

## PREDICTORS LEADING TO THE DEVELOPMENT OF RELAPSE AFTER ALLOPLASTY OF VENTRAL HERNIAS

*Karimov Sardor Suvankulovich*

*Private clinic "Diagmed" Pastdargom district, Republic of Uzbekistan, Samarkand*

*Shonazarov Iskandar Shonazarovich*

*Samarkand State Medical University, Samarkand, Uzbekistan*

*Murodullaev Sardorbek Olimjon ugli*

*Samarkand branch of the Republican Scientific Center for Emergency Medical Care*

**Purpose:** To identify risk predictors influencing the development of recurrence after different methods of hernioalloplasty in patients with postoperative ventral hernia.

**Material and Methods:** The results of treatment of 107 patients operated on the basis of the Department of Surgery of FPDO Samarkand State Medical University period from 2018 to 2022 were studied.

**Results:** The results of surgical treatment of patients with POG in the immediate postoperative period were analysed within 30 days after surgical intervention, the long-term results of surgical treatment in these patients were studied within 12 to 36 months. Possible risk factors of ventral and postoperative hernia development were studied. For this purpose, we evaluated potential factors influencing the outcome of hernioplasty in the postoperative period.

**Conclusions:** The results of reoperative monitoring of intra-abdominal pressure at  $W3-W4 \geq 11$  substantiate the priority of posterior separation hernioplasty, at  $<11$  anterior separation hernioplasty is possible. Optimisation of tactical and technical aspects of surgical treatment of patients with postoperative ventral hernias allowed to reduce the incidence of immediate postoperative complications from 16.1% to 9.1% and recurrence from 10.7% to 4.5% ( $p < 0.05$ ).

**Keywords:** Postoperative ventral hernia, surgical treatment, separation hernioplasty, hernialloplasty, recurrence predictors.

**Relevance.** Despite the increasing use of minimally invasive surgical techniques for abdominal diseases in recent years, the incidence of postoperative hernias remains high [1,2]. According to several authors, the incidence of postoperative ventral hernias (POVH) after laparotomy reaches up to 20% of cases [3,4]. After emergency surgeries, the incidence of POVH ranges from 18.1% to 58.7%, with a predominance of midline hernias [5].

Currently, the use of alloplastic materials in the repair of postoperative ventral hernias is receiving increased attention, which underscores the need for more in-depth research in this area. Primarily, this concerns the selection of specific hernioplasty techniques and the prevention of postoperative wound complications [6,7].

It is important to note that there is no universal surgical approach to hernia repair today [8]. In open hernioplasty, the results of surgical treatment and the incidence of postoperative complications vary depending on the placement of synthetic materials in the abdominal wall tissues, such as the "sublay," "inlay," or "onlay" techniques. Moreover, the incidence of postoperative complications also depends on the size of the hernia defect, the condition of the local tissues, and how they are managed [9,10].

**Objective of the study.** To identify predictors influencing the risk of recurrence after different types of hernioalloplasty in patients with postoperative ventral hernias.

**Materials and methods.** The treatment outcomes of 107 patients operated on at the Department of Surgery, Faculty of Postgraduate Medical Education at Samarkand State Medical University, from 2018 to 2022, were analyzed. In the observed patients with postoperative ventral and recurrent hernias, hernia defect repair was performed using the onlay and sublay methods, as well as separation hernioplasty with the restoration of normal topographic anatomy. All patients were divided into two groups depending on the surgical technique used.

The first group included 51 patients who underwent open hernioplasty using separation hernioplasty and were divided into two subgroups: 1.1 – 29 patients who underwent anterior separation hernioplasty and 1.2 – patients who underwent posterior separation of the abdominal wall muscles. The second group (comparison) consisted of 56 patients who underwent standard hernioplasty using the onlay (n=38) and sublay (n=18) methods.

All patients were classified into subgroups according to the European Hernia Society (EHS) classification (2009).

