

Aortic Regurgitation: From Medical Therapy to Valve Intervention

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Chronic Aortic Regurgitation

Preoperative predictors of survival after AVR:

		<u>n</u>	<u>LVEF</u>	<u>LVSD</u>
Forman	1980	90	■	
Henry	1980	50	■	■
Cunha	1980	86	■	■
Greves	1981	45	■	
Kumpuris	1982	43		■
Bonow	1985	80	■	■
Daniel	1985	84	■	■
Cormier	1986	73	■	■
Sheiban	1986	84	■	■
Taniguchi	1987	82	■	■
Klodos	1996	219	■	
Turina	1998	192	■	■
Chaliki	2002	450	■	■
Tornos	2006	170	■	■
Total		1728		

Chronic Aortic Regurgitation

Preoperative predictors of survival after AVR:

		n	LVEF	LVSD
Forman	1980	90	✓	
Henry	1980	50	✓	■
Cunha	1980	86	✓	■
Greves	1981	45	✓	
Kumpuris	1982	43		■
Bonow	1985	80	✓	■
Daniel	1985	84	✓	■
Cormier	1986	73	✓	■
Sheiban	1986	84	✓	■
Taniguchi	1987	82	✓	■
Kludas	1996	219	✓	
Turina	1998	192	✓	■
Chaliki	2002	450	✓	■
Tornos	2006	170	✓	■
Total		1728		

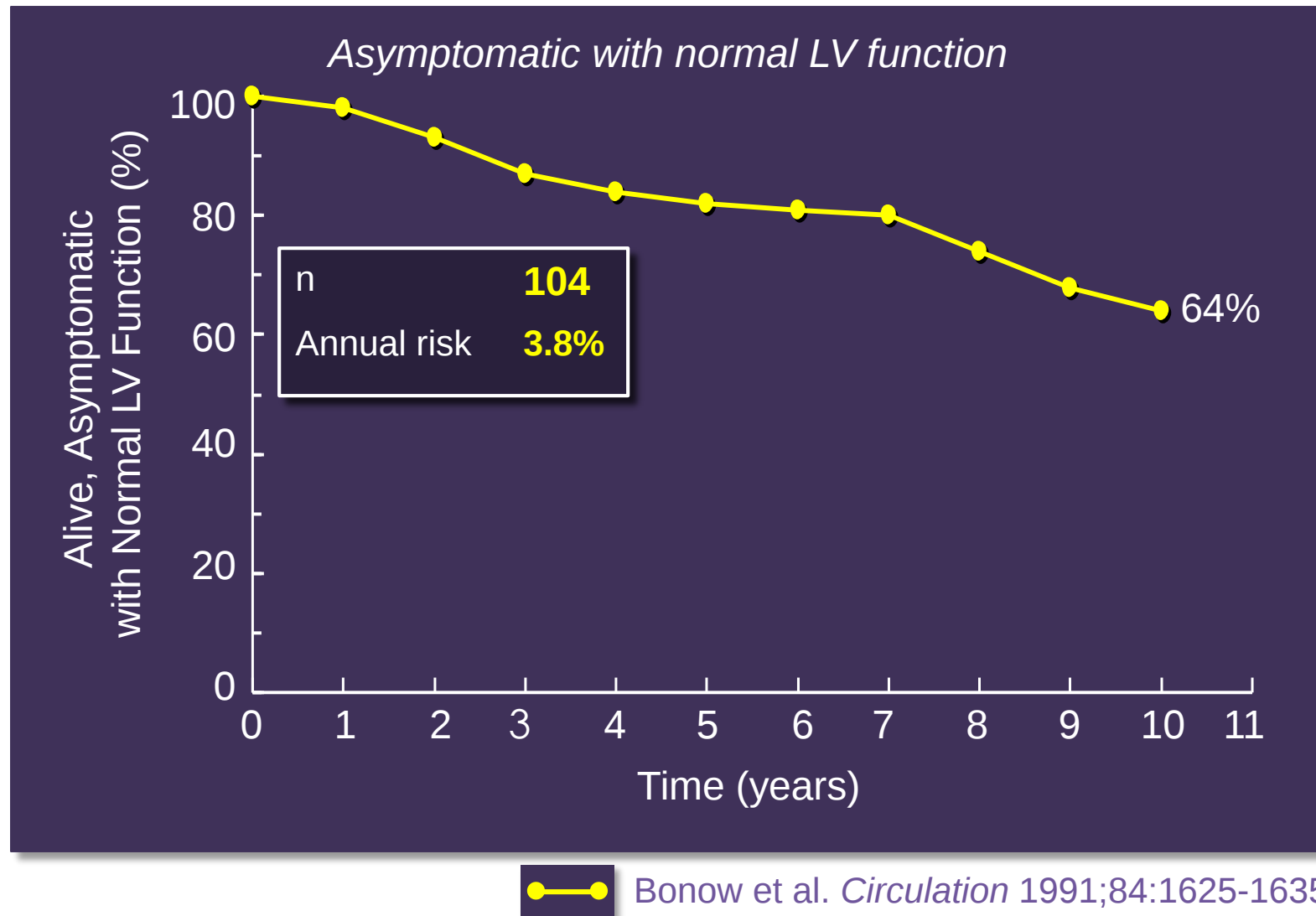
Chronic Aortic Regurgitation

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Bonow	1985	80	✓	✓
Daniel	1985	84	✓	✓
Cormier	1986	73	✓	✓
Sheiban	1986	84	✓	✓
Taniguchi	1987	82	✓	✓*
Kludas	1996	219	✓	
Turina	1998	192	✓	✓*
Chaliki	2002	450	✓	✓
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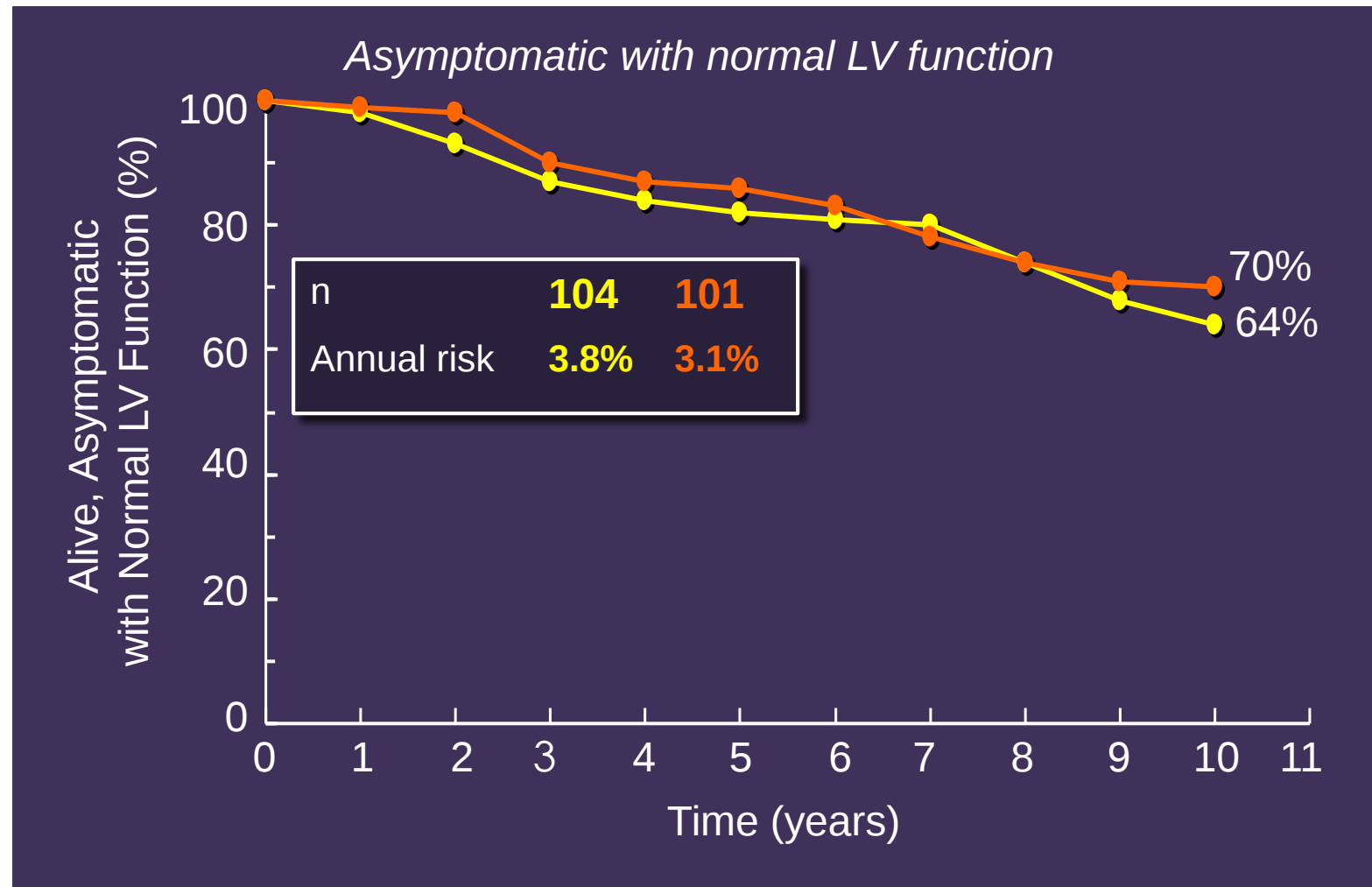
Aortic Regurgitation

Natural History of Asymptomatic Patients



Aortic Regurgitation

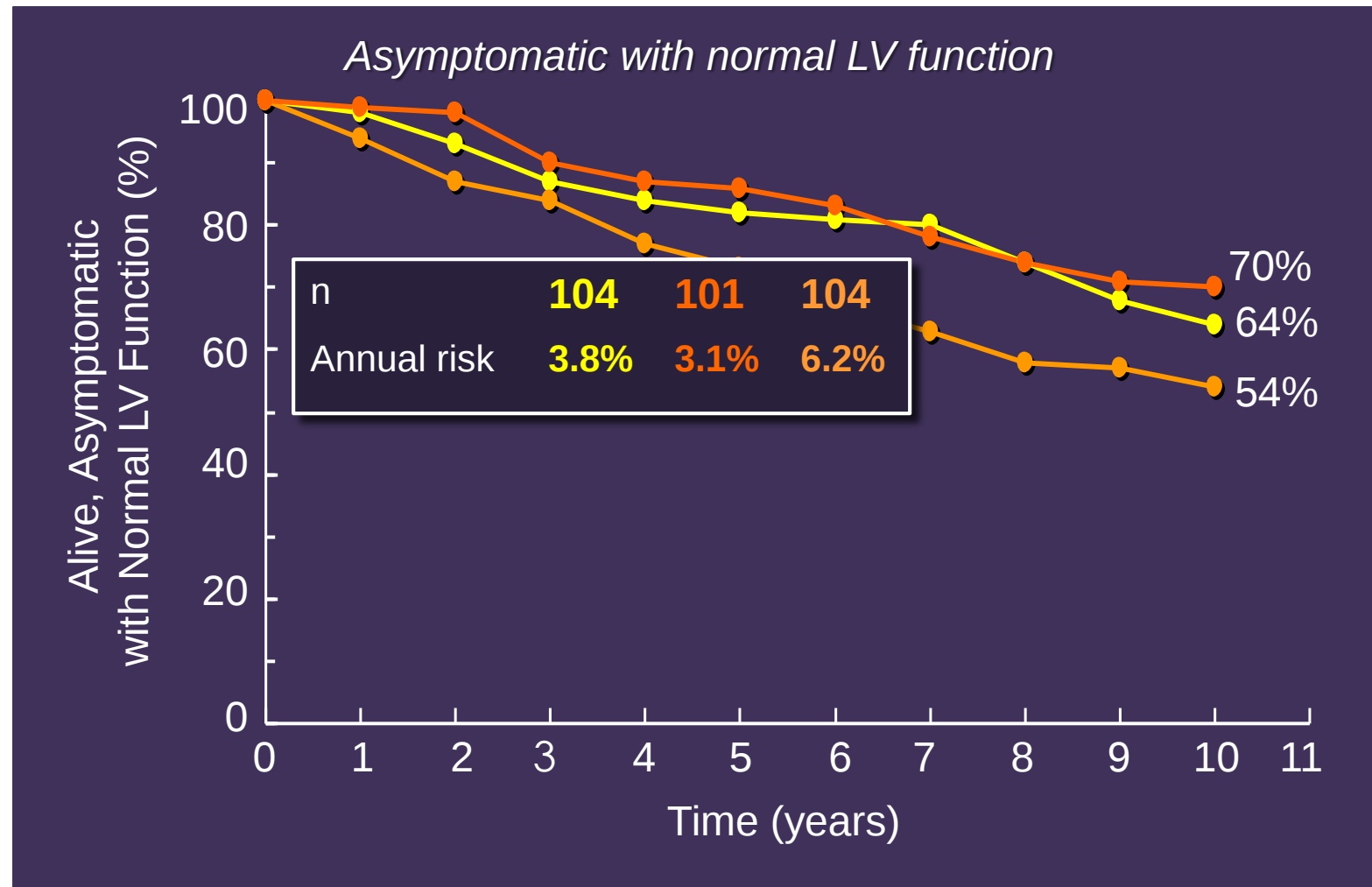
Natural History of Asymptomatic Patients



●—● Bonow et al. *Circulation* 1991;84:1625-1635
●—● Tornos et al. *Am Heart J* 1995;130:333-339

