AN INNOVATIVE APPROACH IN THE TREATMENT OF WOUND COMPLICATIONS IN PATIENTS WITH POSTOPERATIVE VENTRAL HERNIAS

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https://doi.org/10.5281/zenodo.8055572

Abstract. *The article presents the experience of an innovative approach to reducing postoperative complications of allohernioplastic in patients with ventral hernias. The authors divided the patients into three groups: the control group (67 patients) who underwent traditional alloplastic using a polypropylene (PP) mesh, the 1st main (61 patients) group, which intraoperative for alloplastic used a PP mesh after processing it with a hemostatic sponge, the 2nd main group (43 patients), who underwent alloplastic after treatment of the PP mesh with a hemostatic sponge in combination with the antiseptic miramistin. As a result, postoperative wound complications were reduced by more than 3.4-4 times in comparison with the control group.*

Keywords: *alohernioplasty, ventral hernia, endoprosthesis, hemosponge.*

Introduction. The supraponeurotic method of fixing the endoprosthesis "directly" is the most commonly used method in clinical practice, since it justifies the positions of biomechanics, the most durable natural tissues of the anterior abdominal wall are the anterior layers of the sheath of the adjacent muscles, to which the endoprosthesis is attached [3].

A characteristic disadvantage of "in place" fixation of a polypropylene endoprosthesis is the goal of a wide detachment of subcutaneous fat with skin from aponeurotic tissues. In this case, a tumor and a tumor of the vessels occur, which is detected when an abundant wound exudation is detected. In addition, the fixation of polypropylene provokes aseptic inflammation, which results in sulfur infection with subsequent suppuration [1,6,7]. According to B.Sh. Gogia et al., [2], long-term results of surgical treatment of hernia in 243 patients with certain complications from the wound, inflammation, that hernia recurrence occurred in 77.9% of patients after wound suppuration and in 70.7% of patients who had hematomas and seromas.However, the most common type of incisional hernia repair is supraponeurotic [3,4] and, therefore, the search for the most frequently detected diseases.

Clinical studies were performed in surgical plastic surgery at Tashkent Pediatric Medical Institute and in the Republican Center for Disabled during 2010-2022 in three group of patients. Control group of patients (n=67) operated on for postoperative hernias of the anterior abdominal tissue. A light polypropylene mesh was used (Esfil light, dangerous density - 38 g / m2, monofilament diameter - 0.09 mm, thickness 0.3-0.4 mm, pore size - 1.5 mm, volumetric porosity 85-90%) with fixing it on the anterior abdominal wall in the "in place" position. Nets fixed with polypropylene non-absorbable monofilament 2/0. For the prevention of seroma and purulent-inflammatory wound complications, we for the first time used a new domestic biodegradable preparation, a local hemostatic "Hemosponge" collagen (HemG), developed at the Research Center for Chemistry and Polymers of the Academy of Sciences of the Republic of Uzbekistan and State Institution "RSNPTSKh named after acad.V. Vakhidov" [5].

The first group of patients (n=61) was also operated on using a polypropylene mesh (Esfil light, specific gravity - 38 g/m2, pore size - 1.5 mm, monofilament mesh, monofilament diameter - 0.09 mm) "in the prone position".

The second group of patients (n = 43) involved in allohernioplasty (Esphilia of the lung) was performed in initially infected tissues, as a result of penetration into the infection are ligature fistulas and inflammatory infiltrates that occur after previously performed operations. In this group, in the case of hernia ring plasty, after its fixation, the polypropylene mesh is treated with HemH in infections with a broad-spectrum antibiotic - miramistin.

By the nature of the operations performed, by the detection and significant hernia defect, age, gender and other manifestations of pronounced groups of diseases.

Characteristics of patients by sex and age is presented in Table 1

Table 1

Distribution of patients by gender in the compared groups

Gender	Main group I (n=61)		Main group II (n=43)		Control group (n=67)	
	abs	%	abs	%	abs	%
Men	34	55,7±6,4	23	53,5±7,7	41	61,2±6,0
Women	27	44,3±6,4	20	46,5±7,7	26	38,8±6,0
Total:	61	35,7±3,7	43	25,1±3,8	67	39,2±3,7

As follows from Table 1, the number of patients by sex and age is representative in all groups.

Table 2 shows the distribution of patients by comorbidities in the compared groups.

