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COMPARATIVE CHARACTERISTICS OF TRADITIONAL AND MODERN SUTURE MATERIALS FOR THE PREVENTION OF POST-OPERATIVE COMPLICATIONS FROM THE SURGICAL WOUND IN ABDOMINAL SURGERY

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Abstract: In an “in vitro” and “in vivo” experiment, using various techniques (bacteriological, cytological, histological, electron microscopy, tensometry, etc.), 7 types of biologically active threads were studied for the possibility of using them as a surgical suture material. To study the effectiveness of the use of biologically active suture materials in the clinic, an analysis of the immediate results of surgical interventions was carried out in 626 patients with emergency and planned abdominal surgical pathology.
Keywords: Experimental study, biologically active surgical suture materials,method, application in abdominal surgery.

INTRODUCTION

The success of surgical intervention largely depends on the properties of the suture materials used in its implementation. the main requirements for a suture thread: biocompatibility, the presence of a smooth surface, high handling properties, minimal “wicking” [1, 2]. not all known synthetic threads used in surgery fully meet these requirements, which makes it advisable to develop new varieties [3]. One of the promising areas of modern medicine and the medical industry is the production and introduction into surgical practice of so-called biologically active suture materials - threads, which include substances that have the ability to provide one or more effects when implanted into the tissue of a living organism [4, 5].

MATERIALS AND METHODS

The greatest variety of suture materials used is found in abdominal surgery. It is during surgical interventions on the abdominal organs and abdominal wall that it is most often advisable to use biologically active suture threads as a measure to prevent infection of the surgical site (SI) [2]. We are talking about both suturing a laparotomy wound (especially if the operation is performed due to an acute surgical pathology), and about manipulations on the hollow organs of the abdominal cavity with opening of their lumen (suture of wounds of the intestinal wall, application of interintestinal anastomoses, etc.).

Under experimental conditions, laboratory samples of the following threads obtained at VNIIS were studied: 1 – with gentamicin; 2 – with tetracycline; 3 – with doxycycline; 4 – with astragerm or panaxel – substances from the group of germanium-containing organic compounds (GOC), which have the ability to stimulate tissue repair; 5 – with doxycycline and Goc; 6 – with ciprofloxacin; 7 – with ciprofloxacin and astragerm. Polyamide thread samples that do not have biological activity were used as controls.

RESULTS AND DISCUSSION

The procedure for determining antibacterial activity was as follows. Museum strains of test cultures Staphylococcus aureus 906, Escherichia coli K12 and Bacillus subtilis L2 were seeded in the form of a lawn on a solid nutrient medium (5%) in petri dishes. 2 cm long pieces of test threads were placed on the crops. The crops were incubated in a thermostat at a temperature of 37°C for 24 hours. then the zone of growth inhibition of microorganism cultures around the suture material samples was measured (in millimeters).

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The compared groups were comparable to each other in terms of age, gender of patients, length of hospitalization, duration of the preoperative period, nosological structure of diseases, concomitant diseases, severity of the patients' condition, nature of surgical interventions performed (p>0, 05).

The best threads in terms of severity and duration of preservation of antimicrobial properties were studied in an "in vivo" experiment. Data from cytological analysis of wound prints in experiments on rats showed that implantation into the wound of suture materials containing Gos, doxycycline and Gos, ciprofloxacin, ciprofloxacin and astragerm leads to an intensification of the migration of neutrophils and macrophages into the area of damage. We considered this circumstance as a sign of a more active course of regenerative processes

(Table 1).

Table 1

Number (in 10 fields of view) and diameter (in micrometers) of wound exudate cells 12 hours after surgery

series	M±m	neutrophils		macrophages	
		quantity	diameter	quantity	diameter
nylon	M	229,1	12,8	2.9	18,7
	m	14,2	0,1	0,1	0,4
thread with doxycycline	M	231,6	13,3*	3,5	19,7
	m	12,2	0,1	0,2	0,6
thread with doxycycline	M	310,7*	16,5*	12,7*	25,5*
and State	m	13,7	0,3	0,4	0,2
sheathed thread	M	227,3	14,1*	3,7	20,2*
from chitosan with state	m	13,6	0,4	0,4	0,2
thread in a chitosan shell with	M	233,8*	13,1	3,9	20,3*
ciprofloxacin	m	11,1	0,2	0,5	0,7
thread in a chitosan shell with	M	284,3*	14,2*	8,1*	23,4*
ciprofloxacin and Gos	m	12,0	0,3	0,1	0,4

note. * – p < 0.05 (compared to control)