Aortic Regurgitation

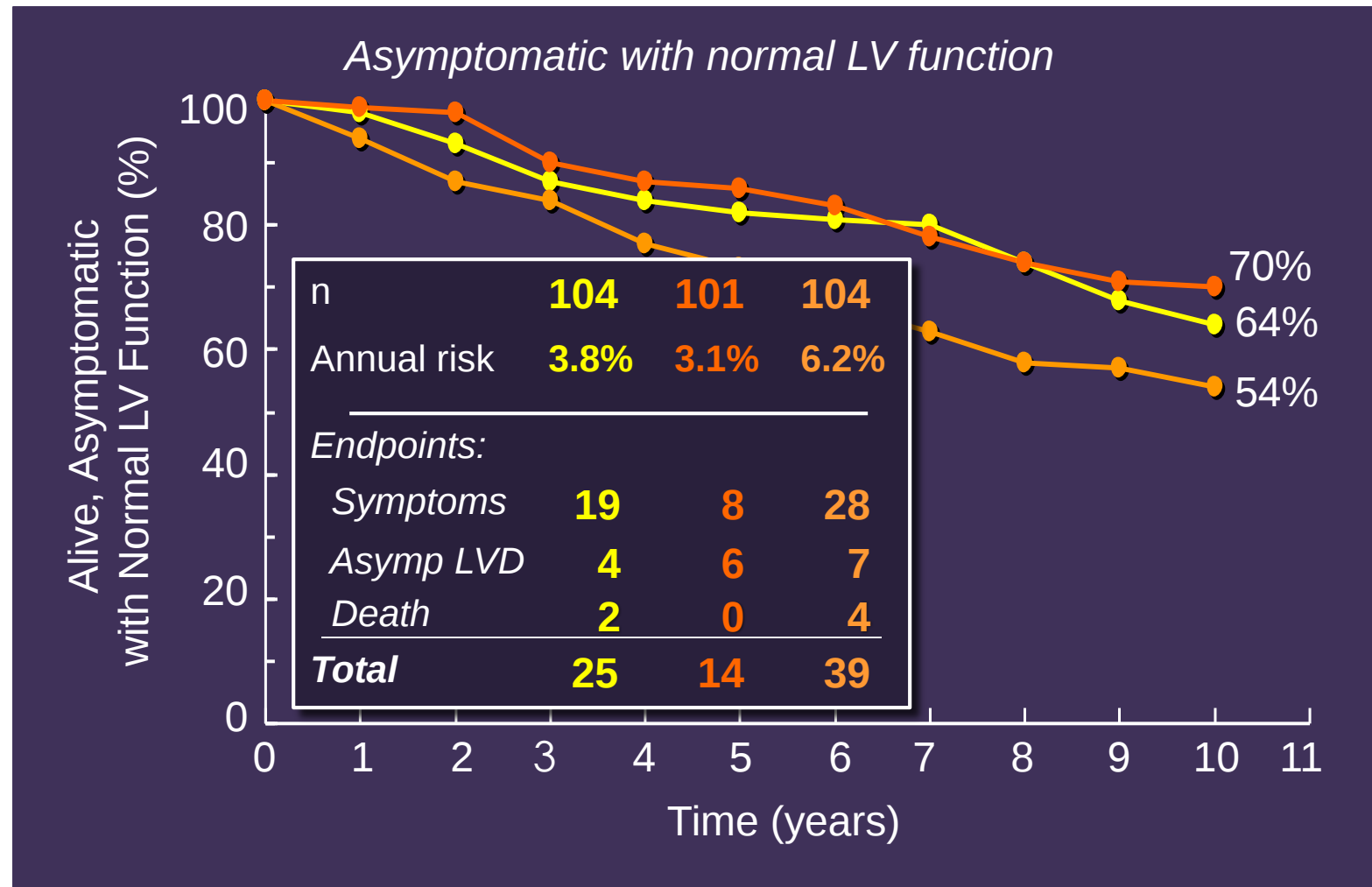
Natural History of Asymptomatic Patients



- Bonow et al. *Circulation* 1991;84:1625-1635
- Tornos et al. *Am Heart J* 1995;130:333-339
- Borer et al. *Circulation* 1998;97:525-534

Aortic Regurgitation

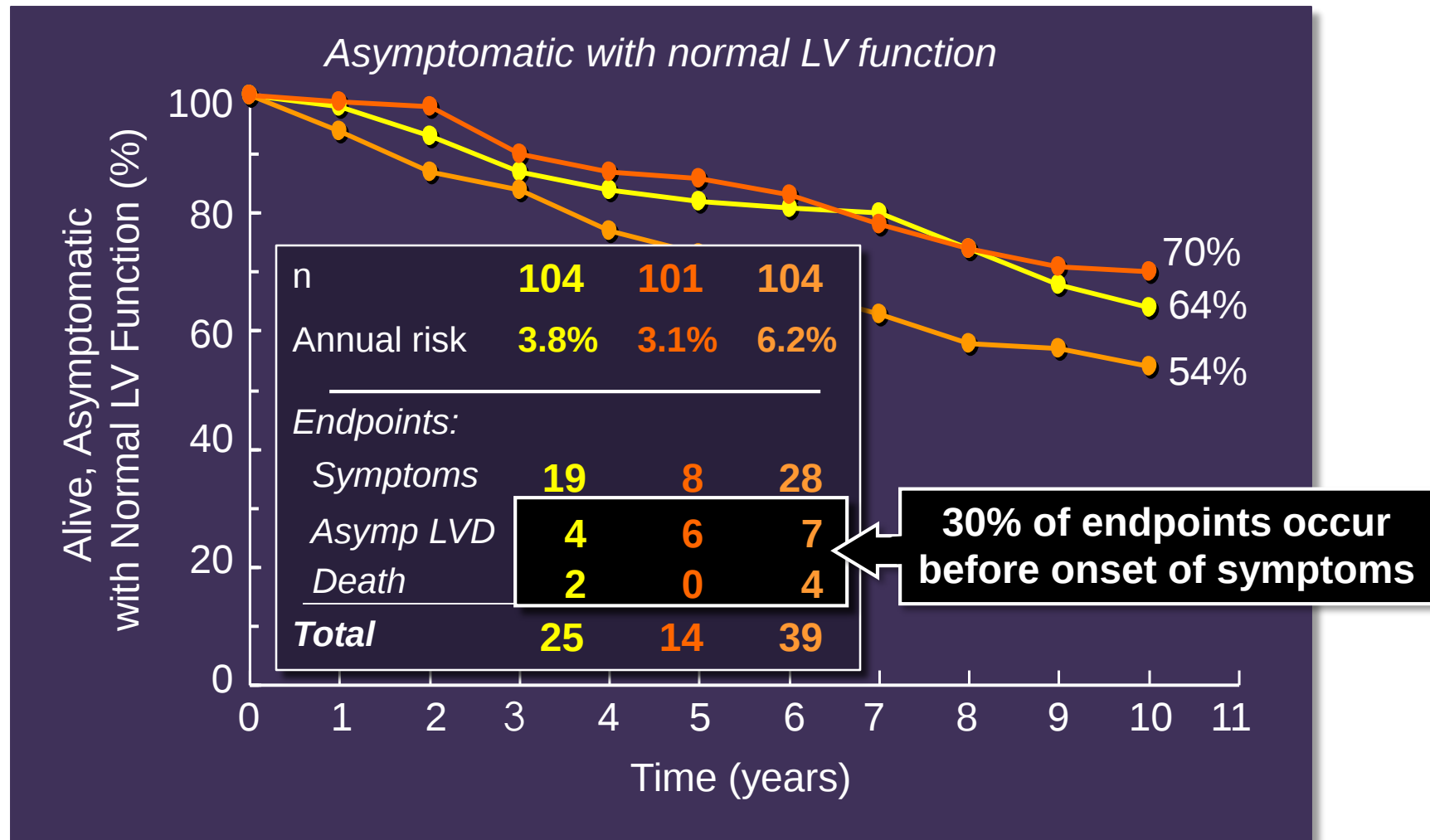
Natural History of Asymptomatic Patients



- Bonow et al. *Circulation* 1991;84:1625-1635
- Tornos et al. *Am Heart J* 1995;130:333-339
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Aortic Regurgitation

Natural History of Asymptomatic Patients



- Bonow et al. *Circulation* 1991;84:1625-1635
- Tornos et al. *Am Heart J* 1995;130:333-339
- Borer et al. *Circulation* 1998;97:525-534

Asymptomatic AR with Normal LV Function

Factors predictive of symptoms and /or LV dysfunction:

- LV end-systolic dimension/volume
- LV end-diastolic dimension/volume
- LV ejection fraction with exercise

Bonow, *Circulation* 1984,1991
Siemieniczuk, *Ann Intern Med* 1989
Tornos, *Am Heart J* 1995
Borer, *Circulation* 1998
Tarasoutchi, *J Am Coll Cardiol* 2003

Aortic regurgitation

Indications for valve replacement

- **Symptomatic patients**



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class I

class I

Aortic regurgitation

Indications for valve replacement

- Symptomatic patients
- LV systolic dysfunction

class I

class I

class I

class I



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Aortic regurgitation



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Indications for valve replacement

- Symptomatic patients
- LV systolic dysfunction
- Patients undergoing CABG

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Aortic regurgitation



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Indications for valve replacement

- Symptomatic patients
- LV systolic dysfunction
- Patients undergoing CABG
- Severe LV dilatation

class I

class I

class I

class I

class I

class I

class IIa

class IIa

Aortic regurgitation



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Indications for valve replacement

- Symptomatic patients
- LV systolic dysfunction
- Patients undergoing CABG
- Severe LV dilatation
- Progressive LV dilatation,
low risk for surgery

class I

class I

class I

class I

class I

class I

class IIa

class IIa

class IIb

class IIa

LVSD >50 mm

Aortic regurgitation



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Indications for valve replacement

- Symptomatic patients
- LV systolic dysfunction
- Patients undergoing CABG
- Severe LV dilatation
- Progressive LV dilatation, low risk for surgery

