

Abstract

Aortic valve-sparing procedures treating patients with aortic root aneurysm with or without aortic insufficiency and patients with ascending aortic aneurysm and aortic insufficiency are no longer experimental and unproven procedures. A successful aortic valve-sparing or repair operation aims not only to correct the failing part of the aortic root but also to restore the intro- and the inter-component relationship of the aortic root elements to optimal dimensions and relations. The avoidance of anticoagulation therapy and prosthesis-related complications makes aortic valve repair a tempting procedure. Considering the increasing rate of cusp repair reported in scientific literature, conservative aortic valve surgery seems to be developing into aortic valve repair surgery. This Dissertation Theses are devoted to the study of some specific technical aspects of aortic root sparing surgery, namely to the study of structural changes occurring in cryopreserved human aortic root allografts and the reproducibility of Coroneo ring implantation procedure.

The Introduction of these Dissertation Theses deals with the general review of aortic valve-sparing operations in the light of the historical aspects of used surgical technique, dynamic anatomy and the current situation. One part of the Introduction is devoted to the new non-surgical technical development, i.e. use of fibrin sealants in cardiac surgery and safety aspects of their use, including some information on specific fibrin sealants currently available to the surgeon. The last part of the Introduction discusses some aspects of cryopreservation of allografts for surgery.

The experimental part of these Dissertation Theses was undertaken with the fact in mind that the surgical improvement of the type of surgery described was achieved. The current effort is aimed at optimization of various technical aspects and not on the principal changes of the procedures used. Consequently, this experimental doctoral work was undertaken with the following objectives: 1) To assess morphological changes of the arterial wall that arise during different thawing protocols of a cryopreserved human aortic root allograft (CHARA) arterial wall; 2) to assess morphological changes of CHARA leaflets that arise during different thawing protocols; and 3) to compare the obtained results with the results arising from the comparison of different thawing protocols of CHARA leaflets. Additionally, 4) reproducibility of Coroneo ring implantation on the aortic annular base under standardized conditions was evaluated.

All parts of this dissertation were performed with keeping up all the relevant and related ethical considerations. Approvals of the Ethical Committees were secured before the work.

For Objectives 1, 2 and 3, two thawing protocols were investigated. For the thawing protocol number 1, CHARA specimens were thawed at a room temperature of 23°C, while when the thawing protocol number 2 was used, CHARAs specimens were placed directly into a water bath at +37°C. After this procedure, microscopic slides for electron microscopy were prepared from all the specimens and evaluated with the use of the scoring system for morphological sample analysis. It was demonstrated that all the samples of CHARAs thawed at the room temperature showed smaller overall structural damage to the arterial wall and no smooth muscle cell contraction in tunica media when compared to the samples thawed in a water bath. Thawing at a room temperature seems to be gentler and does not lead to so severe damage to the CHARAs arterial wall (Objective 1). In the study regarding our objective 2, the performed experimental work following the structural changes occurring during different thawing protocols on cryopreserved AV leaflets showed that different rates of thawing show

identical structural changes. Therefore, the rate of thawing does not play a significant role in minimizing structural changes that occur during thawing of cryopreserved AV leaflet. Consequently, it was demonstrated that different types of aortic root tissue (aortic wall versus aortic leaflets react differently when submitted to different thawing protocols, aortic leaflets being less sensitive to the thawing process alteration (Objective 3).

Objective 4 was to determine the reproducibility of external aortic root annuloplasty with the use of Coroneo external aortic annuloplasty ring (Extra-Aortic TM, CORONEO, Inc., Montreal, QC, Canada) in human aortic root allografts (18 human aortic root allografts were used). This part of my Dissertation Theses is important as a dilated AVJ that stays untreated represents a highly significant factor contributing to the failure of aortic valve-sparing operations and this surgical procedure is being used in significant numbers of patients. The procedure of implanting Coroneo ring was performed twice on each aortic annular base and the results were evaluated. Our results on reproducibility of aortic annular base Coroneo ring implantation and re-implantation indicate that the reproducibility of this procedure is very high and that there is no significant difference between the outcome of the procedures during an implantation and re-implantation of Coroneo ring on the aortic annular base.