The most pronounced differences in the morphology of tissues in the wound area in animals of the main and control groups were noted 7 days after surgery. in the control group, by this time epithelization of the wound defect had occurred; the newly formed epithelial layer consisted of several rows of cells; the basement membrane was uneven, but there were no outgrowths into the underlying tissue; Under the epithelium there was connective tissue with typical cellular structures (Fig. 1 a). In animals of the main group, by the 7th day after surgery, complete epithelization of the wound was noted in the area of damage and an organ-specific regenerate was formed: outgrowths of young epithelium appeared in the thickness of the dermis, new formation of hair follicles and sebaceous glands occurred; the presence of pronounced folds on the surface of the epithelial regenerate indicated contraction of the wound (Fig. 1 b).

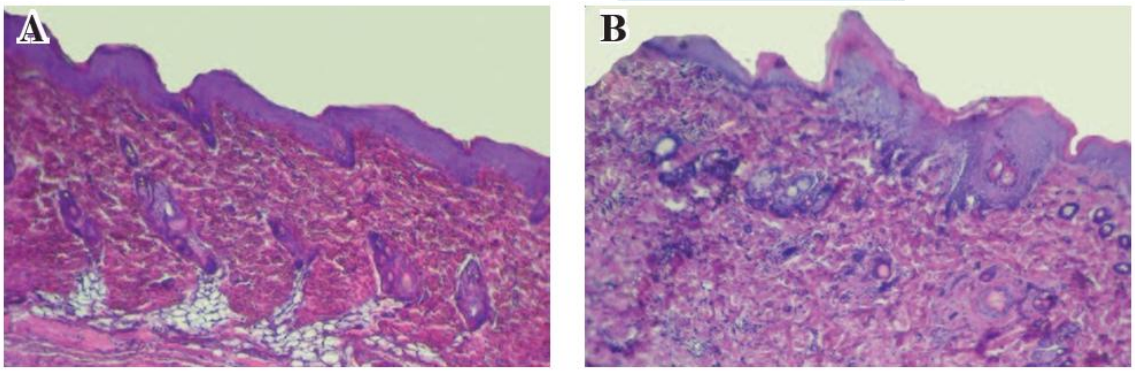

Figure 1. Skin structure in the area of the experimental wound 7 days after surgery. A – newly formed epithelium with underlying connective tissue. Control group. Hematoxylin-eosin. Uv. ×40. B – Outgrowths of young epithelium into the thickness of the dermis and new formation of skin derivatives. Main group (suture of the wound with a thread in a shell of chitosan with ciprofloxacin and astragerm). Hematoxylin-eosin. Uv. ×40.

According to electron microscopy data, the most effective in terms of a positive effect on reparative regeneration and the state of granulation tissue macrophages were threads containing antibacterial drugs and especially antibacterial drugs in combination with State. In the control group, on day 5 after surgery, the population of granulation tissue fibroblasts was represented by young and mature cells, which were characterized by the development of cytoplasmic granular reticulum and other components. bundles of collagen fibers appeared in the intercellular space. We found significant differences in the ultrastructure of granulation tissue at similar times in animals with wound sutures made with antibacterial threads from the State. The cell population here was represented by large fibroblasts with well-developed intracellular structures: cytoplasmic granular reticulum and lamellar complex, a large number of mitochondria. in the intercellular substance there were extensive fields of collagen fibers with an ordered orientation.

CONCLUSION

1. The biologically active suture materials we offer have a pronounced, prolonged antibacterial effect.
2. The results of the experiment indicate a positive effect of the studied biologically active threads on the healing of skin wounds and interintestinal anastomoses (reducing the inflammatory reaction, accelerating tissue repair, increasing the strength of the formed joints). The most effective are suture materials with complex (antimicrobial and stimulating regenerative processes) biological activity.
3. the use of new types of biologically active suture materials in the clinic during operations on the abdominal organs and abdominal wall leads to improved results of interventions performed by reducing the number of local postoperative complications of infectious origin.

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