class I

class I

class I

class I

class I

class I

class IIa

class IIa

class IIb

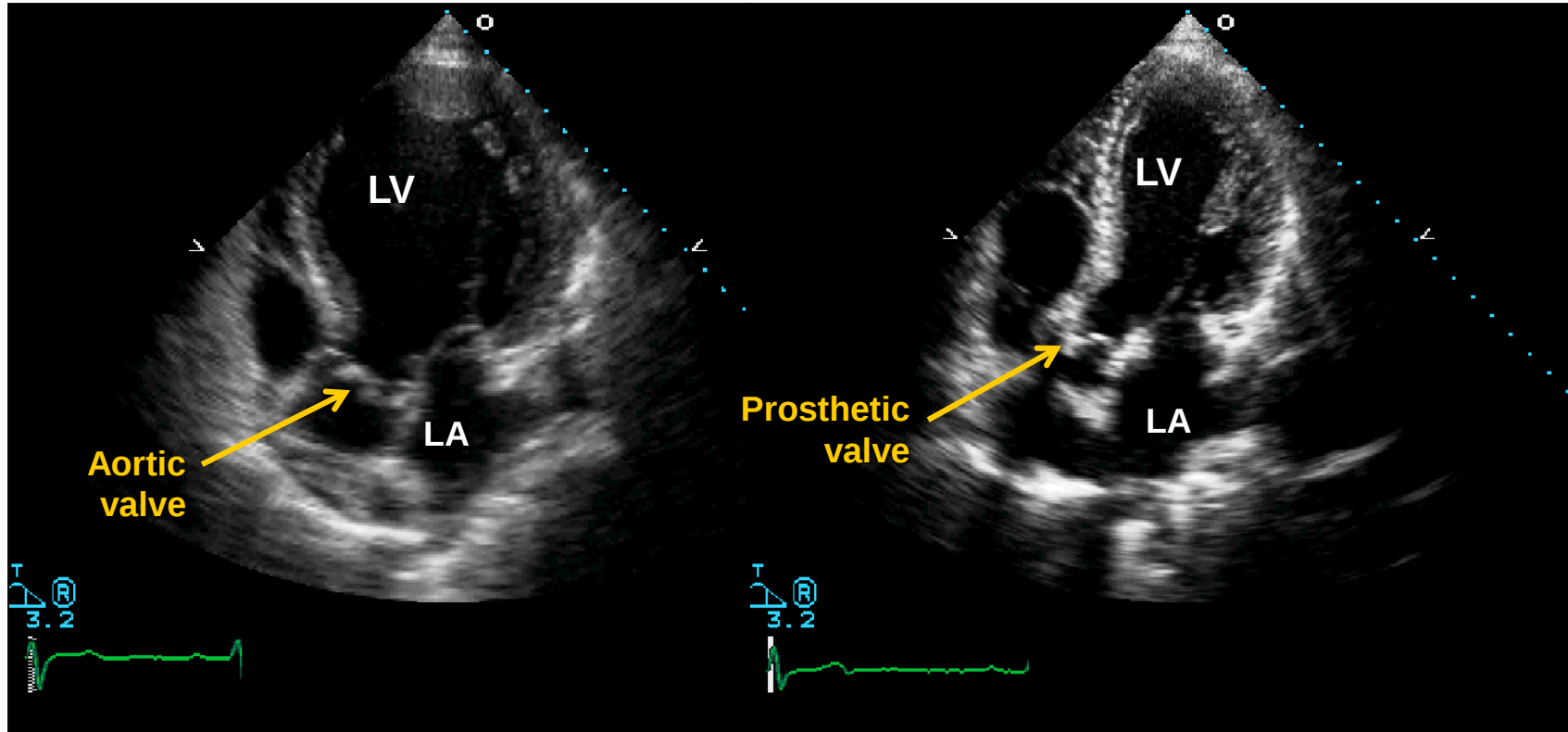
class IIa

LVSD >50 mm

LVSD >50 mm/m²

LVDD >65 mm

LVDD >70 mm

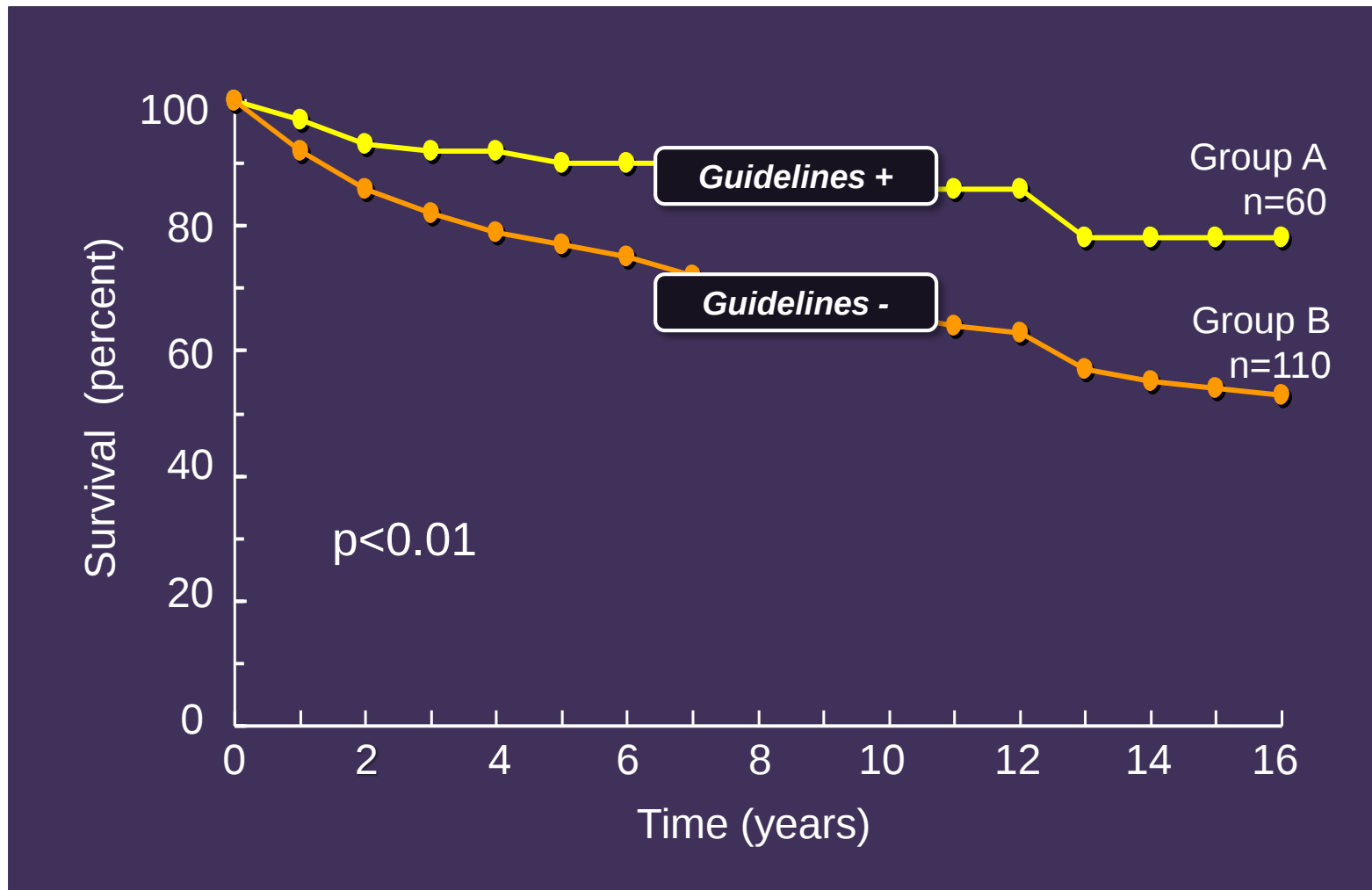


Pre-AVR

Post-AVR

Aortic Regurgitation

Long-Term Survival After AVR

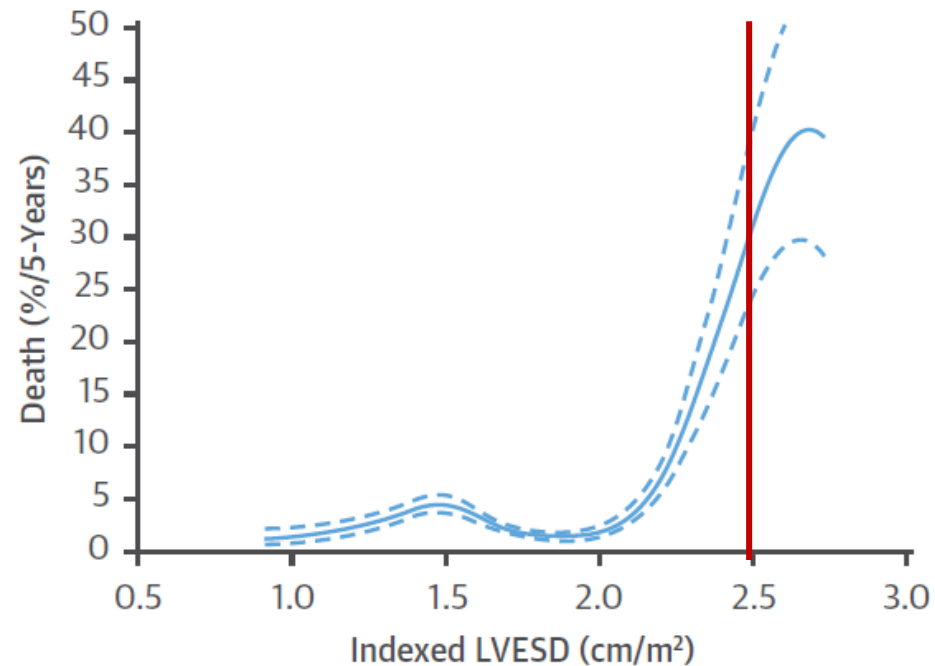


Long-Term Outcomes in Patients With Aortic Regurgitation and Preserved Left Ventricular Ejection Fraction

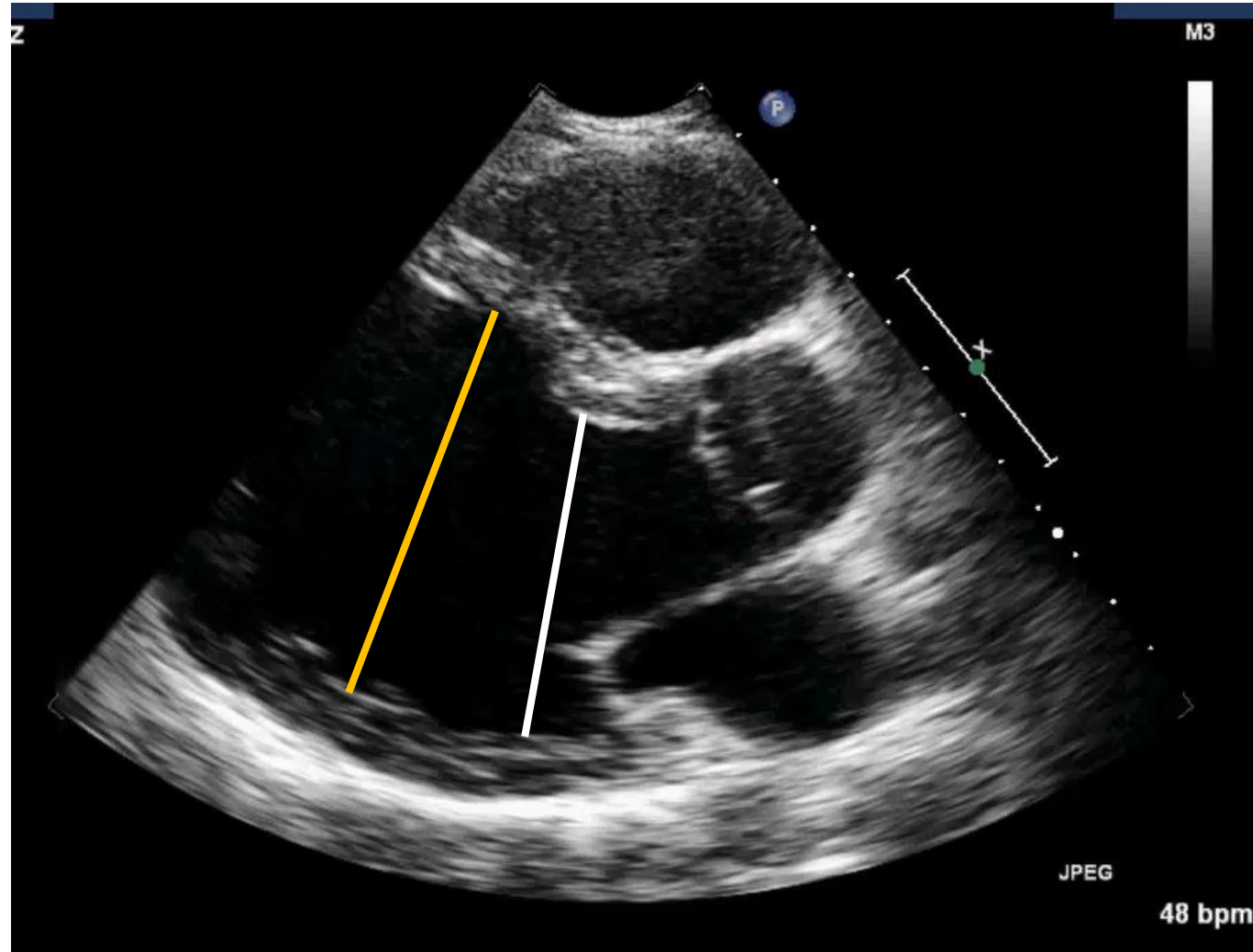
Amgad Mentias, MD, Ke Feng, MD, Alaa Alashi, MD, L. Leonardo Rodriguez, MD, A. Marc Gillinov, MD, Douglas R. Johnston, MD, Joseph F. Sabik, MD, Lars G. Svensson, MD, PhD, Richard A. Grimm, MD, Brian P. Griffin, MD, Milind Y. Desai, MD

J Am Coll Cardiol 2016;68:2144-53

n = 484







Why are we still talking about LV diameters
in 2016 instead of LV volumes?

ORIGINAL RESEARCH

Quantitative Echocardiographic Determinants of Clinical Outcome in Asymptomatic Patients With Aortic Regurgitation

A Prospective Study

Delphine Detaint, MD, David Messika-Zeitoun, MD, Joseph Maalouf, MD, Christophe Tribouilloy, MD, Douglas W. Mahoney, MS, A. Jamil Tajik, MD, FACC, Maurice Enriquez-Sarano, MD, FACC

Rochester, Minnesota

J Am Coll Cardiol Img 2008;1:1-11

Survival Free of AVR

	HR	CI	P value
Regurgitant orifice	1.22	1.16 – 1.28	<0.001
Regurgitant volume	1.42	1.28 – 1.57	<0.001
LV ESV index	1.80	1.20 – 2.57	0.01

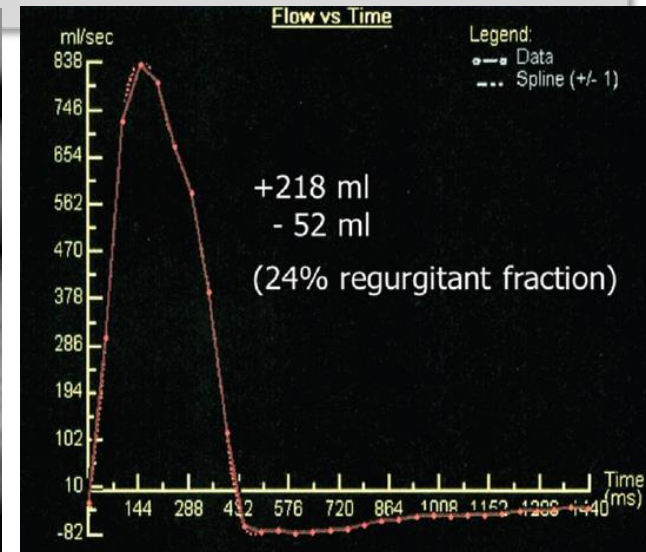
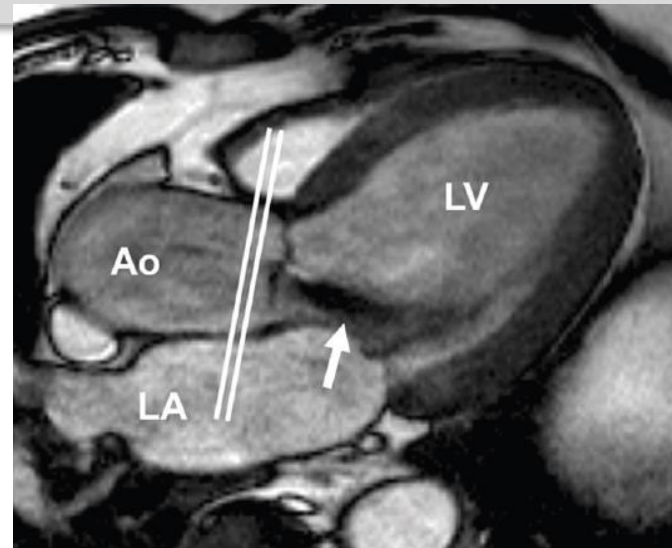
Imaging

Aortic Regurgitation Quantification Using Cardiovascular Magnetic Resonance

Association With Clinical Outcome

Saul G. Myerson, MBChB, MD, MRCP, FESC; Joanna d'Arcy, MBChB, MRCP;
Raad Mohiaddin, PhD, FRCR, FRCP, FESC; John P. Greenwood, MBChB, PhD;
Theodoros D. Karamitsos, MD, PhD; Jane M. Francis, DCR(R), DNM;
Adrian P. Banning, MBBS, MD, FRCP, FESC;
Jonathan P. Christiansen, MBChB, MD, FRACP, FACC, FCSANZ;
Stefan Neubauer, MD, FRCP, FACC, FMedSci

Circulation. 2012;126:1452-1460



Imaging

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Circulation 2012;126:1452-1460

	Univariate		Multivariable	
	HR	P value	HR	P value
Regurgitant fraction	16.0	<0.0001	7.4	<0.0001
Regurgitant volume	13.2	<0.0001	13.2	0.0001
LVEDV	16.3	<0.0001	6.1	0.002
LVESV	7.0	<0.0001		
LV mass	3.2	<0.001		

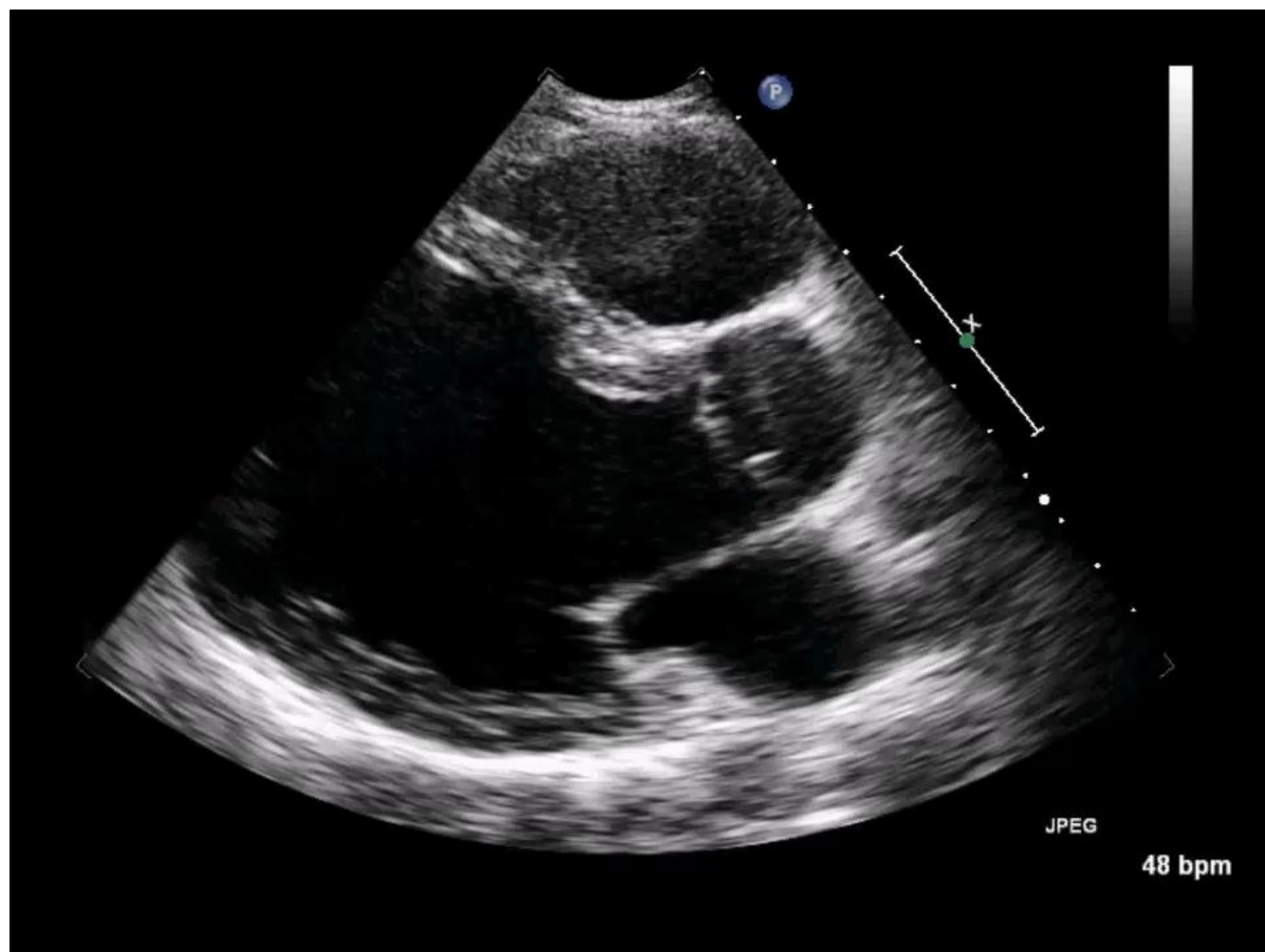
Prospective Validation of the Prognostic Usefulness of B-Type Natriuretic Peptide in Asymptomatic Patients With Chronic Severe Aortic Regurgitation

