

A NEW APPROACH TO COMPOUND INGUINAL HERNIA SURGERY USING ENDOVISUAL TECHNOLOGIES AND ITS CLINICAL ANALYSIS

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Abstract

The incidence of inguinal hernias accounts for about 60% of all types of abdominal hernias. Accordingly, inguinal hernia problems are particularly common in men, and on average, hernioplasties for inguinal hernias make up 40% of all hernia surgeries. In complex and complicated forms of inguinal hernias, finding a proper solution remains challenging. According to the traditional classification, the giant inguinoscrotal hernia is associated with a recurrence rate of 25–35% after hernioplasty. The choice of the surgical method for this type of hernia varies among researchers, depending on the size and shape of the hernia. Currently, there is also no standardized classification based on the size of inguinoscrotal hernias and their recurrence rates.

Keywords: Inguinal hernia, laparoscopic hernioplasty, inguinoscrotal hernia, TAPP, Hand assist.

Introduction

Relevance

Among the most frequently performed procedures in leading medical clinics worldwide in the field of abdominal surgery are hernia repairs. Abdominal hernia hernioplasty accounts for 37% of surgical interventions performed for routine abdominal pathologies [1,7,14,17]. One of the pressing issues in herniology is the proper selection of the optimal plastic repair technique for complicated and recurrent hernias.

The recurrence rate of hernias after autoplasic procedures reaches 30%, whereas after alloplastic repairs this figure remains at 5–7% [4,11,12,16,18]. Nearly two centuries ago, in 1885, Theodor Billroth stated in his works on herniology: *“If a tissue could be created to replace the fascia, we would be entirely free from hernia recurrences.”* However, despite the development of numerous alloplastic materials, recurrence rates still remain considerably high [2,6,9,10].

The introduction of laparoscopic hernioplasty has significantly advanced herniology, resulting in a sharp decrease in recurrence rates. According to Protasov A.V. and Cooper N.J., following



adequately performed laparoscopic hernioplasties, the re-consultation rate for inguinal hernias decreased from 10% to 2% [3,5,12,17]. This demonstrates the significant role and importance of laparoscopic hernioplasty in treating inguinal hernias.

The incidence of inguinal hernias accounts for about 60% of all abdominal hernias [1,8,12,15,16]. Accordingly, inguinal hernia problems are especially prevalent in men, and hernioplasties for inguinal hernias make up 40% of all hernia surgeries on average [3,8,11,12,18]. In complicated and advanced cases of inguinal hernias, finding an appropriate solution continues to pose challenges. According to the traditional classification, the so-called giant inguinoscrotal hernia has a recurrence rate of 25–35% after hernioplasty [12,17,19]. The choice of surgical method for this type of hernia differs among researchers depending on its size and shape. Moreover, there is still no precise classification of inguinoscrotal hernias based on their dimensions and recurrence rates.

Despite their frequency and clinical importance, the use of minimally invasive and open techniques for inguinoscrotal hernias has been poorly investigated and is rarely reported in the literature.

Therefore, our aim was to comparatively analyze the surgical treatment outcomes of complex inguinoscrotal hernias and to improve treatment results by developing novel approaches.

Materials and Methods

This study was conducted at the Department of Thoracoabdominal Surgery of the Multidisciplinary Clinic of the Tashkent Medical Academy. A total of 102 male patients diagnosed with inguinoscrotal hernia type III B according to the L. Nyhus classification, who underwent inpatient treatment between 2014 and 2022, were analyzed.

By age distribution, 34 patients (33.4%) were aged 18–30 years, 43 patients (42.1%) were 31–50 years, and 25 patients (24.5%) were older than 50 years. According to hernia anamnesis, 46 patients (45.1%) had a history of one year, 41 patients (40.1%) between 2–5 years, and 15 patients (14.8%) had been suffering from hernias for more than 5 years.

