EFFECTS OF TRANSVALVULAR PRESSURE ON THE PULMONARY VALVE MICROSTRUCTURE

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The aim of this study is to understand the microstructural response of the native pulmonary valve to pressure loading and to access creep during glutaraldehyde fixation. A similar study was performed on the aortic valve, and it is believed that the native pulmonary valve and the native aortic valve behave in a similar manner.

First, four carbon markers were placed on each of the three cusps of a fresh porcine pulmonary valve. The valve was mounted in a tank filled with a room temperature physiological buffer solution (PBS). An initial photograph of the marker positions was then taken. Next, 50% gluteraldehyde in distilled water was titrated into the solution until its gluteraldehyde concentration reached 0.5%. The fresh porcine pulmonary valve was then subjected to a transvalvular pressure. Photographs were taken periodically at specific time points over a 24-hour period. Marker coordinates were calculated based on the photographs and strain was evaluated. The cusps were then dissected from them root and cleared free floating in graded glycerol/saline solutions for an hour each. Then, the cusps were mounted flat in a thin vertical glass well free floating in 100% glycerol. Finally, small-angle light scattering (SALS) was implemented to compute the fiber structure of the cusps. This procedure was performed at transvalvular pressures ranging from 0, 1, 2, 4, 10, 20, 60, and 90 mmHg.

The greatest changes in fiber alignment occurred between 0 and 1 mmHg, and no evident changes after 4 mmHg. Fixation of the native pulmonary valve with glutaraldehyde caused creep.