

Imaging MV

Jeroen J. Bax

Leiden University Medical Center

The Netherlands

Davos, feb 2015

MV/MR: information needed on..

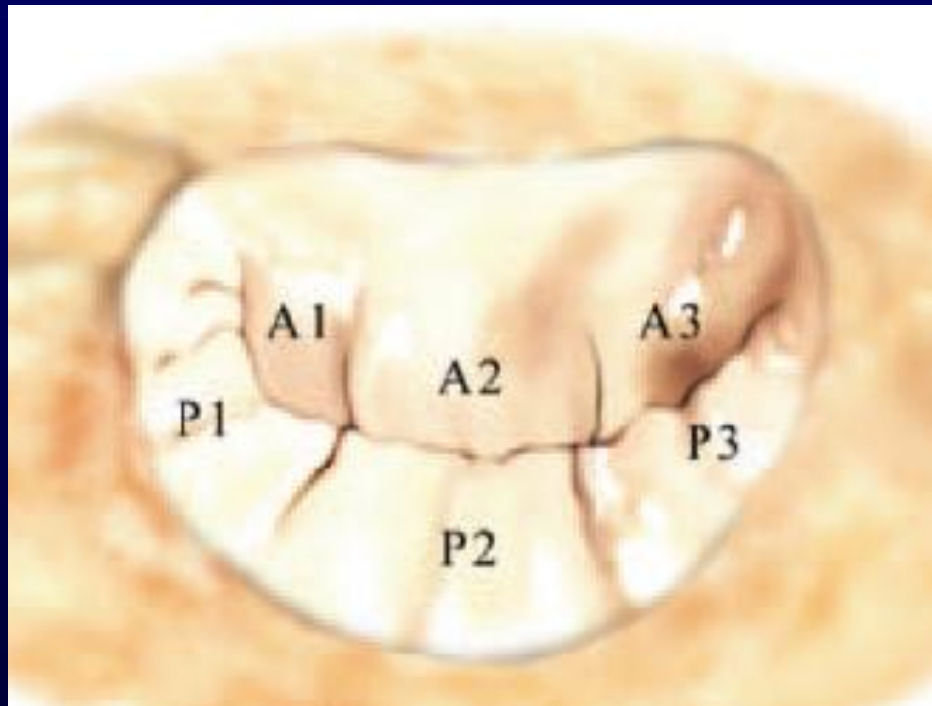
1. MV anatomy
2. MR etiology - primary vs secondary
3. MR severity – quantification
4. Annulus and subvalvular apparatus
5. LV function, size and shape
6. LCX (percut MVR)?

Mitral valve anatomy

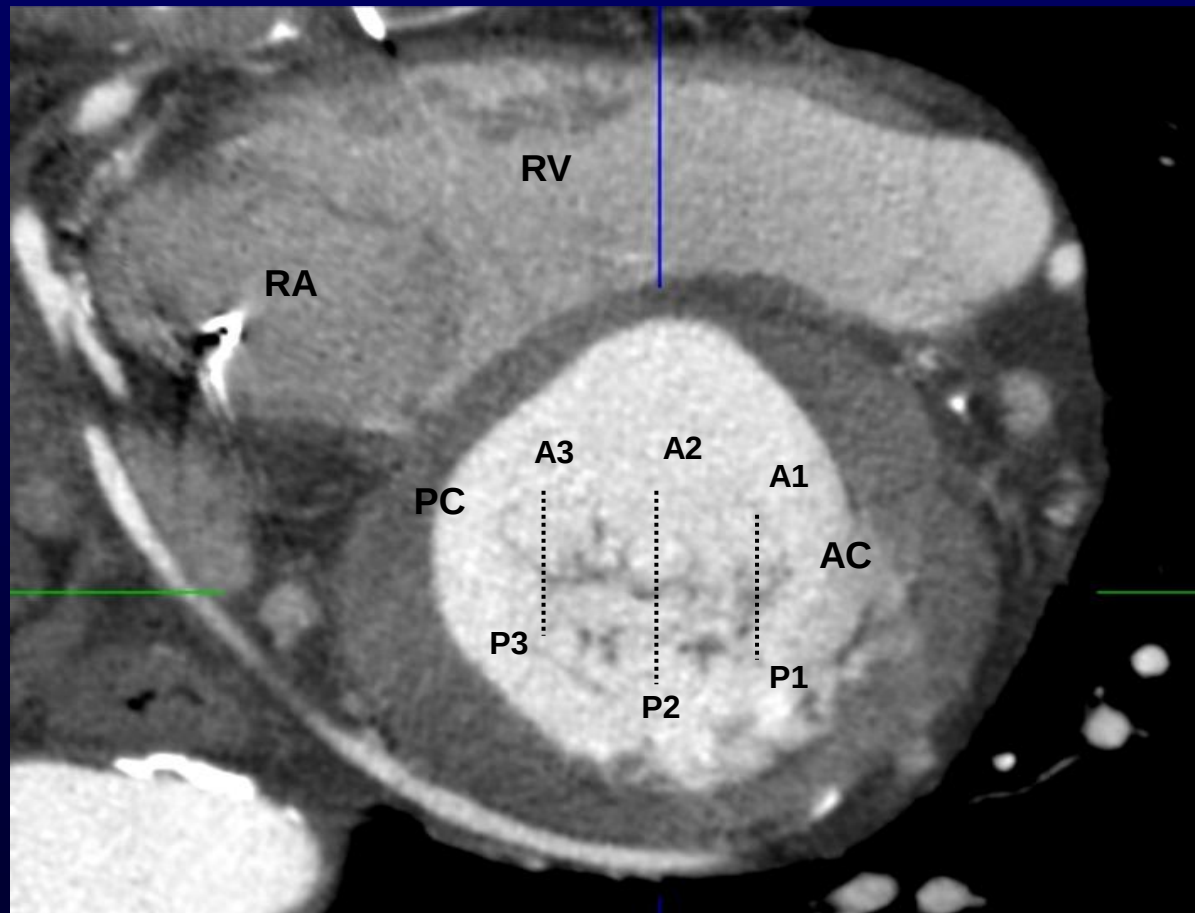


- **Leaflets**
- **Annulus**
- **Chordae tendinae**
- **Papillary muscles**
- **Left ventricle**

