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CREATION OF A TISSUE-ENGINEERED VASCULAR GRAFT BASED ON A POLYMER BIODEGRADABLE SCAFFOLD MADE FROM NANO – AND MICROFIBERS OF POLYLACTIDE AND POLYCAPROLACTONE

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Introduction. The need for autoplastic material of a small diameter (5 mm and shorter) is actual in cardiovascular surgery, especially in connection with the increasing number of reconstructive interventions on major arteries. It is well known that autologous transplants are scarce material; synthetic vascular prostheses are unsuitable for small diameter vessel reconstructions because of the low patency levels. A tissue-engineered vascular graft (TEVG), morphologically appropriate to a natural vessel, devoid of drawbacks of the vascular synthetic prosthesis is highly needed to improve surgical treatment of patients with cardiovascular diseases.

Aim: creation of a TEVG using a biodegradable polymer scaffold based on nano – and microfibers of polylactide and polycaprolactone.

Materials and methods. The tubular double-layered scaffolds were created by means of electrospinning from nano – and microfibers of biodegradable polymers:

poly(L-lactide) used as the internal layer;

poly(e-caprolactone) used as the external layer.

Mechanical properties were assessed by an Instron model 5943 tensile tester. Obtained grafts were implanted into the rats' aorta (Wistar, n=12) using the microsurgical technique. The sample properties were assessed during the operation. The animals' observation periods were 4, 8, 12 and 24 weeks. Histological evaluation was provided. Samples were stained using hematoxylin and eosin and Mallory's trichrome stain.

Results and discussion. Double-layered, biodegradable, polymer scaffolds with high mechanical properties were obtained. Patency was 83%. There were no signs of acute inflammatory reaction in the scaffolds implantation zone. The endothelial lining was formed without any signs of myointimal hyperplasia in the anastomosis zone 6 months later; the graft wall consisted of connective tissue, mainly made of fibroblasts, fibrocites, collagen and elastic fibers.

Conclusion. Our team obtained double-layered tubular scaffolds appropriate for implantation into the vascular system. In long-term in vivo experiments, biosafety and biocompatibility were proven. High patency levels were obtained, 83% to be exact. However, histological evaluation of the neovascular wall did not correspond to the native vessels wall. Thus, further development of the scaffold using cellular material is needed to create a promising TEVG.