In the 1.1 group, medium-sized hernias (W2: 5-10 cm) were observed in 7 (24.1%) patients, large hernias (W3: 10-15 cm) in 20 (68.9%) patients, and giant hernias (W4: more than 15 cm) in 2 (6.9%) patients. In the 1.2 group, medium-sized hernias were observed in 6 (27.3%) patients, W3 hernias in 14 (63.6%) patients, and W4 hernias in 2 (9.1%) patients. In the second group, W2 hernias were observed in 34 (60.7%) patients, W3 hernias in 19 (33.9%) patients, and W4 hernias in 3 (5.3%) patients. Thus, overall, there was a predominance of patients with W3-W4 hernias – 60 (56.1%) patients (in table 1).

**Dimensions hernias by classification EHS table 1**

| Groups           | W2   |      | W3   |      | W4   |     |
|------------------|------|------|------|------|------|-----|
|                  | Abs. | %    | Abs. | %.   | Abs. | %.  |
| 1.1 group (n=29) | 7    | 24,1 | 20   | 68,9 | 2    | 6,9 |
| 1.2 group (n=22) | 6    | 27,3 | 14   | 63,6 | 2    | 9,1 |
| 2 group (n=56)   | 34   | 60,7 | 19   | 33,9 | 3    | 5,3 |
| Total (n=107)    | 47   | 43,9 | 53   | 49,5 | 7    | 6,5 |

The age of the observed patients ranged from 23 to 76 years, with an average age of 51.3±1.2 years. Female patients accounted for 64 (59.8%) cases, while male patients were 43 (40.2%). Postoperative ventral hernias (POVH) most commonly occurred following surgeries on the gallbladder and bile ducts 26.2% of cases. In 21.6% of the patients, two surgical interventions had been performed within 12 months.

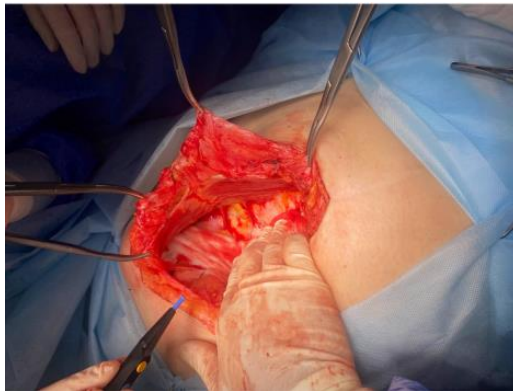
The anesthetic-surgical risk assessment was carried out using the American Society of Anesthesiologists (ASA) classification. In the majority of cases, the patients had a grade III ASA risk. Among patients in group 1.1, 14 (48.3%) had a grade II ASA risk, while 15 (51.7%) had a grade III risk. In group 1.2, 10 (45.5%) patients were classified with a grade II risk, and 12 (54.5%) were classified with a grade III risk. In group 2, 27 (48.2%) patients had a grade II risk, and 29 (51.8%) patients had a grade III risk.

Most patients (n=54, 36.5%) were overweight. The average body mass index (BMI) in group 1.1 was

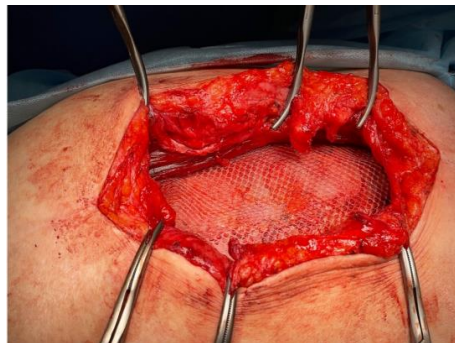
33.4±3.5 kg/m<sup>2</sup>, in group 1.2 it was 34.1±2.2 kg/m<sup>2</sup>, and in group 2 it was 32.2±2.2 kg/m<sup>2</sup>.

In the main group of patients (n=51), 29 patients in subgroup 1.1 underwent hernia repair using the anterior separation technique of the abdominal wall muscles. Following laparotomy, adhesiolysis was performed. Then, the posterior layer of the rectus abdominis muscle sheath was incised, retreating 0.5-1 cm from its edges.