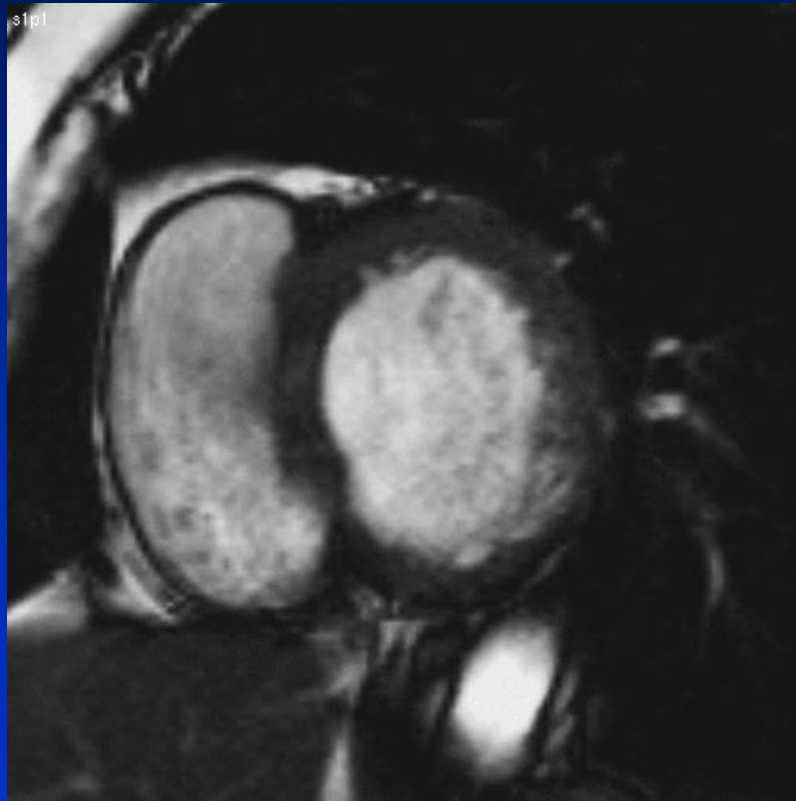
Mitral valve anatomy



Segmental analysis with MSCT



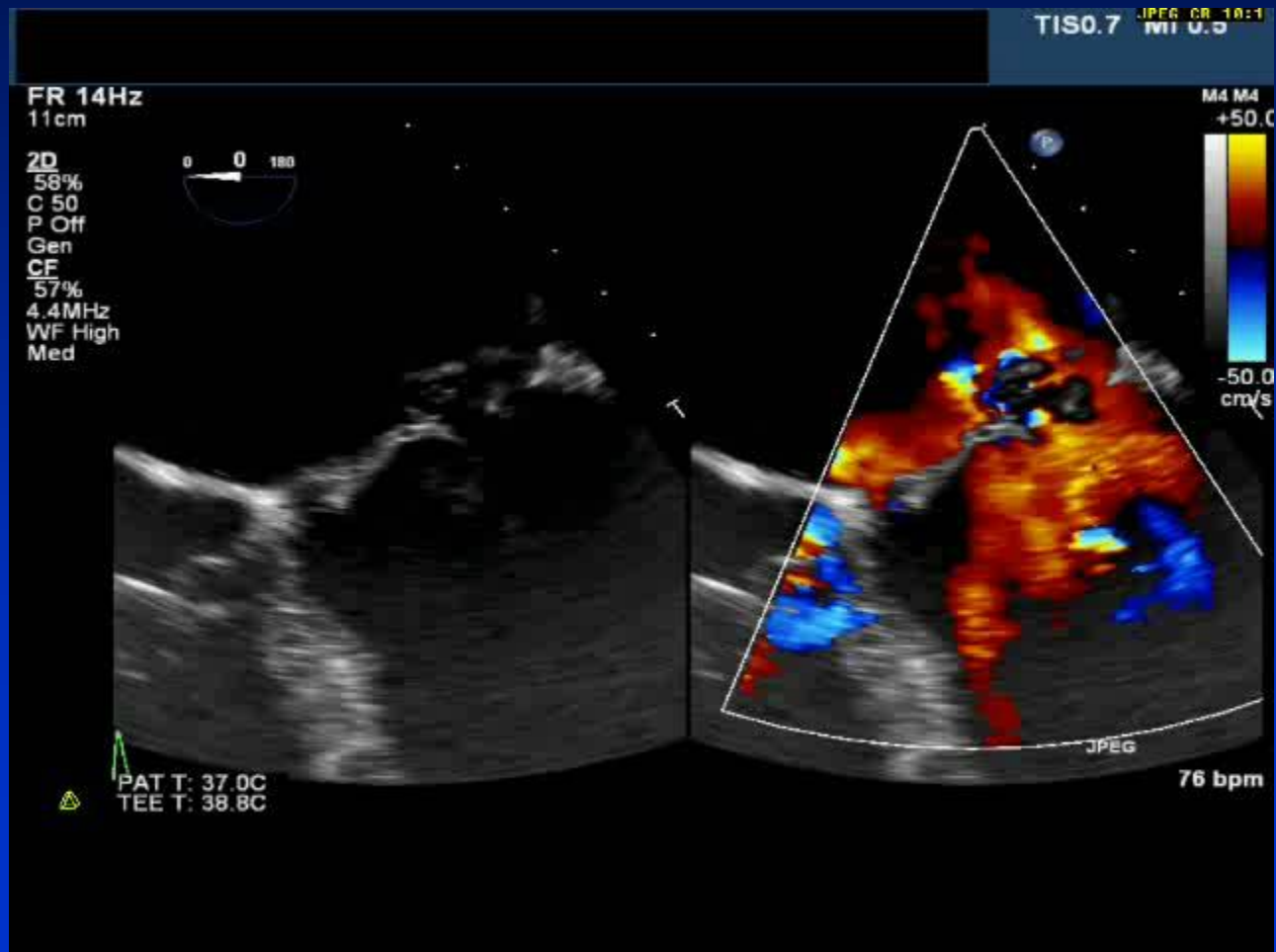
Segmental analysis with MRI



MV/MR: information needed on..

1. MV anatomy
2. MR etiology - primary vs secondary
3. MR severity – quantification
4. Annulus and subvalvular apparatus
5. LV function, size and shape
6. LCX (percut MVR)?

