DEVELOPMENT OF A NEW DOMESTIC BIOCOMPATIBLE COMPOSITE MESH IMPLANT AND EVALUATION OF ITS EFFECTIVENESS IN VENTRAL HERNIA SURGERY IN AN EXPERIMENT

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Abstract*. The scientific article presents the results of the development of a new domestic biocompatible composite mesh implant and an assessment of its effectiveness in ventral hernia surgery in an experiment.Experimental studies were conducted in 109 laboratory rats in the Department of Experimental Surgery of the Russian Academy of Medical Sciences named after Academician V.Vakhidov. In laboratory rats, the formation of a postoperative ventral hernia was performed, followed by non-tensioning hernia repair using a polypropylene mesh in the Onlay position and a similar mesh with a composite coating. At various times (7.14, 21 and 30 days), the engraftment of the mesh implant and the features of tissue healing were studied. Experimental studies have shown that during Onlay alloplasty, a pronounced inflammatory reaction develops in the surrounding tissues within 7-10 days and there was a partial divergence of the peritoneum in the area of mesh fixation. A morphological assessment of the features of the engraftment of a mesh prosthesis with a composite coating with a photosensitizing property under the action of laser irradiation showed that it causes a less pronounced inflammatory reaction, while the coating also provided an increase in the degree of adhesion of the prosthesis to tissues and, accordingly, the strength of restoring the integrity of the anterior abdominal wall.*

Keywords*: experimental postoperative ventral hernia, Onlay allogernioplasty, mesh prosthesis, domestic biocompatible composite coating, photosensitization, laser irradiation.*

CONDUCTION

Ventral Postoperative Hernias (VHR)11-50% of all laparotomies are extremely common and occur [2,7,13]. At the same time, VHR is becoming more and more complex, and surgeries are using more and more complex methods of abdominal wall reconstruction [1,5,8]. Ventral hernias are associated with significant pain, risk of intestinal obstruction, strangulation, and a small but real probability of urgent plastic surgery [9]. Hernia repair is the most common surgical procedure. In the last two decades, procedures using artificial alloplastic meshes have become more important and demonstrated over traditional procedures [9,14]. Abdominal surgery nets are used to support natural tissues that are no longer able to maintain their characteristic shape and physical function. Most of the scientific work in the field of mesh application for hernioplasty has been focused on the clinical outcome, especially on the recurrence rate, biointegration, tissue compatibility and surgical technique [6.10]. Currently used surgical meshes must have high biocompatibility and durability. The main problem when using a surgical mesh is postoperative infectious complications, which can lead to generalized infection. According to reviews, the risk of infection of the mesh during hernia surgery ranges from several to even 10% [11,12], which

corresponds to at least several tens of thousands of cases annually requiring complex, expensive treatment and often the need for hernia removal [3,4,15].To improve treatment standards, new concepts related to the modification of the shape, structure and composition of the mesh are currently being developed. Research focuses on improving the mechanical strength of the meshes, biocompatibility, and provision of antimicrobial agents to accelerate healing, increase cell colonization, and reduce the risk of infection. The experiment describes biomechanical results in rats that have been implanted with selected new materials for implants, which in recent years have been proposed as an alternative to simple polypropylene nets.

Thus, the unresolved issue remains the choice of the best material with high efficiency, inertia, strength and biodegradation. In this regard, the implants used are unpromising for a number of reasons due to their low effect or high cost. An urgent direction is the development of domestic biocompatible composite materials for use in various fields of oral surgery with justification of their effectiveness in experimental research.

The purpose of the study to study the features of allogernioplasty using a mesh implant made of polypropylene and a similar mesh with a composite coating in experimental abdominal hernias.

MATERIALS AND METHODS OF RESEARCH

Experimental studies were conducted in the laboratory of experimental surgery with a vivarium of the State Institution "Republican Specialized Scientific and Practical Medical Center of Surgery named after V.Vakhidov". Mongrel white rats of both sexes, weighing 228±2.7 g, were used. The experiments were conducted in 28 rats in strict accordance with the International Ethical and Scientific Quality Standards for Planning and Conducting Animal Research TPC 125-2008(02040). Experimental studies were conducted in compliance with the rules adopted by the European Convention for the Protection of Vertebrates Used for Experiments or Other Scientific Purposes (ETS N 123), Strasbourg, 03/18/1986.

