23 of March 2013

Challenge of the Multivalvular Heart Disease

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Distribution of Valvular Heart Diseases in the Euro Heart Survey

5001 patients

- **Native Valve Disease 72%**
  - AS 34%
  - AR 10%
  - MS 10%
  - MR 25%
  - Multiple 20%
  - Right 1%
- **Previous Valvular Intervention 28%**
  - Valve Repair 18%
  - Valve Replacement 82%

lung et al. *Eur Heart J* 2003;24:1244-53

European Heart Journal 2012 - doi:10.1093/eurheartj/ehs109 & European Journal of Cardio-Thoracic Surgery 2012 - doi:10.1093/ejcts/ezs455).

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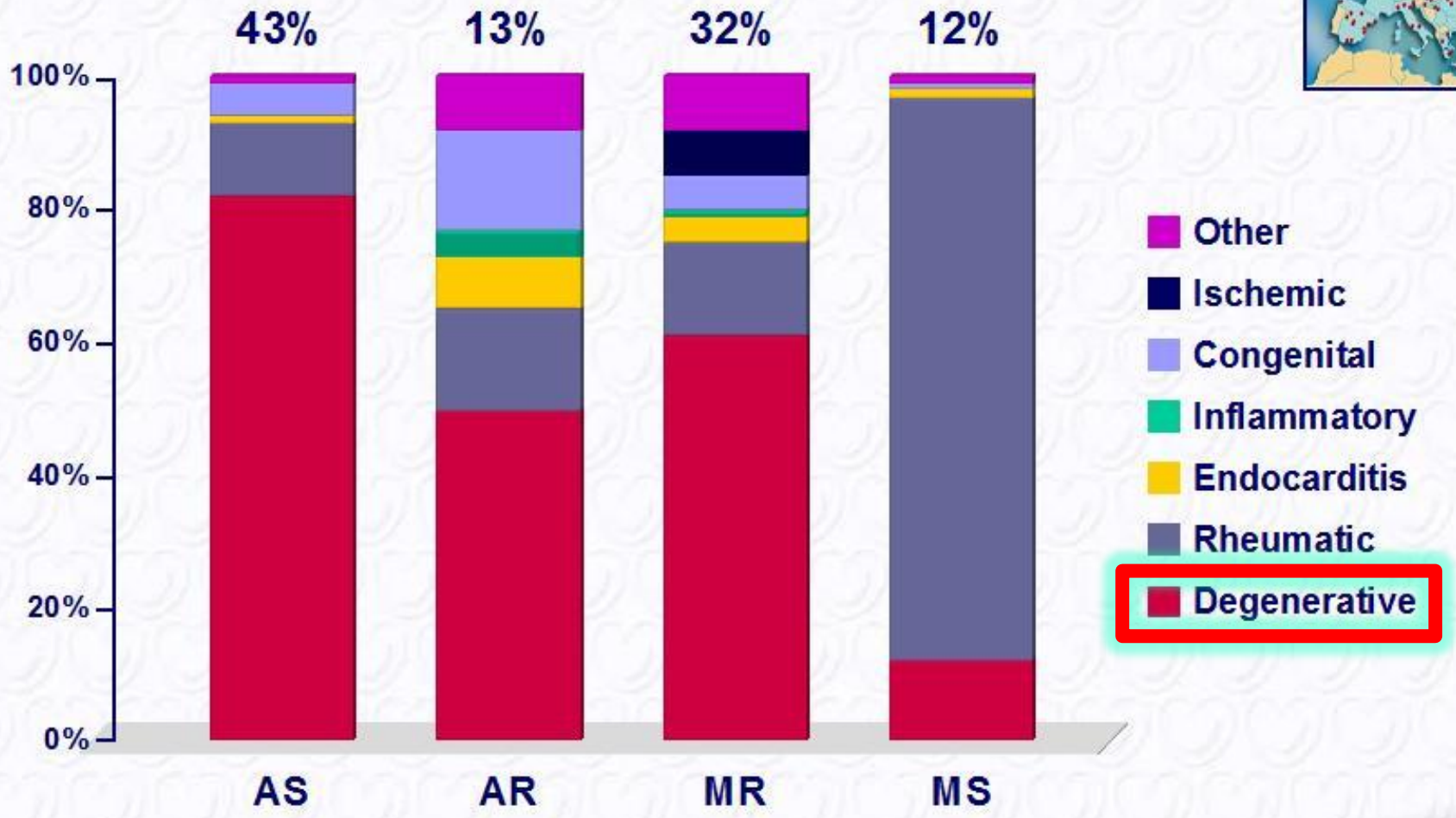
Aetiologies of Single Valvular Heart Diseases in the Euro Heart Survey



Iung et al. *Eur Heart J* 2003;24:1244-53

European Heart Journal 2012 - doi:10.1093/eurheartj/ehs109 &
European Journal of Cardio-Thoracic Surgery 2012 -
doi:10.1093/ejcts/ezs455).

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Echocardiographic criteria for the definition of severe valve stenosis: *an integrative approach*

	Aortic stenosis	Mitral stenosis	Tricuspid stenosis
Valve area (cm^2)	< 1.0	< 1.0	–
Indexed valve area (cm^2/m^2 BSA)	< 0.6	–	–
Mean gradient (mmHg)	> 40	> 10	≥ 5
Maximum jet velocity (m/s)	> 4.0	–	–
Velocity ratio	< 0.25	–	–

Adapted from Baumgartner, EAE/ASE recommendations. *Eur J Echocardiogr.* 2010;10:1-25

European Heart Journal 2012 - doi:10.1093/eurheartj/ehs109 & European Journal of Cardio-Thoracic Surgery 2012 - doi:10.1093/ejcts/ezs455).

Echocardiographic criteria for the definition of severe valve regurgitation: *an integrative approach*

	Aortic regurgitation	Mitral regurgitation	Tricuspid regurgitation
Qualitative			
Valve morphology	Abnormal/flail/large coaptation defect	Flail leaflet/ruptured papillary muscle/large coaptation defect	Abnormal/flail/large coaptation defect
Colour flow regurgitant jet	Large in central jets, variable in eccentric jets	Very large central jet or eccentric jet adhering, swirling, and reaching the posterior wall of the left atrium	Very large central jet or eccentric wall impinging jet
CW signal of regurgitant jet	Dense	Dense/triangular	Dense/triangular with early peaking (peak vel < 2 m/s in massive TR)
Other	Holodiastolic flow reversal in descending aorta (EDV > 20 cm/s)	Large flow convergence zone	–

Adapted from Lancellotti, EAE Recommendations. *Eur J Echocardiogr.* 2010;11:223-244 and 307-332

European Heart Journal 2012 - doi:10.1093/eurheartj/ehs109 &
European Journal of Cardio-Thoracic Surgery 2012 -
doi:10.1093/ejcts/ezs455).

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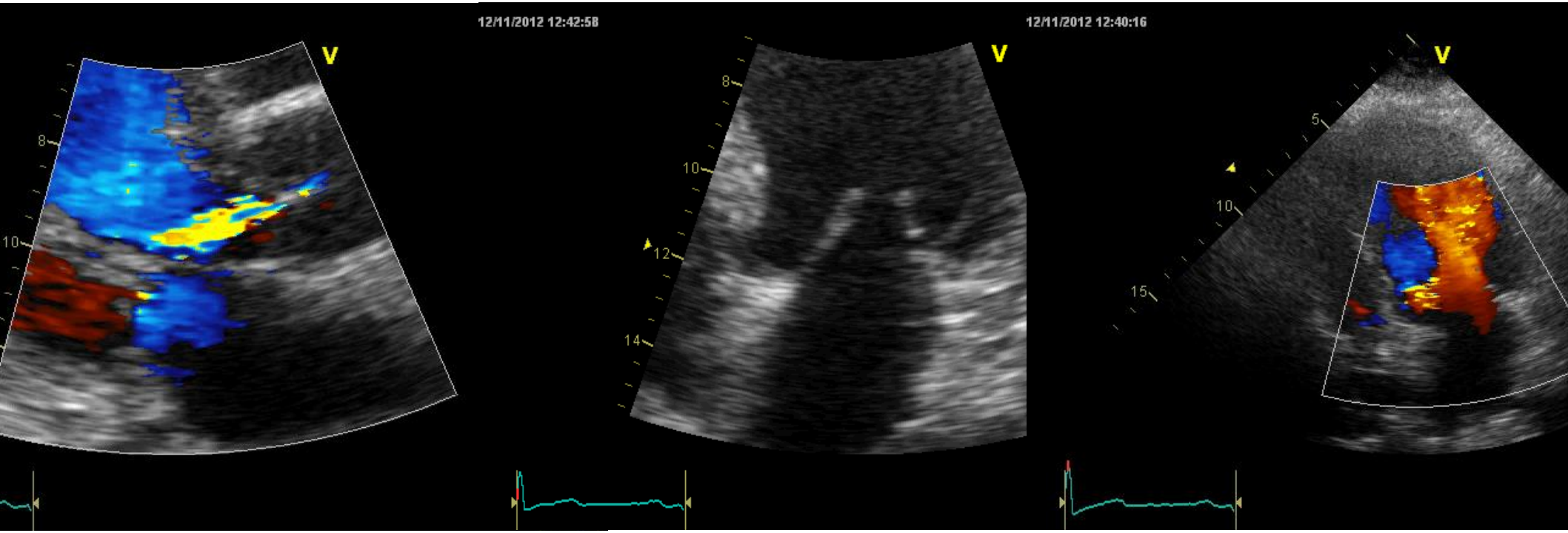
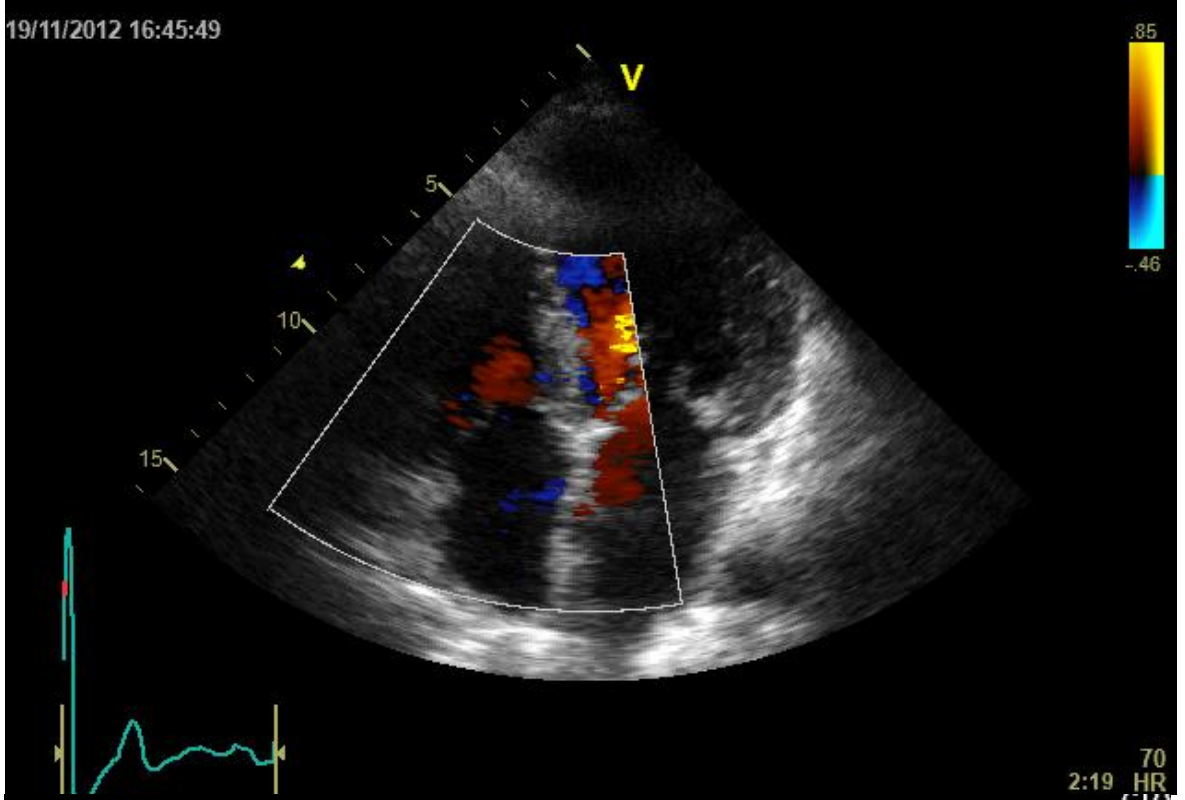
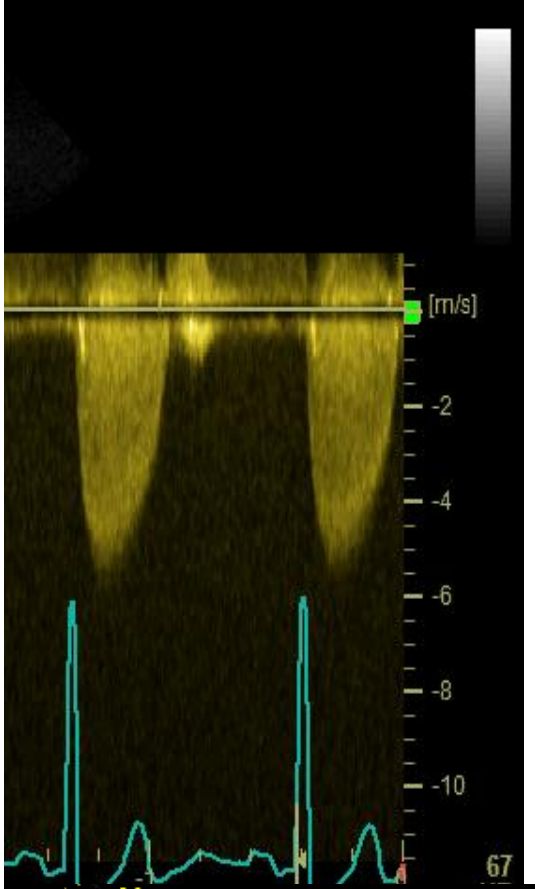
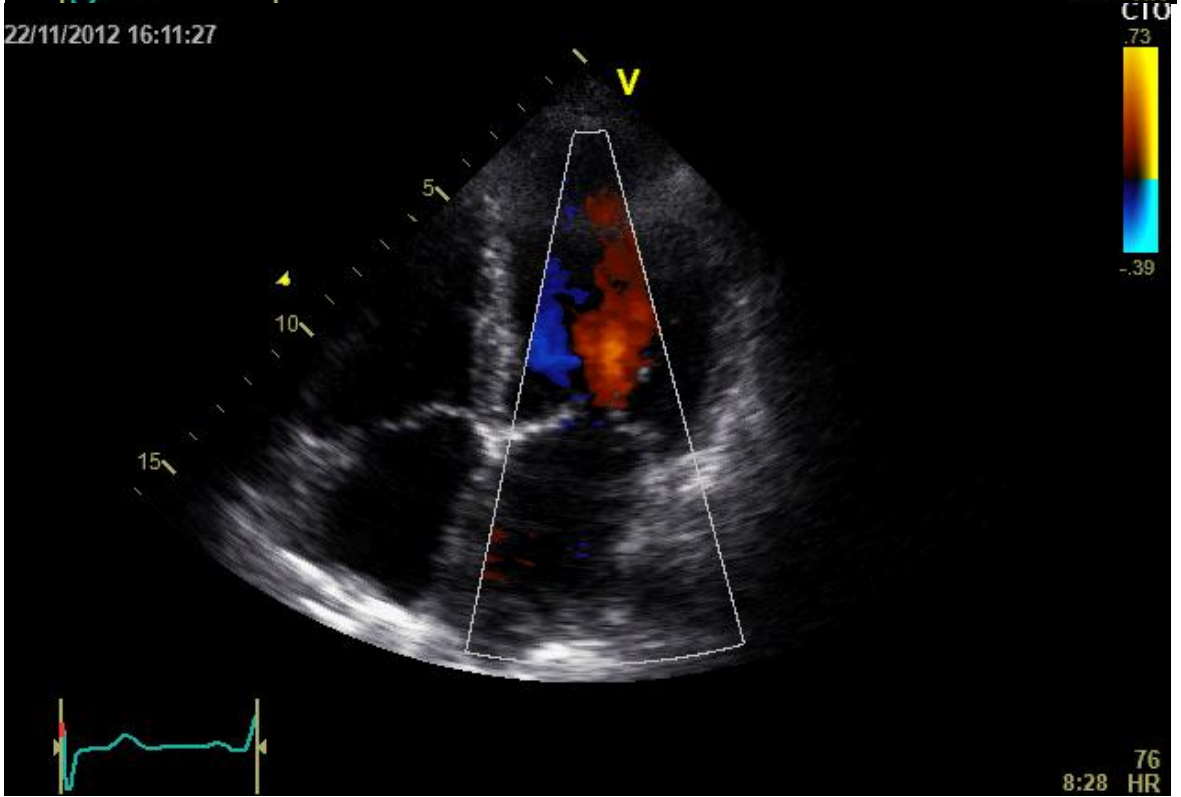
Think about inflammatory or toxic origin!



