DECELLULARIZED AORTIC VALVE ALLOGRAFTS
10 YEARS EXPERIENCE

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Human Tissue Bank – PUCPR - Brazil
✅ Ownership and patent license of the SDS decellularization technique (d-CELL Allograft)

✅ Consultant and Member of the Advisory Board Tissue Regenix Ltd – England
DECELLULARIZED HEART VALVE

✓ Decellularization Technique
✓ Fresh Allografts, no cryopreservation
✓ Storage at 4º C for up to 3 months
Decellularized Heart Valves
Brazilian Experience (2005-2015)
Number of Implants = 1432 cases
Decellularized Heart Valve Allografts

- Pulmonary Allografts for RVOT Reconstruction during the Ross Operation

- Aortic Valve Allografts for AVR as Root Replacement

- Decellularized Allografts for Pediatric Patients under 12 Years of Age with Complex Congenital Heart Disease (ongoing study)
CLINICAL DATA

• Study Period: Nov 2005 – Aug 2017

• Patients: n= 115 (High Risk Profile)

• Age: 45± 18 (min=0,1 – max=81)

• Sex: Male = 77, Female =38

• 26 Concomitant Mitral Valve Disease (Multiple Reoperations]
• 18 Ascending Aorta / Hemiarch Aneurysm
• 23 Bacterial Endocarditis
• 6 Coronary Artery Disease
<table>
<thead>
<tr>
<th>Data</th>
<th>n</th>
<th>%</th>
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<tbody>
<tr>
<td><strong>Valvular Lesion</strong></td>
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<tr>
<td>Aortic Stenosis</td>
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<td>35,6</td>
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<tr>
<td>Aortic Insufficiency</td>
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<td>40</td>
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<td>Mixed Lesion</td>
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<td><strong>Etiology</strong></td>
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<td>Rheumatic</td>
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<td>Endocarditis</td>
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<tr>
<td>I</td>
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<td>II</td>
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<td>III</td>
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<td>IV</td>
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<td><strong>Operation</strong></td>
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<tr>
<td>Reoperation</td>
<td>47</td>
<td>40,8</td>
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</table>
OPERATIVE DATA

- **Surgical Technique**
  Aortic Root Replacement in all patients

- **Allograft Diameter**
  $21 \pm 2.7 \text{ mm (min}=6, \text{ max}=31)$

- **Cross-Clamp Time**
  $90 \pm 32 \text{ min (min}=50, \text{ max}=166)$

- **Extracorporeal Circulation Time**
  $136 \pm 58 \text{ min (min}=71, \text{ max}=279)$
Surgical Technique
Root Replacement
POSTOPERATIVE EVALUATION

Clinical Examination

Echocardiography
- Before hospital discharge
- 6/12 months PO, annually thereafter
- CT Scan
- MRI

Follow-up
- Clinical Follow-up – 90 patients (95% complete)
- Mean clinical follow-up time = 5.1 years (0.1 – 11.7)
Early Mortality = 6.0% (7/115)

• Low Cardiac Output ........................................3
• Sepsis and Multiorgan Failure............................2
• Bleeding .......................................................2
AVR WITH DECELLULARIZED AORTIC VALVE ALLOGRAFTS LATE SURVIVAL

75.3% at 10 Years
CI95% = (62.8% - 84.1%)

Early Deaths = 7
Late Deaths = 14

Patients at Risk
(115) (92) (69) (50) (31) (7)
<table>
<thead>
<tr>
<th>Cause</th>
<th>Count</th>
</tr>
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<td>Sudden Death</td>
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<tr>
<td>Pneumonia</td>
<td>2</td>
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<tr>
<td>Cancer</td>
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<tr>
<td>Stroke</td>
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<tr>
<td>Acute Myocardial Infarction</td>
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<tr>
<td>Reoperation for CABG</td>
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</tr>
<tr>
<td>DVP– Pulmonary Embolism</td>
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<tr>
<td>Trauma</td>
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<tr>
<td>Unknown</td>
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RESULTS

CLINICAL FOLLOW-UP

🎯 Late Functional Status
  - NYHA I - 83 patients
  - NYHA II - 10 patients
  - NYHA III - 1 patient
  - NYHA IV - 0 patient

