VALVE HAEMODYNAMICS AND PROSTHESIS SELECTION

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S A Heart 2018

OVERVIEW

- Sizing issues
- PPM
- Generic choices – mechanical or biological?

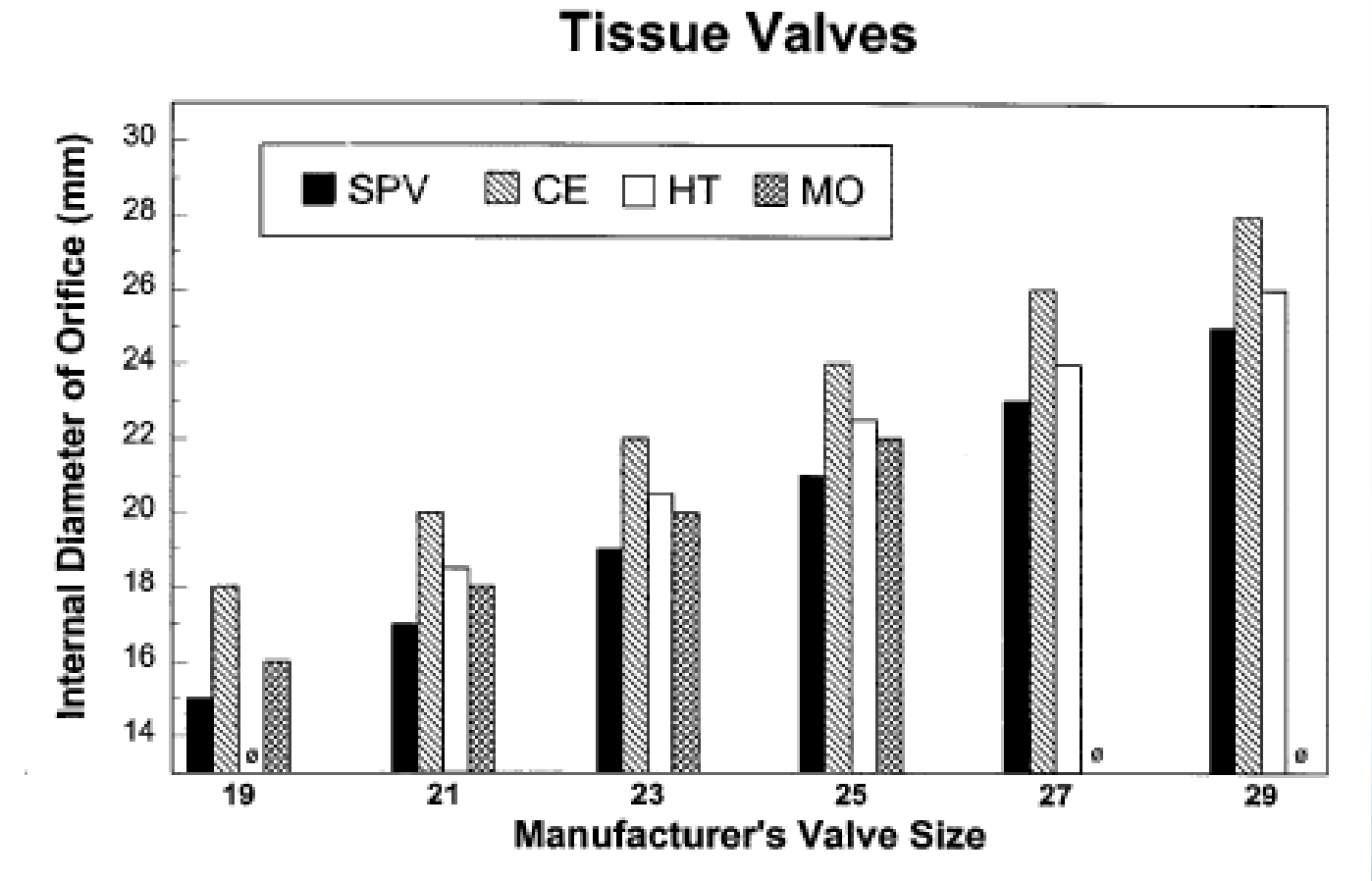
CHOOSING A NEW HEART VALVE

- Size counts
- So does endurance
- Landscape changing with percutaneous technologies
- Must individualise - but is hard data

SIZING

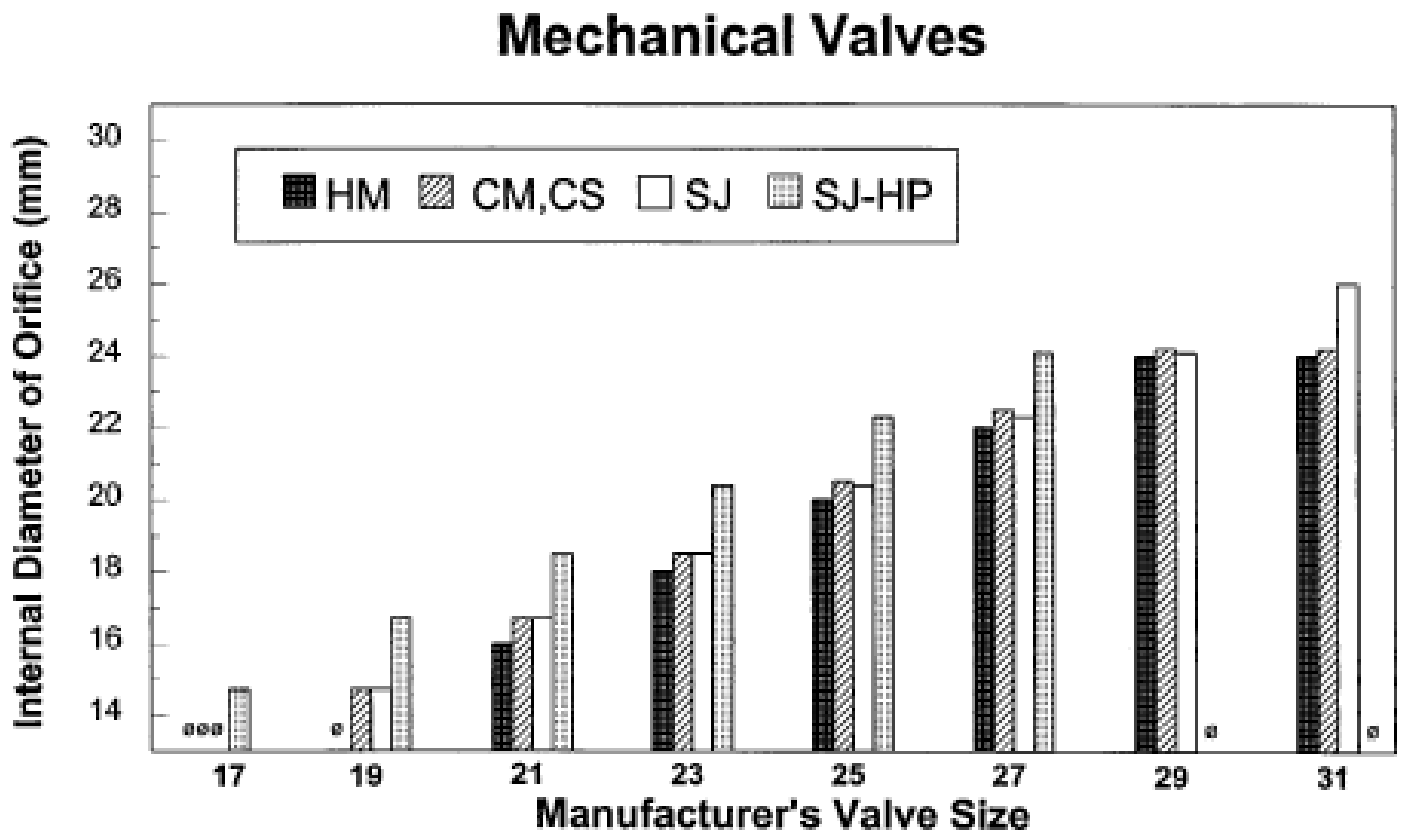
- Manufacturer's size bears little relation to measured size
- Internal or external diameter

