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SUTURE MATERIAL ON THE BASE OF POLYGLYCOIDS-BIOGENIC STIMULATOR FOR FORMATION OF MICROCIRCULATORY CHANNELS/CYCLE

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ШОВНІ МАТЕРІАЛИ НА ОСНОВІ ПОЛИГЛИКОЛИДОВ - БІОГЕННІ СТИМУЛЯТОРИ ФОРМУВАННЯ МИКРОЦИРКУЛЯТОРНОГО РУСЛА

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РЕЗЮМЕ

Експериментально обґрунтоване застосування шовних матеріалів на основі полигликолидов як біогенний стимулятор формування микроциркуляторного русла. Це властивість полигликолидов може знайти застосування в клінічній практиці для оптимізації микроциркуляторного русла у хворих із хронічними облитерирующими захворюваннями нижніх кінцівок.

ШОВНЫЕ МАТЕРИАЛЫ НА ОСНОВЕ ПОЛИГЛИКОЛИДОВ – БИОГЕННЫЕ СТИМУЛЯТОРЫ ФОРМИРОВАНИЯ МИКРОЦИРКУЛЯТОРНОГО РУСЛА

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РЕЗЮМЕ

Экспериментально обосновано применение шовных материалов на основе полигликолидов в качестве биогенного стимулятора формирования микроциркуляторного русла. Это свойство полигликолидов может найти применение в клинической практике для оптимизации микроциркуляторного русла у больных с хроническими облитерирующими заболеваниями нижних конечностей.

Keywords: polyglycoids, implantation, microcirculatory cycle.

Treatment of chronic arterial insufficiency/chronic limb ischemia of lower limbs is one of the most grave/acute problems in surgery. Although during the last years, thanks to the developments in reconstructive vascular surgery, immense success has been achieved in restoration of blood circulation in lower limbs, active surgical manipulations has its restrictions and algorithm of conservative therapy practiced at present is only symptomatic.

This factor does not affectively influence the pathological basis of chronic arterial insufficiency/chronic limb ischemia. Basic method of treatment in patients with occlusive diseases of arteries of lower limbs in most cases is intravenous infusion of medicaments. But use of modern medicinal therapy scheme does not gives enough positive influence on long term results of treatment and does not decrease numbers of amputations[11].

It is hereby of great importance to develop new methods and schemes of chronic arterial insufficiency/chronic limb ischemia therapy, which will allow us to neutralize factors of atherogenesis, slow down the development of sclerotic damage and improve the state of collateral blood circulation in limbs. In context of the problem of chronic arterial insufficiency/chronic limb ischemia, collateral blood circulation represent itself as the main question and without its solution it is not possible to choose the rational treatment scheme. Subsequently many methods to improve collateral blood circulation has been proposed: osteotomy by Г.А.Илизарову-Ф.Н.Зусмановичу [5,6], modification/variants of revascularative osteotrepanation[2,3,7], treatment with extravasations[4], treatment under influence of high intensity laser rays[1].

Experimental research with use of gene engineering technologies in treatment chronic arterial insufficiency/chronic limb ischemia has been conducted[8]. The first clinical results of application of gene which codes for the growth factor of endothelia for simulation of the process neoangiogenesis and ischemic limbs has been received[10,12-15].

To develop and experimentally prove a new method of microcirculation cycle/channel formation. As the prototype the method of treatment with extravasations has been chosen[4]. Authors named multiple aggregations of formed elements of blood which are left in tissue after

infiltration by distal segments of patient's own blood as extravasations. In zones of extravasations, corresponding reaction was observed on the part of interstitial tissue with formation of excessive areolar (or loose) connective tissue rich in vessels like minute arteries, arterioles and capillaries. Improvement in peripheral blood circulation between procedures of formation of extravasations is explained by the aseptic inflammation in tissues of the processed limb.

Within 1-1.5 months or more after formation of extravasations, Improvement of microcirculation is caused by inclusion in blood circulation perivasal vascular system and functioning collaterals with help of micro vessels of the formed areolar/loose nonformalized connecting tissue. Negative aspect of this method is the insufficient clinical affectivity, which is connected with its excessive invasive process which in turn is explained by the necessity of getting autologous blood and its subsequent interstitial introduction.

The designated methodical approach was a precondition of frequent purulent complications. Besides, it is necessary to consider the low level of technology, for reception and subsequent introduction of autologous blood.

