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Comprehensive Surgical Approach for Patients with Ventral Hernia and Morbid Obesity

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Abstract **Introduction.** There is an increasing trend in the number of people with overweight and obesity in almost all developed countries at the present time. The number of patients with co-morbidities associated with obesity, including ventral hernias, is increasing. **The aim of the study** is to improve the quality of ventral hernia treatment in morbidly obese patients by improving the tactical and technical aspects and optimizing the choice of hernioplasty technique. **Materials and methods of investigation.** The study is based on clinical and laboratory examination of 121 patients with ventral hernias, who were operated on at the surgical department of the 1st clinic of Samarkand State Medical Institute during the period from 2012 to 2021. **Results of the study.** The use of the improved pneumobandage has significantly improved the quality of preoperative preparation of patients with ventral hernia and morbid obesity, reduced the risk of intra-abdominal hypertension after hernioplasty, improved the patient's condition earlier and reduced the incidence of postoperative extraabdominal complications from 7.4% to 4.5% accordingly. **Conclusions.** Application of the suggested algorithm taking into account the improved tactical and technical aspects of surgical treatment of ventral hernias in morbidly obese patients permitted to decrease significantly the total rate of postoperative complications from 15% to 9% (p=0,045), including wound complications from 11% to 5%, and also to decrease significantly the duration of surgical treatment and rehabilitation periods after various variants of hernio- and abdominoplasty.

Keywords Postoperative ventral hernia, Complication, Compartment syndrome, Prevention

1. Introduction

There is an increasing trend in the number of people with overweight and obesity in almost all developed countries at the current time. The number of patients with co-morbidities associated with obesity, including ventral hernias, is increasing as well.

One of the causes of ventral hernias is obesity. Patients with varying degrees of obesity constitute 50 to 70% of all ventral hernia patients, with 34% having morbid obesity. Obesity is one of the major contributing factors for Hernia occurrence as well as its recurrence post surgeries, i.e. obesity as an etiologic factor in the occurrence or recurrent ventral hernia is recognized undeniably. The recurrence rate after hernioplasty is 3-13%, and with morbid obesity it reaches up to 28%.

One of the significant problems of large and giant ventral hernia treatment, besides technical aspects, is an increase in intra-abdominal pressure (IAP), which leads to the development of intra-abdominal hypertension, respiratory and cardiac failure, which significantly worsens the early postoperative period, with a high mortality rate.

The significant percentage of unsatisfactory outcomes and the lack of choice of the optimal method of treatment prompt further research in this field. The above dictates the necessity to develop and implement in practice optimal approaches to surgical treatment of ventral hernias in morbidly obese patients, especially in terms of the preparatory phase with an assessment of the human reserve capacity.

2. The Aim of the Study

The aim of the study is to improve the quality of ventral hernia treatment in morbidly obese patients by improving the tactical and technical aspects and optimizing the choice of hernioplasty technique.

3. Materials and Methods of Investigation

The study is based on clinical and laboratory examination of 121 patients with ventral hernias, who were operated on at the surgical department of the 1st clinic of Samarkand State Medical Institute during the period from 2012 to 2021. All patients were operated on routinely. The patients were divided into two groups depending on the choice

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of treatment strategies. The first group, a comparison group, consisted of 54 patients in whom hernioplasty was performed using polypropylene prosthesis. The second group, the main group, consisted of 67 patients in whom hernioplasty was performed using a polypropylene prosthesis in combination with DLE.

All patients underwent anthropometry with the detection of body weight. At the time of measurement, it was noted that patients had pathological obesity, BMI ranged from 30 to 36. - alimentary obesity caused by peculiarities of eating behavior in combination with low physical activity. Obesity was assessed according to the classification proposed by WHO.

Patients were classified according to the degrees of ptosis of the anterior abdominal wall according to the classification of A. Matarasso (1989). Minimal and medium ptosis (I-II degree) was observed in 34 and 42 patients with III-IV degree obesity respectively. Moderate and severe ptosis (III-IV degree) was observed in 20 and 25 patients with III-IV degree obesity.

