Ohio CHAPTER

8th Annual Richard P. Lewis Memorial Lecture

Aortic Stenosis: Fifty Years of Progress

Robert O. Bonow, MD, MS, MACC

Northwestern University Feinberg School of Medicine
Bluhm Cardiovascular Institute
Northwestern Memorial Hospital

Editor-in-Chief, JAMA Cardiology

No Relationships to Disclose

Northwestern Medicine

Richard P. Lewis, MD, MACC

Aortic Stenosis

By JOHN ROSS, JR., M.D. AND EUGENE BRAUNWALD, M.D.

THE ADVENT of corrective operations for various forms of heart disease has placed increasing emphasis upon the need for accurate information concerning the natural history of patients with potentially correctible lesions. An understanding of the natural course assumes particular importance in the case of aortic stenosis because of the significant incidence of sudden death associated with this disease and the grave prognosis that appears to accompany the onset of certain symptoms, patients with isolated valvular aortic stenosis of rheumatic etiology and patients without a history of rheumatic fever who have isolated calcific aortic stenosis; many of the latter patients are now considered to have developed calcification and stenosis of a congenitally bicuspid valve.[1] The review will focus primarily on the prognostic significance of three major symptoms—angina pectoris, syncope, and symptoms related to left ventricular failure

From the Cardiology Branch, National Heart Institute, Bethesda, Maryland.

Supplement V to Circulation, Vols. XXXVII and XXXVIII, July 1968

Ross and Braunwald, *Circulation* 1968;38:V-61

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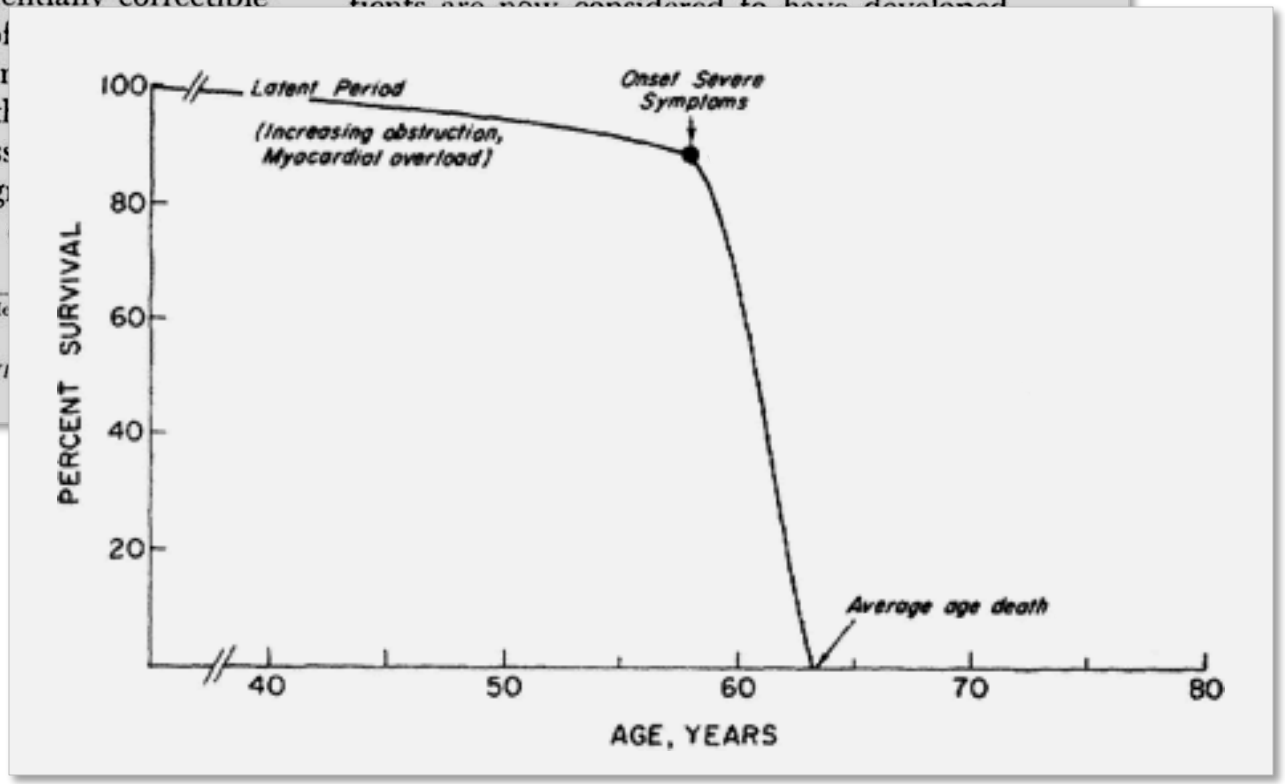

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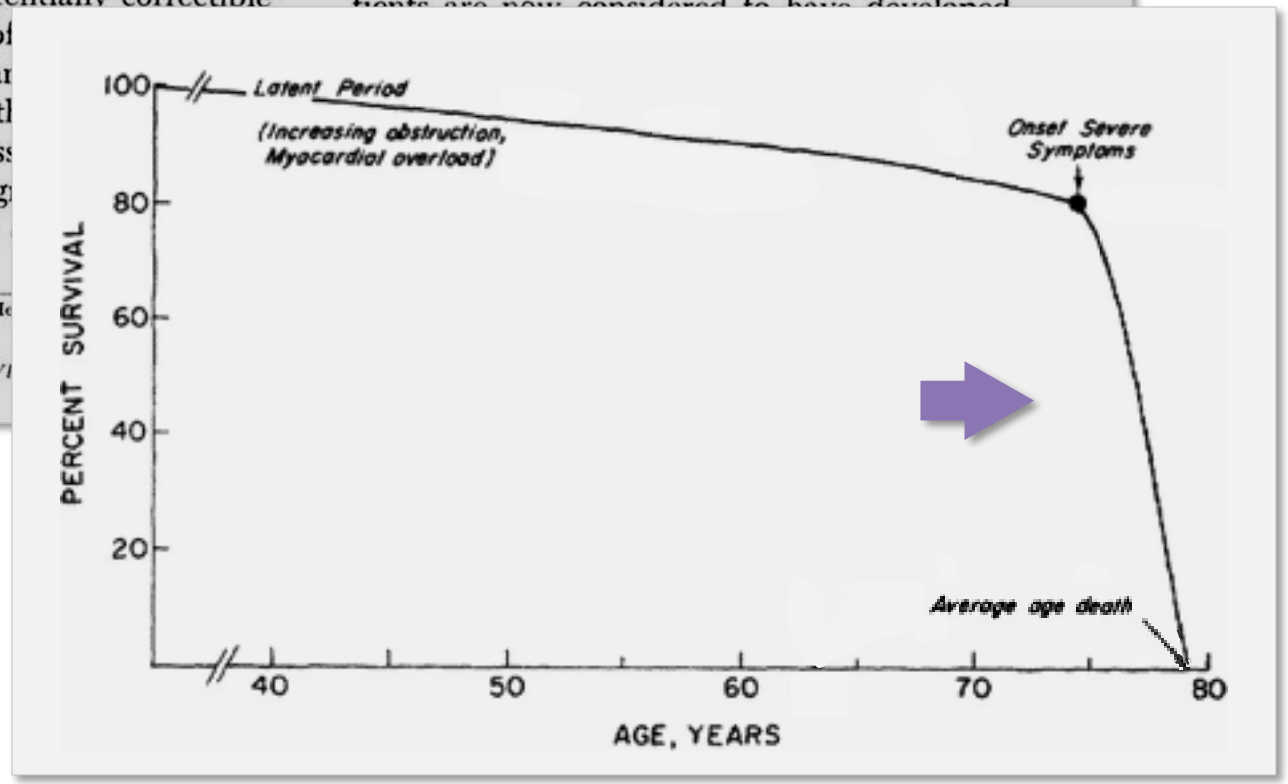

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VALVULAR HEART DISEASE

Comparison of Outcome of Asymptomatic to Symptomatic Patients Older Than 20 Years of Age with Valvular Aortic Stenosis

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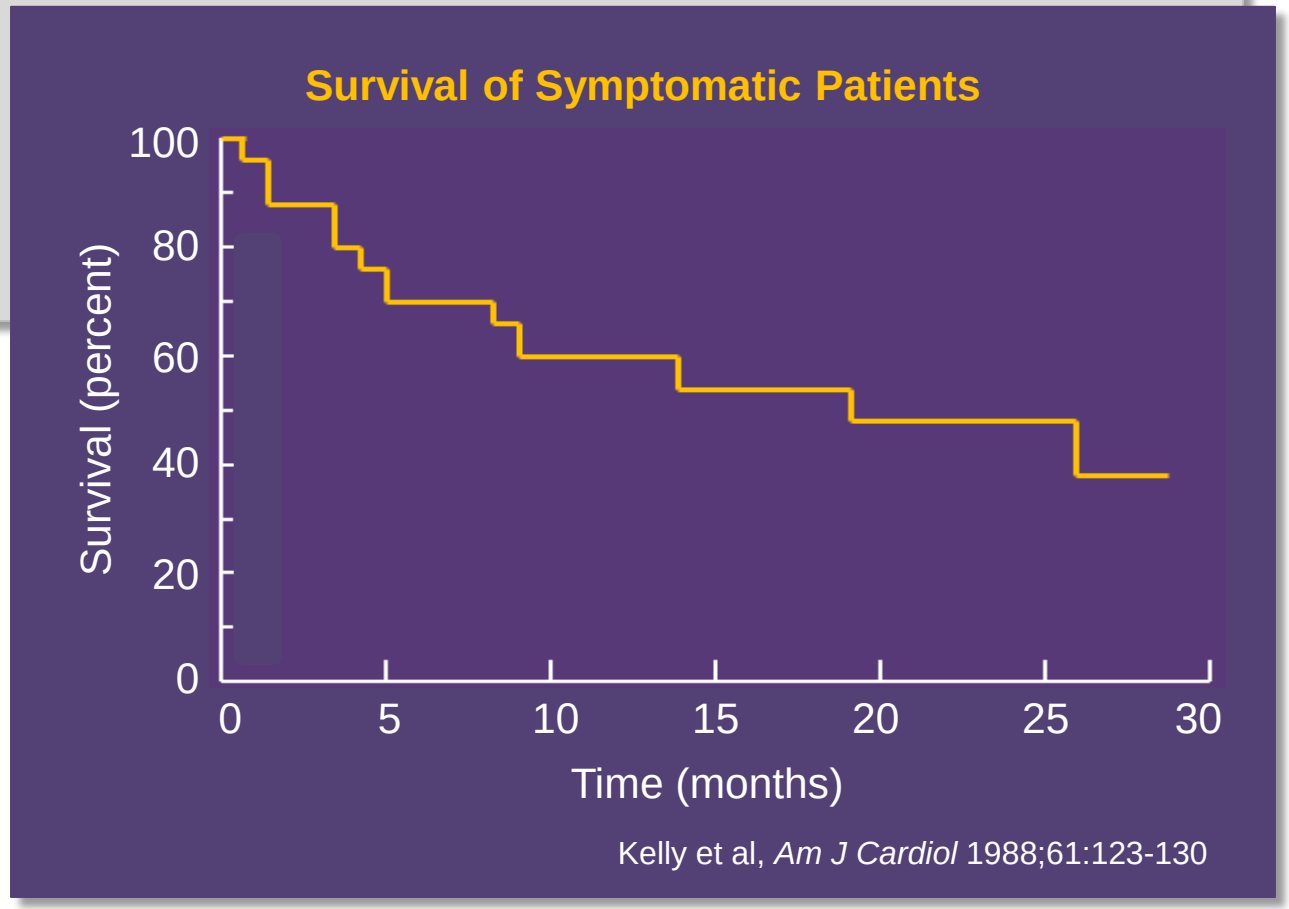
DONALD L. KAISER,



Kelly et al, *Am J Cardiol* 1988;61:123-130

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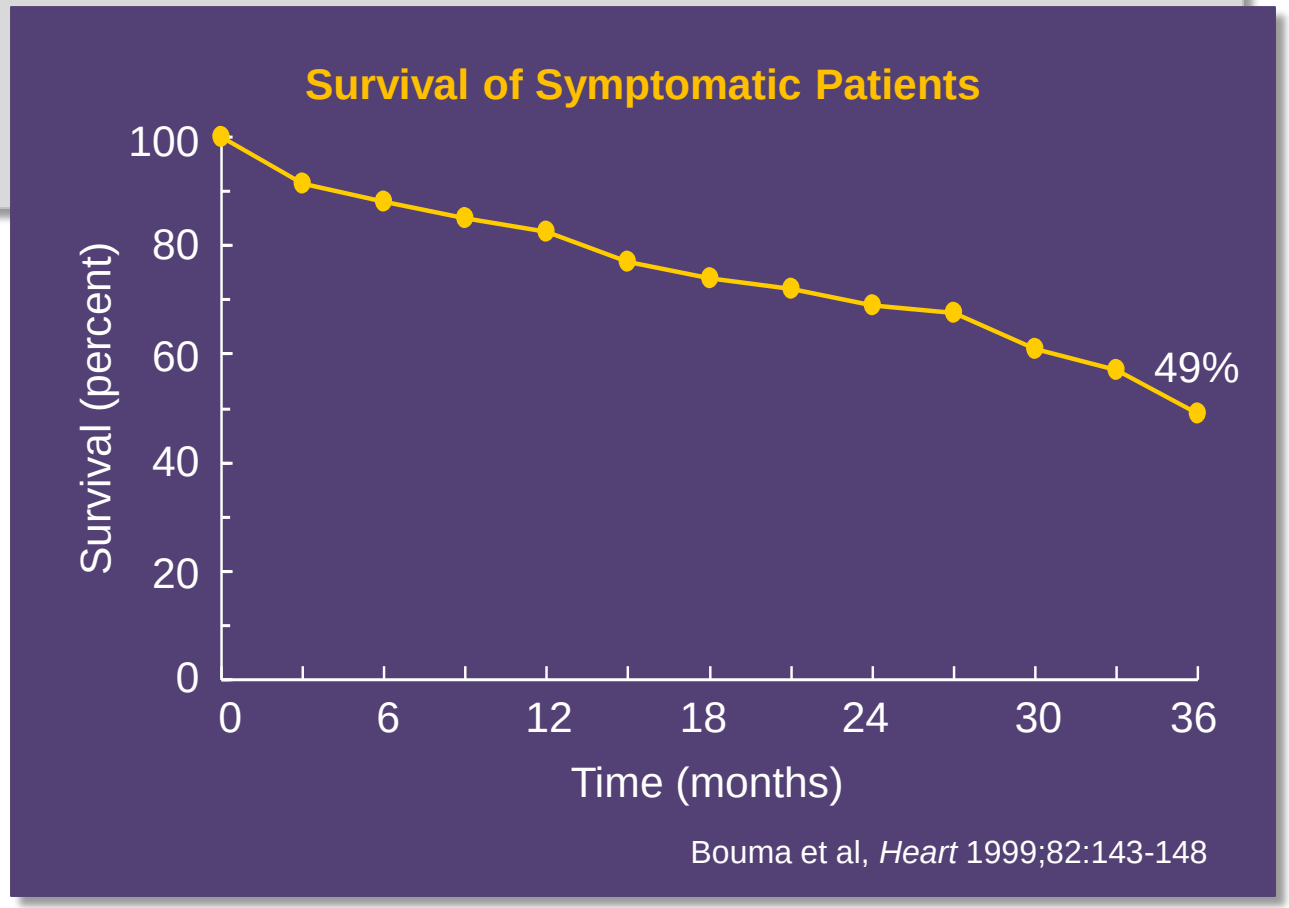
To operate or not on elderly patients with aortic stenosis: the decision and its consequences

B J Bouma, R B A van den Brink, J H P van der Meulen, H A Verheul, E C Cheriex, H P M Hamer, E Dekker, K I Lie, J G P Tijssen



Bouma et al, *Heart* 1999;82:143-148

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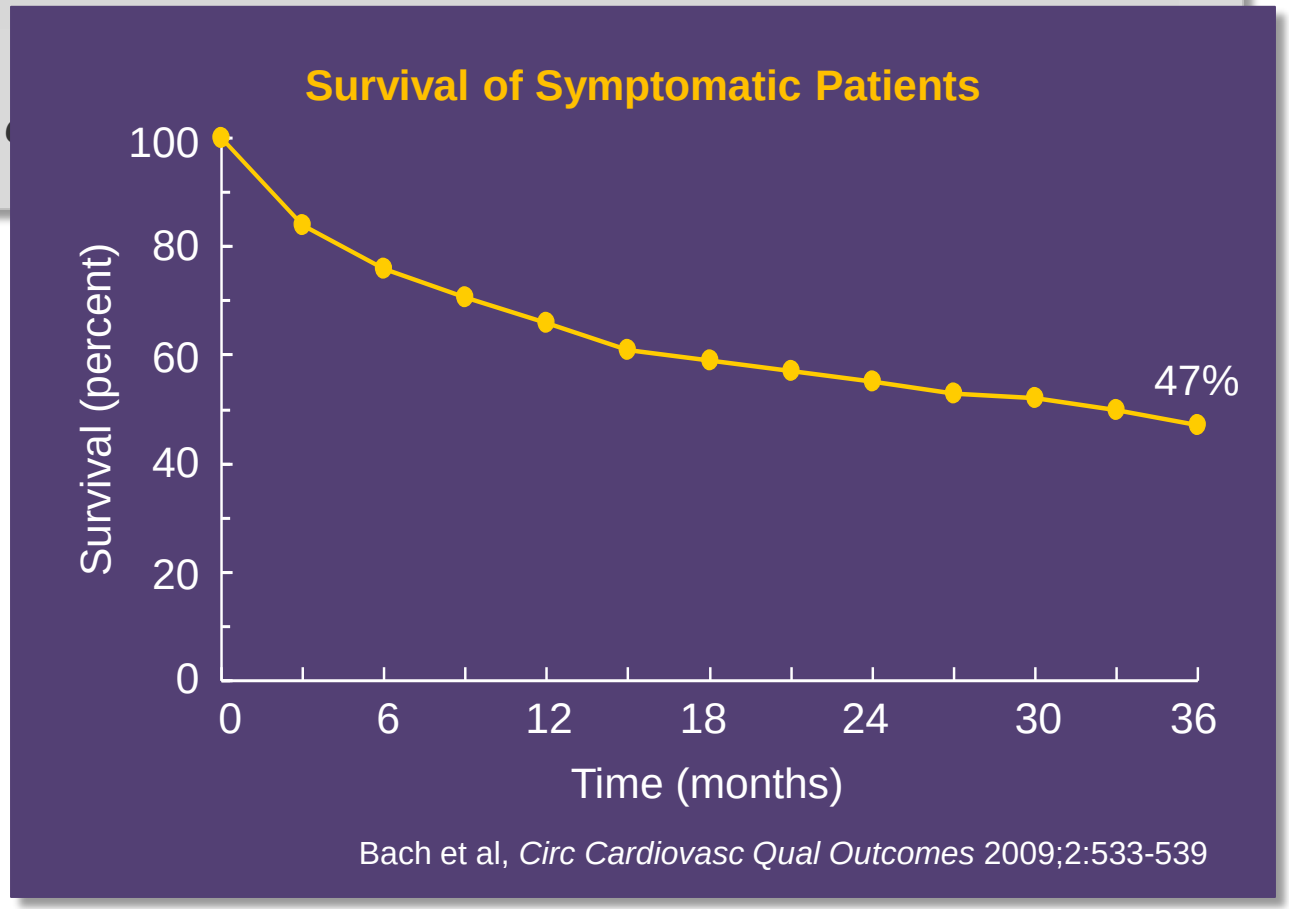
Evaluation of Patients With Severe Symptomatic Aortic Stenosis Who Do Not Undergo Aortic Valve Replacement

The Potential Role of Subjectively Overestimated Operative Risk

David S. Bach, MD; Derrick Siao, MD; Steven E. Girard, MD, PhD; Claire Duvernoy, MD; Benjamin D. McCallister, Jr, MD; Sarah K. Gualano, MD



Bach et al, *Circ Cardiovasc Qual Outcomes* 2009;2:533-539

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Aortic Stenosis

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EACTS

Indications for AVR

- Symptomatic patients with severe AS

class I

…if it is likely that the symptoms are cardiac in origin

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EACTS

Indications for AVR

- Symptomatic patients with severe AS — **class I**
- Asymptomatic patients with severe AS — **?**

… are asymptomatic patients with severe AS *really* asymptomatic?

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EACTS

Indications for AVR

Exercise test results:

- Symptoms — **class I**
- Hypotension — **class IIa**

How are *symptoms* determined?
- Everyone has symptoms on stress test
- Are the symptoms cardiac in origin?
- What level of exercise?

How is *hypotension* defined?
- Less than 20 mmHg increase (?)

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EACTS

Indications for AVR

Exercise test results:

- Symptoms — **class I**
- Hypotension — **class IIa**

What is the outcome of *asymptomatic* patients with AS ?

…when they are *really* asymptomatic?

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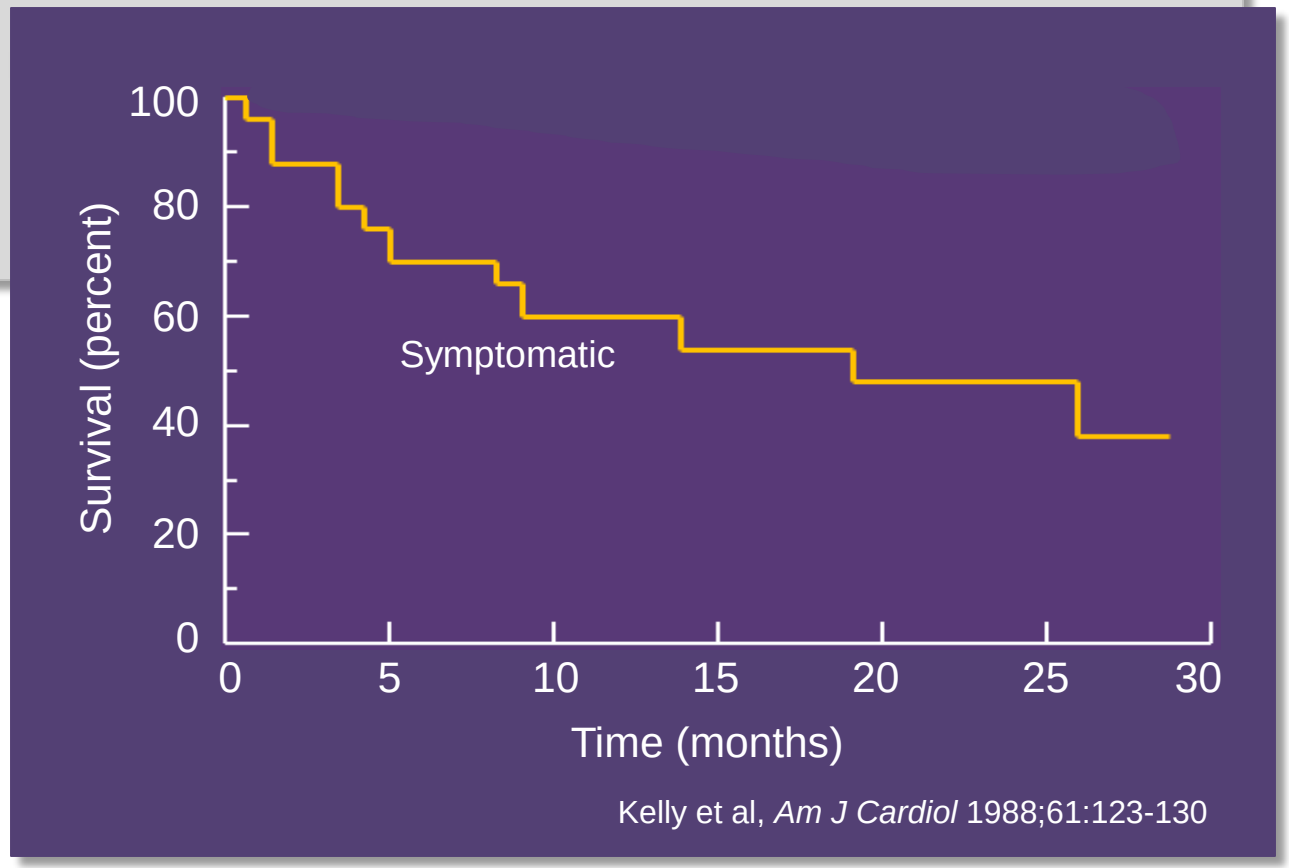

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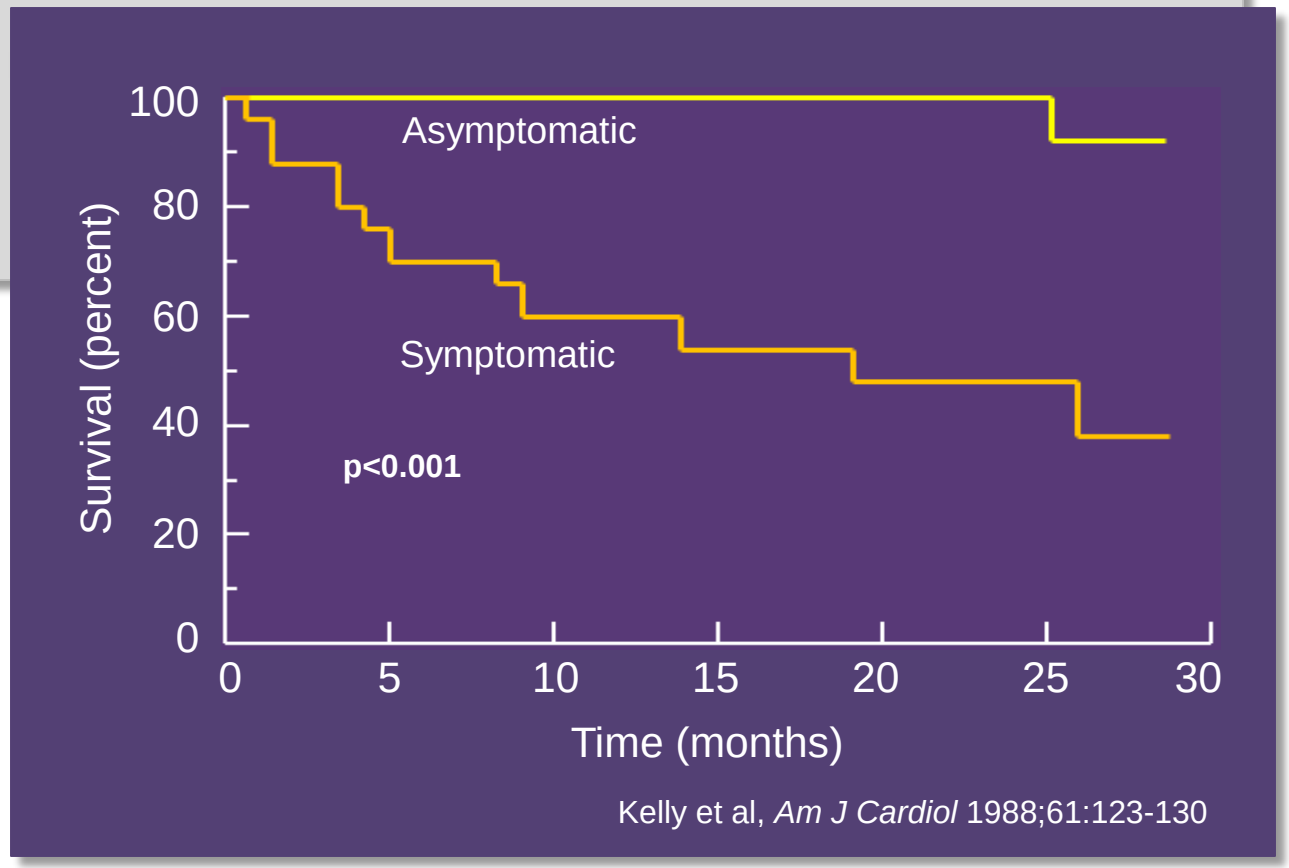

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Journal of the American College of Cardiology
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Published by Elsevier Inc.

