

PROSPECTS FOR APPLICATION OF BOVINE PERICARDIAL SCAFFOLD FOR CARDIAL SURGERY

A. A. Sokol
D. A. Grekov
G. I. Yemets
N. V. Shchotkina
A. A. Dovghaliuk
N. M. Rudenko
I. M. Yemets

State Institution „Scientific — Practical Medical Center of Pediatric Cardiology and Cardiac Surgery of the Ministry of Health of Ukraine“, Kyiv

E-mail: cardiotissue@gmail.com

Received 29.11.2020

Revised 15.12.2020

Accepted 30.12.2020

The aim of the study was to estimate the properties of the scaffold obtained by decellularization with of bovine pericardium a 0.1% solution of sodium dodecyl sulfate. The experiment included standard histological, microscopic, molecular genetic, and biomechanical methods. Scaffold was tested *in vitro* for cytotoxicity and *in vivo* for biocompatibility. A high degree of removal of cells and their components from bovine pericardium-derived matrix was shown. Biomechanical characteristics were of artificial scaffold were the same same as those of the native pericardium. With prolonged contact, no cytotoxic effect on human cells was observed. The biointegration of the scaffold in laboratory animals tissues was noted, thus confirming the potential possibility of the implant application in cardiac surgery.

Key words: pericardium, scaffold, decellularization, cardioimplant, tissue engineering.

Today, cardiovascular diseases are the leading cause of death in the world. According to WHO statistics, heart diseases kill more than 17 million people each year, which is 31% of all deaths [1]. Congenital heart defects occur with a frequency of about 9 % [2]. To date, cardiac surgery is performed in almost all congenital heart defects, where in most cases a complete anatomical correction is performed using artificial implants. The total postoperative mortality from these surgeries in the world's leading clinics is less than 3%. However, the use of artificial prostheses has a number of disadvantages that significantly impair the quality of patients life in the postoperative period. About a third of patients those get operated require repeated surgery at various times in the long term. Patients usually need lifelong anticoagulation therapy. A promising direction in overcoming the above problems may be the use of biological implants. However, they also have a number of unresolved issues, such as complete or partial biodegradation and calcification after implantation [3].

In the world medical practice, bioimplants made of xenogenic tissues, for example from the pericardium of pigs, horses, cattle, which have the elasticity of the material close to human tissues, are increasingly used [4]. To obtain such an implant, the native material is subjected to decellularization, which is the complete elimination of donor cells and purification from antigenic molecules while maintaining the structure of the extracellular matrix. Today, scaffolds are successfully used in the clinic for tissue engineering and regenerative medicine [5–8]. Decellularized extracellular matrix made of bovine pericardium is a promising biomaterial for cardiovascular tissue repair, as the structure of collagen-elastin components of the framework is satisfactorily preserved, and antigenic molecules are properly eliminated and thus reduces the antigenicity of such material [9–11].

Sodium dodecyl sulfate (SDS) is one of the most commonly used anionic detergents to create extracellular matrices, as it can more