The animals were removed from the experiment by overdosing on narcotic drugs within the prescribed time limits: 3, 12 hours and then 1, 3, 7, 14, 21 and 30 days after surgery. Macroscopic studies were carried out by digital photo documentation.

Experimental studies included two directions in which the features of allogernioplasty using a polypropylene mesh implant and a similar mesh with a composite coating were evaluated under conditions of a sterile wound and under conditions of microbial contamination (Table. 1 and 2).

Table 1

Distribution of animals into study groups:
Comparative evaluation of allogernioplasty using a polypropylene mesh implant and a similar mesh with a composite coating

№	Groups	7day	14day	21day	30day	Total
1	Control	10	10	4	4	28
2	Main	10	10	4	4	28
	IN TOTAL	20	20	8	8	56

Note: The fatal outcome occurred in 5 individuals who were associated with anesthesia complications. These animals are not included in the course of research

Table 2

Distribution of animals into study groups:
Comparative assessment of the engraftment of a polypropylene mesh implant with a composite coating under conditions of microbial contamination.

№	Groups	7day	14day	21day	Total
1	Control	10	10	4	24
2	Main	10	10	4	24
	in total	20	20	8	48

A model of postoperative ventral hernia (POVG) in rats.

A model for the formation of large ventral hernias has been used in experimental studies (DuBayDA et al., 2005). The technique is as follows: under general anesthesia, an incision of the skin of the anterior abdominal wall is made in the form of a rectangular flap measuring 6 cm x 3 cm with a base 2 cm laterally to the median line. The flap of skin is separated from the underlying fascia with the exposure of the median line of aponeurosis of the rectus abdominis muscles. Laparotomy is performed up to 5 cm along the midline. The fascial incision is sutured with two 5-0 nodular catgut sutures, involving 3 mm of aponeurosis tissue and 1.25 cm from the upper and lower edges of the incision. The skin is then sutured with a continuous Vicryl 4-0 suture to prevent intestinal eventration. A ventral large hernia forms 28 days after surgery. Repeated surgery - hernia repair can be performed after 28 days to protect against the progression of dormant infection, which occurs early after surgery.

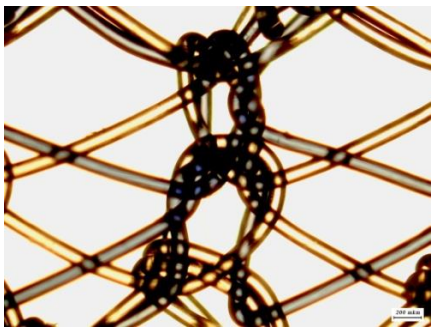
Upon visual examination, a hernial protrusion with the contents of the abdominal cavity is determined along the middle line of large sizes. In the supine position, the contents are easily inserted into the abdominal cavity. The postoperative wound is clean, there is no discharge. There are no infiltrates.

After removing the skin sutures, the edges of the skin wound are separated. Mobilization of the hernial sac and hernial gate. The size of the hernial gate is 4x1cm. In order to form a large defect, corrugating seams along the lateral edge of the spigel line were formed under the control of intra-abdominal pressure measurement.

Methods of alloplasty of ADHD. Corrective non-tensioning hernia repair using polypropylene mesh in the Onlay position. Mobilization of the edges of aponeurosis of the muscles of the anterior abdominal wall at a distance of up to 0.8 cm. Next, a grid of appropriate sizes is cut out - with a grip of up to 5 mm along the periphery of the hernial gate. With nodular seams, the mesh is fixed to the anterior abdominal wall in the Onlay position with a 4/0 prolen thread. Hemostasis control. After excision of the edges of the skin, suturing the wound with a continuous thread prolen - 4/0.

A Vostok 2 diode emitter (Uzbekistan) with a power density of 150 MW/cm2 with a wavelength of 662-664nm in continuous mode was used to carry out antimicrobial photodynamic effects.

Characteristics of the mesh prosthesis. Polypropylene is in the form of a standard braided mesh of an Esfil medical implant certified in Uzbekistan. According to light and scanning microscopy data, the mesh is woven from monofilament with a diameter of 50 microns, at the junction the number of weaves per unit surface is up to 8-10 with slits at the weaving site up to 1-2 microns (Pic. 1).



Pic.1. The nature of the thread and the method of weaving a standard Esfil mesh implant.

Morphological studies.

To prepare morphological preparations, tissue was excised and fixed in a 10% solution of neutral formalin. After the fixation period expired, the biopsy was poured into paraffin. Paraffin blocks were made. Serial sections with a thickness of 3-4 microns were made. Histological preparations were stained with hematoxylin and eosin.

