STRATEGIC CHOICE OF HEART VALVE PROSTHESIS

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BACKGROUND

- 1st mechanical valve replacement in 1960 (Starr-Edwards)
- 1967: Ross procedure was introduced
- 1969: 1st aortic porcine valve was implanted
- 1980: pericardial valve was created (Carpentier-Edwards)
- Early 1990s: 1st generation of stentless tissue valve (Prima, Freestyle & Toronto valve)
- 2012: #20,000 valve in Japan, 90,000 valve in USA & 280,000-300,000 valve in the world were implanted
- In Viet Nam (2015) #800 valve
CLASSIFICATION OF HEART VALVE PROSTHESIS

Mechanical Valves: Caged-ball, Tilting disc, Bileaflet

Tissue Valves: Bioprosthetic
- Porcine (heterograft)
- Pericardial (Pericardial)
- Biological (Aortic homograft)
- Pulmonary autograft

Self-expandable
- TAVI (Core valve, Sapien 3)
- TAVI (Lotus valve)

Sutureless
- Perceval (Sorin)
Annulus range 18-29mm
Outcomes 15 Years After Valve Replacement With a Mechanical Versus a Bioprosthetic Valve: Final Report of the Veterans Affairs Randomized Trial

Karl Hammermeister, MD, FACC,* Gulshan K. Sethi, MD, FACC,† William G. Henderson, PhD,‡

CONCLUSIONS

At 15 years, patients undergoing AVR had a better survival with a mechanical valve than with a bioprosthetic valve, largely because primary valve failure was virtually absent with mechanical valve. Primary valve failure was greater with bioprosthesis, both for AVR and MVR, and occurred at a much higher rate in those aged <65 years; in those aged ≥65 years, primary valve failure after AVR was not significantly different between bioprosthesis and mechanical valve. Reoperation was more common for AVR with bioprosthesis. Thromboembolism rates were similar in the two valve prostheses, but bleeding was more common with a mechanical valve. (J Am Coll Cardiol 2000;36:1152–8) © 2000 by the American College of Cardiology

The Edinburgh heart valve study
**PROSTHETIC VALVE: INTERVENTION**

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>COR</th>
<th>LOE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Choice of valve intervention and prosthetic valve type should be a shared decision process</td>
<td>I</td>
<td>C</td>
</tr>
<tr>
<td>A bioprosthesis is recommended in patients of any age for whom anticoagulant therapy is contraindicated, cannot be managed appropriately, or is not desired</td>
<td>I</td>
<td>C</td>
</tr>
<tr>
<td>A mechanical prosthesis is reasonable for AVR or MVR in patients &lt;60 years of age who do not have a contraindication to anticoagulation</td>
<td>IIa</td>
<td>B</td>
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</table>
### PROSTHETIC VALVE: INTERVENTION (CONT.)

<table>
<thead>
<tr>
<th>Recommendations</th>
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<th>LOE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A bioprosthesis is reasonable in patients &gt;70 years of age</td>
<td>IIa</td>
<td>B</td>
</tr>
<tr>
<td>Either a bioprosthetic or mechanical valve is reasonable in patients between 60 years of age and 70 years of age</td>
<td>IIa</td>
<td>B</td>
</tr>
<tr>
<td>Replacement of the aortic valve by a pulmonary autograft (the Ross procedure), when performed by an experienced surgeon, may be considered in young patients when VKA anticoagulation is contraindicated or undesirable</td>
<td>IIb</td>
<td>C</td>
</tr>
</tbody>
</table>
### Table 17  Choice of the aortic/mitral prosthesis. In favour of a mechanical prosthesis.

<table>
<thead>
<tr>
<th>Class&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Level&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>A mechanical prosthesis is recommended according to the desire of the informed patient and if there are no contraindications for long-term anticoagulation. e</td>
<td>I</td>
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<tr>
<td>A mechanical prosthesis is recommended in patients at risk of accelerated structural valve deterioration. d</td>
<td>I</td>
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<tr>
<td>A mechanical prosthesis is recommended in patients already on anticoagulation as a result of having a mechanical prosthesis in another valve position.</td>
<td>I</td>
</tr>
<tr>
<td>A mechanical prosthesis should be considered in patients aged &lt;60 years for prostheses in the aortic position and &lt;65 years for prostheses in the mitral position. a</td>
<td>IIa</td>
</tr>
<tr>
<td>A mechanical prosthesis should be considered in patients with a reasonable life expectancy, f for whom future redo valve surgery would be at high risk.</td>
<td>IIa</td>
</tr>
<tr>
<td>A mechanical prosthesis may be considered in patients already on long-term anticoagulation due to high risk of thromboembolism. g</td>
<td>IIb</td>
</tr>
</tbody>
</table>