Vol. 50, No. 20, 2007
ISSN 0735-1097/07/$32.00

CORRESPONDENCE

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Unoperated Patients With Severe Aortic Stenosis

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Nina Cimino
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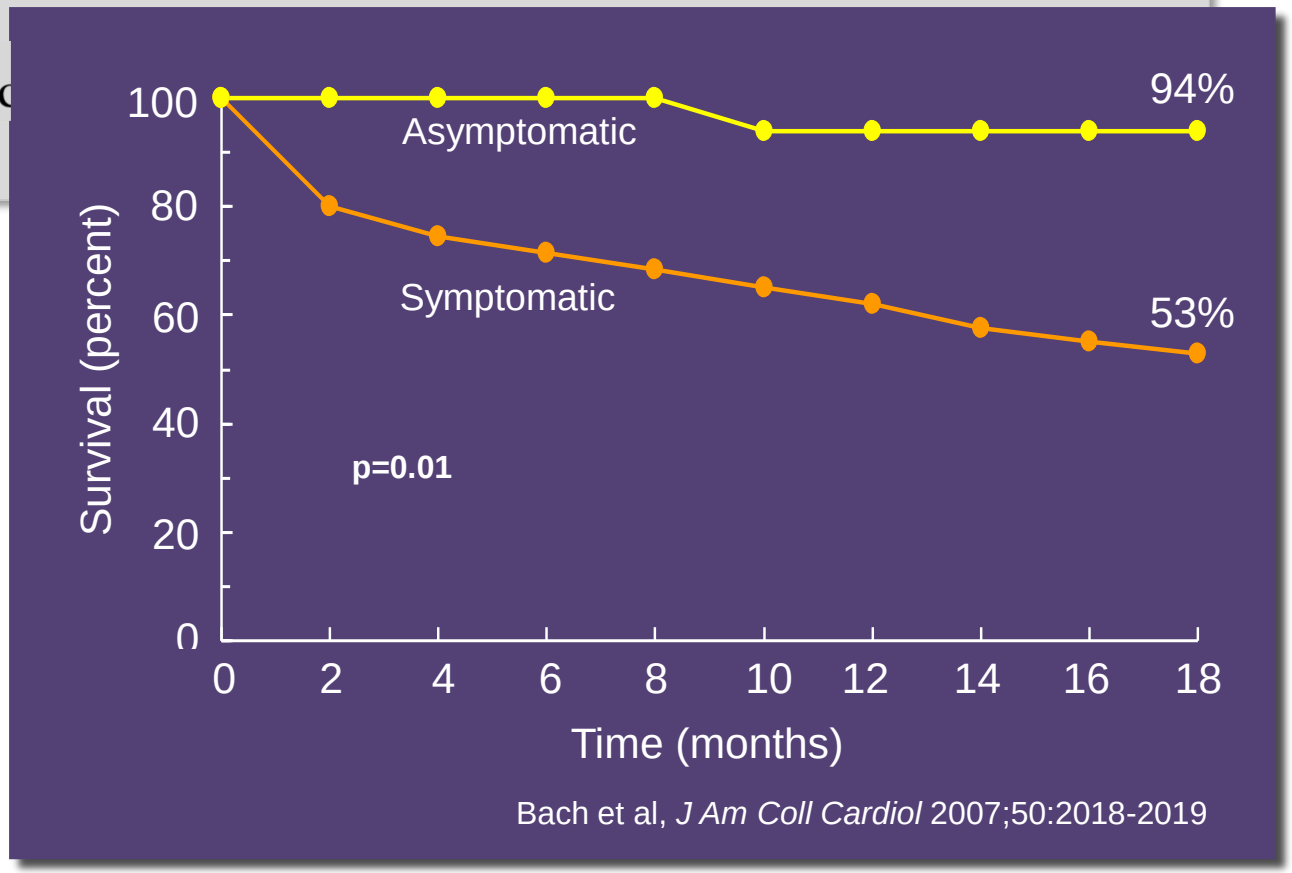

Bach et al, *J Am Coll Cardiol* 2007;50:2018-2019

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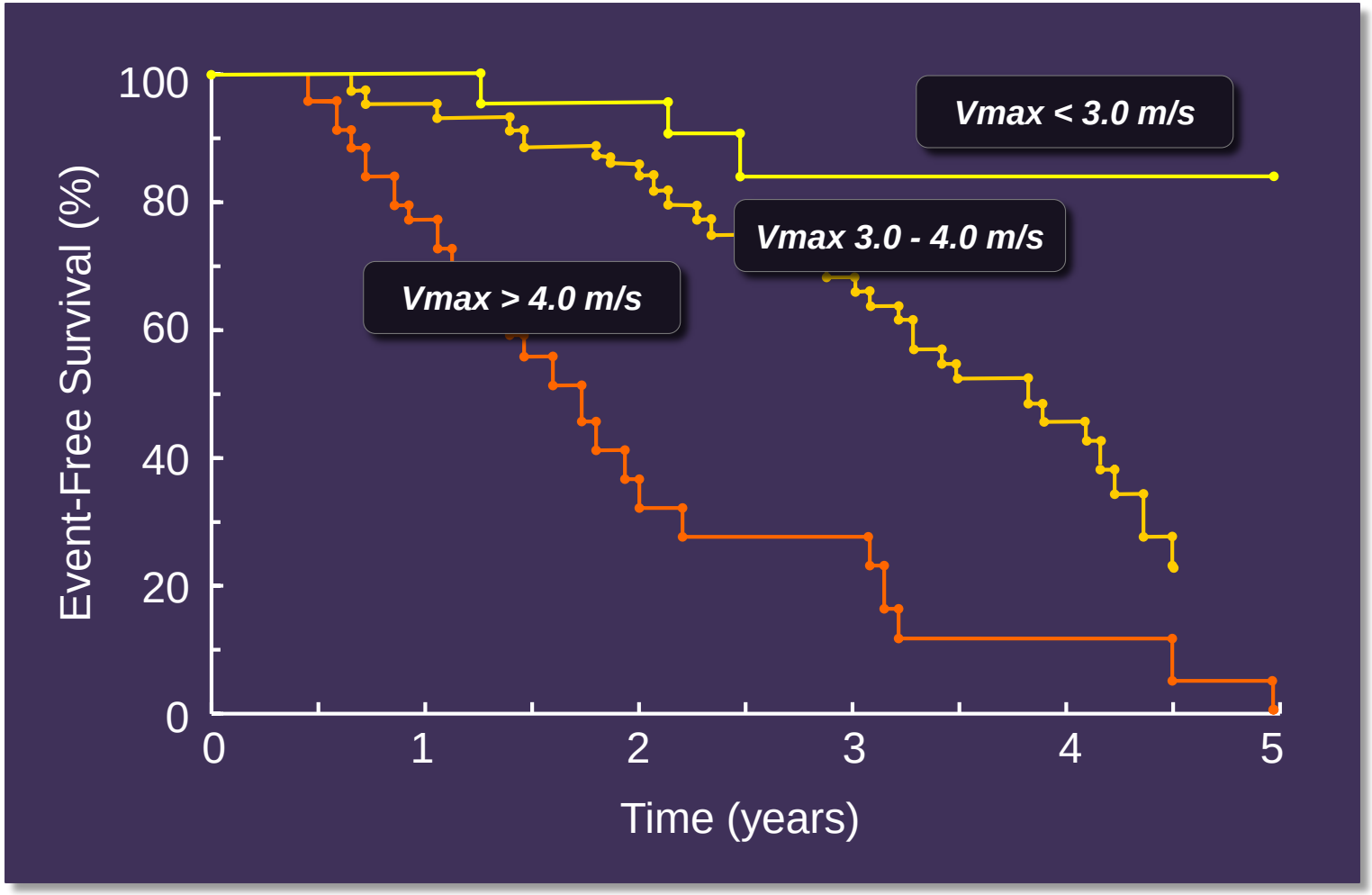
Natural History of Asymptomatic AS



Otto et al. *Circulation* 1997;95:2262-2270

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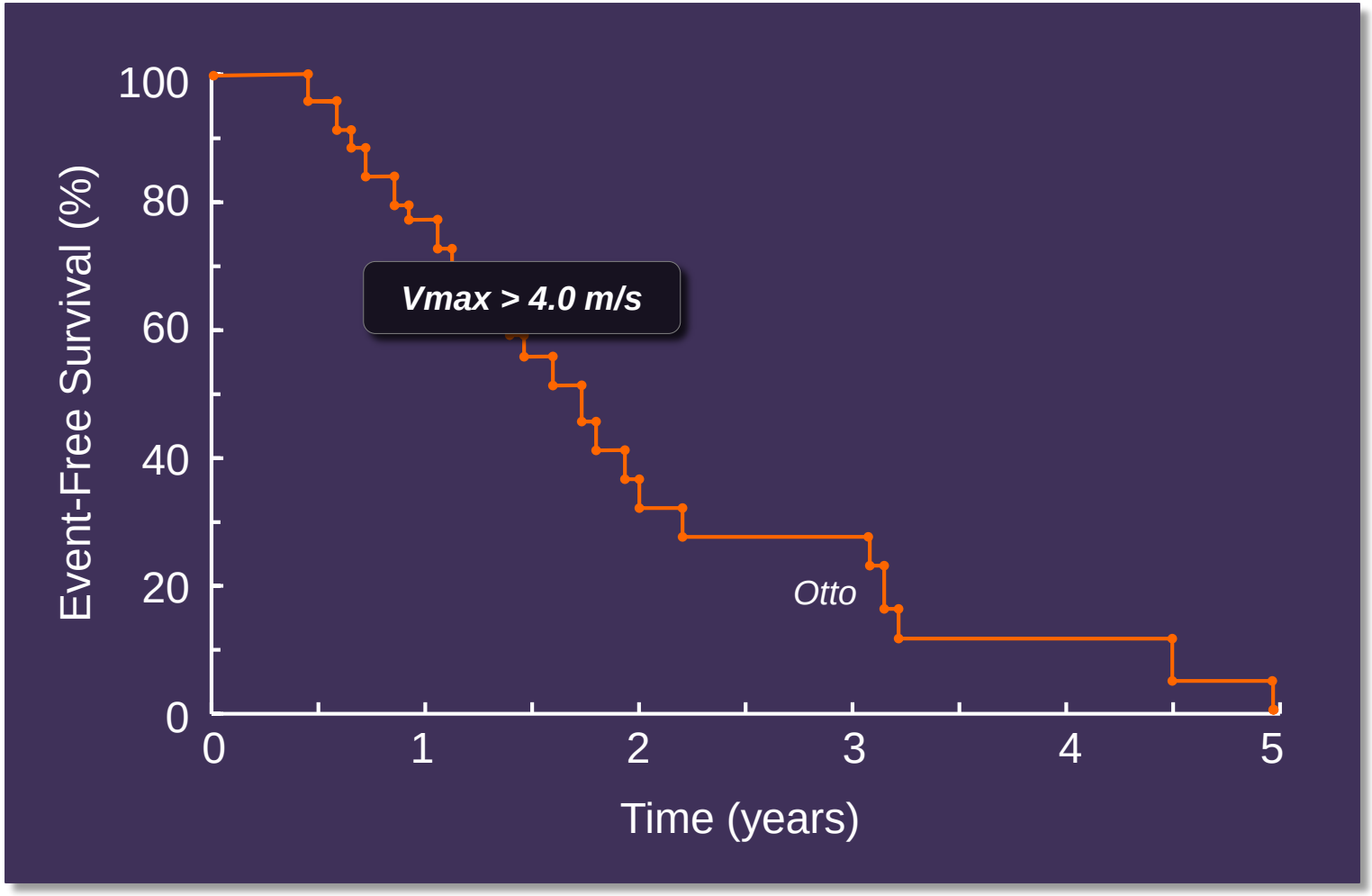

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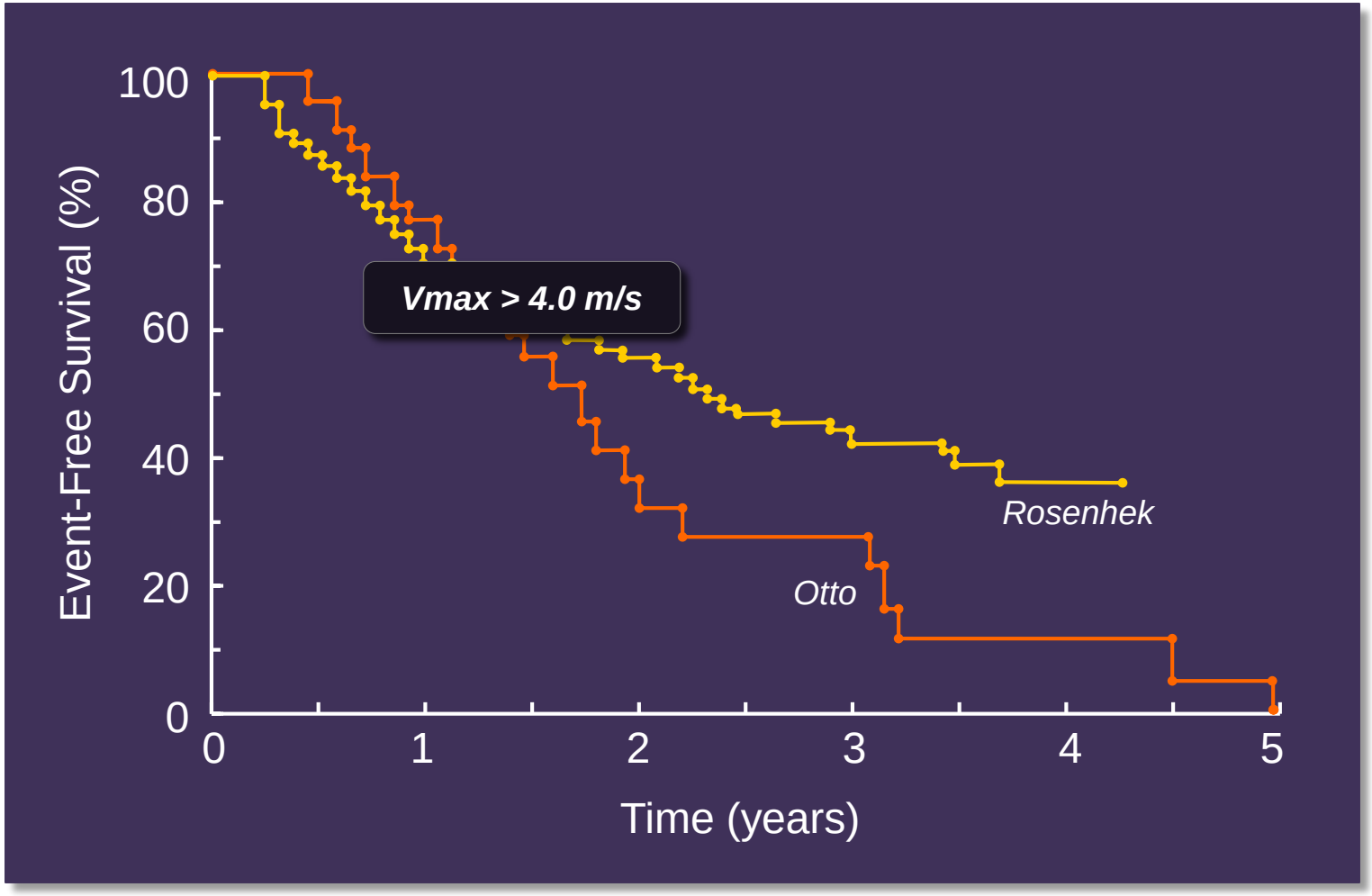

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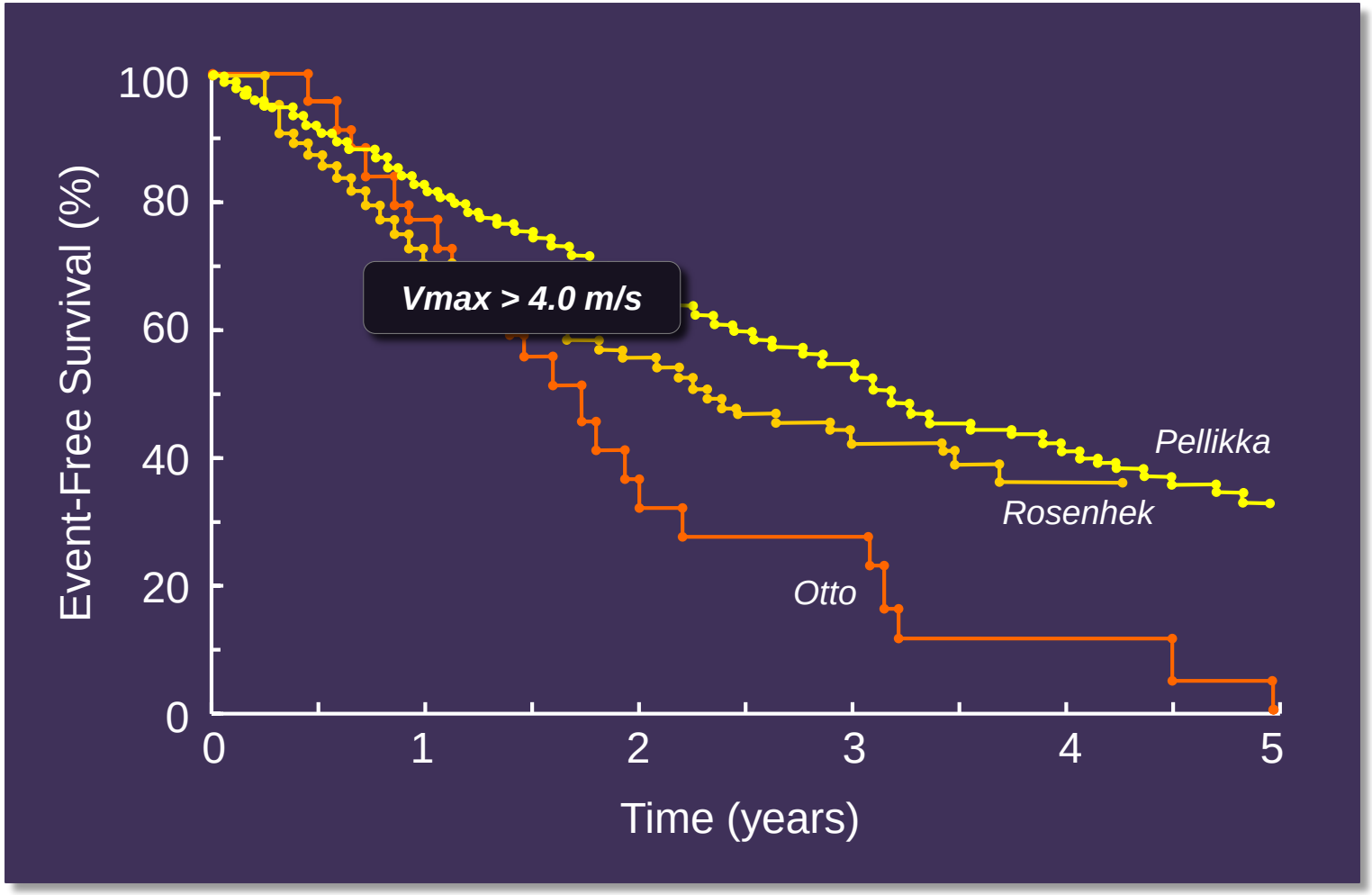

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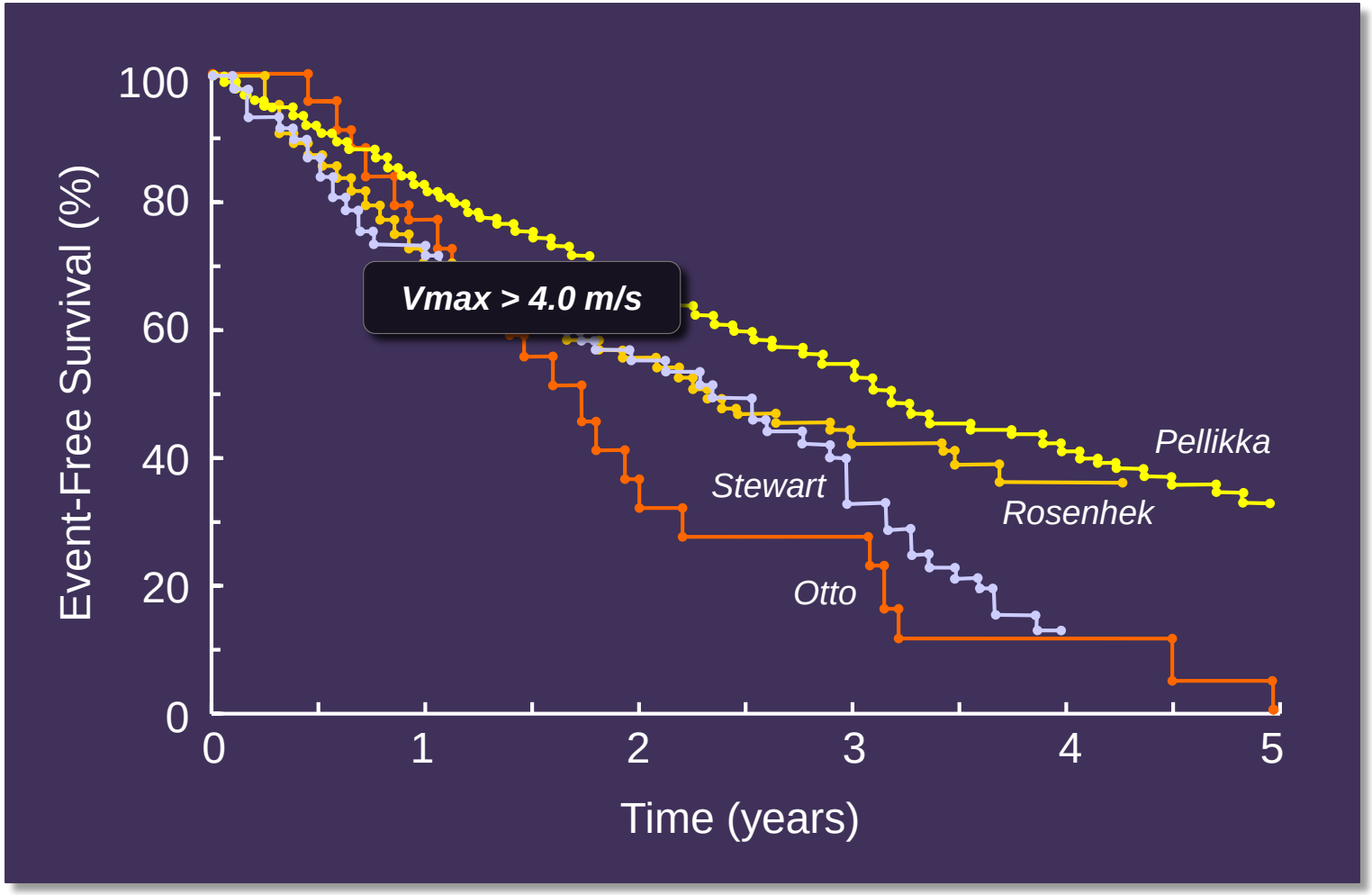

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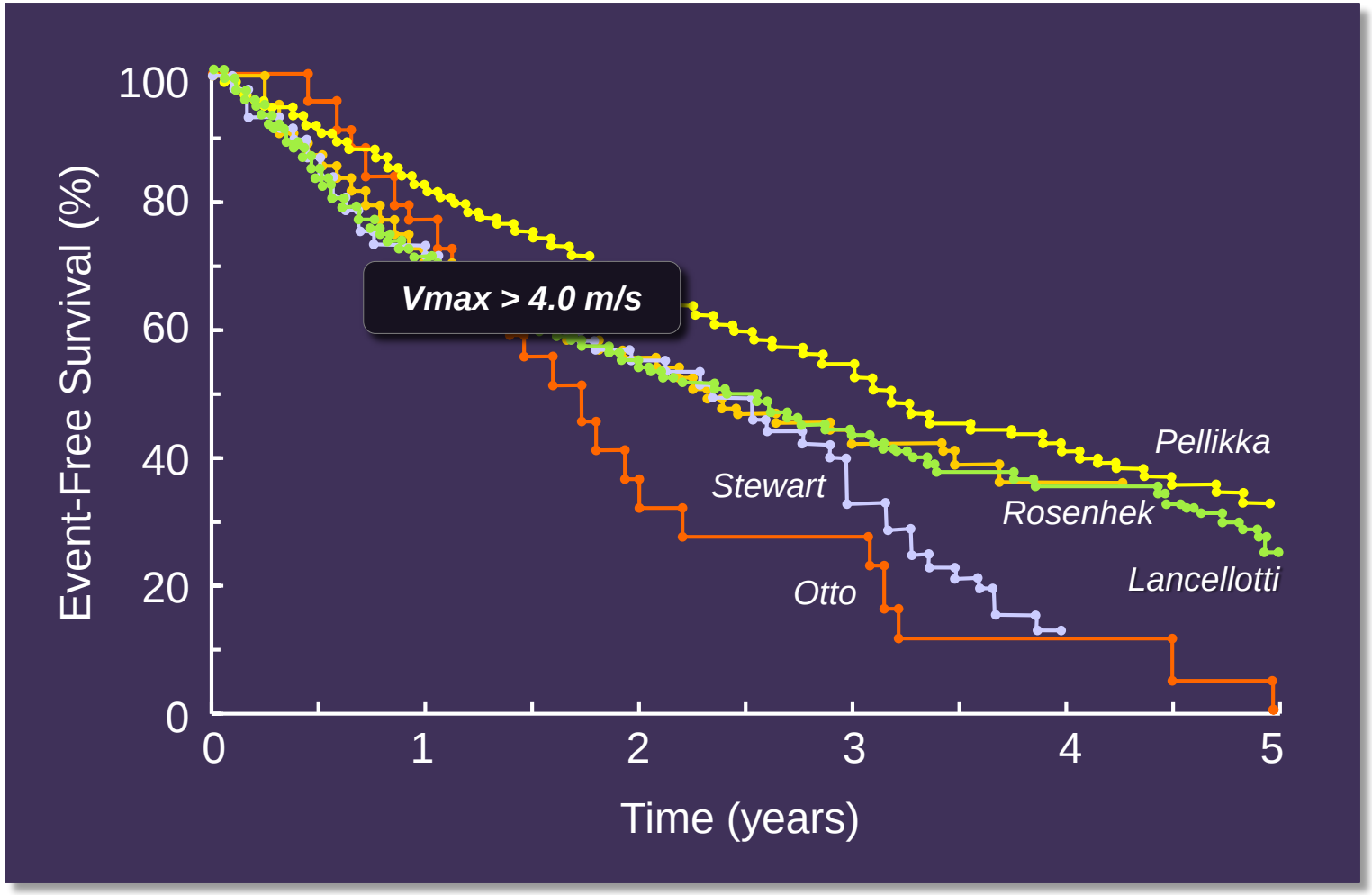

