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Residual Cellularity, Antigen, and DNA

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Objectives:

To demonstrate decreased cellularity and cell related antigen from human heart valves exposed to a decellularization technique (SynerGraft® process), while retaining structural features and organization important to valve function.

Method:

Antibiotic-treated human aortic and pulmonary heart valves were exposed to hypotonic lysis, nuclease (DNaseI/RNaseA) digestion, and isotonic washout prior to standard cryopreservation. Decellularized valves and conventionally cryopreserved valves were assessed for cellularity (H&E stain), DNA content (fluorometric assay), tissue antigen (MHC-I; immunohistochemistry), and structural features (collagen, elastin, and glycosaminoglycans; pentachrome stain).

Results:

All components (leaflet, conduit, myocardium) of decellularized valves exhibited 98% or greater reduction in cells and DNA content. MHC-I staining of conventional valves was restricted to cells lining blood vessels in conduit and myocardium; no MHC-I staining was detected in decellularized tissues. No fragmentation of collagen or elastin fibers was found in decellularized valves, and glycosaminoglycan content was unchanged as compared to conventional tissue.

Conclusions:

The process used to decellularize human heart valves achieved substantial reduction in cellularity and transplant-related antigen without affecting structural elements relevant to valve function.