Tribouilloy et al. Circulation 2013


19/11/2012 16:45:49
V
5
10
15
.85
-.46
70
2:19 HR


[m/s]
-2
-4
-6
-8
-10
67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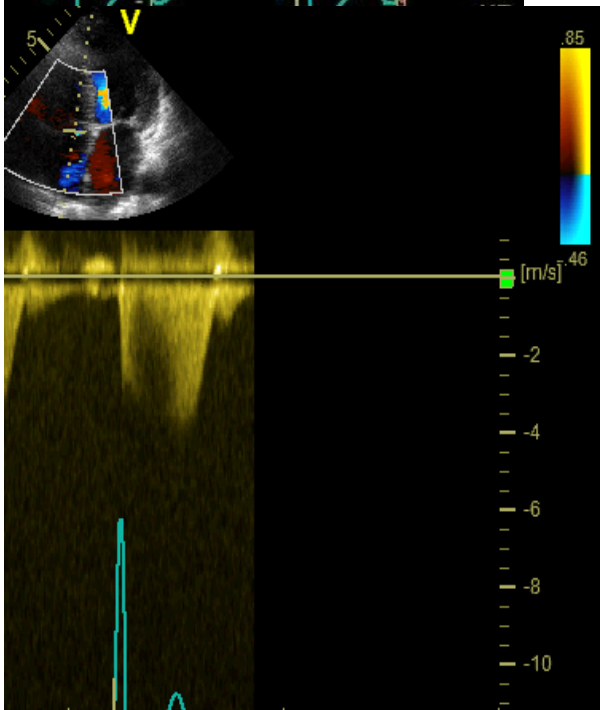
V
5
10
15
.73
-.39
76
8:28 HR


V
5
.85
[m/s]
-.46
-2
-4
-6
-8
-10

Echocardiographic criteria for the definition of severe valve regurgitation: *an integrative approach*

	Aortic regurgitation	Mitral regurgitation		Tricuspid regurgitation
Semiquantitative				
Vena contracta width (mm)	> 6	≥ 7 (> 8 for biplane)		≥ 7
Upstream vein flow	–	Systolic pulmonary vein flow reversal		Systolic hepatic vein flow reversal
Inflow	–	E-wave dominant ≥ 1.5 m/s		E-wave dominant ≥ 1 m/s
Other	Pressure half-time < 200 ms	TVI mitral/TVI aortic > 1.4		PISA radius > 9 mm
Quantitative		*Primary*	*Secondary*	
EROA (mm^2)	≥ 30	≥ 40	≥ 20	≥ 40
R Vol (ml/beat)	≥ 60	≥ 60	≥ 30	≥ 45
+ enlargement of cardiac chambers/ vessels	LV	LV, LA		RV, RA, inferior vena cava

Adapted from Lancellotti, EAE recommendations. *Eur J Echocardiogr.* 2010;11:223-244 and 307-332

European Heart Journal 2012 - doi:10.1093/eurheartj/ehs109 & European Journal of Cardio-Thoracic Surgery 2012 - doi:10.1093/ejcts/ezs455).

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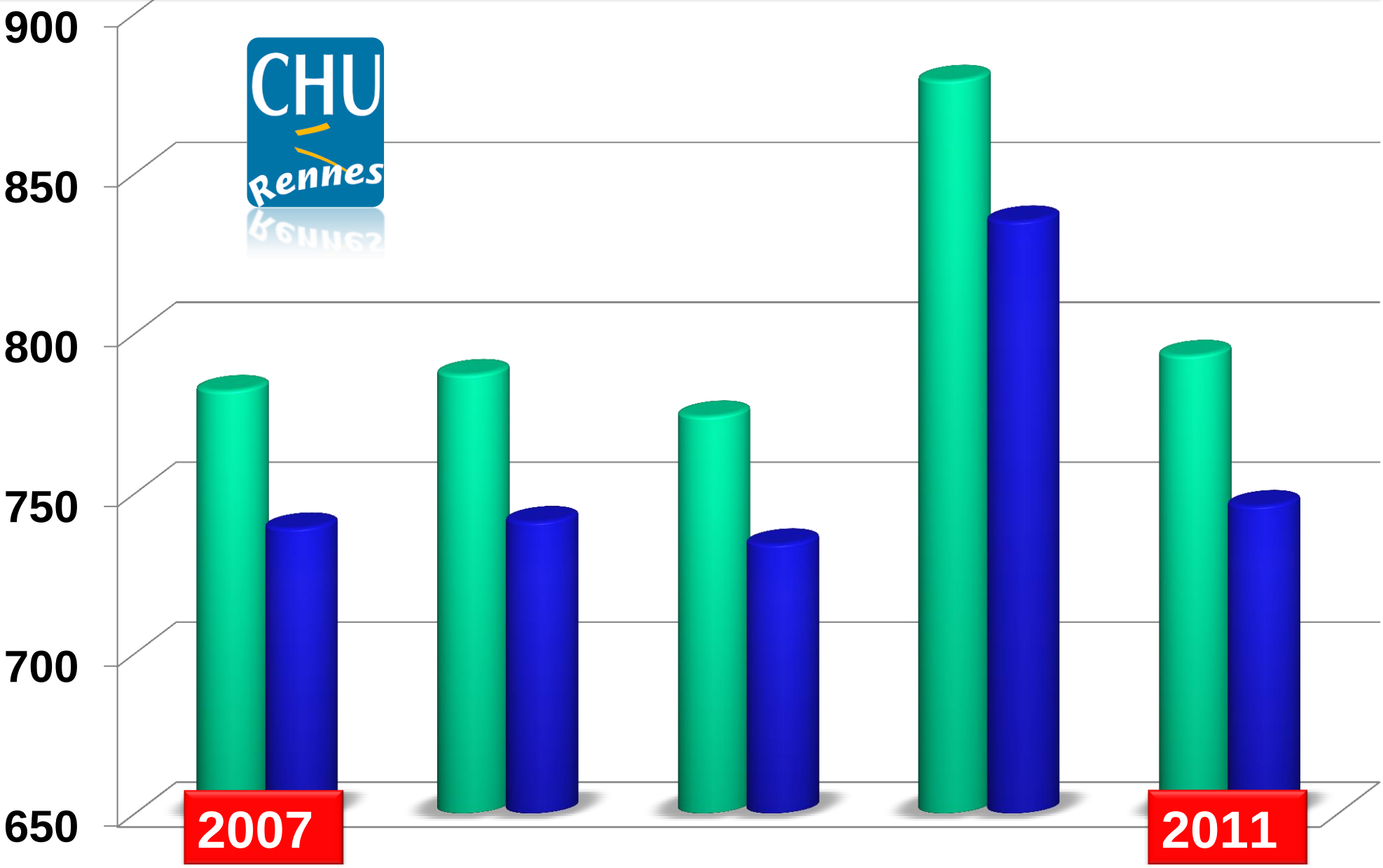
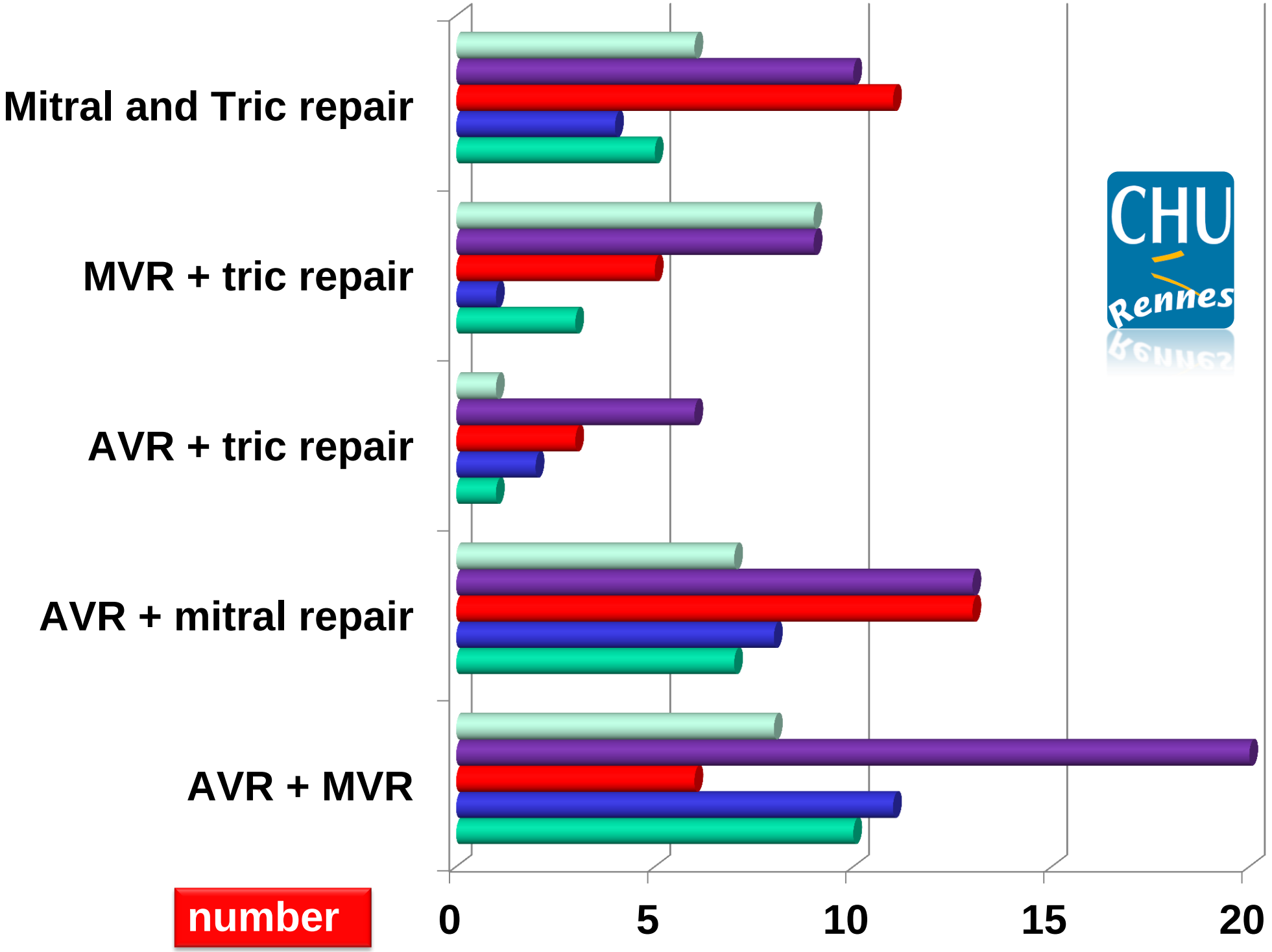
Valvular surgery Experience from 2007 to 2011 in Rennes University Hospital

(4015 valvular surgery including 3795 planed surgery)




Mitral and Tric repair
MVR + tric repair
AVR + tric repair
AVR + mitral repair
AVR + MVR
number
0
5
10
15
20
CHU
Rennes

AoS & Mitral Regurg

At the time of aortic valve replacement, many patients with aortic stenosis (AS) exhibit varying degrees of mitral regurgitation (MR).

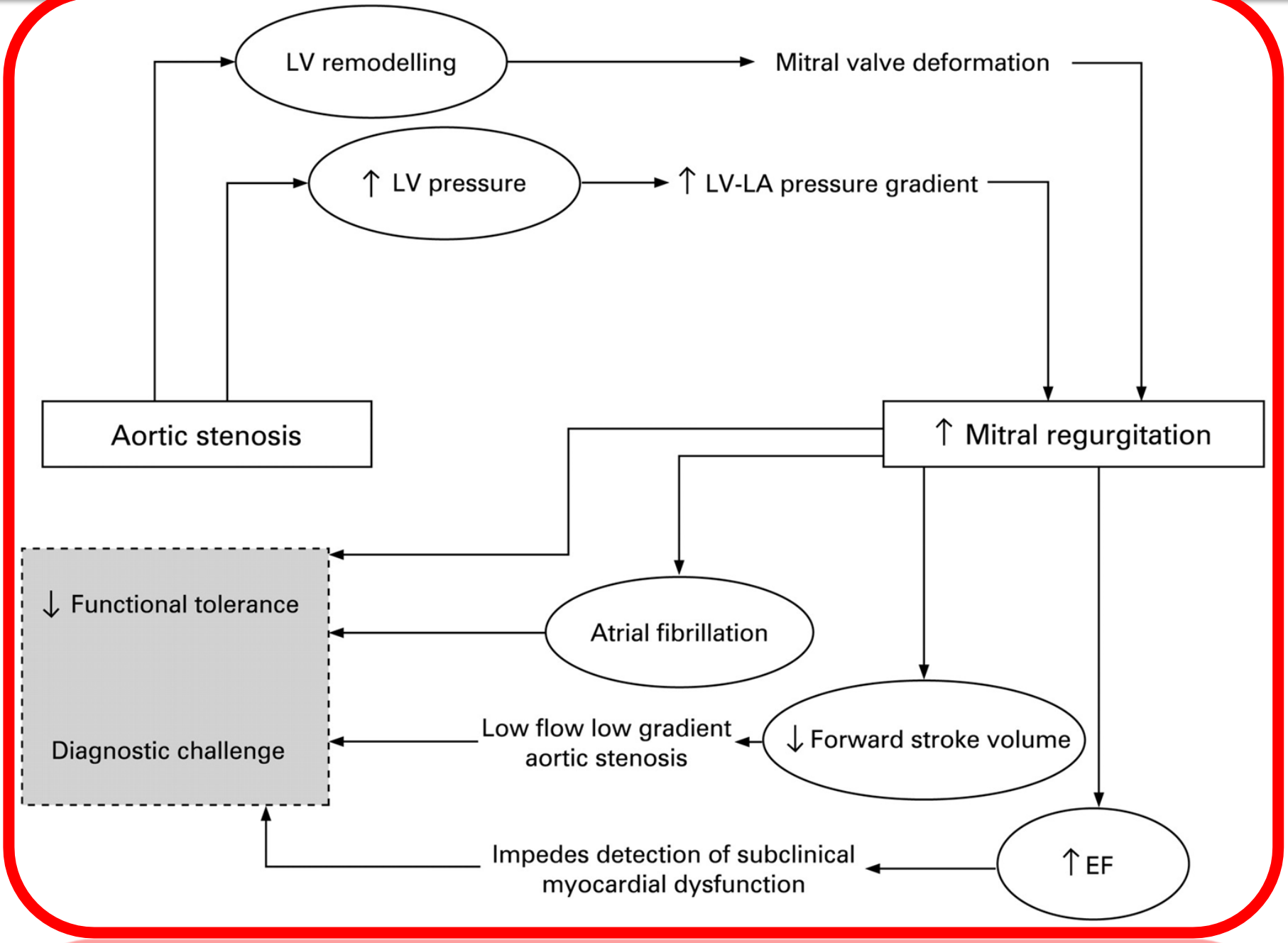
The aetiology of **MR is often** (but not systematically):

► **functional** *in nature, occurring in the absence of any significant intrinsic valvular lesion*.

- Increased afterload,
- LV-remodelling,
- fluid overload and
- concomitant ischaemic heart dysfunction

may account for the development of functional MR.