INTERNAL DIAMETER



(Ann Thorac Surg 1998;66:1198–203)

INTERNAL DIAMETER



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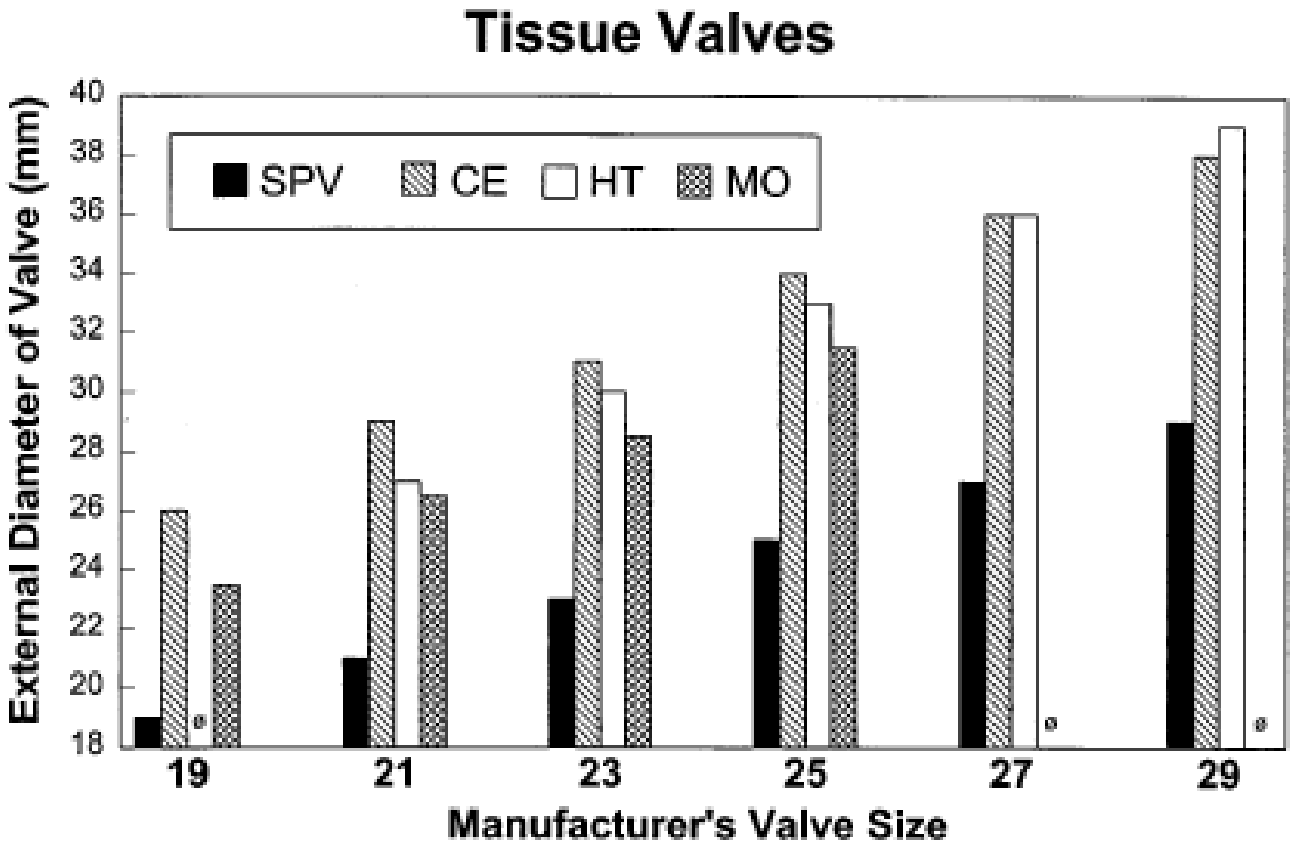
EXTERNAL DIAMETER



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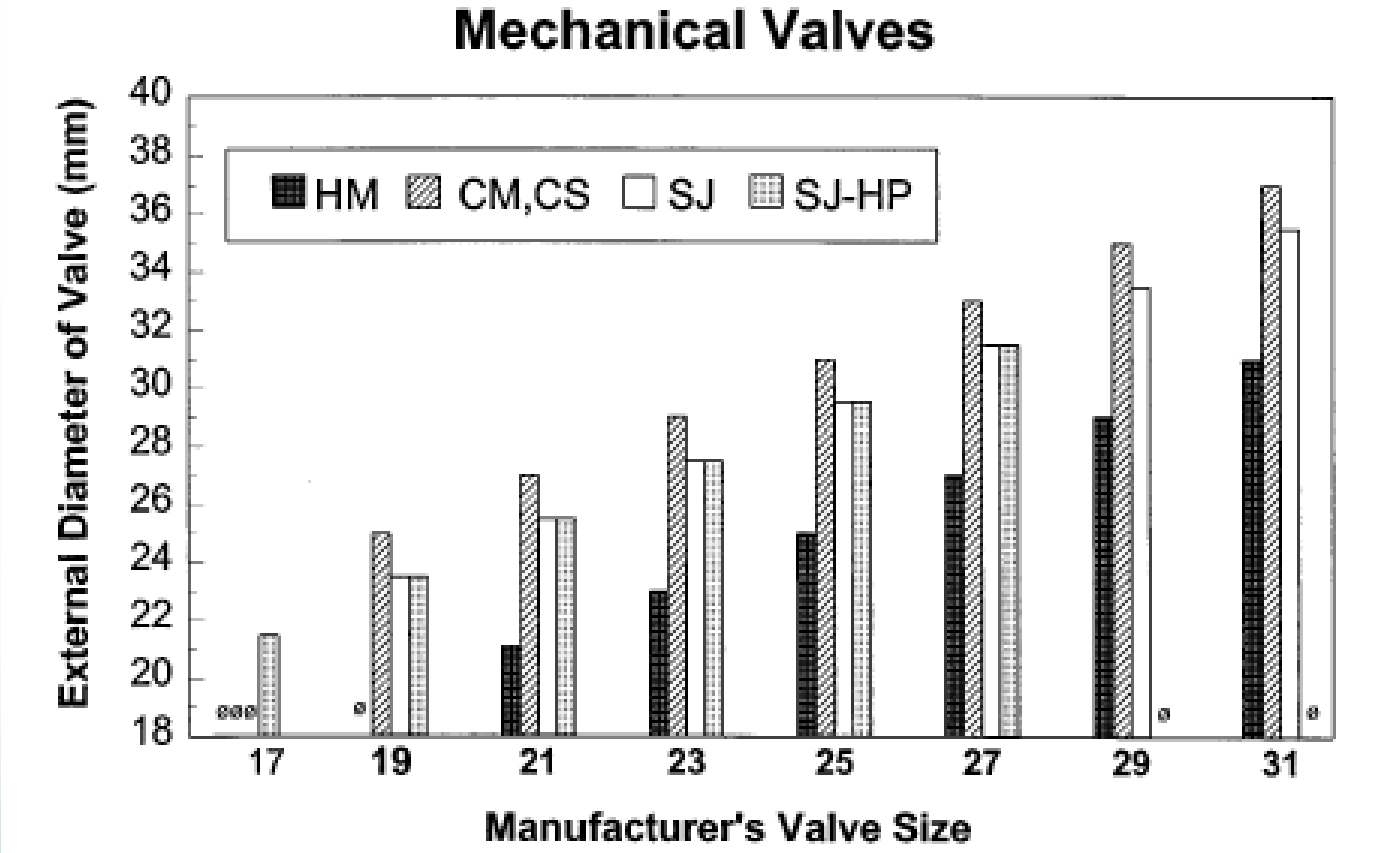
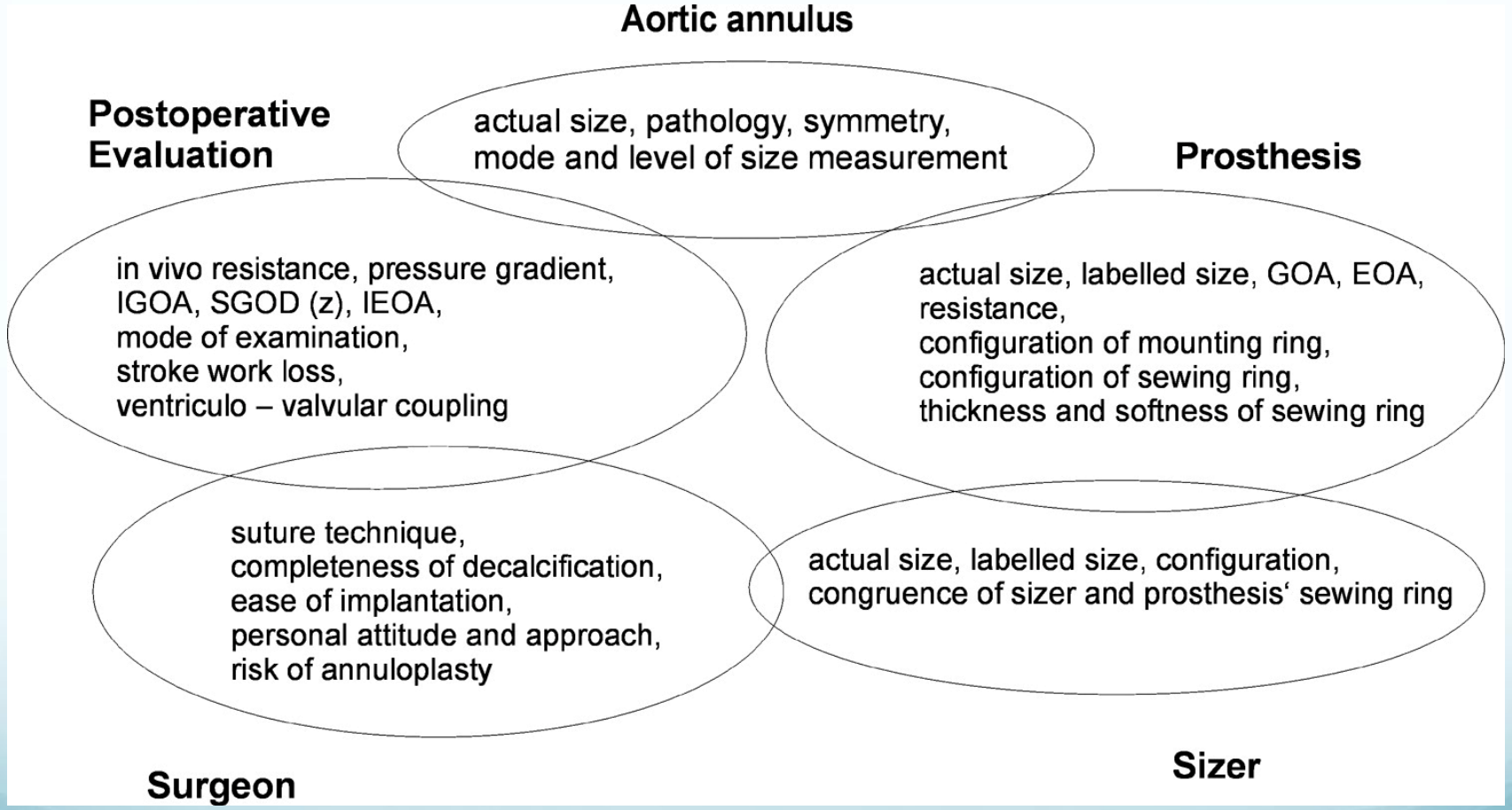