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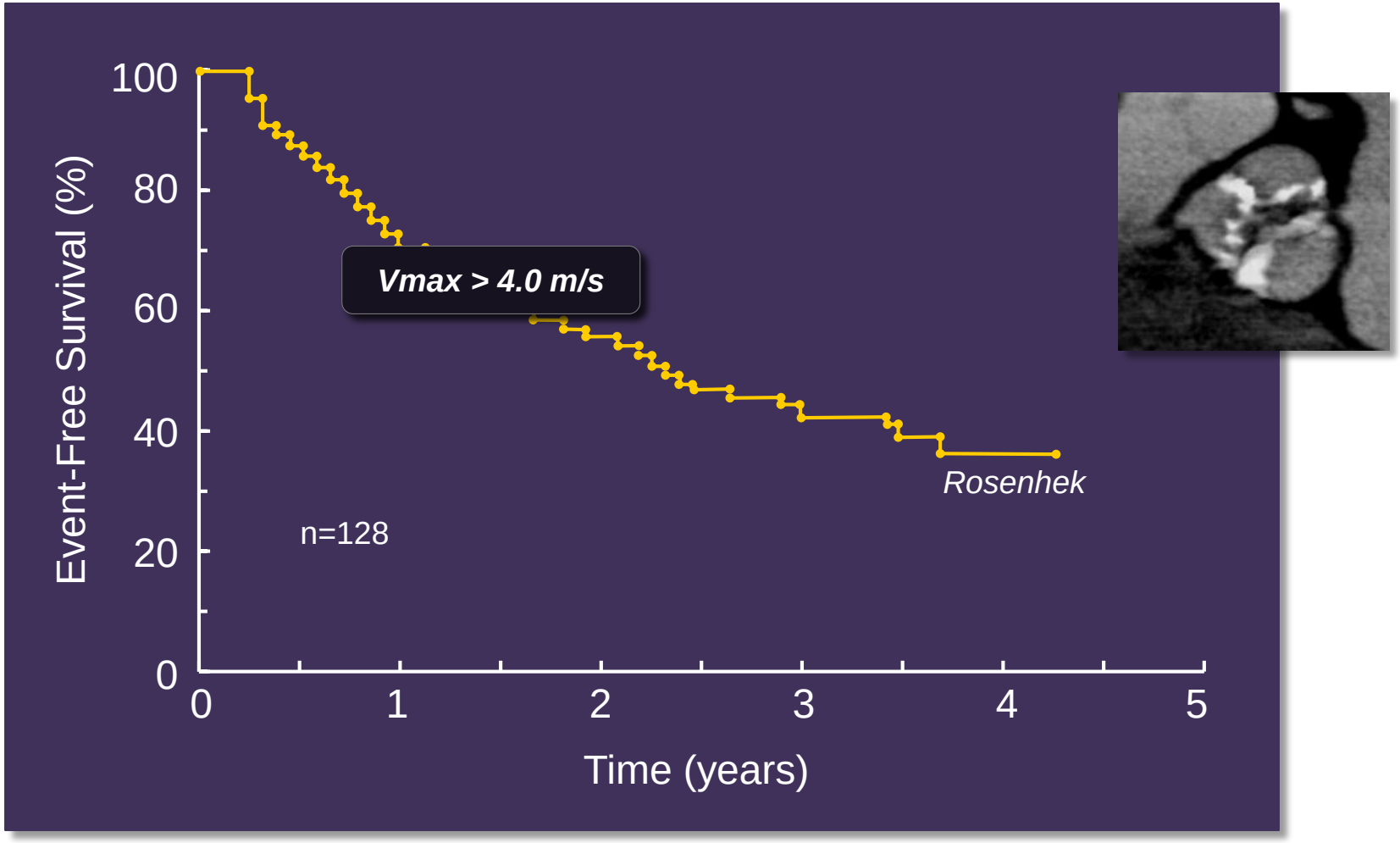

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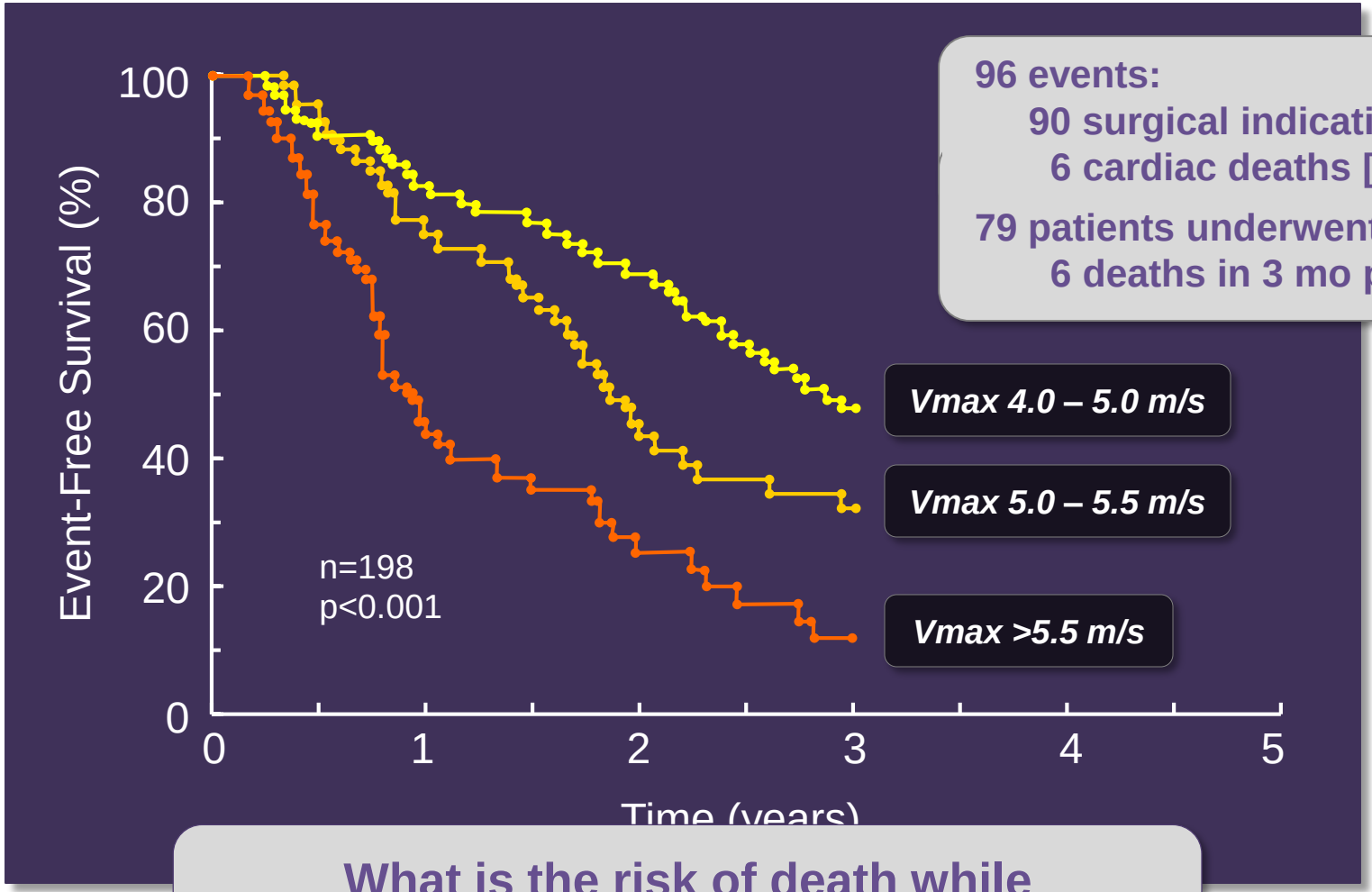

96 events:
- **90 surgical indication**
- **6 cardiac deaths [1 SCD]**

79 patients underwent AVR
- **6 deaths in 3 mo postopx**

What is the risk of death while waiting for symptoms to trigger AVR?

;121:151-156

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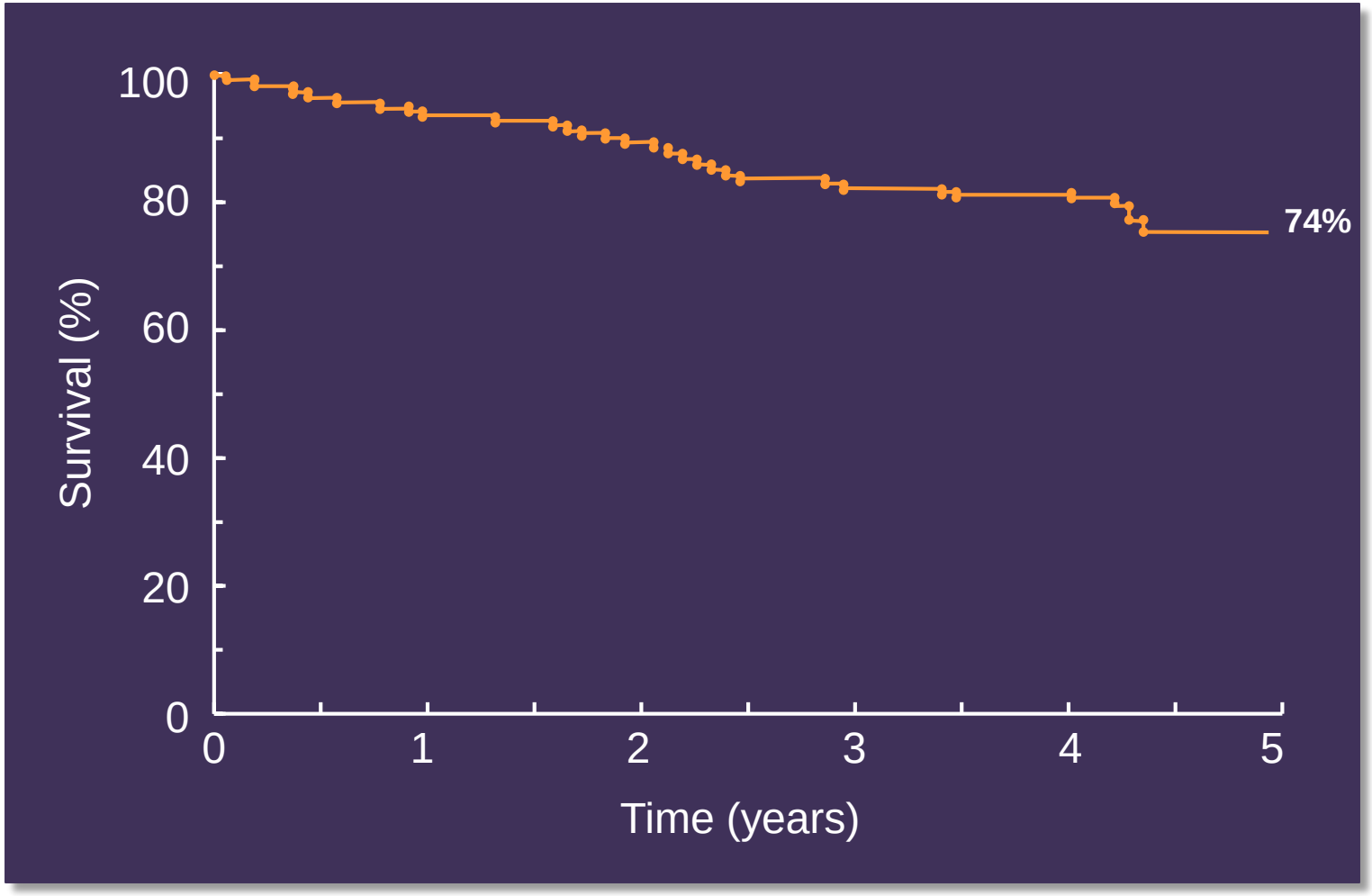
Natural History of Severe Asymptomatic AS



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Taniguchi et al. *J Am Coll Cardiol* 2015;66:2827-2838

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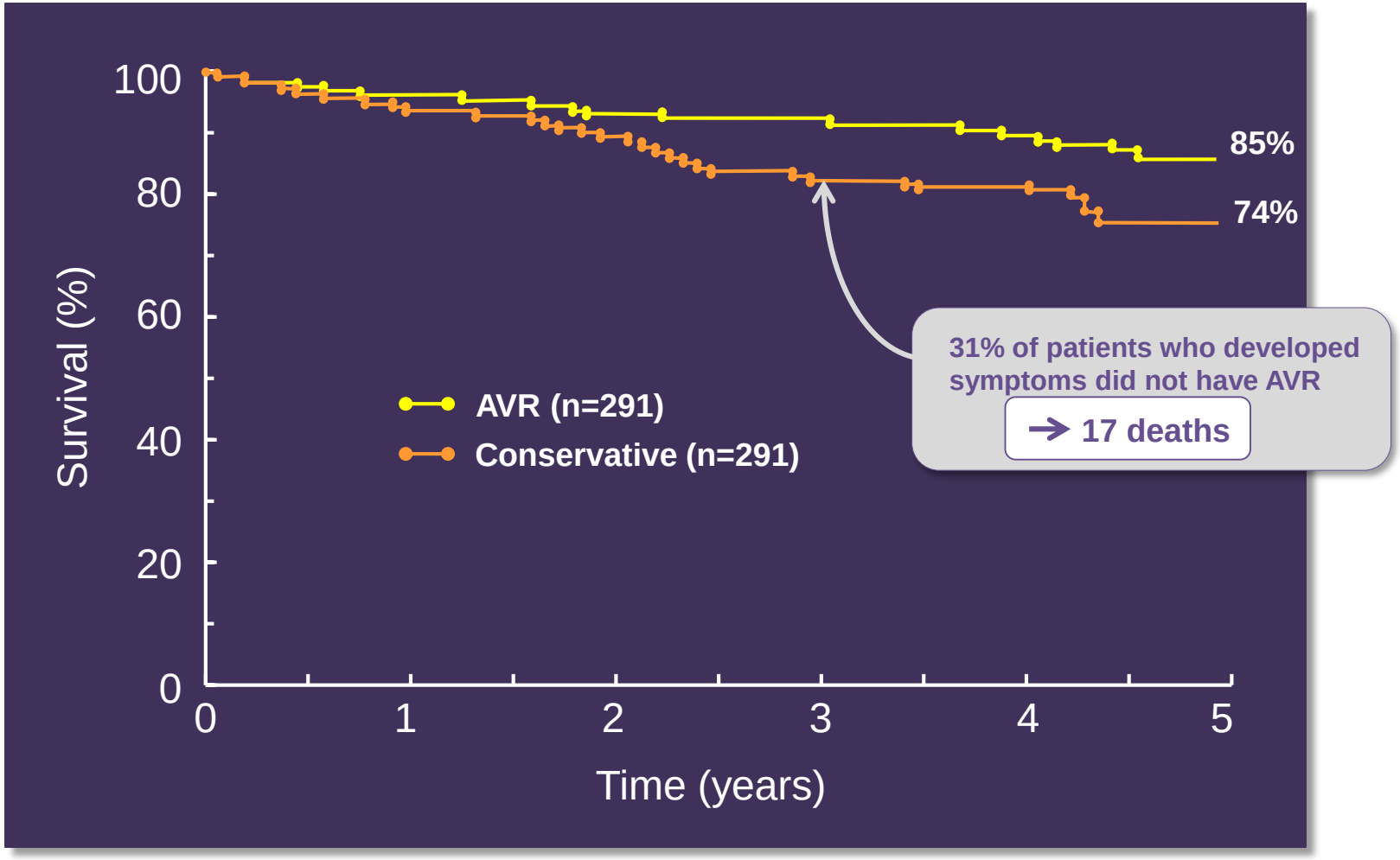

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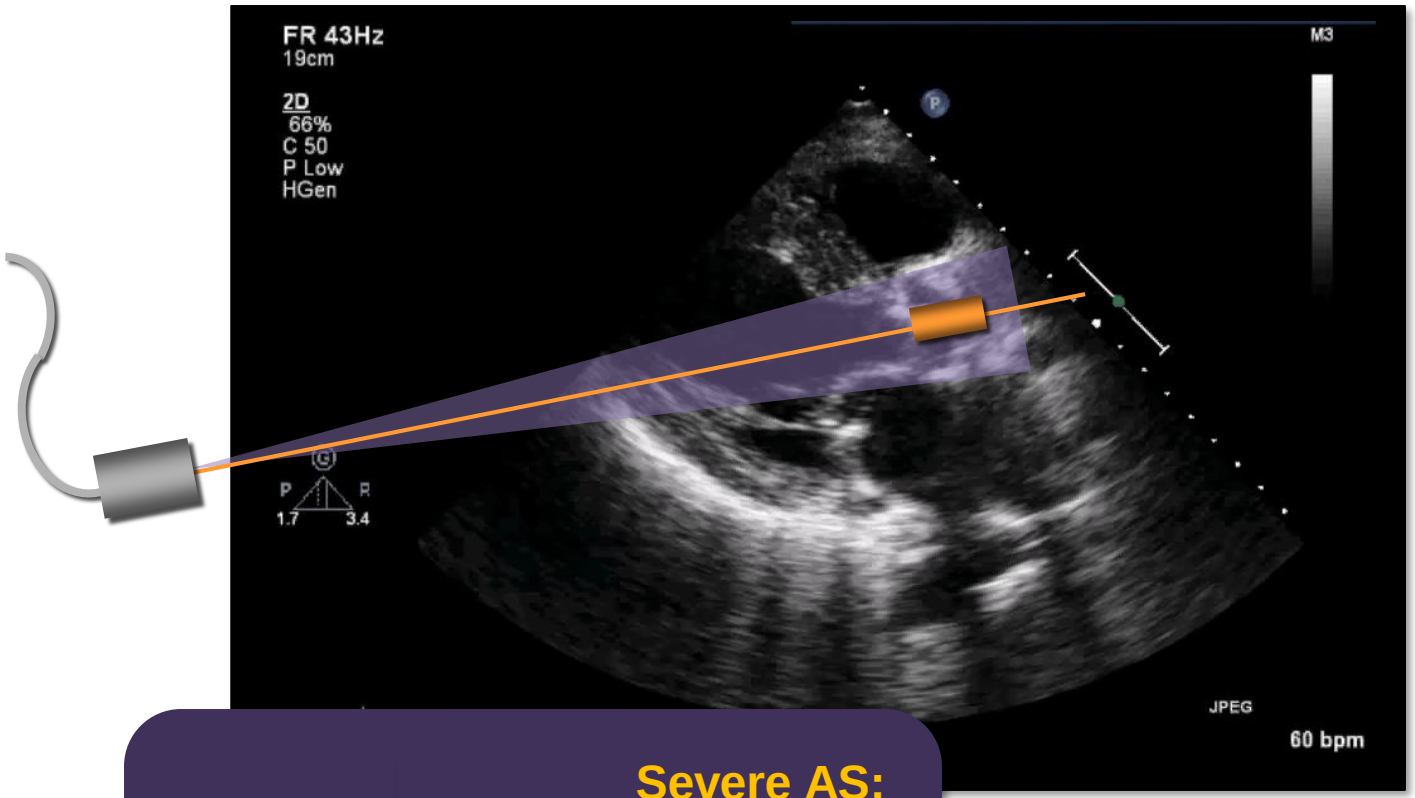

		Severe AS:
Vmax:	4.6 m/s	>4.0 m/s
Mean Δ:	52 mmHg	>40 mmHg
AVA:	0.7 sq cm	<1.0 sq cm

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Aortic Stenosis

84 year old man with severe AS

- Watchful waiting? *
- More data (more testing)?
- Aortic valve replacement?
- Enroll him in a clinical trial?

*Wait until he develops symptoms in 5-6 years and then recommend TAVR?

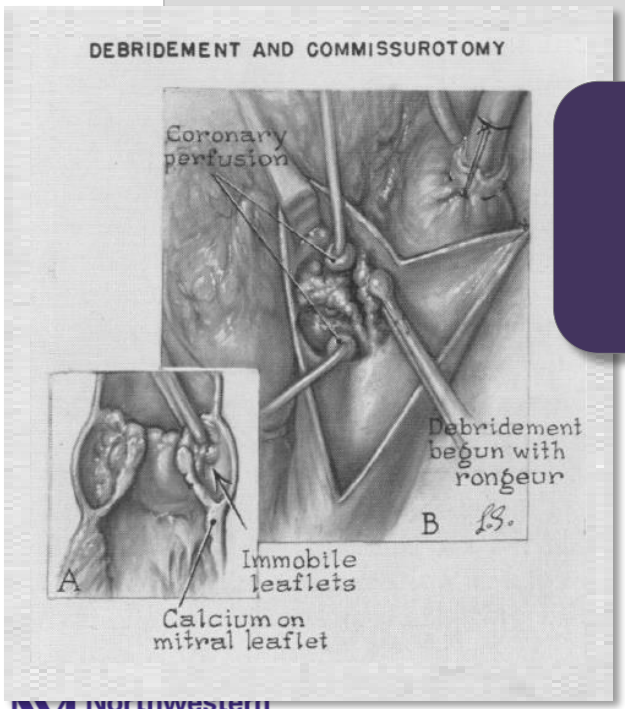
The Surgical Treatment of Calcific Aortic Stenosis: *

Operative Methods and the Results of the Pre- and Postoperative Hemodynamic Assessments

ANDREW G. MORROW, M.D., W. GERALD AUSTEN, M.D., EUGENE BRAUNWALD, M.D.

From the Clinic of Surgery and Cardiology Branch, National Heart Institute Bethesda, Maryland

Ann Surg 158:936, 1963



"Primary atherosclerosis of the valve may sometimes occur without previous rheumatic valvulitis."

JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY

VOL. 69, NO. 10, 2017
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http://dx.doi.org/10.1016/j.jacc.2016.11.033

ORIGINAL INVESTIGATIONS

Association Between Cardiovascular Risk Factors and Aortic Stenosis

The CANHEART Aortic Stenosis Study

Andrew T. Yan, MD,[a] Maria Koh, MSc,[b] Kelvin K. Chan, MD, MSc,[c] Helen Guo, MSc,[b] David A. Alter, MD, PhD,[b,d] Peter C. Austin, PhD,[b] Jack V. Tu, MD, PhD,[b,e] Harindra C. Wijeysundera, MD, PhD,[b,e] Dennis T. Ko, MD, MSc[b,e]

J Am Coll Cardiol 2017;69:1523-1532

1.12 million individuals in Ontario
Age >65
Median follow-up 13 years
20,995 developed aortic stenosis

JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY

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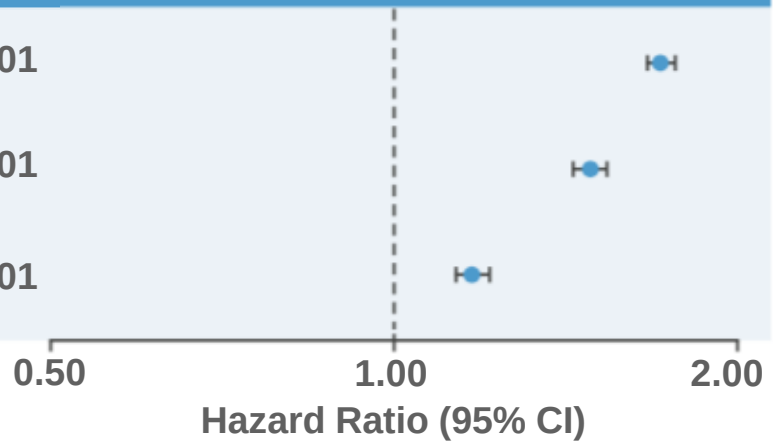
	Adjusted HR (95% CI)	P value
Hypertension	1.71 (1.66-1.76)	<0.001
Diabetes	1.49 (1.44-1.54)	<0.001
Dyslipidemia	1.17 (1.14-1.21)	<0.001



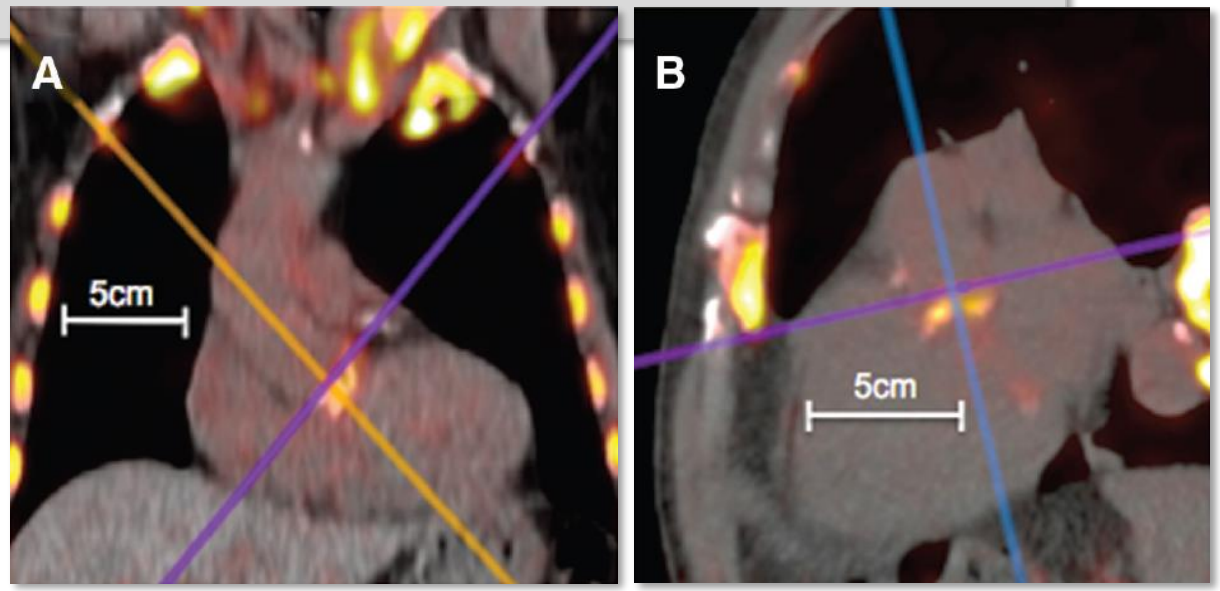
Yan et al, *J Am Coll Cardiol* 2017;69:1523-1532

Imaging

Assessment of Valvular Calcification and Inflammation by Positron Emission Tomography in Patients With Aortic Stenosis

Marc Richard Dweck, MD; Charlotte Jones, BSc; Nikhil V. Joshi, MD; Alison M. Fletcher, PhD; Hamish Richardson, BSc; Audrey White; Mark Marsden, BSc; Renzo Pessotto, MD; John C. Clark, DSc; William A. Wallace, PhD; Donald M. Salter, MD; Graham McKillop, MD; Edwin J.R. van Beek, PhD; Nicholas A. Boon, MD; James H.F. Rudd, PhD; David E. Newby, DSc

Circulation. 2012;125:76-86



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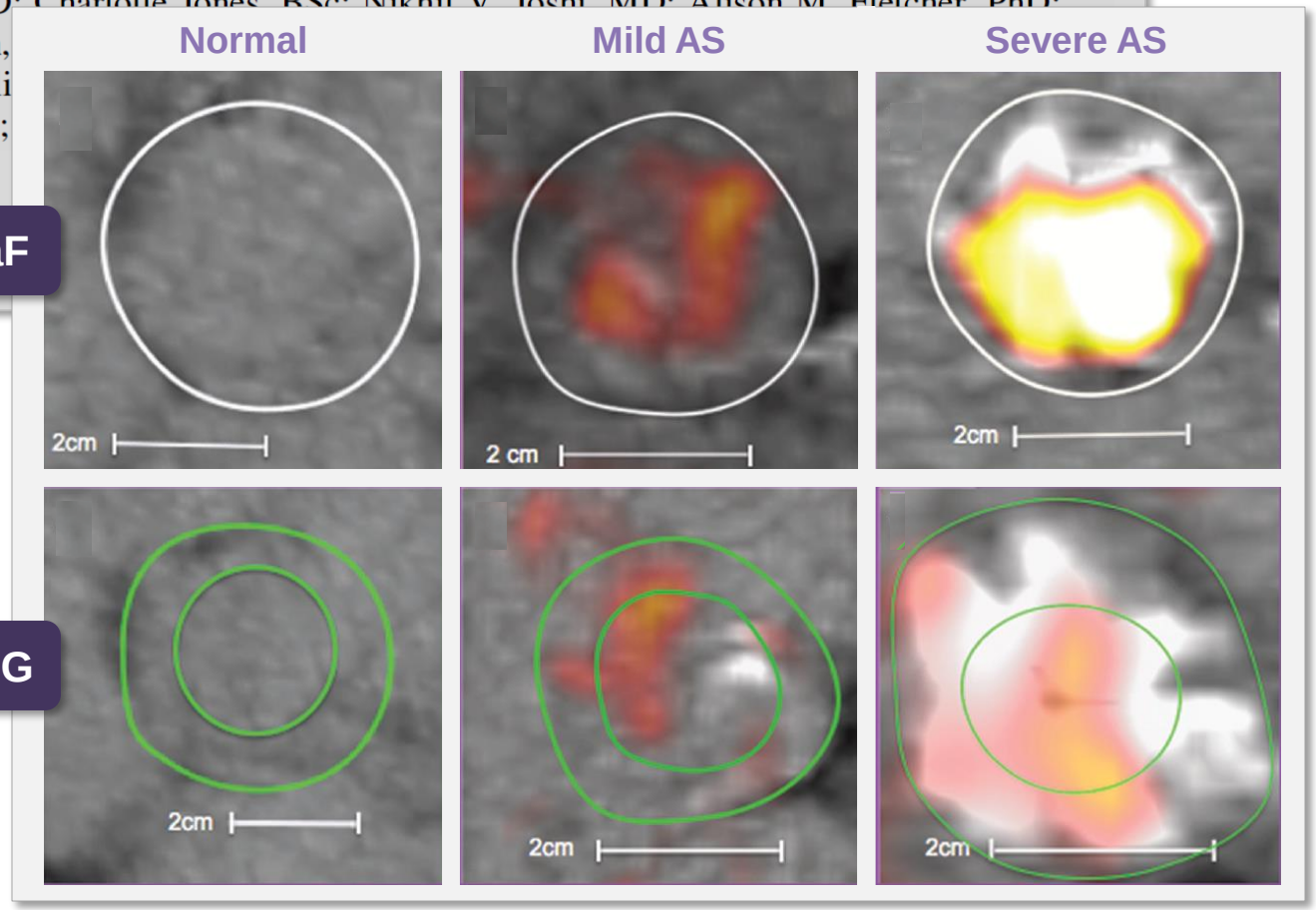