MR etiology - excessive motion of the leaflets (P2) – primary MR



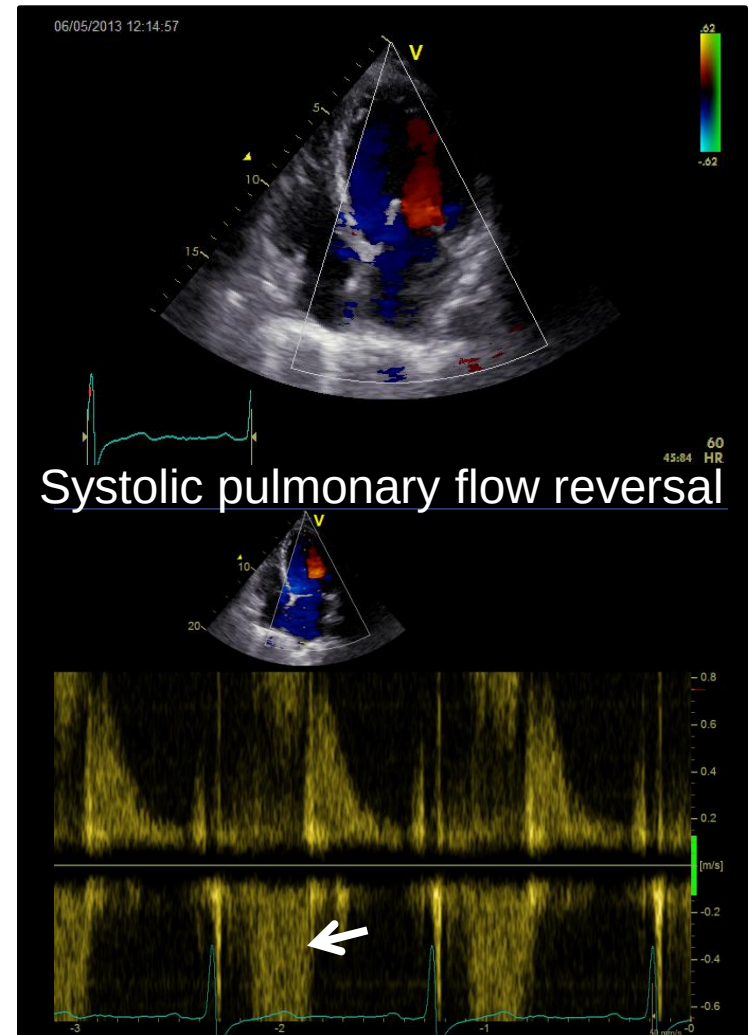
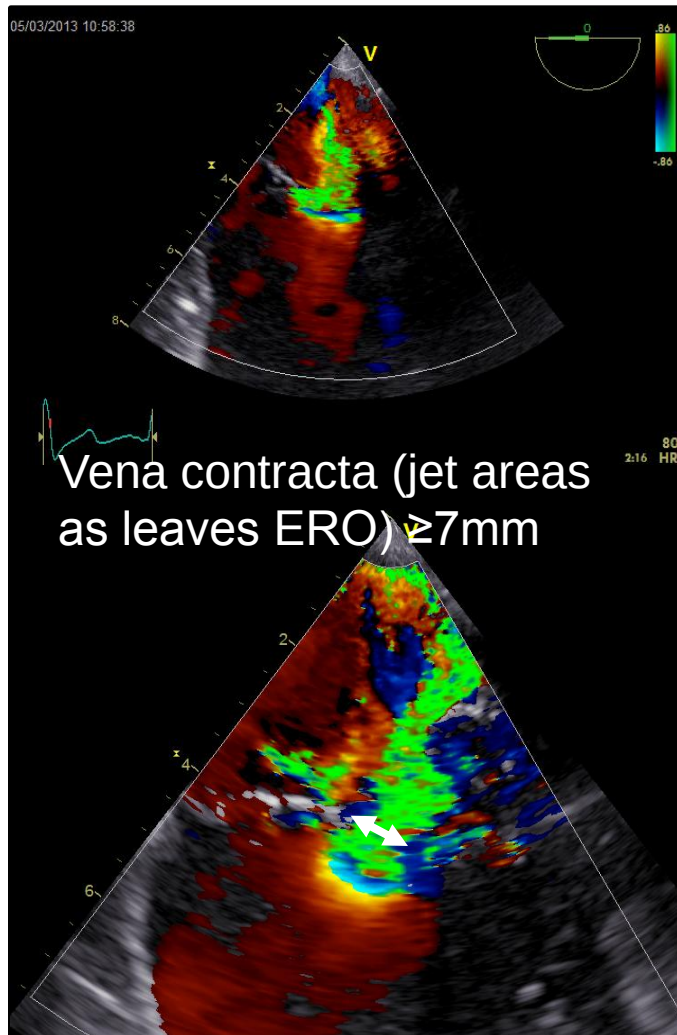
MR etiology - LV remodeling (functional, secondary MR)



MV/MR: information needed on..

