Aortic Valve Repair versus Replacement

Dr. Giovanni Marchetto
CONVENTIONAL AV Replacement

UNSOLVED ISSUES

- Thromboembolism
- Bleedings
- Valve degeneration/malfunction
- Patient-prosthesis mismatch
- Quality of life
- Endocarditis
- Long term survival
Valve repair improves the outcome of surgery for chronic severe aortic regurgitation: A propensity score analysis

Christophe de Meester, MS, Agnès Pasquet, MD, PhD, Bernhard L. Gerber, MD, PhD, David Vancaeynest, MD, PhD, Philippe Noirhomme, MD, Gébrine El Khoury, MD, and Jean-Louis J. Vanoverschelde, MD, PhD

de Meester et al. JTCVS 2014
Why aortic valve repair today?

Low adoption rate because of:

- Technical complexity
- Single Centre (single surgeon) series
Why aortic valve repair today?

Recent renewed interest:

• Better understanding of the surgical anatomy

• Systematic valve analysis to address repair

• Dedicated surgical instruments and devices to standardize and simplify the procedure

• Intraoperative quality control to predict long term results
Sinotubular junction

Crown-like ring

Anatomic ventriculo-arterial junction

Virtual ring formed by joining basal attachments of aortic valvar leaflets

Sino-tubular junction

Aortic annulus

2D

3D
Different AV Types

Aortic valve
- Tricuspid
  - Type 0: 0 raphe
  - Type 1: 1 raphe
  - Type 2: 2 raphe

Bicuspid valve
- Type 0

Unicuspid valve
- Type 2

Pattern of fusion
- P
- P
- P
- R
- L

Degree of fusion

Commissural orientation
- 180°
- 179-121°
- 120°
- A
- Equal 27 (99%)
- Unequal 484 (55%)
- Thirds 13 (2%)
Mechanisms of AR are a combination of:

- **Root pathology:**
  - STJ
  - Sinuses of valsalva
  - Basal Ring

- **Cusp pathology:**
  - Cusp Prolapse
  - Calcific degeneration
  - Perforation
A logical approach

1. Functional analysis of the aortic root and valve leaflets
2. Choice of the appropriate surgical technique

Functional classification of AI

<table>
<thead>
<tr>
<th>Ai Class</th>
<th>Type I</th>
<th>Type II</th>
<th>Type III</th>
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<tbody>
<tr>
<td></td>
<td>Normal cusp motion with FAA dilatation or cusp perforation</td>
<td>Cusp Prolapse</td>
<td>Cusp Restriction</td>
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<thead>
<tr>
<th>Mechanism</th>
<th>Repair Techniques (Primary)</th>
<th>STJ remodeling</th>
<th>Aortic Valve sparing: Reimplantation or Remodeling with SCA</th>
<th>Patch Repair</th>
<th>Prolapse Repair</th>
<th>Leaflet Repair</th>
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<tr>
<td></td>
<td>Ascending aortic graft</td>
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<td>SCA</td>
<td>Autologous or bovine pericardium</td>
<td>Triangular resection</td>
<td>Shaving Decalcificatio Patch</td>
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<tr>
<td></td>
<td>STJ remodeling</td>
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<td>Leaflet Repair</td>
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TTE/TEE

Echo: Diameters of the aortic root and ascending aorta, Valve morphology, Central/Eccentric jet, Cusp height/configuration/morphology
Functional classification of aortic insufficiency

Mechanism of AV dysfunction

Type 1

- Central jet
- All cusps have same coaptation height
- Lack of central coaptation
Root correction:

Reimplantation of Aortic Valve
(David 1992) (AVJ ≥ 30 mm)

Root Remodeling
(Yacoub 1993) (Sinus > 45 mm)

ST Junction Remodelling
(Frater 1986) (Sinus < 40-45 mm)
Evolution of the Remodeling technique

M. Yacoub

Evolution of the Remodeling technique (Yacoub)

Remodelling | Partial external band | Remodelling + Subvalvular Aortic Anuloplastic | Suture Anpl.

Annular stabilization

• **Suture annuloplasty**: PTFE suture
  
  (Schneider U et al. Ann Thorac Surg 2016)

• **External annuloplasty**: expansible ring placed externally
  

• **Internal annuloplasty**: crown-shaped internal ring characterized by an elliptical base geometry and three (for tricuspid valves) subcommissural posts
  
Functional classification of aortic insufficiency

Mechanism of AV dysfunction

Type 2 AI characteristics:

• Eccentric jet
  Sens. 92%, spec. 96%

• Cusp prolapse

• Cusp quality

M. Boodhwani, JTCVS 2013
Intraoperative Valve Evaluation: Paramount Step

Exposure and cusp examination are essential to achieve successful repair
Favorable INTRAOP Characteristics

Configuration/ coaptation of cusps: cusp height

TAV: 17-22 mm
BAV: 20-25 mm

Schäfers HJ; J Thorac Cardiovasc Surg. 2013;
EFFECTIVE HEIGHT
Assessment of aortic cusp geometry

Measured intraoperatively with Schafers caliper, effective height (eH) should be of 9mm or more.

STJ: sinotubular junction
ZK: zone of coaptation
eH: effective height
AN: aortic anulus

Schäfers HJ; J Thorac Cardiovasc Surg. 2006
Cusp Correction:

Variety of Surgical Techniques

- Plication of free margin
- Resuspension of free margin
- Triangular resection
- Patch correction
Reconstructive Technique: Free Margin Plication/Resuspension

- Prolapse => Risk
  - undercorrection leaving residual prolapse
  - overcorrection leading cusp restriction
Reconstructive Technique: Triangular resection

- Fibrosis,
- Calcium,
- Redundancy
Reconstructive Technique: Patch Correction

• Fenestration
To Preserve or Not to Preserve?