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Valvular ^{18}F-Fluoride and ^{18}F-Fluorodeoxyglucose Uptake Predict Disease Progression and Clinical Outcome in Patients With Aortic Stenosis

^{18}F-Fluoride is a positron emis
radiotracer that preferentially
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used to measure vascular inflar
first prospective longitudinal
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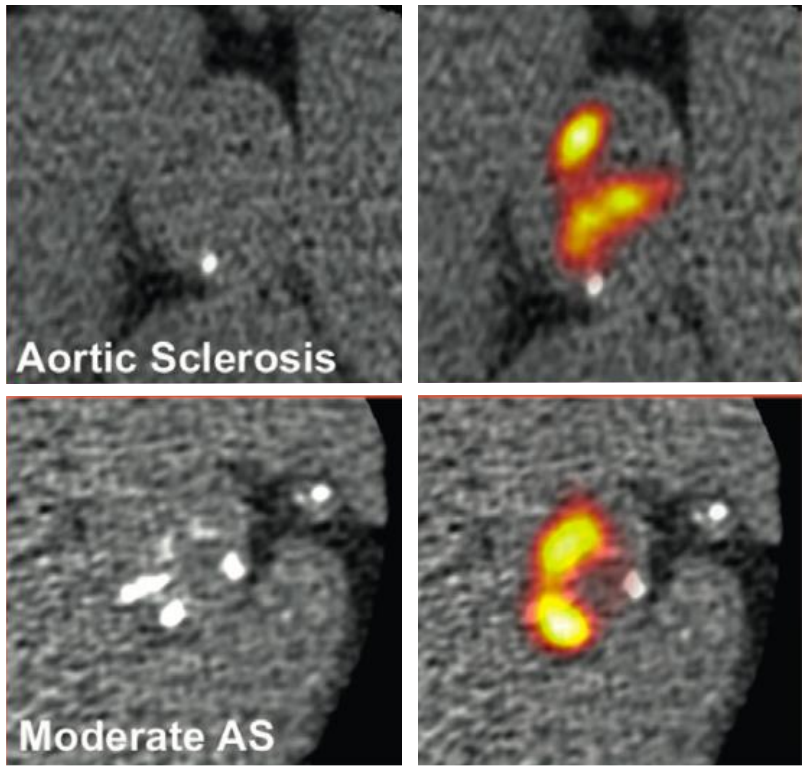
Ninety-nine participants (81%) returned for repeat
diography at the
nterquartile range
ollment). Ninety-
peat CT calcium
able). Aortic valve
5 to 226) AU/year,
nt increased by
After a median of
patients had un-
whereas 7 experi-



Jenkins et al, *J Am Coll Cardiol* 015;66:1200-1201

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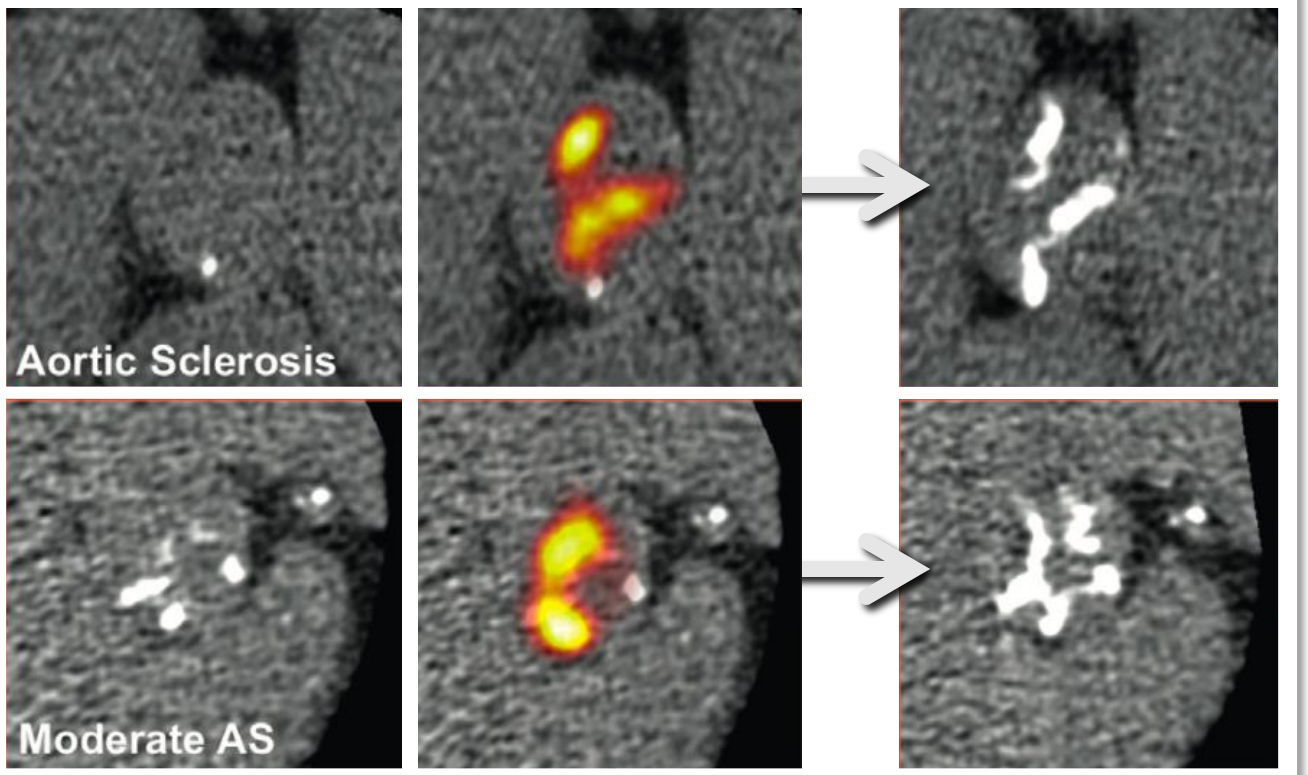

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Journal of the American College of Cardiology
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Published by Elsevier Inc.

Vol. 63, No. 5, 2014
ISSN 0735-1097/$36.00
http://dx.doi.org/10.1016/j.jacc.2013.05.105

Heart Valve Disease

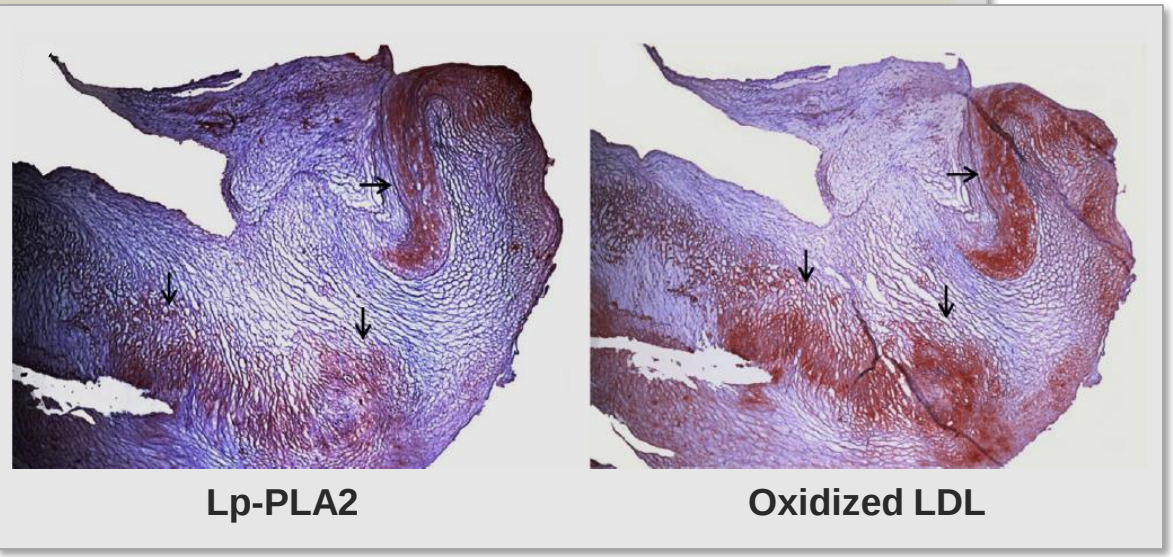
Elevated Expression of Lipoprotein-Associated Phospholipase A2 in Calcific Aortic Valve Disease

Implications for Valve Mineralization

Ablajan Mahmut, MD, MSc,* Marie-Chloé Boulanger, PhD,* Diala El Husseini, MSc,* Dominique Fournier, MSc,* Rihab Bouchareb, PhD,* Jean-Pierre Després, PhD,† Philippe Pibarot, PhD,† Yohan Bossé, PhD,† Patrick Mathieu, MD*

Quebec City, Quebec, Canada

J Am Coll Cardiol 2014;63:460–9



Lp-PLA2 Oxidized LDL

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 FEBRUARY 7, 2013 VOL. 368 NO. 6

Genetic Associations with Valvular Calcification and Aortic Stenosis

George Thanassoulis, M.D., Catherine Y. Campbell, M.D., David S. Owens, M.D., J. Gustav Smith, M.D., Ph.D., Albert V. Smith, Ph.D., Gina M. Peloso, Ph.D., Kathleen F. Kerr, Ph.D., Sonali Pechlivanis, Ph.D., Matthew J. Budoff, M.D., Tamara B. Harris, M.D., Rajeev Malhotra, M.D., Kevin D. O'Brien, M.D., Pia R. Kamstrup, M.D., Ph.D., Børge G. Nordestgaard, M.D., D.M.Sc., Anne Tybjaerg-Hansen, M.D., D.M.Sc., Matthew A. Allison, M.D., M.P.H., Thor Aspelund, Ph.D., Michael H. Criqui, M.D., M.P.H., Susan R. Heckbert, M.D., Ph.D., Shih-Jen Hwang, Ph.D., Yongmei Liu, Ph.D., Marketa Sjogren, Ph.D., Jesper van der Pals, M.D., Ph.D., Hagen Kälsch, M.D., Thomas W. Mühleisen, Ph.D., Markus M. Nöthen, M.D., L. Adrienne Cupples, Ph.D., Muriel Caslake, Ph.D., Emanuele Di Angelantonio, M.D., Ph.D., John Danesh, F.R.C.P., Jerome I. Rotter, M.D., Sigurdur Sigurdsson, M.Sc., Quenna Wong, M.S., Raimund Erbel, M.D., Sekar Kathiresan, M.D., Olle Melander, M.D., Ph.D., Vilmundur Gudnason, M.D., Ph.D., Christopher J. O'Donnell, M.D., M.P.H., and Wendy S. Post, M.D., for the CHARGE Extracoronary Calcium Working Group

The NEW ENGLAND JOURNAL of MEDICINE

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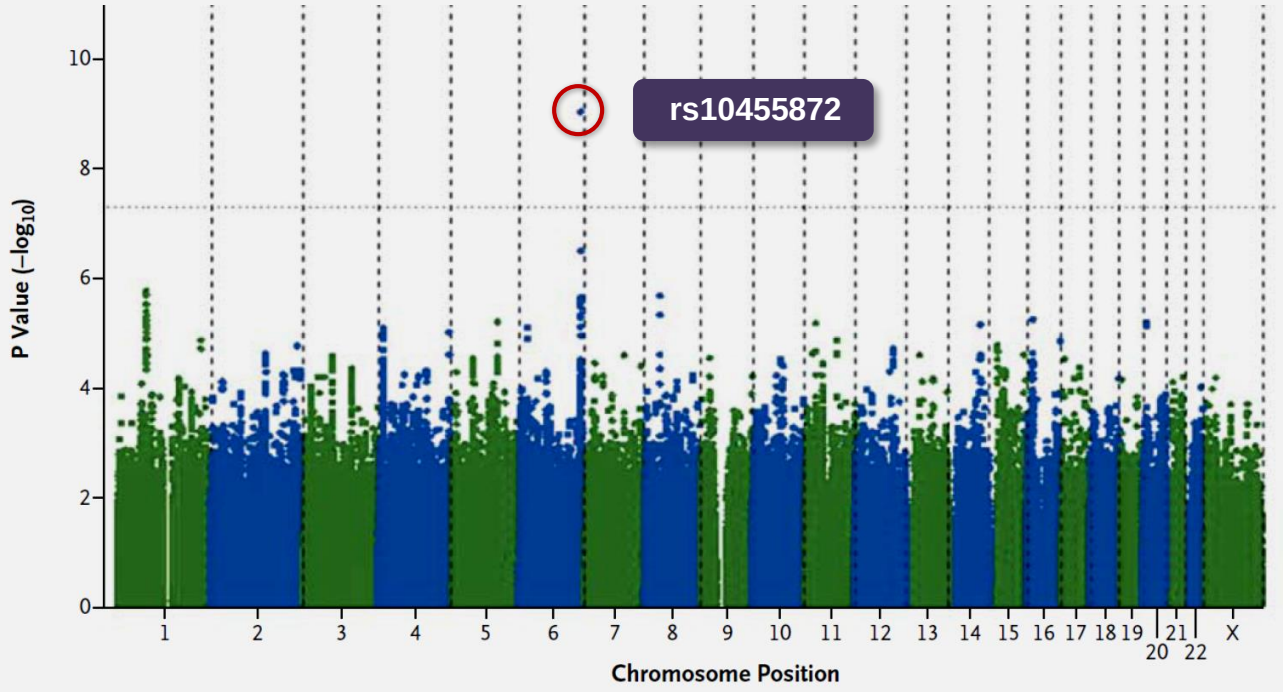
Børge G. Nordestgaard
Thor Aspelund, Ph.D.,
Yongmei Liu, Ph
Thomas W. Mühleis
Emanuele Di Angelanto
Quenna Wong
Vilmundur Gudna



Thanasoulis et al, *N Engl J Med* 2013;368:503-512

Northwestern Medicine

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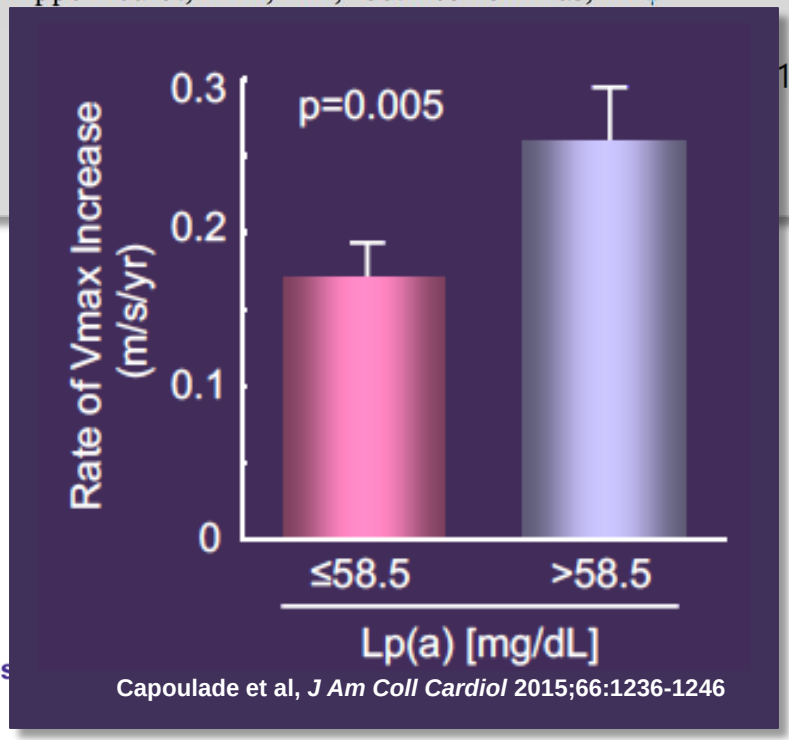
VOL. 66, NO. 11, 2015
ISSN 0735-1097/$36.00
http://dx.doi.org/10.1016/j.jacc.2015.07.020

Oxidized Phospholipids, Lipoprotein(a), and Progression of Calcific Aortic Valve Stenosis

Romain Capoulade, PhD,* Kwan L. Chan, MD,† Calvin Yeang, MD, PhD,‡ Patrick Mathieu, MD,* Yohan Bossé, PhD,* Jean G. Dumesnil, MD,* James W. Tam, MD,§ Koon K. Teo, MBBCh, PhD,‖ Ablajan Mahmut, MD, MSc,* Xiaohong Yang, BSc,‡ Joseph L. Witztum, MD,¶ Benoit J. Arsenault, PhD,* Jean-Pierre Després, PhD,* Philippe Pibarot, DVM, PhD,* Sotirios Tsimikas, MD‡

15;66:1236-46



Capoulade et al, *J Am Coll Cardiol* 2015;66:1236-1246

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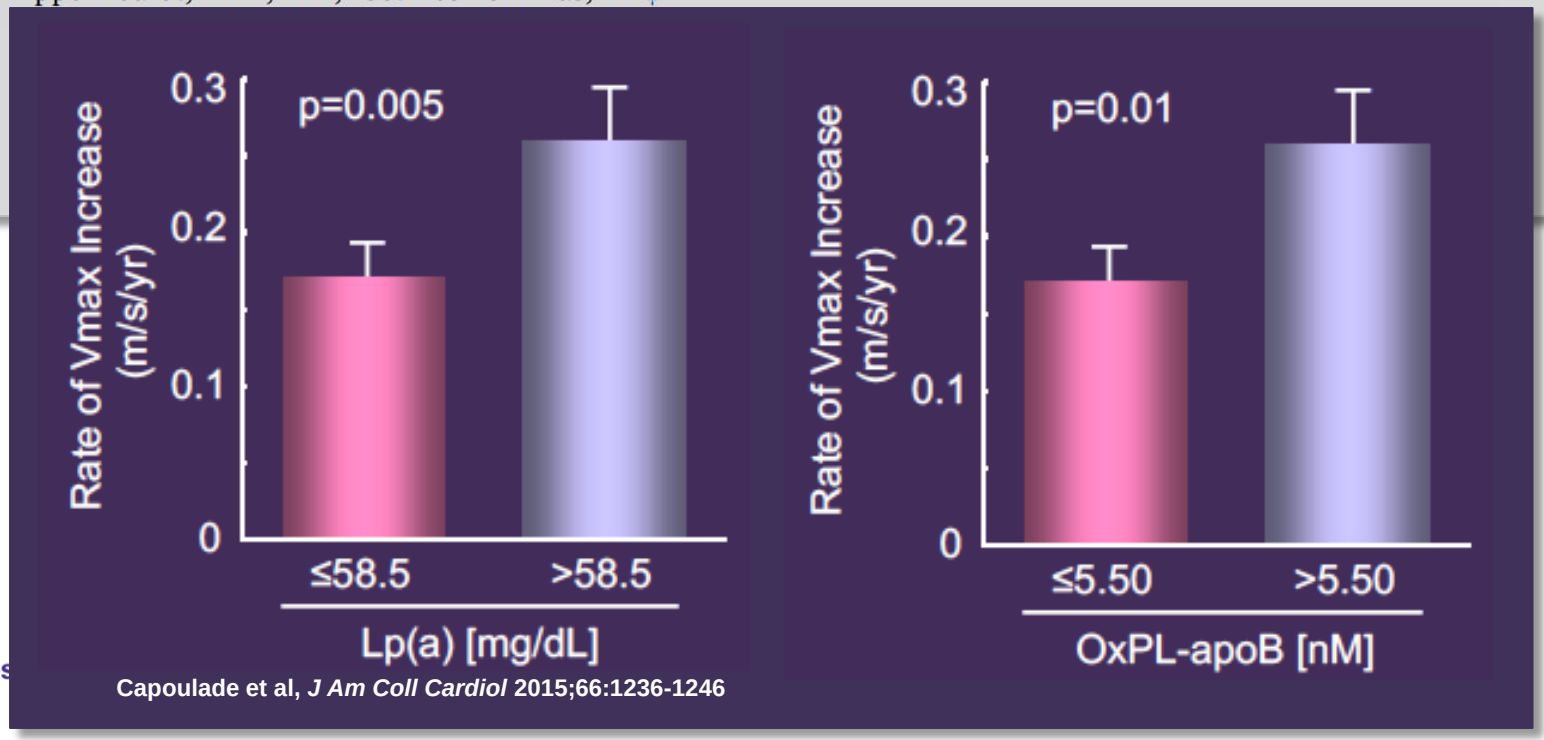
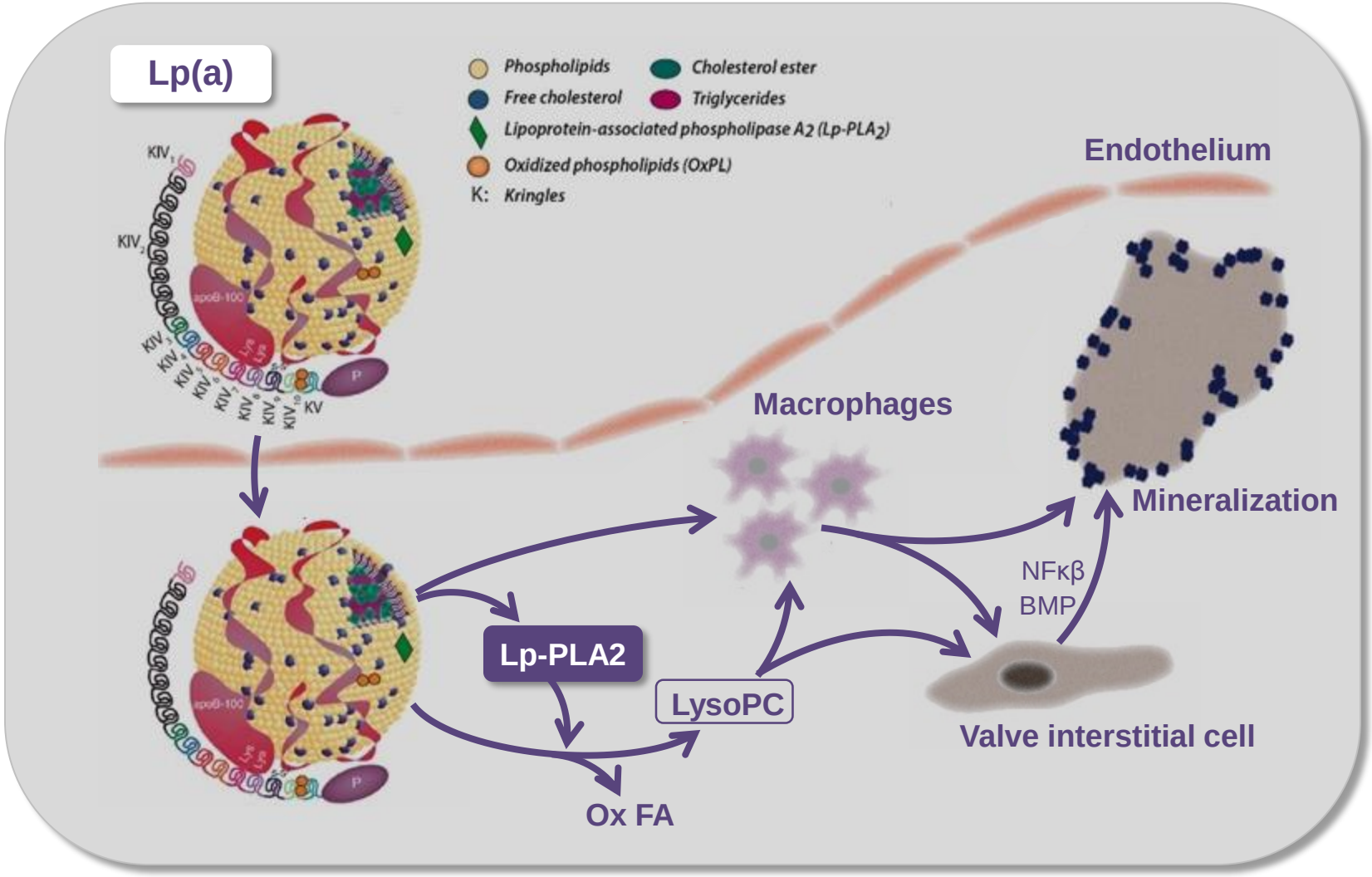


Capoulade et al, *J Am Coll Cardiol* 2015;66:1236-1246



Courtesy, Dr. Philippe Pibarot

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Vol. 63, No. 19, 2014
ISSN 0735-1097/$36.00
http://dx.doi.org/10.1016/j.jacc.2014.02.581

Heart Valve Disease

B-Type Natriuretic Peptide Clinical Activation in Aortic Stenosis

Impact on Long-Term Survival

Marie-Annick Clavel, DVM, PhD, Joseph Malouf, MD, Hector I. Michelena, MD,
Rakesh M. Suri, MD, DPhil, Al
Maurice Enriquez-Sarano, MD
Rochester, Minnesota

J Am Coll Cardiol 2014;63:2016–2

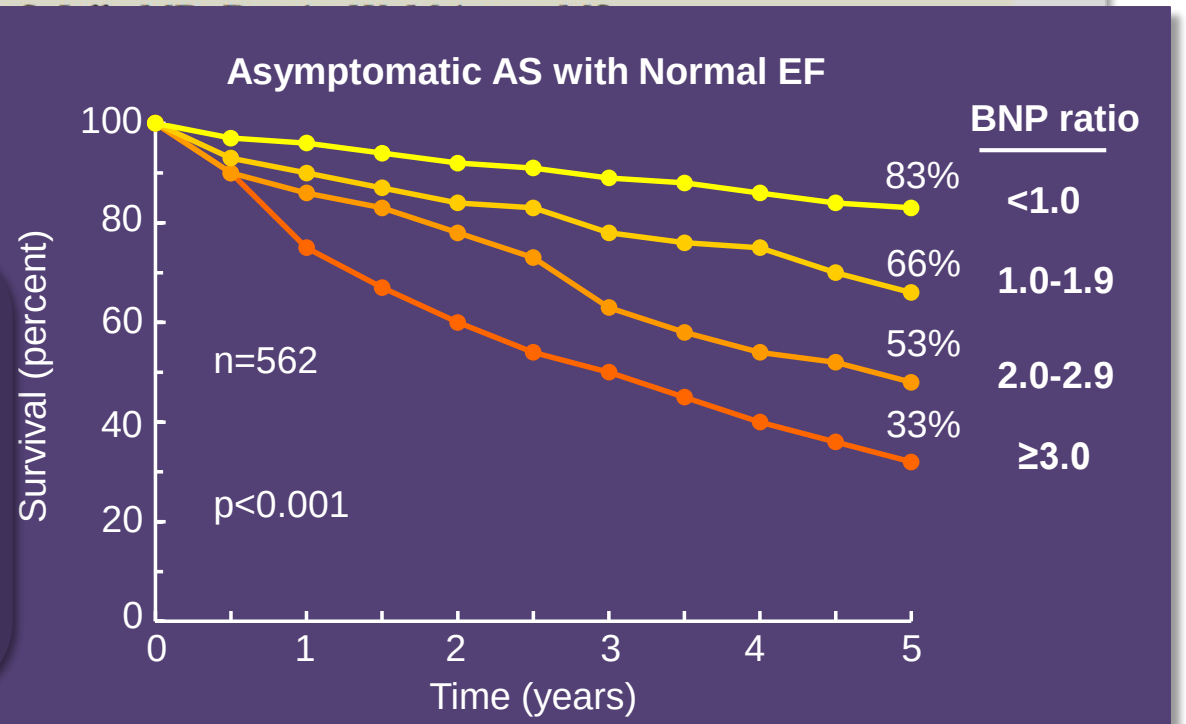
Novel biomarkers

hsTroponin I

Chin et al, *Eur Heart J* 2014;35:2312-2321

GDF15, soluble ST2, NTproBNP

Lindman et al, *Heart* 2015;101:1382-1388



Clavel et al, *J Am Coll Cardiol* 2014;63:2016-2025

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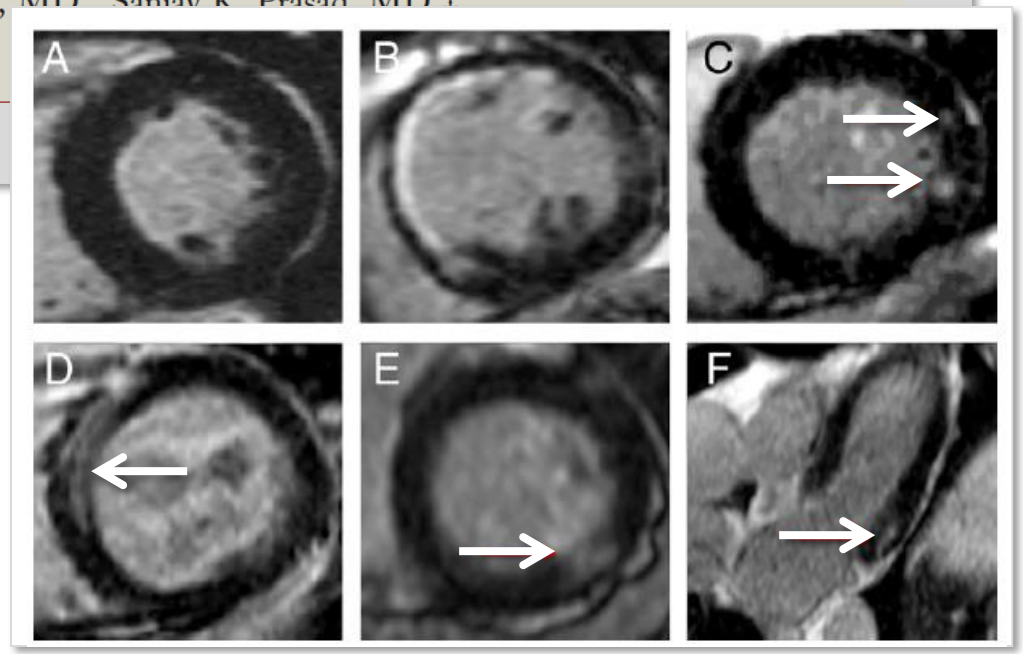
Vol. 58, No. 12, 2011
ISSN 0735-1097/$36.00
doi:10.1016/j.jacc.2011.03.064