As can be seen from Table 2, almost 81% of patients had certain comorbidities, among which cardiovascular diseases, respiratory diseases and diabetes mellitus were more common, as well as obesity. They are risk factors and may cause postoperative systemic complications.

Table 2

Distribution of patients by comorbidity in the compared groups

Related pathology	Main group I (n=61)		Main group II (n=43)		Control group (n=67)	
	abs.	%	abs.	%	abs.	%
Ischemic heart disease	16	26,2±5,7	9	20,9±6,3	15	22,4±5,1
Hypertension	12	19,7±5,1	7	16,3±5,7	14	20,9±5,0
History of myocardial infarction	3	4,9±2,8	1	2,3±2,3	3	4,5±2,6
Chron. obstruction disease lungs	6	9,8±3,8	5	11,6±4,9	8	11,9±4,0
Obesity	8	13,1±4,4	6	14,0±5,4	13	19,4±4,9
Diabetes mellitus	5	8,2±3,5	4	9,3±4,5	5	7,5±3,2
Diseases of the digestive organs	3	4,9±2,8	5	11,6±4,9	4	6,0±2,9
History of acute disorders of cerebral circulation	1	1,6±1,6	-	-	1	1,5±1,5
Chronic pyelonephritis	2	3,3±2,3	4	9,3±4,5	1	1,5±1,5
Total patients with comorbidities	56	91,8±3,5	41	95,3±3,3	64	95,5±2,6

Total patients without concomitant pathology	5	8,2±3,5	2	4,7±3,3	3	4,5±2,6
Total:	61	35,7±3,7	43	25,1±3,3	67	39,2±3,7

We used the classification of J.P. Chevrel and A.M. Rath (1999) [8], which distinguish postoperative hernias of the abdominal wall by location, size of the hernia orifice and recurrence rate after primary surgery (Table 3).

Table 3

Distribution of patients according to the location of the hernial defect according to the classification of J.P. Chevrel and A.M. Rath in the compared groups

Symptom	I main group (n=61)		II main group (n=43)		Control group (n=67)	
	абс.	%	абс.	%	абс.	%
M1	40	65,6±6,1	28	65,1±7,4	41	61,2±6,0
M2	11	18,0±5,0	9	20,9±6,3	18	26,9±5,5
M3	6	9,8±3,8	5	11,6±4,9	5	7,5±3,2
M4	3	4,9±2,8	1	2,3±2,3	1	1,5±1,5
L3	1	1,6±1,6	-	-	2	3,0±2,1
Total:	61	35,7±3,7	43	25,1±3,3	67	39,2±3,7

Table 4 shows the distribution of patients according to the size of the hernial defect in the two main groups and in the comparison group. As shown in the table, the main group consisted mainly of patients with hernia defects W2 and W3.

Table 4

Distribution of patients according to the size of the hernial defect according to the classification of J.P. Chevrel and A.M. Rath in the compared groups

Symptom	I main group (n=61)		II main group (n=43)		Control group (n=67)	
	abs.	%	abs.	%	abs.	%
W1 (up to 5 см)	6	9,8±3,8	4	9,3±4,5	7	10,4±3,8
W2 (5-10 см)	31	50,8±6,5	26	60,5±7,5	37	55,2±6,1
W3 (10-15 см)	18	29,5±5,9	11	25,6±6,7	16	23,9±5,2
W4 (> 15 см)	6	9,8±3,8	2	4,7±3,3	7	10,4±3,8
Total:	61	100	43	100	67	100

Table 5 shows the distribution of patients by hernia location.

Table 5

Distribution of patients by hernia location according to the classification of J.P. Chevrel and A.M. Rath in the compared groups.

Symptom	I main group (n=61)		II main group (n=43)		Control group (n=67)	
	abs.	%	abs.	%	abs.	%
M (median)	60	98,4±1,6	43	100±0,0	65	97,0±2,1
L(lateral)	1	1,6±1,6	-	-	2	3,0±2,1
M+L(combination)	-	-	-	-	-	-

Total:	61	100	43	100	67	100

In the patients of the comparison group, after applying the PP mesh in the onlay position, all of them had serous hemorrhagic exudate discharge, especially in the repair of large incisional hernias. In 23 (%) patients in this group, the drainage period was more than 4 days due to the continued release of exudate in a volume of more than 30-40 ml per day (Table 6). In the main group I, in 53.33% of patients, the drainage tube was removed on the first day after the operation, on the 2nd day in 11 (36.66%), in 3 (10%) the drainage was removed on the 3rd day after the operation. In the main group II, the drainage tube was removed on the 1st day in 10 (41.66%) patients, on the 2nd day in 12 (50%) patients, in 2 (8.33%) patients on the 3rd day. The average duration of wound drainage in I and II main groups was 1.78±0.46 and 2.14±0.18 days, respectively, and in the comparison group 3.86±0.28. It should be noted that in the I main group in 24 and in the II main group in 13 patients the postoperative wound was not drained and there were no complications associated with the refusal of drainage.