Out of 121 patients, 90 (74.4%) patients had comorbidities. Among them 49 patients had 1 concomitant pathology, 29 patients had 2 and 12 patients had 3 concomitant diseases. Among the comorbidities there were often cardiovascular diseases in 83.4% of patients, respiratory system pathology in 22 (10.1%) patients, varicose veins of the lower extremities in 29 (13.4%) patients, and diabetes mellitus in 12 (5.5%) patients. The frequency of concomitant pathology in the study groups is presented in Fig. 2.4.

Preoperative preparation for surgery was performed with the participation of cardiologist and pulmonologist. We studied the following Lung Indices by common methods: such as Stange's test, respiratory rate, respiratory volume, minute respiratory volume, vital capacity, maximal lung ventilation.

In 46 (68.6%) patients of the main group with ventral hernias at the preoperative stage we performed training adaptation to increase intra-abdominal pressure using an improved pneumatic bandage belt.

Before the operation, the patients underwent hygienic treatment of the anterior abdominal wall, and an area on the skin was marked. Patients in the first comparison group underwent hernioplasty with local tissues and hernioplasty with a polypropylene prosthesis (Fig. 1).

In the main group, the choice of optimal hernioplasty was more differentiated. For this purpose, a quantitative assessment of risk factors for postoperative hernia recurrence was developed.

The developed program on the basis of clinical and computerized hernioabdominometry of the anatomical and functional state of the abdominal wall in the examined patients as well as taking into account the size of the hernia gate, age, functional state of the respiratory, digestive and urinary systems. Obesity allows us to optimize the choice of treatment tactics for ventral hernias in morbidly obese patients (Table 1).

These factors, which influence the results of treatment, were evaluated on a point scale. Patients in the main group were divided into 3 subgroups based on the results of the program.