Pathophysiology of interactions between aortic stenosis and mitral regurgitation



Unger et al. Heart 2011

Severe Ao S

Significant MR

Decrease forward Stroke Volume

>> reduced aortic Pressure Gradient

>> making detection of AS more Challenging

Afib …further reduce forward output

severe MR may impede the ***detection of subclinical myocardial dysfunction*** by preserving ejection phase indices of myocardial performance

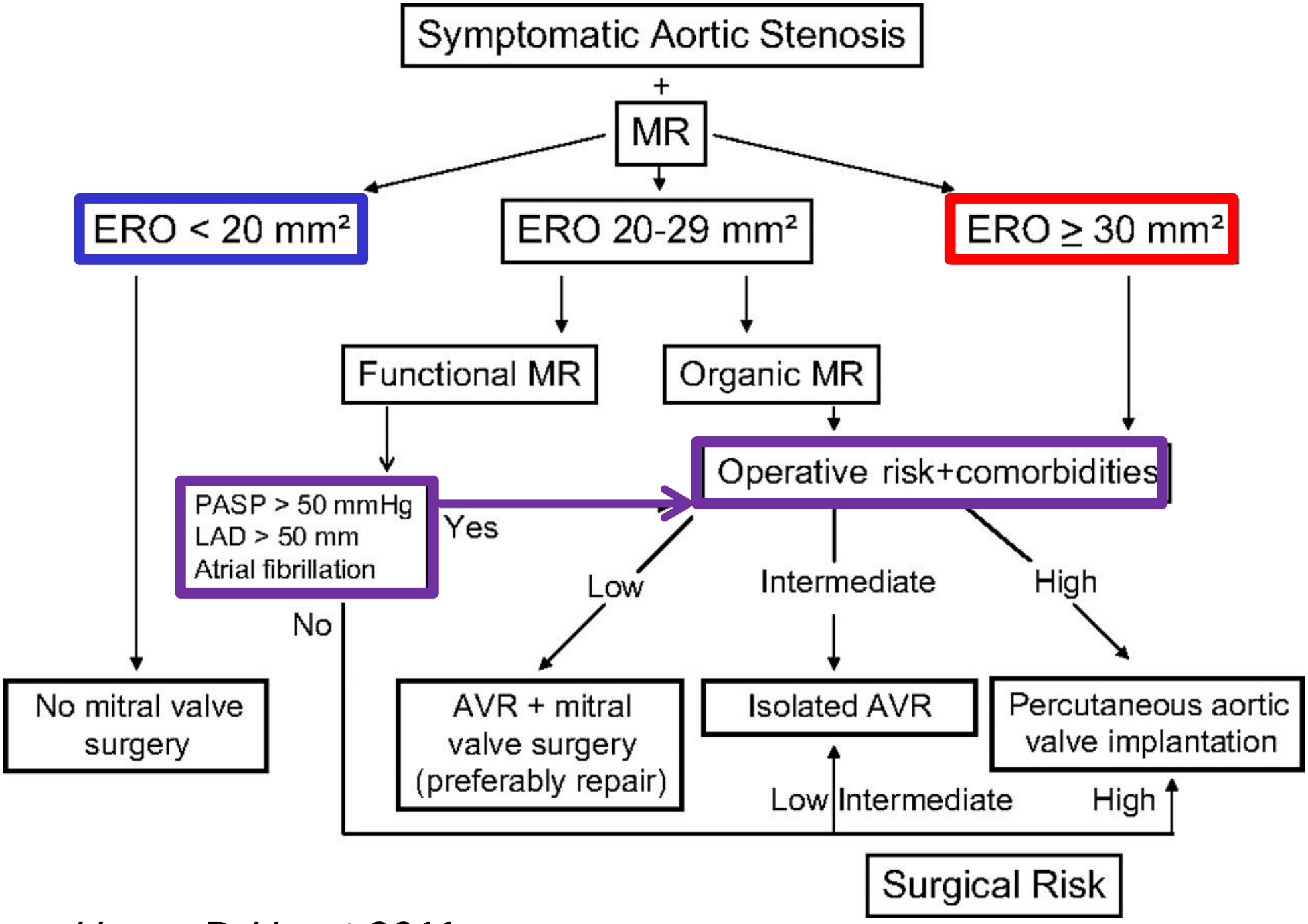
The decision to operate on both valves requires:

- assessment of MR severity (ERO)

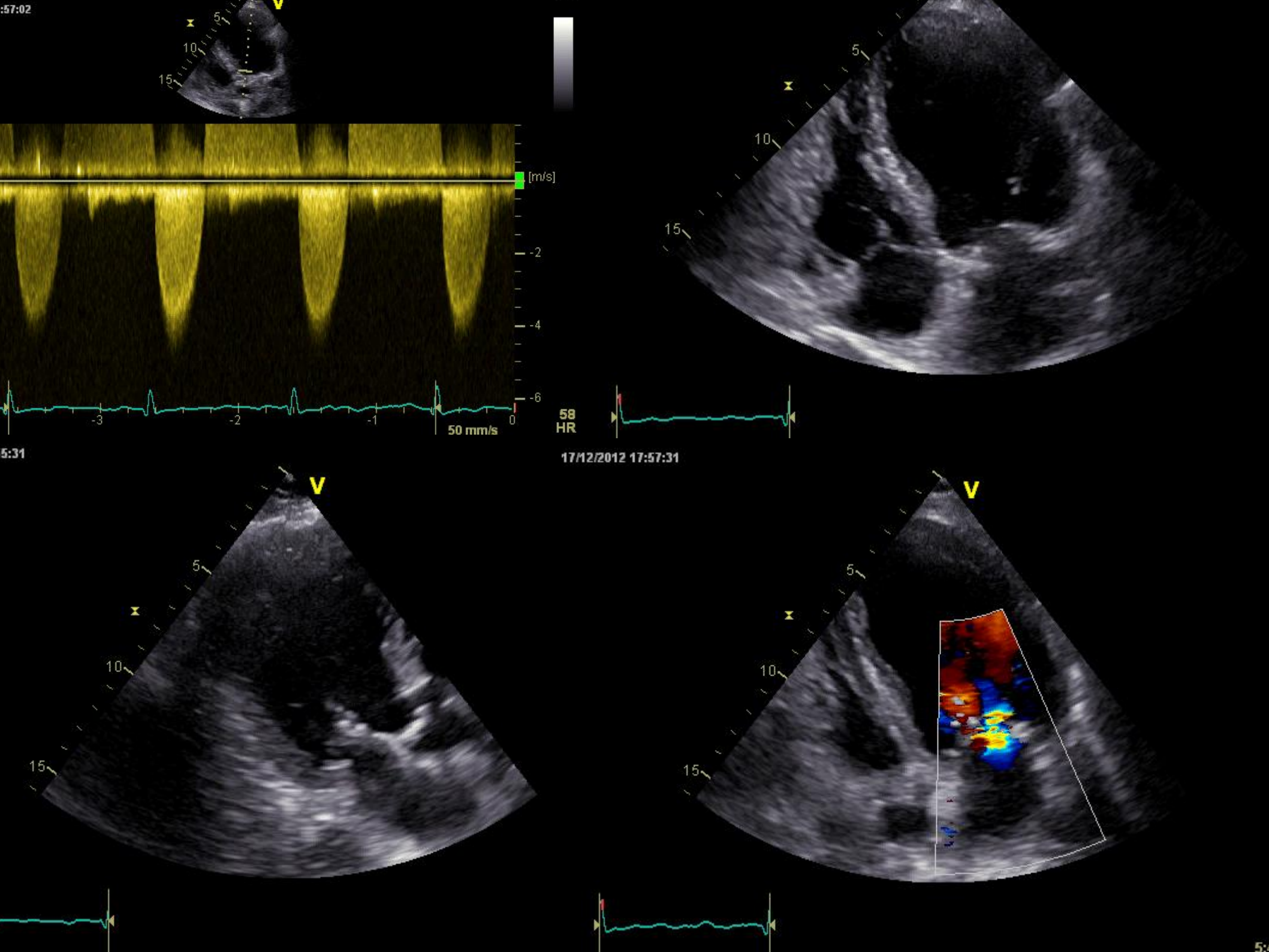
- knowledge of the functional or organic aetiology of MR and

- determination of the suitability for mitral valve repair.

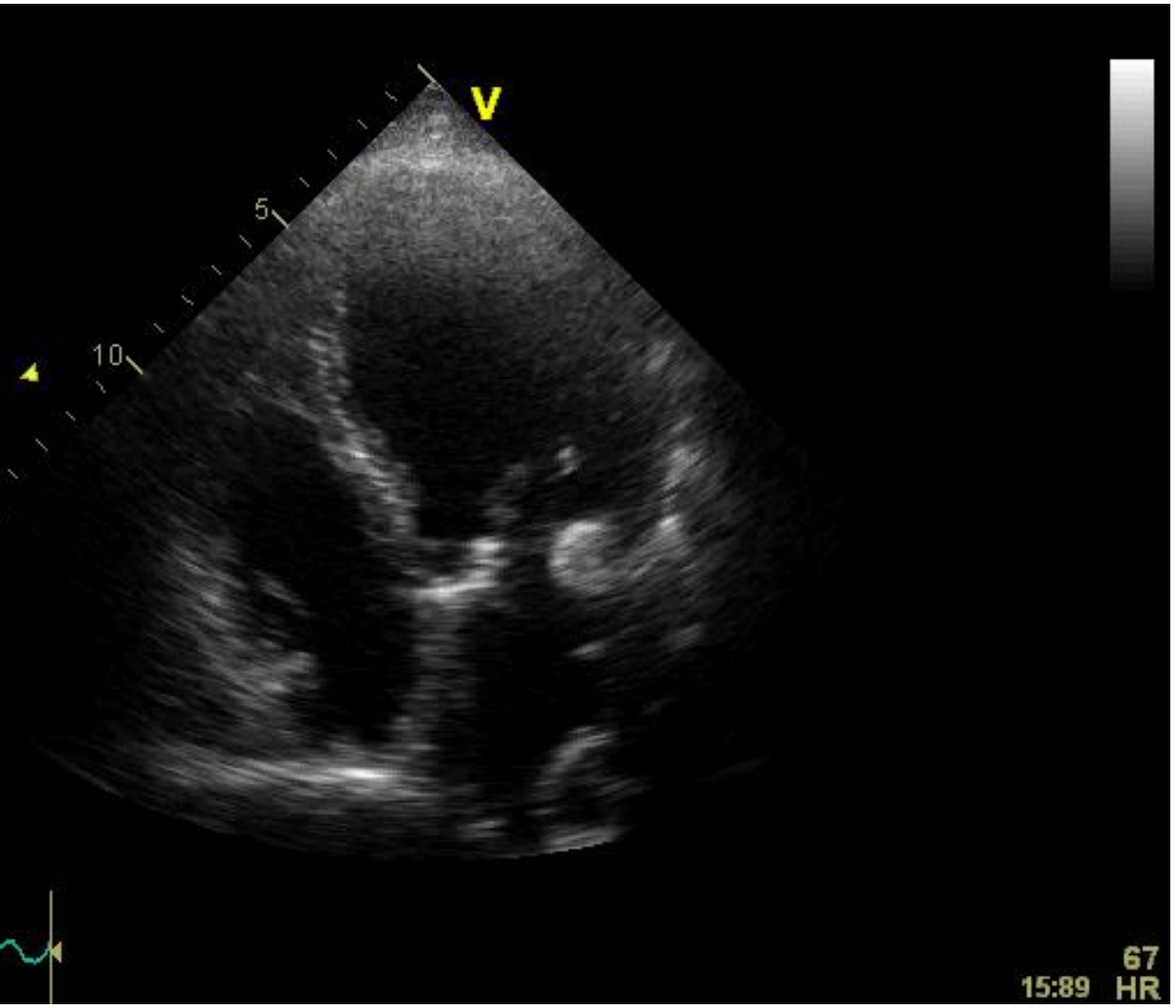
For Quantifying the MR associated to the AoS : no American or ESC guidelines



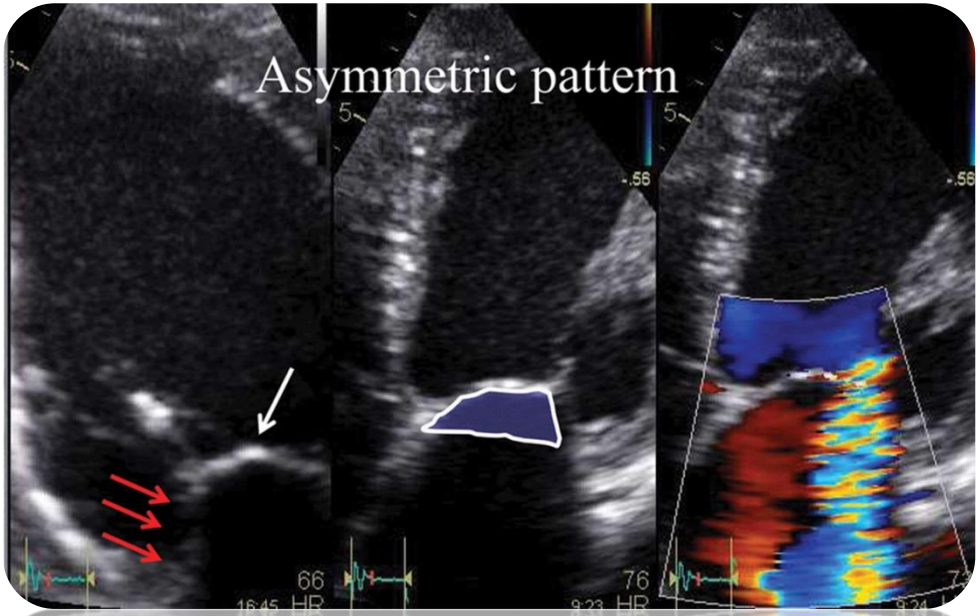
Unger P. Heart 2011

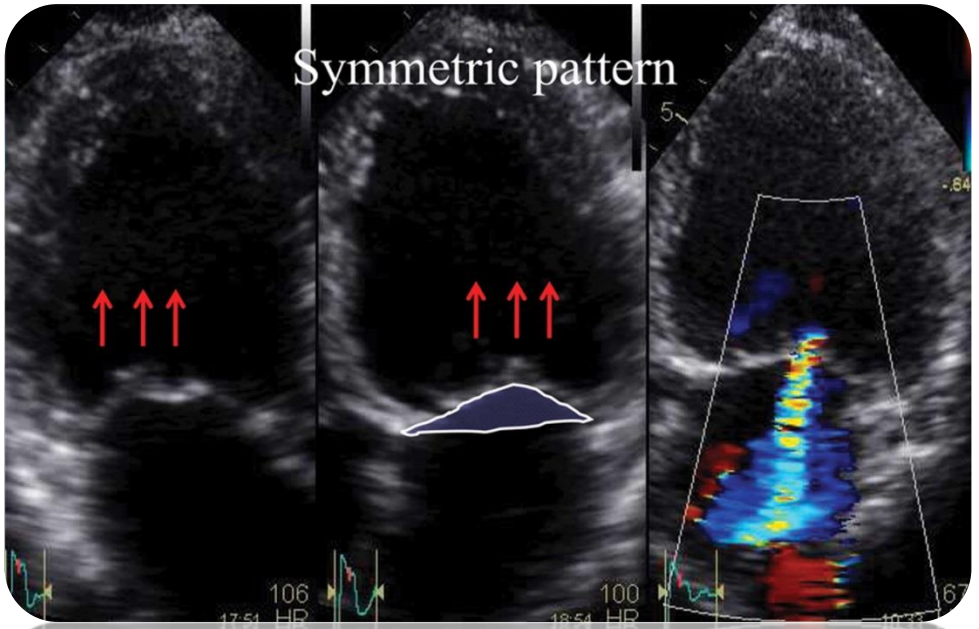

:57:02
V
5
10
15
[m/s]
-2
-4
-6
-3
-2
-1
0
50 mm/s
58
HR
5:31
17/12/2012 17:57:31
V
5
10
15
V
5
10
15

Look at the valve!