Table 6

Distribution of patients according to the timing of wound drainage in the compared groups

Признак	I основная группа (n=61)		II основная группа (n=43)		Контрольная группа (n=67)	
	абс.	%	абс.	%	абс.	%
Number of patients	37[&]	60,7±6,3***	30[&]	69,8±7,1**	65[&]	97,0±2,1
Time of drainage, days	1,57±0,11***		2,10±0,14***		4,12±0,29	
Drainage Timing						
Day 1 (%)	20	32,8±6,1***	7	16,3±5,7*	-	-
Day 2 (%)	13	21,3±5,3*	13	30,2±7,1	25	37,3±6,0
Day 3 (%)	4	6,6±3,2**	10	23,3±6,5	18	26,9±5,5
Day 4 and more (%)	-	-	-		22	32,8±5,8

Note: * - significantly compared with the indicators of the control group (*- P <0.05; **- P <0.01; ***-P<0.001)

&- &- in the I main group in 24 and in the II main group in 13 patients, the postoperative wound was not drained.

In the study of the dynamics of the formation of wound exudate, we found that in comparison with the control group in patients of the main groups, this indicator is statistically significant (p = 0.007) and significantly less, especially on days 2-4. In the comparison group in patients, the maximum exudate values were 131.3±8.7 ml, and in the I main and II main groups, respectively, 56.1±6.8 and 53.1±6.8 ml. It should be noted that the highest production of exudate during the wound process in the main group takes place on the 2nd day after surgery and then tends to decrease, while in patients of the control group, the peak of the volume of exudate released through the drainage falls on days 2-4. At earlier terms in the main group, the hemorrhagic component of exudation is replaced by serous-hemorrhagic and serous, which indicates more intensive reparative processes in the area of plastic surgery. In order to objectify the study and control the adequacy of drainage of the implantation area, patients underwent ultrasound examinations of the anterior abdominal wall in the implantation area on days 2-5.

Table 7 shows the duration of postoperative wound drainage in the main group and in the comparison group. In the main group I, the duration of drainage was minimal, i.e. 1.78±0.46, and in the II main group 2.14±0.18.

Relatively long drainage in the second main group, we associate with the fact that the operations were performed under conditions of infection. Given these circumstances, in some cases, the drainage tubes were removed on the 3rd day, and in 1 patient, the drainage was removed on the 4th day. The criterion for removal of the drainage was a decrease in the volume of exudation below 30 ml and the results of a control-dynamic ultrasound examination of the surgical area.

Table 7

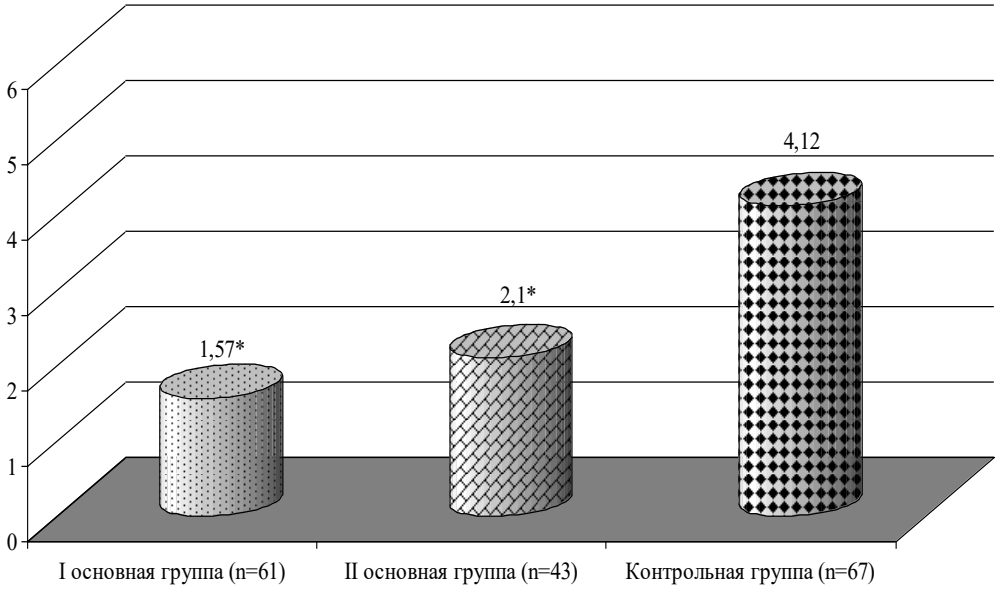
Dynamics of the volume of wound discharge in patients of the main groups and the comparison group (in ml)