Table 1

	18-30 Age	31-50 Age	Over 50 years	Total
1 year	15(14,8%)	20(19,6%)	11(10,8%)	46(45,1%)
2-5 year	14(13,7%)	17(16,7%)	10(9,8%)	41(40,1%)
ore than 5 years	5(4,9%)	6(5,8%)	4(3,9%)	15(14,8%)
	34 (33,4%)	43(42,1%)	25(24,5%)	102 (100%)

In the preoperative period, 79 (77.4%) patients had monolateral localization and 23 (22.6%) patients had bilateral inguinal hernia, of which 8 (7.8%) were assessed as bilateral inguinoscrotal hernia, while in the remaining 15 (14.7%) cases one-sided inguinal hernia and contralateral inguinoscrotal hernia were diagnosed and operated on. In 28 (27.5%) cases, patients were found to have recurrent inguinoscrotal hernia, of which 3 (2.9%) had re-recurrence.

In 18 (17.6%) patients, cholelithiasis was detected; in 3 (2.9%) patients, simple liver cyst; in 5 (4.9%) patients, hiatal hernia; and in 2 (1.9%) patients, grade II obesity, simultaneous surgical interventions were performed.



Among comorbidities, 7 (6.9%) patients had ischemic heart disease with arterial hypertension grade II; in 4 (3.9%) cases, type 2 diabetes mellitus with moderate course; in 5 (4.9%) patients, chronic cerebral circulatory insufficiency grade I; and in 4 (3.9%) patients, chronic obstructive pulmonary disease in remission.

Inguinoscrotal hernia is a variant of inguinal hernia in which the hernia sac is located at the upper border of the scrotum (below the base of the male genital organ). According to L. Nyhus classification, patients were assigned to type III B inguinal hernia. The difficulty for us was that its irreducible types, as well as classification by size, shape, and recurrence rate, were not clearly defined in this system.

In order to preoperatively determine the surgical tactics by intraoperative analysis, we subdivided inguinoscrotal hernias into several degrees. For this, in standing position, the localization of the hernia sac was divided according to anthropometric structures.

We studied inguinoscrotal hernias by dividing them into degrees according to the following criteria:

- **IS I – degree.** Small-sized hernia (up to 10 cm). The hernia is reduced into the abdominal cavity, scrotum size unchanged. Patient has not previously undergone hernia surgery. Congenital inguinoscrotal hernias.
- **IS II – degree.**
 - Large hernias (up to 20 cm), reducible into the abdominal cavity, scrotum enlarged. Acquired inguinoscrotal hernias. Sliding inguinoscrotal hernias (up to 10 cm).
 - Recurrent inguinoscrotal hernias (up to 10 cm).
 - Small congenital inguinoscrotal hernias (up to 10 cm).
- **IS III – degree.** Irreducible inguinoscrotal hernias, up to 20 cm in size. Recurrent hernias up to 10 cm. Large congenital inguinoscrotal hernias more than 10 cm. Large sliding hernias (10 to 20 cm).
- **IS IV – degree.** Giant hernias (more than 20 cm), deforming the scrotum (expanding it), interfering with walking. Irreducible hernias, or hernias impossible to reduce into the abdominal cavity due to their large size.

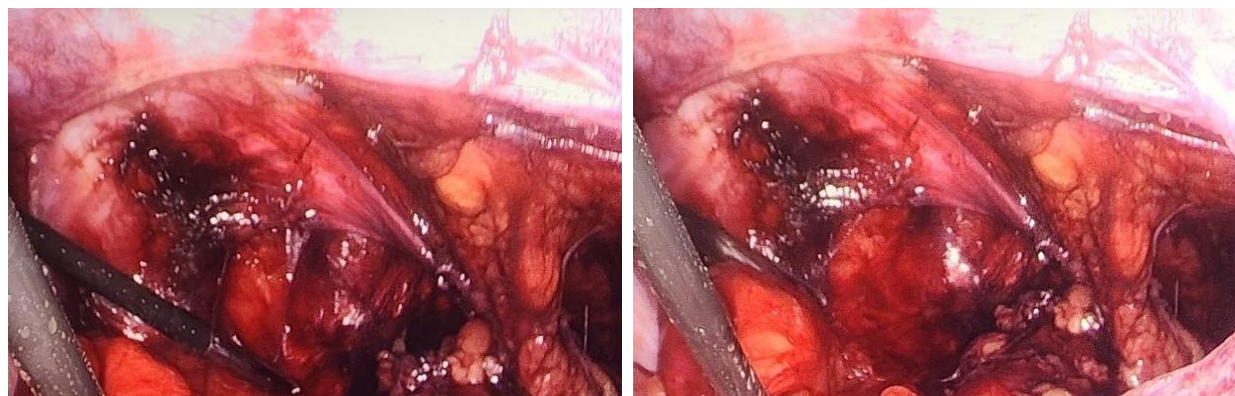
In reducible types of inguinoscrotal hernia, according to our developed classification, in 48 (47.1%) cases IS I – degree was identified and surgical operations were performed by transabdominal preperitoneal hernioplasty (TAPP) method. In 19 (18.6%) patients with IS II – degree, laparoscopic surgery was performed, and in 11 (10.8%) patients the operation was completed using TAPP method. In the remaining cases, conversion to Hand assist method was required.