(Ann Thorac Surg 1998;66:1198–203)

Prosthetic aortic valve replacement

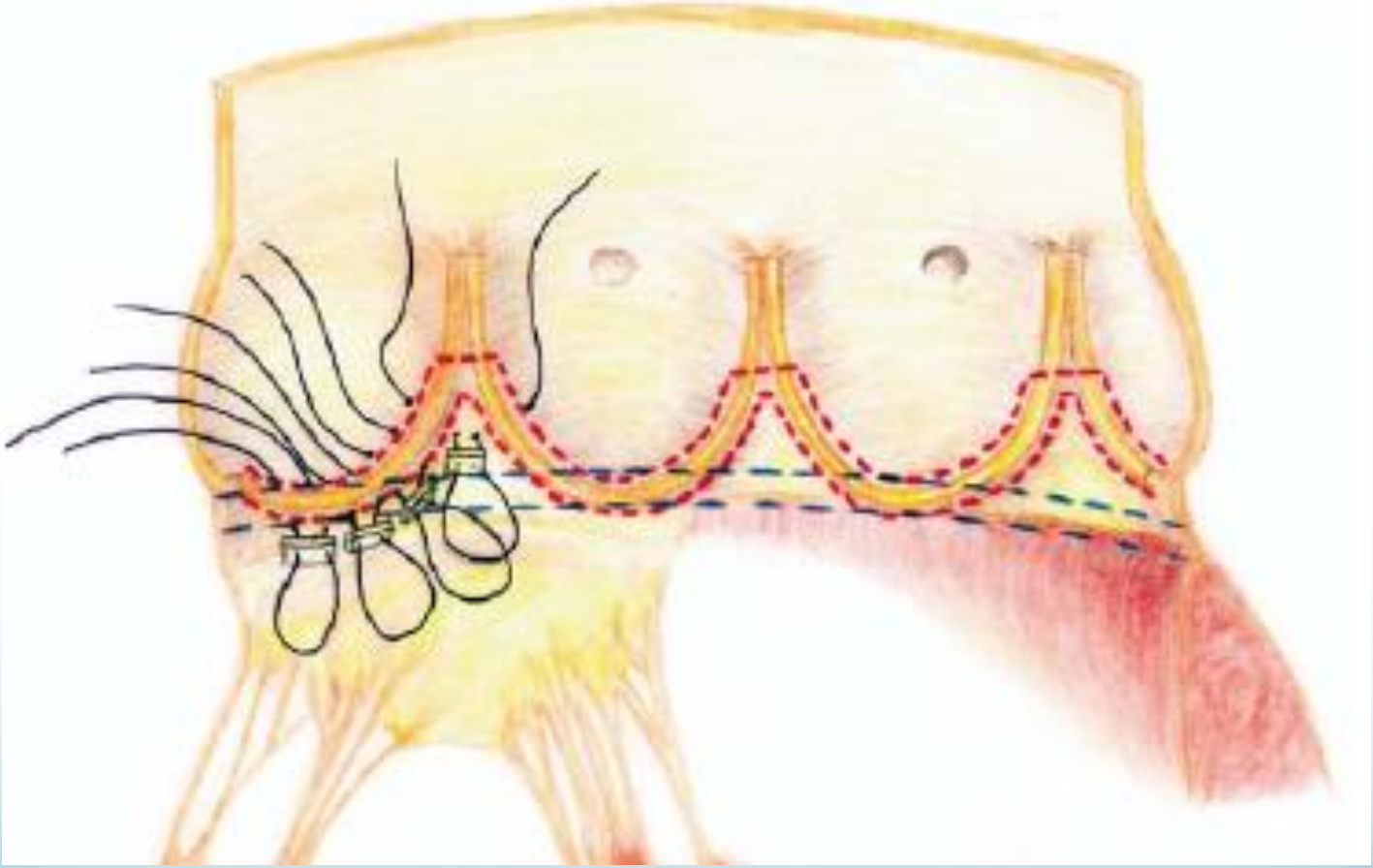
Hans-Hinrich Sievers, MD

J Thorac Cardiovasc Surg 2005;129:961-5



J Thorac Cardiovasc Surg 2005;129:961-5

Where is annulus?