During the separation of the rectus abdominis muscles from the posterior aponeurosis, it was possible to preserve the perforating vessels and nerves in this area. Additionally, mobilization of the anterior abdominal wall was performed bilaterally along the surgical wound by incising the aponeurosis of the external oblique abdominal muscle (M. obliquus externus abdominis) from the costal margin down to the inguinal canal (in Figure 1).



**Figure 1** Stage of separation of the rectus muscle



**Figure 2** Location of the mesh implant

A lightweight polypropylene mesh endoprosthesis was placed on the prepared site and sutured transdermally in 6 areas using monofilament suture material with long-term absorbable properties (in Figure 2). The aponeurosis of the anterior abdominal mesh was sutured using a continuous suture with the same monofilament material, following the "Small Bite 4:1" technique. Drainage tubes for Redon suction drainage were inserted into the subcutaneous adipose tissue, with the external ends brought out through separate punctures on the anterior abdominal surface. The operation was completed by suturing the skin. The average duration of the surgery in the first group of patients was 134.4±41.2 minutes.

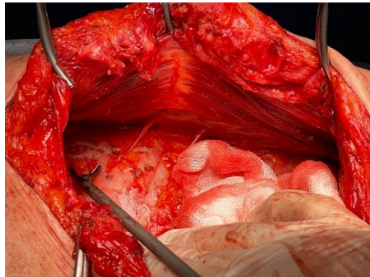
In patients from group 1.2 (n=22), the posterior component separation technique was used for hernioplasty. This method involves performing a laparotomy and adhesiolysis. The posterior layer of the rectus sheath

was then incised, 5–10 mm from the muscle's edge. It is important to note that thoracoabdominal nerve branches are located at the transition between the anterior and posterior layers of the aponeurosis, and care should be taken to preserve them. Incision of the posterior layer of the sheath was performed 5 mm medially from the junction of the two aponeurotic layers above the transverse muscle (in Figure 4).

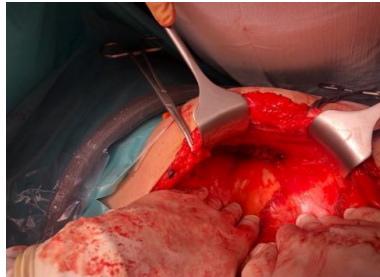
This stage of the operation is considered most optimal in the upper third of the abdomen, as the muscle in this area is the most developed and closer to the midline. Next, the transverse muscle fibers were separated from the corresponding fascia, and the muscle fibers were then incised (in Figure 5).

This created access to the space between the transverse fascia and the lateral edge of the incised transverse muscle. The tissues were mobilized upwards to the costal margin and the xiphoid process, and downward to the Retzius space and Cooper's ligaments. Only after bilateral tissue mobilization could the posterior rectus sheath be sutured without tension.

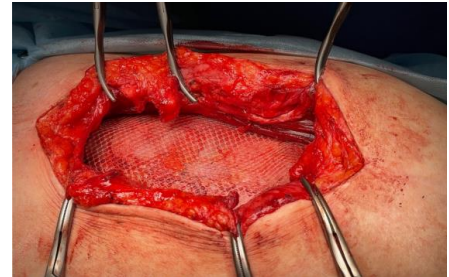
Following this, a mesh endoprosthesis was placed beneath the rectus muscles and sutured transdermally in 6 areas using long-term absorbable monofilament suture material (in Figure 6).



**Figure 4 Stage of separation of the rectus muscle**



**Figure 5 Stage of intersection of the transverse muscle**



**Figure 6 Location of the mesh implant**

Two drainage tubes were placed adjacent to the endoprosthesis, and their external ends were brought out onto the surface of the abdomen through separate punctures. The edges of the aponeurosis were then sutured using a long-absorbable monofilament suture material, applying a continuous suture technique following the Small byte 4:1 method. The duration of the surgical intervention averaged  $148.6 \pm 38.4$  minutes. There was no statistically significant difference in the duration of surgery between the two main groups ( $p < 0.05$ ). In the second group of patients ( $n=56$ ), hernioplasty was performed using standard techniques (onlay and sublay) without tissue separation techniques. The onlay method was performed on 38 (67.8%) patients, while the sublay method was used in 18 (32.1%) patients. The average duration of the surgical intervention in this group was  $81.7 \pm 21.4$  minutes.

