

P167. Designing Cardiac Jelly Based Tissue Engineered Pulmonary Valves In Congenital Heart Disease

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OBJECTIVES: Biochemical signals which guide normal fetal cardiac valve development will likely have similar effects during the formation of tissue engineered heart valves (TEHV). We hypothesize that the combined effect of circulating endothelial progenitor cells (EPCs) and relevant signaling factors can be used to guide extracellular matrix (ECM) synthesis, organization, and remodeling of EPC-TEHV.

METHODS: Elastomeric poly(glycerol sebacate) scaffolds were pre-coated individually with cardiac jelly ECM. Characterized ovine blood EPCs were seeded onto scaffolds.

RESULTS: Pre-coated scaffolds (n= 3) revealed significantly increased cellularity and cellular ingrowth compared to controls. Seeded EPCs demonstrated substantial increased cell growth at 21 days of incubation ($99.9 \pm 0.002\%$ and $2.27 \times 10^4 \pm 1.57 \times 10^3$ fold, $p < 0.0001$), compared to initial cell density. Comparison of pre-coated versus uncoated scaffolds revealed statistically significant cellularity ($98.9 \pm 0.071\%$ and 110.8 ± 8.58 fold, $p < 0.0001$). Heparan sulfate coated scaffolds revealed substantial increase in cellularity compared with initial cell density and uncoated controls ($7.99 \times 10^{11} \pm 6.99 \times 10^{10}$ versus 1.5×10^7 and $3.85 \times 10^9 \pm 8.92 \times 10^7$ per cm^2 respectively, $p < 0.0001$). Hyaluronan, Chondroitin sulfate, and Versican precoated scaffolds demonstrated similar trend, however revealed a $56.9 \pm 4.66\%$ decrease in cellularity compared with HS-precoated scaffolds.

CONCLUSIONS: Circulating EPCs seeded onto the PGS scaffolds can respond to physical and soluble signals. Manipulation of these signals by closely mimicking embryonic cardiac valve morphogenesis can favorably influence the development of TEHV scaffolds. The composition of the in vivo cardiac jelly could potentially serve as design criteria to construct clinically applicable TEHV.

Cardiac Jelly