J Thorac Cardiovasc Surg 2005;129:961-5

STATE-OF-THE-ART PAPER AND COMMENTARY

Valve Prosthesis–Patient Mismatch (VP–PM)

A Long-Term Perspective

Samuel A. Daneshvar, MD, Shahbudin H. Rahimtoola, MB, FRCP, DSc (Hon)

(J Am Coll Cardiol 2012;60:1123–35)

PATIENT PROSTHESIS MISMATCH

- Developed 1978, generally accepted
- Clinical relevance less generally accepted
- Moderate 0.65- 0.85 sq cm/ sq m
- Severe < 0.65 sq cm/ sq m
- Should assess early postop and at 6 months

PPM

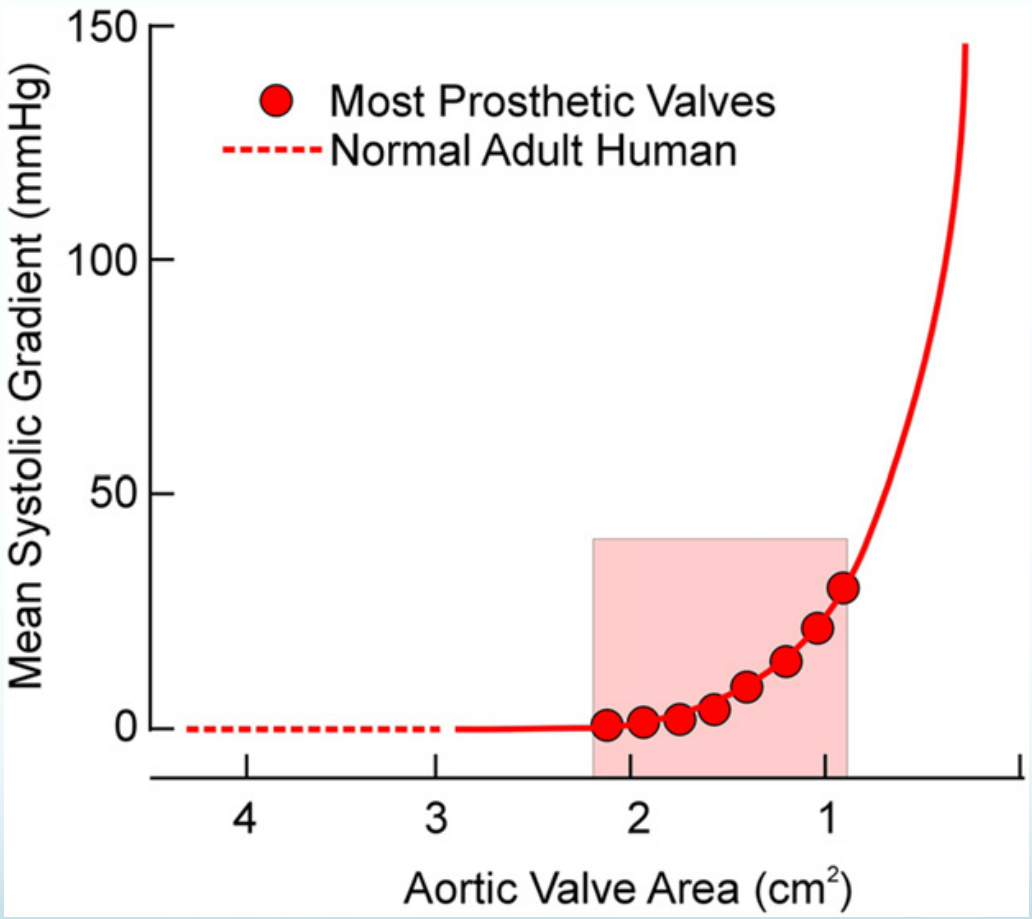
- Valve
  - Inherent design, opening, implantation technique
- Patient
  - 4 phases to response – platelet and fibrin deposit, inflammatory response, granulation tissue, encapsulation
  - Time since implant
  - Mostly complete by 6 months, but ongoing calcification, thrombosis, pannus ingrowth

HOW TO MEASURE VALVE AREA

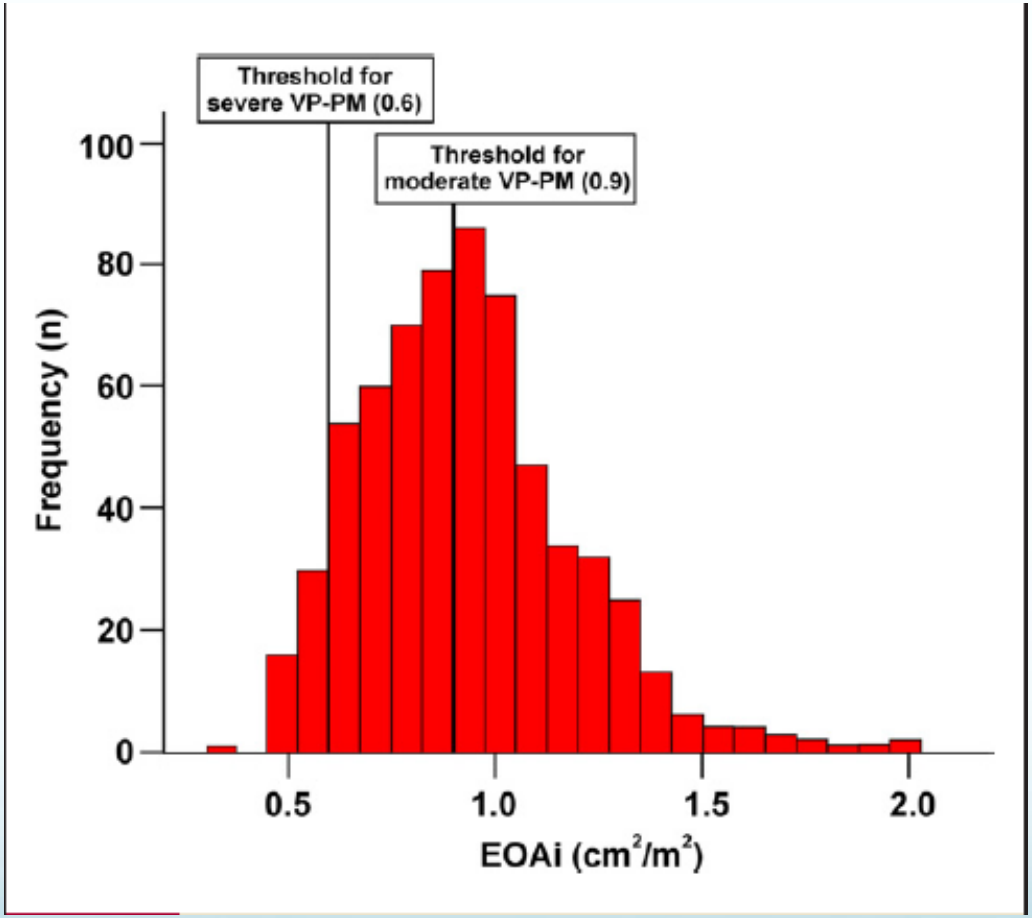
- Measured EOAi
  - Echo, analagous to NVA, LVOT may be difficult, central orifice in bilealfet valve may impact
- Projected EOAi
  - Reference data from in vivo or pulse duplicator studies
  - Limited value
- Geometric orifice area
  - Direct ex vivo measurement, no relation to PPM

PPM IMPACT

- Early mortality – little impact
- Long term mortality
  - Moderate – none
  - Mod-severe – little
  - Severe – significant



(J Am Coll Cardiol 2012;60:1123–35)



(J Am Coll Cardiol 2012;60:1123–35)

Table 4 EOA Determined at 6 Months After AVR for PHV Labeled Size 23

	n	EOA, cm^2	
		Mean	Range
Edwards Perimount	113	1.82	1.7–1.9
Edwards Perimount Magna	38	1.82	1.7–2.0
Medtronic Mosaic	23	1.53	1.3–1.8
Sorin Mitroflow	19	1.53	1.4–1.7
Sorin Freedom Solo	7	2.00	1.6–2.3
St. Jude Epic Supra	35	1.81	1.6–2.0
St. Jude Toronto Root	6	1.60	1.4–1.8

(J Am Coll Cardiol 2012;60:1123–35)

HOW TO CHOOSE ?