**Results and Discussion:** The analysis of the results of surgical treatment in patients with postoperative ventral hernias (POVH) in the immediate postoperative period was conducted over 30 days after surgery, while long-term outcomes were studied over a period ranging from 12 to 36 months. In patients from group 1.1, wound complications in the immediate postoperative period after anterior separation hernioplasty occurred in 4 (13.8%) cases. In group 1.2, where posterior separation hernioplasty was applied, such complications were observed in 2 (9.1%) patients, aged over 60 years, with large epigastric hernias and obesity. In group 2, where standard tension hernioplasty techniques were used, wound complications were observed in 9 (16.1%) cases. Therefore, wound complications were less frequently observed in group 1.2 where posterior separation hernioplasty was used—9.1% of cases (in table 2).

**table 2**

Note: r - statistical significance differences indicators between in groups (By criterion  $\chi^2$  For arbitrary tables; \*By precise criterion Fisher), \*\*y one The patient may experience several complications, which is why the total number of patients with complications lower than number complications themselves

**Analysis complications postoperative period, abs (%) table 2**

| Complications                           | 1.1 group<br>(n=29) | 1.2 group<br>(n=22) | 2 group<br>(n=56) | r      |
|---|---------------------|---------------------|-------------------|--------|
| <b>Wounds complications</b>             |                     |                     |                   |        |
| Seroma                                  | 2 (6,9%)            | 1 (4,5%)            | 4 (7,1%)          | >0,05  |
| Hematoma / bleeding                     | 1 (3,4%)            | 1 (4,5%)            | 2 (3,6%)          | >0,05  |
| Infection<br>operating wound            | 1 (3,4%)            | -                   | 3 (5,3%)          | >0,05  |
| General number complications<br>**      | 4 (13,8%)           | 2 (9,1%)            | 9 (16,1%)         | <0,05  |
| <b>General somatic complications</b>    |                     |                     |                   |        |
| Thrombosis vessels lower<br>extremities | 1 (3,4%)            | 1 (4,5%)            | 2 (3,5%)          | >0,05  |
| Pneumonia                               | 1 (3,4%)            | -                   | 4 (7,1%)          | >0,05* |
| <b>General number<br/>complications</b> | 6 (20,7%)           | 3 (13,6%)           | 15 (26,8%)        | <0,05  |
| Lethal Exodus                           | -                   | -                   | 1 (1,8%)          | >0,05* |
| Relapse , n (%)                         | 2(6,9%)             | 1 (4,5%)            | 6 (10,7%)         | <0,05  |



Note: r - statistical significance differences indicators between in groups (By criterion  $\chi^2$  For arbitrary tables; \*By precise criterion Fisher), \*\*y one The patient may experience several complications, which is why the total number of patients with complications lower than number complications themselves

A fatal outcome was observed in the second group of patients in 1 (1.8%) and 1 (2.8%) cases, with the main cause of death being the development of multiple organ failure. It is important to note that the age of the patient exceeded 65 years, and the patient had grade III obesity, as well as a history of diabetes mellitus. There were no statistically significant differences in specific types of postoperative complications between the groups ( $p > 0.05$ ). However, when analyzing the total number of complications in the immediate postoperative period, there was a higher prevalence in groups 1.1 and 2—6 (20.6%) and 15 (26.8%), respectively. In group 1.2, where posterior separation hernioplasty was used, complications were observed in 3 (13.6%) cases. The rate of recurrence was highest in groups 2 and 1.1—10.7% and 6.8%, respectively. In group 1.2, where posterior separation hernioplasty was used, the recurrence rate was 4.5%. The potential risk factors for the development of ventral and postoperative hernias were studied. To do this, an assessment of potential factors influencing the outcome of hernioplasty in the postoperative period was conducted. It was found that larger hernial defects were observed in older patients. Additionally, the BMI ( $\text{kg}/\text{m}^2$ ) was significantly higher in patients with larger hernial defects (in table 3).