Midwall Fibrosis Is an Independent Predictor of Mortality in Patients With Aortic Stenosis

Marc R. Dweck, MD,*† Sanjiv Joshi, MD,* Timothy Murigu, BSc,* Francisco Alpendurada, MD,* Andrew Jabbour, MD,* Giovanni Melina, MD,* Winston Banya, MSc,* Ankur Gulati, MD,*‡ Isabelle Roussin, MD,* Sadaf Raza,* Nishant A. Prasad,* Rick Wage, BSc,* Cesare Quarto, MD,* Emiliano Angeloni, MD,* Simone Refice, MD,* Mary Sheppard, MD,* Stuart A. Cook, MD, PhD,* Philip J. Kilner, MD, PhD,*‡ Dudley J. Pennell, MD,*‡ David E. Newby, MD, DSc,† Raad H. Mohiaddin, MD,*‡ John Pepper, MD,* Sanjay K. Prasad, MD*†

London and Edinburgh, United Kingdom

J Am Coll Cardiol 2011;58:1271–9



Northwestern Medicine

JACC: CARDIOVASCULAR IMAGING

VOL. 10, NO. 11, 2017
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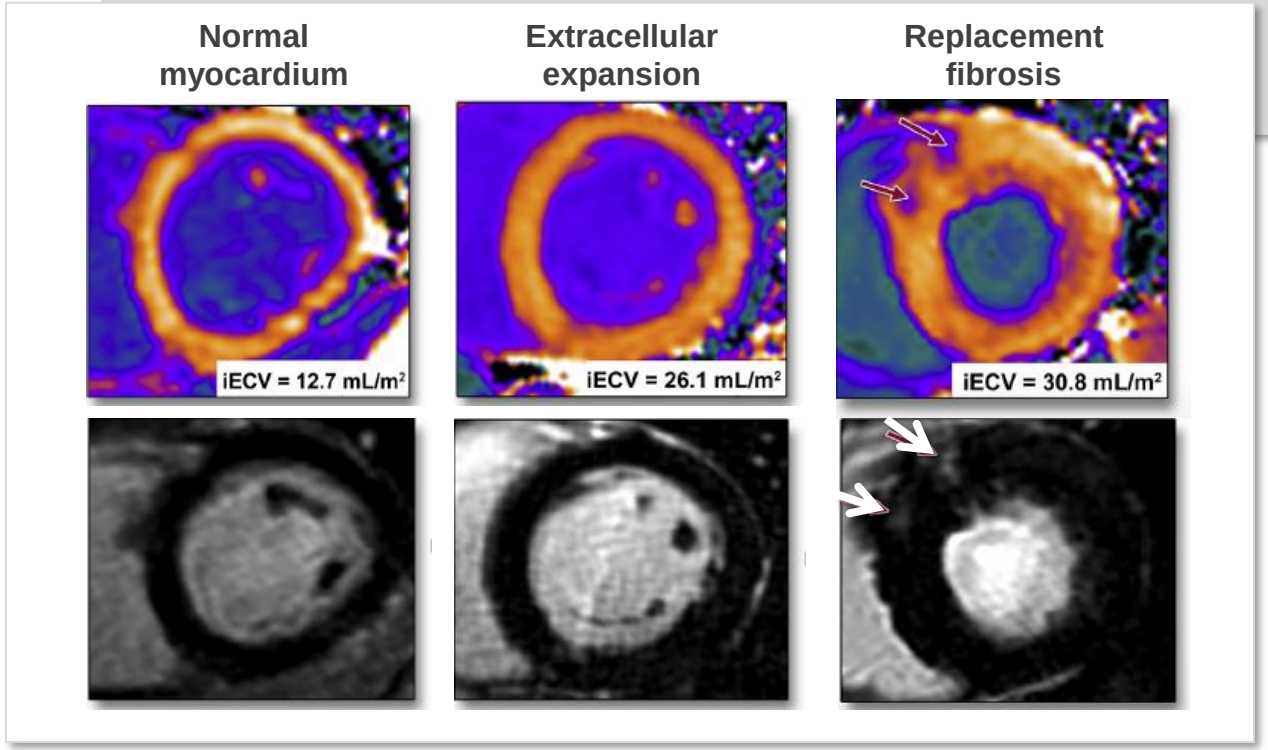
Myocardial Fibrosis and Cardiac Decompensation in Aortic Stenosis

Calvin W.L. Chin, MD,[a,b] Russell J. Everett, MD,[a] Jacek Kwiecinski, MD,[a,c] Alex T. Vesey, MD, PhD,[a] Emily Yeung,[a] Gavin Esson,[a] William Jenkins, MD,[a] Maria Koo,[a] Saeed Mirsadraee, MD,[a] Audrey C. White,[a] Alan G. Japp, MD, PhD,[a] Sanjay K. Prasad, MD,[d] Scott Semple, PhD,[e] David E. Newby, MD, PhD,[a] Marc R. Dweck, MD, PhD[a]



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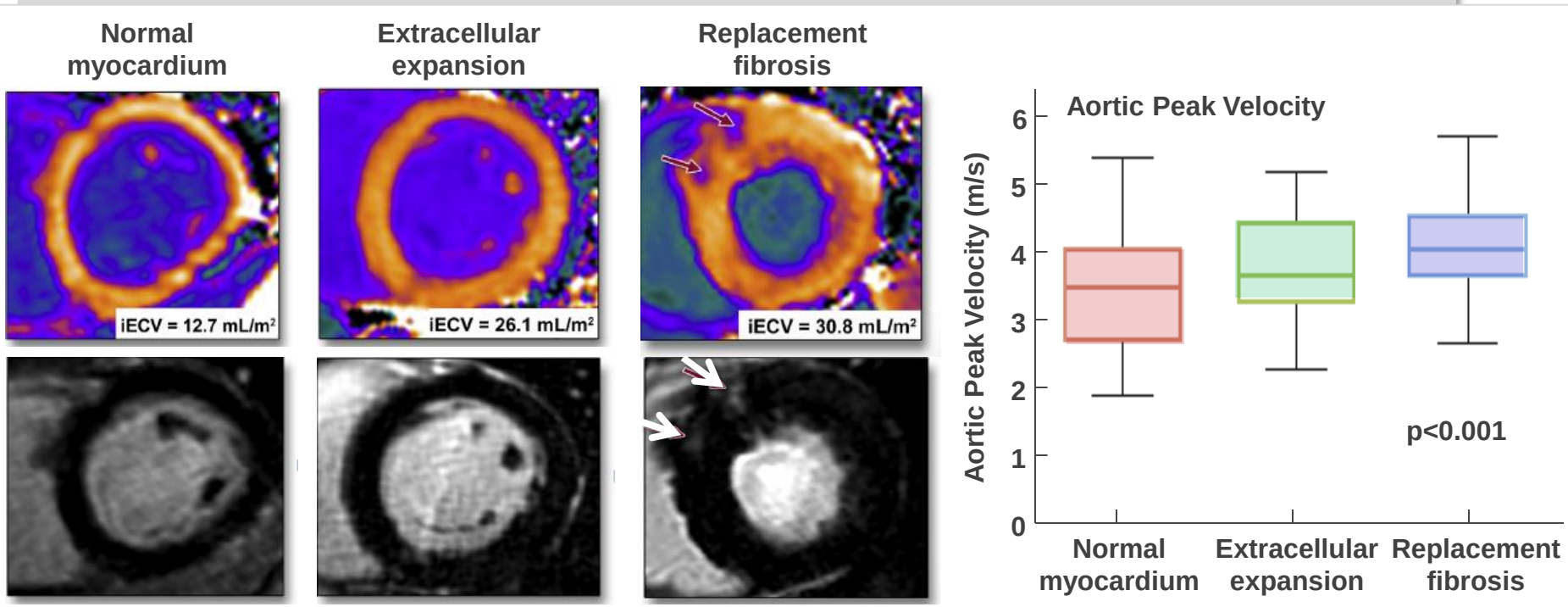

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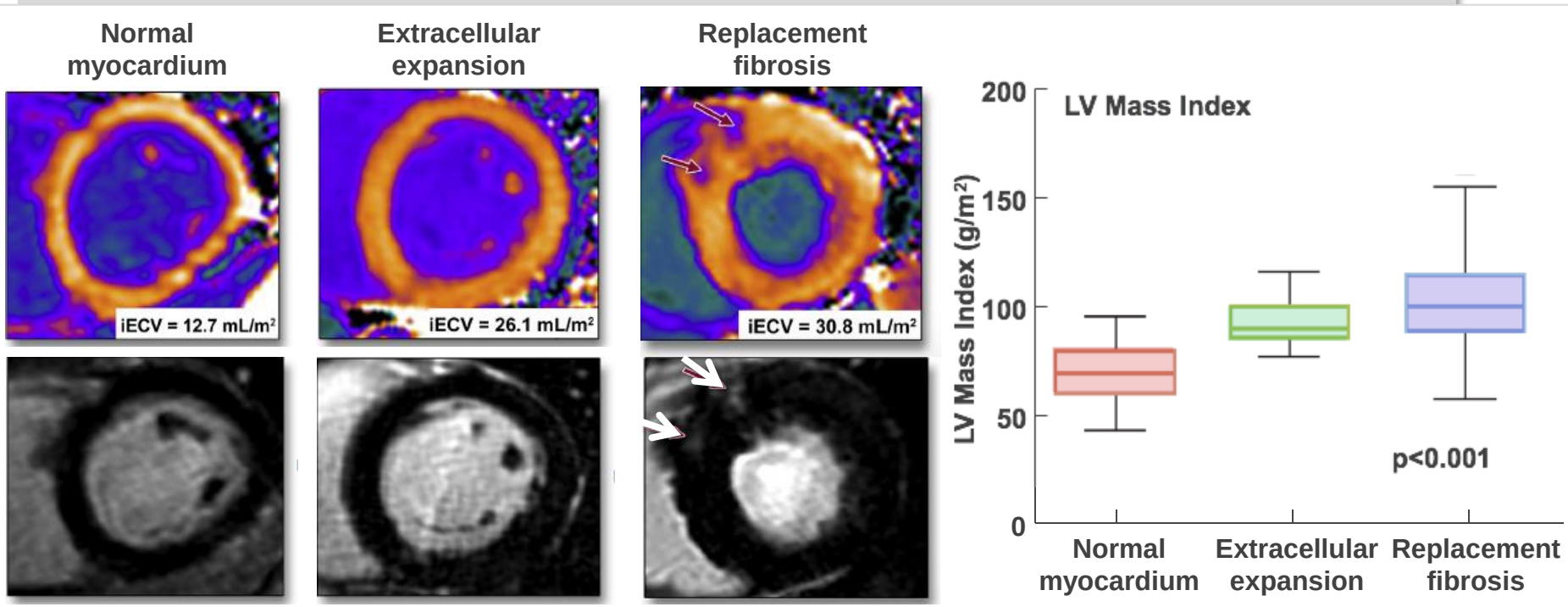

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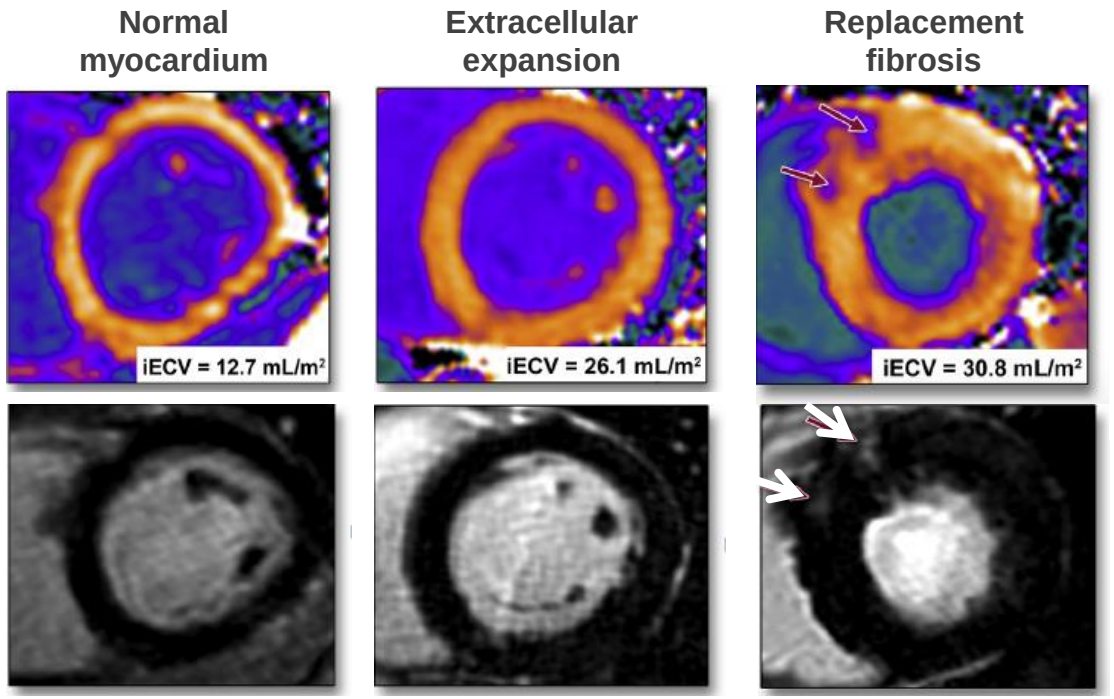

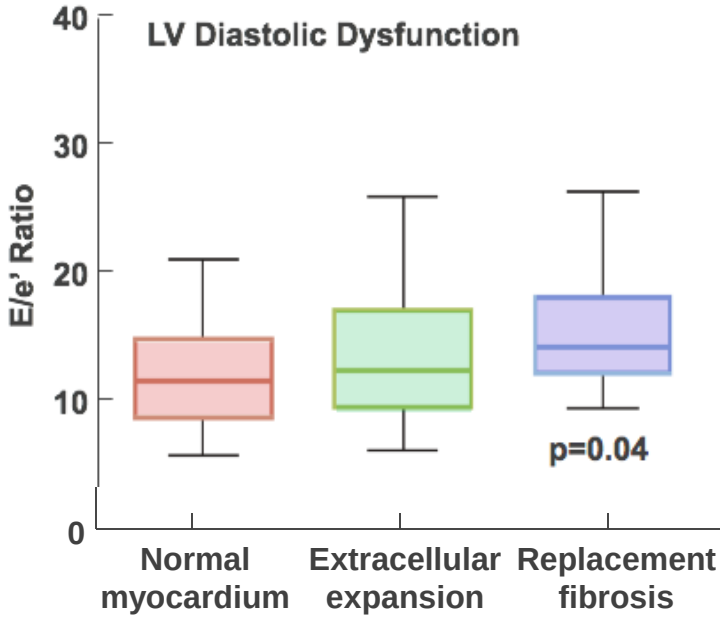

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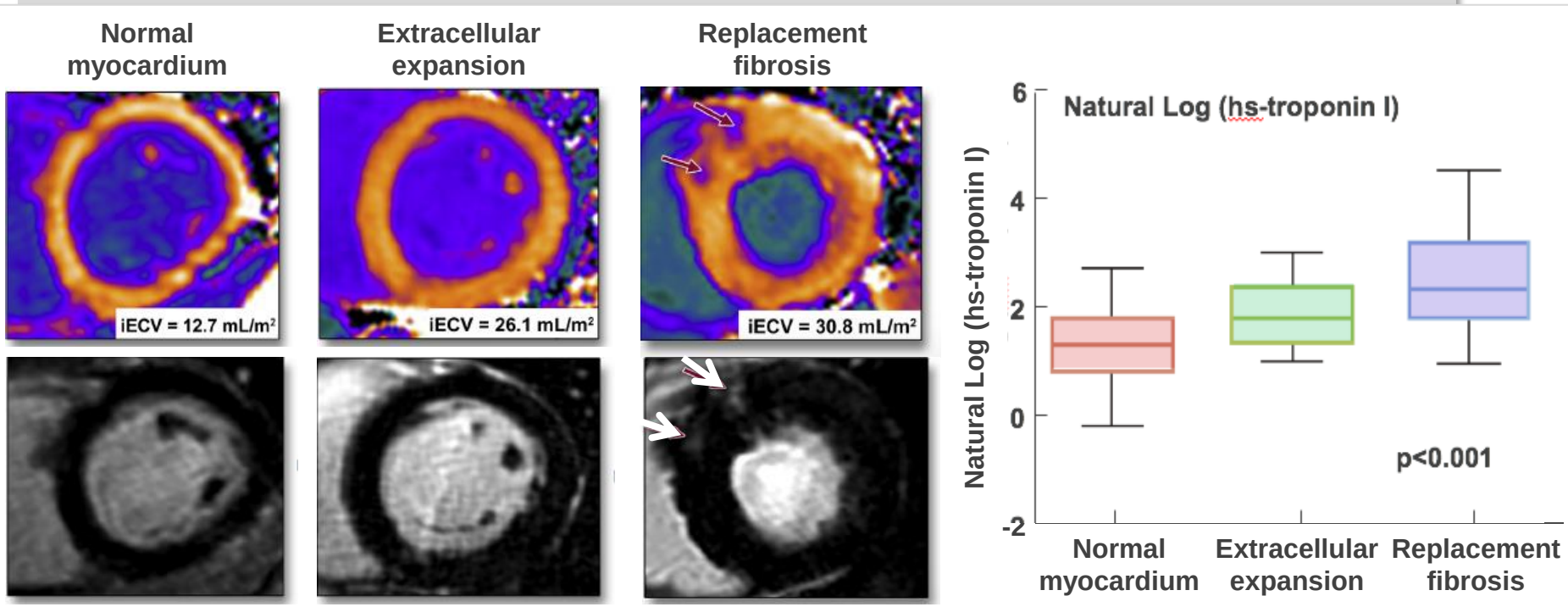


Research

JAMA Cardiology | Original Investigation

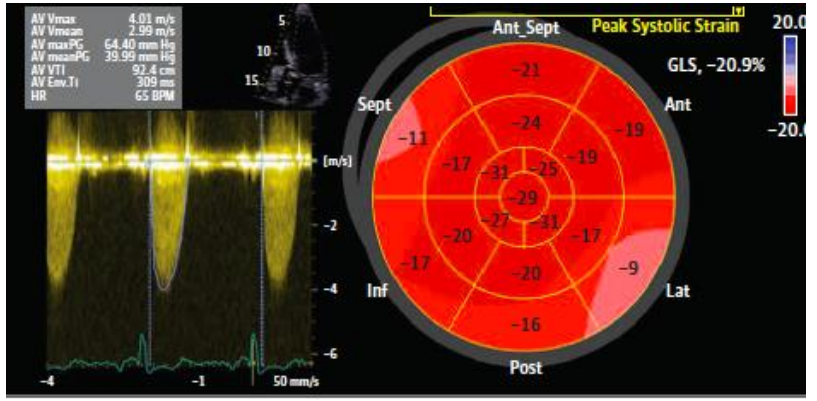
Association of Left Ventricular Global Longitudinal Strain With Asymptomatic Severe Aortic Stenosis

Natural Course and Prognostic Value

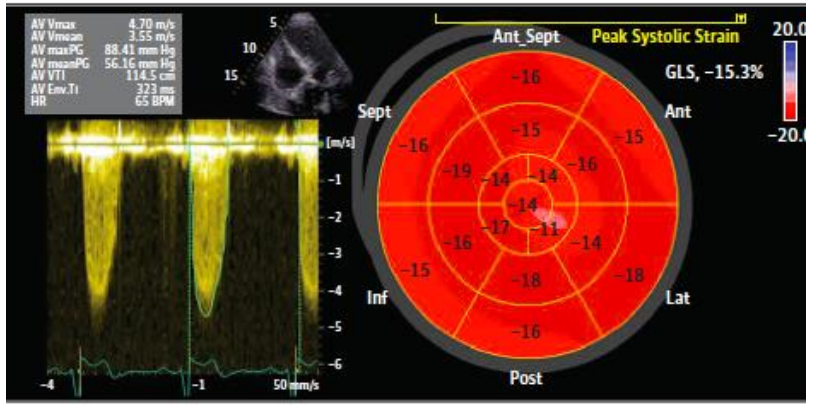
E. Mara Vollema, MD; Tadafumi Sugimoto, MD; Mylène Shen, MSc; Lionel Tastet, MSc, MS
Arnold C. T. Ng, MD, PhD; Rachid Abou, MD; Nina Ajmone Marsan, MD, PhD; Bart Merten
Raluca Dulgheru, MD; Patrizio Lancellotti, MD, PhD; Marie-Annick Clavel, DVM, PhD; Phili
Philippe Genereux, MD; Martin B. Leon, MD; Victoria Delgado, MD, PhD; Jeroen J. Bax, M

JAMA Cardiol. 2018;3:839-847

Baseline



Follow-up



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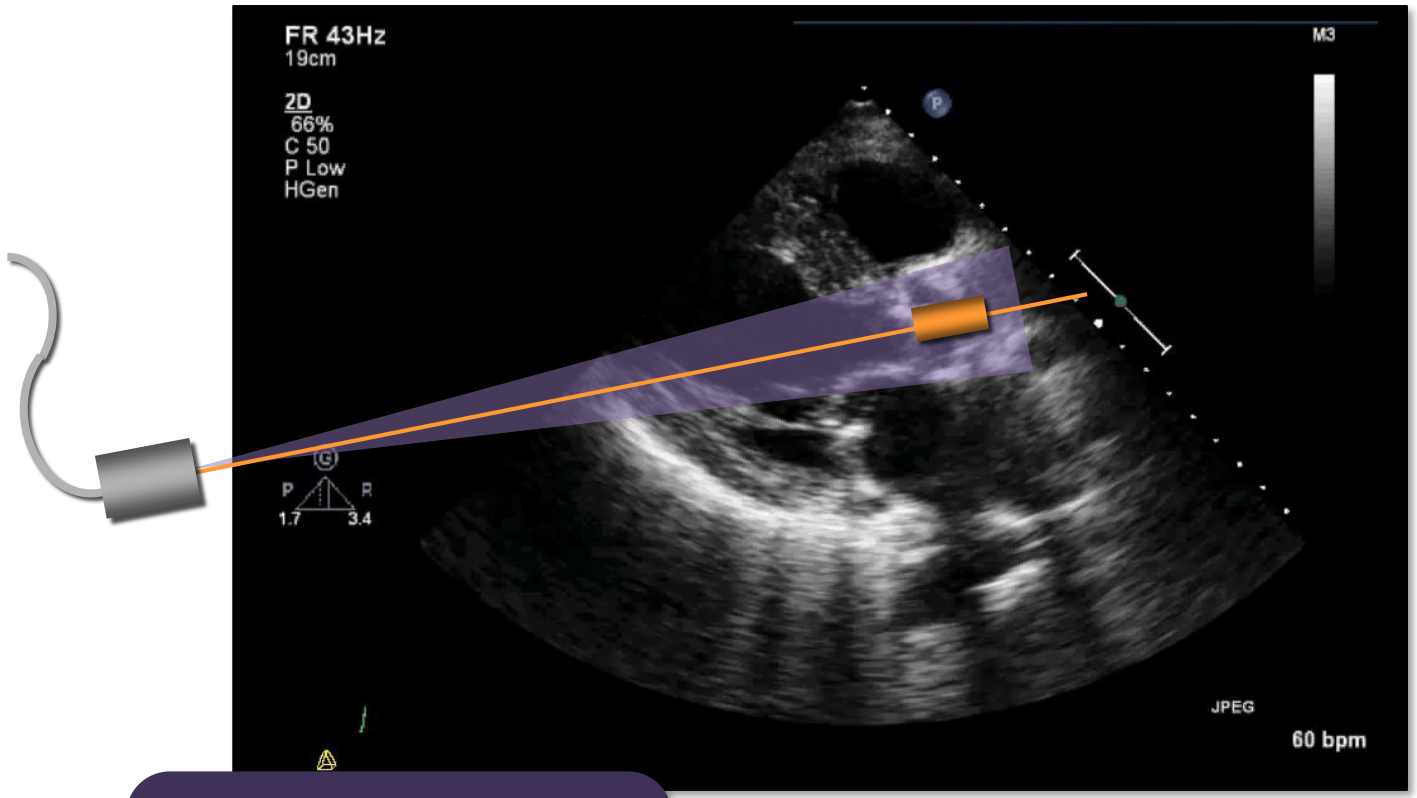
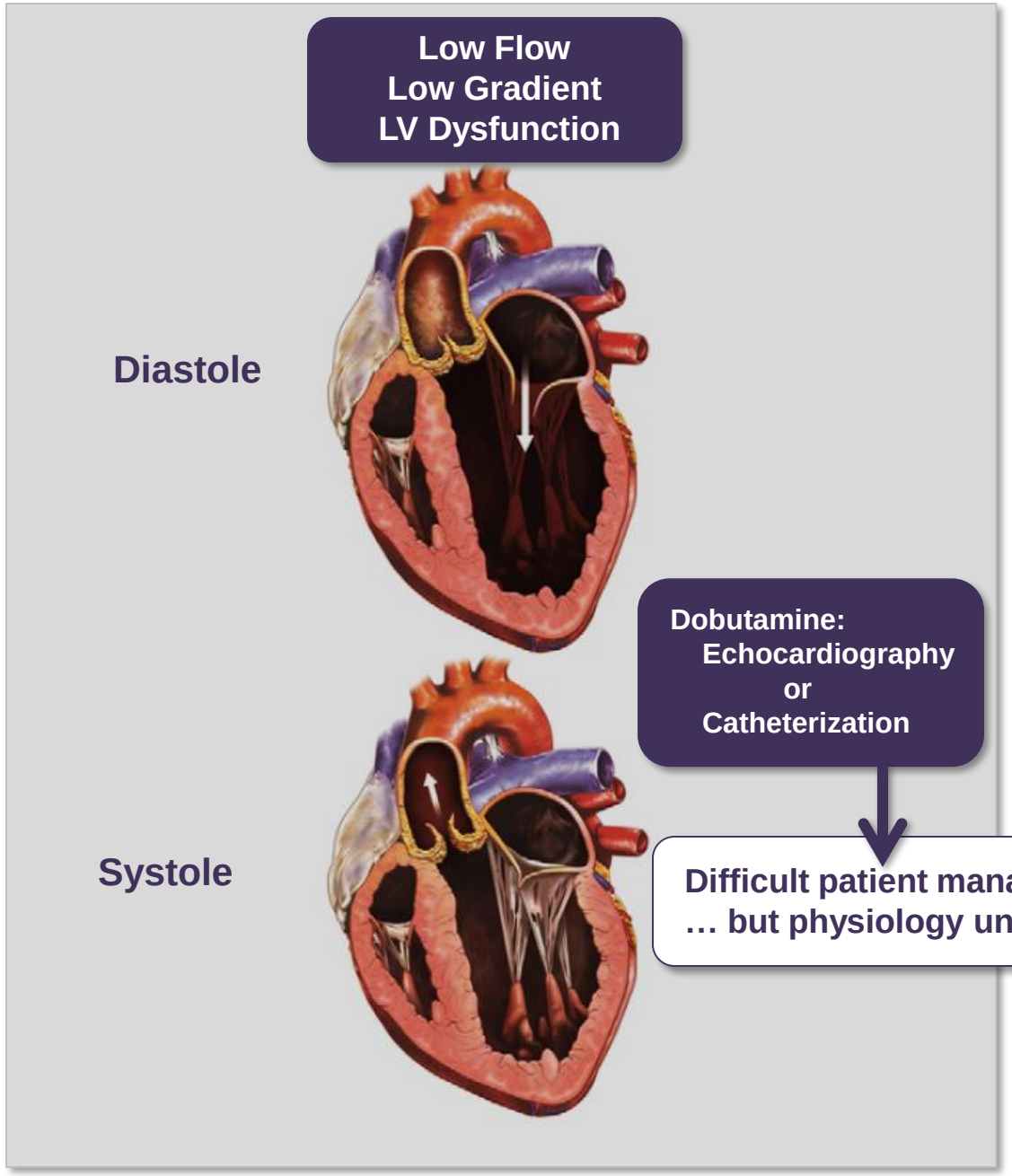