### Table 18  Choice of the aortic/mitral prosthesis. In favour of a bioprostheses.

<table>
<thead>
<tr>
<th>Class&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Level&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>A bioprostheses is recommended according to the desire of the informed patient</td>
<td>I</td>
</tr>
<tr>
<td>A bioprostheses is recommended when good quality anticoagulation is unlikely (compliance problems; not readily available) or contraindicated because of high bleeding risk (prior major bleed; comorbidities; unwillingness; compliance problems; lifestyle; occupation).</td>
<td>I</td>
</tr>
<tr>
<td>A bioprostheses is recommended for reoperation for mechanical valve thrombosis despite good long-term anticoagulant control.</td>
<td>I</td>
</tr>
<tr>
<td>A bioprostheses should be considered in patients for whom future redo valve surgery would be at low risk.</td>
<td>IIa</td>
</tr>
<tr>
<td>A bioprostheses should be considered in young women contemplating pregnancy.</td>
<td>IIa</td>
</tr>
<tr>
<td>A bioprostheses should be considered in patients aged &gt;65 years for prosthesis in aortic position or &gt;70 years in mitral position, or those with life expectancy lower than the presumed durability of the bioprostheses. d</td>
<td>IIa</td>
</tr>
</tbody>
</table>
1ST AND 2ND GENERATION BIOPROSTHETIC VALVES

![Graph showing % free from failure over years for Hancock and Hancock II]

- Hancock
- Hancock II

Hancock - Stanford
Hancock II - Toronto
Trends in Valve Prosthesis Selection

1992
- Bioprosthesis: 32%
- Mechanical: 60%
- Other: 8%

2002
- Bioprosthesis: 63%
- Mechanical: 32%
- Other: 5%

STS Database
Type of Valve Surgery

Use of bioprostheses in aortic valve replacement increased from 44.1% in 1999 to 72.7% in 2011 \((P < .001)\). Conversely, mechanical prosthetic implants decreased from 55.9% to 27.3% \((P < .001)\). Among age, sex, and race strata in 2011, use of bioprostheses was highest for patients who were 85 years or older,
### Survival and Outcomes Following Bioprosthetic vs Mechanical Mitral Valve Replacement in Patients Aged 50 to 69 Years

Joanna Chikwe, MD; Yuting P. Chiang, BA; Natalia N. Egorova, PhD; Shinobu Itagaki, MD; David H. Adams, MD

<table>
<thead>
<tr>
<th>Outcome at 15 Years</th>
<th>No. (%) [95% CI] by Type of Mitral Valve Replacement</th>
<th>Hazard Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mechanical Prosthetic (n = 664)</td>
<td>Bioprosthetic (n = 664)</td>
</tr>
<tr>
<td>Death</td>
<td>209</td>
<td>221</td>
</tr>
<tr>
<td>Actuarial 15-year survival, % (95% CI)</td>
<td>57.5 (50.5-64.4)</td>
<td>59.9 (54.8-65.0)</td>
</tr>
<tr>
<td>Stroke</td>
<td>65 (14.0) [9.5-18.6]</td>
<td>41 (6.8) [4.5-8.8]</td>
</tr>
<tr>
<td>Reoperation</td>
<td>28 (5.0) [3.1-6.9]</td>
<td>47 (11.1) [7.6-14.6]</td>
</tr>
<tr>
<td>Bleeding events</td>
<td>72 (14.9) [11.0-18.7]</td>
<td>49 (9.0) [6.4-11.5]</td>
</tr>
</tbody>
</table>
THROMBOSIS, BLEEDING, STROKE, PANNUS

Emergent treatment
Very high mortality
Linear risk

STRUCTURED DEGENERATION

Planned treatment
Moderate mortality
Late risk
Is Tissue Valve the Preferred Option for Patients Aged 60 Years and Older?