The patient was positioned on the operating table in Trendelenburg's position. TAPP was performed in the standard manner: the camera was inserted above the umbilicus, and under its control, two working instruments were introduced from the right and left iliac regions. Then, starting 3 cm above the internal inguinal ring, the preperitoneal tissue was carefully dissected. The symphysis pubis lateral angle and the anterior superior iliac spine were identified. In most cases, the hernia sac adhered to the spermatic cord and its vessels, and it was carefully separated without damaging the vessels and pushed into the abdominal cavity. The mesh prosthesis was fixed to the edge of the symphysis and anterior superior iliac spine with herniostaplers, and the peritoneum was closed intracorporeally with continuous absorbable sutures.



Simultaneous laparoscopic procedures were performed in the second stage, for which, without changing the optical trocar, additional working trocars were inserted in the upper abdominal regions as needed.

The peculiarity of inguinoscrotal hernias is that due to the extension of the peritoneum into the scrotum, in most cases it adheres to the testicles. The longer the hernia history, the more intimately the peritoneum adheres to the testis. Separation of the parietal layer in such cases was more difficult than in ordinary inguinal hernias and was often accompanied by hematoma of the spermatic cord vessels or damage/peeling of the testicular tunics.



Clinical Results and Analysis

In cases of inguinoscrotal hernia, 67 (65.7%) patients with reducible hernias underwent TAPP procedure, while the remaining 35 (34.3%) patients, with hernia history of 5 years or longer and diagnosed with irreducible inguinoscrotal hernia, were operated on.

According to the intraoperative method we proposed for determining the size of the hernia gate, the width of the defect was measured in each case. It was found that in 34 (33.4%) cases of reducible inguinoscrotal hernias, the hernia gate width was 2×3 cm; in 17 (16.7%) cases – 3×4 cm; in 8 (7.8%) cases – 4×5 cm; and in 7 (6.9%) patients it exceeded 5 cm. Accordingly, prosthetic materials of sizes 6×12 cm, 10×15 cm, and 15×15 cm were prepared and placed into the preperitoneal space.

Table 2

	Hernial orifice width	Patients who underwent TAPP surgery
1	2x3 cm	34(33,4%)
2	3x4 cm	17 (16,7%)
3	4x5 cm	8 (7,8%)
4	greater than 5 cm	7 (6,9%)
	Total	67