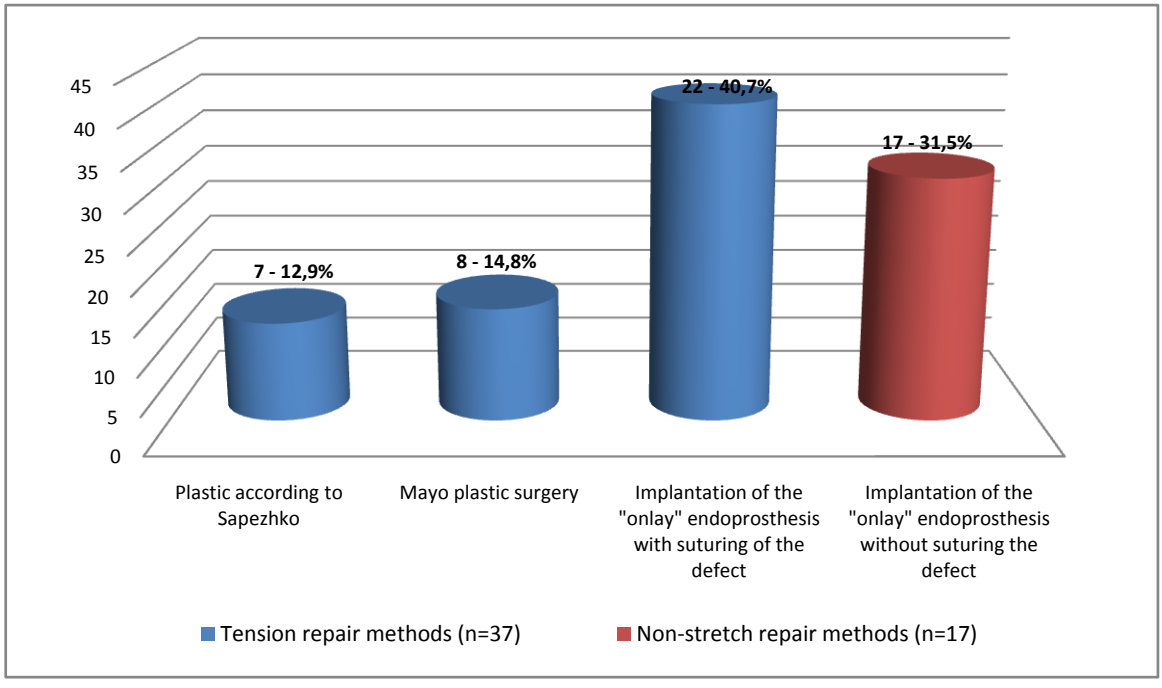

Figure 1. Distribution of patients in the comparison group by type of hernioplasty

Table 1. Scoring system of indications for the use of different methods of plastic surgery

№	Risk Factors	Quantitative characteristics	Points
1	State of the abdominal wall according to ultrasound, CT scan.	Norma Mild weakness Severe weakness	0 1 2
2	Dimensions of the hernia gate	Up to 5 cm 6-10 cm 11-15 cm More than 15 cm	0 1 2 3
3	Abdominoptosis	Grade I II degree III degree IV degree	0 1 2 3
4	Age	25-44 years old 45-59 years old Age 60-74 75-90 years old.	0 1 2 3
5	Functional state of the respiratory system	No violations Intermittent difficulty breathing Chronic respiratory failure	0 1 2
6	Functional state of the digestive system	No violations Intermittent constipation Constant constipation	0 1 2
7	Functional condition of the urinary system	No violations Intermittent difficulty Persistent difficulty urinating	0 1 2
8	Severity of adhesions	No adhesions Spikes between the hernia sac Abdominal adhesions	0 1 2

Patients in the 1st subgroup with a total score of up to 5 (Table 1) and with a hernia gate diameter of less than 5 cm according to computerized hernioabdominometry (Fig. 2) underwent "onlay" endoprosthesis implantation with suturing of the defect (Fig. 3). This group consisted of 24 (35.8%) patients who usually had small defects. All patients in this subgroup underwent abdominoplasty due to obesity and abdominoptosis.

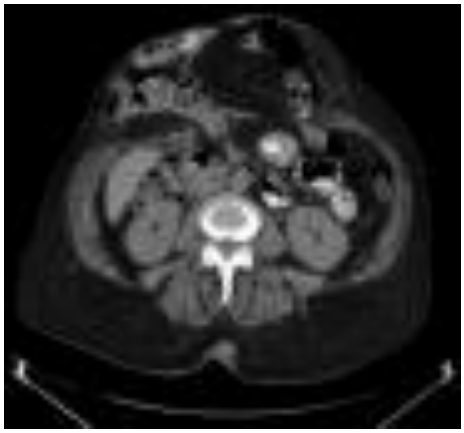

Figure 2. CTGA of patient P. 59 years old, No. IB 3754/296

Figure 3. Onlay implantation with suturing of the defect

Figure 4. CTGA of patient R. 49 years old, No. IB 2965/268

Figure 5. Onlay implantation without suturing the defect

In the 2nd subgroup with a score from 6 to 10, taking into account CTGA data on the diameter of the hernia gate up to 10 cm (Fig. 4) and taking into account the risk of tissue tension, constitutional features affecting the postoperative period, we performed tension-free plasty. In order to increase the volume of the abdominal cavity, to prevent the development of SAC, after the abdominal cavity was separated by the hernia sac flap, the anterior abdominal wall plasty was performed by applying a mesh over the aponeurosis without suturing it (Fig. 5). Endoprosthesis

fixation was performed with U-shaped sutures. These sutures were preliminarily placed before the closure of the abdominal cavity with a hernia sac flap, which captured all layers of the muscular-aponeurotic wall up to the peritoneum.