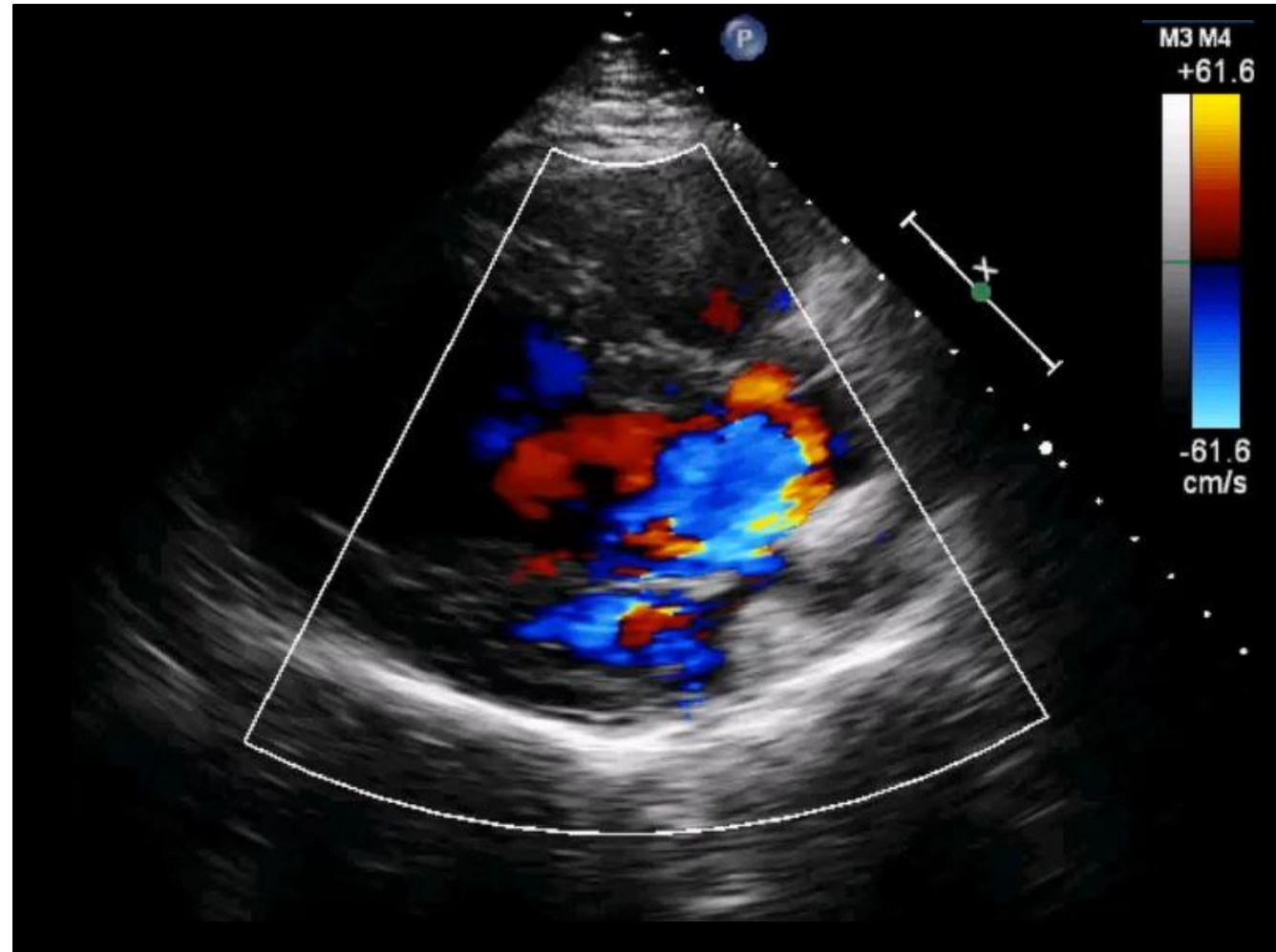
Rodolfo Pizarro, MD, Oscar O. Bazzino, MD, Pablo F. Oberti, MD, Mariano L. Falconi, MD, Aníbal M. Arias, MD, Juan G. Krauss, MD, Arturo M. Cagide, MD

Buenos Aires, Argentina

J Am Coll Cardiol 2011; 58:1705–14

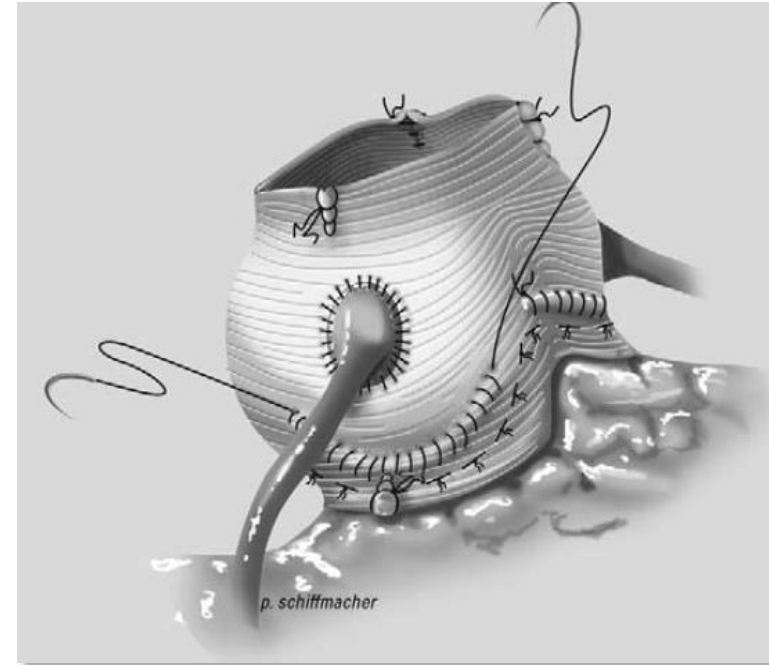
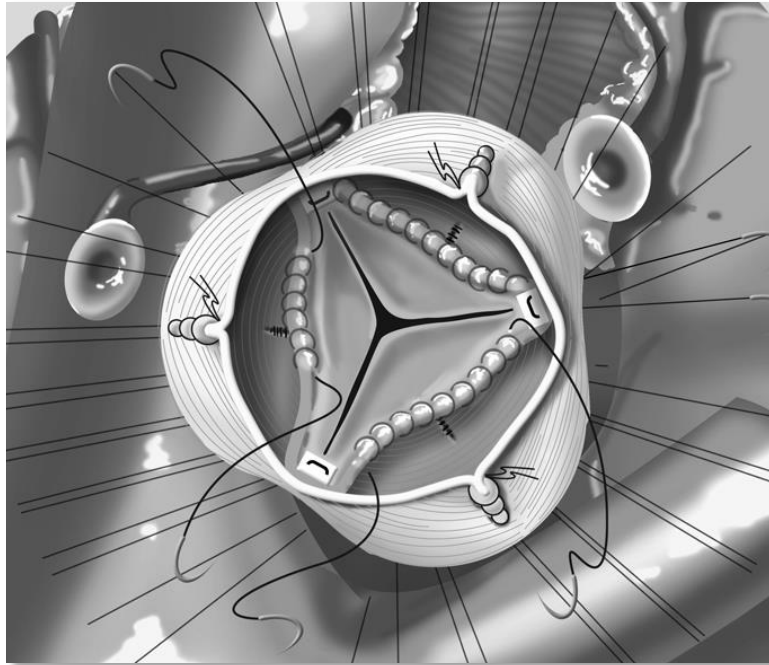
	Univariate		Multivariable	
	HR	P value	HR	P value
BNP	6.6	0.0001	6.9	0.0001
Regurgitant orifice	4.4	0.0001	3.4	0.001
LVESD index	3.6	0.001	4.3	0.01
LVEDD index	2.2	0.01	2.1	0.09
LVESV index	2.1	0.031		
LVEDV index	1.8	0.045		



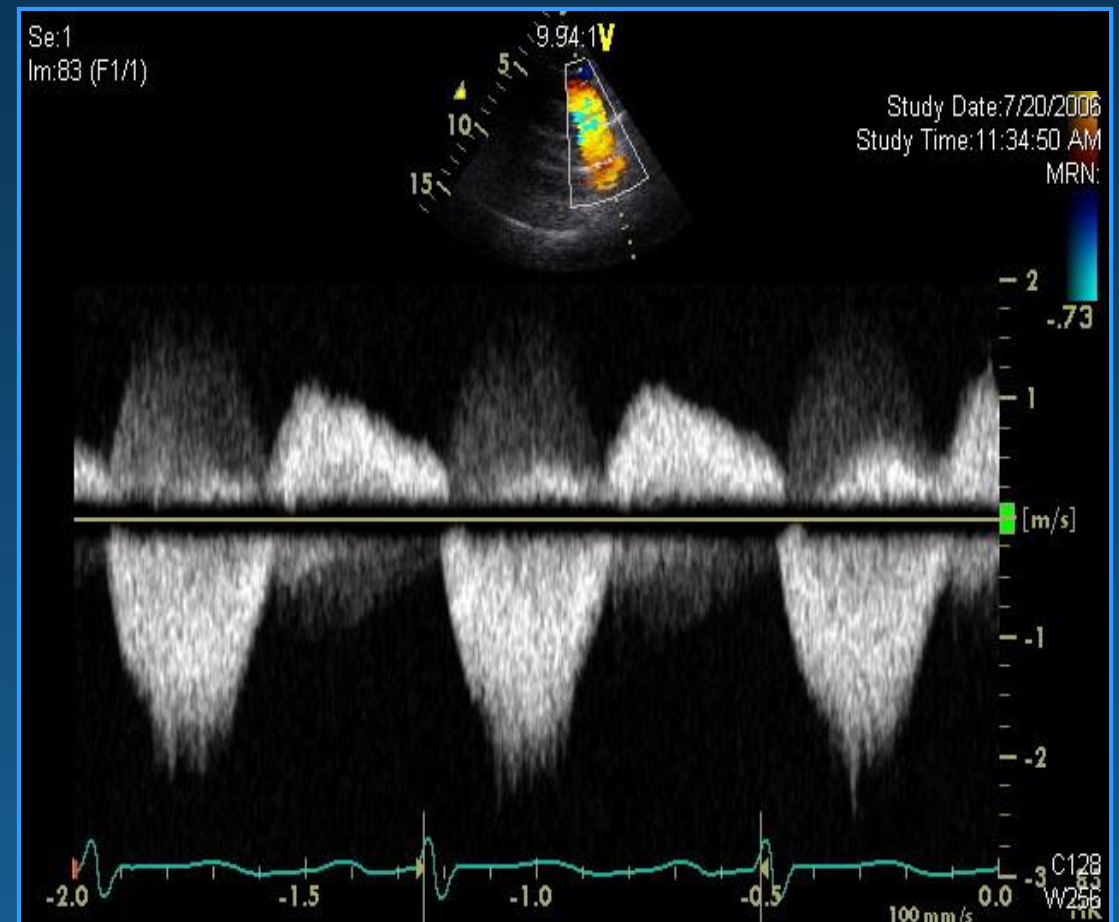
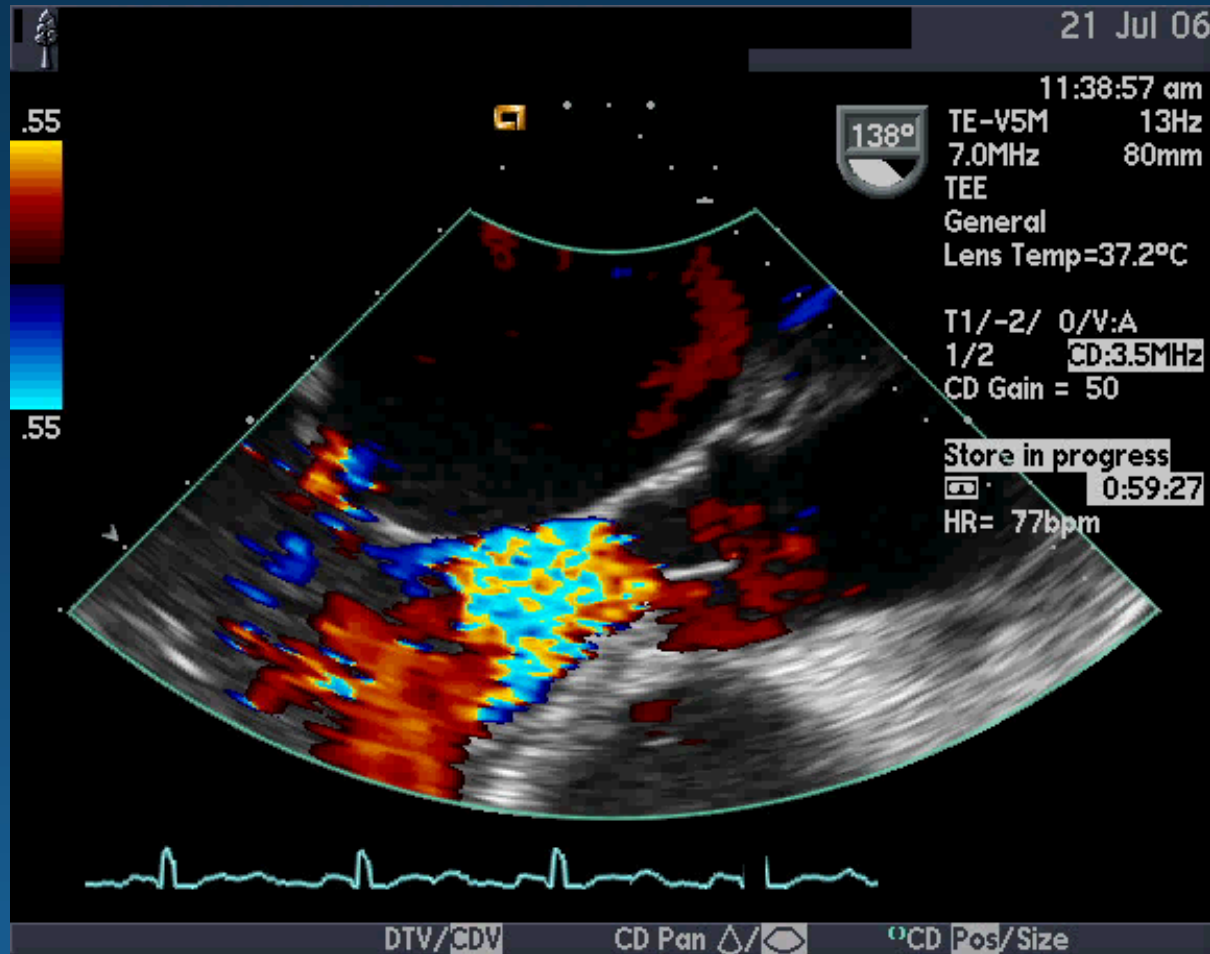