The **DECISION** depends on

- Feasibility
- Expected Durability

The **EVALUATION** rests on

- Preop Imaging
- Intraop Assessment
Favorable ECHO Characteristics

• **CUSPS**
  - Thin
  - Little to no calcium
  - Sufficient tissue length (Gh)

• **COMMISSURES (BAV)**
  - Close to symmetric circumferential orientation 160-180°
Optimal coaptation + Stabilisation

- Effective height (eH) ≥ 9 mm
- Coaptation length ≥ 4 mm
- No residual AR

Pethig K. ATS 2002
le Polain de Waroux JB. JACC Card. Im. 2009
Bierbach BO. EJCTS 2010
Aicher D. Circ. 2011
De Kerchove L. JTCVS 2011
Relationship between height of resuspension of the reimplanted valve and occurrence of postoperative aortic insufficiency

AVOIDANCE OF PATCH REPAIR

Boodhwani et al. JTCVS 2010
Pericardial Patch Augmentation

Other materials

*Presented at the EACTS 2016*
Patient selection

- Patient's preference
- Age
- Quality of life
- Surgical alternatives
- Comorbidity: Renal failure, Contraindication for anticoagulation
- Durability of repair procedure

Should all valves be repaired?
Root Remodeling+Annuloplasty+AV repair
Bicuspid AV repair + Annuloplasty
AV repair + HAART annuloplasty ring
Av repair:
Our Experience 2006-2017: 94pts
AORTIC VALVE REPAIR: 94 PATIENTS

- David ± Av repair (n=66)
- Remodelling ± Av repair (n=15)
- Lone Av repair (n=13)
### Baseline characteristics

**2006-2017 94pts**

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<th>Characteristics</th>
<th>Number</th>
<th>Percentage</th>
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<td>Patients number</td>
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<tr>
<td>Male</td>
<td>78</td>
<td>82.98%</td>
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<tr>
<td>Female</td>
<td>16</td>
<td>17.02%</td>
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<tr>
<td>Age (years)</td>
<td>57.71 ± 15.14</td>
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<td>Smoke</td>
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<td>37.23%</td>
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<td>Family history of heart disease</td>
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<td>26.60%</td>
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<td>Cerebrovascular disease</td>
<td>4</td>
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<tr>
<td>Previous acute myocardial infarction</td>
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<td>NYHA class</td>
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<tr>
<td>EF</td>
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<td>61.10% ± 6.64%</td>
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<tr>
<td>Bicuspid</td>
<td>15</td>
<td>15.96%</td>
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</table>
Freedom from re AI>2+

Patients at risk

| Patients |   94 |   79 |   73 |   61 |   56 |   49 |   43 |   36 |   30 |   21 |   12 |   2 |
Freedom from Reoperation

Patients at risk

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<tr>
<th>94</th>
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Overall survival

Patients at risk

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<th>Years</th>
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<th>26</th>
<th>18</th>
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<th>2</th>
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ESC GUIDELINES 2017:

Management of aortic regurgitation

Significant enlargement of ascending aorta

No

Severe aortic regurgitation

No

Symptoms

LVEF ≤50% or LVEDD >70 mm or LVESD >50 mm (or >25 mm/m² BSA)

No

Follow-up

Yes

Surgery

Indications for surgery

A. Severe aortic regurgitation

- Surgery is indicated in symptomatic patients.
- Surgery is indicated in asymptomatic patients with resting LVEF ≤50%.
- Surgery is indicated in patients undergoing CABG or surgery of the ascending aorta or of another valve.
- Heart Team discussion is recommended in selected patients in whom aortic valve repair may be a feasible alternative to valve replacement.

B. Aortic root or tubular ascending aortic aneurysm (irrespective of the severity of aortic regurgitation)

- Aortic valve repair, using the reimplantation or remodeling technique, is recommended in young patients with aortic valve dilation and transcervical aortic valves with repair performed by experienced surgeons.
- Surgery is indicated in patients with Marfan syndrome who have aortic root disease with a maximal ascending aortic diameter ≥40 mm.
- Surgery should be considered in patients who have aortic root disease with maximal ascending aortic diameter:
  - ≥45 mm in the presence of Marfan syndrome and additional risk factors or patients with a 3G2BR1 or 3G2BR2 mutation (including Loeys–Dietz syndrome).
  - ≥50 mm in the presence of a bicuspid valve with additional risk factors or coarctation.
  - ≥55 mm for all other patients.

- When surgery is primarily indicated for the aortic valve, replacement of the aortic root or tubular ascending aorta should be considered when ≥45 mm, particularly in the presence of a bicuspid valve.
Conclusions

1. Aortic valve repair is a valuable surgical option especially in patients with prolonged anticipated life expectancy

2. Functional classification of AI and dedicated surgical instruments and devices have facilitated this procedure

3. Preoperative and Intraoperative Echocardiographic evaluation are essential to achieve successful repair

4. Intraoperative surgical valve analysis in a systematic approach avoiding “eyeballing” evaluations is mandatory

5. Intraoperative parameters are available to predict long term results

6. New tissue engineering materials may improve results also in complex leaflet extension surgery
Respect rather than Resect!