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UDC 616.34-007.43-007.271**EXPERIMENTAL REASONING ALLOPLASTY OF COMPLICATED HERNIA**

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Abstract. Hernia of abdominal wall found in 10% of the adult population and take 3-4 place in the structure of surgical diseases. Each year, on the planet performed over 20 million operations of hernia, which is 10-15% of all interventions. For plastic hernias of the abdominal wall during 1 year used 1 million synthetic fishing nets. In Ukraine, about 13 thousand operations performed on strangulated hernias of the abdominal wall when there is inflammatory exudate, infection in the wound.

Purpose. In the experiment to prove the applicability of polypropylene mesh for hernioplasty in cases of infection, phlegmon of hernia sac.

Materials and methods. The experimental research was conducted on 150 white male rats breed "Wistar" weighing 250-300 g, same age, without disease, detained in accordance with generally accepted standards, at least 10 days before the experiment. In carrying out the experiment followed the major domestic and international standards according to national "general ethical principles of animal experimentation" (Ukraine, 2001).

The open question of herniology is possibility of surgical treatment of hernia defect of abdominal wall at the hurt hernia, infecting of wound, phlegmon of hernia. For the study of problem, in an experiment on 150 white rats with the phlegmon of hernia complex research of features of flow of reparative process on an area the allogenioplastic polypropylene net of Linteks esfil is executed. The rats were divided into 3 groups: 1-st group – the plastic arts of hernia by the net of polypropylene of Linteks esfil standard; 2 group – the plastic arts by the net of Linteks esfil easy; 3 group – the plastic arts by the net of Linteks esfil heavy. The opened sore was washed by 0,02% solution of Decasan, Octenisept farblos (Germany), intramuscular entered 1 ml of Imunophan, Ceftriaxon during a week. A positive dynamics was marked toward diminishing of contamination by microorganisms to 7 days after an operation. There were inflammatory changes in three groups: it was swollen hyperemia of tissues, serous-hemorrhagic excretions from a wound. On the 14th days reticulated implant was densely fixed to the muscles and was in the thin layer of connecting fabric with more mature granulation fabric. In 21 day reticulated implant surrounded connective capsule which consisted of well-organized collagen fibres with the insignificant external signs of inflammation.

The results of experimental researches confirm possibility of application of reticulated implant for the plastic arts of hernia defect in the phase of inflammation which more frequent meets at the hurt hernia. At presence of festerings excretions in hernia, the use of polypropylene net for the plastic arts must be accompanied careful rehabilitation of wound, abdominal region with adequate antibacterial therapy.

Conclusions:

1. The reaction of tissue to implant mesh matches with reaction of tissue bordering to necrotic cells, and the presence of an infected hernia does not worsen the conditions of integration polypropylene implant with tissues.
2. Strengthening mesh in tissues observed at 21 day, and the most pronounced effects of fixation - on 90 days after alloplastic hernioplasty of the hernia defect.
3. The results of experimental researches confirm the possibility of using plastic mesh implants for hernia defect in phase of inflammation that often occurs in strangulated hernia.

Keywords: jammed hernia, experimental ground, polypropylene mesh.

Introduction. Hernia of abdominal wall found in 10% of the adult population and take 3-4 place in the structure of surgical diseases. Each year, on the planet performed over 20 million operations of hernia, which is 10-15% of all interventions. For plastic hernias of the abdominal wall during 1 year used 1 million synthetic fishing nets [1]. In Ukraine, about 13 thousand operations performed on strangulated hernias of the abdominal wall when there is inflammatory exudate, infection in the wound [1,2]. The main method of surgical treatment of complicated hernias is plastic hernial by the local tissues. In patients with large and giant hernias, which are often complicated by strangulation, relapse is 30-50% [3]. Notice opportunity alloplastic of abdominal wall by the

polypropylene mesh in infected conditions are solitary in nature [4].