Vmax: 3.2 m/s
Mean Δ: 32 mmHg
AVA: 0.8 sq cm

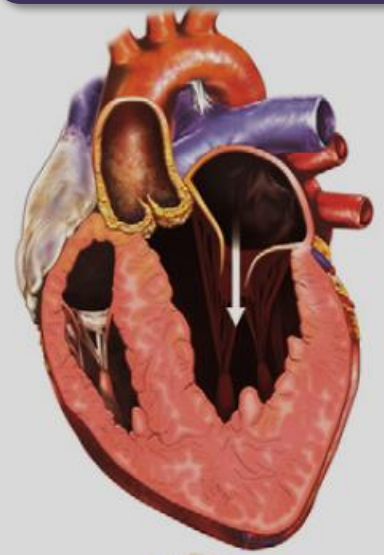
→ **Low gradient AS**



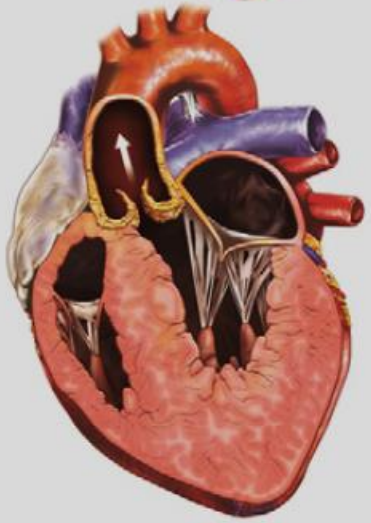
from Pibarot and Dumesnill, *J Am Coll Cardiol* 2012:60:1845-1853

Low Flow
Low Gradient
Normal LV Function

Diastole



Systole



- **Treat hypertension**
- **Cardiac catheterization**

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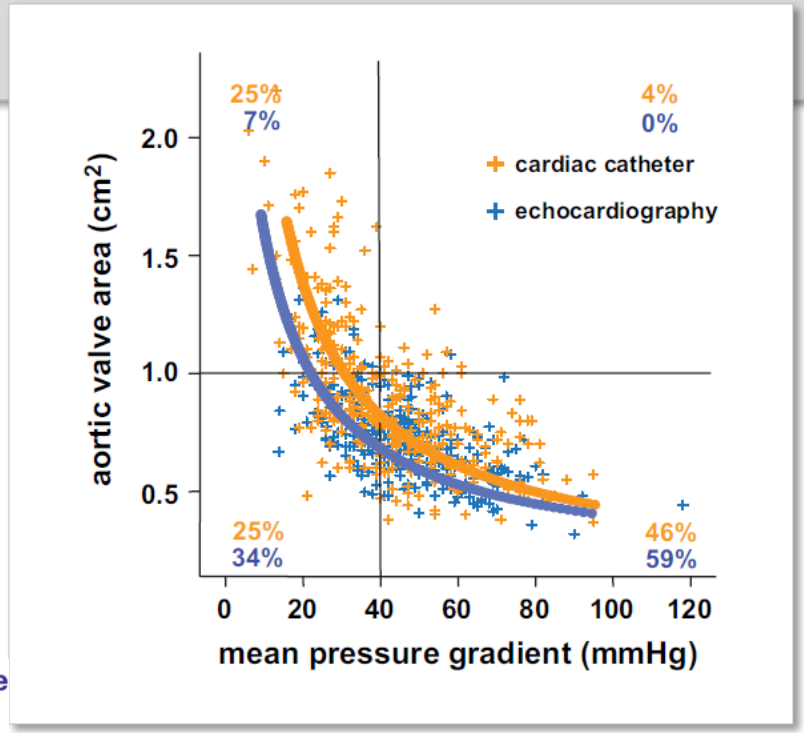
from Pibarot and Dumesnill, *J Am Coll Cardiol* 2012:60:1845-1853

Inconsistent grading of aortic valve stenosis by current guidelines: haemodynamic studies in patients with apparently normal left ventricular function

Jan Minners, Martin Allgeier, Christa Gohlke-Baerwolf, Rolf-Peter Kienzle, Franz-Josef Neumann, Nikolaus Jander

Heart 2010;**96**:1463–1468



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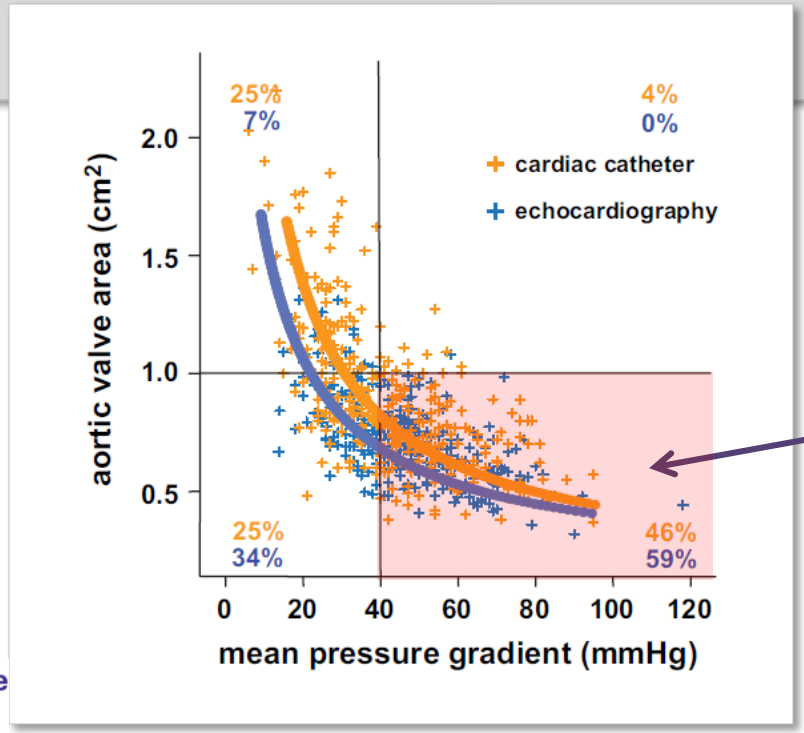

Severe AS

Inconsistent grading of aortic valve stenosis by current guidelines: haemodynamic studies in patients with apparently normal left ventricular function

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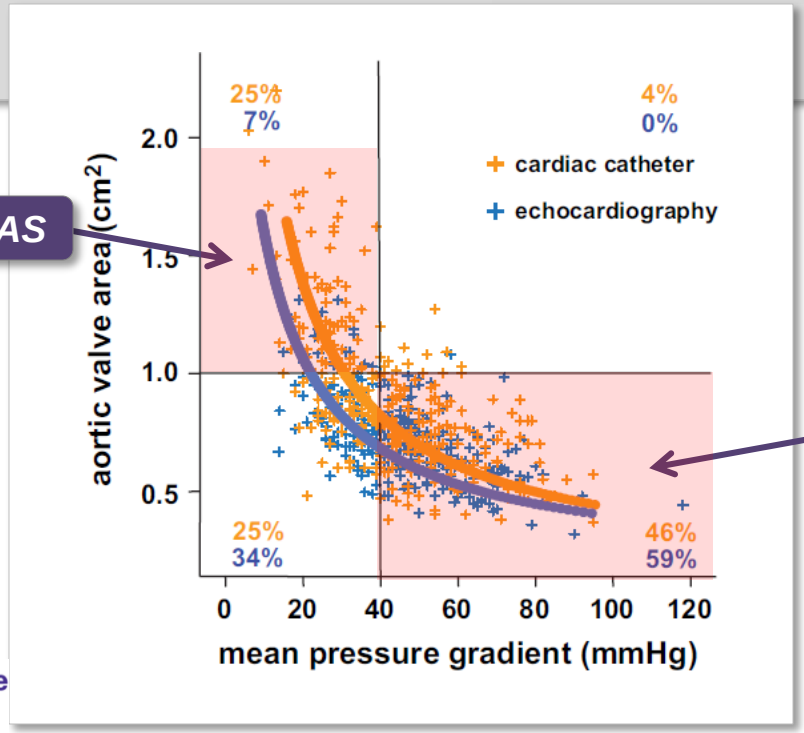

Not severe AS

Severe AS

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Inconsistent grading of aortic valve stenosis by current guidelines: haemodynamic studies in patients with apparently normal left ventricular function

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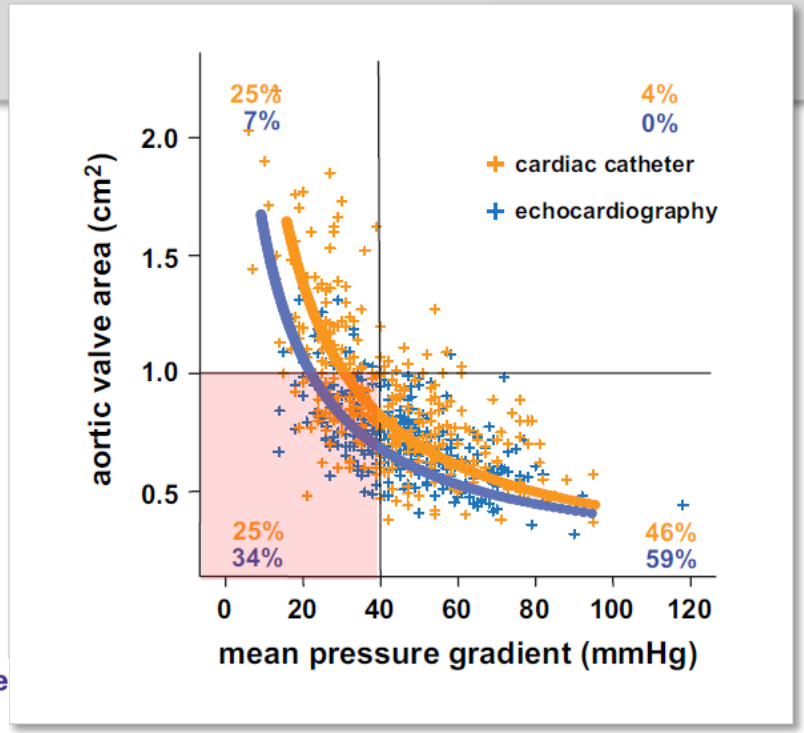

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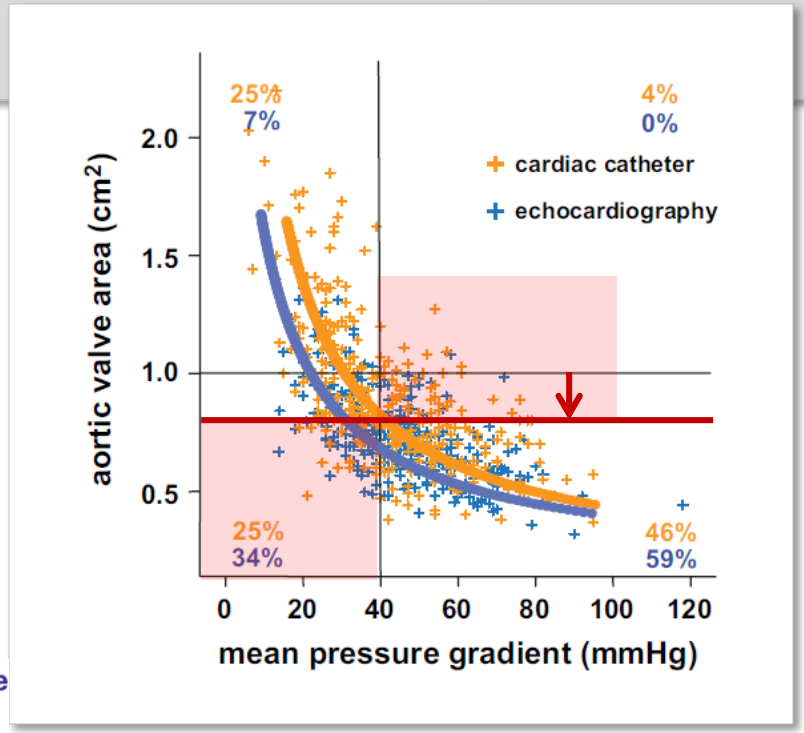

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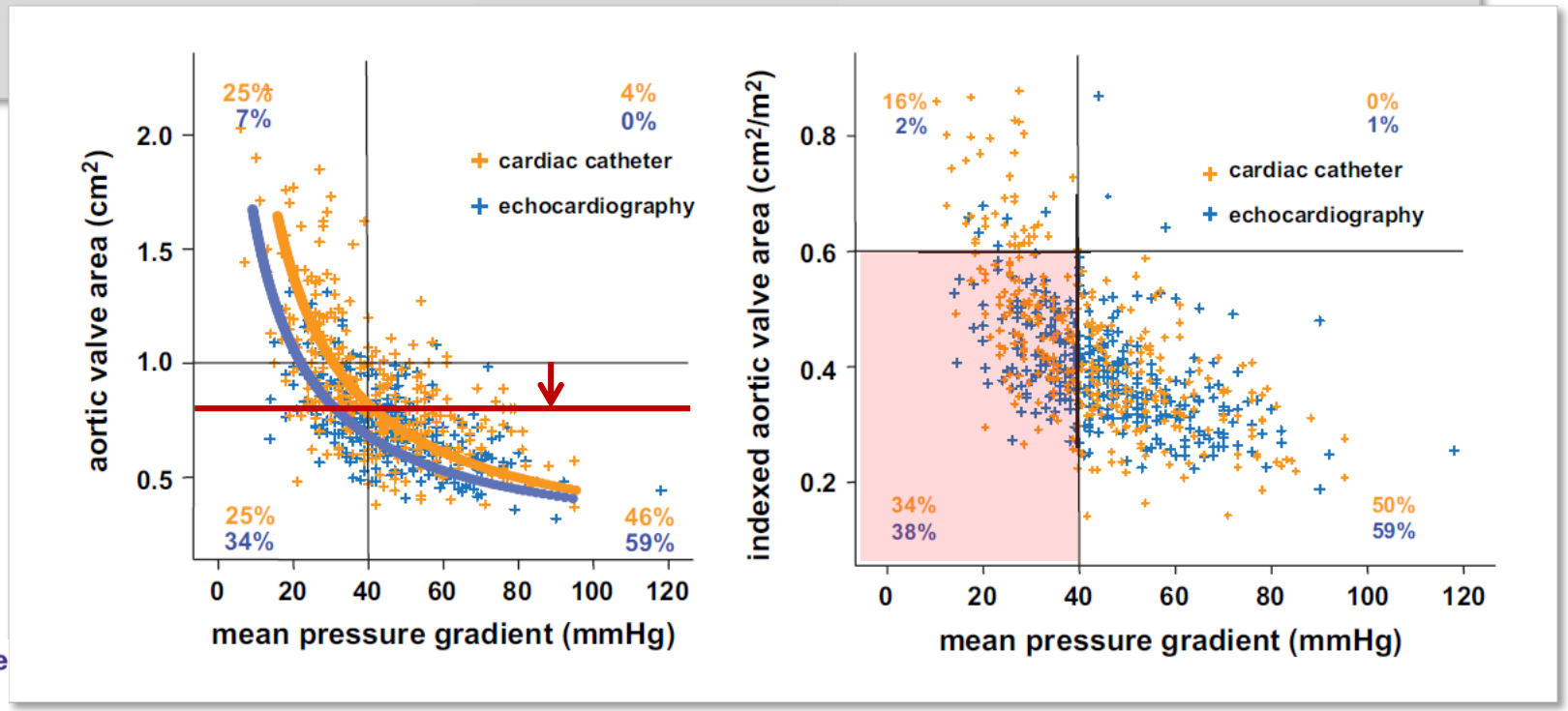


JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY
VOL. 74, NO. 15, 2019

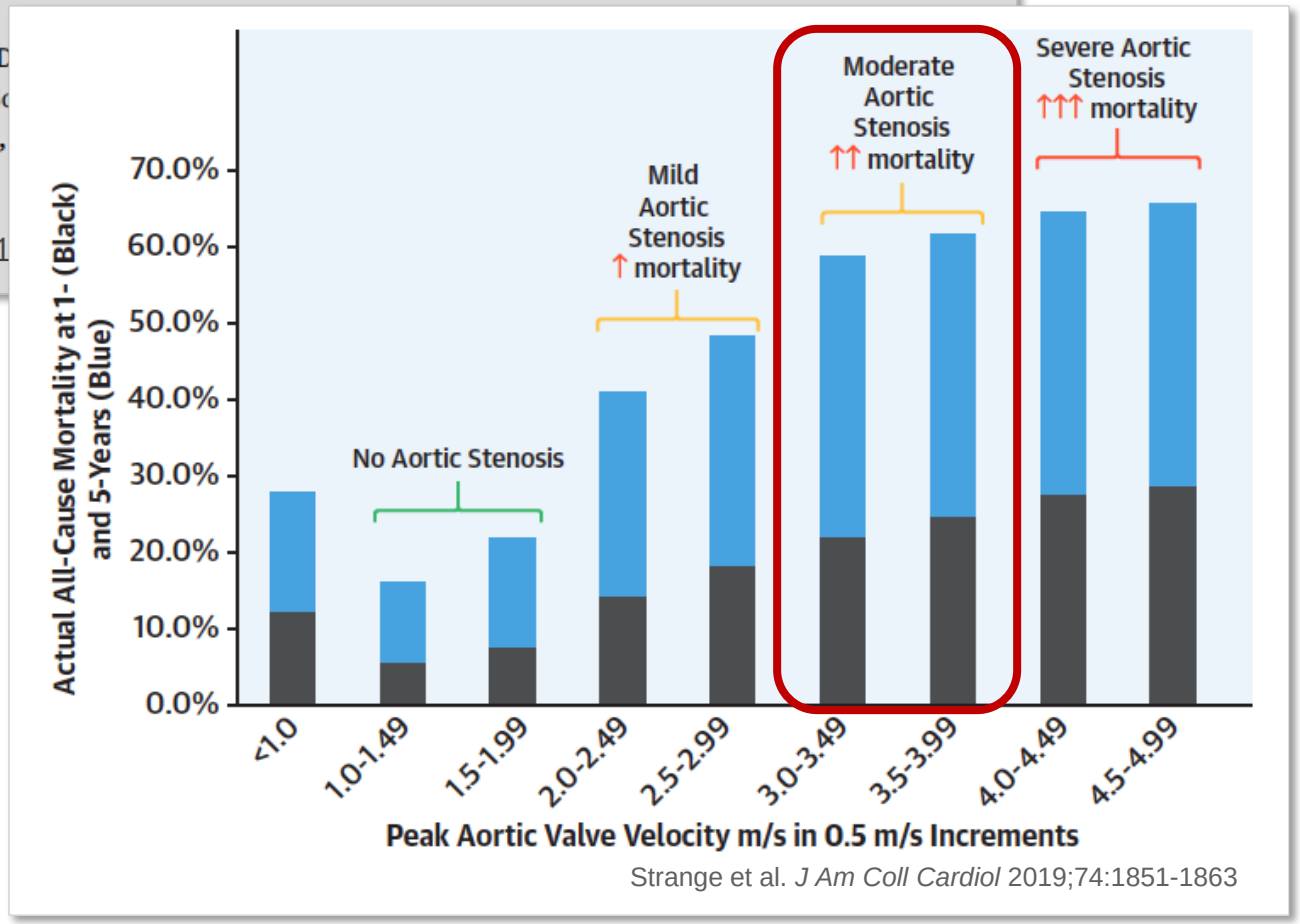
ORIGINAL INVESTIGATIONS

Poor Long-Term Survival in Patients With Moderate Aortic Stenosis

Geoff Strange, PhD,[a] Simon Stewart, PhD
Gregory M. Scalia, MBBS (Hons), MMedSc
Jim Codde, PhD,[i] David Playford, MBBS,
contributing sites

J Am Coll Cardiol 2019;74:1851-1

N = 241,301
Mean age 62
Median f/u 3.3 years



Strange et al. *J Am Coll Cardiol* 2019;74:1851-1863

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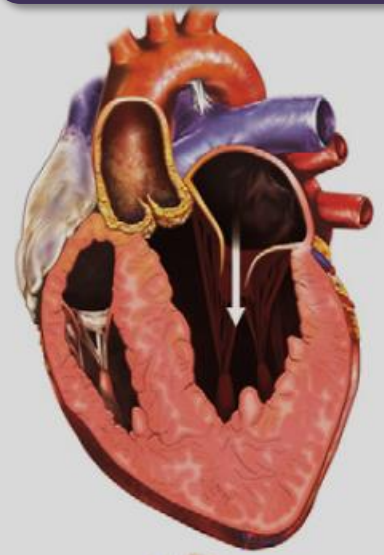
Low Flow
Low Gradient
Normal LV Function

Diastole



Systole

- Treat hypertension
- Cardiac catheterization
- Valve calcification
- Advanced imaging
- **Clinical skillset**

This scenario can be under-diagnosed … and over-diagnosed

Northwestern Medicine

from Pibarot and Dumesnill, *J Am Coll Cardiol* 2012:60:1845-1853

Journal of the American College of Cardiology
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Published by Elsevier Inc.

Vol. 58, No. 4, 2011
ISSN 0735-1097/$36.00
doi:10.1016/j.jacc.2011.02.059

Valvular Heart Disease

CME

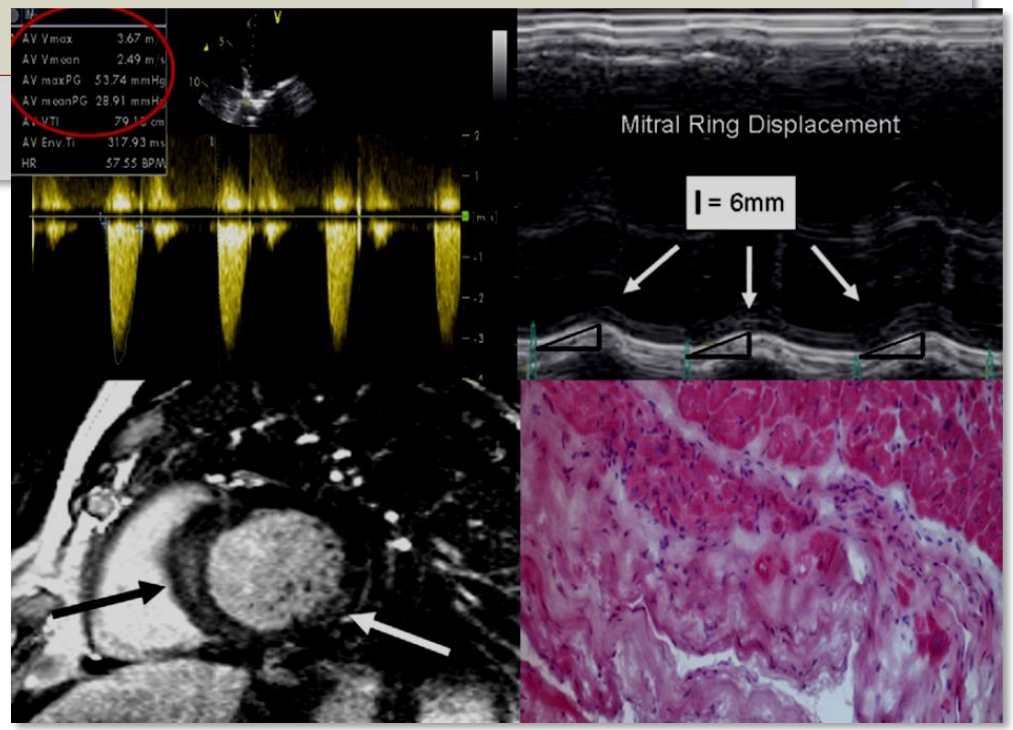
Low-Gradient Aortic Valve Stenosis

Myocardial Fibrosis and Its Influence on Function and Outcome

Sebastian Herrmann, MD,*† Stefan Störk, MD, PHD,*† Markus Niemann, MD,*†
Volkmar Lange, MD,§ Jörg M. Strotmann, MD,* Stefan Frantz, MD,*† Meinrad Beer, MD,†‖
Stefan Gattenlöhner, MD,‡ Wolfram Voelker, MD,*† Georg Ertl, MD,*† Frank Weidemann, MD*†

Würzburg, Germany

J Am Coll Cardiol 2011;58:402–12



Northwestern Medicine

ESC European Society of Cardiology

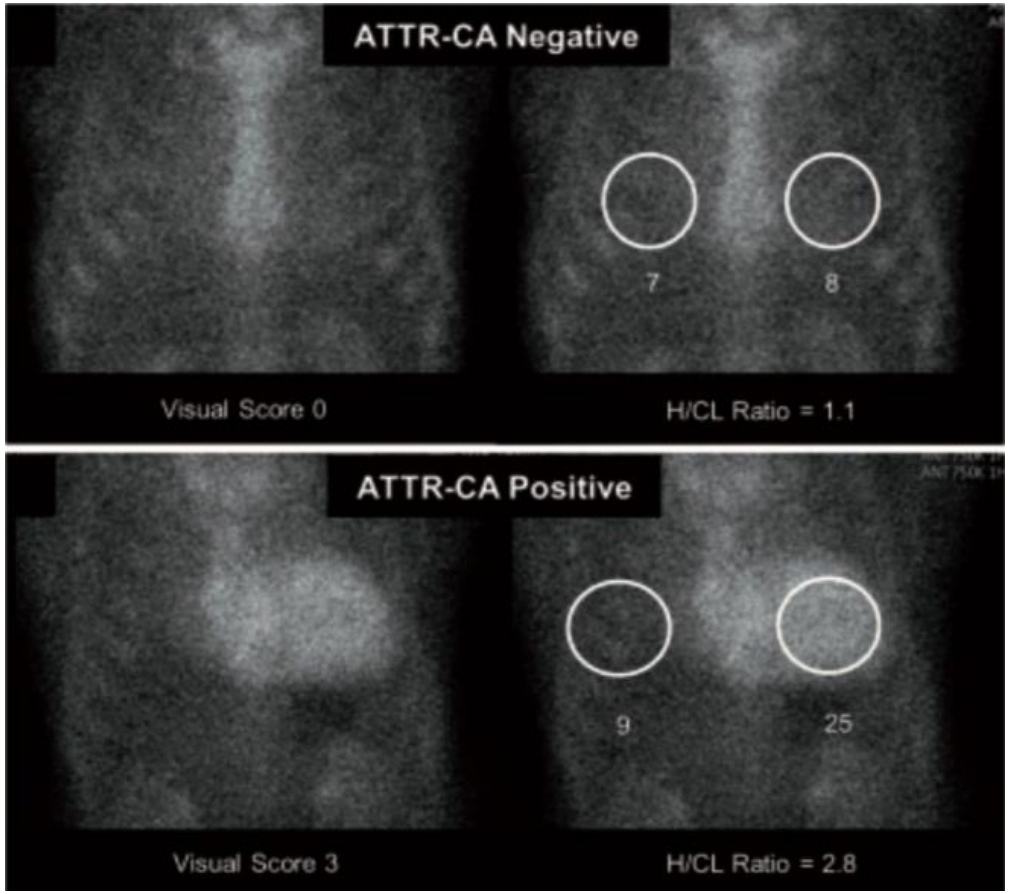
European Heart Journal (2017) **38**, 2879–2887
doi:10.1093/eurheartj/ehx350