- Diameter of the annulus
- Size and localization of the calcifications
- Prolapsus
- Chordae?
- …
- Precise description of the anatomy using TEE if necessary

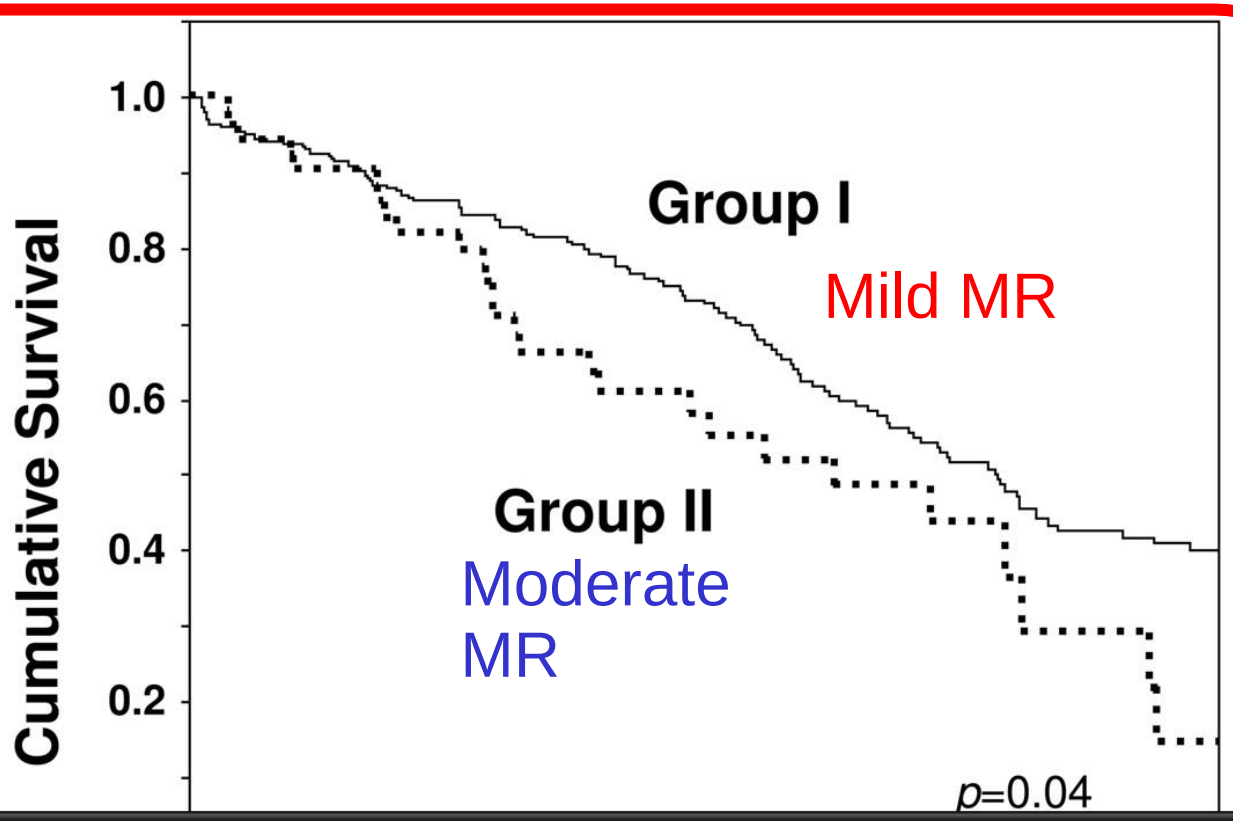




Functional MR – most of the time, systolic restriction – Carpentier IIIb

results from an imbalance between tethering forces—annular dilatation, LV dilatation, papillary muscles displacement, LV sphericity and closing forces, reduction of LV contractility, global LV dyssynchrony, papillary muscle dyssynchrony, altered mitral systolic annular contraction.

Lancellotti P et al. Eur J Echocardiogr 2010;11:307-332



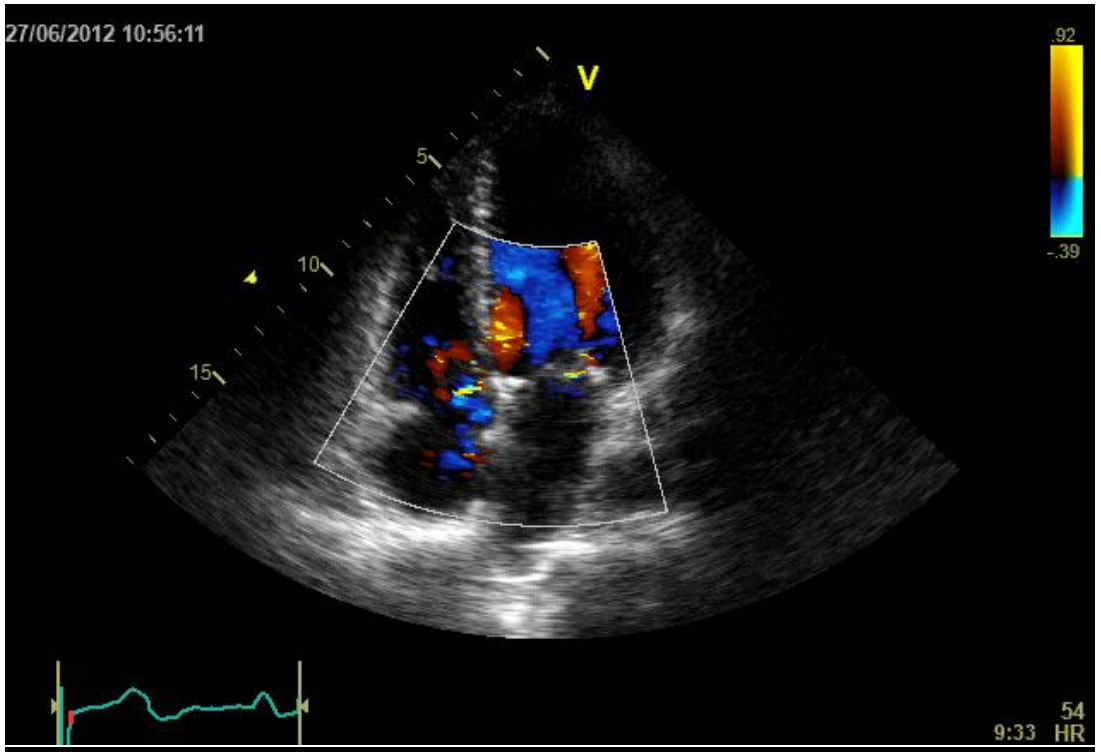
retrospective review identified 408 consecutive elderly (>70yo) patients who underwent isolated AVR from January 1983 to February 2004

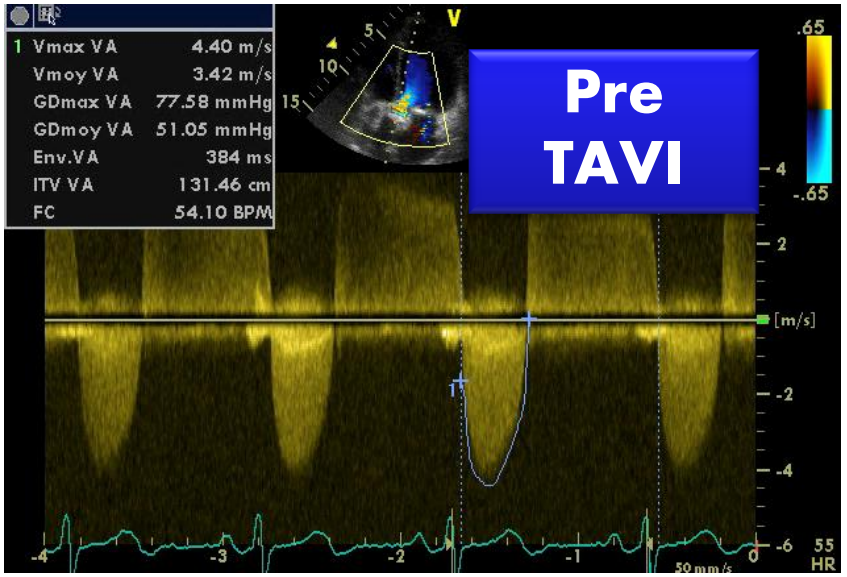
Moderate MR is an independent risk factor impacting long-term survival in elderly patients undergoing AVR.
Therefore, patients with intrinsic mitral valve disease should be considered for concomitant MV surgery.

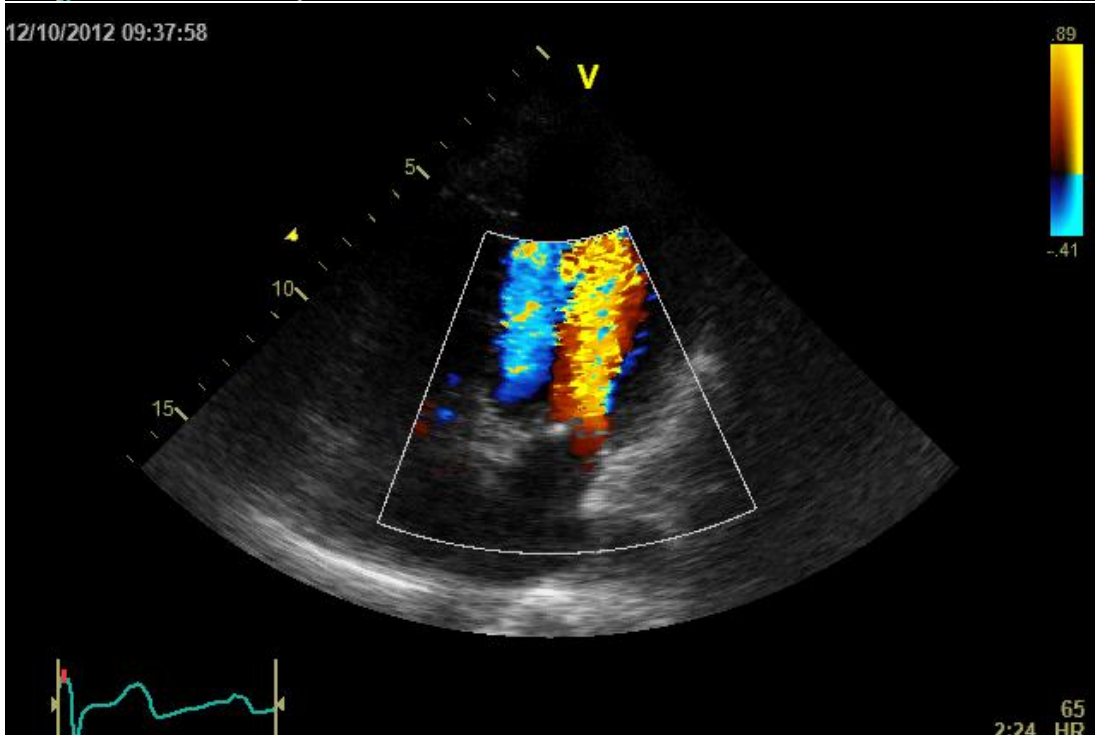
Number of patients at risk each year

	1	2	3	4	5	6	7	8	9	10
Group I	239	201	176	151	125	100	82	65	53	45
roup II	48	40	31	23	20	15	10	5	4	

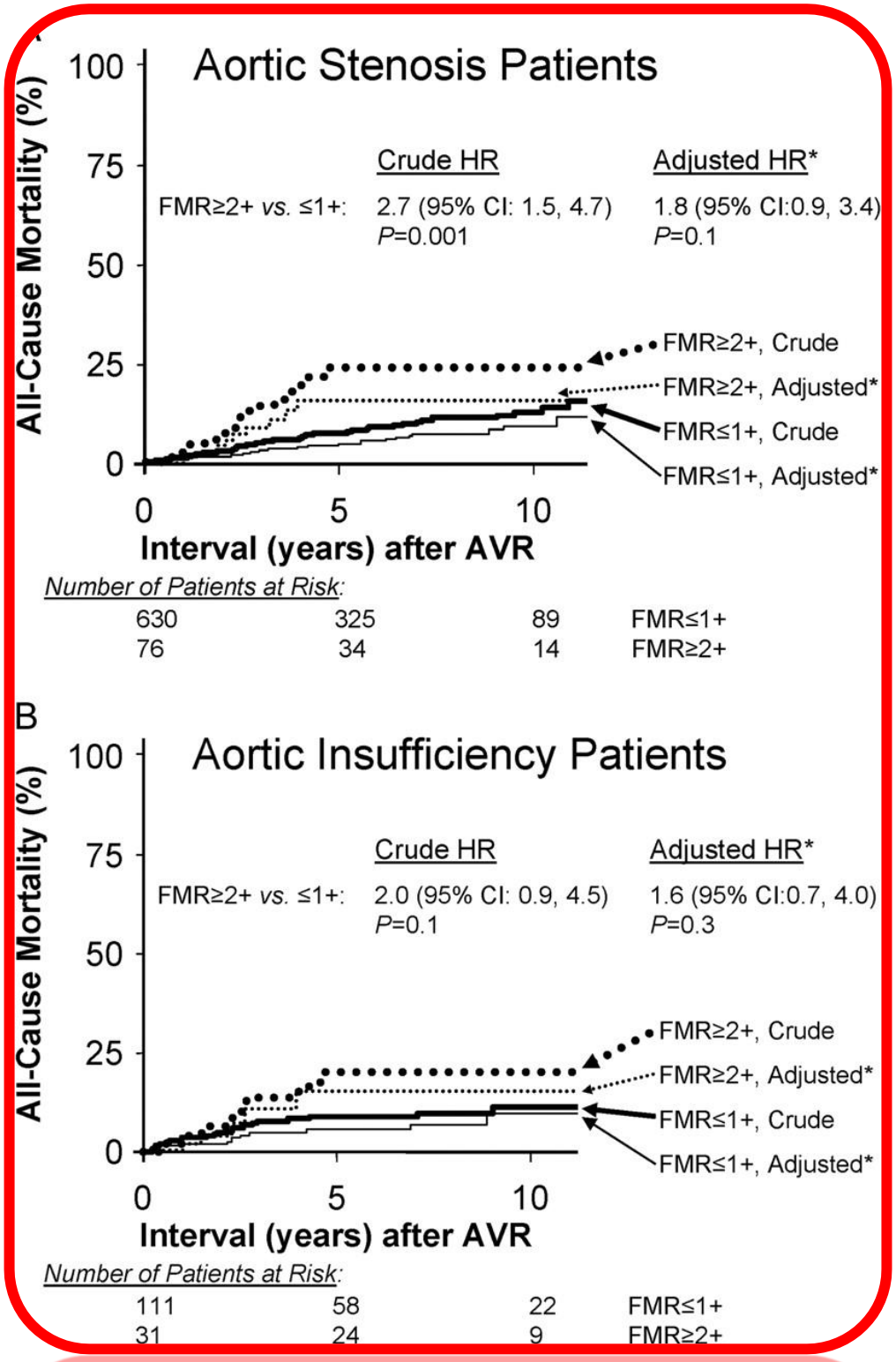
Barreiro C J et al. Circulation 2005;112:I-443-I-447


27/06/2012 10:56:11
.92
-.39
54
9:33 HR


1 Vmax VA 4.40 m/s
Vmoy VA 3.42 m/s
GDmax VA 77.58 mmHg
GDmoy VA 51.05 mmHg
Env.VA 384 ms
ITV VA 131.46 cm
FC 54.10 BPM
Pre TAVI
.65
-.65
[m/s]
55 HR