Selection of Aortic Valve Prostheses: Contemporary Reappraisal of Mechanical Versus Biologic Valve Substitutes

Rakesh M. Suri, MD, DPhil; Hartzell V. Schaff, MD

Conclusion

Long-term survival after AVR may be better in patients receiving the latest-generation mechanical valves compared with biological prostheses (pericardial or porcine) across a broad range of age groups up to 65 to 70 years. The possible sur-
AVR: Choice of Prosthesis

1. Patients’ age is probably the most important factor in recommending tissue or mechanical valve.

2. Bioprosthetic valves are ideally suitable for older patients (>70 years) or those who are not likely to outlive the valve (co-morbidities).

3. Mechanical valves should be recommended to younger patients (<60 years).

4. If anticoagulation is a perceivable problem, tissue valves can be used in younger patients but the probability of reoperation is high.
FACTOR DETERMINING SELECTION OF VALVE PROSTHESIS

- Age (life expectancy)
- SR or AF
- Anti-coagulation (will, risk, benefit, complication related)
- Underlying disease (quality of life)
- Permanent address (healthcare condition)
- Hemodynamic performance (supra-annular valve)
- Income
AGE

- Longevity age (WEF 2016) VN : 75.6 ; Singapore : 82.6 ; Thailand : 74.4; Philippines : 68.3 ; China : 75.8 ; Hong Kong : 84; Japan : 86.3 ; USA : 78.9 ; France : 82.4 ; Italia : 82.7; UK : 81.1; Australia : 82.3 ….

- Physical activity by age : lower than western countries

- Healthcare-Geriatric care : in big city only

<table>
<thead>
<tr>
<th>Table 4</th>
<th>Linearised (%/patient-year) rate of composite valve-related morbidity by age, and actuarial freedom from valve related morbidity at 15 years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Valve related morbidity</td>
</tr>
<tr>
<td>Age (years)</td>
<td>Bioprosthesis (B)</td>
</tr>
<tr>
<td>≤40</td>
<td>0.0</td>
</tr>
<tr>
<td>41–50</td>
<td>0.0</td>
</tr>
<tr>
<td>51–60</td>
<td>0.3</td>
</tr>
<tr>
<td>61–70</td>
<td>0.4</td>
</tr>
</tbody>
</table>
HEART RHYTHM

- Not always select by patient's rhythm (SR = Tissue, AF = Mechanic)
- Associated with AF surgery: Tissue valve > Mechanical
- Special situation: Tissue valve
ANTI-COAGULANT & ANTI-PLATELET

- Can’t take OAC or will not take OAC: Tissue valve
- Can’t follow up closely: Tissue valve
- Need to minimize bleeding: Tissue valve
- Special jobs: Tissue valve
- Lifestyle
- Pregnancy
1. Need to aortic or mitral valve replace associated with CABG: Bioprosthetic > Mechanical valve.

2. History of haemorrhage (stroke, severe GI tract bleeding, cancer...): Bioprosthetic valve


If life expectancy > 5y: Mechanical > Bioprosthetic valve (Contemporary perioperative results of heart valve replacement in dialysis patients: analysis of 1,616 patients from the Japan adult cardiovascular surgery database. Tadeka K et al. J Heart Val Dis 2013 Nov;22(6):850-8.)
Regular examinations and echocardiograms, anti-thrombotic therapy, and appropriate antibiotic prophylaxis against endocarditis

- Nearly heart center or provincial hospital: Mechanical > Tissue valve
- Far away heart center or cannot FU regularly: Tissue valve
- Ethnics group: Tissue valve
Hemodynamic Performance of Valve

- New choice: new generation of heart valve prosthesis (CE Magna Ease, SJM Trifecta, Solo Freedom, OnX, Regent, ATS-Medtronic, Slimline...)
- For AVR: supra-annular valve is better
INCOME

+ SOCIO-ECONOMIC STATUS
+ EDUCATIONAL BACKGROUND
+ COST AND AVAIBILITY OF PROSTHESIS
+ QUALITY AND AVALIBILTY OF MEDICAL SERVICES
Algorithm for selecting a valve procedure

Durable valve repair

> 10y possible

Yes

No

Life expectancy < 15y
Major co-morbidity

Life expectancy 15-30 y
No co-morbidity

Life expectancy >30 y
No co-morbidity

1. Accept risk of reoperation
2. No coagulation
3. Minimal life style change

1. Minimize reoperation
2. Will take anticoagulation
3. Accept life style change

Tissue valve

Mechanical valve

Physician assessment

Patient’s preference

Valve repair

CONCLUSION

1. No ideal heart valve prosthesis until now (ideal # valve for life!)
2. Appropriate chosen > Desirable chosen
3. Healthcare condition is one of the most important thing.