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Biomechanical properties of biological lung scaffold in non-human primates

Elena V Kuevda[1], Elena A Gubareva[1], Ivan S Gumenyuk[1], Alexander S Sotnichenko[1], Irina V Gilevich1, Dzhina D Karal ogly[2] , A N Redko[1] and **S N Alekseenko[1]**
[1]Kuban State Medical University, Russia
[2]Federal State Budgetary Institution, Russia

We focused on extensive characterization of biomechanical proprieties of biological lung scaffolds obtained from non-human primates. Bilateral lung blocs were isolated from four male Macacae mulattae according to ethical requirements. After mounting in bioreactor lungs were decellularized with modified detergent-enzymatic method: Perfusion with 2% sodium deoxycholate, Triton X–100 and bovine pancreatic DNase. The quality of obtained scaffolds was proved with histological staining. Collagen I, IV and elastin components were visualized with immunohistochemistry and quantified with ImageJ software. DNA quantification was performed with spectrophotometer BioDrop. Lung slice culture (decellularized tissue punches seeded with autologous mesenchymal stem cells) was used for evaluation of cells-matrix interactions. XTT assay and Live/Dead staining demonstrated cell viability and metabolic activity on the scaffold. Biomechanical testing was conducted with Instron Tensile Tester Model 5965 both for tangential modulus and peak stress. Haematoxylin and eosin showed no visible nuclei but well preserved matrix architecture after decellularization, DAPI staining validated efficiency of cell removal. Total DNA decreased from 771.20±67.99 ng/μg to 148.30±16.22 ng/μg after decellularization ($p<0.0001$).Conservation of extracellular matrix proteins was confirmed with positive staining for collagen I, collagen IV and elastin. Quantitative evaluation shows more than a half elastin loss after decellularization (from 31.16% to 6.81%, $p=0.0437$). Peak stress curves and tangential modulus correlated with elastin changes but proved collagen preservation. The tissue slice model showed biocompatibility and cells attachment to the scaffold ($p=0.0455$). Acellular lung matrix retains structure and qualitative content of native extracellular matrix. Additional investigations are needed to enlarge elastin preservation before recellularization.

Biography

Elena V Kuevda has completed her MD and the PhD from Kuban State Medical University, Krasnodar, Russia. She works as Researcher in International Research, Clinical and Education Center of Regenerative Medicine, Kuban State Medical University, Krasnodar, Russia. She has published more than 31 papers in reputed journals both in Russia and abroad.

elenakuevda@yandex.ru

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