Changes in Mechanical, Structural Integrity and Microbiological Properties Following Cryopreservation of Human Cadaveric Iliac Arteries

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Abstract

Introduction: The study seeks to investigate how the duration of storage of cryopreserved human cadaveric iliac arteries impacts their mechanical, structural and microbiological properties as compared to their fresh sample. Materials and Methods: Iliac arteries were harvested from 12 human cadavers and divided into 2 groups. One group underwent mechanical stress-strain assessment immediately and another was cryopreserved for a pre-determined time-period (range, 29 to 364 days). Mechanical functionality was assessed with a customised clamping mechanism. The arteries' microbiological properties were studied pre- and post-cryopreservation. The post-thawed arteries were also assessed histologically for structural integrity. Results: Of the 12 pairs, only 7 (58, 119, 150, 252, 300, 332 and 364 days) iliac arteries were included in the final analysis. The other 5 pairs (29, 90, 188, 205 and 270 days) had abundant local calcification and their stress-strain curves could not be characterised. From the curves, pre- and post-cryopreserved arteries had the most similar mechanical properties when stored for 119 days. A trend of increasing relative stiffness with increased duration of storage was noted. The post-thawed arteries demonstrated minimal fragmentation except in atherosclerotic areas. Majority of the arteries were not contaminated by bacterial or fungal infection pre- and post-cryopreservation. Also, 2 arteries (364 and 332 days) which had initial bacterial colonisation showed no bacterial growth on their post-thawed sample. Conclusion: Mechanically, non-atherosclerotic cryopreserved arteries can be a good substitute to their corresponding fresh arterial graft. However, the length of cryopreservation has an effect on the relative stiffness of the pre- and post-cryopreserved arteries. Histological and microbiological findings suggest that cryopreservation have little impact on an artery structural integrity and may possibly have a role in maintaining sterility and sterilising the arteries.

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