Microscopy was used to evaluate the dynamics of the development of an inflammatory reaction, the features of regeneration in the area of the prosthesis, as well as the degree of destruction of the implant under study.

RESULTS AND THEIR DISCUSSION

After the formation of a hernia of the anterior abdominal wall according to the specified method, the rats of the control group of studies were taken to the operating room. Previously, they were on a starvation diet for a day with sufficient water supply.

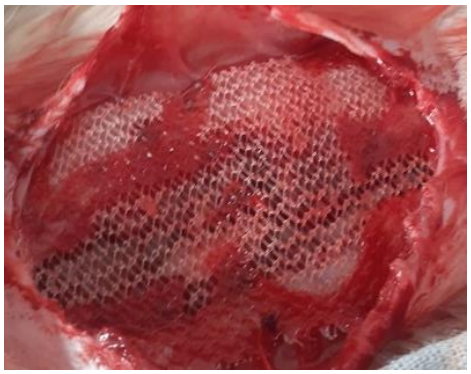
General anesthesia was achieved by inhalation of isoflurane vapors. Dissection of the skin in the projection of a hernia of the white line of the abdomen. Isolation of the hernial gate and hernial sac. During the revision of the abdominal cavity through a peritoneal defect, it was found that the contents of the hernial sac are intestinal loops and omentum. In most cases, no adhesions were detected in the abdominal cavity (Pic. 2).

Pic. 2. Isolation of the hernial sac and hernial gate of an experimental postoperative hernia.

Mobilization of the anterior abdominal wall at a distance of up to 0.5 cm from the edge of the hernial gate. Alloplasty using an Esfil mesh in the Onlay position by fixing to the anterior surface of the rectus aponeurosis with separate nodular sutures with a prolene 4/0 thread. The wound surface was treated with a 0.5% betadine solution. The skin wound was sutured with a continuous 3/0 prolene suture (Pic. 3).

In the postoperative period, the operated animals were in separate cages of 2 individuals. Within 3 days after the operation, painkillers in the form of ibuprofen powder were added to the water at the rate of 250 mg per 50 ml of water.

A day after the operation, the animals were transferred to a regular diet.



Pic. 3. After mobilization of the edges of the rectus abdominis muscles along the anterior surface, hernia repair was performed with a mesh in the Onlay position.

Visual (macroscopic) changes on the 7th day of the experiment:

On the 7th day after the operation, against the background of an uncomplicated course, euthanasia was performed by overdosing on narcotic drugs. When diluting the edges of the wound, the mesh turned out to be fixed to the anterior abdominal wall and the edges of the hernial gate. Tissue swelling and loose connective tissue adhesions with mesh were determined. Upon opening the abdominal cavity, adhesions to the mesh fixation area were formed due to a moderate inflammatory process, as well as partial divergence of the peritoneum with the exposure of the mesh into the lumen of the abdominal cavity (Pic. 4 and Pic. 5).

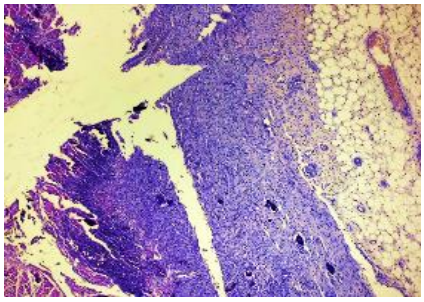
Pic. 4. 7 days after Onlay alloplasty. There is an adhesive process of the anterior abdominal wall with the organs of the abdominal cavity.

Pic. 5. View of the hernia correction area from the abdominal cavity. The edges of the rectus abdominis muscles with a diastasis of 1 cm are visible. The mesh is traced, which is located above the peritoneum. Some areas of the peritoneum have parted, and the exposed surface of the mesh is covered with fibrin and remnants of the omentum (after excision of adhesions).

