6th International Conference on Nanotechnologies and Biomedical Engineering Proceedings of ICNBME-2023, September 20–23, 2023, Chisinau, Moldova - Volume 1: Nanotechnologies and Nano-biomaterials for Applications in Medicine

Mechanical Characterization of Decellularized Blood Vessels: A Valuable Tool to Provide Comprehensive Information About the Scaffold

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Abstract

Cardiovascular diseases (CVDs) remain an important global health problem. Surgical revascularization (or bypass surgery) has been established as the most optimal therapeutic approach for patients with severe injury; however, not in all cases a suitable vascular substitute can be identified. The field of vascular tissue engineering and regenerative medicine aim to produce suitable tissue-engineered vascular grafts (TEVGs) for vascular repair, replacement, or reconstructive aims. Decellularization (DC) is a promising approach because it completely removes the antigenic cellular components. The goal of the proposed study was to examine the mechanical integrity of the decellularized porcine carotid arteries (a prototype of small-diameter vascular grafts).

The developed DC procedure included osmotic shock, chemical surfactant treatment, and enzymatic digestion. Agree to other DC protocols reported previously, we were able to demonstrate, on the one hand, complete removal of cells throughout the arterial wall by performing H&E staining and DAPI, on the other hand, good biomechanical properties of decellularized tissue by performing the suture retention strength testing. The average suture retention strength of native porcine vessels was 1.08 ± 0.39 N. The average suture retention strength of decellularized vessels was 1.14 ± 0.38 N ($p = 0.0731$). In summary, the both control and treated vessels exhibited similar mechanical properties; the used combined method had beneficial effect in this study.

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Keywords: decellularization, blood vessels, cardiovascular diseases, tissue-engineered, vascular grafts, decellularized porcine carotid arteries

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