Outstanding issues of herniology is scientific justification the possibility of surgical alloplastic treatment hernia defect of the abdominal wall hernia in case of jamming with the development of infection wounds, phlegmon of hernia sac, and so on.

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Materials and methods. The experimental research was conducted on 150 white male rats breed "Wistar" weighing 250-300 g, same age, without disease, detained in accordance with generally accepted standards,

at least 10 days before the experiment. In carrying out the experiment followed the major domestic and international standards in accordance with national "general ethical principles of animal experimentation" (Ukraine, 2001), and in compliance with the provisions of the basic "rules of work using experimental animals" Decree №755 of 12.08.1977r., GLP (1981), the Council of Europe Convention for the Protection of Vertebrate Animals and MOH Ukraine №281 from 01.11.2000r. and "general ethical principles of animal experimentation" [5].

Experimental tests were performed under general anesthesia, which was performed by intraperitoneal by 5% Ketamine solution rate of 0.05 ml per 100 g of weight white rat. Animals were taken from experiment by deep anesthesia [6].

Rats operated for the purpose of modeling the abdominal wall hernia by method Harpola A.J in our modification. The technique was followed: in animals was created defect in the abdominal wall size 1,5-1,5 cm saving skin-subcutaneous parietal flap. To prevent iatrogenic damages, disclosure of abdomen was used hidropreparation of aponeurosis by saline. The skin sutures were placed on a thin wire, which prevented the rats from cracking the sutures. The wounds healed and formed a hernia of the anterior abdominal wall. Modeling phlegmon of hernia bag conducted as follow: in the outer surface of the hind legs subcutaneously injected 0.5 mL of 10% solution of calcium chloride [1]. After 48 hours prepared 5% fecal mixture and injected in abdominal wall above the existing hernial protrusion (based on a mixture of 3 ml of 1 kg of weight) [2]. In animals after 2 days in the area of hernia formed abscess. The rats were divided into 3 groups: group 1- animals, which held plastic of hernia by polypropylene mesh Linteks esfil standard (St. Petersburg); 2 group - animals who performed plastic of hernia by polypropylene mesh Linteks esfil light; group 3- animals, who performed plastic of hernia by polypropylene mesh Linteks esfil heavy. During surgery-implantation, festering wound was thoroughly washed with 0.02% solution of Decamethoxine, then treated by Octenidine Dihydrochloride and Phenoxyethanol (Octenisept farblos, Germany). During 7 days of test animals injected solution of Mono and ceftriaxon intramuscular in back leg, based on body weight. Obtained microbiological results from content of the simulated abscess in the area of hernia in 96% of cases showed intestinal sticks, and in 95% of animals cultured infection that is highly sensitive to the cephalosporin group of antibiotics.

In the postoperative period the behavior, appetite of rats, wound state with implanted mesh were observed. Deduced from experimental animals at 7, 14, 21 days. For morphological studies the biopsy material was fixed in 10% of neutral formalin solution. Histological sections were stained with hematoxylin and eosin for, threechrom by Masson.

Results and discussion. In postoperative period in 30% of three groups of rats during 3-5 days was observed reduced activity of movements and appetite, which we associate with the development of inflammation in the wound. After the said period in the main part of the rats the mentioned features were disappeared. Inspecting of the operation area shows that the mesh implant germinate throughout the muscles of the abdominal wall, and from the abdomen adhesive process was observed in 68% of

cases. Received results of wound seeding wounds of the abdomen confirmed a high concentration of microorganisms *E. coli* in rats of 3 experimental groups and only in 22 cases detected staphylococcus aureus, Proteus and Klebsiella. On the 7th day after implantation in rats of 1 group the inflammatory changes were observed in the form of swelling, redness and tissue sero-hemorrhagic discharge from the wound. Morphologically in the area of implantation visualized macrophagal infiltration of a small number of lymphocytes. The phenomena necrosis of surrounding tissue, neutrophilic infiltration absent. In some areas between the mesh and tissues are observed hemorrhages with a loose location of red blood cells. Red blood cells with intact tinctorial properties. Also in the surrounding tissues observed small focal hemorrhage. Between fiber mesh and on the perimeter is characteristic swelling of connective tissue with easing connective tissue fibers.