An important innovative solution was undertaken in 12 (17.9%) patients in the 3rd subgroup of the main group of patients. In these patients with a hernia defect size of more than 10 cm according to CTGA data, a combined tension-free hernioplasty "onlay + sublay" was performed, i.e. one implant was placed behind the muscular-aponeurotic layer after the abdominal cavity delineation with a hernia sac flap, the second implant was placed above the aponeurosis.

After the abdominal cavity was delineated with peritoneum, an implant was cut out; its perimeter was 3 cm larger than the size of the hernia defect; then the edges of the mesh implant were sutured with U-shaped sutures in advance.

We would like to draw attention to this technical aspect: pre-stitching the implant greatly simplifies the technique of its fixation.

Then the endoprosthesis was placed according to the "sublay" type, the previously placed U-shaped sutures were passed through all layers over the aponeurosis and the second endoprosthesis was fixed to these sutures with the placed "onlay".

We also applied nodal sutures between the endoprostheses, creating an artificial "white line" of the abdomen. Of particular importance of this method is anatomical and physiological reconstruction of the anterior abdominal wall as well as the white line of the abdomen. The use of this method in the clinic gave good anatomical and functional results.

In the 4th subgroup of patients with grade III-IV abdominoprotosis and scores from 16 to 20, there was also a high risk of tissue tension and IAP increase, with excessive tissue tension during suturing and high probability of suture eruption in the postoperative period being a significant factor that kept us from performing only non-tensioned alloplasty. In such cases we used non-tensioned alloplasty with mobilization of the vaginas of rectus abdominis muscles according to Ramirez (1990) (Table 2).

In general, the improvement of technical aspects in the main group allowed: due to suturing the implant in advance with U-shaped sutures, the surgical technique was simplified; and due to combined implant fixation in the distant postoperative period, the cases of recurrence were reduced to zero.

In the main group, all patients underwent dermatolipidectomy (DLE) after completing anterior abdominal wall plasty.

Immediately before the surgery, a skin "marking" was performed. The skin area to be removed, which bordered the hernial bulge, the old postoperative scar, and the skin-fat fold, was determined when the patient was standing (Fig. 6).

Based on a comparative analysis of the effectiveness of the proposed tactical and technical aspects in ventral hernias in morbidly obese patients, we developed an algorithm for preoperative preparation and selection of a hernioplasty technique (Fig. 7).

Table 2. Types of hernioplasty in the main group

Subgroups	Type of operation	Quantity	%
Tension methods of plastic surgery			
1st subgroup	Implantation of "onlay" endoprosthesis with suturing of the defect +DLE	24	35,8
Non-tensioned methods			
2nd subgroup	"Onlay" endoprosthesis implantation without suturing the defect + DLE	18	26,9
Subgroup 3	Combined "onlay + sublay" implantation of an endoprosthesis without suturing the defect + DLE	12	17,9
4th subgroup	Implantation by the combined method "onlay + sublay" without suturing the defect with mobilization of the vaginas of rectus abdominis according to Ramirez + DLE	13	19,4
	Total	67	100

Figure 6. Anchor-type skin marking (Castanares cut)

