Are Stented Bioprostheses Appropriate for Aortic Valve Replacement in Young Patients?

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NO DISCLOSURES
Accelerated Degeneration of a Bovine Pericardial Bioprosthetic Aortic Valve in Children and Young Adults

CLINICAL PERSPECTIVE

by Susan F. Saleeb, Jane W. Newburger, Tal Geva, Christopher W. Baird, Kimberlee Gauvreau, Robert F. Padera, Pedro J. del Nido, Michele J. Borisuk, Stephen P. Sanders, and John E. Mayer

Circulation
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Stented Bioprosthetic Valves
Morbidity, Mortality, Durability

Plot of bioprosthetic aortic valve maximal instantaneous gradient (MIG) on serial echocardiograms by patient.

*Mitroflow Magna

*Patient died suddenly 7 months later

Time from AVR (years)

MIG (mm Hg)

Susan F. Saleeb et al. Circulation. 2014;130:51-60

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Explanted Mitroflow LXA valve (patient 12) showing aortic (A) and ventricular (B) surfaces of a leaflet with a large calcific nodule.

Susan F. Saleeb et al. Circulation. 2014;130:51-60
Stented Bioprosthetic Valves
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Freedom from valve failure (death or explantation).
Aortic and mitral valve replacement in children: is there any role for biologic and bioprosthetic substitutes?**

Bahaaldin Alsoufi a,*, Cedric Manlhiot b, Brian W. McCrindle b, Charles C. Canver a, Ahmed Sallehuddin a, Saud Al-Oufi a, Mansour Joufan a, Zohair Al-Halees a

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b Labatt Family Heart Center, The Hospital for Sick Children and the University of Toronto, Toronto, Ontario, Canada

Received 1 September 2008; received in revised form 20 February 2009; accepted 24 February 2009; Available online 14 April 2009

Abstract

Objective: The ideal valve substitute in children does not exist. Biologic and bioprosthetic valves do not require anticoagulation, however their use is complicated by accelerated degeneration and requirement for reoperation. We examine results following mitral (MVR) or aortic (AVR) replacement with biologic and bioprosthetic valves at our institution. Methods: Medical records of children who underwent AVR or MVR from 1986 to 2006 were reviewed. Median follow-up duration was 10.5 years. Competing-risks methodology determined time-related prevalence and associated factors for three mutually exclusive end states: death, valve reoperation, and survival without subsequent reoperation. Results: One hundred and ten children (age 15.6 ± 2.6 years, 80% females) underwent 123 valve replacements with biologic and bioprosthetic substitutes including 87 MVR and 36 AVR (13 had both). Underlying pathology was mainly rheumatic fever (91%). Thirty-nine patients (35%) had undergone a previous cardiac surgery. Most common mitral substitute was Hancock (73%) and homograft (8%); most common aortic substitute was homograft (41%) and Carpentier– Edwards (39%). Competing-risks analysis showed that 15 years after valve replacement, 16% of patients had died without subsequent reoperation, 66% underwent valve reoperations, and only 18% remained alive without further reoperation. Factors associated with increased reoperation risk included younger age at surgery (p = 0.005), AVR (p = 0.005), male gender (p = 0.02) and homograft use (p = 0.007) especially in the mitral position (p = 0.002). Fifteen-year freedom from endocarditis was 97% while freedom from bleeding and thrombo-embolic complications was 100%. Majority of patients (95%) were in NYHA functional classes I/II at last follow-up. Conclusion: While valve reoperation is inevitable following AVR and MVR with biologic and bioprosthetic substitutes; favorable results such as low valve-related morbidity rate, good long-term survival and functional status encourage their consideration as valid replacement alternatives in selected children especially females. Valve durability is higher in the mitral position and longevity of bioprosthetic valves is greater than that of homografts especially in the mitral position.