- Must avoid severe PPM
- Individual factors – age, co-morbidity, life style, compliance

TRADITIONAL FACTORS

BIOPROSTHESES

- Less anticoagulants
- Less bleeding
- Fewer strokes
- Higher degeneration
- Higher reoperation risk

MECHANICAL PROSTHESES

- Lifelong warfarin
- More bleeding
- Higher stroke rate
- Fewer mechanical failures
- Lower reoperation rate

Mechanical or Biologic Prostheses for Aortic-Valve and Mitral-Valve Replacement

Andrew B. Goldstone, M.D., Ph.D., Peter Chiu, M.D., Michael Baiocchi, Ph.D., Bharathi Lingala, Ph.D., William L. Patrick, M.D., Michael P. Fischbein, M.D., Ph.D., and Y. Joseph Woo, M.D.

ABSTRACT

BACKGROUND

In patients undergoing aortic-valve or mitral-valve replacement, either a mechanical or biologic prosthesis is used. Biologic prostheses have been increasingly favored despite limited evidence supporting this practice.

METHODS

We compared long-term mortality and rates of reoperation, stroke, and bleeding between inverse-probability-weighted cohorts of patients who underwent primary aortic-valve replacement or mitral-valve replacement with a mechanical or biologic prosthesis in California in the period from 1996 through 2013. Patients were stratified into different age groups on the basis of valve position (aortic vs. mitral valve).

RESULTS

From 1996 through 2013, the use of biologic prostheses increased substantially for aortic-valve and mitral-valve replacement, from 11.5% to 51.6% for aortic-valve replacement and from 16.8% to 53.7% for mitral-valve replacement. Among patients who underwent aortic-valve replacement, receipt of a biologic prosthesis was associated with significantly higher 15-year mortality than receipt of a mechanical prosthesis among patients 45 to 54 years of age (30.6% vs. 26.4% at 15 years; hazard ratio, 1.23; 95% confidence interval [CI], 1.02 to 1.48; P=0.03) but not among patients 55 to 64 years of age. Among patients who underwent mitral-valve replacement, receipt of a biologic prosthesis was associated with significantly higher mortality than receipt of a mechanical prosthesis among patients 40 to 49 years of age (44.1% vs. 27.1%; hazard ratio, 1.88; 95% CI, 1.35 to 2.63; P<0.001) and among those 50 to 69 years of age (50.0% vs. 45.3%; hazard ratio, 1.16; 95% CI, 1.04 to 1.30; P=0.01). The incidence of reoperation was significantly higher among recipients of a biologic prosthesis than among recipients of a mechanical prosthesis. Patients who received mechanical valves had a higher cumulative incidence of bleeding and, in some age groups, stroke than did recipients of a biologic prosthesis.

CONCLUSIONS

The long-term mortality benefit that was associated with a mechanical prosthesis, as compared with a biologic prosthesis, persisted until 70 years of age among patients undergoing mitral-valve replacement and until 55 years of age among those undergoing aortic-valve replacement. (Funded by the National Institutes of Health and the Agency for Healthcare Research and Quality.)

- Isolated, first time AVR
- First time mitral valve, +/- TA, Maze, CABG
- 1996-2013
- Age stratified
  - AVR – 45-54 yrs, 55-64 yrs. 9942 pts
  - MVR – 40-49 yrs, 50-69 yrs, 70-79yrs. 15503 pts

GUIDELINES

- Don’t differentiate between AVR and MVR
- Based on data on older valves, and studies which are not powered to draw these conclusions
- Mostly just “opinions”
- <50 yrs old – mechanical
- >70 yrs old – biological
- 50-70 – either