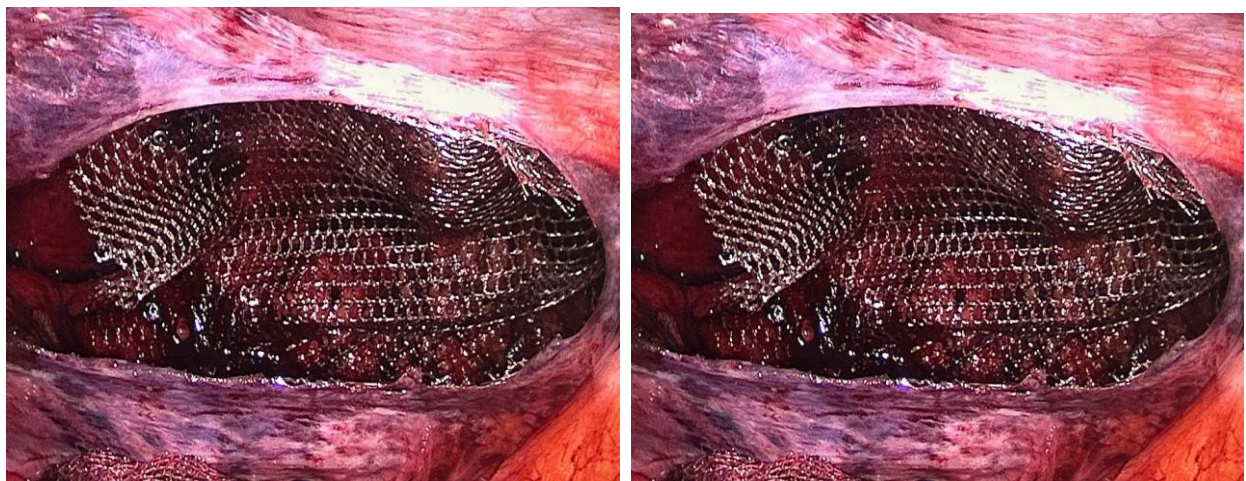
In reducible inguinoscrotal hernias, TAPP was performed in 31 (30.4%) cases without technical difficulties. Among the remaining 16 (15.7%) cases, spermatic cord hematoma developed in 8 (7.8%) patients, while in 4 (3.9%) cases the peritoneum was found to be adherent to the testis. During dissection, bleeding of the tunica vaginalis occurred, and in place of the hernia sac, a residual



cavity formed in the scrotum. In another 4 (3.9%) cases, persistent bleeding from the tunica vaginalis was stopped using electrocoagulation.

In the postoperative period, patients were mobilized early. In cases of reducible inguinoscrotal hernia, the mean duration of surgery for unilateral procedures was 65 ± 6 minutes. In the early postoperative period, among patients who experienced technical difficulties, 3 (2.9%) presented with scrotal enlargement and pain. Ultrasound examination revealed scrotal hematoma in 2 (1.9%) patients and signs of acute orchiepididymitis in 1 patient. As hematoma size did not decrease dynamically, 2 (1.9%) patients underwent scrotal exploration and hematoma evacuation. Patients with acute orchiepididymitis received conservative treatment as recommended by the urologist.

Intraoperatively, in 2 (1.9%) patients aged 20–22 years, the inguinoscrotal hernia was determined to be congenital, as the hernia sac contained the testis and a portion of the greater omentum. Since complete dissection of the hernia sac was not possible, the testis was preserved together with the surrounding parietal peritoneum, while the remaining portion was resected and repositioned into the abdomen, and the testis returned to the scrotum. In the late postoperative period, testicular hydrocele developed in these patients, and under ultrasound guidance puncture was performed with fluid evacuation. At 3 months after surgery, 1 (0.98%) patient re-presented with persistent hydrocele, for which Winkelmann surgery was performed.



In 4 (3.9%) patients with recurrent inguinoscrotal hernia, due to severe scarring in the pelvic cavity, it was not possible to isolate the hernia gate. In 3 (2.9%) cases, the hernia sac contained the urinary bladder as a sliding hernia, and since the hernia gate was large, conversion to the Hand-assist technique was performed. Under laparoscopic guidance, if the hernia sac consisted only of the greater omentum, the intra-abdominal portion of the omentum was ligated and resected, while the part adherent to the scrotal walls was excised through a small scrotal incision.

According to long-term outcomes, 4 (3.9%) patients presented with hernia recurrence. Review of the operative records of these patients revealed that in all cases the hernia gate measured larger than 5 cm. Repeated TAPP repair was performed, and before placing the prosthetic mesh, the hernia gate was closed with intracorporeal sutures, after which the prosthesis was implanted. In long-term follow-up, no further recurrences were observed.