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Keywords: Mitral valve replacement; Aortic valve replacement; Rheumatic fever; Homograft; Pulmonary autograft; Bioprosthetic valve
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Alsoufi, et al, 2009
Antimineralization treatment and patient-prosthesis mismatch are major determinants of the onset and incidence of structural valve degeneration in bioprosthetic heart valves

Willem Flameng, MD, PhD, Filip Rega, MD, PhD, Monique Vercalsteren, RN, Paul Herijgers, MD, PhD, and Bart Meuris, MD, PhD

**Background:** We examined the influence of multiple valve-related parameters on the onset and incidence of valve degeneration in aortic bioprostheses through detailed echocardiographic follow-up.

**Methods:** In 648 patients (mean age, 73.8 ± 4.9 years) receiving an aortic valve bioprosthesis, long-term clinical (mean, 7.5 ± 3.2 years) and echocardiographic (mean, 6.5 ± 3.4 years) follow-up were performed. The occurrence of signs of structural valve degeneration (stenosis type and regurgitation type) was studied through multivariate analysis, including tissue origin, design and label size of the prosthesis, effective orifice area index (EOAi), patient-prosthesis mismatch (PPM; EO Ai < 0.85 cm²/m²), and antimineralization treatment.

**Results:** Structural valve degeneration (SVD) was diagnosed in 12.6% of patients. In 7.6%, it was of the stenosis type (S-SVD); in 5%, it was the regurgitation type (R-SVD). The absence of antimineralization treatment is an independent predictor of SVD, S-SVD, and R-SVD. Patient-prosthesis mismatch is an independent predictor of SVD and S-SVD, but not of R-SVD. Patients receiving a nontreated valve show a freedom of SVD at 10 years follow-up of 70.1 ± 4.3% versus 90.9 ± 3.6% in patients receiving a treated valve ($P < .0001$). Patients having PPM and receiving a nontreated valve show a freedom of SVD at 10 years of follow-up of only 59.8 ± 7.0% versus 88.7 ± 3.6% in patients also having PPM but receiving a treated valve ($P < .0001$). In patients not having PPM, the corresponding values were 78.0 ± 4.3% and 92.7 ± 3.4% for nontreated versus treated valves respectively ($P = .01$).

**Conclusions:** Antimineralization treatment of bioprosthetic heart valves is effective and reduces the incidence of SVD significantly. Because valve type and size are determined at the moment of implantation, the surgeon carries an important responsibility in protecting the patient from valve degeneration. (J Thorac Cardiovasc Surg 2013; 1:1-6)
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Freedom from Structural Valve Deterioration

Ross Operation
BCH 2000-2014

62 patients

- Root replacement 97%
- Konno 47%
- Mitral Valve Repair 37%
- DKS/BiV conversion 19%
Ross Operation
BCH 2000-2014

Patient Survival (%) vs. Follow-up (years)

96% at 5.5 years of follow-up
Ross Operation
BCH 2000-2014

2 Valve sparing neo-aortic repairs year 3.5, 4
124 patients

- Median age 16 years
- 42 patients required root enlargement procedure
- St Jude 62%
- On-X 35%
- Carbomedics 2%
Mechanical AVR
BCH 2000-2014

Probability of survival

Follow-up (years)

Patients at risk: 124  81  65  46  96  18  4  1
Mechanical AVR
BCH 2000-2014

Probability of freedom from reoperation

Follow-up (years)

Log-rank, P < 0.001

4 thromboembolic complications
5 bleeding episodes
9/588 patient years ~ 1.5%/pt year

Patients at risk:
Carbomedics  3  3  3  2  1
On-X         43  28 21 11  7
St Jude      78  51 41 34 27 18 4 1
Mechanical AVR
BCH 2000-2014

4 thromboembolic complications
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Patients at risk:
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<tr>
<th>Device</th>
<th>Risk 1</th>
<th>Risk 2</th>
<th>Risk 3</th>
<th>Risk 4</th>
<th>Risk 5</th>
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<td>St Jude</td>
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<td>51</td>
<td>41</td>
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  – What is the real risk of coumadin in young patients??
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