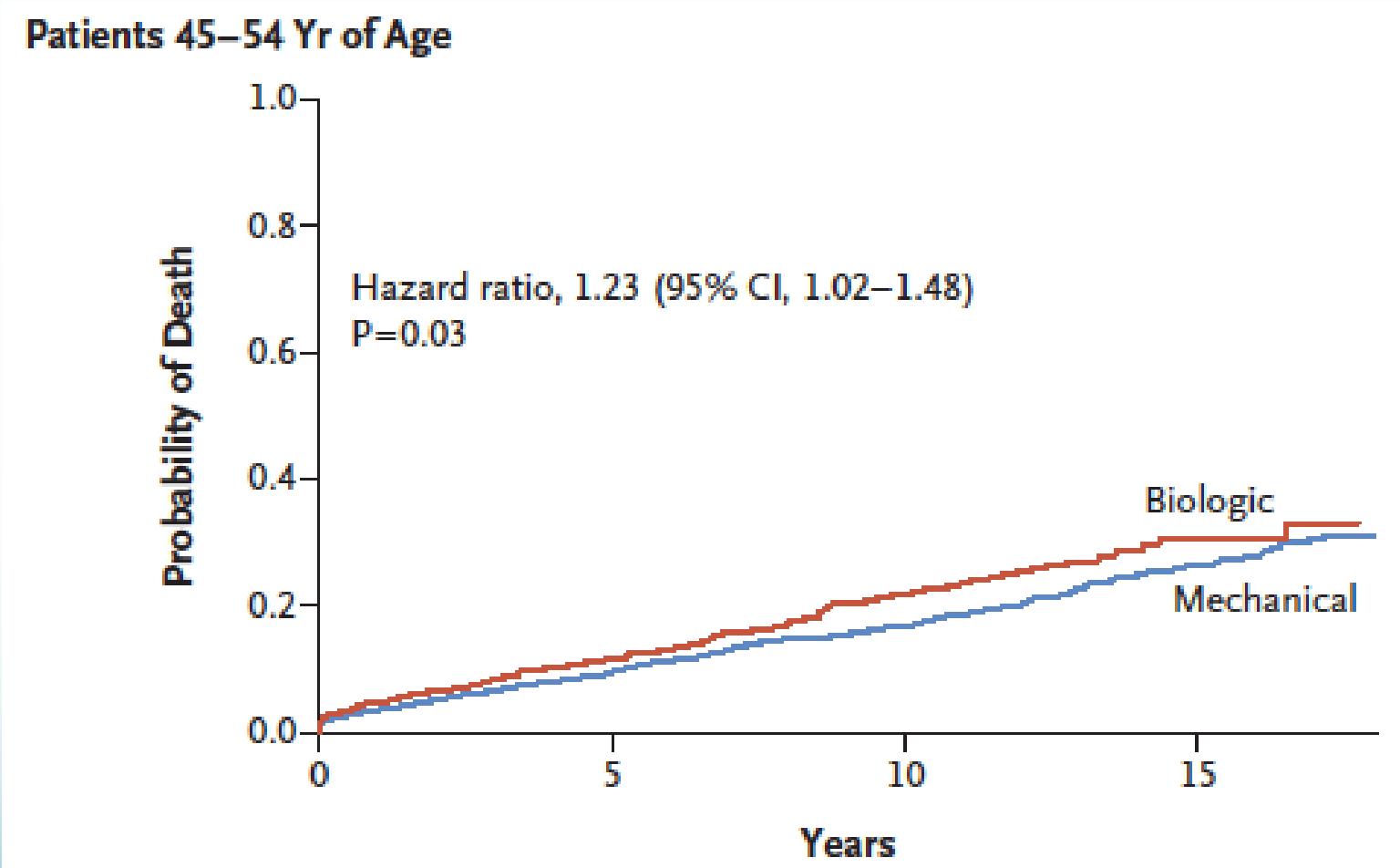
BIOPROSTHESIS USE

	1996	2013
MVR	16.8%	53.7%
AVR	11.5%	51.6%

RESULTS

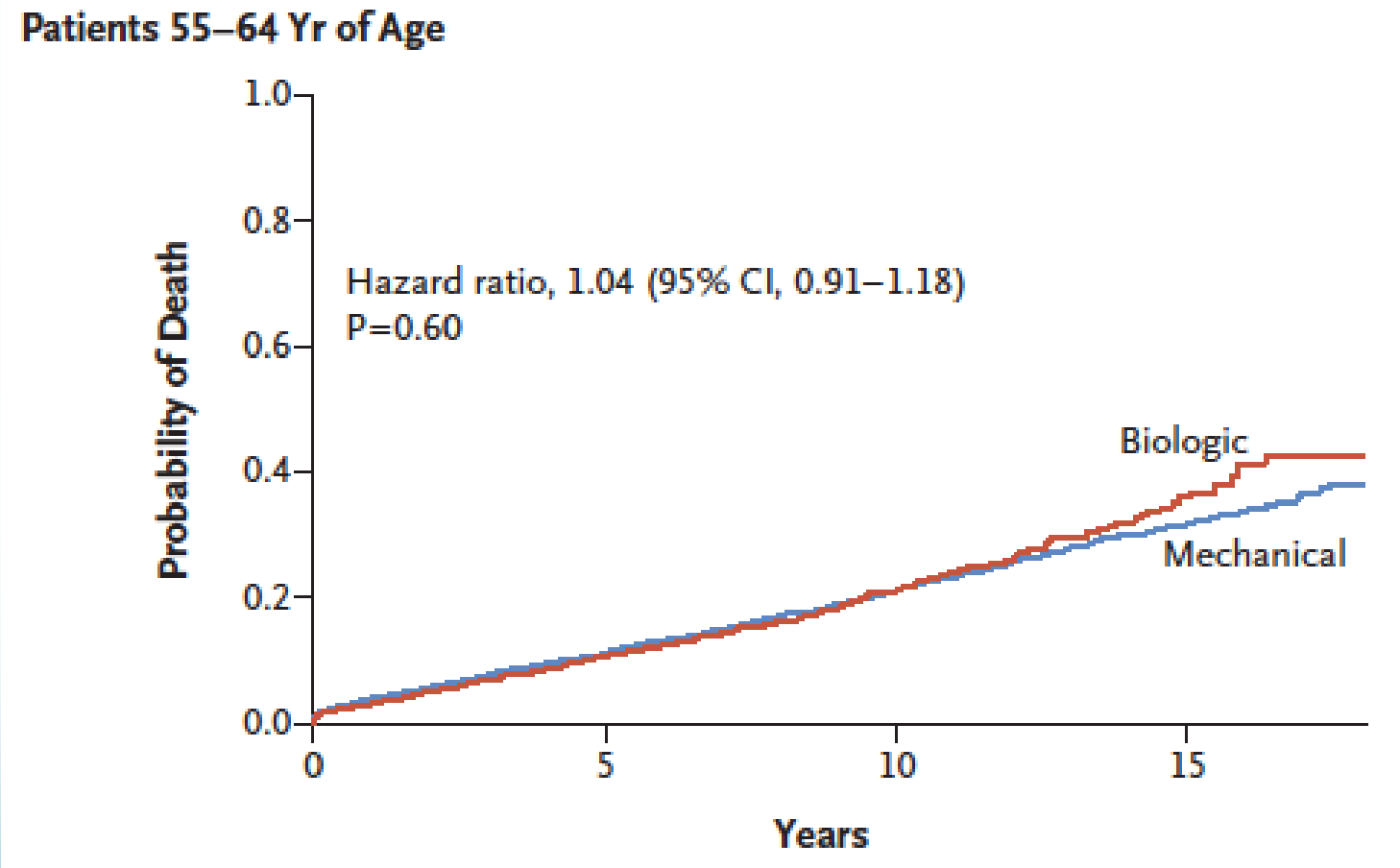
- AVR
  - 45-54 yrs – biological valve higher long term mortality
  - Redo operative risk – 7.1%
- MVR
  - 40-49 yrs, and 50-69 yrs – biological valve higher long term mortality
  - Redo operative risk – 14%

AVR



N Engl J Med 2017;377:1847-57.

AVR



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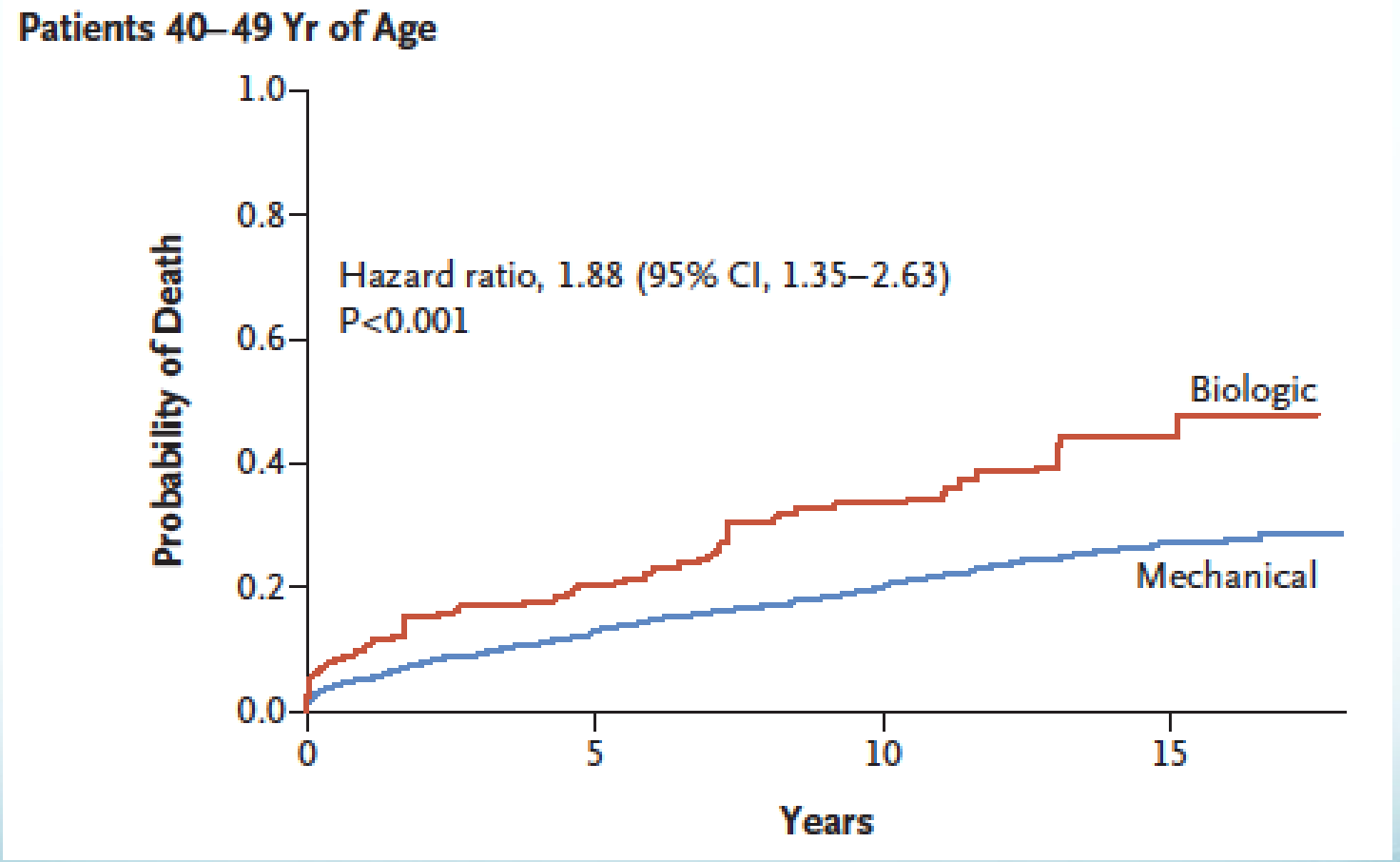
MVR