12/10/2012 09:37:58
.89
-.41
65
2:24 HR

Post TAVI

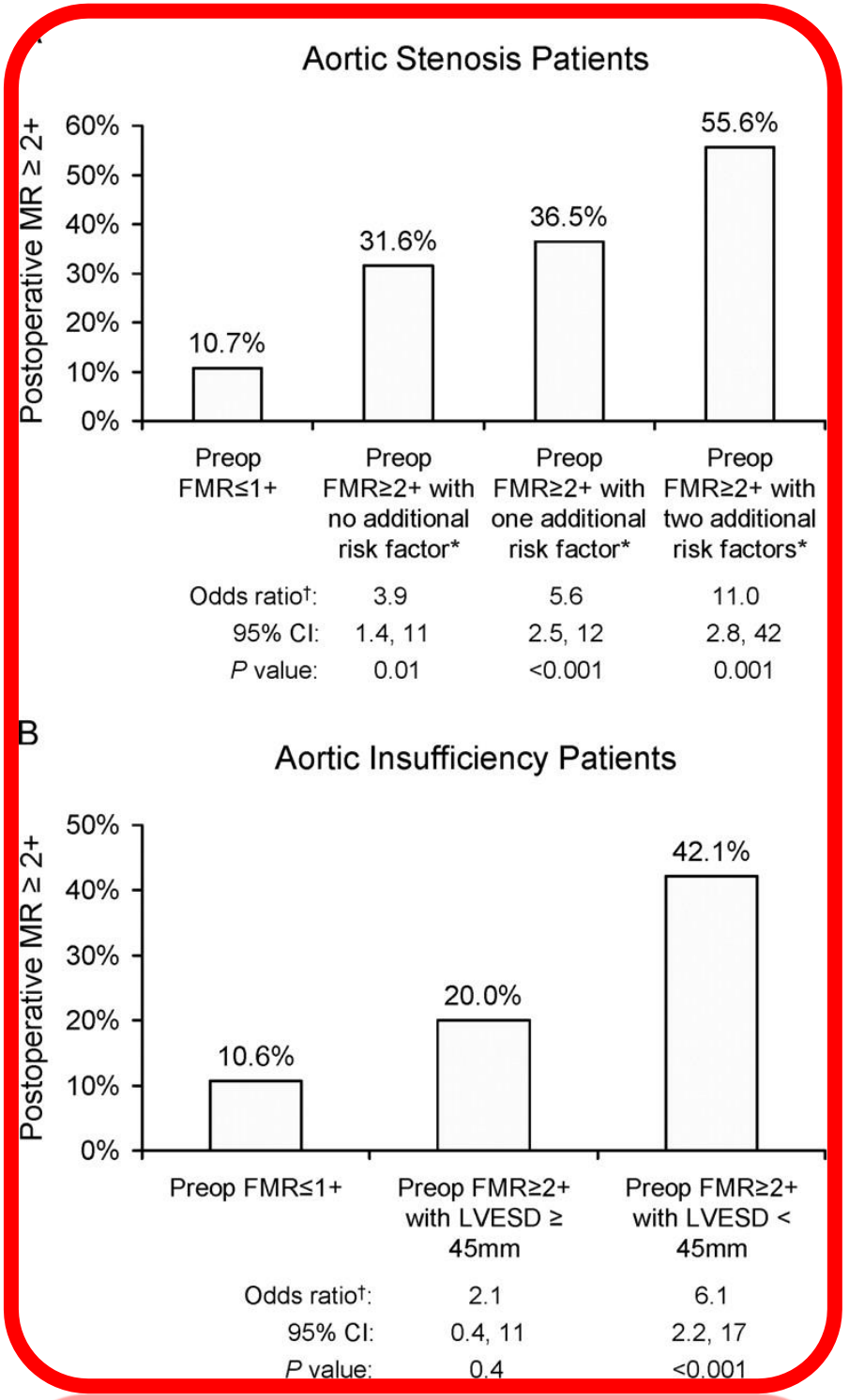


848 patients who underwent AVR after 1990. follow-up 5.4 years

AS patients with FMR ≥2 and a left atrial diameter >5 cm, preoperative mean aortic valve gradient <40 mm Hg, or atrial fibrillation have a significantly higher risk of CHF and persistent mitral regurgitation after AVR than other AS patients.

- **AI** patients with FMR ≥2 and a left ventricular end-systolic diameter <45 mm preoperatively are also at increased risk

Ruel M et al. Circulation 2006;114:I-541-I-546



Effects of functional mitral regurgitation at the time of aortic valve replacement on postoperative mitral regurgitation at a mean of 18 months postoperatively.

Additional risk factors are:

- left atrial diameter >5 cm,
- peak aortic gradient <60 mm Hg,
- mean aortic gradient <40 mm Hg,
- atrial fibrillation

Ruel M et al. Circulation 2006;114:I-541-I-546

Indications for surgery in tricuspid disease

	Class	Level
Surgery is indicated in symptomatic patients with severe TS.	I	C
Surgery is indicated in patients with severe TS undergoing left-sided valve intervention.	I	C
Surgery is indicated in patients with severe primary, or secondary, TR undergoing left-sided valve surgery.	I	C
Surgery is indicated in symptomatic patients with severe isolated primary TR without severe right ventricular dysfunction.	I	C
Surgery should be considered in patients with moderate primary TR undergoing left-sided valve surgery. .	IIa	C
Surgery should be considered in patients with mild or moderate secondary TR with dilated annulus (≥ 40 mm or > 21 mm/m²) undergoing left-sided valve surgery.	IIa	C
Surgery should be considered in asymptomatic or mildly symptomatic patients with severe isolated primary TR and progressive right ventricular dilation or deterioration of right ventricular function.	IIa	C
After left-sided valve surgery, surgery should be considered in patients with severe TR who are symptomatic or have progressive right ventricular dilatation/dysfunction, in the absence of left-sided valve dysfunction, severe right or left ventricular dysfunction, and severe pulmonary vascular disease.	IIa	C

European Heart Journal 2012 - doi:10.1093/eurheartj/ehs109 &
European Journal of Cardio-Thoracic Surgery 2012 -
doi:10.1093/ejcts/ezs455).

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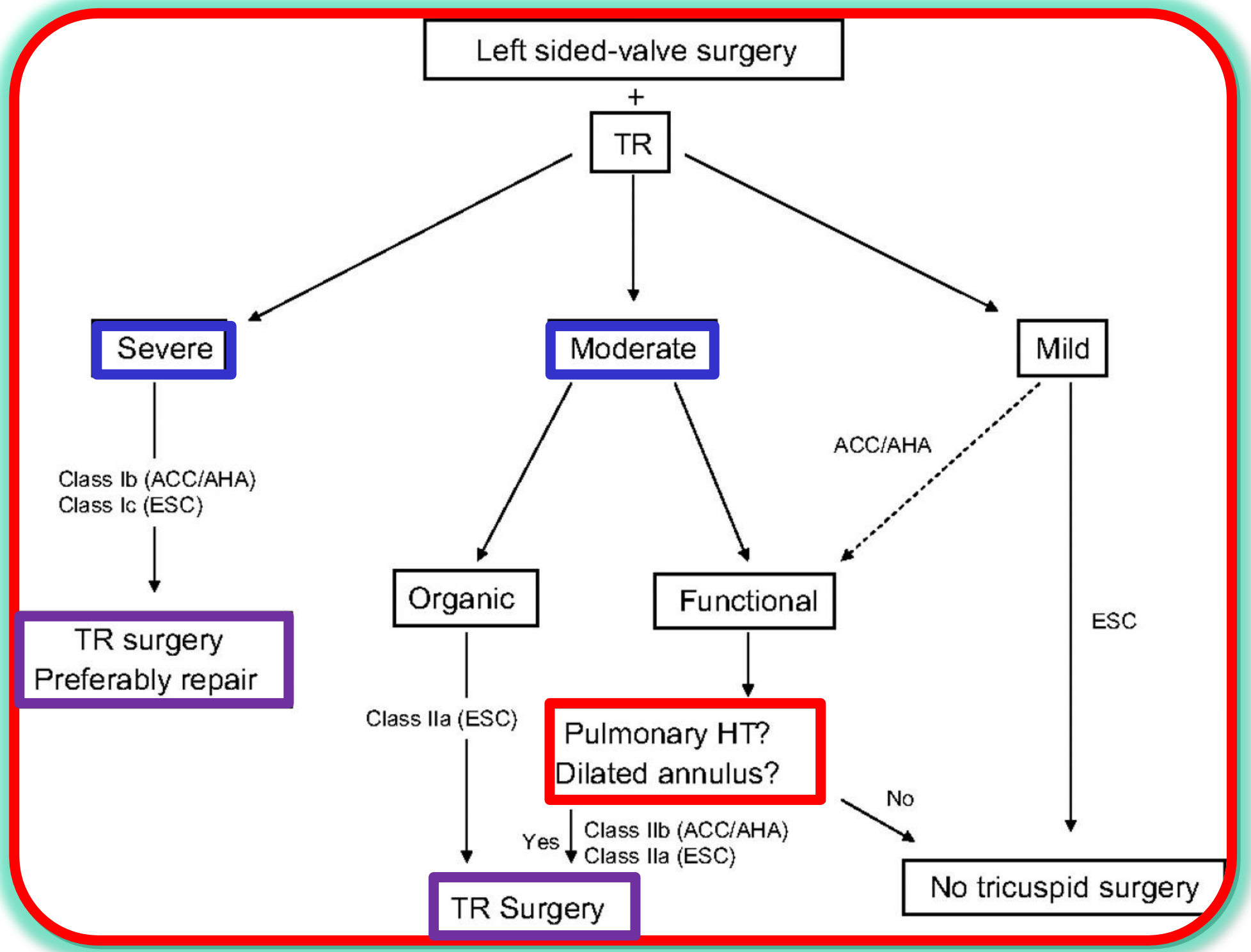
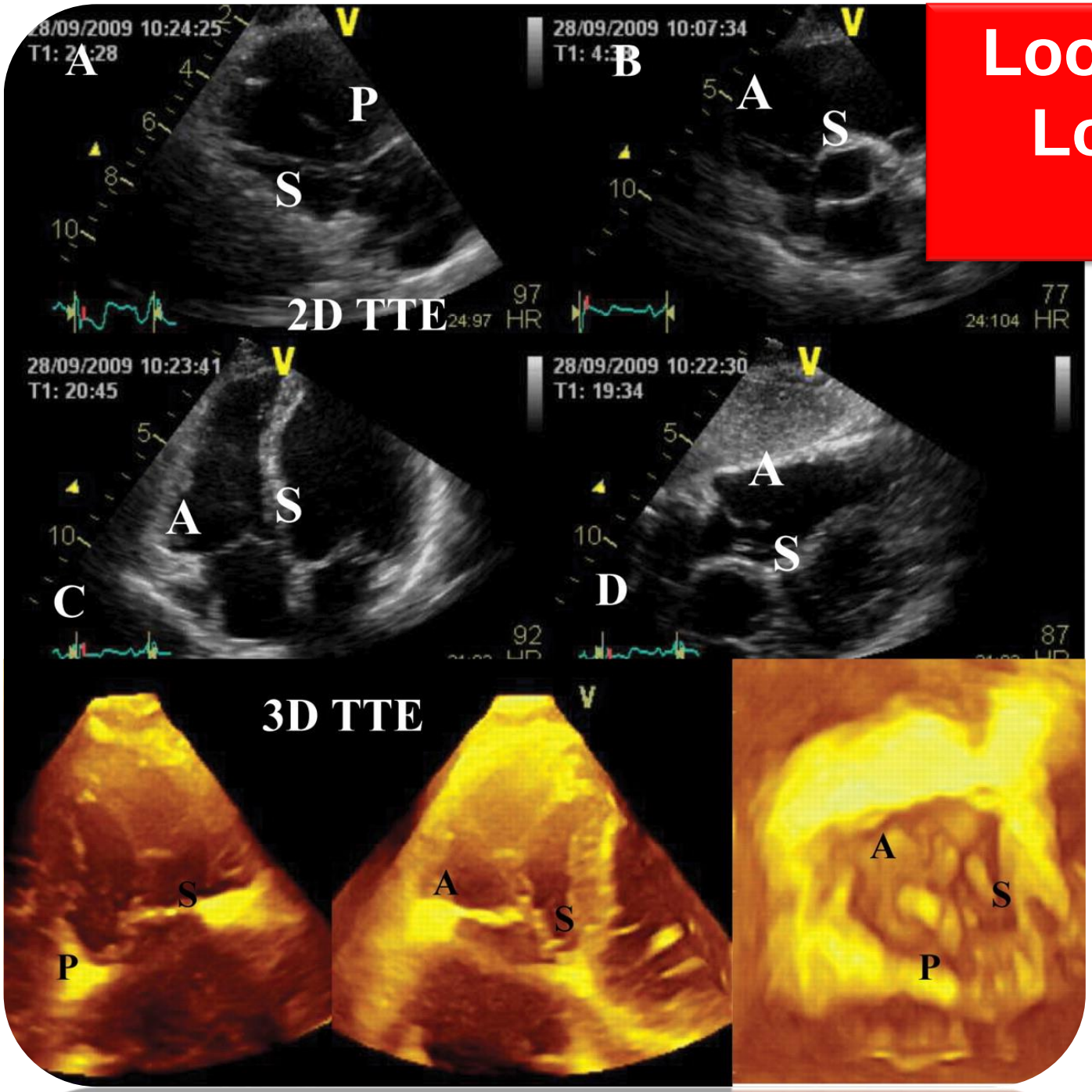


Unger P et al. Heart 2011;97:272-277

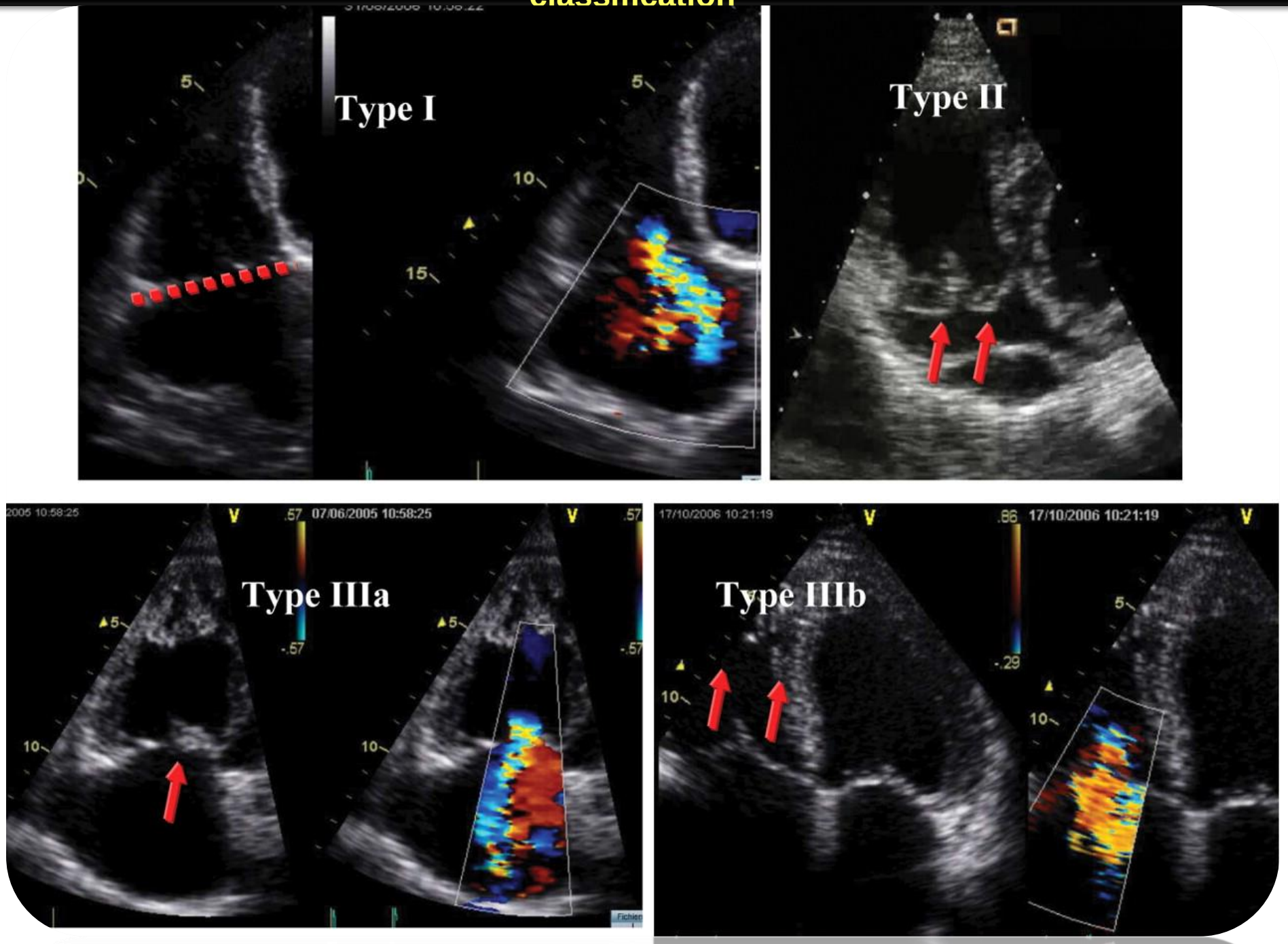


Look at the valve! Look at the RV function!