CLINICAL RESEARCH
Heart failure/cardiomyopathy

Unveiling transthyretin cardiac amyloidosis and its predictors a severe aortic steno aortic valve replace

**Adam Castaño[1,2]*, David L. Narot
Rachelle Morgenstern[2], Albert De
Tamim Nazif[3], Torsten Vahl[3], Isaa
Rebecca Hahn[3], Sabahat Bokhari[2]**

European Heart Journal (2017) **38**, 2879



Northwestern Medicine

Castano et al. *Eur Heart J* 2017;38:2879-2887

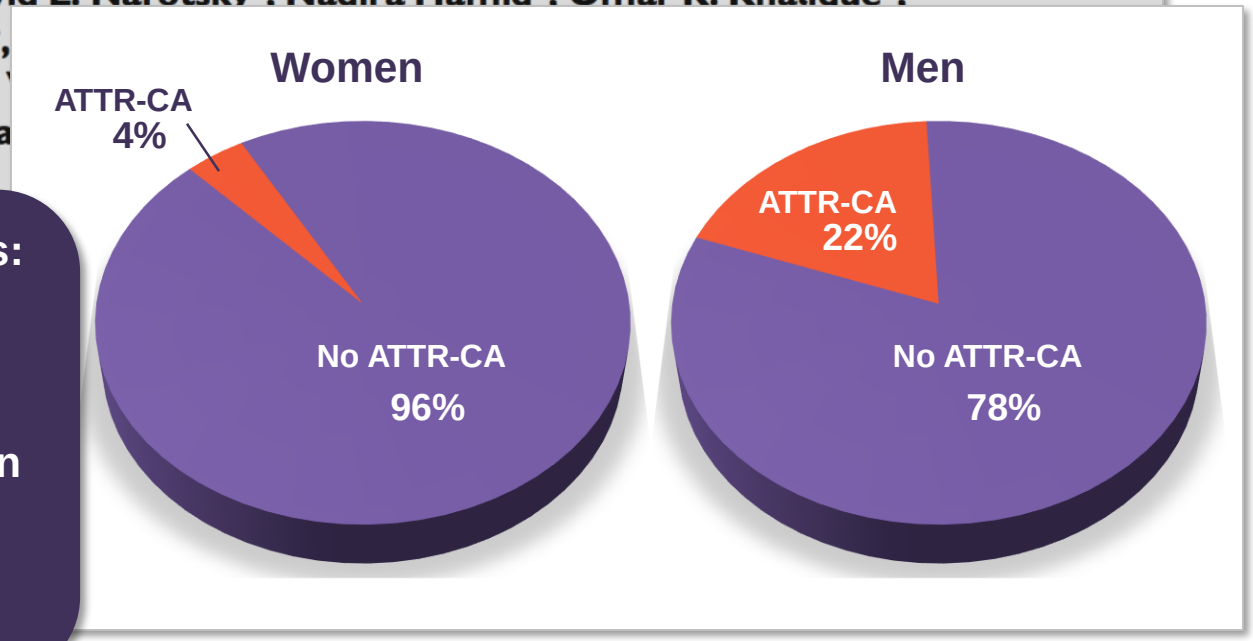
ESC European Society of Cardiology

European Heart Journal (2017) **38**, 2879–2887
doi:10.1093/eurheartj/ehx350

CLINICAL RESEARCH
Heart failure/cardiomyopathy

Unveiling transthyretin cardiac amyloidosis and its predictors among elderly patients with severe aortic stenosis undergoing transcatheter aortic valve replacement

Adam Castaño[1,2]*, David L. Narotsky[1], Nadira Hamid[3], Omar K. Khalique[3], Rachelle Morgenstern[2], Tamim Nazif[3], Torsten [illegible] Rebecca Hahn[3], Sabaha[illegible]



Patients with ATTR-amyloidosis:

- Greater wall thickness
- Greater LV mass
- Lower stroke volume index
- Greater diastolic dysfunction
- Lower ejection fraction
- More abnormal global longitudinal strain

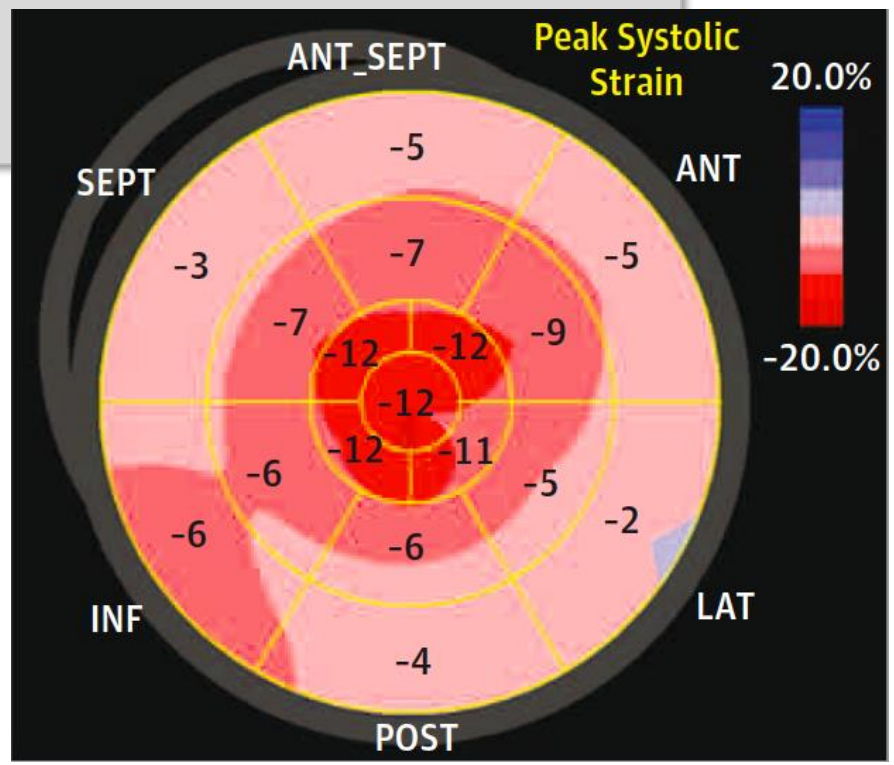
Castano et al. *Eur Heart J* 2017;38:2879-2887

JAMA Cardiology | Review

The Diagnostic and Prognostic Value of Echocardiographic Strain

Arushi Singh, MD; Woo Bin Voss, MD; Robert W. Lentz, MD; James D. Thomas, MD; Nausheen Akhter, MD

JAMA Cardiol. 2019;4:580-588



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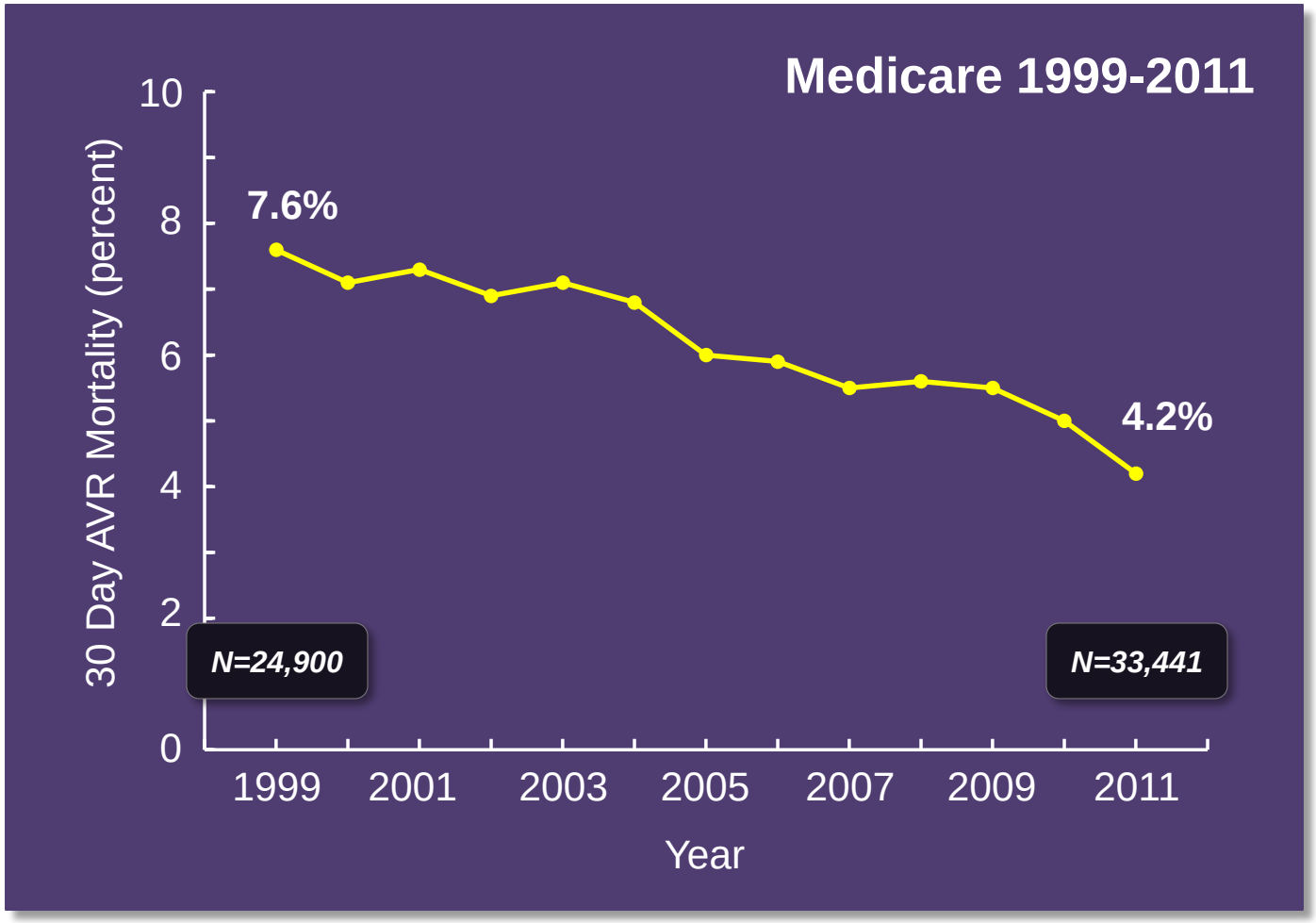
Aortic Valve Replacement

Hospital Mortality

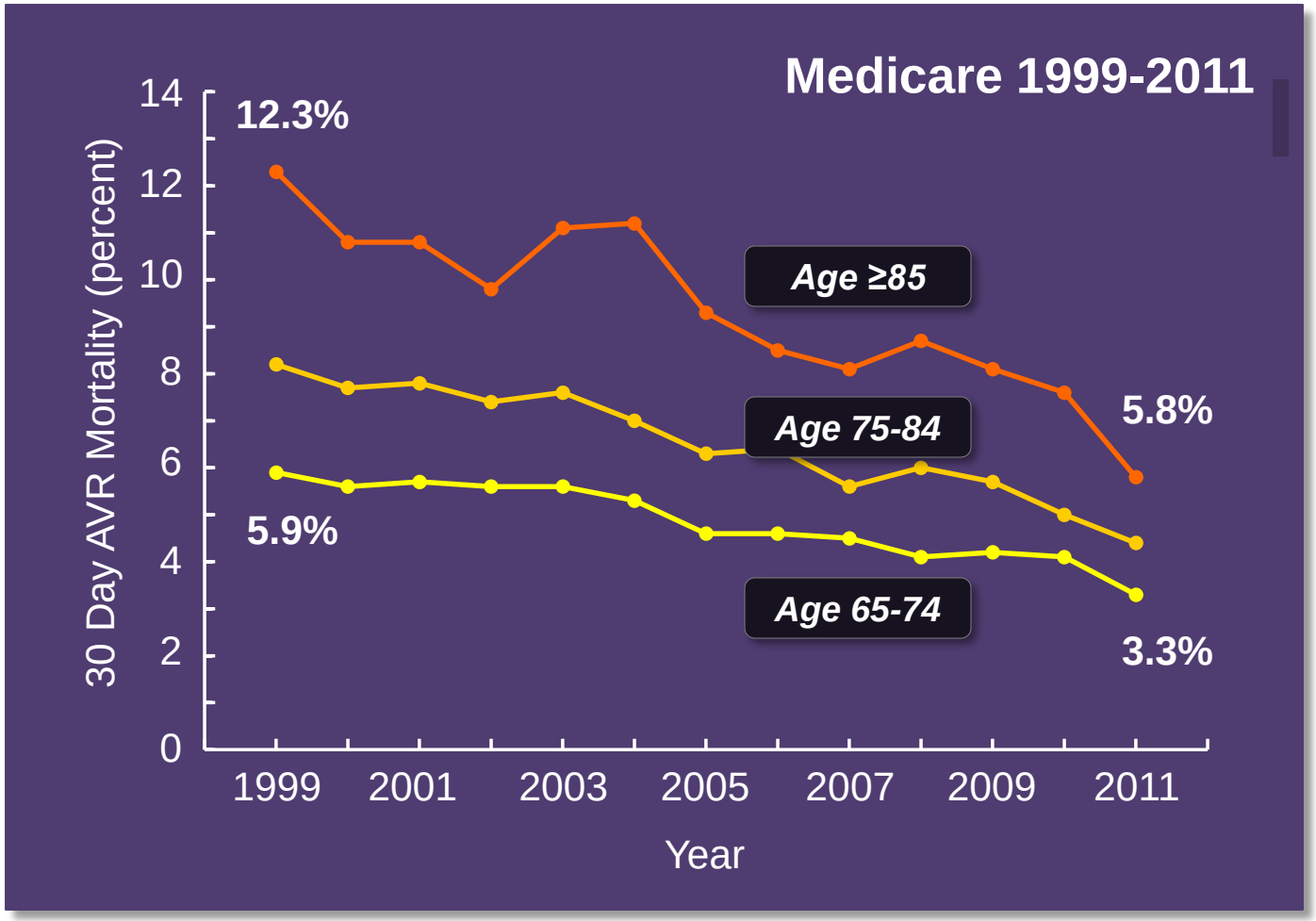


Northwestern Medicine

Barreto-Filho et al, *JAMA* 2013;210:2078-2085

Aortic Valve Replacement

Hospital Mortality

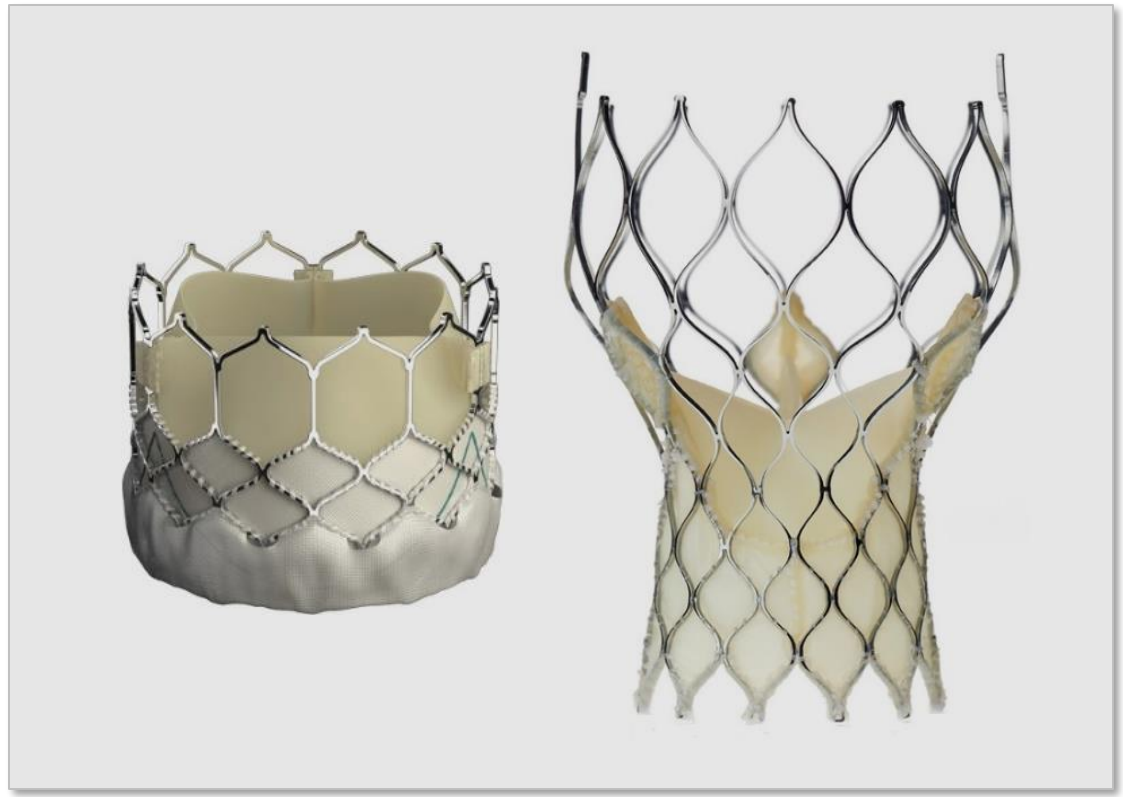


Northwestern Medicine

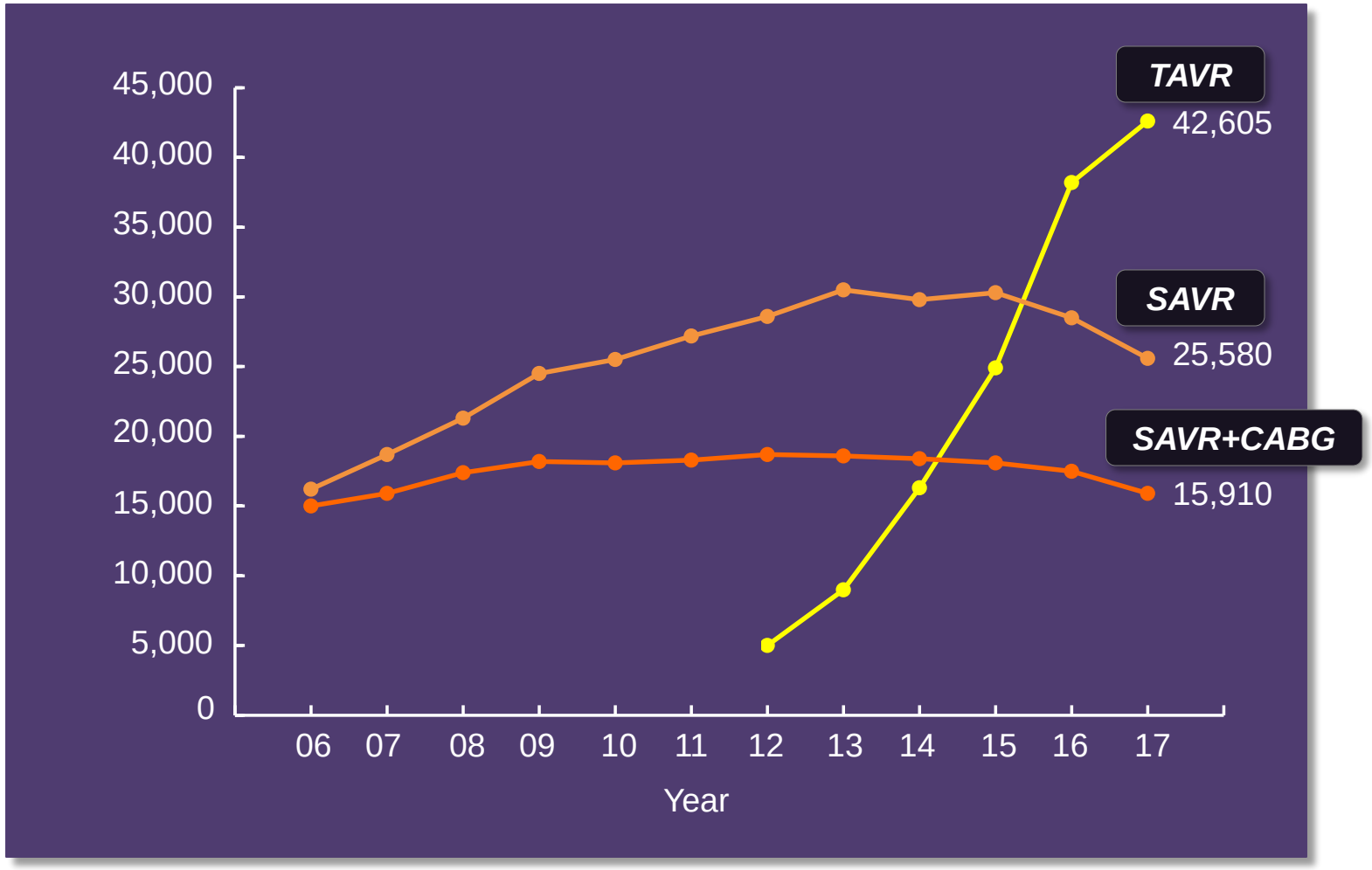
Barreto-Filho et al, *JAMA* 2013;210:2078-2085

Key Knowledge Gaps

1. The symptomatic patient — **Cardiac symptoms ?**
2. The asymptomatic patient — **Truly asymptomatic ?**
3. Mechanisms of inflammation and calcification ?
4. Role of biomarkers?
5. Valve area / gradient / flow ?
6. Ventricular-vascular coupling ?
7. Evolution of TAVR to lower-risk patients ?



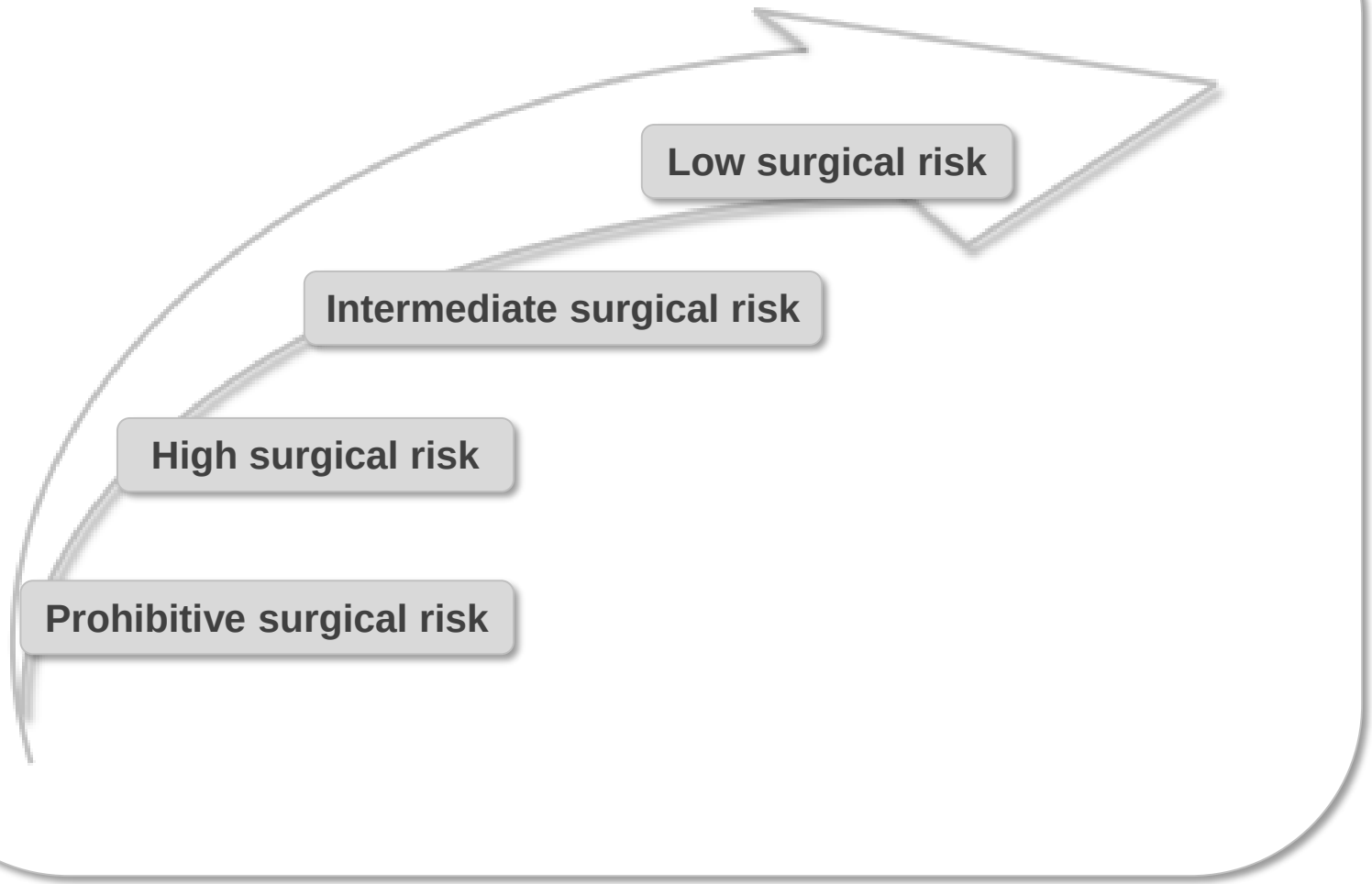
Aortic Valve Replacement



Northwestern Medicine

D'Agostino et al. *Ann Thorac Surg* 2018.doi:org/10.1016/j.athoracsur.2018.10.004

Evolution of TAVR



The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Transcatheter Aortic-Valve Replacem
Balloon-Expandable Valve in Low-Ris

M.J. Mack, M.B. Leon, V.H. Thourani, R. Makkar, S.K. Koda
S.R. Kapadia, S.C. Malaisrie, D.J. Cohen, P. Pibarot, J. Leips
P. Blanke, M.R. Williams, J.M. McCabe, D.L. Brown, V. Babalia
W.Y. Szeto, P. Genereux, A. Pershad, S.J. Pocock, M.C. Alu
and C.R. Smith, for the PARTNER 3 Investigator

N Engl J Med 2019;380:1695-705

Mean age: 73 years
Mean STS score: 1.9
Low degree of comorbidities

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Transcatheter Aortic-Valve Replacement with a Self-Expanding Valve in Low-Risk Patients

Jeffrey J. Popma, M.D., G. Michael Deeb, M.D., Steven J. Yakubov, M.D., Mubashir Mumtaz, M.D., Hemal Gada, M.D., Daniel O'Hair, M.D., Tanvir Bajwa, M.D., John C. Heiser, M.D., William Merhi, D.O., Neal S. Kleiman, M.D., Judah Askew, M.D., Paul Sorajja, M.D., Joshua Rovin, M.D., Stanley J. Chetcuti, M.D., David H. Adams, M.D., Paul S. Teirstein, M.D., George L. Zorn III, M.D., John K. Forrest, M.D., Didier Tchétché, M.D., Jon Resar, M.D., Antony Walton, M.D., Nicolo Piazza, M.D., Ph.D., Basel Ramlawi, M.D., Newell Robinson, M.D., George Petrossian, M.D., Thomas G. Gleason, M.D., Jae K. Oh, M.D., Michael J. Boulware, Ph.D., Hongyan Qiao, Ph.D., Andrew S. Mugglin, Ph.D., and Michael J. Reardon, M.D., for the Evolut Low Risk Trial Investigators*

N Engl J Med 2019;380:1706-15

Mean age: 74 years
Mean STS score: 1.9
Low degree of comorbidities

Low Risk TAVR Trials

	PARTNER 3		Evolute	
	TAVR	SAVR	TAVR	SAVR
Age (years)	73.3	73.6	74.1	73.6
STS score	1.9	1.9	1.9	1.9