🎯 1 case of Thromboembolism (Stroke)
🎯 No case of Bleeding
🎯 1 case of Bacterial Endocarditis
DECELLULARIZED AORTIC VALVE ALLOGRAFTS
EARLY AND LATE MAX INSTANTANEOUS GRADIENTS

Mean Early Peak Gradients
9.9 ± 7.8 mm Hg

Mean Late Peak Gradients
9.1 ± 9.2 mmHg
DECELLULARIZED AORTIC VALVE ALLOGRAFTS
AORTIC REGURGITATION

Graph showing the number of observations of aortic regurgitation over time:
- X-axis: Time (Years) ranging from 0-2 to 9-10
- Y-axis: Aortic Regurgitation (Number of Observations)

Key for observations:
- None/Trivial: Blue
- Mild: Green
- Moderate: Yellow
- Severe: Red
DECELLULARIZED AORTIC VALVE ALLOGRAFTS
FREEDOM FROM ≥ MODERATE AR

97.5% at 10 Years
CI95% = (90.4% - 99.3%)

2 Events
1 Bacterial Endocarditis
1 Cusp Prolapse *

Patients at Risk
(115) (92) (69) (50) (31) (7)
DECELLULARIZED AORTIC VALVE ALLOGRAFTS REOPERATIONS (N=3)

- AR due to Healed Bacterial Endocarditis .......... 1
- Primary Cusp Prolapse * .................................. 1
- Patient Outgrowth ........................................ 1

* PATIENT REOPERATED ELSEWHERE – NO ECHO AVAILABLE – SURGEON REPORT ONLY
DECELLULARIZED AORTIC VALVE ALLOGRAFTS
FREEDOM FROM REOPERATION ON THE ALLOGRAFT

94.3% at 10 years
CI95% = (81.4% - 98.3%)

Patients at Risk: (115), (92), (69), (50), (31), (7)
EXPLANTED AORTIC ALLOGRAFT
8 YEARS OF FOLLOW-UP

AORTIC WALL

• Well preserved aortic wall
• Elastic fibers intact
• “in vivo” repopulation
• Endothelization
• Minimal Intimal Hyperplasia
The Early and Midterm Function of Decellularized Aortic Valve Allografts

Francisco D. A. da Costa, MD, Ana Claudia B. A. Costa, Roberta Prestes, Ana Carolina Domanski, MD, Eduardo Mendel Balbi, MD, Andreia D. A. Ferreira, MD, and Sergio Veiga Lopes, MD

Decellularized Ao Allografts - Calcium Scores
CT SCAN EVALUATION – CALCIUM SCORES -

ABSENT OR MINIMAL CALCIFICATION ON CUSPS AND CONDUITS UP TO 2 YEARS OF FOLLOW-UP !!!!!

DECELLULARIZED AO VALVE ALLOGRAFTS
CT SCAN EVALUATION – CALCIUM SCORES -

ABSENT OR MINIMAL CALCIFICATION ON CUSPS
MILD – SPOTTY AREAS OF WALL CA AT 9 YEARS
CT SCAN EVALUATION
- CALCIUM SCORES -

ABSENT OR MINIMAL CALCIFICATION ON CUSPS
MILD – SPOTTY AREAS OF WALL CA AT 8 YEARS
CT SCAN EVALUATION  
– CALCIUM SCORES –

ABSENT OR MINIMAL CALCIFICATION ON CUSPS  
MILD – SPOTTY AREAS OF WALL CA AT 10 YEARS
CONCLUSIONS

• Decellularized Aortic Allografts have demonstrated promising results up to 10 years of follow-up
• Hemodynamic performance is optimal, with low gradients and no or minimal regurgitation at short and mid-term follow-up
• Decellularized allografts appears to be very resistant to infections
• Decellularized aortic valve cusps appears very resistant to calcific degeneration. On the conduit wall, spotty areas of calcification are frequently seen after 5 years of follow-up.
• There were no documented cases of aneurysmal dilatation of the allograft up to 10 years.
• Longer follow-up is still necessary to determine the merits of this new technology.
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