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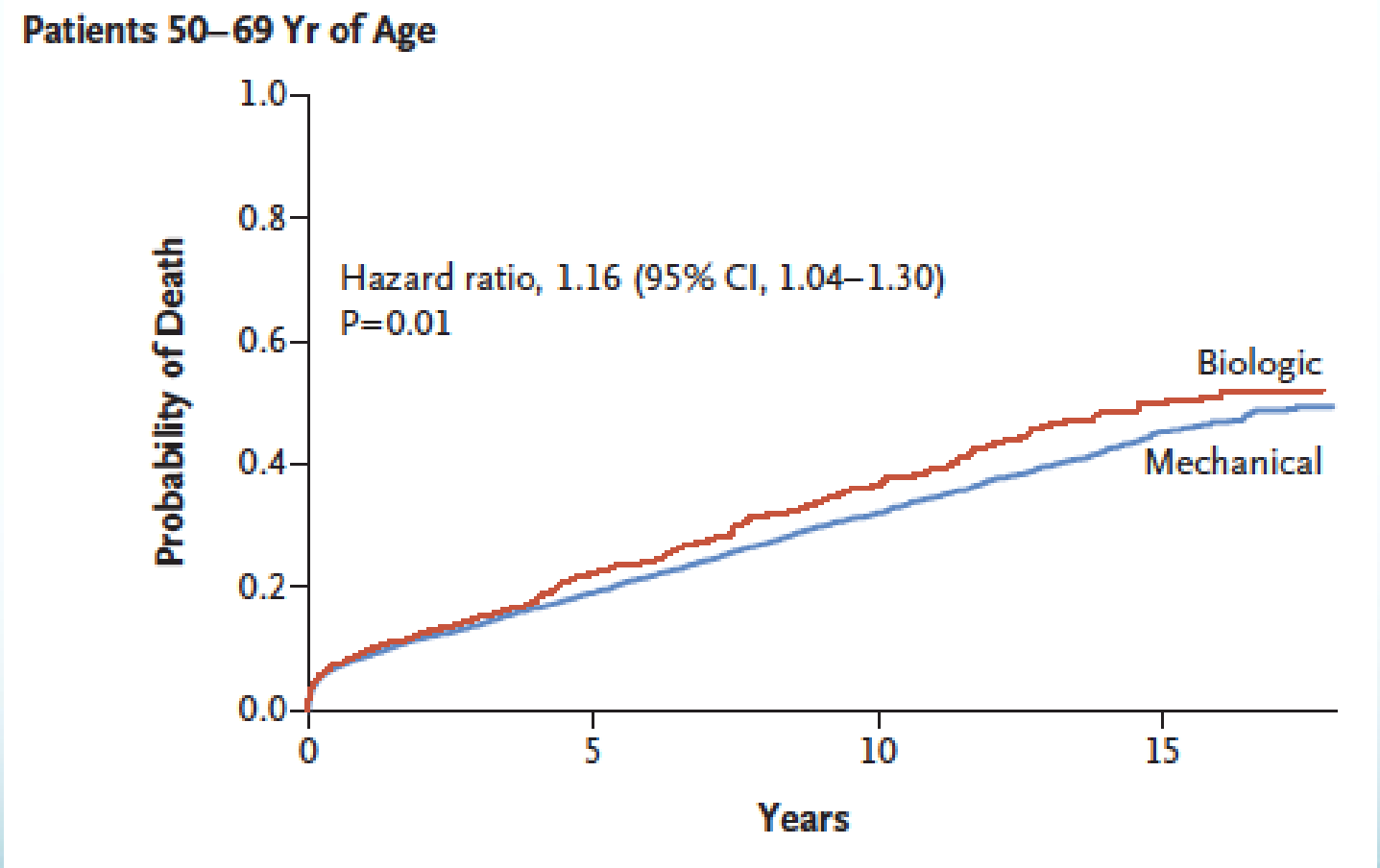
MVR



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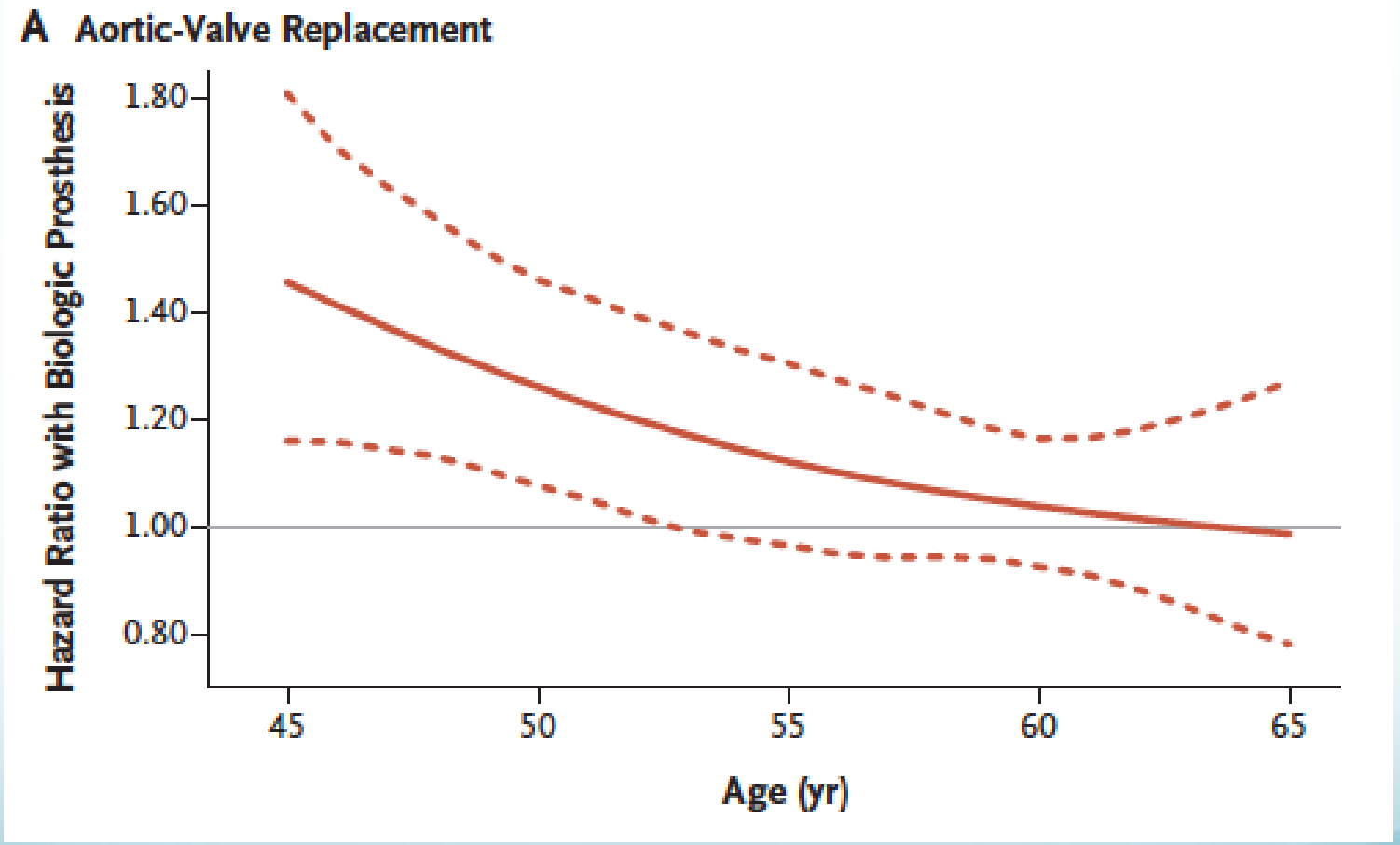
AGE AS CONTINUOUS VARIABLE