Low Risk TAVR Trials

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	TAVR	SAVR	TAVR	SAVR
Age (years)	73.3	73.6	74.1	73.6
STS score	1.9	1.9	1.9	1.9
Prior MI	5.7%	5.8%	6.6%	4.9%
PAD	6.9%	7.3%	7.5%	8.3%
Diabetes	31.2%	30.2%	31.4%	30.3%

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Diabetes	31.2%	30.2%	31.4%	30.3%
AVA (cm2)	0.8	0.8	0.8	0.8
Mean gradient (mmHg)	49.4	48.3	47.0	46.6
LVEF (%)	65.7	66.2	61.7	61.9

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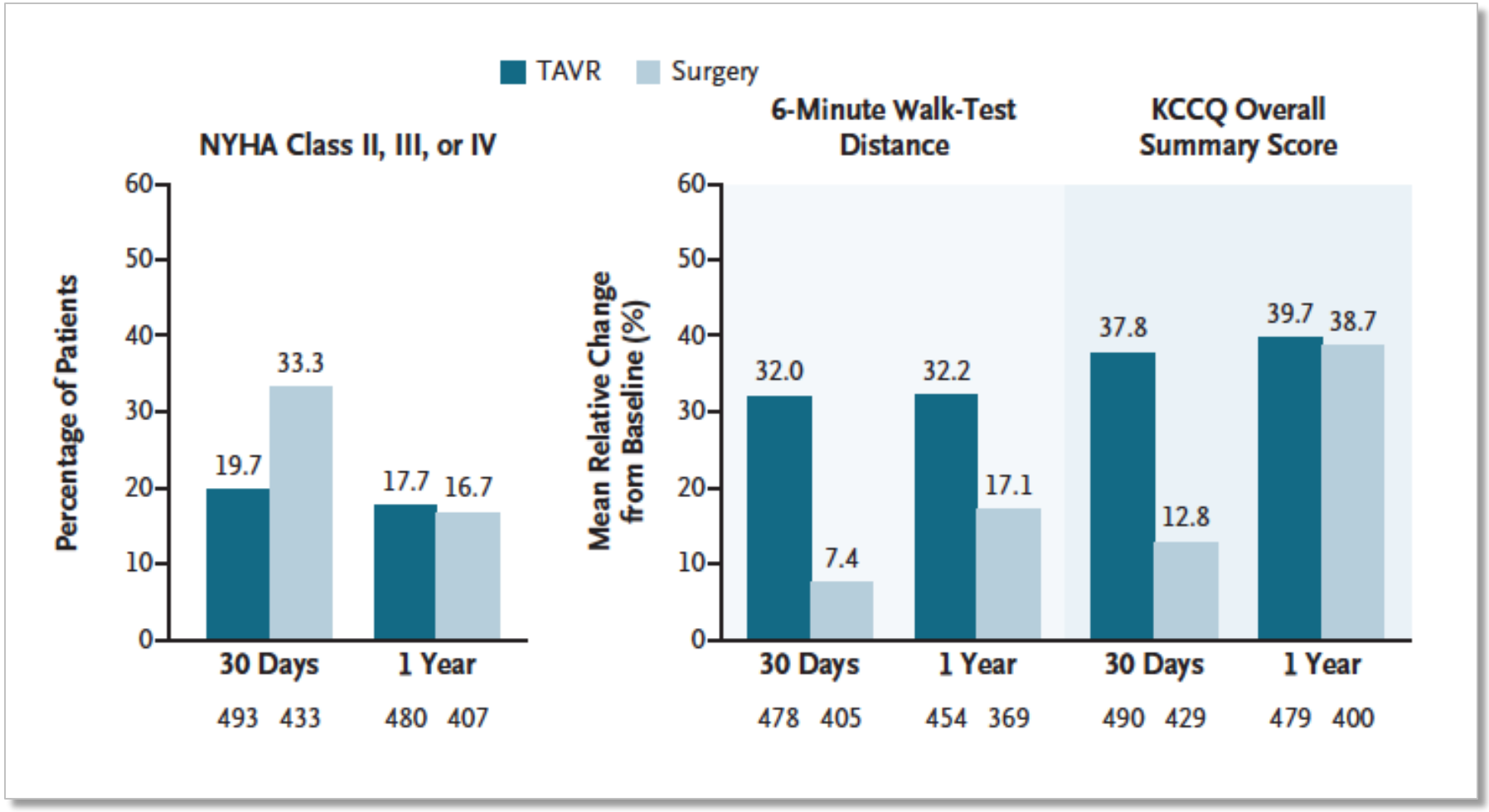
LVEF (%)	65.7	66.2	61.7	61.9
Composite (1 year)	8.5	15.1	2.9	4.6
Mortality (1 year)	1.0	2.5	2.4	3.0
Stroke (30 days)	0.6	2.4	3.4	3.4
Atrial fibrillation (30 d)	5.0	39.5	9.8	38.3
New pacemaker (30 d)	6.6	4.1	17.4	6.1

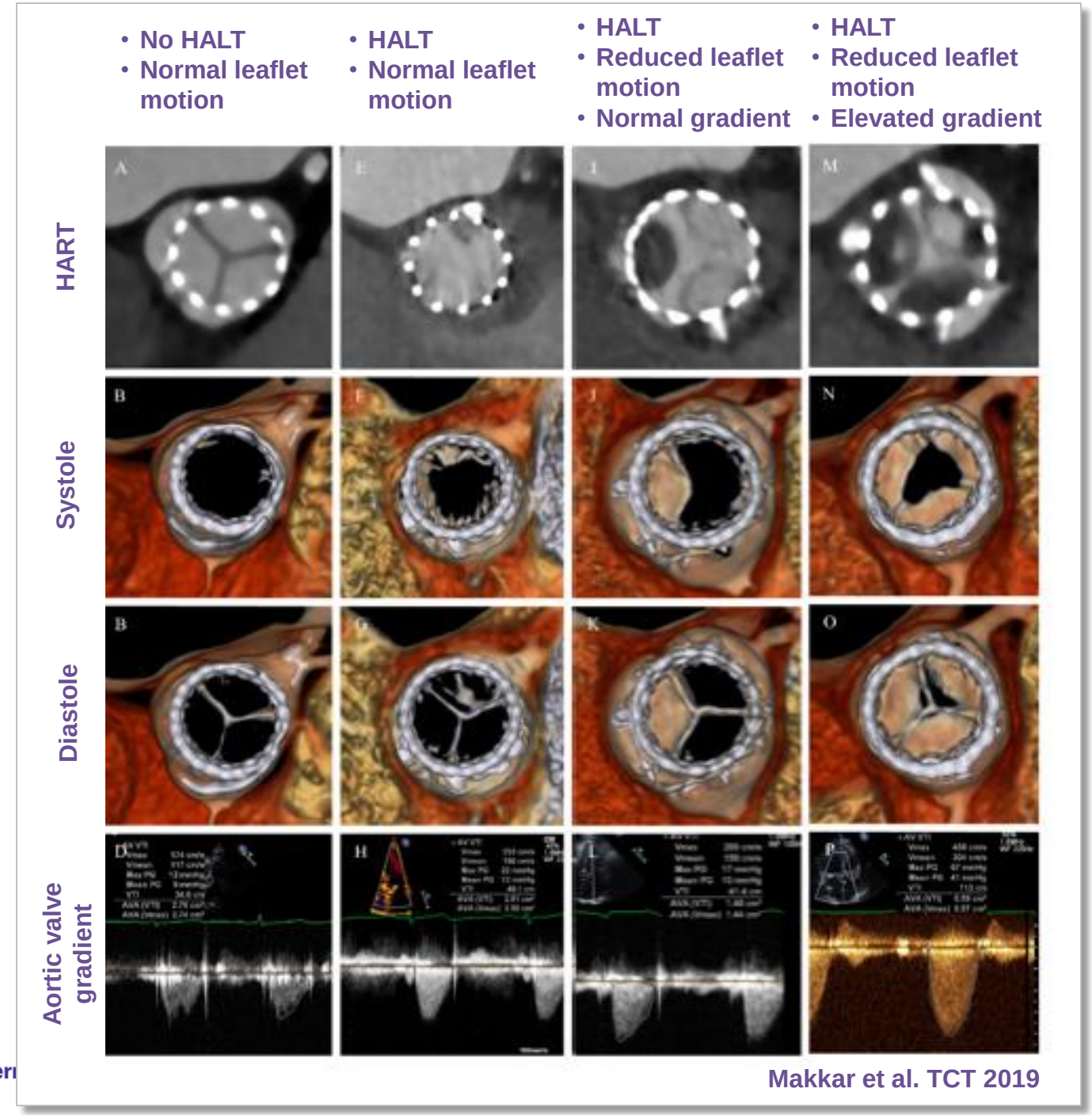


Northwestern Medicine

Mack et al. N Engl J Med 2019;380;1695-1705

Low Risk TAVR Trials: Missing Pieces

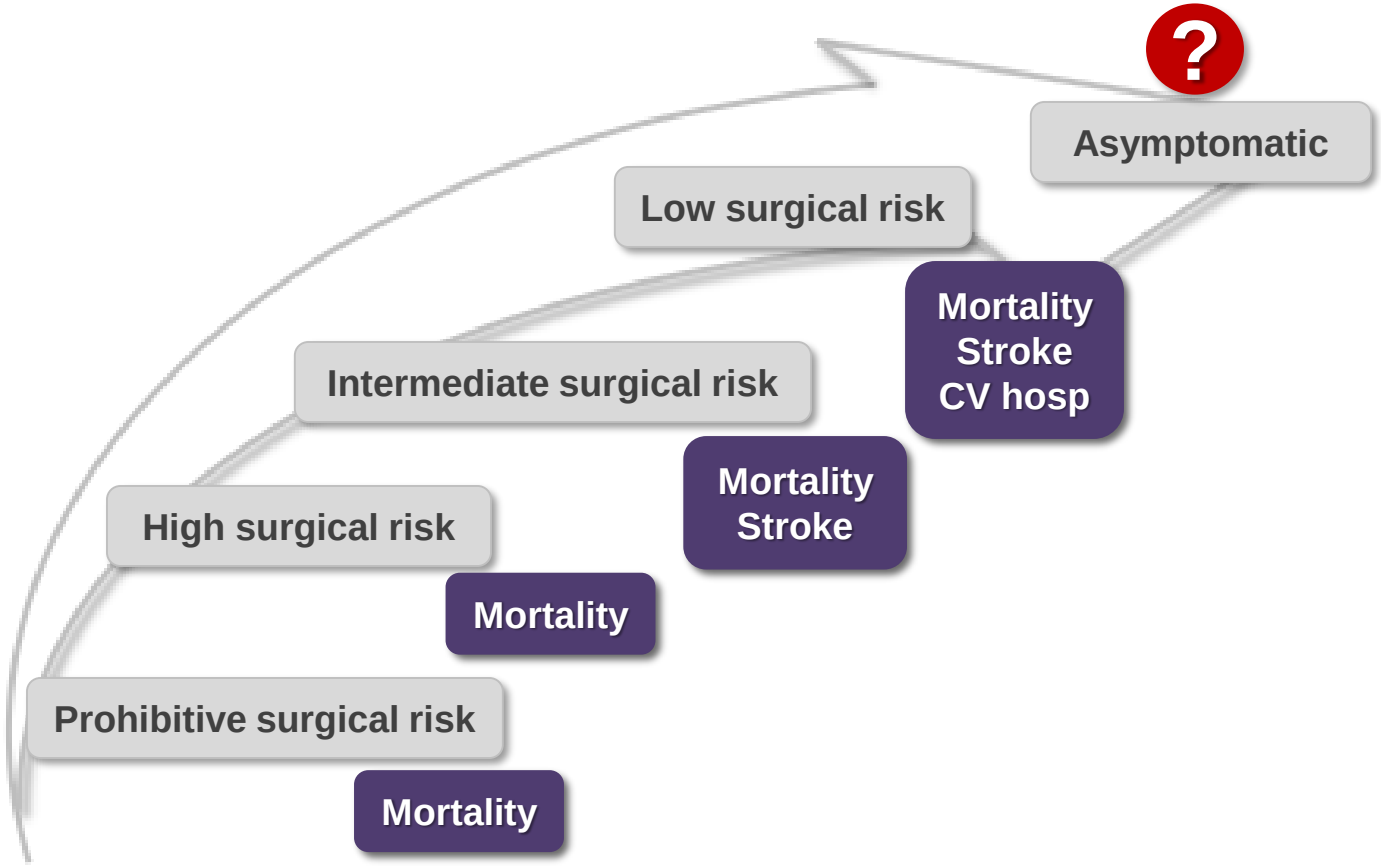
- Durability of transcatheter valves
- Subclinical leaflet thrombosis

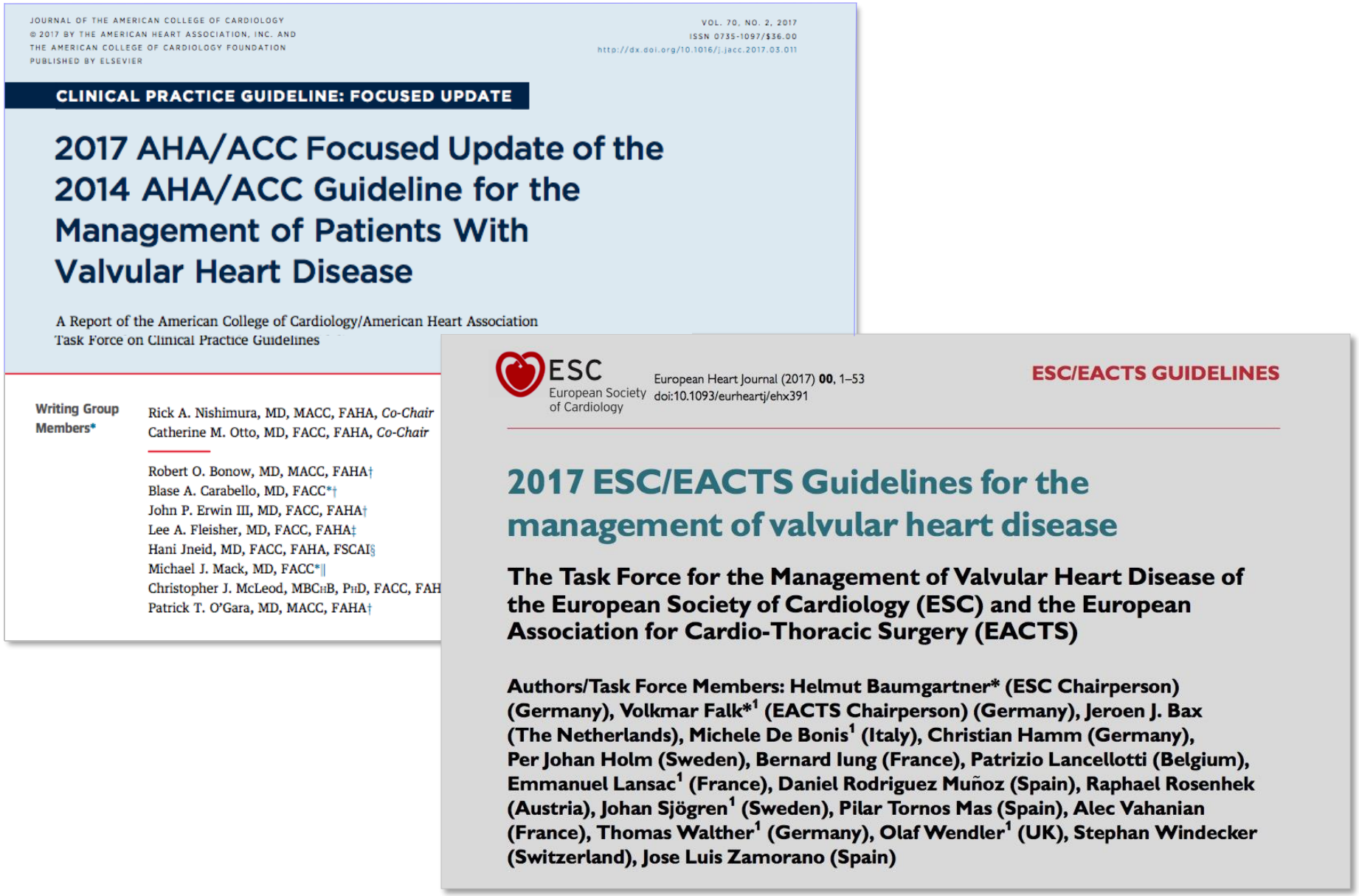


Low Risk TAVR Trials: Missing Pieces

- Durability of transcatheter valves
- Subclinical leaflet thrombosis
- Patients with:
  - Bicuspid aortic valves
  - Extensive CAD
  - Aortic aneurysms
  - Associated MR / TR
- Younger patients **Durability? Pacemaker rates?**
- Asymptomatic patients

Evolution of TAVR





JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY
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VOL. 70, NO. 2, 2017
ISSN 0735-1097/$36.00
http://dx.doi.org/10.1016/j.jacc.2017.03.011

CLINICAL PRACTICE GUIDELINE: FOCUSED UPDATE

2017 AHA/ACC Focused Update of the 2014 AHA/ACC Guideline for the Management of Patients With Valvular Heart Disease

A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines

Writing Group Members*

Rick A. Nishimura, MD, MACC, FAHA, *Co-Chair*
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ESC European Society of Cardiology

European Heart Journal (2017) **00**, 1–53
doi:10.1093/eurheartj/ehx391

ESC/EACTS GUIDELINES

2017 ESC/EACTS Guidelines for the management of valvular heart disease

The Task Force for the Management of Valvular Heart Disease of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS)

Authors/Task Force Members: Helmut Baumgartner* (ESC Chairperson) (Germany), Volkmar Falk*[1] (EACTS Chairperson) (Germany), Jeroen J. Bax (The Netherlands), Michele De Bonis[1] (Italy), Christian Hamm (Germany), Per Johan Holm (Sweden), Bernard Iung (France), Patrizio Lancellotti (Belgium), Emmanuel Lansac[1] (France), Daniel Rodriguez Muñoz (Spain), Raphael Rosenhek (Austria), Johan Sjögren[1] (Sweden), Pilar Tornos Mas (Spain), Alec Vahanian (France), Thomas Walther[1] (Germany), Olaf Wendler[1] (UK), Stephan Windecker (Switzerland), Jose Luis Zamorano (Spain)

TAVR 2019

- TAVR has been truly transformative
- Surgical AVR has been the standard with proven durability and safety for most patients
- TAVR provides treatment options for patients who previously had no options other than a predictably very poor short term outcome
- TAVR is an alternative to SAVR in patients at high and intermediate surgical risk
- The threshold for TAVR is declining in clinical trials, registries and clinical practice
- Multidisciplinary heart team is essential
- All patients want this
- Determining when to withhold TAVR is difficult

Is TAVR now the standard?

… and now low risk

Clinical Studies

Aortic Stenosis*

PAUL WOOD, O.B.E., M.D., F.R.C.P.

London, England

AORTIC stenosis is a simple mechanical fault, which, if severe enough, imposes a heavy burden on the left ventricle and sooner or later overcomes it. An obstructive lesion of this sort present
surgeon. T
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definition of severe stenosis is one with sufficient hypertrophy of the left ventricle to cause inversion of the T wave of the electrocardiogram in left ventricular surface leads or their

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of mitral

Aortic stenosis is a simple mechanical fault which, if severe enough, imposes a heavy burden on the left ventricle and sooner or later overcomes it.

The 1958 Morris H. Nathanson Lecture, University of Southern California, Los Angeles.

…it's not simple any more

Wood P, *Am J Cardiol* 1958;1:553-571

Journal of the American College of Cardiology
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Published by Elsevier Inc.

Vol. 55, No. 22, 2010
ISSN 0735-1097/$36.00
doi:10.1016/j.jacc.2010.03.019

Atherosclerosis

Associations of Long-Term and Early Adult Atherosclerosis Risk Factors With Aortic and Mitral Valve Calcium

George Thanassoulis, MD,*†# Joseph M. Massaro, PHD,**‡‡ Ricardo Cury, MD,‖ Emily Manders, BS,* Emelia J. Benjamin, MD, SCM,*††§§‖‖ Ramachandran S. Vasan, MD,*‖‖ L. Adrienne Cupple, PHD,* **†† Udo Hoffmann, MD, MPH,‖ Christopher J. O'Donnell, MD, MPH,*†¶¶ Sekar Kathiresan, MD*†‡§¶

Framingham, Boston, and Cambridge, Massachusetts; and Bethesda, Maryland

J Am Coll Cardiol 2010;55:2491–8

- 1323 subjects in Framingham Offspring Study
- Enrolled between 1971 and 1975
- Mean age at enrollment 34 ± 9 years
- MDCT imaging between 2002 and 2005
- Median 26.9 year follow-up

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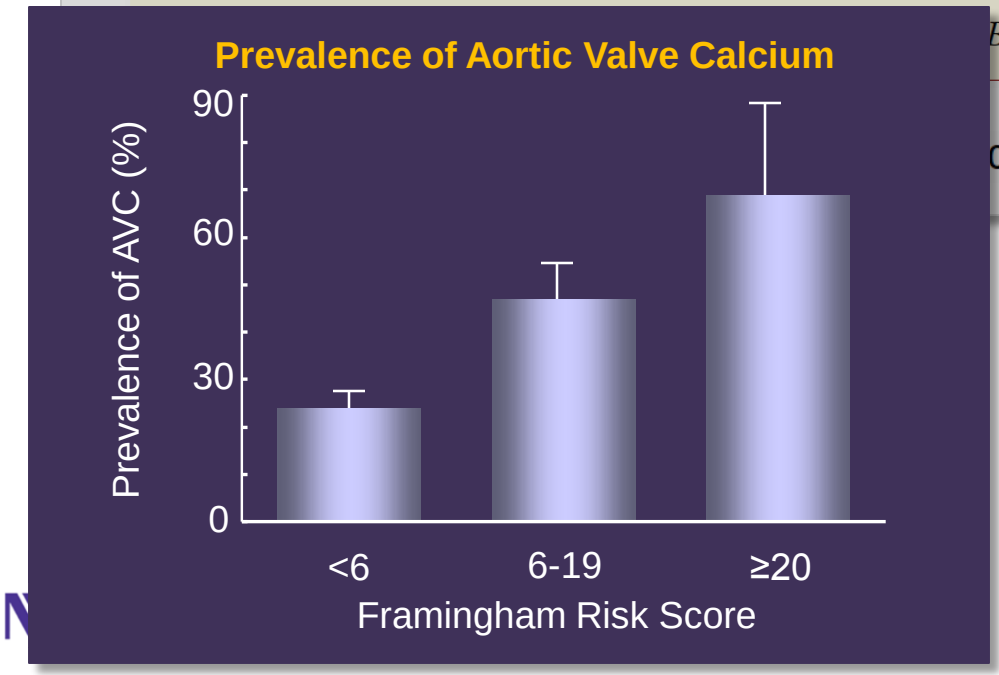
Bethesda, Maryland

0;55:2491–8



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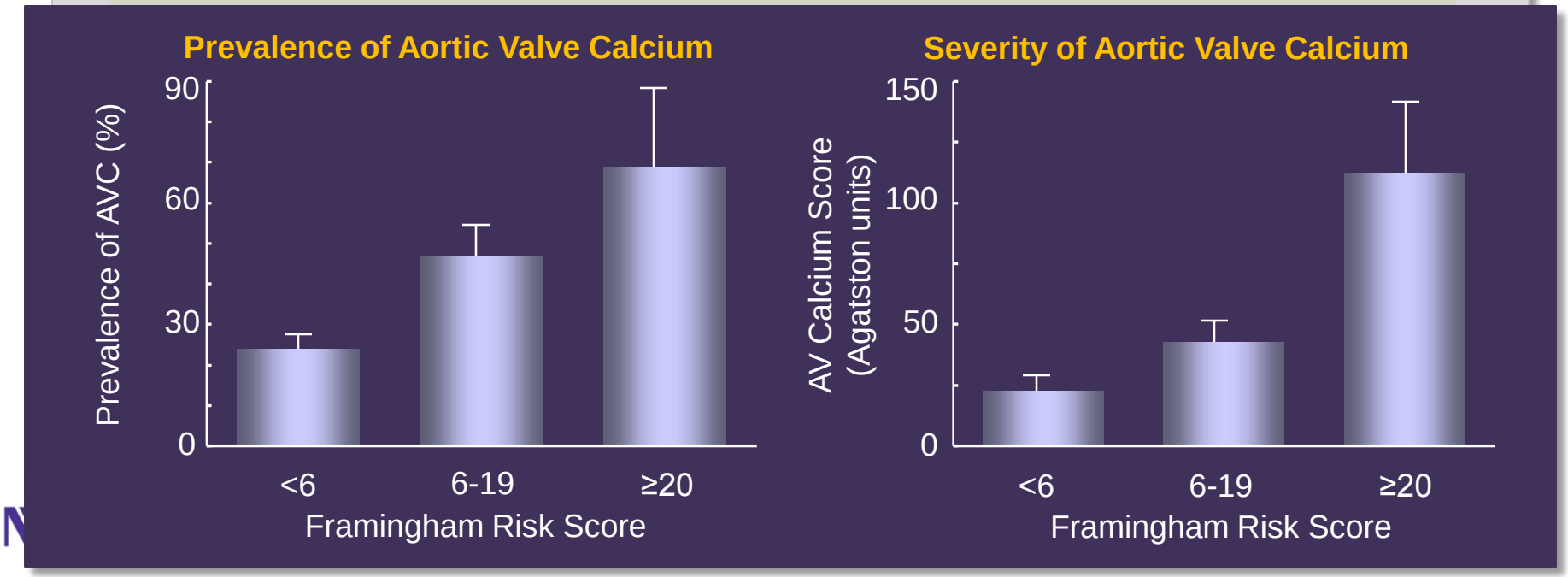

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Published by Elsevier Inc.

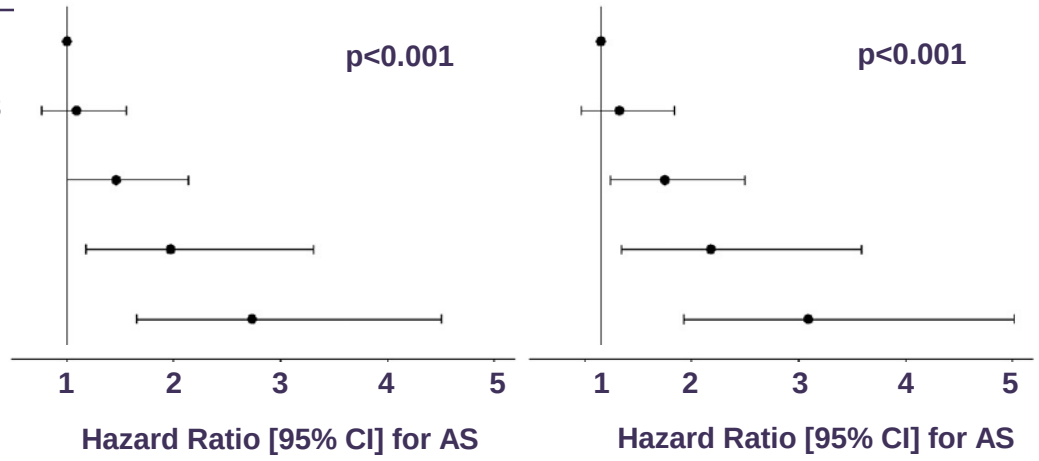
Vol. 63, No. 5, 2014
ISSN 0735-1097/$36.00
http://dx.doi.org/10.1016/j.jacc.2013.09.038

Elevated Lipoprotein(a) and Risk of Aortic Valve Stenosis in the General Population

Pia R. Kamstrup, MD, PhD,*† Anne Tybjærg-Hansen, MD, DMSc,†‡§‖
Børge G. Nordestgaard, MD, DMSc*†§‖

Copenhagen, Denmark

rs10455872 carriers	Lp(a) Percentile	Lp(a) mg/dL	No. of subjects
1%	<22	2-4	6123
1%	22-66	7-17	13053
31%	67-89	30-51	6677
59%	90-95	63-95	1728
45%	>95	104-148	1435



Kamstrup et al. *J Am Coll Cardiol* 2014;53:470-477

Northwestern Medicine