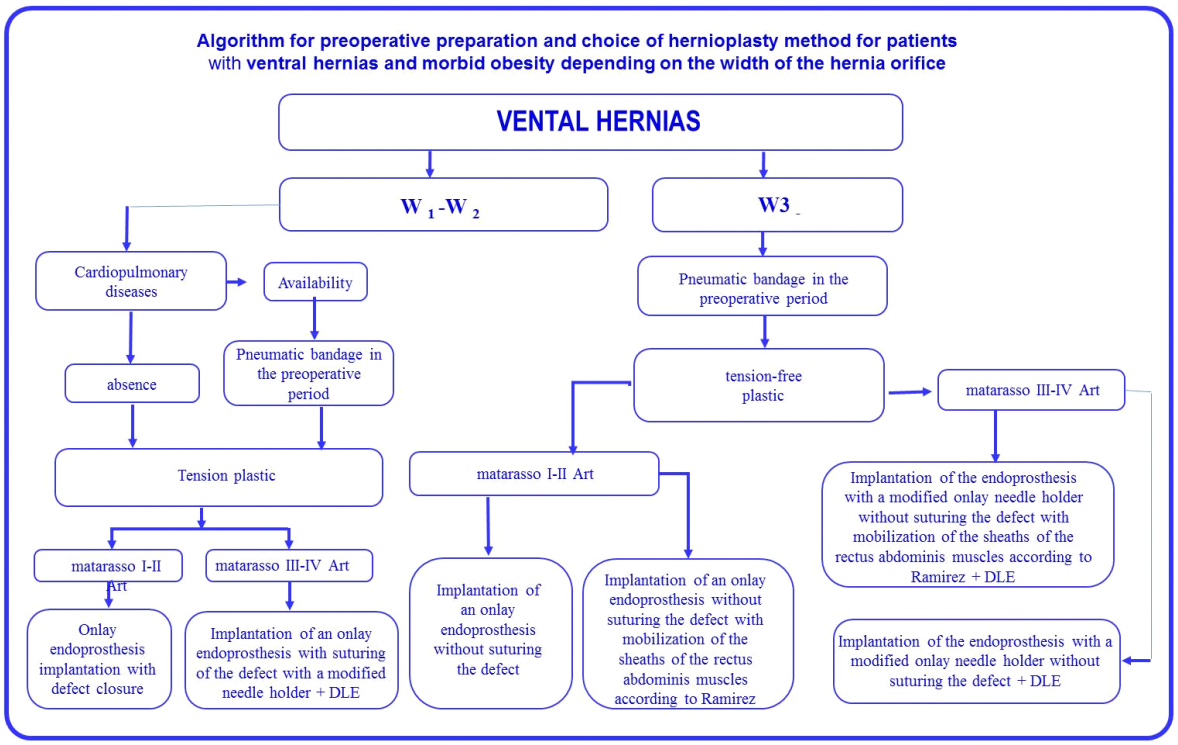

Figure 7. Algorithm of hernialloplasty method selection

4. Results of the Study

Improved choice of surgical treatment tactics for ventral hernia, surgical techniques and other innovations developed and introduced in this study could not but have an impact on the immediate results of management of this category of patients. Normal gastrointestinal function was preserved in 119 (98,4%) patients after surgery, only 2 (1,6%) patients (one patient per each study group) had intestinal paresis and 1 (0,8%) patient from the comparison group had urinary retention treated with medication.

Bronchopulmonary complications were noted in 3 (2.5%) cases. The development of CAD (compartment) occurred in 1 (1.8%) patient of the comparison group, the patient required prolonged EVI with breathing training, which was successfully treated conservatively. Cardiovascular complications occurred in 2 (1.6%) patients. Both respiratory and cardiovascular complications were also associated with abdominal compression due to hernioplasty of large ventral hernias. Among wound complications, postoperative hematomas were noted in 2 (3.7%) and 1 (1.2%) cases, respectively, seromas in 2 (3.7%) and 1 (1.5%) patients, lymphoria in 3 (2.5%) patients, in 2 and 1 cases in comparison and main groups respectively, wound suppuration in 1 (1.8%) patient in comparison group and skin flap edge necrosis in 2 (3.7%) and 1 (1.5%) cases.

It should be noted that, on average, there were 2-3 complications per patient in the comparison group in the form of a combination of bronchopulmonary and/or cardiovascular complications with wound complications. Overall, there were 8 (14.8% of 54) patients in the comparison group with different complications, of which 6 (11.1%) had wound complications and 4 (7.4%) had general extra-abdominal complications (Fig. 8).

There were 6 (8.9% of 67) patients in the main group with various complications, 3 (4.5%) had wound complications and another 3 (4.5%) had general complications. On a comparative basis, there was a significant improvement in the number of complications in the main group (Criterion χ^2 =4.043; Df=1; p=0.045).