Aortic Regurgitation

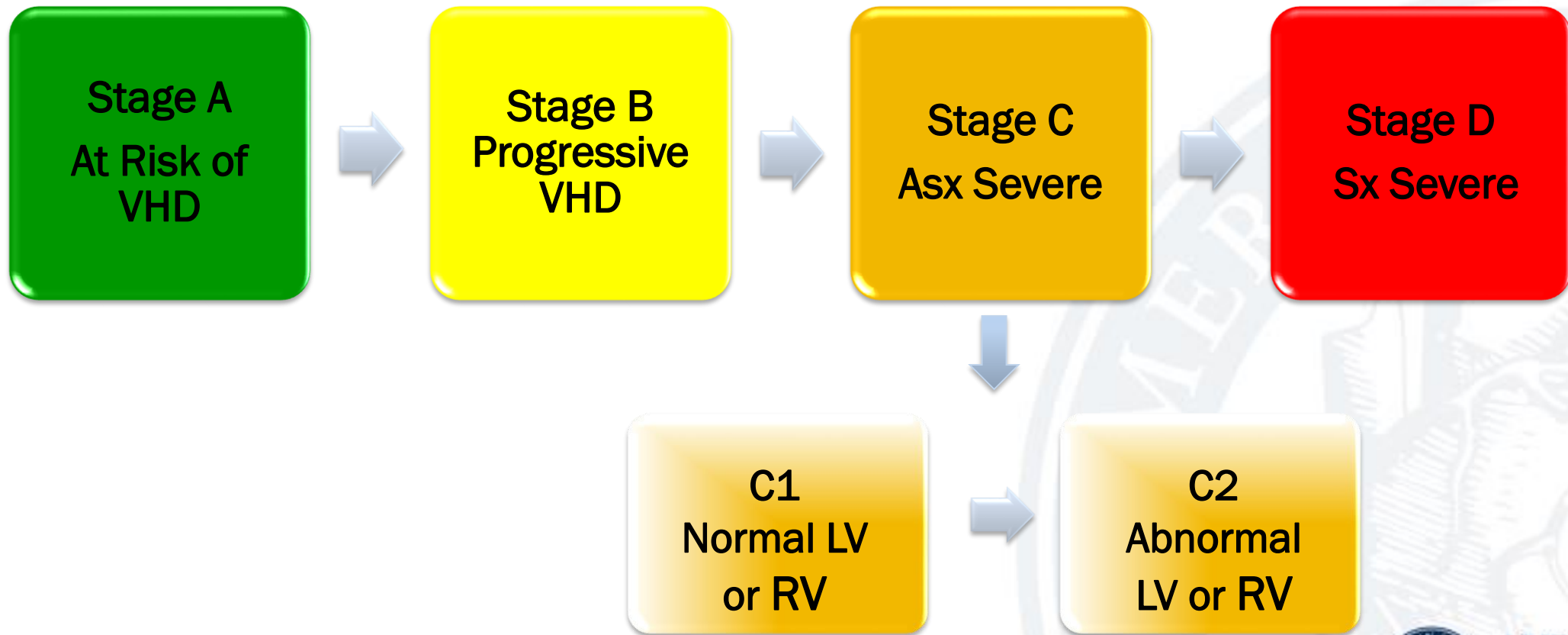
Aortic Valve Repair



Acute Severe AR



Stages of Chronic VHD



Aortic Regurgitation

Medical Therapy

Recommendations	COR	LOE
Treatment of hypertension (systolic BP >140 mm Hg) is recommended in patients with chronic AR (stages B and C), preferably with dihydropyridine calcium channel blockers or angiotensin-converting enzyme (ACE) inhibitors/angiotensin-receptor blockers (ARBs)	I	B
Medical therapy with ACE inhibitors/ARBs and beta blockers is reasonable in patients with severe AR who have symptoms and/or LV dysfunction (stages C2 and D) when surgery is not performed because of comorbidities	IIa	B

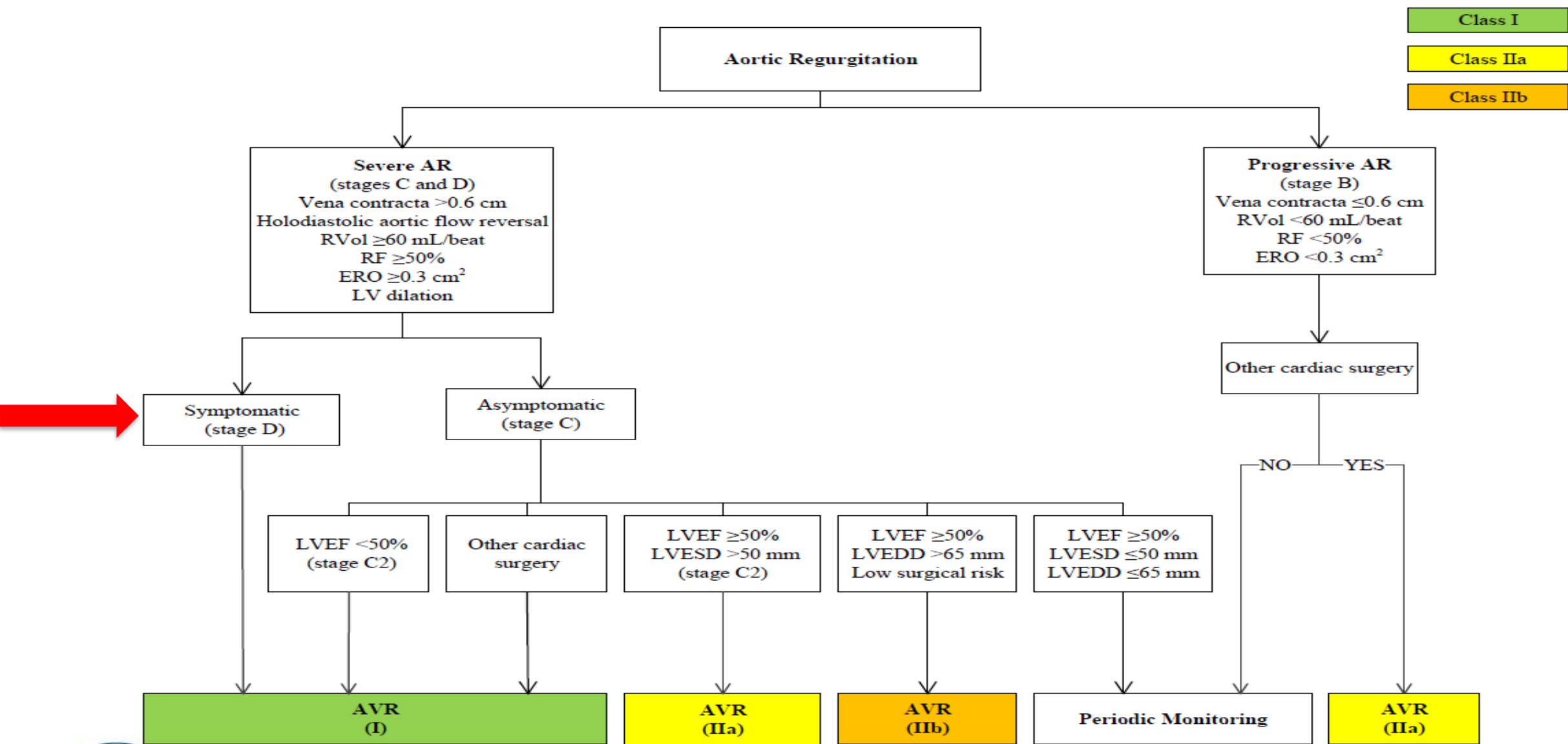


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Indications for Aortic Valve Replacement for Chronic Aortic Regurgitation



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Aortic Regurgitation

Intervention

Recommendations	COR	LOE
AVR is indicated for symptomatic patients with severe AR regardless of LV systolic function (stage D)	I	B
AVR is indicated for patients with severe AR (stage C or D) who are undergoing other cardiac surgery	I	C

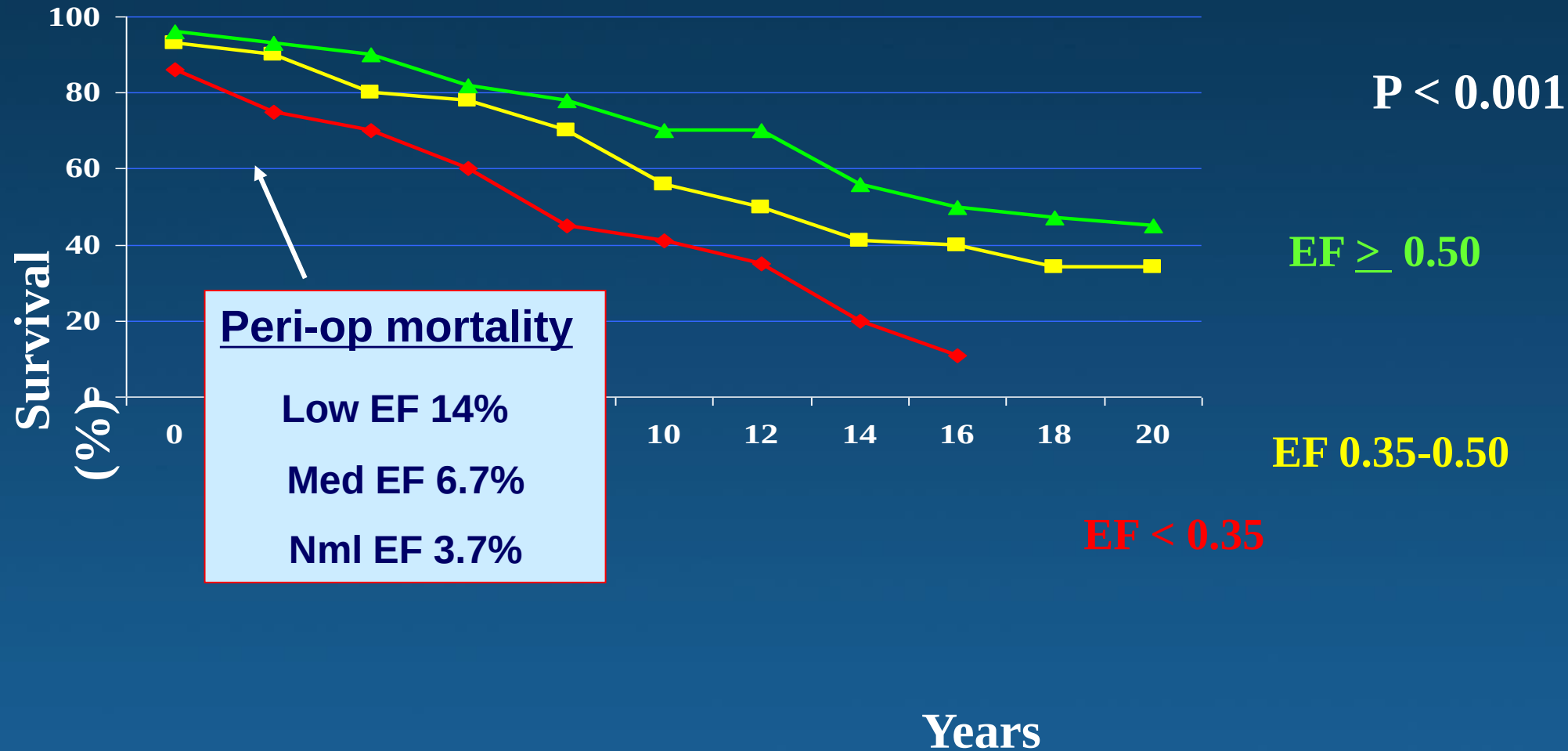


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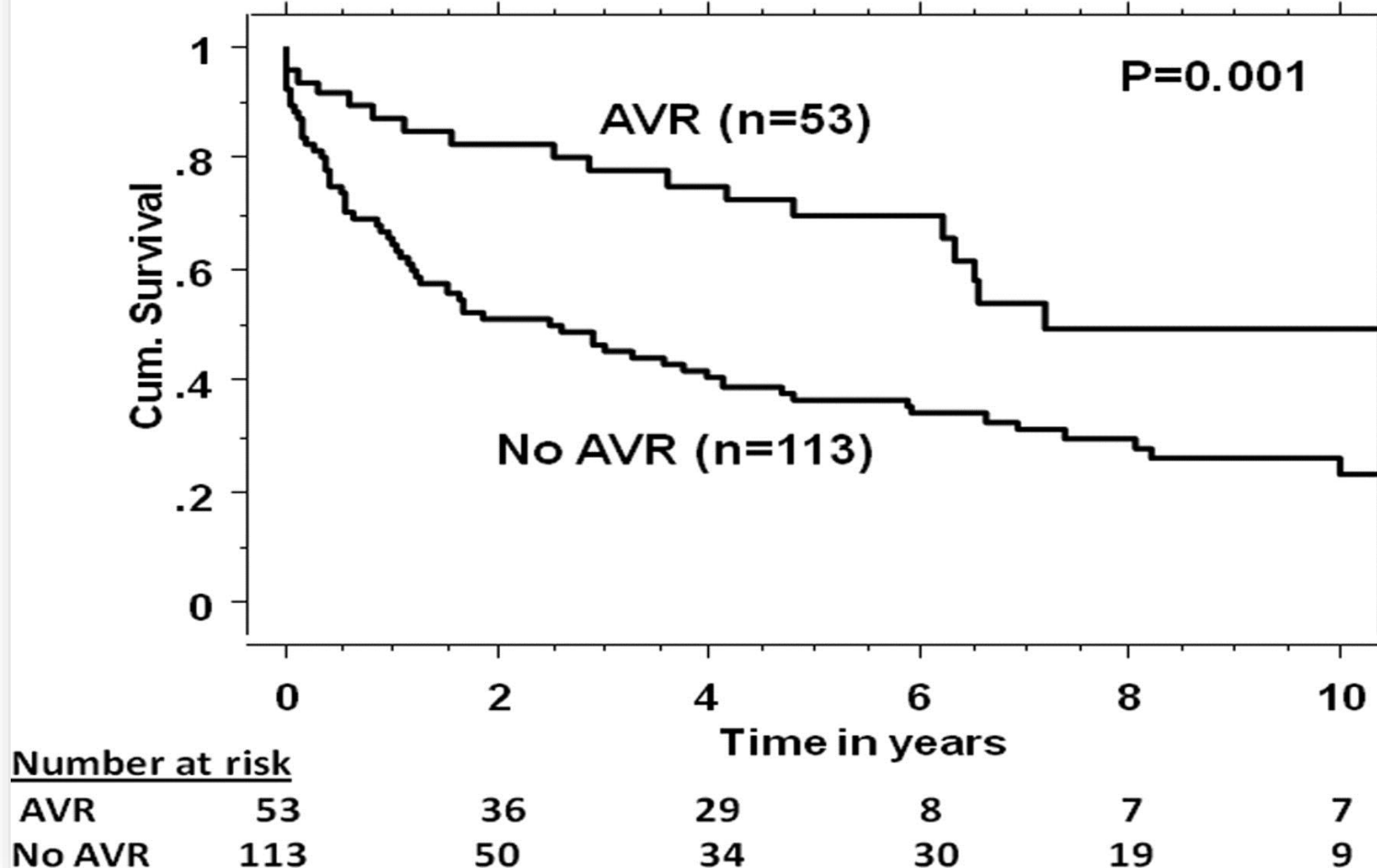


