Ross Operation With a Tissue-Engineered Heart Valve

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Background
The Ross procedure has gained increasing acceptance due to excellent hemodynamic results by replacing the diseased aortic valve with the viable autologous pulmonary valve. Consequently, the right ventricular outflow tract (RVOT) has to be reconstructed. In this report a viable heart valve was created from decellularized cryopreserved pulmonary allograft that was seeded with viable autologous vascular endothelial cells (AVEC).

Method
A 43-year-old patient suffering from aortic valve stenosis underwent a Ross operation on May 20, 2000, using a tissue engineered (TE) pulmonary allograft to reconstruct the RVOT. Four weeks before the operation a piece of forearm vein was harvested to separate, culture and characterize AVEC. Follow-up was completed at discharge, 3, 6 and 12 months postoperatively by clinical evaluation, transthoracic echocardiography (TTE), and magnetic resonance imaging (MRI). Additionally, at 1-year follow-up multislice computed tomography was performed.

Results
After four weeks of culturing $8.34 \times 10^6$ AVEC were available to seed a 27-mm decellularized pulmonary allograft. Trypan blue staining confirmed 96.0 % viability. Reendothelialization rate after seeding was $9.0 \times 10^5$ cells/cm$^2$. TTE and MRI revealed excellent hemodynamic function of the TE heart valve and the neoaortic valve as well. Multislice computed tomography revealed no evidence of valvular calcification.

Conclusion
After 1 year of follow-up the patient is in excellent condition without limitation and exhibits normal aortic and pulmonary valve function.