Group of patients		Control group (n=67)	I& main group (n=37)	II& main group (n=30)
The volume of exudate by the terms of the study (days)	Day 1	131,3±3,7 (n=67)	56,1±2,9* (n=37)	53,1±2,6* (n=30)
	Day 2 cyr.	148,4±5,1 (n=56)	44,3±2,7* (n=17)	50,1±2,2* (n=16)
	Day 3 cyr.	153,1±5,6 (n=27)	30,1±1,8* (n=6)	30,0±1,7* (n=3)
	Day 4 cyr.	87,3±8,3 (n=7)	-	-
	Day 5 cyr.	39,4±3,6 (n=2)	-	-
	Day 6 & more	30,4±2,4 (n=1*)	-	-

Note: *-significant compared with the control group (*-P<0.001)

&- in the main group I in 24 and in the main group II in 13 patients the postoperative wound is not drained.

Figure 1 shows the duration of serous exudation in patients of the main groups and the comparison group.



P<0.001) Fig.1. The duration of serous exudation in patients of the main groups and the comparison group

Note: *-significantly compared with the control group (*-).

In a number of cases in the comparison group, the discharge of serous discharge was delayed, and did not tend to decrease in volume. However, there were no infiltrative changes in the postoperative wound. In main group I, the duration of serous exudation was 1.78±0.46*, and in main group II, 2.14±0.18* days. As can be seen from Table 4.9, in the control group, the duration of serous exudation in comparison with the main groups exceeded more than 2 and 2.5 times, respectively.

In the I main group in 9 and in the II main group in 7 patients, the postoperative wound was not drained, i.e. in 16 patients. In accordance with the classification of J.P. Chavrel et A.M. Rath (1999), 9 patients had medium-sized hernias (W2), 7 had large-sized ones (W3). In 15 patients, the hernial defect was localized along the midline M, and in 1 patient in the right iliac region (L). Patients from the first day underwent control-dynamic ultrasound examination of the postoperative wound for the presence of accumulations of fluid in the subcutaneous tissue, in the area of the allograft. In 1 patient on the 3rd day, ultrasound examination revealed the presence of a seroma in the form of a cavity formation of a homogeneous structure of small size (3x2 cm), which resolved without additional interventions.

The measures we have developed for the prevention of postoperative wound complications of allohernioplasty are presented below. Measures for the prevention of wound complications of allohernioplasty were aimed at eliminating the causes of complications: 1) thorough hemo- and lymphocytosis; 2) prevention of seroma formation; 3) careful elimination of dead zones in the area of hernia ring plasty (between aponeurosis and muscles, mesh); 4) using HemG to achieve sealing of the pores of the mesh of a light mesh, because bacteria with a diameter of 0.6-1.5 microns penetrate into the pores, and for the first hours and days in the operation area, cells responsible for local immunity, as a rule, do not exist; 5) treatment of the mesh with a mixture of HemG and a broad-spectrum antibiotic is aimed at combating infection in the area of the surgical wound and implantation infection, because the antibacterial properties of miramistin are preserved until the complete resorption of HemH. Local complications in patients operated on using PP are presented in Table 8. We most often observed seromas and infiltrates. Hematomas of postoperative wounds are associated with the technique and the inevitable trauma of the operation; therefore, along with the "sparing technique" of the intervention, it is necessary to use various methods of local hemostasis. Infiltrates in the area of wounds during arthroplasty in most cases are associated with a natural reaction of the body to a foreign body. In order to reduce the amount of foreign material, we used a light mesh endoprosthesis "Esfil" and to cover them with HemG, which significantly reduces the reaction of tissues to the endoprosthesis. This phenomenon is called "mimicry" in the literature, when the tissues of the body do not recognize a foreign body covered with an inert composite material. It should be noted that the HemG preparation is a powder, and after alloplasty of the hernial orifice in the on lay position, the powder covers the entire surface of the mesh and the edges of the surgical wound, while hemo- and lymphorrhea stops immediately, and the pores of the mesh are filled with the drug powder. Within 3-5 minutes, the powder takes on a gel-like consistency, dead zones in the plastic area are eliminated, the mesh is glued to the aponeurosis and muscles. We used additional hemostasis using electrocoagulation only in the presence of bleeding from relatively large vessels. At the same time, we carried out local and sparing coagulation.