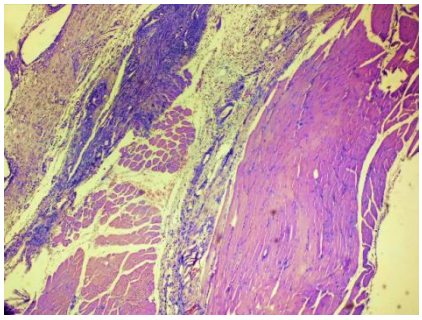
Morphological changes on the 7th day of the experiment:

At this time, the main exudative-necrobiotic changes prevailed over the inflammatory process. The main reason why the necrobiotic process can be observed even after 7 days is that it develops more often due to the direct effect of a synthetic polymer (mesh) on the inflammatory process in the wound

area. For this reason, necrosis zones were observed during these periods. Different levels of necrotic changes are observed in the polymer (mesh) and muscle, as well as in the layer between the polymer and the peritoneum. Focal or diffuse lymphocyte-leukocyte infiltration of the musculocellular layer, chaotic changes in the connective tissue layer, thickening of the vessel wall, expansion (dilation) and fullness (stasis) in various forms, diapedesis of erythrocytes around the vessel, edema is observed throughout the layer (Pic. 6 and 7).



Pic. 6. The area of the surgical wound. Necrotic changes of varying degrees in the layer between the muscle layers, polymer and peritoneum. Diffuse lymphocytic-leukocyte infiltration with spread in the muscle and cellular layers, varying degrees of tissue swelling. The technique of hernia repair by the onlay method. Day 7. SEE G-E 10x2.



Pic. 7. The area of interaction between muscle tissue and a synthetic polymer. Diffuse lymphocytic-leukocytic focal infiltration, spreading throughout, chaotic changes in the connective tissue layer, thickening of the vessel wall, dilation and stasis of various shapes. The technique of hernia repair by the onlay method. Day 7. SEE G-E 10x2.

Visual (macroscopic) changes on the 14th day of the experiment:

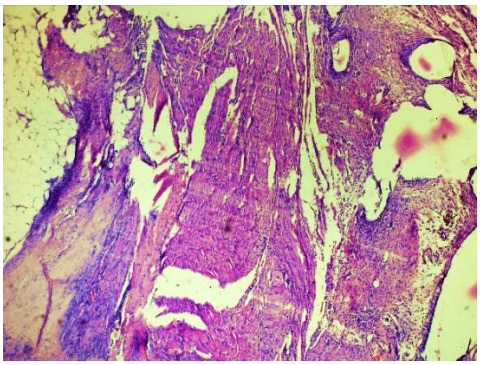
On the 14th day of the uncomplicated course, the postoperative wound is almost completely healed. The mesh is intimately fused with the surrounding tissues of the anterior abdominal wall. The adhesive process persists in the abdominal cavity with the area of fixation of the polypropylene mesh (Pic. 8-9).

Pic. 8. 14 days after alloplasty of hernias in the Onlay position. There is an adhesive process of the anterior abdominal wall with the organs of the abdominal cavity.

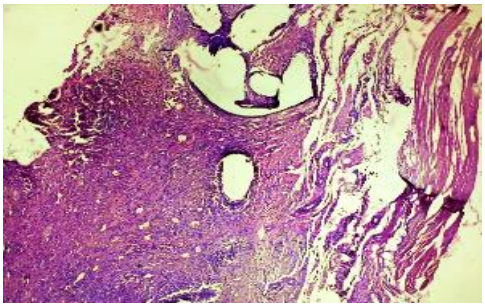
Pic. 9. 14 days after alloplasty Onlay view from the abdominal cavity. The edges of the rectus abdominis muscles with a diastasis of 1 cm are visible. The mesh is traced, which is located above the peritoneum. The divergence of the area of the peritoneum where the omentum was soldered.

Morphological changes on the 14th day of the experiment:

On the 14th day of the experiment, chaotic fibroblasts formed between the synthetic polymer and biological tissues. Microscopy of the preparations in the implantation zone in these animals revealed that the filaments of the implanted prosthesis were surrounded by a wide zone of newly formed connective tissue with a reaction of productive inflammation (focal infiltrates consisting of lymphocytes and giant cells of the type of foreign bodies) (Pic. 10 and 11).



Pic. 10. Onlay method. Chaotic fibroblasts formed between the synthetic polymer and biological tissues. The vessel wall is thickened, expanded, and the lumen is full-blooded. Focal lymphocytic infiltration. Hernia repair using the onlay method. Day 14. SEE G-E 10x2



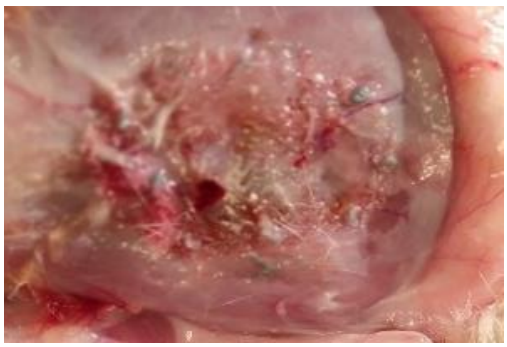
Pic. 11. The field of impact on the hernia of a synthetic polymer by the Onlay method. Synthetic polymer (mesh) in places of contact with the biological tissues of focal infiltrates consisting of lymphocytes and giant cells. The technique of hernia repair by the onlay method. Day 14. SEE G-E 10x2.