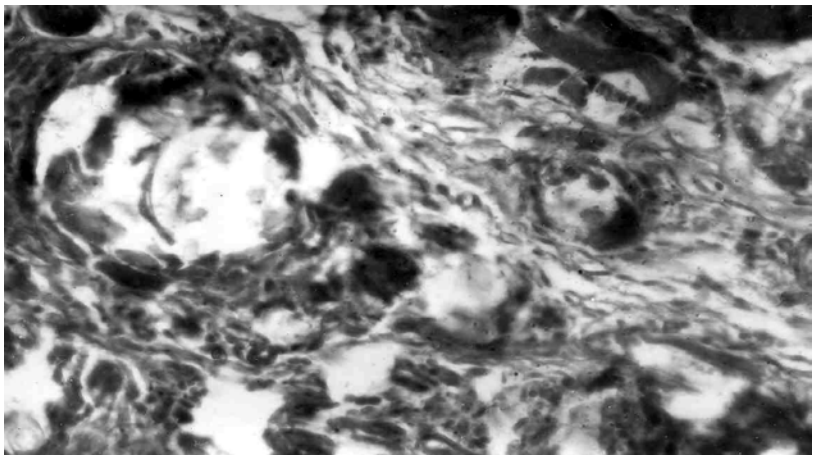
The method proposed by us for formation of microcirculatory channels/cycles [9], which is based on which is based on intramuscular implantation of polymers of glycolic acids. Polyglycolic acid is widely used in surgery, in form of suture material (dexon, maxon, biosorb, PGA Resorba, serafit, biosyn). In human organism, sutures with these material gets hydrolytically absorbed, i.e. under the influence of water with mild irritation of tissues by glycolic acid, which then takes participation in metabolism, decaying on carbonic acid and water. In case of intramuscular implantation absorption of this particular type of suture material is minimum 40 days and full absorption occurs in 60-90 day.

MATERIAL AND METHODS

The experiment was carried out on 75 white rats, who were administered Nembutal/ Aethaminalum-natrium as anesthesia, with the dose of 0.5 ml of 5% sol of Aethaminalum-natrium per 1 kg mass of rats. Then in one of the limbs ligature was implanted in strips (1-3 grams of suture material in 1 sq dm of tissue. Animals were deduced from experience on 5th, 7th, 14th, 30th and 90th day, by intra pleural introduction of 1 ml of 5 % sol of Aethaminalum-natrium. Estimation of efficiency of process of formation of microcirculatory cycle/ channels was carried out by the means of the histological analysis of muscles; with preliminary implanted biogenic stimulator i.e. suture material.

RESULTS AND ANALYSIS

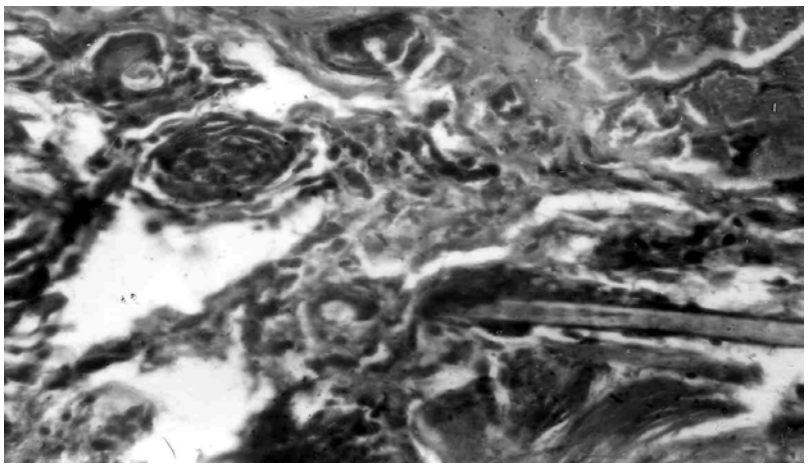
After 5th day post implantation, in the muscular tissues neogenic capillaries were revealed and from the 7th day intense growth granulation tissue with a significant amount of vessels was observed. In histological research of slide stained with hemotoxilin – eosin on 14th day a region of absorption of suture material was revealed. On edge of the implanted suture material elements of «areolar» connective tissue were found. This connective tissue is represented by collagen fibers, fibroblasts, fibrocytes and units lymphocytes. Among areolar/loose connective tissue, hemo-capillaries with isolated erythrocytes were determined (pic. 1).



