P157. Biomechanical Testing Of Low Concentration SDS Decellularised Porcine Pulmonary Valves

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OBJECTIVES: The aims of this study were to assess the effectiveness of a decellularisation treatment incorporating low-concentration SDS in the production of acellular pulmonary valve conduits, and to investigate the treatment in the biomechanics of the acellular pulmonary valves.

METHODS: Porcine pulmonary roots (n=6) were washed in: hypotonic Tris buffer (HTB; 10mM Tris pH 8.0, 0.1% EDTA, 10KIU aprotinin); 0.1% SDS in HTB; treated with DNase and RNase and washed in PBS. Decellularisation was assessed histologically using H&E, Hoechst and Miller?s elastin. Uni-axial tensile tests to failure were used to compare the tensile properties of fresh (FL) and decellularized leaflets (DL; n=6~9) and pulmonary artery walls (FW; DW n=6) in the circumferential [C] and radial [R] directions for the leaflets, and the circumferential [C] and axial [A] direction for the pulmonary artery wall.

RESULTS: Histology confirmed complete decellularisation and retention of histioarchitecture. Biomechanical parameters were derived from tensile tests (see Table, mean±95% C.I). With the exception of leaflet failure stress in the radial direction and wall failure stress in the circumferential direction, there were no significant differences in the rest of the biomechanical parameters between treated and native leaflet /pulmonary wall tissues.

CONCLUSIONS: Porcine pulmonary roots were successfully decellularised using low-concentration SDS. The acellular valves have the potential to be used, either seeded or non-seeded with cells, as valve replacements in the pulmonary position.

Table: Biomechanical properties of FL, DL, FW & DW

	Elastin phase (GPa)	Collagen phase (GPa)	Transition stress (MPa)	Transition strain (%)	Failure stress (MPa)	Failure strain (%)
FL[C]	$1.4\pm0.2\times10^{-3}$	$2.4\pm0.9\times10^{-2}$	0.72±0.25	16.1±5.1	7.3±0.8	59±11.6
DL[C]	$1.4\pm0.8\times10^{-3}$	$4.3\pm1.3\times10^{-2}$	1.11±0.33	17.3±2.8	9.9±2.3	44±4.1
FL[R]	$6.2\pm1.4\times10^{-4}$	$4.0\pm0.8\times10^{-3}$	0.20±0.06	15.1±6.1	1.8±0.4	66±15.4
DL[R]	$5.1\pm1.1\times10^{-4}$	$3.3\pm0.8\times10^{-3}$	0.14±0.04	16.1±3.7	0.8±0.2*	56±9.0
FW[C]	$5.7\pm0.6\times10^{-5}$	$1.7\pm0.4\times10^{-3}$	0.18±0.04	120.8±8.5	1.1±0.3	195±13.1
DW[C]	$6.9\pm0.9\times10^{-5}$	$9.6\pm1.8\times10^{-4}$	0.16±0.03	109.0±8.1	0.7±0.1*	188±18.3
FW[A]	$5.9\pm0.7\times10^{-5}$	$9.7\pm2.3\times10^{-4}$	0.12±0.01	96.5±13.1	0.6±0.1	156±18.5
DW[A]	$6.7\pm1.4\times10^{-5}$	$8.5\pm1.7\times10^{-4}$	0.13±0.03	92.8±13.7	0.6±0.1	167±14.6
*P<0.05 ANOVA						