as control. Testicular blood flow was assessed by the peak systolic velocity, which was determined inside the testicle in the postoperative period (after 1 month) The data obtained indicate that there was a slight decrease in the systolic peak velocity in the intratesticular arteries after alloplasty of the hernial defect of the inguinal hernia ($p > 0.05$) relative to that in the control.

4. Conclusions

Surgery using the I.L. Lichtenstein method is technically simple and available in execution, however, it gives a recurrence of hernia in 5.3% of patients. Preperitoneal alloplasty of a hernial defect in the modification we propose is a reliable alternative to surgery according to the I.L. Lichtenstein technique in the treatment of patients with inguinal hernia of medium and large sizes, recurrent inguinal hernia, which, if performed correctly, does not give relapses and has a low number of complications characteristic of alloplasty, which do not depend on the type of mesh implant used.

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