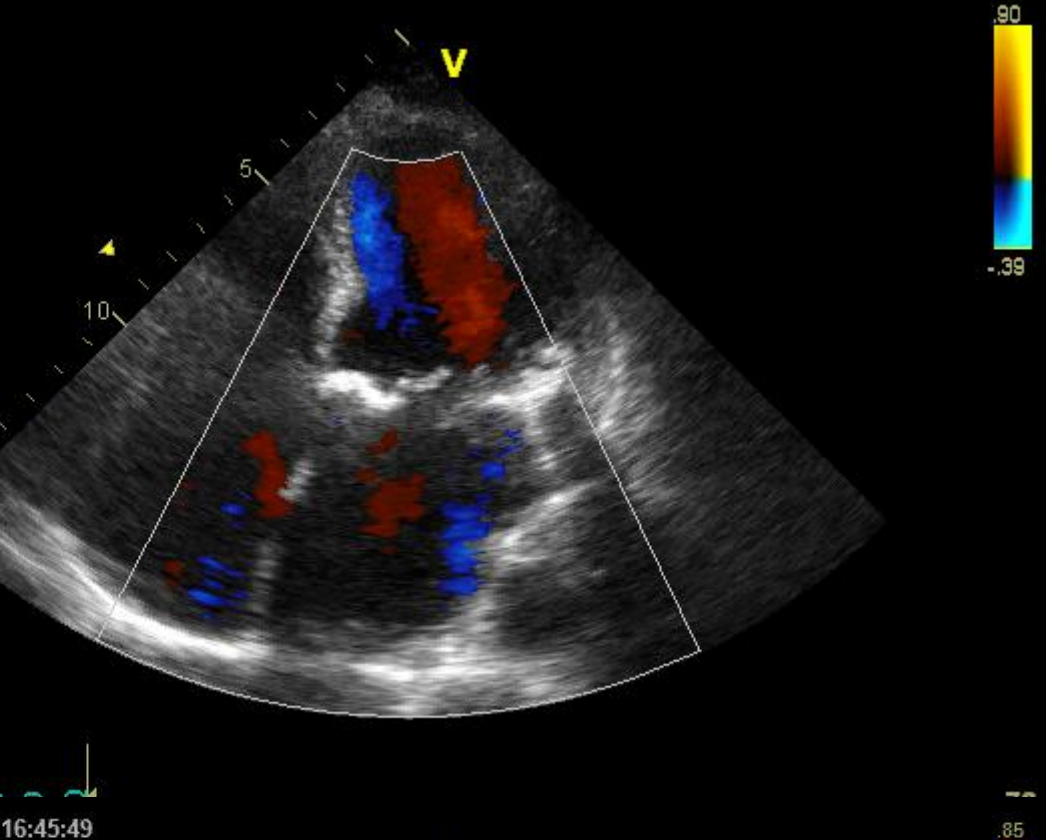
2D and 3D echo recordings of the tricuspid valve.

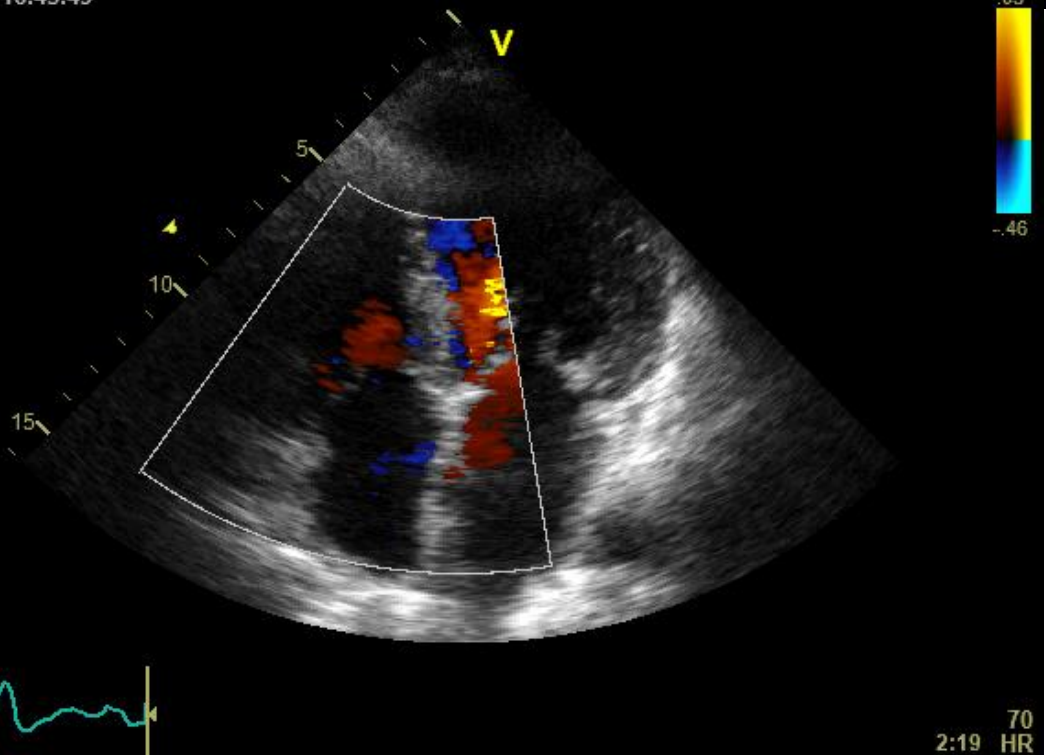
Lancellotti P et al. Eur J Echocardiogr 2010;11:307-332

Mechanisms of mitral regurgitation according to the Capentier's functional classification



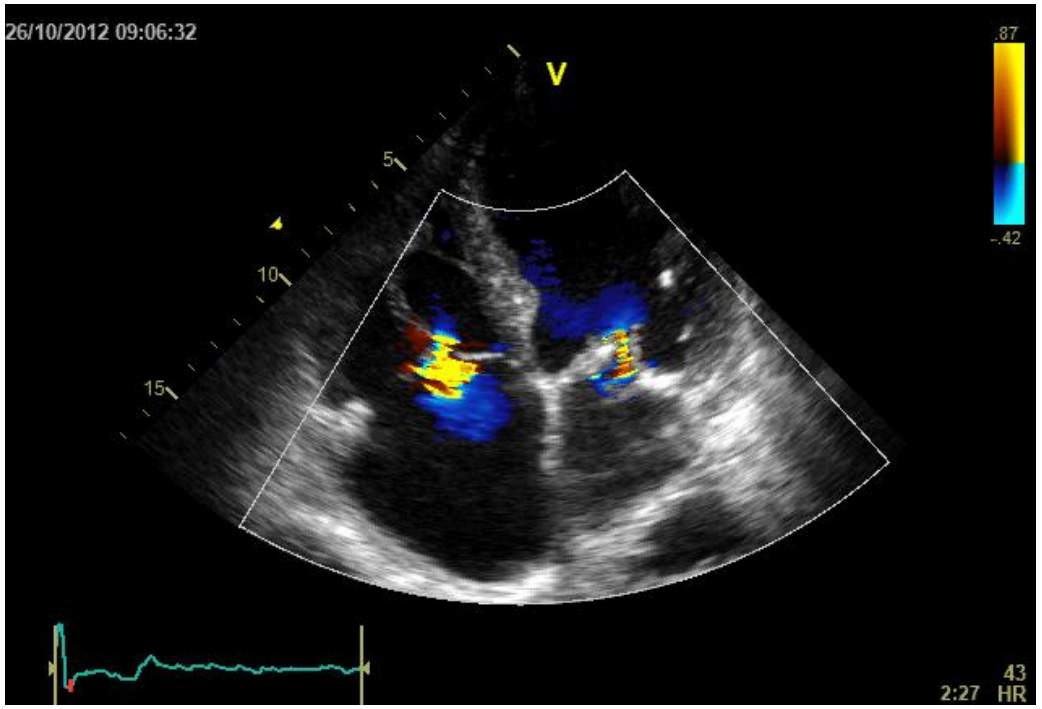
Lancellotti P et al. Eur J Echocardiogr 2010;11:307-332

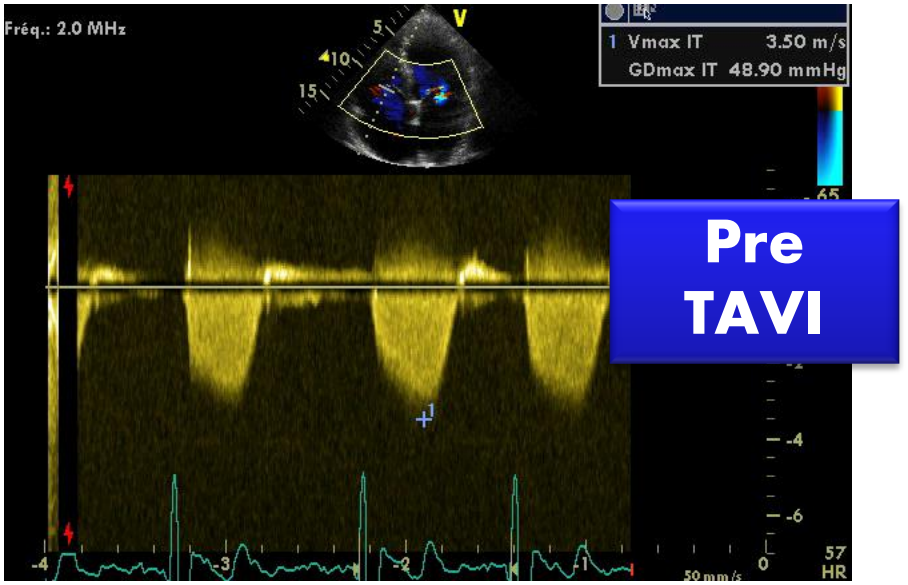




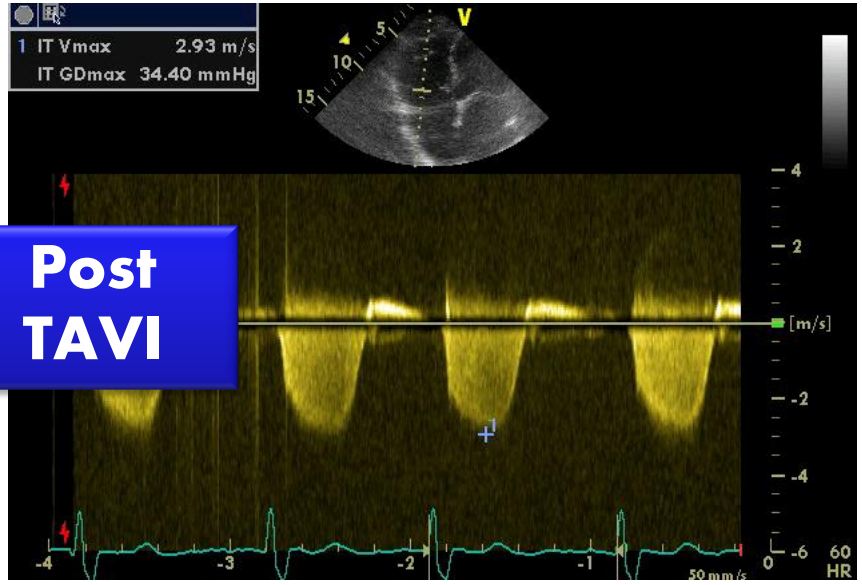
Look at the valve!

- Diameter of the annulus: parasternal, apical and sub-costal views+++
- The annulus should not > 40mm
- Restriction of the valve motion despite a normal thickness
- Even mild TR: be careful
- Look at the RV size and function
- Look at RA and rhythm!

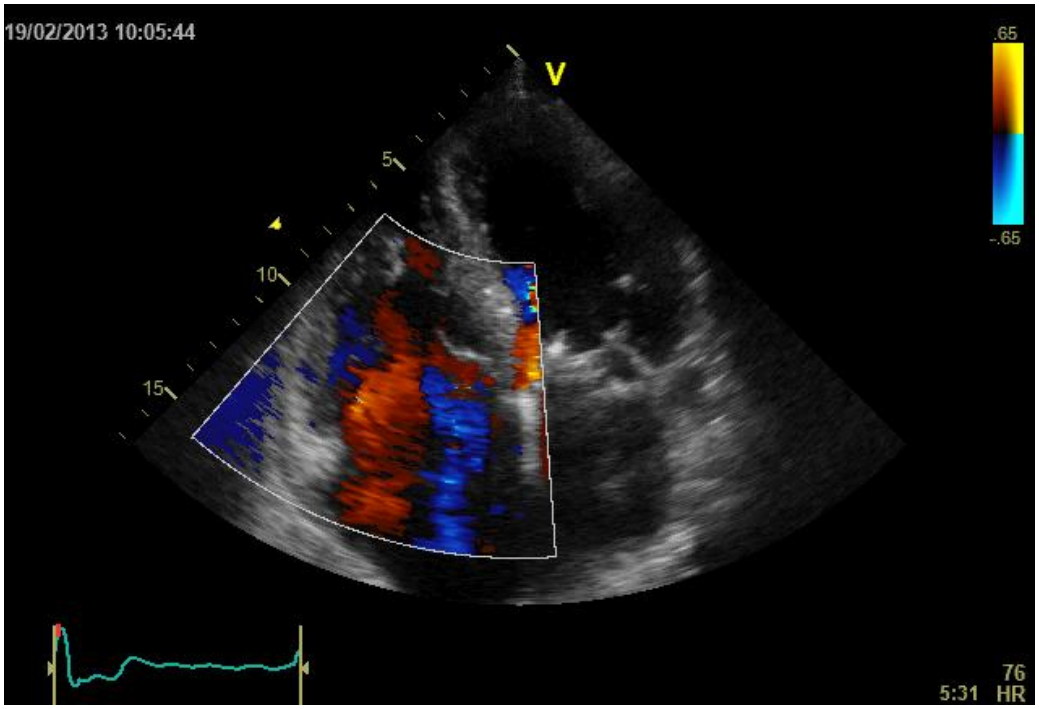




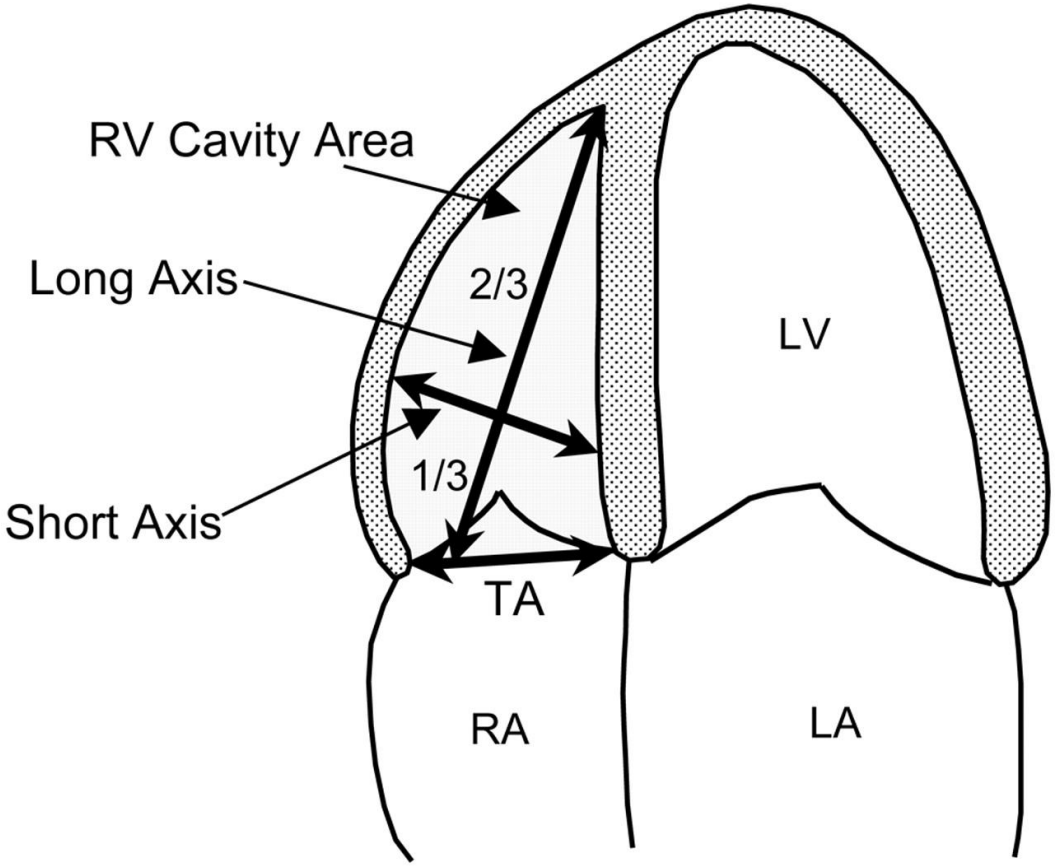
Pre TAVI



Post TAVI



Functional TR is frequently associated with functional **ischemic** MR. After MVRep, close to 50% of patients have TR.