On the 14th day of postoperative period, the net is fixed in mature GT, which forms a clearly delimited shaft around necrotic cells. In GT is available with a large number of fibroblasts isolated fibrocytes, a small amount of thin collagen fibers. In areas of implantation available macrophage infiltrates in the thickness of which displays fibroblasts and lymphocytes. Cellular infiltration by macrophages and lymphocytes is a manifestation of immune responses to implant. At the same time as fibroblasts cells with nuclei rounded-oval, containing 1-2 nucleoli, basophilic cytoplasm.

On the 21st day after operation a net is fixed in aponeurosis tissue, which existing collagen fibers of varying thickness, preferably sealed. A small number of fibroblasts, more fibrocytes, a small number of macrophages and lymphocytes are present among collagen fibers. In the direction of the necrotic cells, the tissue is visualized according to the type of mature granulations. The last available capillaries have thick walls, some of them do not have erythrocytes in the lumen.

In the experimental material of animals of the 2nd group on the 7th day, a large number of macrophages are also visualized in the thickness of the granulation tissue, and a small number of neutrophilic leukocytes in the foci. Granulation tissue from the aponeurosis distributed in intramuscular intervals of striped abdominal muscles. Granulation tissue is more mature at 14 days after surgery, compared with 1 and 3 groups of animals. Perifocal the plethora of vessels less pronounced. Isolated areas of perifocal fibrinoid necrosis are also noted, which indicates a tendency to stop spreading and reduce the size of the inflammatory infiltrate. Mucoïd swelling in the form of relaxation of collagen fibers is observed in the tissue of the aponeurosis, which borders the focus of necrosis. Perifocal necrosis, present around neutrophilic leukocytes, decreases with an increase in macrophages and fibroblasts. Marked increase in the size of granulation tissue at 21 days in a large number of thin-walled plethora vessels between which are available fibroblasts, tissue basophils, macrophages, amorphous substance of connective tissue and a small amount of connective tissue fibers. So, the observed reduction in the size of active inflammatory infiltration with increasing reparative properties in the tissue.

In experimental animals of 3 groups more common skin necrosis in the course of the wound, flushing the wound edges with sero-hemorrhagic, sometimes purulent

discharge, small area of colliquation necrosis 7 days after surgery. Granulation tissue forms a clearly delimited shaft like a band for 14 days. In the thick of granulation tissue available a large number of fibroblasts with few connective tissue fibers. In 4 cases, from the wound continued purulent discharge, which led to the rejection of the mesh implant. In the remaining animals around granulation tissue (peripheral from necrosis) focal macrophage infiltration available. In muscle tissue of striped muscles displays isolated macrophages, lymphocytes. This indicates about trend reduction of zone inflammatory infiltrate at 14 days after surgery. After 3 weeks mesh implant surrounding by connective tissue capsule, which consists of ordered collagen fibers with few outward signs of inflammation.

So, despite the mesh fixation in altered the tissue aponeurosis of abdominal wall hernia infected with, reaction of animals to implantation of polypropylene mesh Linteks-esfil is universal and correlates with literature data and is similar to the general biological response to the penetration of a foreign body.