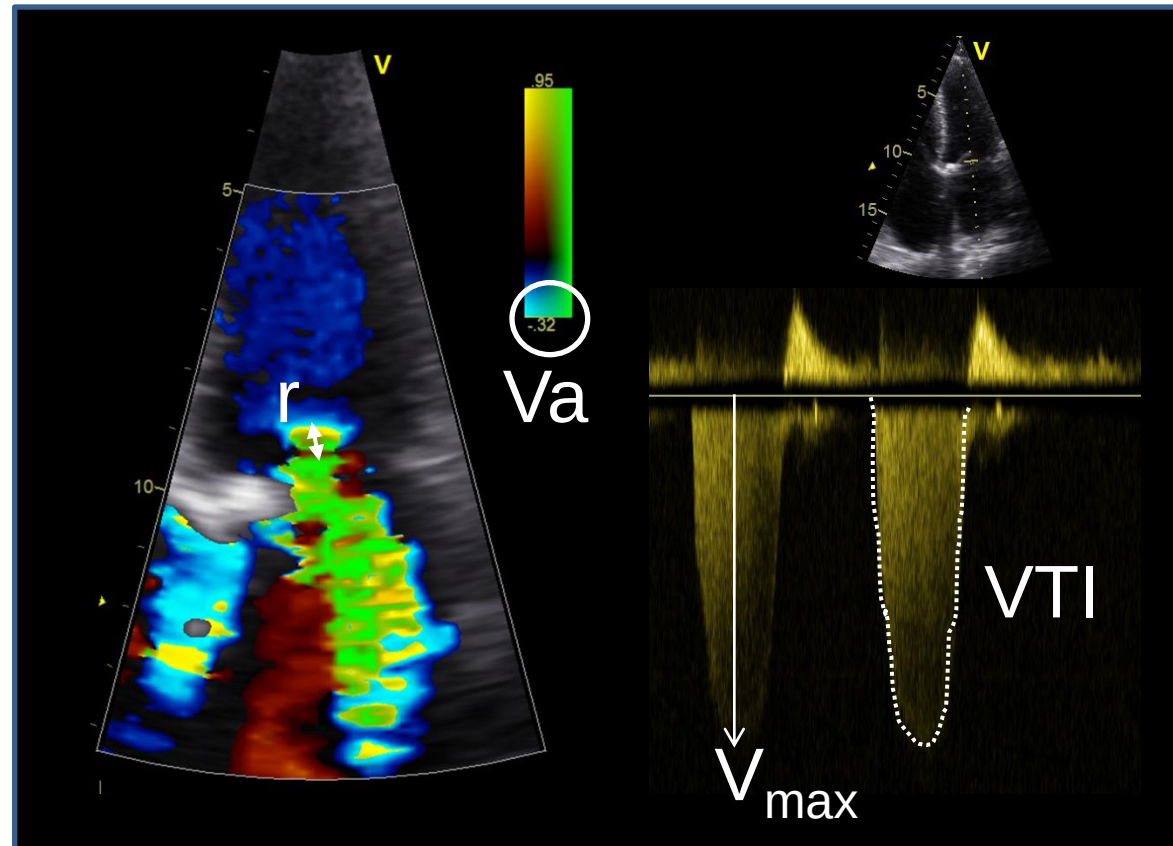
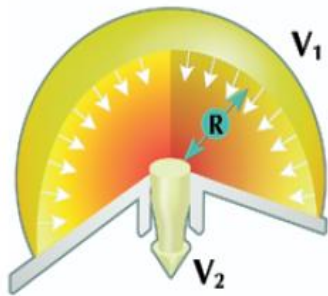
1. MV anatomy
2. MR etiology - primary vs secondary
3. MR severity – quantification
4. Annulus and subvalvular apparatus
5. LV function, size and shape
6. LCX (percut MVR)?

MR quantification semiquantitative parameters



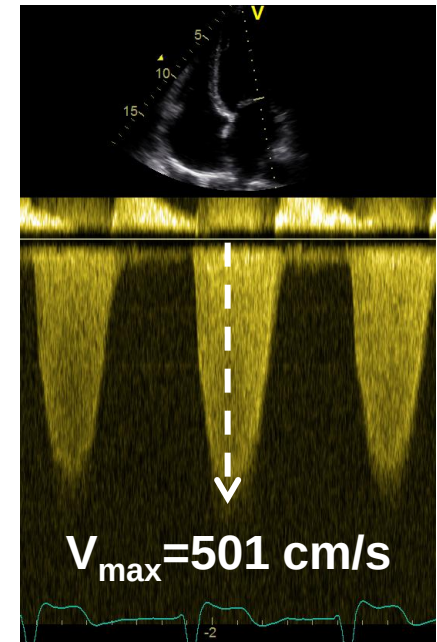
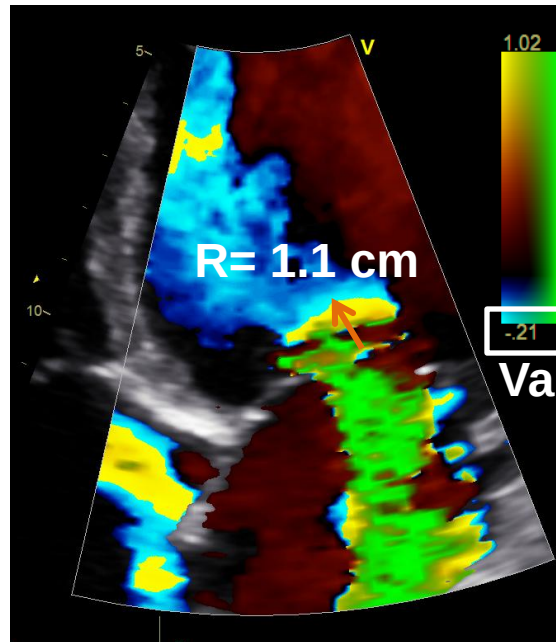
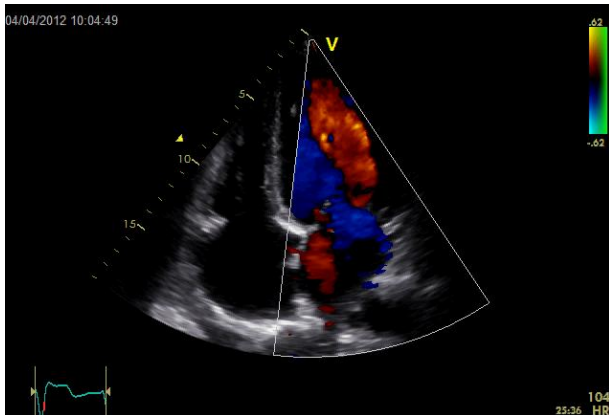
MR Quantification-PISA