Considering that one of the reasons for the formation of seroma is a wide separation of the skin with subcutaneous fatty tissue, usually for 5 cm. In cases of a well-developed

musculoaponeurotic complex, we performed mobilization of the skin and subcutaneous tissue up to 3-4 cm. foreign body volume, i.e. meshes and areas of detachment of subcutaneous adipose tissue. In addition, using vertical U-shaped sutures, the subcutaneous tissue was fixed to the prosthesis and the bottom of the wound. Thus, the use of HemH, as well as suturing the wound with U-shaped sutures, allowed us in some cases to refuse to drain the wound. These measures allowed us to reduce the formation of seroma, i.e. predictor of suppuration of postoperative wounds and improve treatment outcomes.

The main group II included patients with a burdened history in terms of the presence of foci of infection or a dormant infection in the area of the hernia defect. In this group, we also used the same approaches as in the main group I, and taking into account the likelihood of infection in the area of surgical intervention, ex tempore immediately before the operation, we prepared a mixture consisting of HemH and the antibiotic Miramistin (2 grams). It should be noted that the prepared combination of HemG and the antibiotic miramistin fills the pores of the mesh, and thus provides a prolonged antibacterial action of the mesh during the biodegradation of HemH (the period of HemH biodegradation is 14 days). The postoperative wound in the II main group was sutured as in the I main group in order to eliminate the dead space.

Table 8 shows the frequency and nature of postoperative wound complications in the two main groups and in the comparison group.

Table 8

The frequency and nature of postoperative wound complications in patients with postoperative ventral hernias

Postoperative complications	I main group (n=61)		II main group (n=43)		Control group (n=67)	
	абс.	%	абс.	%	абс.	%
Seroma	3	4,9±2,8*	3	7,0±3,9	10	14,9±4,4
Hematoma	1	1,6±1,6	-	-	4	6,0±2,9
Infiltrate	4	6,6±3,2	1	2,3±2,3	3	4,5±2,6
Wound suppuration	-	-	-	-	4	6,0±2,9
Ligature fistulas	-	-	-	-	1	1,5±1,5
Marginal skin necrosis	-	-	-	-	2	3,0±2,1
Total	8	13,1±4,4**	4	9,3±4,5**	24	35,8±5,9

Note: * - significant compared with the control group (*-P<0.05; **-P<0.01)

From Table 8 it follows that in the comparison group; complications of prosthetic hernioplasty were observed in 24 (35.8%) cases, of which the highest frequency was prolonged seroma discharge (14.92%). We observed the formation of a hematoma in the area of mesh implantation in 4 patients suffering from grade II and III obesity (BMI 25–40 kg/m2), who had a large and one giant multi chamber postoperative hernia in two cases. To what extent they were associated with the technique and the inevitable trauma of the operation, possibly with the use of electrocoagulation for hemostasis. In all cases, hematomas were drained through the surgical wound. Wound suppuration was observed in 4 (6%) cases, with 2 patients being overweight and 2 suffering from diabetes. The wounds were treated according to the general principles of the treatment of purulent wounds, with a satisfactory outcome. We observed postoperative wound infiltration in 3 (4.47%) patients. On the one hand, this complication is associated with the natural

reaction of the body to a foreign body, the trauma of the operation, and with the use of electrocoagulation for the purpose of hemostasis in a large area.

We observed marginal skin necrosis in 2 (3%) patients with overweight and insulin-dependent diabetes mellitus, which required subsequent plastic closure of the skin defect with a satisfactory effect. In 1 (1.5%) patient, the formation of a ligature fistula emanating from a thread applied to the subcutaneous tissue in the lower section of the wound was noted. The ligature was removed, the wound channel was sanitized with an antiseptic, and the patient was discharged for outpatient treatment. The seroma formed in 10 (14.92%) required sanitation punctures under ultrasound control. We did not observe wound suppuration, and the removal of the mesh implant was not required in any case. There were no lethal outcomes in the observed patients.