Survival After AVR

Pre-Operative LV Function

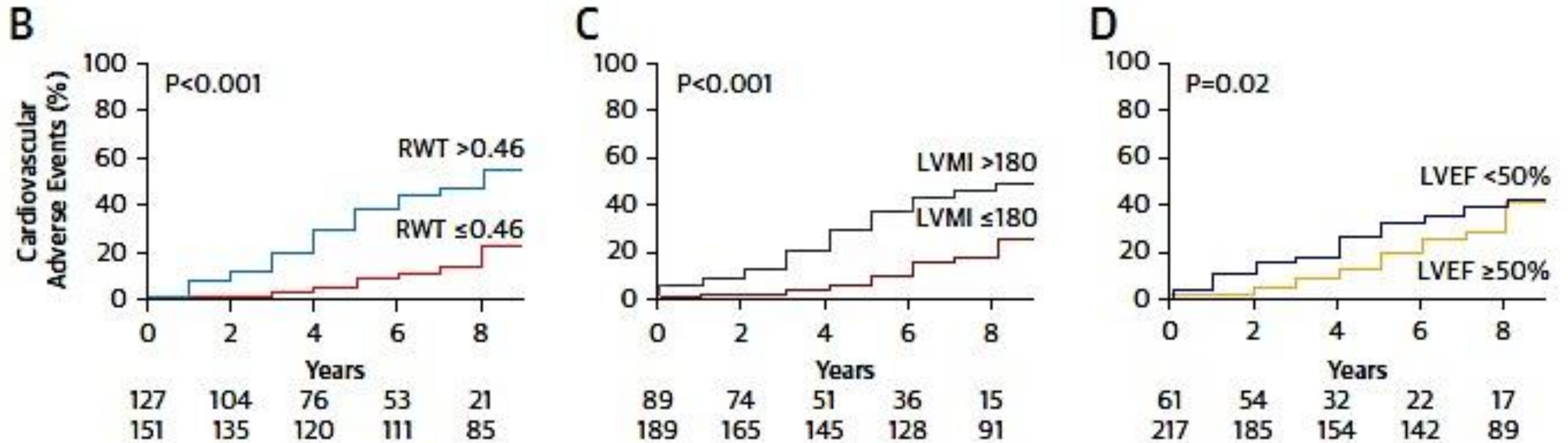


AVR with $EF \leq 0.35$



Kamath A R et al. *Circulation* 2009;120:S134-S138

Outcomes in Patients with AS/AR

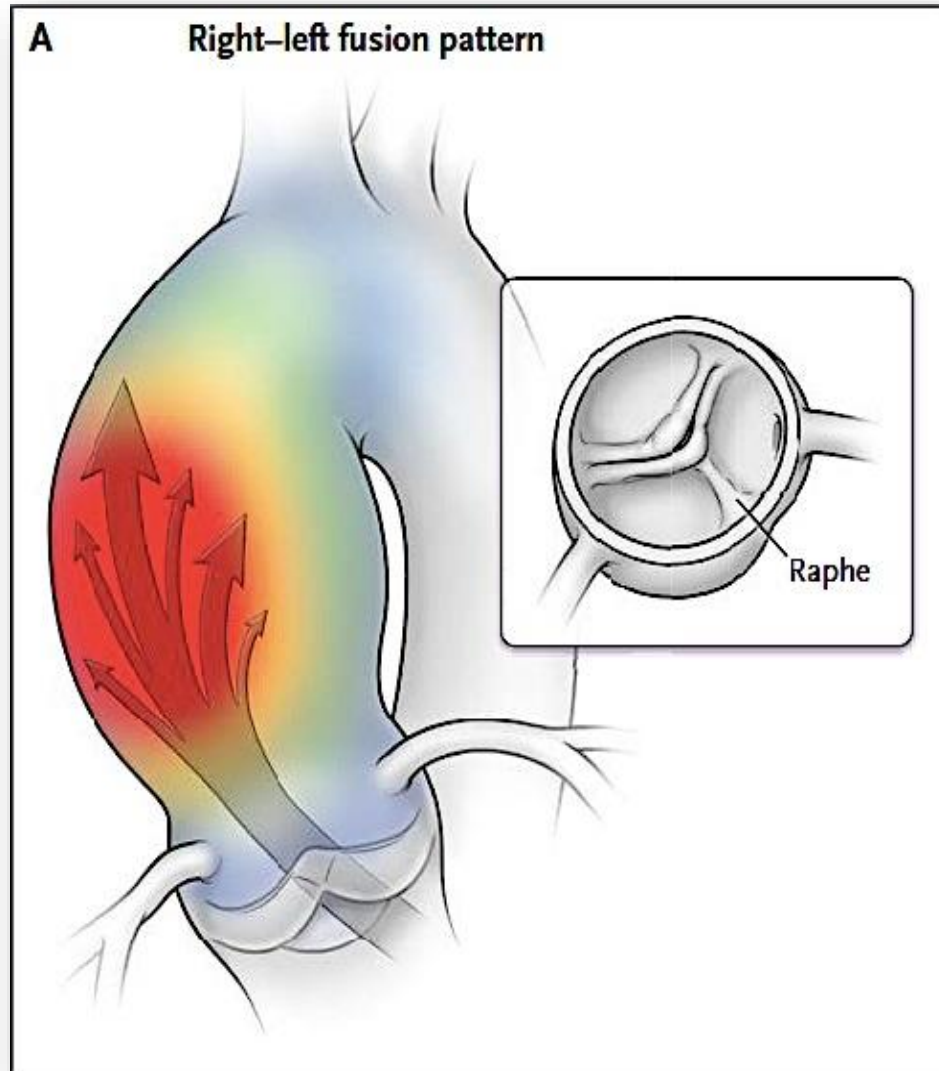


Egbe AC and Warnes CA. JACC 2016;68:2591-3

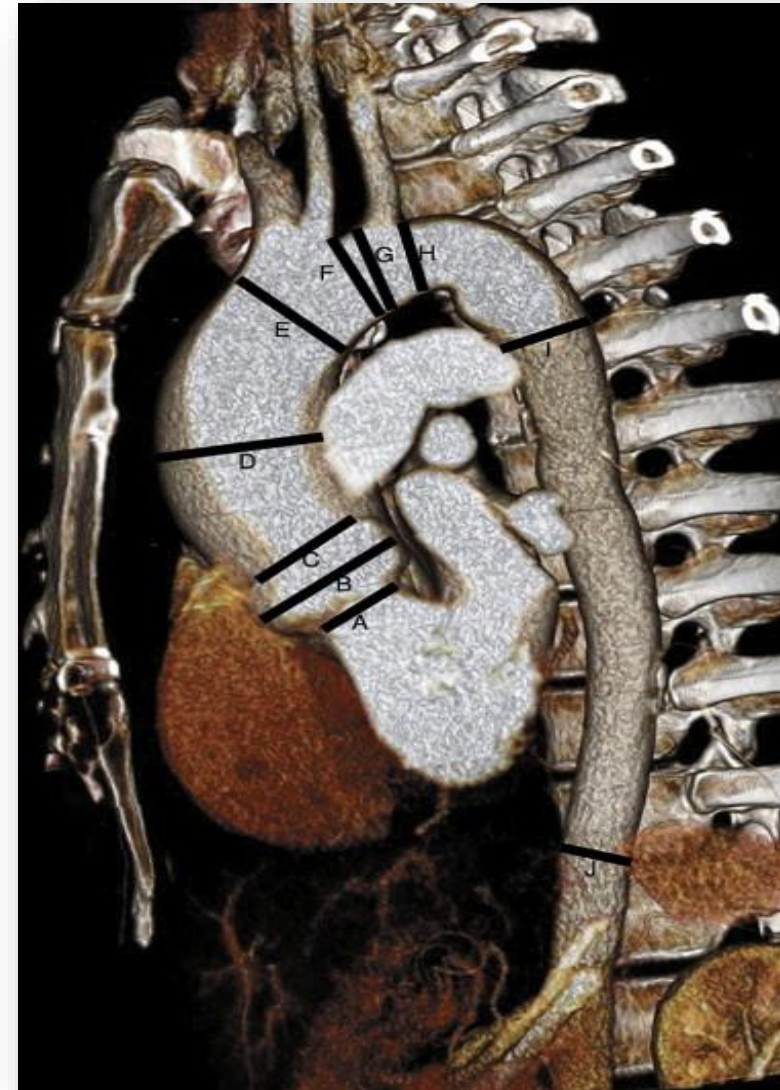


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Aortopathy



Verma S and Siu SC. NEJM 2014; 370:1920-9.



Fazel SS et al. JTCVS 2008; 131:901-7

Bicuspid Aortic Valve and Aortopathy

Intervention

Recommendations	COR	LOE
Operative intervention to repair the aortic sinuses or replace the ascending aorta is indicated in patients with a bicuspid aortic valve if the diameter of the aortic sinuses or ascending aorta is greater than 5.5 cm	I	B
Operative intervention to repair the aortic sinuses or replace the ascending aorta is reasonable in patients with bicuspid aortic valves if the diameter of the aortic sinuses or ascending aorta is greater than 5.0 cm and a risk factor for dissection is present (family history of aortic dissection or if the rate of increase in diameter is ≥ 0.5 cm per year)	IIa	C
Replacement of the ascending aorta is reasonable in patients with a bicuspid aortic valve who are undergoing aortic valve surgery because of severe AS or AR (Sections 3.4 and 4.4) if the diameter of the ascending aorta is greater than 4.5 cm	IIa	C