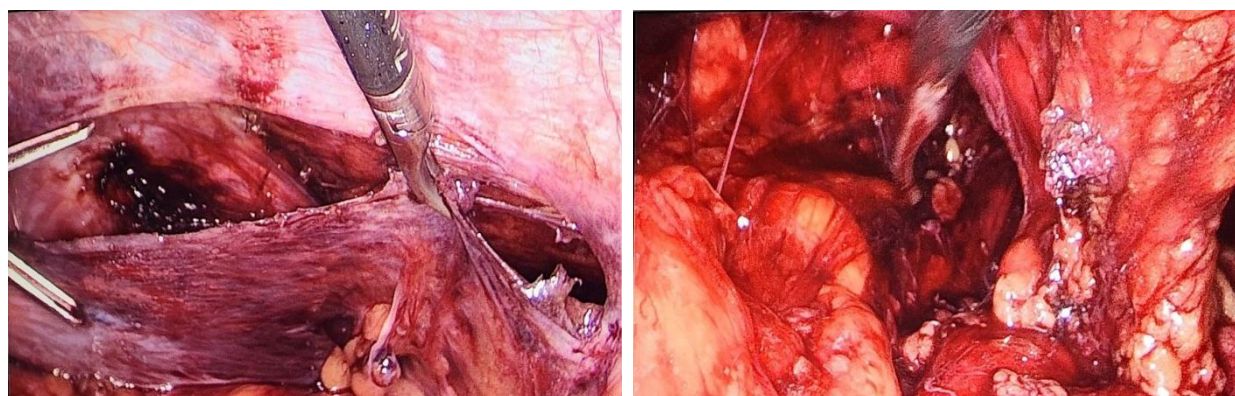
A total of **35 (34.3%) patients** with irreducible inguinoscrotal hernia were scheduled for TAPP repair. All patients had a hernia history of 5 years or more, and in 3 (2.9%) patients incarceration had occurred in the past. Seven (6.8%) patients presented with recurrent inguinoscrotal hernia, among whom 3 (2.9%) had previously undergone Lichtenstein repair and 2 (1.9%) had undergone autoplasmic repair twice.

According to our developed classification, irreducible hernias were divided into the following categories: 21 (20.6%) patients were classified as ChE-III and 14 (13.7%) as ChE-IV.

Table 4. Distribution of irreducible inguinoscrotal hernias according to the developed classification

	Grades of Inguinoscrotal Hernia	Patients
	IGO-III	21 (20,6%)
	IGO-IV	14 (13,7%)

Among the patients diagnosed with Grade III inguinoscrotal hernia, in 16 cases (15.7%) intraoperative dissection of the tissues around the hernia defect was insufficient to reposition the hernia contents into the abdominal cavity, and reduction could not be achieved. In such cases, we considered it appropriate to switch to the Hand-assist technique. In 7 patients (6.9%), where the hernia content consisted of intestinal loops, reduction into the abdominal cavity was performed through a small incision. In the remaining 9 cases (8.8%), the hernia content was the greater omentum, and partial omentectomy was performed through the external incision.



Afterwards, the hernia defect was sutured with intracorporeal stitches, and the prosthetic mesh was placed in the preperitoneal space and fixed to the symphysis and iliac bone. The parietal peritoneal defect was closed intracorporeally using Vicryl 2-0 sutures. In 2 patients (1.9%), during laparoscopy, part of the small intestine was identified as the hernia content. While performing the Hand-assist technique, deserosalization of the intestinal wall occurred; therefore, conversion was required in these cases.

Technical difficulties were observed in patients diagnosed with Grade IV inguinoscrotal hernia. Intraoperatively, the hernia defect was found to be firmly adherent. Dissection of the hernia defect was performed, but reduction of the hernia contents was not possible, necessitating the use of the Hand-assist method. However, in 1 patient (0.98%), hydrocele developed, and Winkelmann's



procedure was performed. In 7 patients (6.9%), dense adhesions in the hernia region during laparoscopy made it impossible to determine the hernia contents, and open alloplasty was performed in all these cases.

All patients who underwent TAPP were mobilized early in the postoperative period. In patients who underwent Hand-assist and open procedures, pain syndrome persisted for 3–4 days. The mean duration of TAPP was 80 ± 5 minutes for unilateral cases, while Hand-assist averaged 105 ± 4 minutes, and Lichtenstein procedures averaged 120 ± 7 minutes.

No complications were observed at the wound sites after TAPP and Hand-assist procedures, and rapid healing was noted. Only in 2 patients (1.9%) after TAPP was a scrotal hematoma observed, which was evacuated through a small incision. In 1 patient (0.98%), signs of orchiepididymitis developed, for which conservative treatment was administered under urologist consultation. In 3 patients (2.9%) with Grade III hernias, wound redness was noted, which resolved after conservative therapy. In 1 patient (0.98%), signs of postoperative intestinal obstruction were detected, which resolved after gastrointestinal stimulation.