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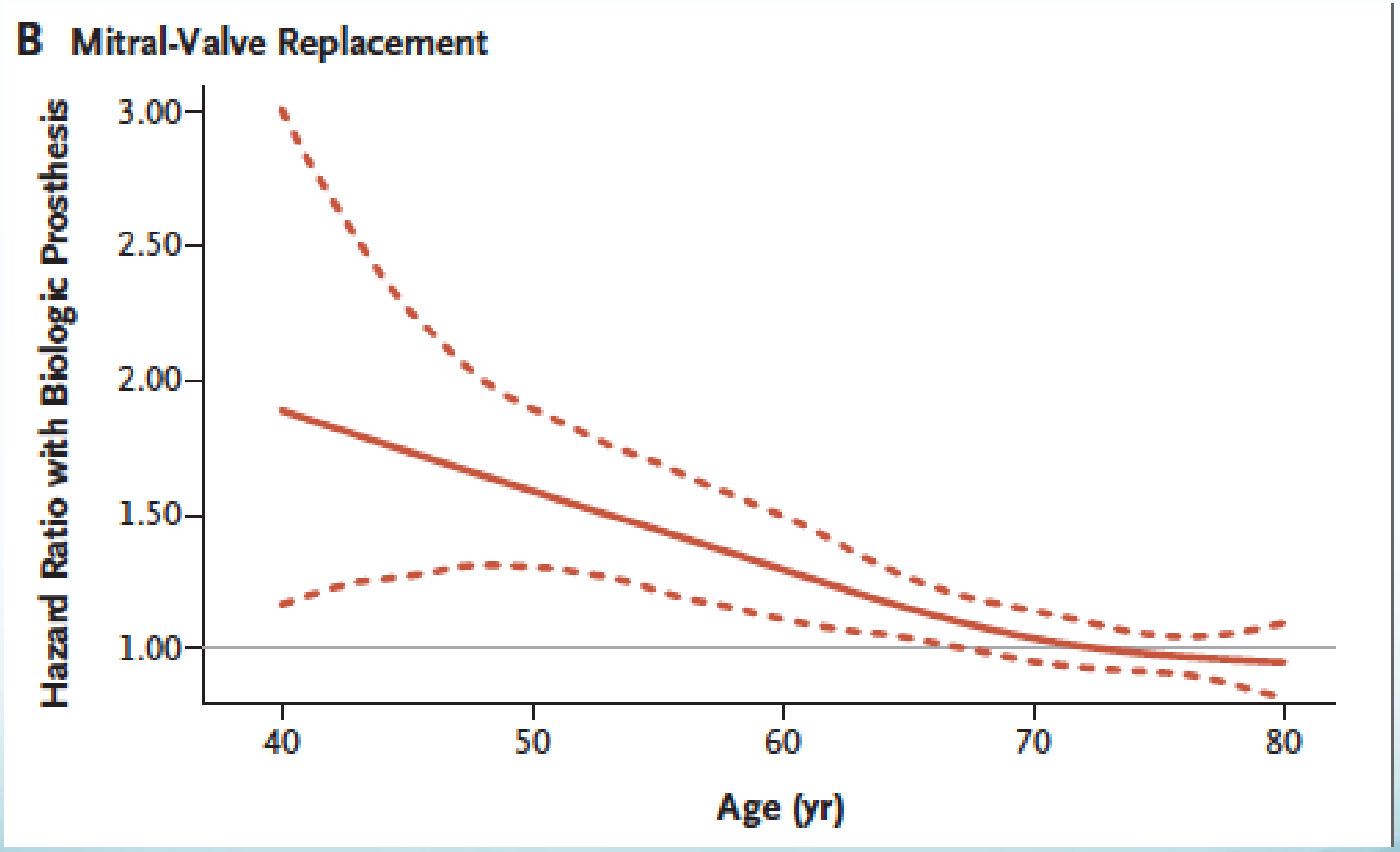

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TAKE HOME MESSAGES

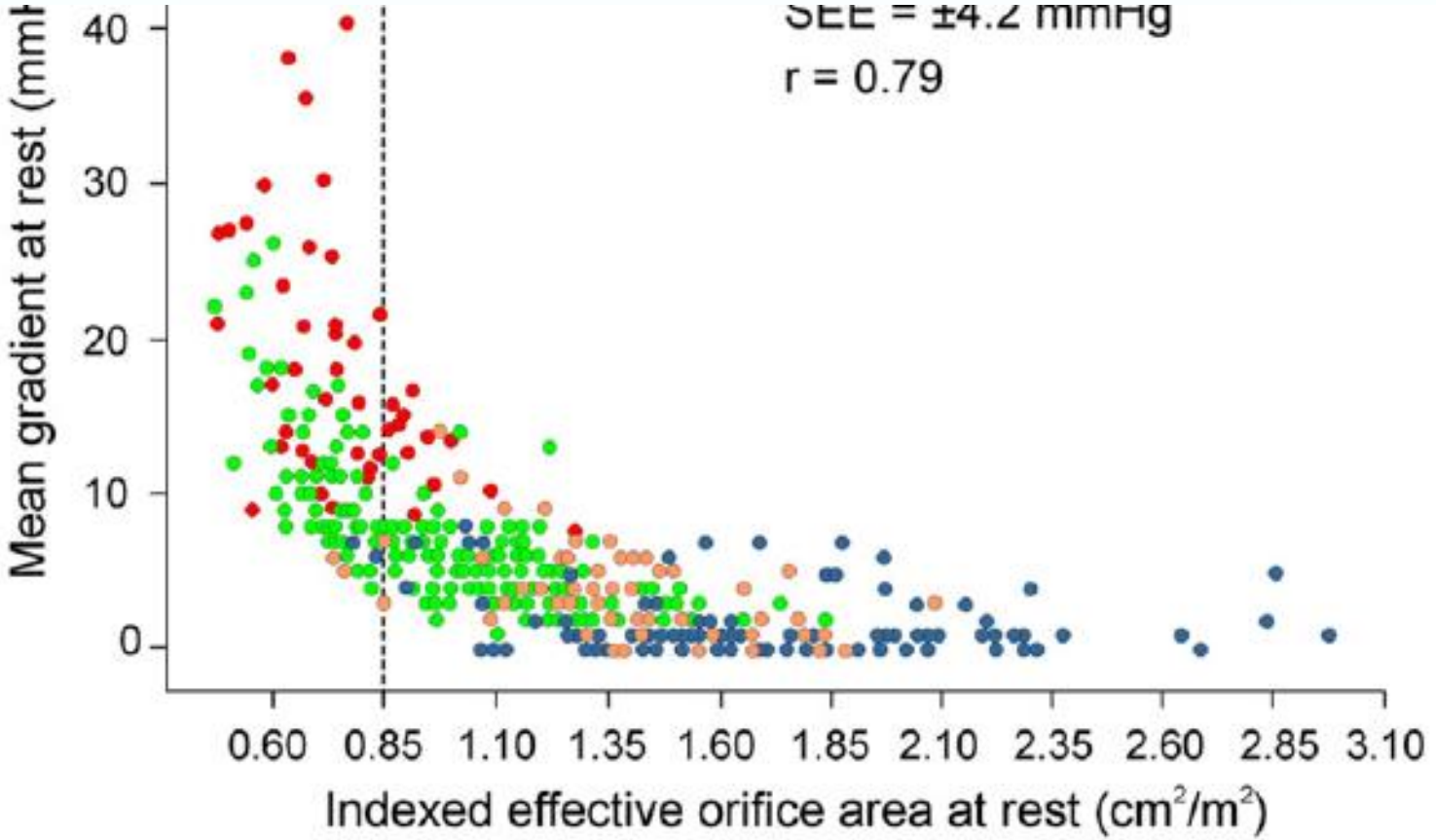
- Balance reoperation risk with anticoagulation risk – assumes no mortality advantage to one choice. NOT TRUE.
- Guidelines should be position sensitive
- Greater stroke and bleeding risk with mechanical valves outweighed by survival advantage in younger pts, probably accounts for result in older ages
- Should probably temper recent trend of "biological valves for everyone"

CONCLUSIONS

- Size counts
- So does durability
- So does position
- Severe PPM matters
- Survival benefit for mechanical valves in AVR pts < 55, MVR pts < 70.

Age of the patient
Comorbid conditions: cardiac and noncardiac
Expected life span of patient
Choose a PHV
That does not require root replacement for isolated aortic valve disease
With long-term follow-up outcomes that are at least as good as the best of the available PHV
With which individual physicians and medical centers have the necessary skill and experience
Probability of adherence and compliance with warfarin therapy
Patient's wishes and expectations

(J Am Coll Cardiol 2012;60:1123–35)



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