Visual (macroscopic) changes on the 21st and 30th days of the experiment:

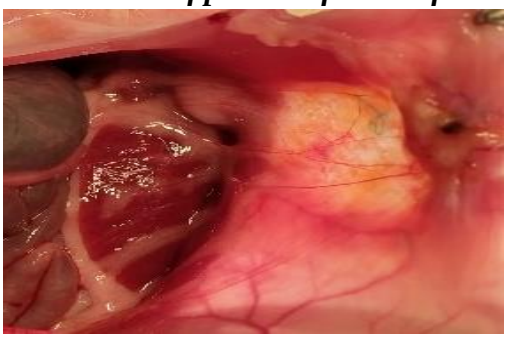
On the 21st and 30th days after alloplasty with polypropylene mesh, the skin wound has almost completely healed, in places it is necessary to excise the skin sutures (Pic. 12-13).

Pic. 12. 21 days after alloplasty. After excision of the skin, a mesh is visible, the cells of which are filled with loose fibrous connective tissue.

Pic. 13. 21 days after Onlay alloplasty. The tissues of the anterior abdominal wall are raised with one flap. There is an adhesive process with a hernia correction zone with an omentum.



Pic. 14. 30 days after postoperative hernia alloplasty. The mesh can be traced among the forming connective tissue. There is a site of partial infection of the mesh with inflammation

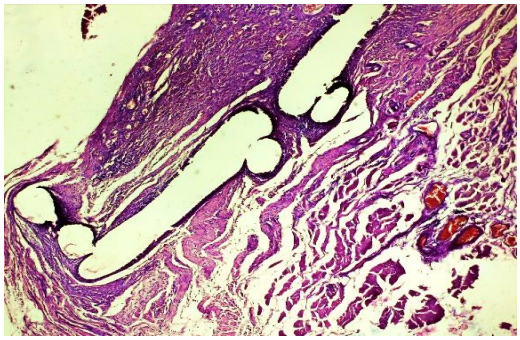


Pic. 15. 30 days after surgery. View from the abdominal cavity. The mesh located above the peritoneum is contoured. The inflammatory process subsides, the process of resorption of adhesions.

Morphological changes on the 21st and 30th days of the experiment:

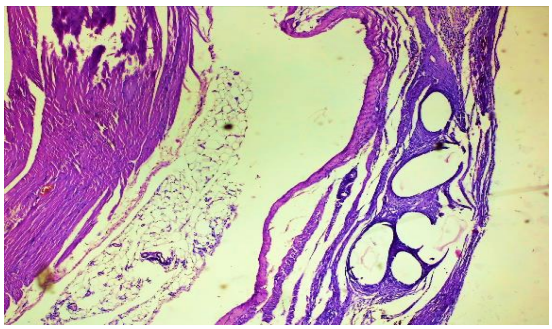
On the 21st day of the study: in the group where the online model was used, proliferative processes began to prevail, but inflammatory processes persisted and reactive changes between the

synthetic polymer (mesh) and biological tissues persisted. At the same time, rough regeneration of connective tissue was observed in the affected area (mainly between the peritoneum and the synthetic polymer), lymphocytic-macrophage inflammatory infiltration was observed in almost all areas, especially between the filaments of the mesh (Pic. 16).



Pic. 16. Synthetic polymer and the area of impact on muscles and peritoneum. The predominance of proliferative processes in inflammation. There are coarse connective tissue regeneration formations between the peritoneum and the synthetic polymer, lymphocytic-macrophage inflammatory infiltration. The technique of hernia repair by the onlay method. 21 days. SEE G-E 10x2.

By the 30th day of the experiment in the Onlay alloplasty group, connective tissue prevails in the restructuring of the layers. Coarse adhesions with clearly defined connective tissue were found at the sites of exposure to synthetic polymer (mesh) and peritoneum. Although the reaction between the synthetic polymer (mesh) and the tissue is weak, lymphocytic-macrophage inflammatory infiltration persists (Pic. 17).