Intraabdominal Pressure was measured at all stages of treatment Based on the data obtained, regular changes in intra-abdominal pressure values towards their increase at the stages of surgery associated with hernial content immersion and hernioplasty were revealed, as it was mentioned earlier.

We analyzed the long-term results in 98 (76.8%) out of 121 morbidly obese patients operated on for ventral hernia (Table 5.3). To assess the long-term results, the patients were subjected to a thorough questionnaire, outpatient and inpatient examination. The long-term results were studied over a period of 1 to 5 years. The course of 37 (92.5%) patients in the comparison group and 42 (79.2%) in the main group could be followed for more than 3 years, sufficient for final confirmation of clinically significant disease recurrence.

In general, the improved method for prevention and treatment of ventral hernia in morbidly obese patients by implanting an endoprosthesis by the combined method "onlay + sublay" without suturing the defect and with Ramirez mobilization of rectus abdominis muscle vaginas

made it possible to level out the recurrence from 12.5% in the comparison group to 1.9% in the main group (Fig. 9).

In the dynamic follow-up of patients in the comparison group with morbid obesity, body weight indicators did not undergo significant changes. However, the addition of hernioplasty with abdominoplasty had a positive effect on further life prospects, because it is the abdominal type of fat tissue distribution that is most associated with a high risk of cardiovascular diseases and type 2 diabetes mellitus that undergoes significant changes.

All patients who underwent abdominoplasty had excellent aesthetic effect, the patients got rid of skin-subcutaneous folds, the abdomen became flat, taut, the suture line runs along the line connecting the spinous appendages of the iliac bone and is practically not visible. All the patients were satisfied with the obtained aesthetic result.

In the aspect of functional effect, due to the optimal scheme of preoperative preparation, performing abdominoplasty, there was an improvement of external respiration indices, and complications from the cardiovascular system were minimized. Indexes of spiometry in comparison preoperatively and postoperatively improved, i.e. there was a stable increase of respiratory volume and vital capacity of the lungs in all patients.

In the studied groups 70 patients (57,8%) initially had arterial hypertension of various degrees. In the dynamic observation in the distant postoperative period the patients in the comparison group showed the preservation of high BP values, with a tendency to transition to more severe degrees of arterial hypertension. The patients in the main group showed a decrease in high BP values, with a tendency to transition to a milder degree of arterial hypertension.