**Characteristics of age, BMI and duration indicators operations V dependencies from sizes hernial defect By classifications EHS ( $M \pm SD$ ) table 3**

| Parameters                | Classification widths EHS     |                          | P      |
|---------------------------|-------------------------------|--------------------------|--------|
|                           | W2 ( $\geq 4-10 \text{ cm}$ ) | W3 ( $> 10 \text{ cm}$ ) |        |
| Age , years               | 64,4 $\pm$ 12,5               | 64,9 $\pm$ 11,9          | >0,05  |
| BMI, kg / $\text{m}^2$    | 29,5 $\pm$ 5,8                | 29,9 $\pm$ 5,9           | >0,05  |
| Duration operations , min | 86,7 $\pm$ 21,4               | 138,4 $\pm$ 41,2         | <0,001 |

Note: p – statistical significance of the difference in indicators between groups (according to U- criterion Mann-Whitney)

The mean duration of the disease was notably longer in patients with larger hernial defects. We conducted an analysis of the relationship between the width of the hernial defect as per the European Hernia Society (EHS) classification and intra- and postoperative surgical complications, overall complications, reoperations related to complications, recurrences, as well as pain at rest, pain during physical exertion, and chronic pain requiring treatment during the one-year follow-up period. A significant correlation was found between the width of the hernial defect according to the EHS classification and all outcome variables. For all outcome parameters, the relevant indicator increased in proportion to the increase in hernial defect width according to the EHS classification. The risk of intraoperative complications was significantly associated with the surgical technique, hernial defect width as per EHS, and use of drainage (in each case,  $p < 0.001$ ), as well as age ( $p = 0.012$ ) and gender ( $p = 0.024$ ). Separation hernioplasty techniques were associated with a lower risk of intraoperative complications. Additionally, the use of drains and larger hernial defect sizes according to EHS were linked with a higher risk of intraoperative complications. Similarly, elderly patients had a higher risk of intraoperative complications. The rate of postoperative complications in the immediate postoperative period was significantly dependent on hernial defect width according to the EHS classification, the surgical technique, BMI, risk factors, and the use of drainage (in each case,  $p < 0.001$ ), and was moderately associated with the ASA score ( $p = 0.002$ ) and age ( $p = 0.041$ ). The wider the hernial opening, the higher the risk of postoperative complications. Regarding the surgical technique, the lowest risk of postoperative complications was observed with the use of posterior separation hernioplasty. Higher BMI was associated with an increased frequency of postoperative complications. Analysis of reoperations related to complications showed that this risk was significantly linked with hernial defect width, use of drains, presence of risk factors, and the surgical technique (in each case,  $p < 0.001$ ), as

well as the ASA score and BMI ( $p = 0.019$ ). The risk of reoperation due to complications, like the aforementioned postoperative complication rate, was particularly related to larger hernial defects. The use of drainage and the presence of at least one risk factor were also associated with a higher risk of reoperation, while the use of posterior separation hernioplasty reduced this risk. Higher ASA scores and BMI were also linked to a higher risk of reoperation. Overall complications (model fit:  $p < 0.001$ ) were significantly associated with hernial defect width, risk factors, age, use of drainage, and ASA scores (in each case,  $p < 0.001$ ). As with postoperative complications, for which the effect size was somewhat smaller, wider hernias increased the risk of overall complications by 48% to 140%. Risk factors such as age, higher ASA scores, and the use of drainage were associated with a higher overall complication risk. Multivariate analysis of recurrence rates after one year of follow-up showed that recurrence was closely related to the surgical technique, hernial defect width according to EHS, and BMI (in each case,  $p < 0.001$ ). The recurrence rate was higher, especially with the use of standard non-tension hernioplasty techniques. Posterior separation hernioplasty had a lower recurrence risk compared to other methods. Additionally, larger hernial defects per the EHS classification and higher BMI were associated with a higher recurrence risk. Thus, the width of the hernial defect according to the EHS classification, the type of hernioplasty, the presence of preoperative pain reported by the patient, and female gender are the most important factors influencing the outcomes of surgical treatment of postoperative hernias. Accordingly, the results presented here can be used to adjust the risk during postoperative hernia repair. However, this implies preoperative determination of the hernial defect size using ultrasound, CT, or MRI. Therefore, the EHS hernial defect width classification based on radiological study results can be used to assess expected outcomes. Based on this analysis, it is possible to identify patients with postoperative hernia who have a higher risk of perioperative complications and adverse outcomes after one year of follow-up. These patients should be operated on by experienced surgeons. In particular, this applies to patients with a postoperative hernia with a defect width  $> 10$  cm, who, according to recommendations, should undergo open surgery. These patients have the highest risk of perioperative complications, as well as a less favorable prognosis concerning recurrence rates and pain frequency during one year of follow-up. Regardless of hernial defect width, female patients and patients with preoperative pain are at higher risk of developing chronic pain requiring treatment. Thus, the results of the study suggest an increased risk of developing complications during and after surgery, general complications, and an increased risk of reoperation due to complications as the hernial defect size increases according to the EHS classification. There is also an unfavorable relationship with recurrence rates and pain frequency after one year. Pain at rest and during physical exertion, as well as chronic pain requiring treatment, were closely related to female gender, preoperative pain, and higher ASA scores. Compared to standard non-tension hernioplasty techniques, the posterior separation hernioplasty technique demonstrated significantly lower rates of intraoperative and postoperative complications, as well as reoperations related to these complications. Since postoperative hernias increase in size over time, with correspondingly worse outcomes, the feasibility of a wait-and-see approach in hernia repair should be carefully considered. Patients with very significant adverse factors should be operated on by an experienced hernia surgeon.