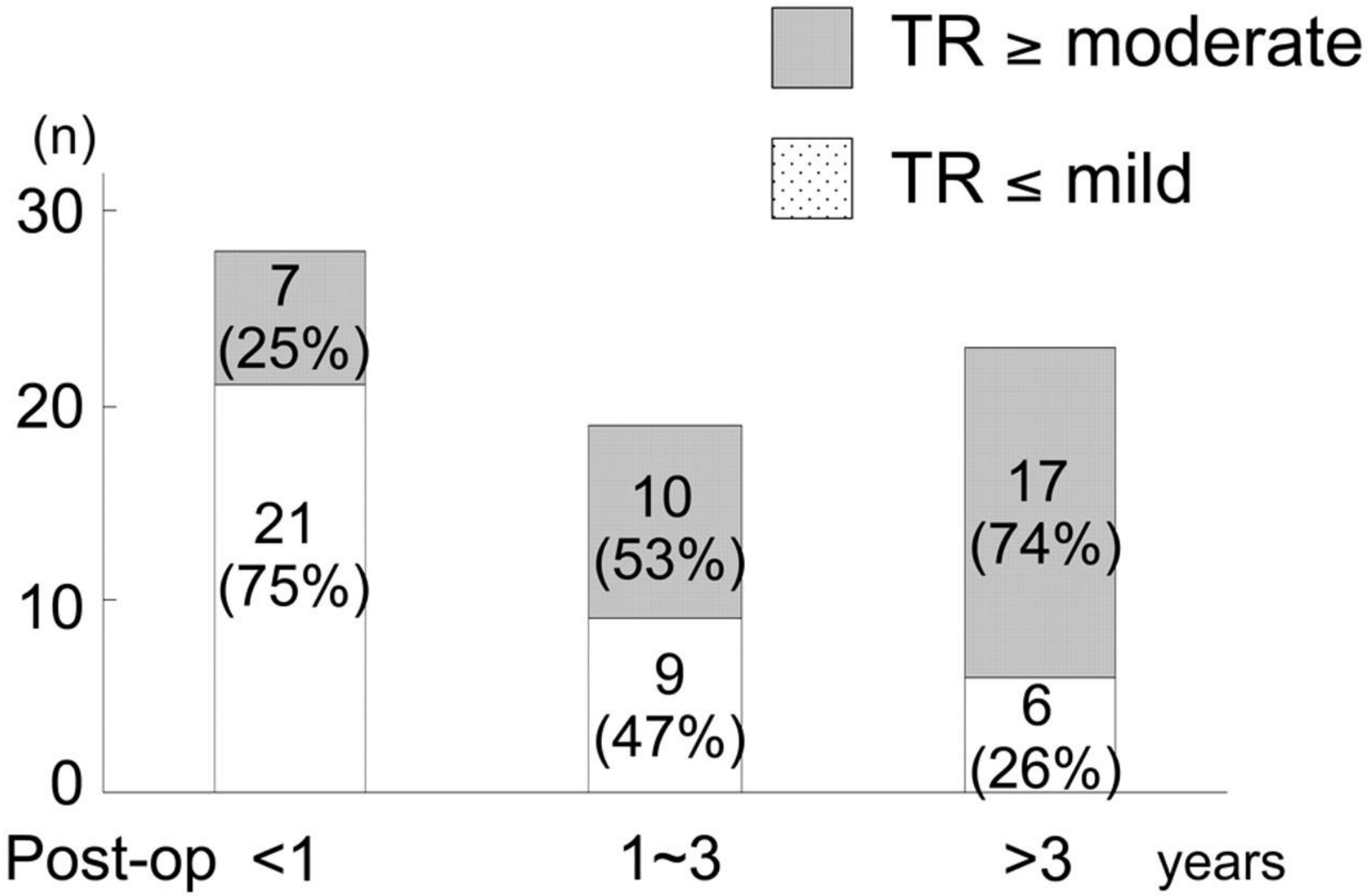


124 patients were explored before and followed after Mitral valve repair

The incidence of postoperative TR increases with time. Preoperative tricuspid annulus dilation might be a predictor of late TR

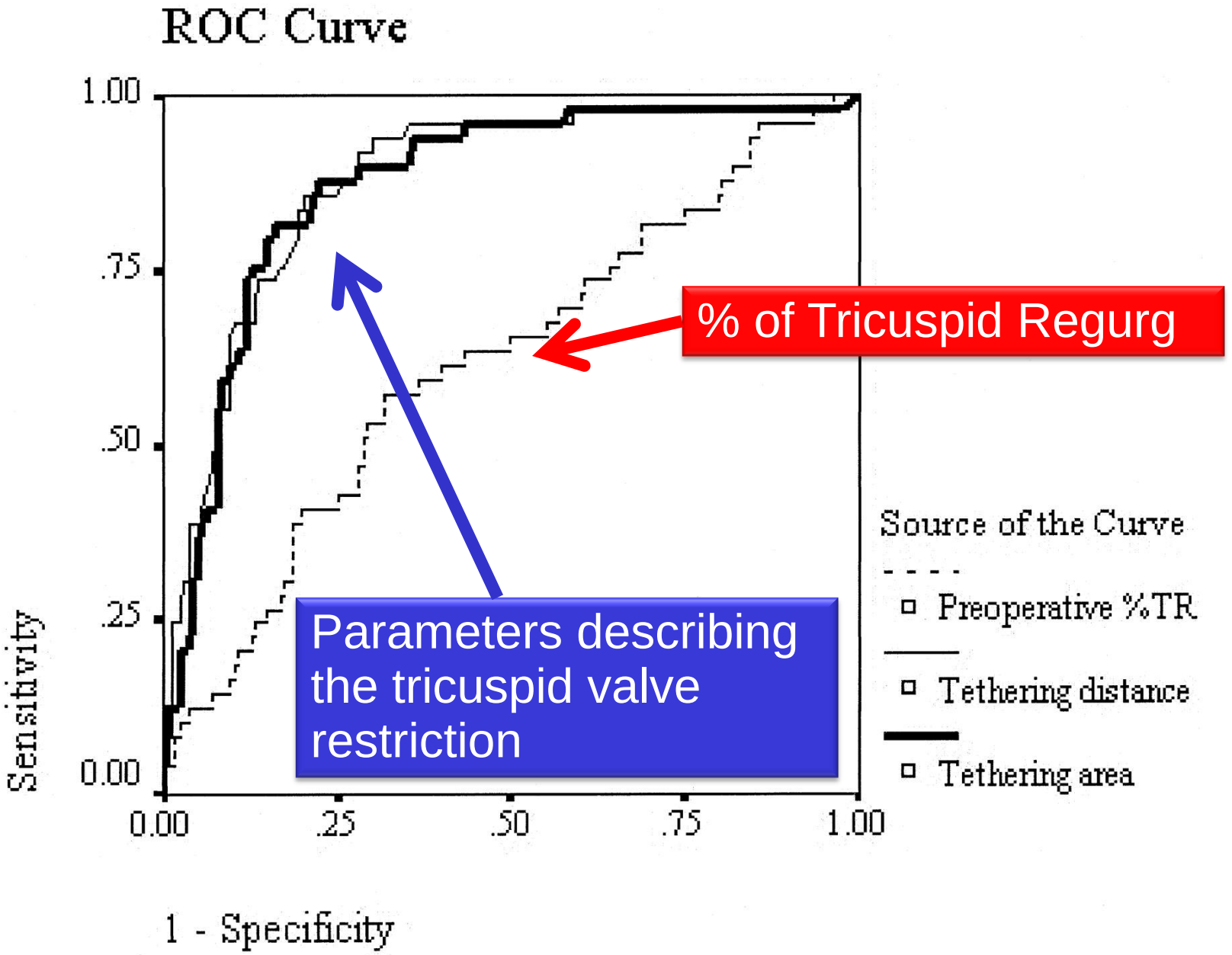
Matsunaga A , and Duran C M G Circulation 2005;112:I-453-I-457

Presence of TR during the postoperative period.



Matsunaga A , and Duran C M G Circulation 2005;112:I-453-I-457

216 patients with functional TR had 2D echocardiography before and after TV annuloplasty.



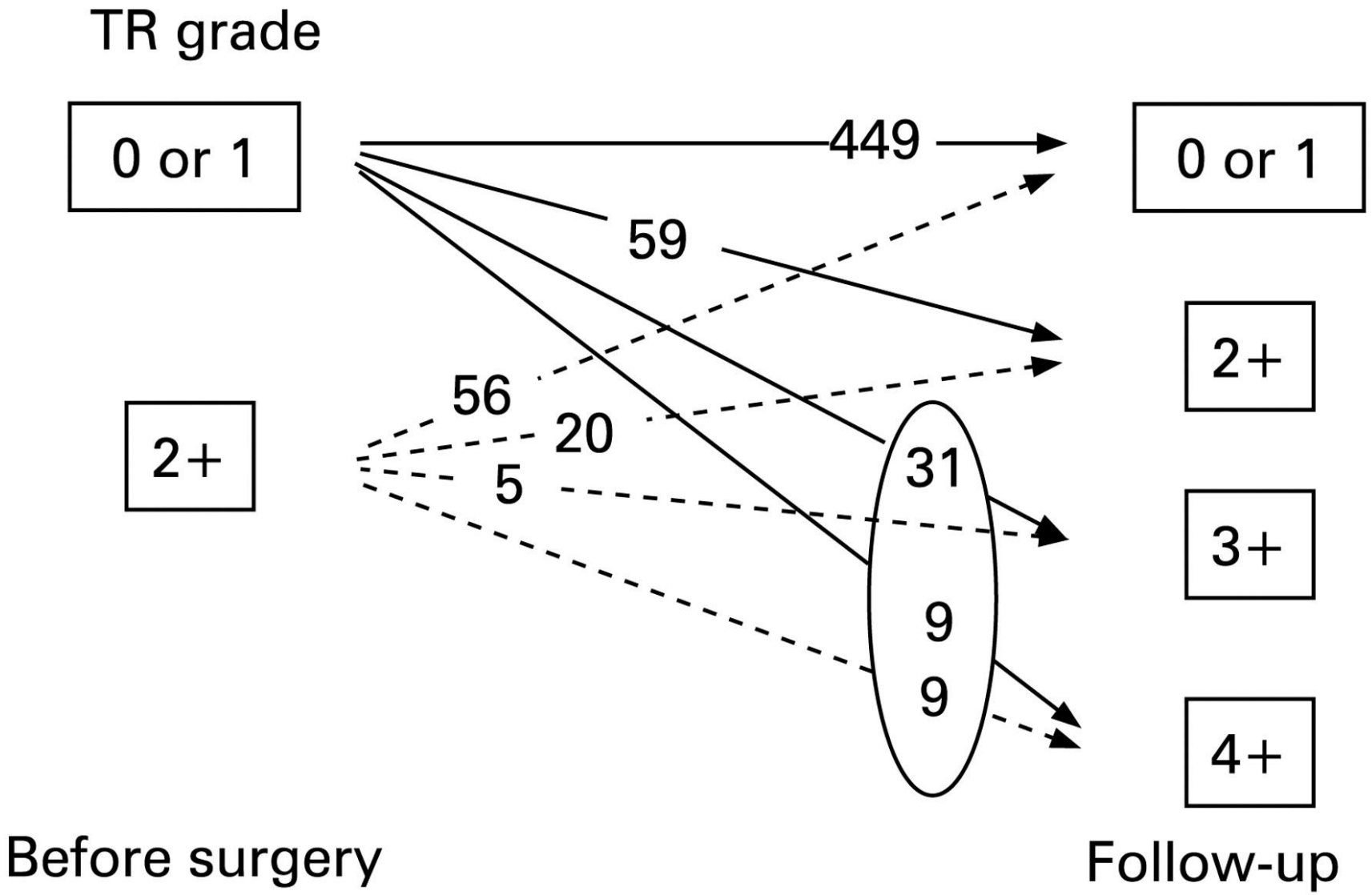
Fukuda S et al. Circulation 2005;111:975-979

Factors associated with development of late significant tricuspid regurgitation after successful left-sided valve surgery

- 638 patients (age 52 (14) years) who had mild (grade 2/4) TR and underwent successful surgery without any procedure for TR were analyzed.
- **Development of significant TR definition: TR increase by more than one grade and final TR grade >3/4 at follow-up.**
- Clinical events : cardiovascular death, repeated open-heart surgery, and congestive heart failure requiring hospital admission.
- **The overall incidence of late significant TR was 7.7% (49/638).**
- During clinical follow- up of 101 (24) months, patients who developed late significant TR showed a significantly lower 8-year clinical event-free survival rate (76 (6) vs 91 (1)%, $p<0.001$).

Song H et al. Heart 2009;95:931-936

Changes in severity of tricuspid regurgitation (TR) after open-heart surgery.



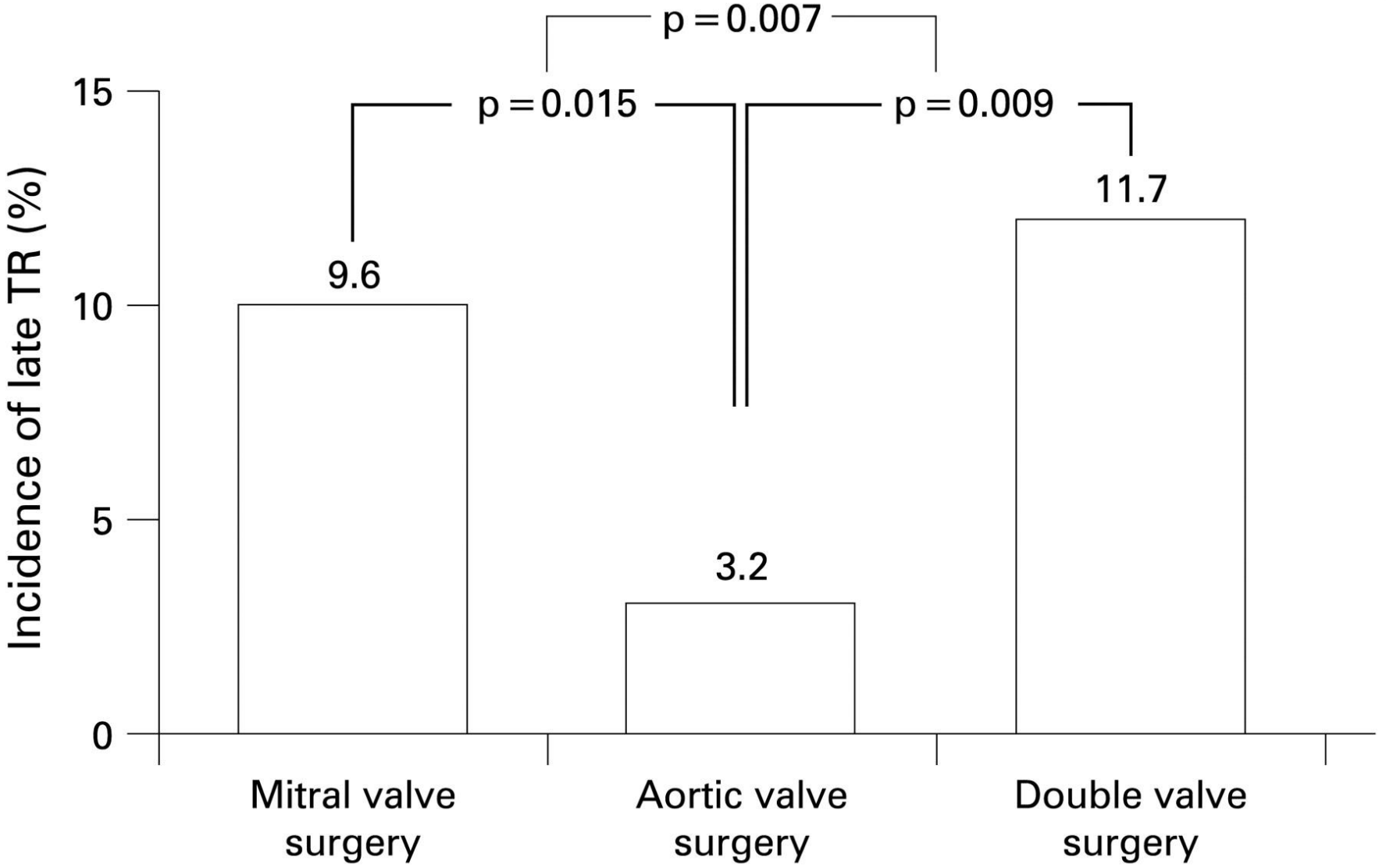
Song H et al. Heart 2009;95:931-936

The overall incidence of late significant TR :7.7% (49/638).