proximal isovelocity surface area



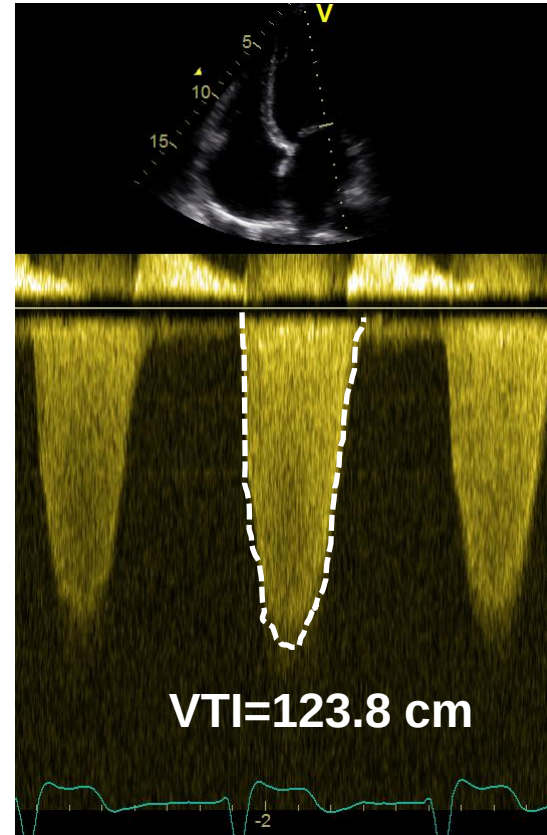
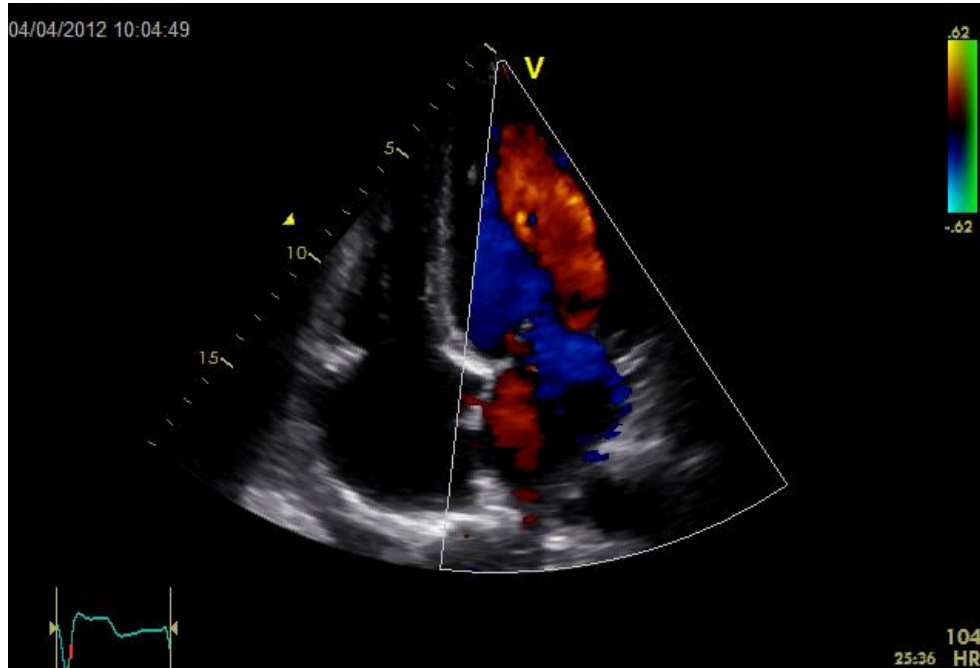
$$\text{EROA} = 2\pi r^2 \times V_a / V_{\text{max}}$$
$$\text{Rvol} = \text{EROA} \times \text{VTI}$$

MR Quantification-PISA



$$EROA = 2\pi(1.1)^2 \times 21 / 501 = 0.3 \text{ cm}^2$$

MR Quantification-PISA



$$R_{vol} = 0.3 \times 123.8 = 37 \text{ ml/beat}$$

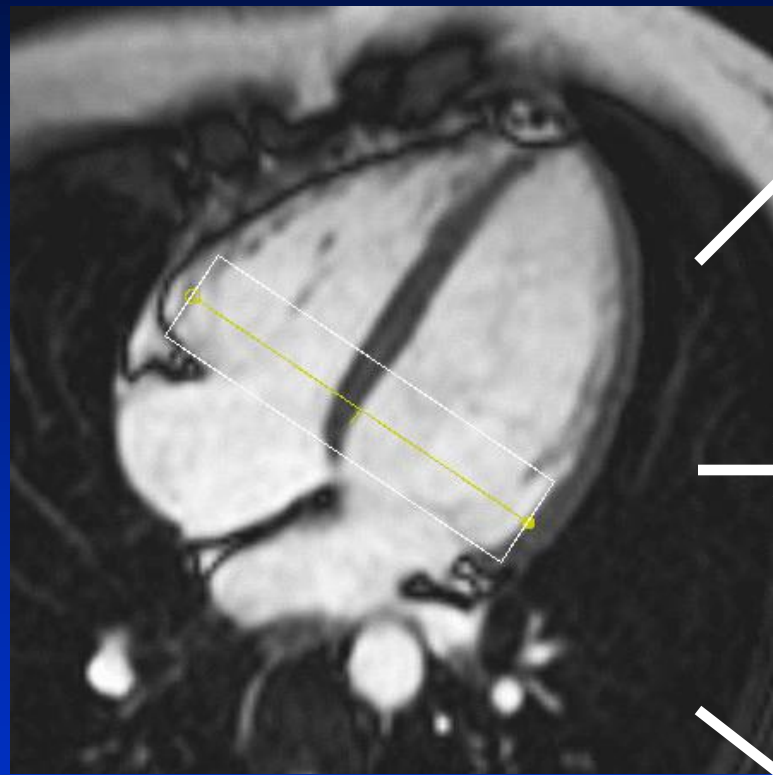
Echocardiographic criteria for the definition of severe valve regurgitation: *an integrative approach*

Mitral regurgitation		
Semiquantitative		
Vena contracta width (mm)	≥ 7 (> 8 for biplane)	
Upstream vein flow	Systolic pulmonary vein flow reversal	
Quantitative	Primary	Secondary
EROA (mm ²)	≥ 40	≥ 20
R Vol (ml/beat)	≥ 60	≥ 30

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

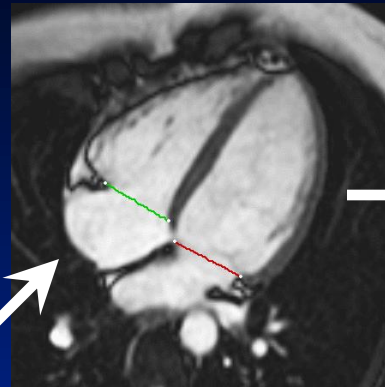
European Heart Journal 2012 - doi:10.1093/eurheartj/ehs109 &
European Journal of Cardio-Thoracic Surgery 2012 -
doi:10.1093/ejcts/ezs455).