Conclusions:

1. The reaction of tissue to implant mesh matches with reaction of tissue bordering to necrotic cells, and the presence of an infected hernia does not worsen the conditions of integration polypropylene implant with tissues.
2. Strengthening mesh in tissues observed at 21 day, and the most pronounced effects of fixation - on 90 days after alloplastic hernioplasty of the hernia defect.
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References:

1. Zhebrovskyy VV, Dzhemyleeva ER, Torotadze NM, Strangulated postoperative hernia. Materials III Ukrainian scientific conference with international participation "Modern methods of surgical treatment of abdominal hernia". Kyiv, 14-15 April. 2006; 35-36.
2. Khimich SD, Zheliba MD, Reva AI, Funikov AV, Prevar AP, Formanchuk A.M, Katelian O.V, Rautskis VP. Likuvannia hryzh zhyvota z vykorystanniam riznykh plastychnykh materialiv. Visnyk Vinnytskoho natsionalnoho medychnoho universytetu". 2019; 23(2).
3. Lytkovskiy RA. Alopastyka pupkovykh hryzh z vykorystanniam polipropilеноvoi sitky, modyfikovanoi antyseptykom ta vuhletsevymy nanotrubkamy. Khirurhiia Ukrainy. 2019; 3(71).
4. Lutkovskiy RA, Feleshtynskiy JP, Viltanuk OA, Rezanova NM vinachidniki. Vinnuckuj nazionalnij medichnij universitet imeni M. I.Pirogova patentovlasnik. Sposib alopastyki pisljaoperacijnykh ventralnykh grug s vikorystannjam nanomodifikovanoi polipropilеноvoi sitku Patent Ukrainu na korusnu model № 132818. 2019 Ver 11 (Ukrainian).
5. The general ethical principles of animal experimentation. First National Congress on Bioethics. Endokrynology. 2003; 1:142-145.
6. Romanov RV, Parshikov VV, Samsonov AA, et al. Experimental and clinical rationale for the use of synthetic material "frames" in the surgical treatment of the

anterior abdominal wall Grijó. Nizhny Novgorod Medical Journal. 2008; 1:53-59.

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ЕКСПЕРИМЕНТАЛЬНЕ ОБГОВОРЕННЯ АЛОПЛАСТИКИ УСКЛАДНЕНОЇ ГРИЖІ

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Резюме. Відкритим питанням герніології є можливість хірургічного лікування грижового дефекту черевної стінки при ускладненій грижі, інфікованні рани, флегмоні грижі. Для вивчення проблеми в експерименті на 150 білих щурах з флегмоною грижі виконано комплексне дослідження особливостей перебігу репаративного процесу на ділянці алогерніопластичної поліпропіленової сітки Лінтекс есфіл. Щури розділені на 3 групи: 1-а група – пластика грижі сіткою з поліпропілену стандарту Лінтекс есфіл; 2 група – пластика сіткою Лінтекс есфіл легка; 3 група – пластика сіткою Лінтекс есфіл важка. Запущену рану промивали 0,02% розчином декасану, Октенісепт фарблос (Німеччина), внутрішньом'язово вводили 1 мл імунофану, цефтриаксону протягом тижня. Відзначена позитивна динаміка в бік зменшення забруднення мікроорганізмами до 7 діб після операції. Запальні зміни були в трьох групах: набряклість, гіперемія тканин, серозно-геморагічні виділення з рани. На 14 добу сітчастий імплантат був щільно закріплений до м'язів і знаходився в тонкому шарі сполучної тканини з більш зрілою грануляційною тканиною. Через 21 добу сітчастий імплант оточував сполучну капсулу, яка складалася з добре організованих колагенових волокон з незначними зовнішніми ознаками запалення.

Висновки:

1. Реакція тканини на сітку імплантату збігається з реакцією тканини, що межує з некротичними клітинами, і наявність інфікованої грижі не погіршує умови інтеграції поліпропіленового імплантату з тканинами.
2. Зміцнення сітки в тканинах спостерігається на 21 добу, а найбільш виражені ефекти фіксації - на 90 добу після алопластичної герніопластики грижового дефекту.
3. Результати експериментальних досліджень підтверджують можливість використання пластикових сітчастих імплантатів при грижовому дефекті у фазі запалення, що часто виникає при ущемленій грижі.

Ключові слова: защемлена грижа, експериментальна модель, поліпропіленова сітка.

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