Our clinical results show that reducible inguinoscrotal hernias should necessarily be treated laparoscopically. According to statistical data, the recurrence rate after open alloplasty for inguinoscrotal hernias can reach 5–10%, and factors such as surgeon's expertise and mesh quality play a significant role [1,6,10,13,19]. In our experience, even patients who had undergone up to 8 open herniotomies were observed, and laparoscopy revealed that the internal ring had been reinforced, while the hernia recurred from the external ring. After TAPP, no recurrence was observed. Considering the ongoing development of minimally invasive techniques, their significant clinical importance, and the low complication rate, TAPP is highly justified in the treatment of inguinoscrotal hernias.

Nevertheless, complications may also occur after TAPP in reducible inguinoscrotal hernias. Intraoperative injury to inguinal structures, postoperative orchiepididymitis, or scrotal hematomas indicate the necessity of further improvement of the method and the development of surgical treatment algorithms.

Irreducible inguinoscrotal hernias, on the other hand, require a preoperative individualized approach. In our opinion, the L. Nyhus classification is insufficient for this type of hernia. According to L. Nyhus, type III B includes oblique inguinal hernias or inguinoscrotal hernias, but it does not specify the criteria for reducible versus irreducible, or congenital versus acquired inguinoscrotal hernias. This creates some difficulties in surgical decision-making. Therefore, to refine the diagnosis, we divided irreducible inguinoscrotal hernias into types I, II, III, and IV, and developed clear criteria for them.

It is not always possible to completely manage inguinoscrotal hernias laparoscopically. Our clinical findings also indicate that the previously used term “giant hernia” stands in opposition to laparoscopic techniques. However, we identified the exact situations in which surgery can be continued fully laparoscopically, when it is appropriate to switch to the Hand-assist method, and when the Lichtenstein approach is preferable.

According to our results, the postoperative complication rate was 1.9% after TAPP, 1.9% after Hand-assist, and 2.9% after Lichtenstein procedures. Overall, the complication rate did not exceed





5%. According to Prof. I.I. Egiev (2022), complications after inguinoscrotal hernia surgery range from 4–6%, while in complex hernias they may reach up to 10% [4,13,16,18].

Thus, inguinoscrotal hernias are more difficult to treat than inguinal hernias and present a more complex clinical course, requiring an individualized approach for each patient. Particularly in irreducible, large-sized inguinoscrotal hernias, surgical procedures are technically challenging and often necessitate conversion from laparoscopic approaches. Establishing diagnostic criteria for irreducible inguinoscrotal hernias based on their clinical course and anthropometric measurements of the body helps determine the surgical approach in advance and contributes to favorable clinical outcomes. Our clinical results indicate that much further research is needed in this field, leading us to the following primary conclusions.

Conclusion

- Regardless of the size and clinical history of reducible inguinoscrotal hernias, the TAPP procedure should be performed. If intraoperatively the hernia defect is found to be large, it must first be sutured with intracorporeal stitches, after which a wide prosthetic mesh should be placed in the preperitoneal space. In patients with a large hernia sac, to prevent the development of scrotal hematoma, it is advisable to insert a rubber drain into the scrotal sac through a small incision.
- In inguinoscrotal hernias, classification into Grades I, II, III, and IV should be made based on anthropometric parameters and clinical criteria. In Grade I cases, the hernia can be completely managed using the TAPP method. In Grade II cases, if technical difficulties arise during laparoscopy, the use of the Hand-assist technique provides good outcomes. In Grade III hernias, if the hernia content consists of organs other than the greater omentum, the Hand-assist technique should be applied; however, in cases of dense adhesions with risk of organ injury, the Lichtenstein procedure is recommended. In Grade IV hernias, open alloplasty is considered the most appropriate approach.
- Hernia repair using minimally invasive technologies does not require abandoning traditional alloplasty but demonstrates distinct advantages. In cases where contraindications to general anesthesia exist, as well as in congenital inguinoscrotal hernias, open alloplasty may be clinically preferable. At the same time, conservative measures should be prescribed to prevent the development of orchiepididymitis.

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