Pic. 17. Synthetic polymer (mesh) and peritoneum with well-developed connective tissue coarse adhesive regeneration in the affected areas. Weak lymphocytic-macrophage inflammatory infiltration. Hernia repair only. 30 days. SEE G-E 10x2.

The conducted studies led to the conclusion that the implant in the form of a polypropylene mesh causes a pronounced reaction of the surrounding tissues within 7 to 10 days after implantation and, when positioned above the peritoneum, can cause the formation of adhesions with the abdominal organs. At the same time, the severity of adhesions depends more on the integrity of the peritoneum, since the divergence of its edges contributes to the formation of a pronounced adhesive process that does not tend to dissolve in the long term.

In the experimental group of animals, mesh implantation operations proceeded similarly to the control group of animals. Immediately during the operation, the standard Esfil mesh was covered with a composite composition.

It should be noted that in the process of fixing the mesh with a continuous suture to the anterior abdominal wall and the edges of the hernial gate, there was a dense adhesion of the mesh, which made

it possible to fix the mesh without deformation and formation of cavities. The degree of adhesion of the composite mesh to fabrics in comparison with polypropylene mesh exceeded 2-3 times (Pic. 18).

Pic. 18. The skin is separated from the underlying tissues of the anterior abdominal wall. The composite mesh is laid on the anterior abdominal wall.

After fixing the mesh to the anterior abdominal wall, the implant surface was treated with a laser in the range of 620-660 nm with a power density of 50-100 MW/cm2. The irradiation time was 2-3 minutes (Pic. 19-20).

After fixing the mesh to the anterior abdominal wall, the implant surface was treated with a laser in the range of 620-660 nm with a power density of 50-100 MW/cm2. The irradiation time was 2-3 minutes (Pic. 19-20).

Pic. 20. The state after laser irradiation.

It should be noted that effective laser irradiation is accompanied by a significant decrease in the blue color of the composite coating, which indicates that a photochemical reaction has occurred.

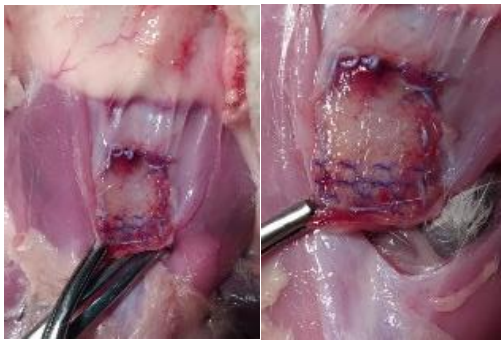
On the 7th day after the operation, almost all the animals were in an active state, moved freely around the cage, took food and water. When trying to pick up, they tried to run away.

When palpating the area of the operation, they behaved calmly, which indicated the absence of a painful reaction. The skin wounds remained clean without signs of inflammation and infiltration; the edges were well matched.

Visual (macroscopic) changes on the 7th day of the experiment:

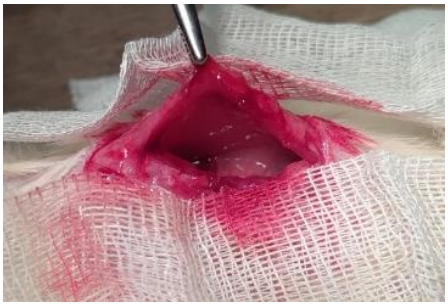
During euthanasia on day 7, it was found that the mesh was sufficiently tightly soldered to the surrounding tissues, no signs of inflammation and fluid accumulation were detected.

The mesh is fixed by loose adhesions to the subcutaneous tissue and surrounding tissues (Pic. 21).



Pic. 21. 7 days. Experience. The condition of the implanted composite mesh. The mesh is permeated with newly formed connective tissue. There are no signs of infection.

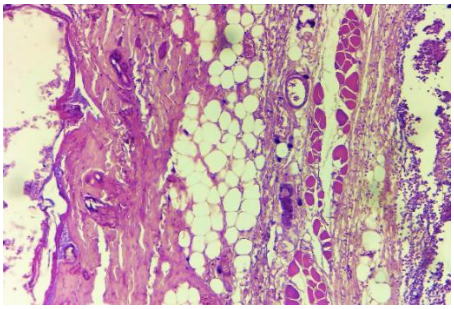
When opening the abdominal cavity with a hemilunar incision, it was found that the adhesive process is minimal, there is no divergence of the edges of the peritoneum. Abdominal organs are without pathology, there is no effusion (Pic. 22).