- Age (HR, 1.0, 95% CI, 1.0 to 1.1; p=0.005),
- female gender (HR, 5.0; 95% CI 2.0 to 12.7; p=0.001),
- rheumatic aetiology (HR, 3.8; 95% CI 1.4 to 10.3; p=0.011),
- atrial fibrillation (HR, 2.6; 95% CI 1.1 to 6.4; p=0.035)
- peak pressure gradient of TR at follow-up (HR, 1.1; 95% CI 1.0 to 1.1; p,0.001)

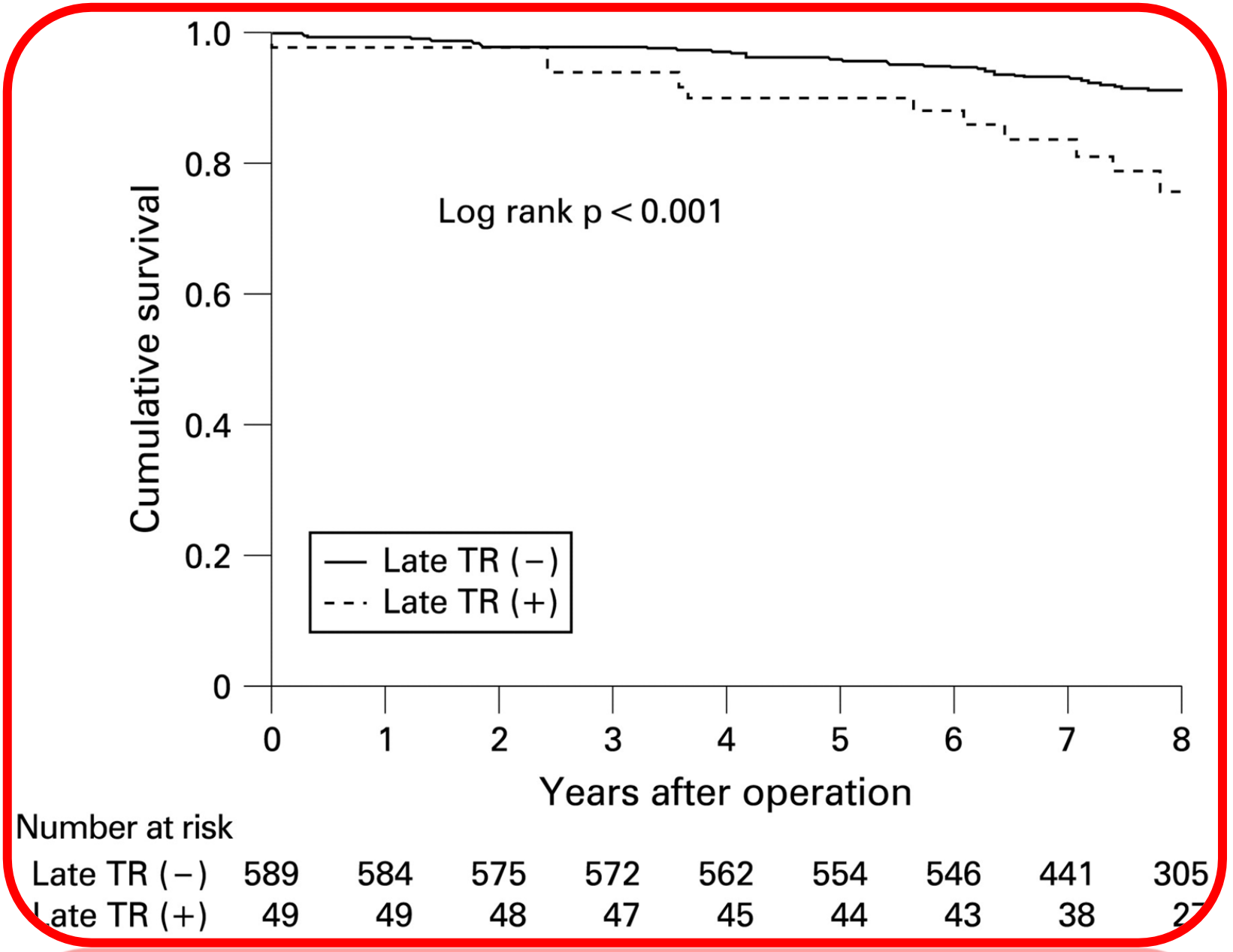
independent factors associated with development of late significant TR.

Incidence of late significant tricuspid regurgitation (TR) according to the surgical procedure for the underlying valvular lesion.

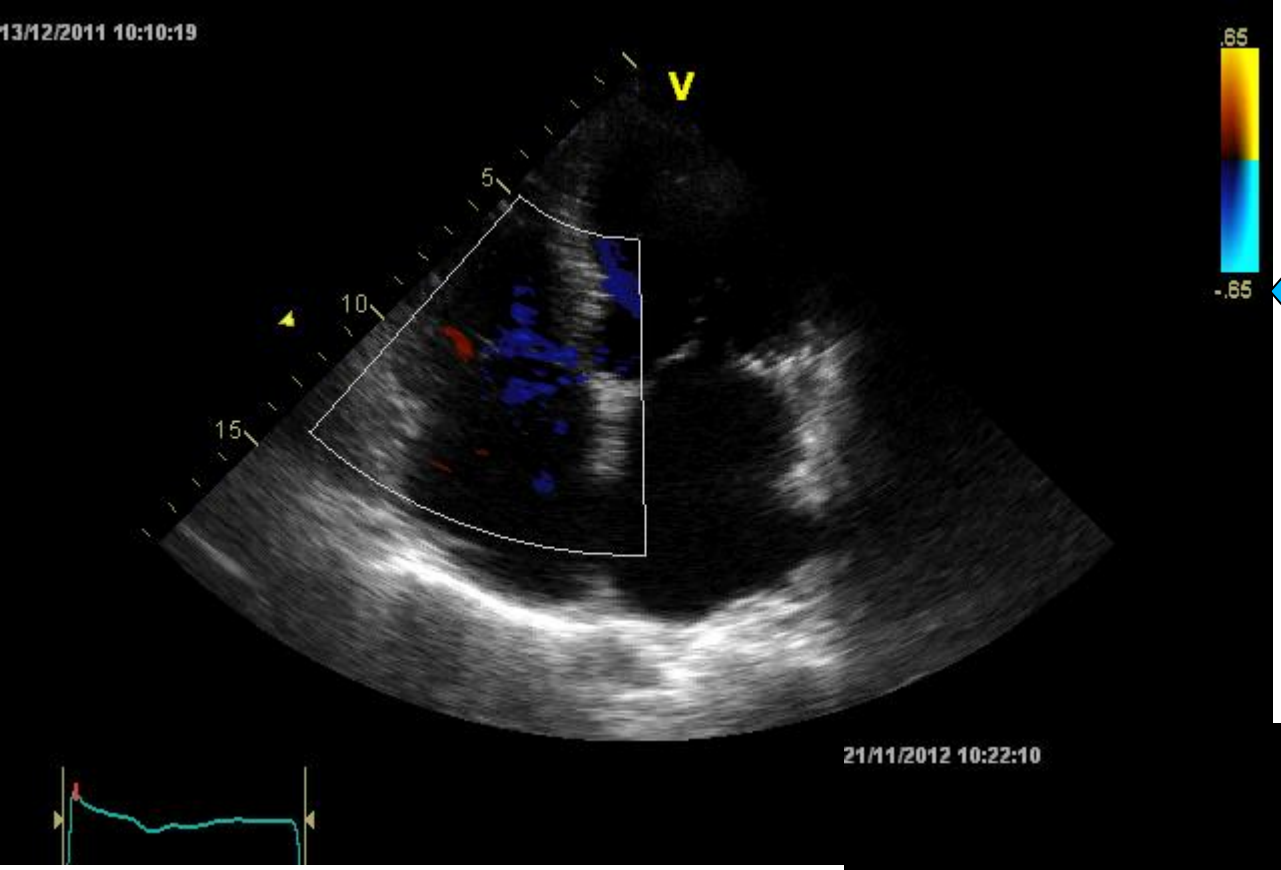


Song H et al. Heart 2009;95:931-936

Comparison of event-free survival rates in patients who did and did not develop late significant tricuspid regurgitation (TR).

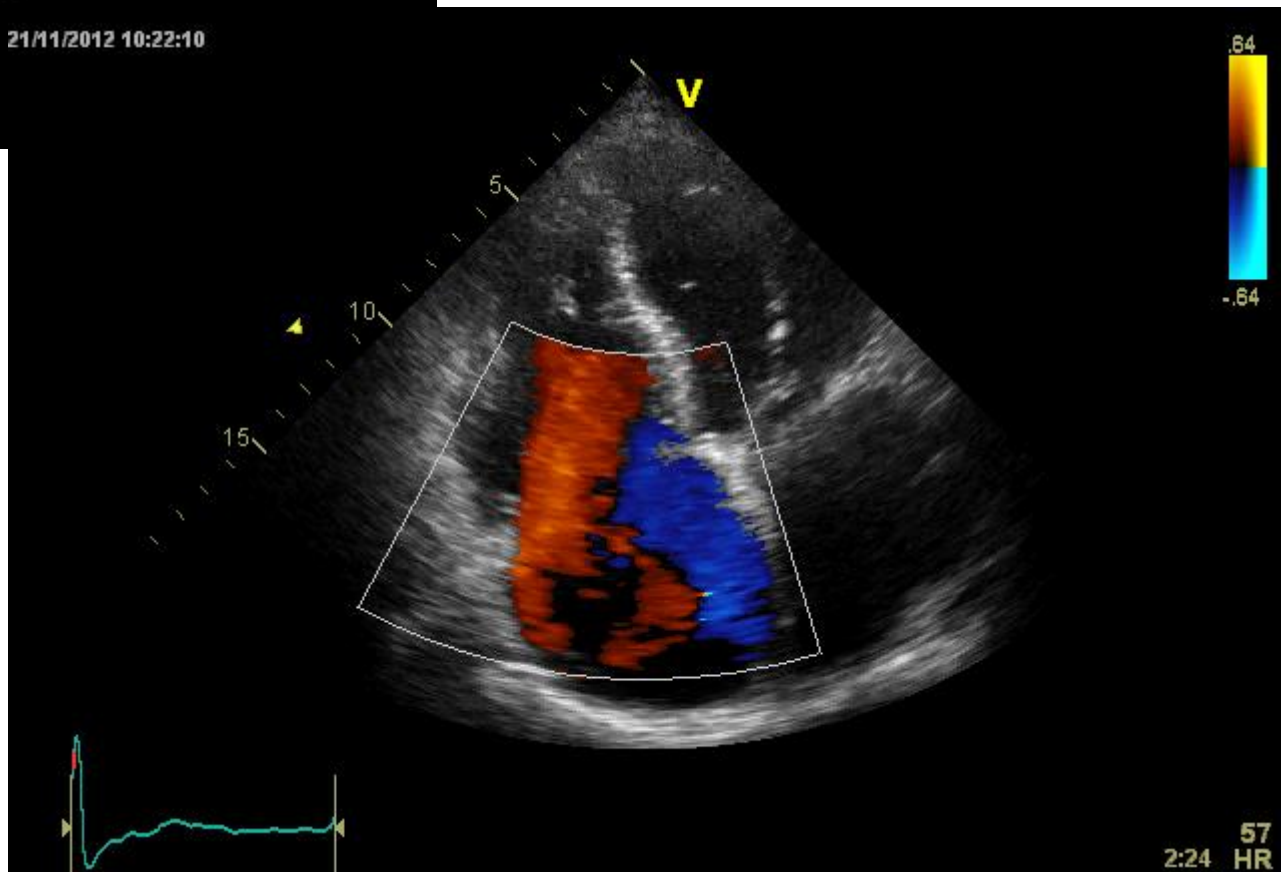


Song H et al. Heart 2009;95:931-936

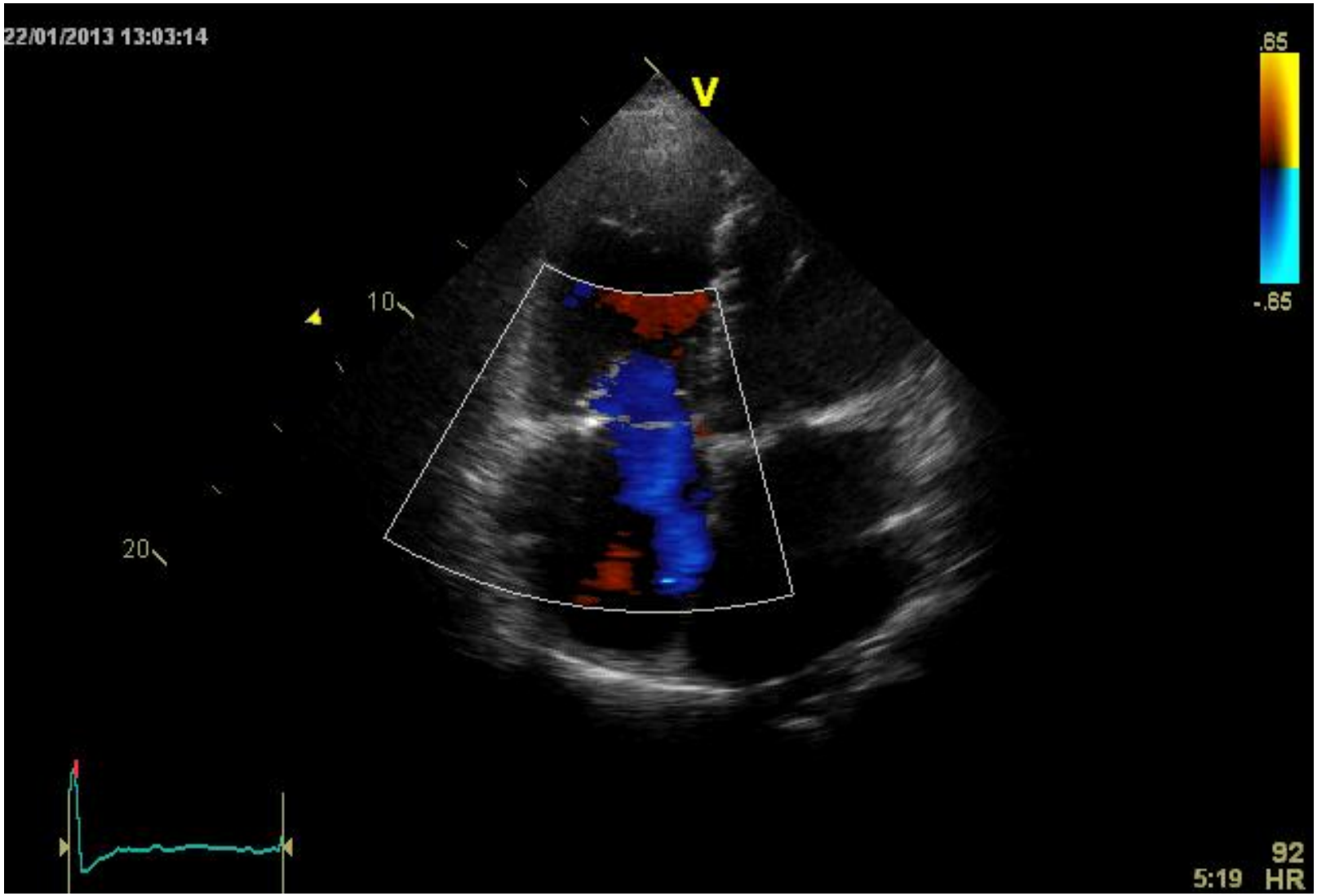


Pre-AoV replacement for symptomatic AoS

Post-AoV replacement for symptomatic AoS



Post redux for Tricuspid valve repair



To Conclude

Very low level of evidence

Importance of a careful assessment of the valves anatomy (rhumatismal ≠degenerative)

Importance of Afib, Atrial size, severity of the global heart disease and after…

case to case decision making process