Homografts

for the treatment of heart valve disease

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Harvesting Facilities in Austria

- Österreichisches Rotes Kreuz, Landesverband OÖ, Blutzentrale Linz
  - Types of donors: multi-organ donors, non-heart beating donors
  - Procurement outside the center
  - Authorization for the processing, storage and distribution of heart valves

- Univ. Klinik für Chirurgie, Klinische Abteilung für Herzchirurgie, Homograft-Entnahmeeinrichtung Wien
  - Types of donors: living donors, multi-organ donors
  - Procurement inside the center
  - Currently no authorization for the processing, storage and distribution of heart valves
Implanted homografts at the AKH Wien

- Implantation of homografts from the “Homograft-Entnahmeeinrichtung Wien“ (summer 2015 till today)
Homograft performance in Vienna

Freedom from reoperation

Green: Vienna
Blue: Cryolife

p=0.016
Clinical indications for homograft implantation

Adult cardiac surgery

- Ross procedure
- Aortic valve replacement for endocarditis

Pediatric cardiac surgery

- RVOT reconstruction (Fallot, ..)
- Norwood
- ...

Medical University Vienna
Aortic Valve Disease
Surgical Treatment Options

- Standard mechanic / biologic valves
- New surgical prosthesis (sutureless/rapid deployment)
- Transfemoral / transapical TAVI

Pediatric and young adults -> optimal prosthesis?

- Aortic Homografts
- Ross procedure
- Bioregenerative aortic valve replacement (ARISE-Project)
Long-term outcomes after autograft versus homograft aortic root replacement in adults with aortic valve disease: a randomised controlled trial

Ismail El-Hamamsy, Zeynep Eryigit, Louis-Mathieu Stevens, Zubair Sarang, Robert George, Lucy Clark, Giovanni Melina, Johanna J M Takkenberg, Magdi H Yacoub

Summary

Background The ideal substitute for aortic valve replacement in patients with aortic valve disease is not known. Our hypothesis was that the regulatory and adaptive properties of a living valve substitute could improve the long-term outcomes in patients. We therefore compared these outcomes after autograft aortic root replacement (Ross procedure) versus homograft aortic root replacement in adults.

Methods Male and female patients (<69 years) requiring aortic valve surgery were randomly assigned in a one-to-one ratio to receive an autograft or a homograft aortic root replacement in one centre in the UK. The random allocation sequence was computer generated. Treatment was not masked. The primary endpoint was survival of patients at 10 years after surgery. This study is registered as an International Standard Randomised Controlled Trial, number ISRCTN03530985.

Findings 228 patients were randomly assigned to receive an autograft or a homograft aortic root replacement. 12 patients were excluded because they were younger than 18 years; 108 in each group received the surgery they were assigned to and were analysed. There was one (<1%) perioperative death in the autograft group versus three (3%) in the homograft group (p=0.621). At 10 years, four patients died in the autograft group versus 15 in the homograft group. Actuarial survival at 10 years was 97% (SD 2) in the autograft group versus 83% (4) in the homograft group. Hazard ratio for death in the homograft group was 4·61 (95% CI 1·71–16·03; p=0·0060). Survival of patients in the autograft group was similar to that in an age-matched and sex-matched British population (96%).

Interpretation Our findings support the hypothesis that a living valve implanted in the aortic position can significantly improve the long-term outcomes in patients.

Funding Magdi Yacoub Institute.
Figure 3: Actuarial freedom from need of (A) aortic valve reoperation and (B) any (aortic or pulmonary) reoperation in patients after autograft versus homograft aortic root replacement. Data are percentage (SD).
Ross Procedure
Survival

Risks of the Ross procedure

- Dilatation of the autograft
- Stenosis of the pulmonary homograft
- Complex surgery
- Systemic reaction to the homograft?
Case: Heart transplantation after Ross procedure

- Patient with congenital aortic valve stenosis and dilative cardiomyopathy
- Ross procedure 1998
- Heart transplantation 2015
- Severe antibody mediated graft failure
- Homograft Donor HLA-A02, Recipient HLA-A01
- PRA prä TX: 0%, but anti A02 antibodies
  -> PRA 83% post HTX
Sensitized Patients

- Increasing number
- Risk factors: blood transfusion, pregnancy, previous surgery
- PRA show potential risk
- Potential prospective crossmatch
- Transplant may have a booster effect on memory cells
Bioregenerative AVR – The Future?

Future Innovations will make the difference!!

palliative therapy
curative therapy

Decellularized Homografts (ARISE Study)
Decellularized Fresh Homografts for Pulmonary Valve Replacement: A Decade of Clinical Experience; Samir Sarikouch, Alexander Horke, Igor Tudorache, Philipp Beerbaum, Mechthild Westhoff- Bleck, Dietmar Boethig, Oleg Repin, Liviu Maniuc, Anatol Ciubotaru, Axel Haverich and Serghei Cebotari (EACTS 2015)
Decellularized Fresh Homografts for Pulmonary Valve Replacement: A Decade of Clinical Experience; Samir Sarikouch, Alexander Horke, Igor Tudorache, Philipp Beerbaum, Mechthild Westhoff- Bleck, Dietmar Boethig, Oleg Repin, Liviu Maniuc, Anatol Ciubotaru, Axel Haverich and Serghei Cebotari (EACTS 2015)
Freedom from explantation

Decellularized Fresh Homografts for Pulmonary Valve Replacement: A Decade of Clinical Experience; Samir Sarikouch, Alexander Horke, Igor Tudorache, Philipp Beerbaum, Mechthild Westhoff- Bleck, Dietmar Boethig, Oleg Repin, Liviu Maniuc, Anatol Ciubotaru, Axel Haverich and Serghei Cebotari (EACTS 2015)
SAVR for Aortic Valve Disease

1828 Friedrich Wöhler:

First Urea synthesis

Inspiration for Bioregeneration: Homunculus

Valve Therapy of the future will be Bioregenerative Replacement!!!
Transplantation einer dezellularisierten Herzklappe

Herzklappe (AKH)

Dezellulareisierung corlife
dezellulareierte Herzklappe (AKH)

Spontane Rebesiedlung (Patient/in)
Freigabe

1. Sterilität (keine Antibiotika!)
2. Histologie
   • keine intakten Zellkerne
   • intakte Wandstruktur
3. geringe Mengen von dsDNA
Rechtliche Aspekte

Entnahme, Zertifikat
INS-680226-0001-006

Betriebsführungsvertrag

In-Verkehr-Bringung

GSG-Sicherheitsvertrag
Zeiten

100 h nach Ischämie

Tag 30-59 (nach Ischämie)

Haltbarkeit: 60 Tage (nach Ischämie)
Conclusion

- Homografts play a major role in **specialized procedures** in cardiac surgery

- **Legal requirements** for graft harvesting and tissue banking are demanding

- **Decellularization process** may broaden the clinical spectrum

- A palliative therapy may be changed to a **curative therapy**