3D Flow Quantification in All Valves

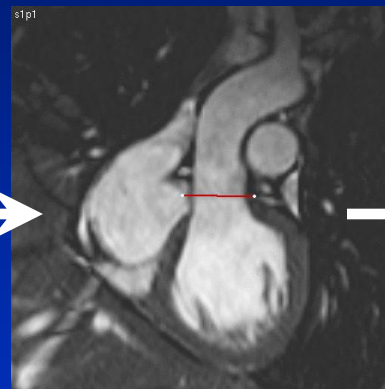


3D volume scan /w 3-dir
velocity encoded MRI

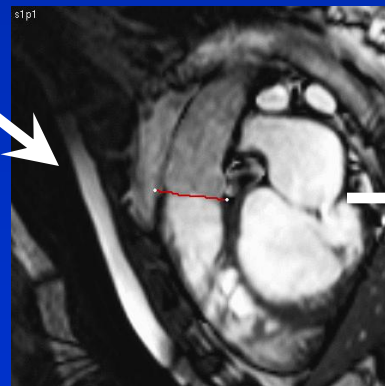
Westenberg, LKEB



MV & TV



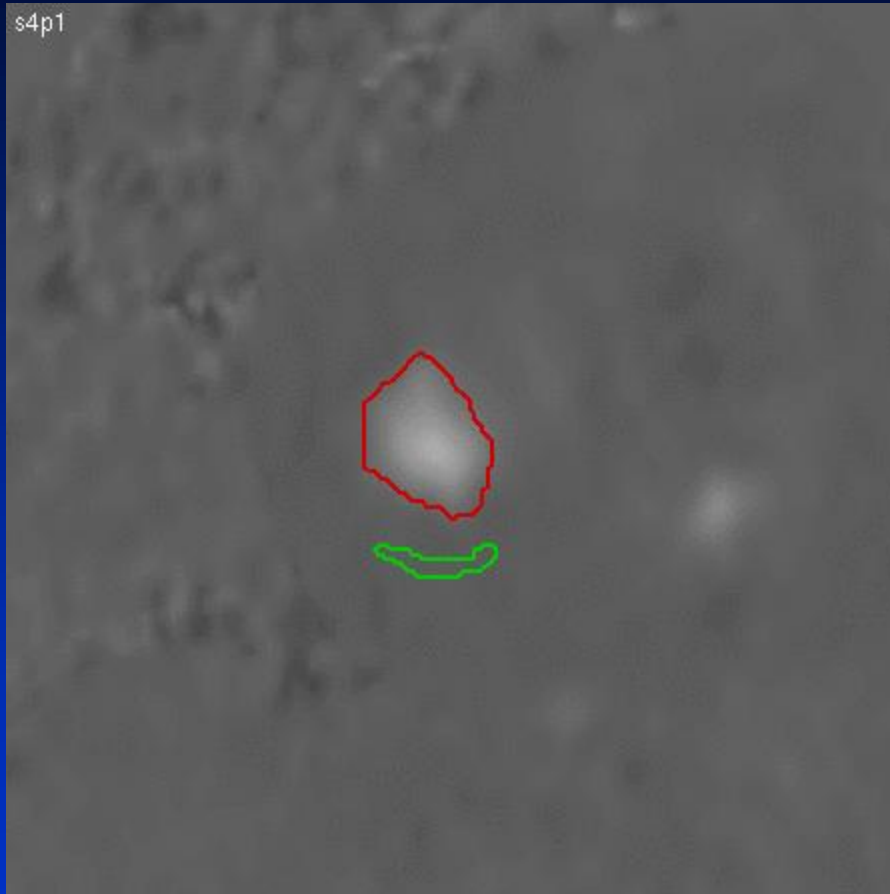
AV



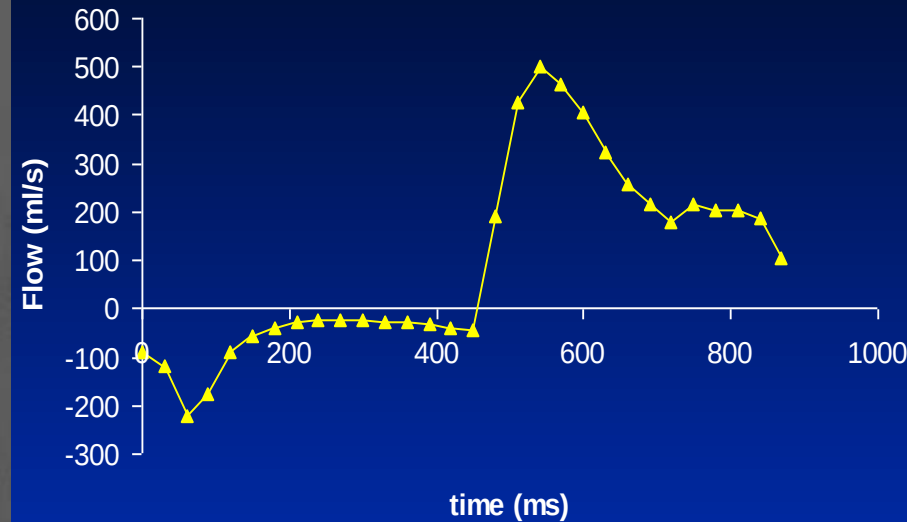
PV



MRI: 3D Flow Quantification MV



MV flow



$$V_{\text{forward}} = 116 \text{ ml}$$

$$V_{\text{back}} = 32 \text{ ml}$$

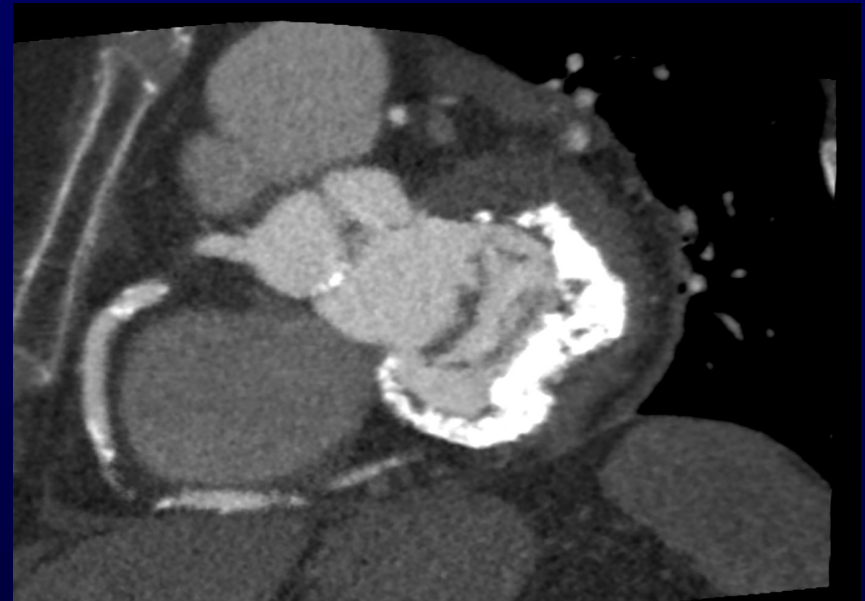
$$V_{\text{eff}} = 84 \text{ ml}$$