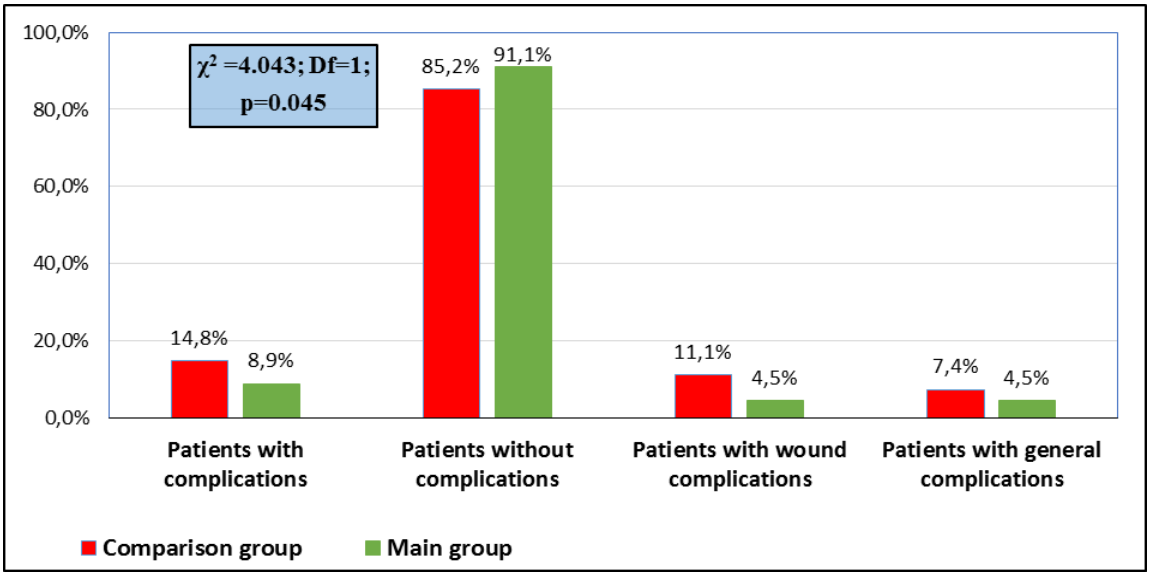

Figure 8. Distribution of patients according to the frequency of complications after hernioplasty

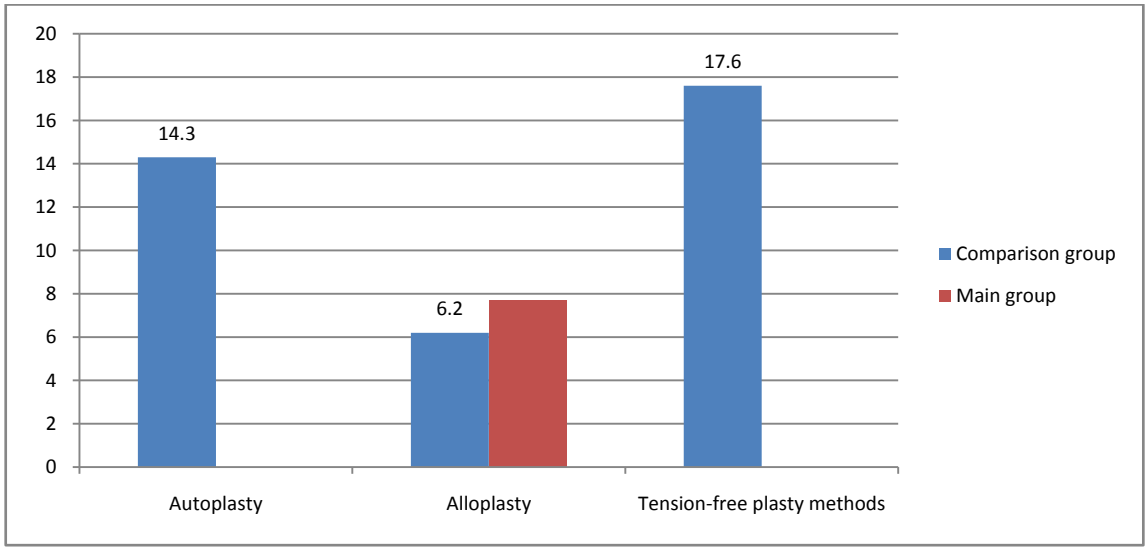

Figure 9. Recurrence rate in ventral hernia after hernioplasty

5. Conclusions

- The use of the improved pneumobandage has significantly improved the quality of preoperative preparation of patients with ventral hernia and morbid obesity, reduced the risk of intra-abdominal hypertension after hernioplasty, improved the patient's condition earlier and reduced the incidence of postoperative extra abdominal complications from 7.4% to 4.5% accordingly.
- Improvement of technical aspects made it possible: due to stitching the implant in advance with U-shaped sutures, the surgical technique was simplified; and due to combined implant fixation in the distant postoperative period, the cases of recurrence were reduced to zero;
- Application of the suggested algorithm taking into account the improved tactical and technical aspects of surgical treatment of ventral hernias in morbidly obese patients allowed reducing the total rate of postoperative complications from 15% to 9% (p=0,045), including wound complications from 11% to 5%, as well as significantly reducing the duration of surgical treatment and rehabilitation periods after various variants of hernio- and abdominoplasty.

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