Pic 1: Areolar/loose connective tissue, formation of capillaries. Absorption of suture material. Stained with hemotoxilin – eosin.

From this period, growth of young granulation tissue with well defined vascular component was revealed and from 30th day vessels thick walls were revealed (pic. 2).In the period between 30th and 90th day significant change in the development of the micro vessels was not seen, which points to the fact that reaction of microcirculatory apparatus on heterogenic stimulator ends during the period of 1 month. On the basis of experiments, technically based recommendation has been given for the manufacture of atraumatic straight needle with suture

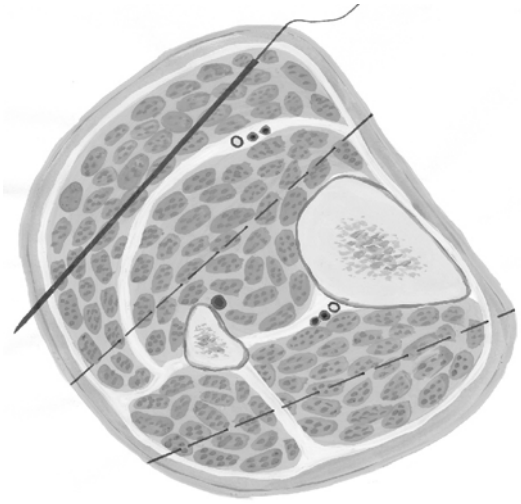
material for transmuscular implantation. This has been done as none of the suture material manufactures does not manufacture atraumatic needle-suture complex which meets these parameters and aims.



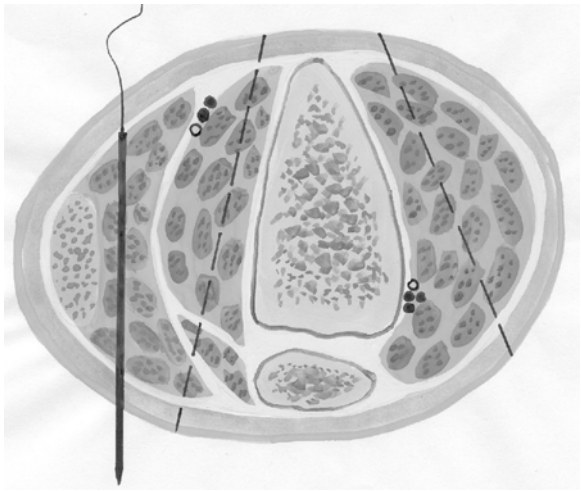
Pic 2: Coarse-fibred connecting tissue around suture material. Formed vessels- arterioles. Stained with hemotoxilin – eosin.

Straight/linear needle polyglycoid suture material is meant for implantation in muscle of calf as in case of chronic arterial insufficiency of lower limbs mostly the distal segments of the limbs are affected. Considering, that the average diameter of calf of a person ranges from 10-16 cm, and that the needle should be fixed on the needle holder, the length of a needle should be not less than 12-18 cm. It should have certain rigidity so that not to get deformed while movement through tissue of the calf (skin hypodermic layer, fascia, muscles). The needle is used only as a conductor for implantation of the suture material, and thus trauma should be minimal. The most optimal in this case is the choice of piercing cutting edge needle as well as the suture as well as the choice of suture material-polyglycoids due to its ability of bio-destruction with minimal inflammatory reaction. Therefore the suture material should be small diameter so that its absorption occurs quickly enough. In our opinion the parameters for these purposes are satisfied by a suture material with the size 2-0 or 3-0.

In pic 3,4 Transverse cross section calf in different levels is represented. Various variants of transmuscular implantation of polyglycoids with help of atraumatic needle-suture complex is demonstrated.



Pic 3: Transverse Cross section through middle part of calf. Black dotted line shows the direction of transmuscular implantation of polyglycoids.



Pic 4: Transverse Cross section through lower one third part of calf. Black dotted line shows the direction of transmuscular implantation of polyglycoids.

CONCLUSIONS

The proposed procedure provides better possibility with the prototype level of technology and biogenic efficiency and can be used in clinical practice or optimization of microcirculatory system of tissue of lower limb.

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