Adult Echo

X5-1

50Hz

16cm

2D

63%

C 50

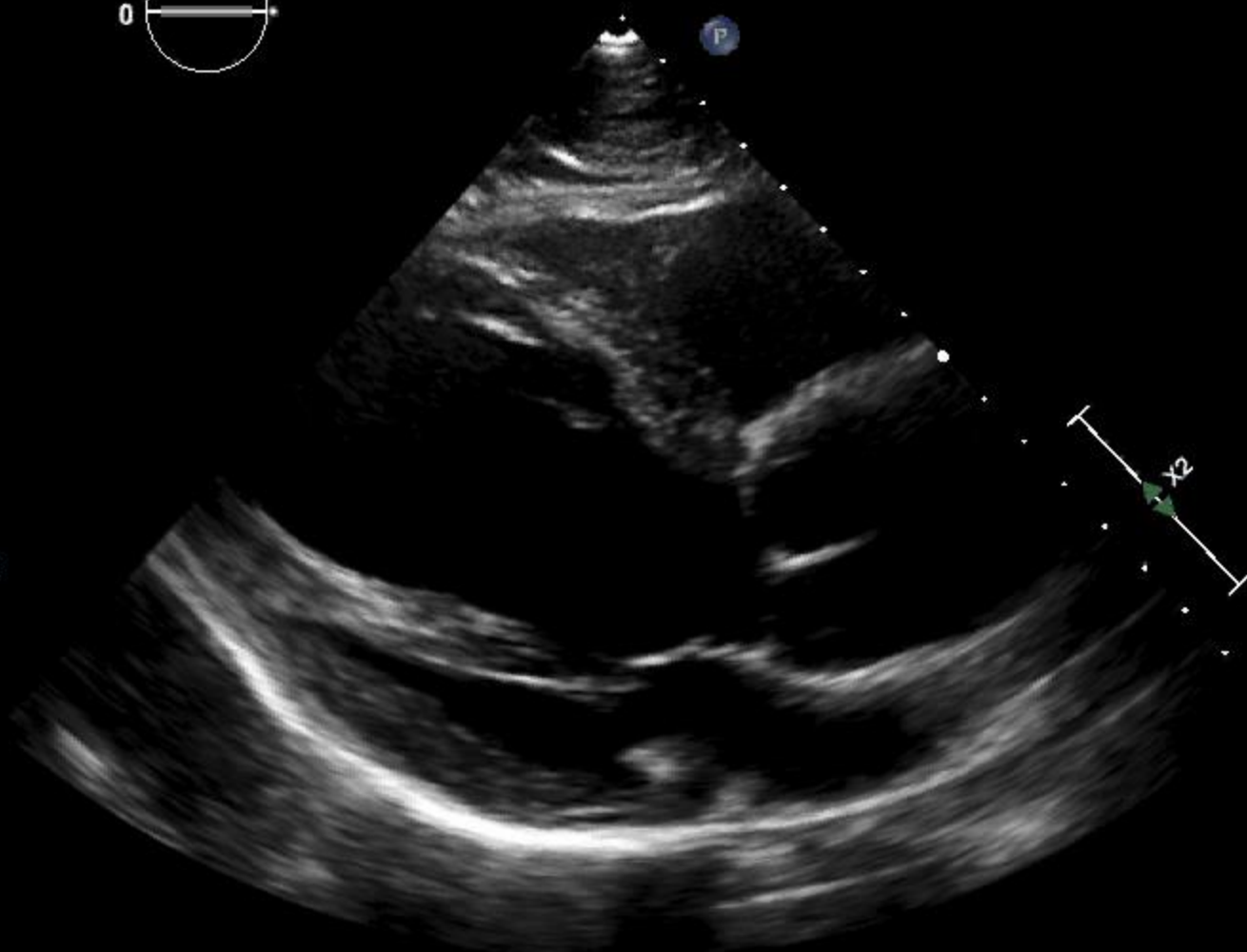
P Low

HGen



TIS0.4 MI 1.3

M3



59 bpm

Adult Echo

X5-1

21Hz

16cm

2D

65%

C 50

P Low

HGen

CF

50%

5011Hz

WF 501Hz

2.5MHz

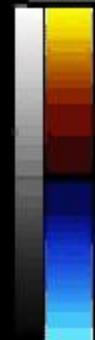
ⓐ
P R
1.6 3.2



TIS0.8 MI 0.8

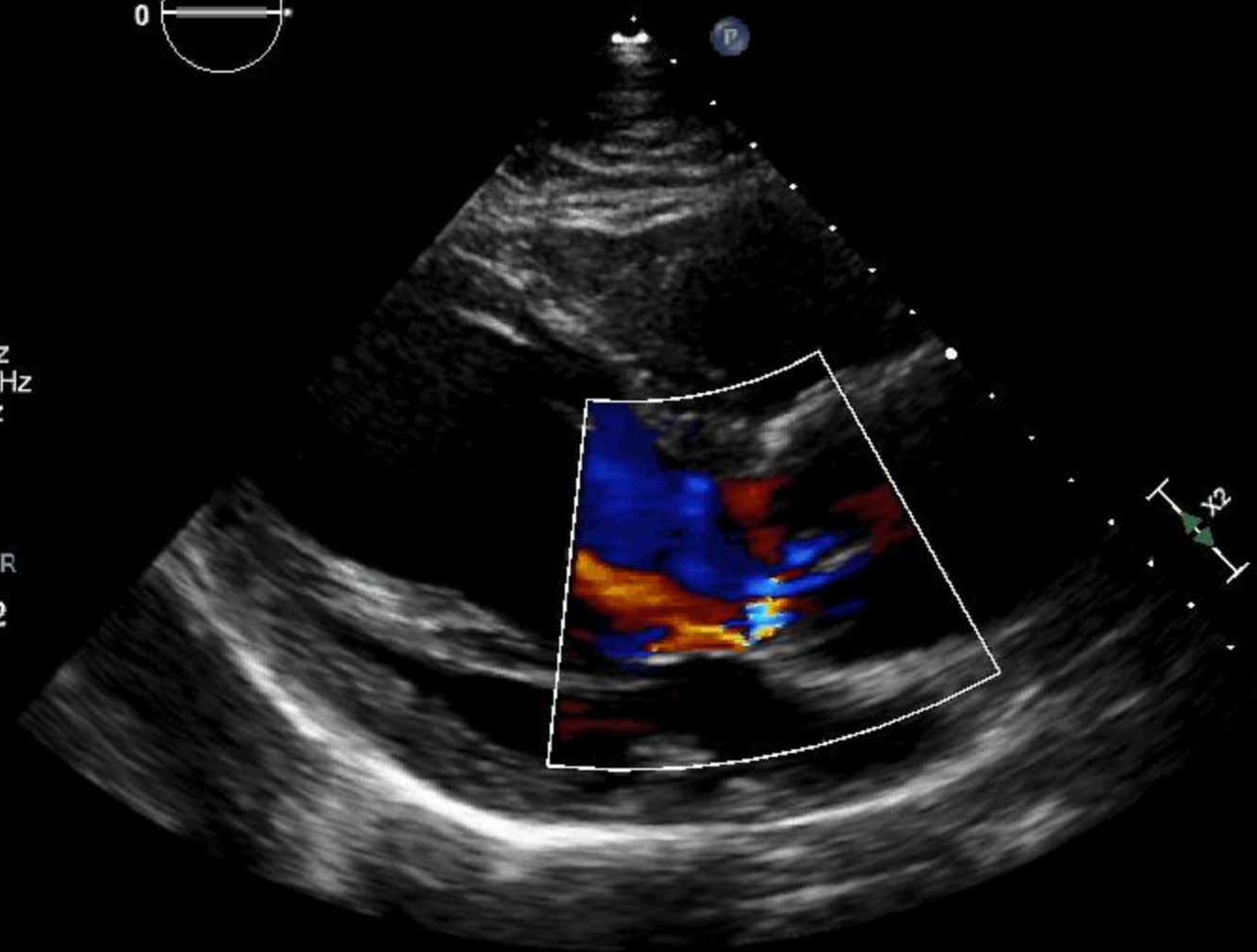
M3 M4

+77.2



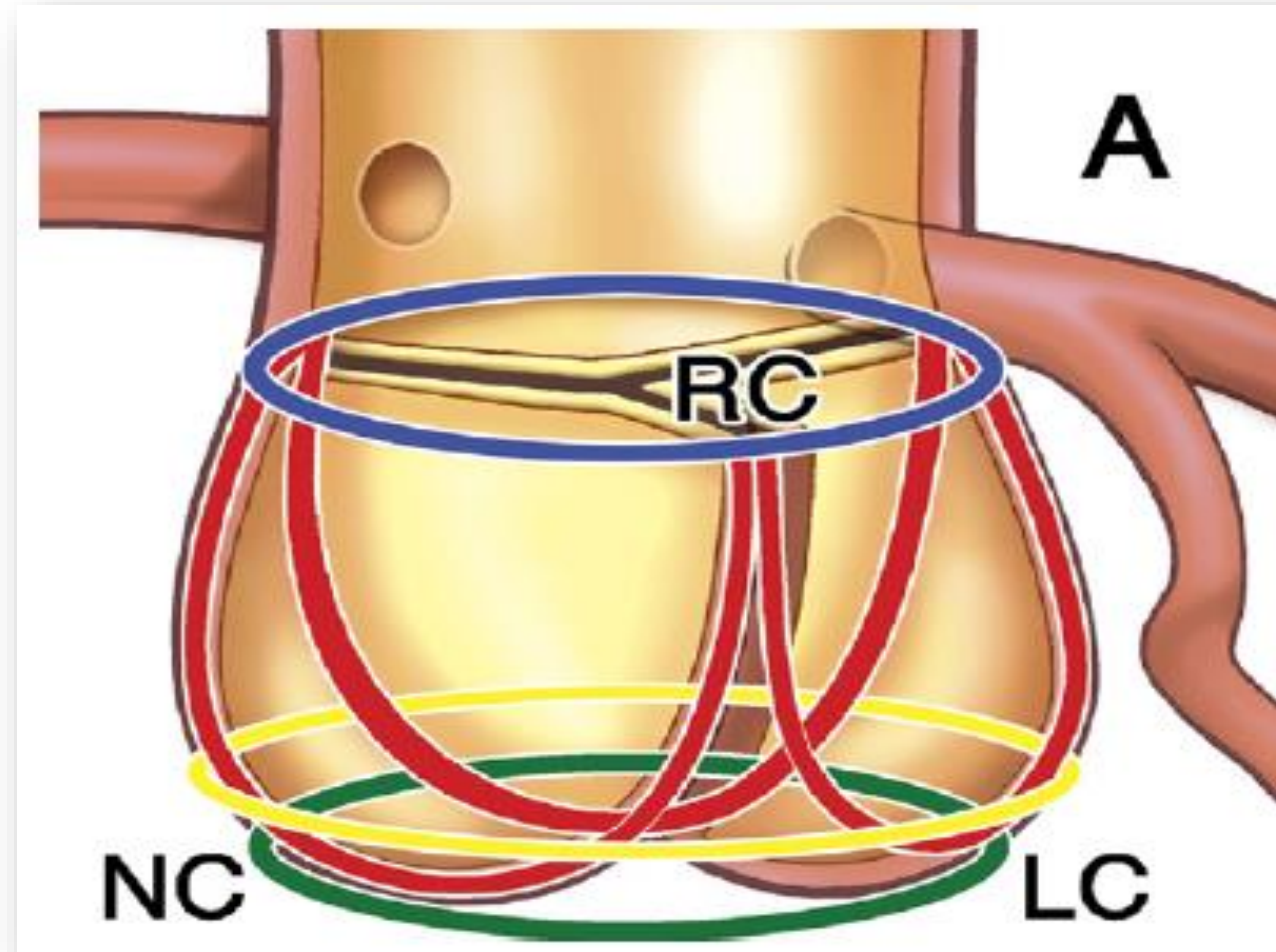
-77.2

cm/s



57 bpm

Aortic Valve and Root

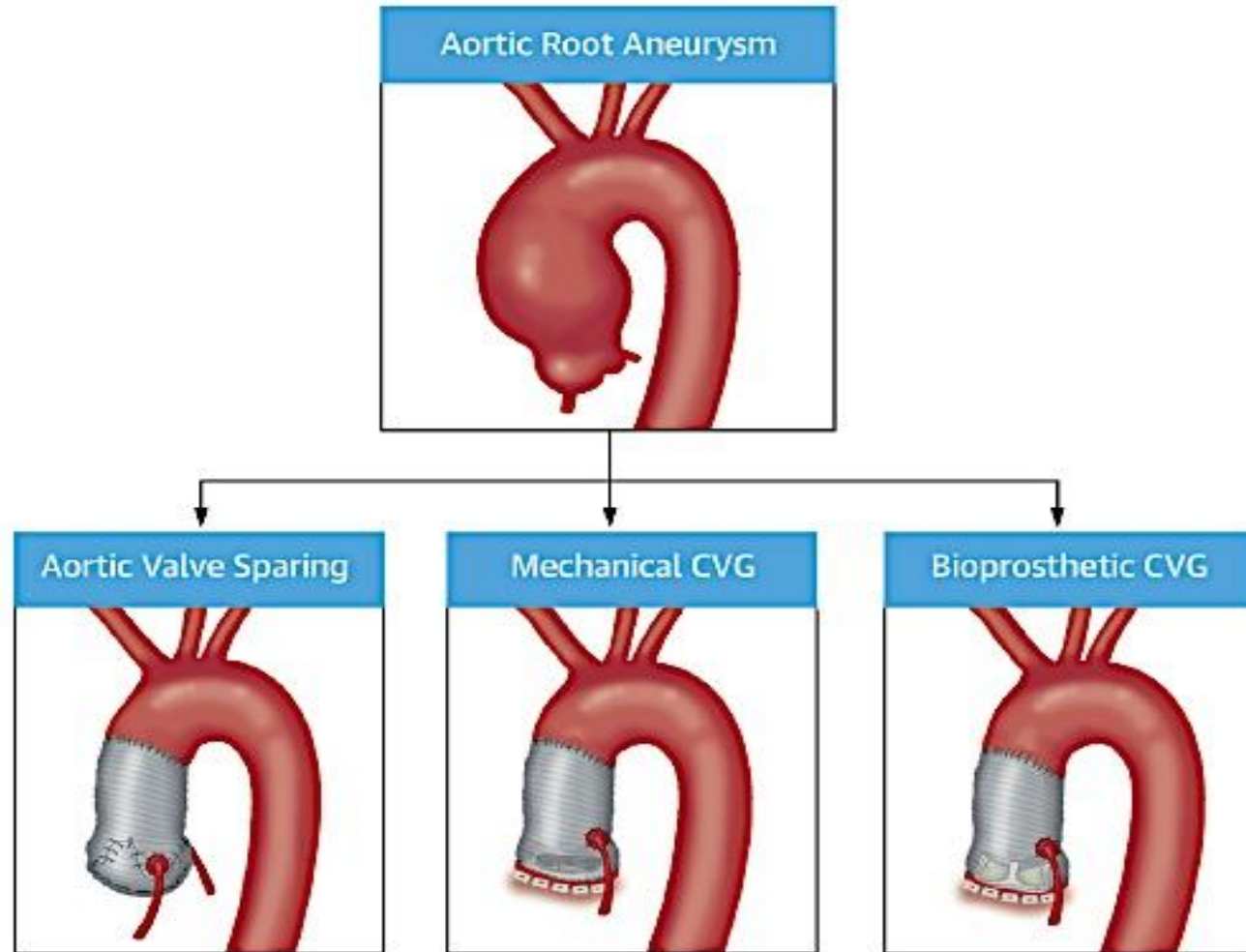


Leipsic J et al. JACC Imag 2011; 4:416-29



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Aortic Root Surgery

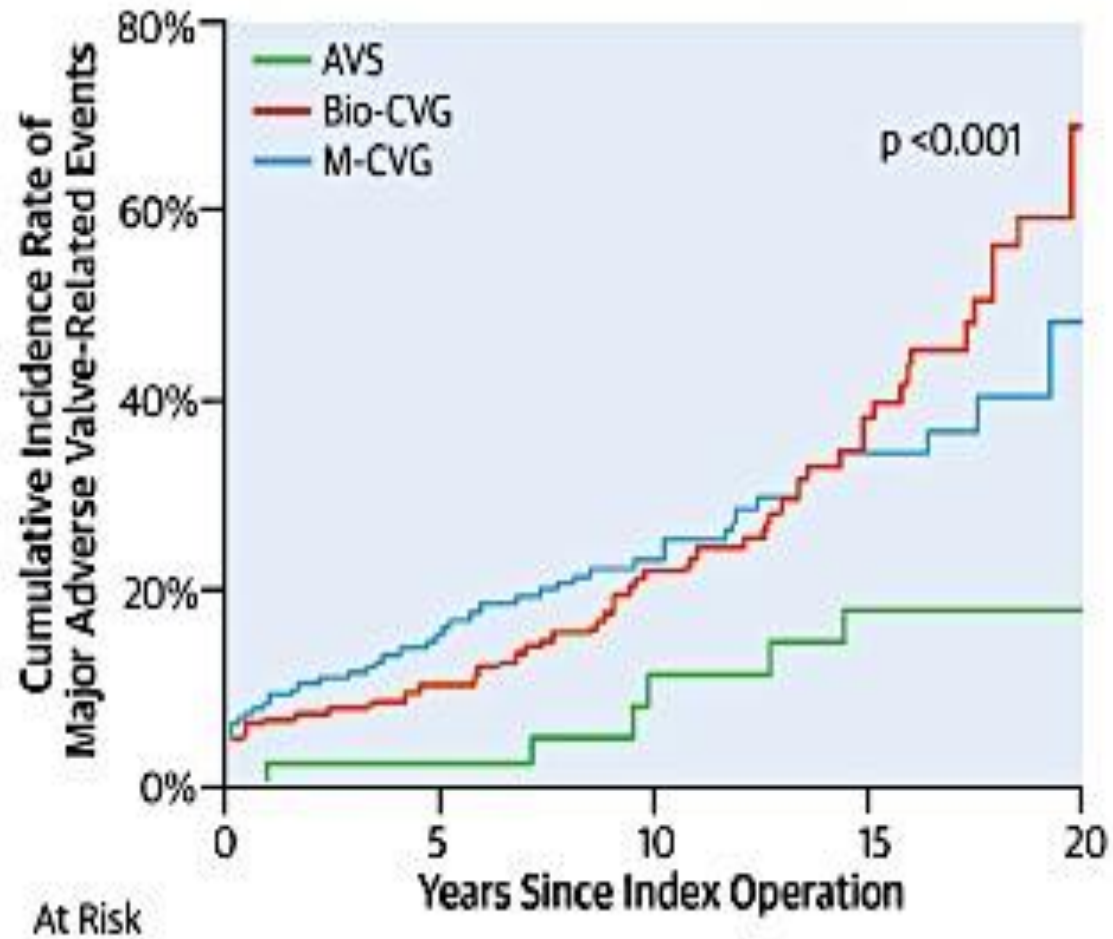


Ouzounian M et al. JACC 2016;68:1838-47



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Major Adverse Valve-Related Events