$$\text{Regurg. Fraction} = 27\%$$

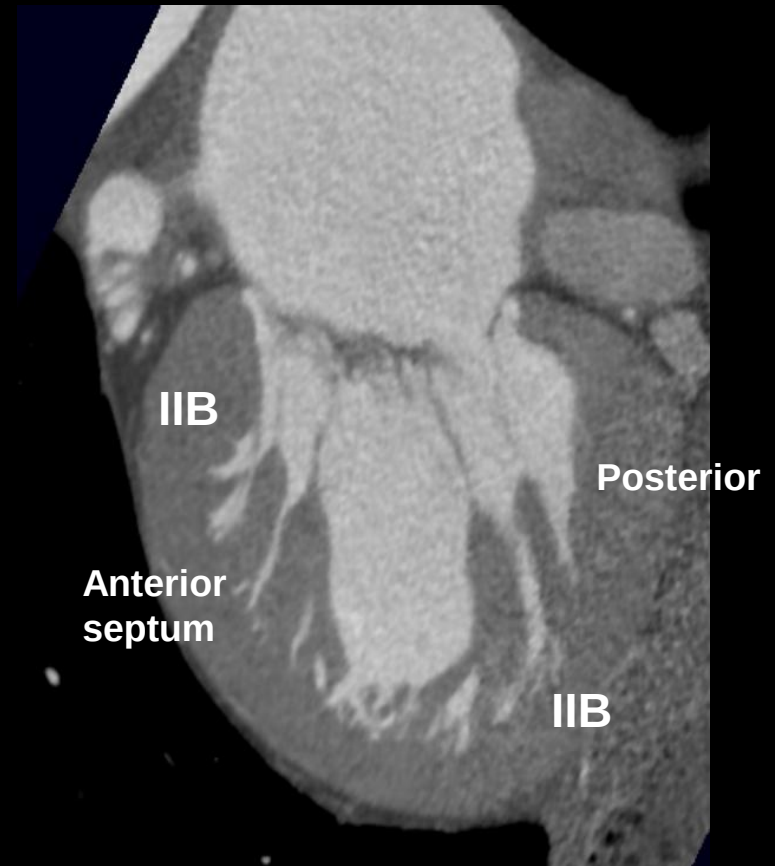
MV/MR: information needed on..

1. MV anatomy
2. MR etiology - primary vs secondary
3. MR severity – quantification
4. Annulus, subvalvular apparatus
5. LV function, size and shape
6. LCX (percut MVR)?

Mitral annulus - calcifications



MV subvalvular apparatus

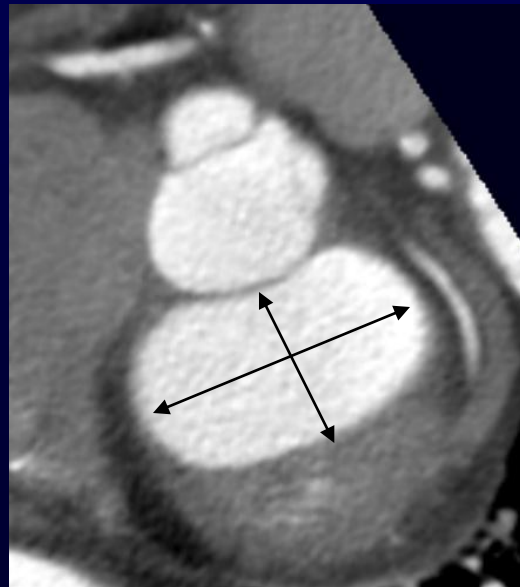
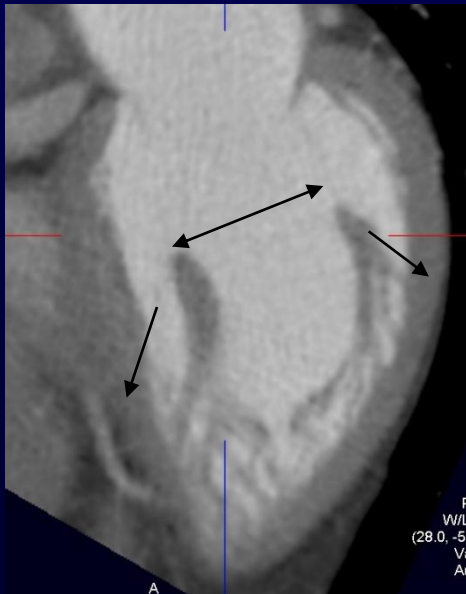
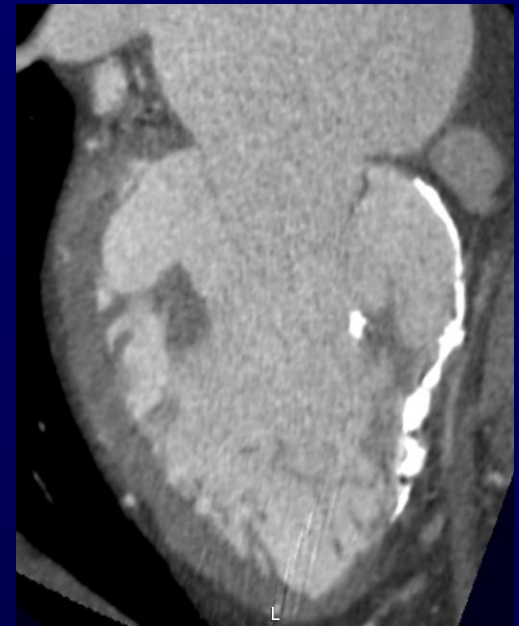


MV/MR: information needed on..