Pic. 22. In operated animals, a minimal adhesive process was noted after 7 days.

Morphological changes on the 7th day of the experiment:

Histological examination revealed a slight neutrophil infiltration. A slight edema is detected in the histological layers of the wound (Pic. 23).

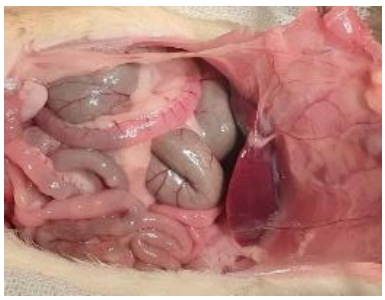


Pic. 23. Histological examination revealed a slight neutrophil infiltration. A slight edema is detected in the histological layers of the wound.

Visual (macroscopic) changes on the 14th day of the experiment:

On the 14th day after alloplasty with a composite mesh, there are no signs of infection. The mesh is covered with loose connective tissue. There is a single spike with an omentum in the abdominal cavity (Pic. 24-25).

Pic. 24. 14 days after implantation of the composite mesh. There are no signs of infection



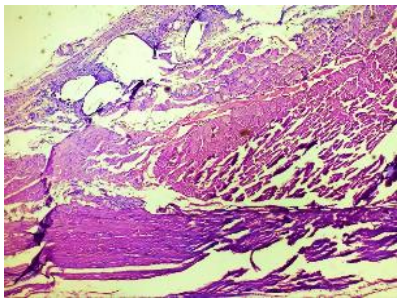
Pic. 25. The condition of the abdominal cavity after alloplasty with a mesh with a composite coating.

Morphological changes on the 14th day of the experiment:

In the implantation zone of the composite mesh (CS), the reaction to foreign tissue was determined, represented by a cellular infiltrate consisting of lymphocytes, plasma cells, macrophages and mast cells. The fibers of the connective tissue looked shaped, loose, with edema and preserved newly formed vessels. The presence of giant cells of foreign bodies, other inflammatory cells and fibrosis was noted, but their number was significantly less than when using a standard grid (Pics. 19 and 20). There were significantly fewer histiocytes and eosinophils in the CS samples. The lack of reactivity was confirmed by the discovery of the fact that a significant decrease in fibrosis was also found when using CS in comparison with standard grids (Pic. 26).

*Visual (macroscopic) changes on the 21st and 30th days of the experiment^*

On the 21st day after alloplasty with a composite mesh, there are no signs of infection. The skin of the anterior abdominal wall is separated by a mesh with almost complete implantation into the surrounding tissues and the anterior abdominal wall. The nodes and threads of the grid are not visible. The peritoneum is clean, without adhesions. Abdominal organs without pathology (Pic. 27-29).



Pic. 26. The area of CS implantation. In the area of lesion with mesh polymer filaments, lymphocytes, plasma cells, macrophages and mast cells are detected. The fibers of the connective tissue are decorated, loose, with edema and preserved newly formed vessels. A small number of diffusely distributed histiocytes and eosinophils are detected on day 14. SEE G-E 10x2.

Pic. 27. 21 days. Experience. The skin wound has almost healed. There are places where single ligatures depart.

Pic. 28. 21 days. Experience. The skin of the anterior abdominal wall is separated. The mesh is almost completely implanted into the surrounding tissues. The nodes and threads of the grid are not visible.

Pic. 29. 21 days. Experience. The peritoneum is clean, without adhesions. Abdominal organs without pathology.

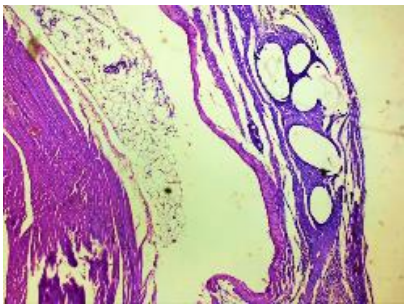
On the 30th day after alloplasty with a composite mesh, the skin of the anterior abdominal wall is separated, there are no defects, adhesions are not traced. The mesh is translucent due to the removal of the skin in the area of allogernioplasty. The mesh is fully attached to the anterior abdominal wall. There are no signs of infection (Pic. 30,31).

Pic. 30. Experience. The skin of the anterior abdominal wall is separated. The mesh is fully attached to the anterior abdominal wall. There are no signs of infection.