In patients of the main group, the frequency and nature of wound complications are presented as follows: in groups II, and I seroma was observed, respectively, in 2 patients in each group - 4.08% and 5.7%, and in the control group - 14.92. Thus, seroma, which is one of the main predictors of purulent-inflammatory wound complications in allohernioplasty in the control group, is more than 2.5 times higher than in the main groups. Hematoma in the I main group, we observed in patients in the initial stages of the use of HemH, i.e. this complication was associated with technical errors and an important factor - the patients were obese II and III degrees.

As can be seen from Table 8, wound suppuration occurred in 4 (6%) patients in the control group, and we did not observe wound suppuration in the main group. We associate high rates of postoperative wound suppuration in the control group with the use of electrocoagulation for hemostasis, which, causing necrosis of the subcutaneous tissue, and in some cases, muscles, is a breeding ground for infection. Therefore, in this group of patients in the postoperative period, relatively prolonged hyperthermia after surgery is observed. We attribute this to a significant decrease in the frequency of seromas in the area of hernia repair in connection with the method we have developed to prevent the formation of seromas by using HemH. In the structure of postoperative wound complications, the leading place is occupied by: seromas, infiltrates, hematomas and suppuration of the wound. In the comparison group, with a significant difference (X2=5.167; p=0.023), patients with infectious complications prevailed.

Thus, the domestic preparation "Hemosponge" collagen is an effective means of hemo- and lymphostasis, has high adhesive characteristics and provides reliable hemostasis. In allohernioplasty of incisional hernias, it is necessary to sharply limit the use of electrocoagulation for the purpose of hemostasis. The use of a new domestic drug, local hemostatic "Hemosponge" collagen in allohernioplasty of large ventral hernias is an effective drug as a means of preventing seromas, hematomas, reducing wound discharge and purulent complications.

The complex of measures developed by us made it possible to reduce postoperative complications, the length of stay of patients in the hospital in the I main group - 5.9 ± 1.74 bed-days, in the II main group - up to 6.1 ± 2.12 bed-days, and in the control group - 11.3±3.47 bed-days.

REFERENCES

1. Anurov M.V. Influence of structural and mechanical properties of mesh endoprostheses on the effectiveness of plastic surgery of hernial defects of the anterior abdominal wall: abstract. cand. honey. Sciences. / M.V. Anurov. – M.: 2014. URL: http://rsmu.ru/fileadmin/rsmu/img/about_rsmu/disser/3/d_anurov_m v.pdf.

2. Gogia B.Sh., Chekmareva I.A., Paklina O.V. and other Morphofunctional aspects of recurrence of postoperative ventral hernias / Surgery. -2016.-№12.-p.55-60.
3. Meloyan, A.K., V.B. Bogdanovich, E.A. Nadyrov. The choice of tissue dissection technique for allohernioplasty of postoperative ventral hernias using the on-lay method// News of Surgery. - 2016. - V. 16, No. 3. - S. 53-60.
4. Parshikov V.V. To the question of the possibility of using ultralight titanium-containing mesh endoprostheses for abdominal wall plasty in conditions of infection (experimental study) / Surgery. Journal them. N.I. Pirogov. -2016.-No.11.-S.64-70.
5. Sadykov R.A., Ismailov B.A., Kim O.V. New film coating of cellulose derivatives for local hemostasis. News of surgery. Volume 27. - No. 3. -2019. -WITH. 256-263.
6. Sukovatykh B.S., Valuyskaya N.M., Pashkov V.M., Alimenko O.V., Grigoryan A.Yu. Indications and choice of abdominal wall prosthesis technology for the prevention and treatment of postoperative ventral hernias. Bulletin of Siberian medicine. 2016; 1(15): 89–97.
7. Cherkasov M.F., Khindikainen A.Yu., Pomazkov A.A., Sulima V.I. Experimental substantiation of the method for the prevention of postoperative wound complications of hernioplasty // Modern problems of science and education. -2017.-No.3.-S.17-23.
8. Chevrel J.P., Rath A.M. Polyester mesh for incisional hernia repair// Incisional hernia. - Berlin - Hiedelberg, 1999. - P. 327-330.