### Conclusions:

1. The most significant predictors of hernia recurrence are the hernia repair technique, the hernial defect size according to the EHS classification, and the BMI.
2. The results of perioperative monitoring of intra-abdominal pressure for  $W3-W4 \geq 11$  support the priority of posterior separation hernioplasty, while for  $< 11$ , anterior separation hernioplasty may be performed.
3. The algorithm for selecting the method of repair (onlay, sublay) or separation (anterior, posterior) hernioplasty for postoperative ventral hernias W2, W3, W4 is based on the condition of the musculo-

aponeurotic structures of the anterior abdominal wall and the intraoperative intra-abdominal pressure monitoring.

4. Optimization of the tactical and technical aspects of surgical treatment in patients with postoperative ventral hernias reduced the rate of early postoperative complications from 16.1% to 9.1% and recurrence from 10.7% to 4.5% ( $p < 0.05$ ).

#### Literature.

1. Mahmoud, N. N. et al. (2017) minimally invasive surgery for complicated diverticulitis. *Journal of Gastrointestinal Surger*, vol. 21, no 4, pp. 731-738.
2. Canton, S. A. et al. (2017) Laparoscopic ventral hernia repair with the Slim-Mesh technique. *Updates Surg*, vol. 69, no 4, pp. 479-483.
3. Burla, M. M. et al. (2023) Management of obturator hernias: A systematic review and meta-analysis. *Hernia*, vol. 27, no 4, pp. 795-806.
4. Alayon-Rosario, M. et al. (2021) Primary thoracoabdominal hernias. *Hernia*, vol. 25, no 6, pp.1621-1628.
5. Linn, J. G. et al. (2022) Evaluation of long-term intraperitoneal biomaterials in ventral hernia treatment. *Surgical Endoscopy*, vol. 36, no 4, pp. 3210-3220.
6. Miserez, M. et al. (2009) The European Hernia Society classification of primary and incisional abdominal wall hernias. *Hernia*, vol. 13, no 4, pp. 407-414.
7. Girardi, A. et al. (2015) Impact of mesh type on incisional hernia recurrence. *Hernia*, vol. 19, no 2, pp. 259-266.
8. Carbonell, A. et al. (2021) Single-stage mesh repair of ventral hernias in contaminated fields. *JAMA Surgery*, vol. 156, no 4, pp. 345-354.
9. Rosen, M. et al. (2022) Comparison of biologic vs synthetic mesh in complex hernia repair. *JAMA Surgery*, vol. 157, no 4, pp. 293-301.
10. Mallett, S. et al. (2021) Systematic review and meta-analysis of ventral hernia repair outcomes. *Hernia*, vol. 25, no 2, pp. 377-389.