Pic. 31. Experience. 30 days. Anterior abdominal wall in the area of allogernioplasty. There are no defects, spikes are not traceable. The mesh is translucent due to the removal of the skin in the area of allogernioplasty.

Morphological changes on the 21st and 30th days of the experiment:

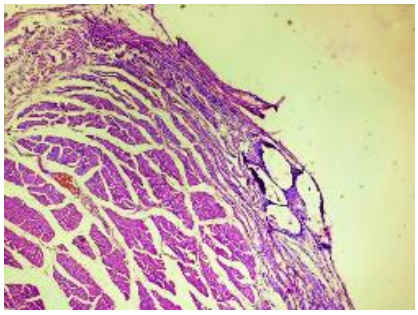
The above-mentioned inflammatory process had practically subsided by day 21, and the proliferative phase of inflammation began to prevail in the process. There were significantly fewer histiocytes and eosinophils in the CS samples. The lack of reactivity was confirmed by the discovery of the fact that a significant decrease in fibrosis was also found. In the area of contact with the composite mesh, activation of the neovascularization process is felt in the connective tissue and surrounding histomorphological layers (Pic. 32).



Picure 32. The field of interaction between the composite mesh and biological tissues. There are few histiocytes and eosinophils in the tissue layers. The ordered arrangement of the fibrous layer and the beginning of the neovascularization process. 21 days. SEE G-E 10x2.

After 30 days, the number of giant cells continued to decrease when using CS. Eosinophils and histiocytes were significantly reduced and there was less fibrosis around CS.

When using composite meshes, there was less tissue damage, at the same time a greater degree of neovascularization. This is a positive indicator of healthy tissue growth (Pic. 33).



Picure 33. CS between histomorphological layers. A condition without inflammatory infiltration and fibrous tissue between the fibers of the mesh. The process of neovascularization is clearly developed. 30 days. SEE G-E 10x2.

In this study, we demonstrated that the composite coating resulted in a significant reduction in immediate and chronic responses to a foreign body. The number of giant cells detected after 2 weeks decreased significantly, and it lasted for more than 4 weeks.

The second phase of the inflammatory process is an acute inflammatory response, which leads to the attraction of neutrophils to the implantation site. As shown, there was a significant reduction in neutrophils during the 2-week follow-up period. After that, a chronic inflammatory phase occurs. In the early period, the number of macrophages and eosinophils was reduced. These results demonstrate a significant reduction in the inflammatory response to CS compared to uncoated polypropylene (PP).

Neovascularization is critically important for healthy tissue integration of polypropylene into tissues. In our studies, we have demonstrated a significant increase in neovascularization in response to CS compared to PP. It has been shown that the absence of neovascularization is associated with an increase in fibrosis.

CONCLUSIONS:

1. Experimental studies on hernia alloplasty using the Onlay technique have shown that in almost all cases of uncomplicated course, during the first 7-10 days, a pronounced inflammatory reaction develops in the surrounding tissues and there is a partial divergence of the peritoneum in the area of mesh fixation with the formation of an adhesive process in which abdominal organs are involved, while by 30 days after surgery, partial resorption of adhesions is noted only in the area of peritoneal integrity, whereas in the area of its absence, a dense adhesive process was determined.

2. During experiments with allogernioplasty and using a model with infection of the surgical field by pathogenic microbes, it was found that the proposed variant of the composite coating of the prosthesis allows filling the gaps of the nodes of the polypropylene mesh and is the first barrier to infection into the implant, and the second line of protection provides irradiation of the mesh after implantation into the tissue with laser radiation in the spectrum of 640-660 nm with the development of a photodynamic effect methylene blue, in this case, the biodegradable material used is absorbed within 1 week without the development of an inflammatory reaction.

3. A morphological assessment of the features of the engraftment of a mesh prosthesis with a composite coating with a photosensitizing property showed that it causes a less pronounced inflammatory reaction, which manifested itself already in the initial period of observation with minor cellular infiltration, while the coating also provided an increase in the degree of adhesion of the prosthesis with tissues and, accordingly, the strength of restoring the integrity of the anterior abdominal wall.

4. Experimental studies with the implantation of a mesh prosthesis under conditions of microbial contamination have shown that the composite coating, which has a photosensitizing property under the action of laser light irradiation, is characterized by a pronounced bactericidal effect sufficient to prevent the development of a purulent-inflammatory process in the area of implantation of the prosthesis.

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