Ouzounian M et al. JACC 2016;68:1838-47



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A

Morphological Features of Aortic Valve Stenosis or Regurgitation

Calcific Aortic Valve Stenosis

- 1- Nodular calcific deposits on aortic side



Aortic Valve Regurgitation

- 1- Minimal or absent cusp calcification
2- Dilated aortic root
3- Frequent coexistence of dilated ascending aorta



Technical Challenges of TAVR in Aortic Valve Regurgitation

Suboptimal Fluoroscopic Visualization of the Native Valve

Insufficient Anchoring and Sealing of the Transcatheter Device

Risk of Misplacement and Migration of the Device

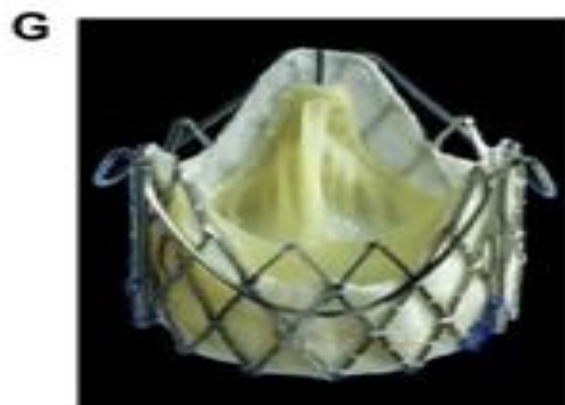
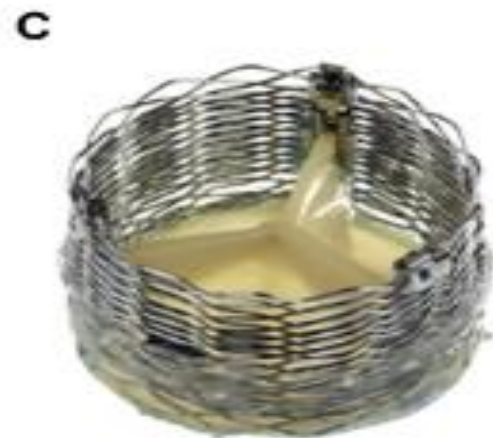
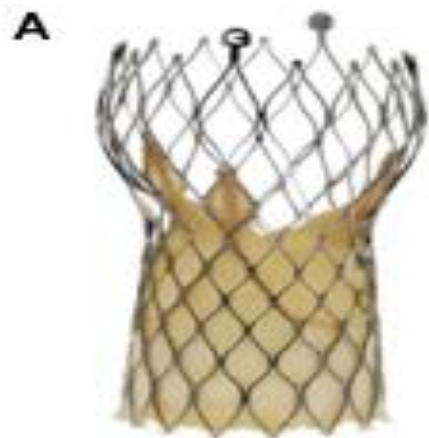
Risk of Residual Valvular Regurgitation

Franzone A et al. JACC Interv. 2016
<http://dx.doi.org/10.1016/j.jcin.2016.09.030>



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TAVR for AR



J-Valve for AR

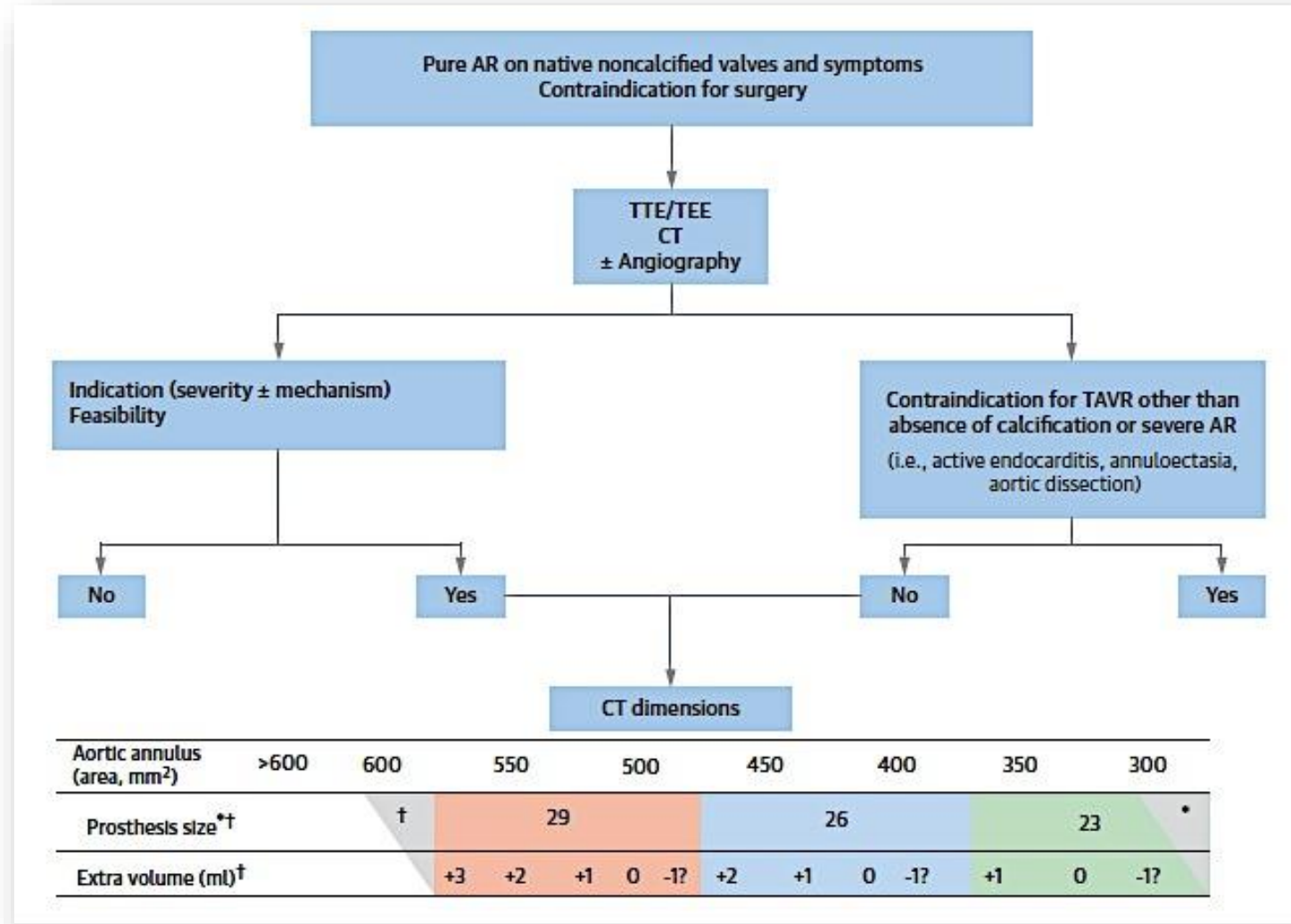


Zhu D et al. JACC 2016;67:2802-8



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Imaging for TAVR in AR: Sapien 3

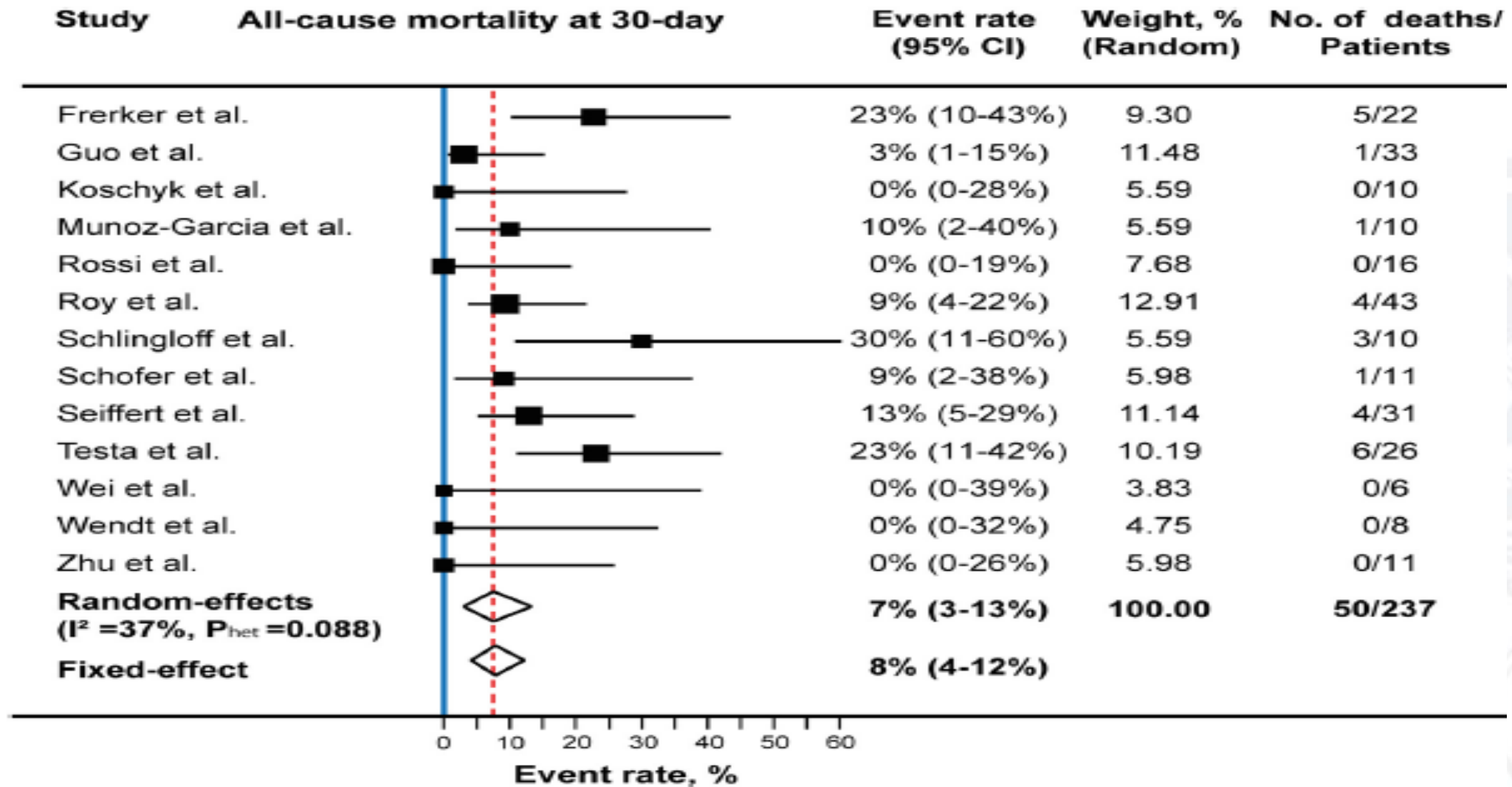


Urena M et al. JACC 2016; 68.



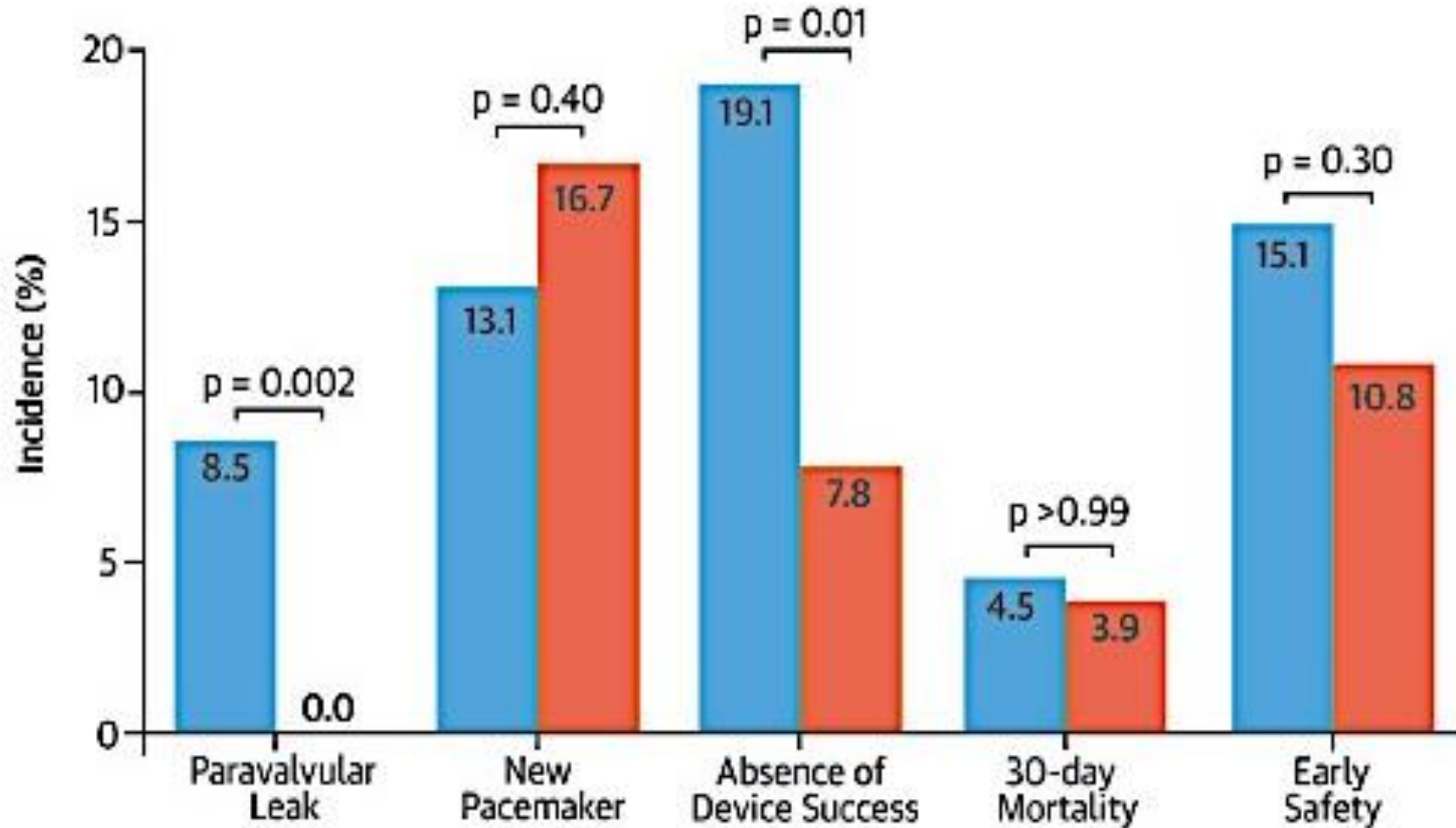
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TAVR Experience in Pure AR



TAVR for BAV Disease

B-TAVR Registry (n=301)



Yoon S-H et al. JACC 2016;68:1195-205



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Aortic Regurgitation

- **Establish etiology & mechanism**
- **Determine severity**
- **Evolving indications for intervention**
- **Surgical approaches**
- **Emerging TAVR capabilities**