1. MV anatomy
2. MR etiology - primary vs secondary
3. MR severity – quantification
4. Annulus and subvalvular apparatus
5. LV function, size and shape
6. LCX (percut MVR)?

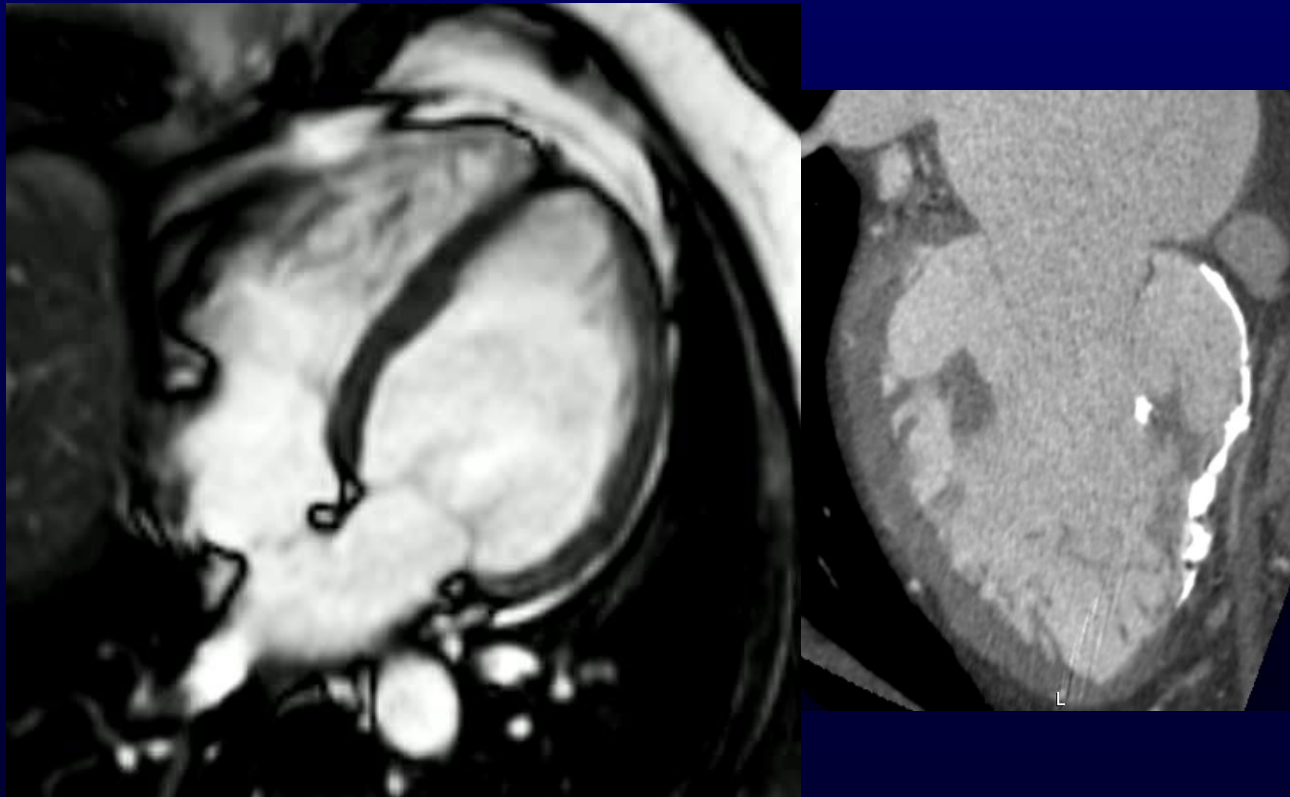
LV size and shape – assessment of MSCT

- FMR related to:
 1. Remodeling of left ventricle
 2. Displacement of papillary muscles
 3. Annular dilatation
 4. Leaflet tethering



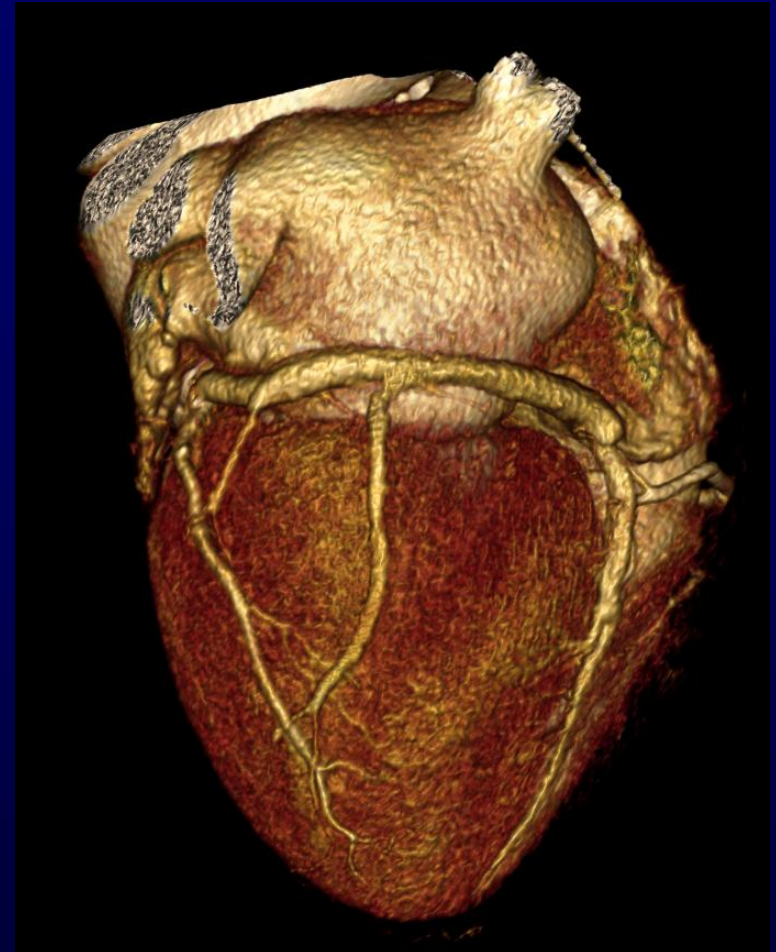
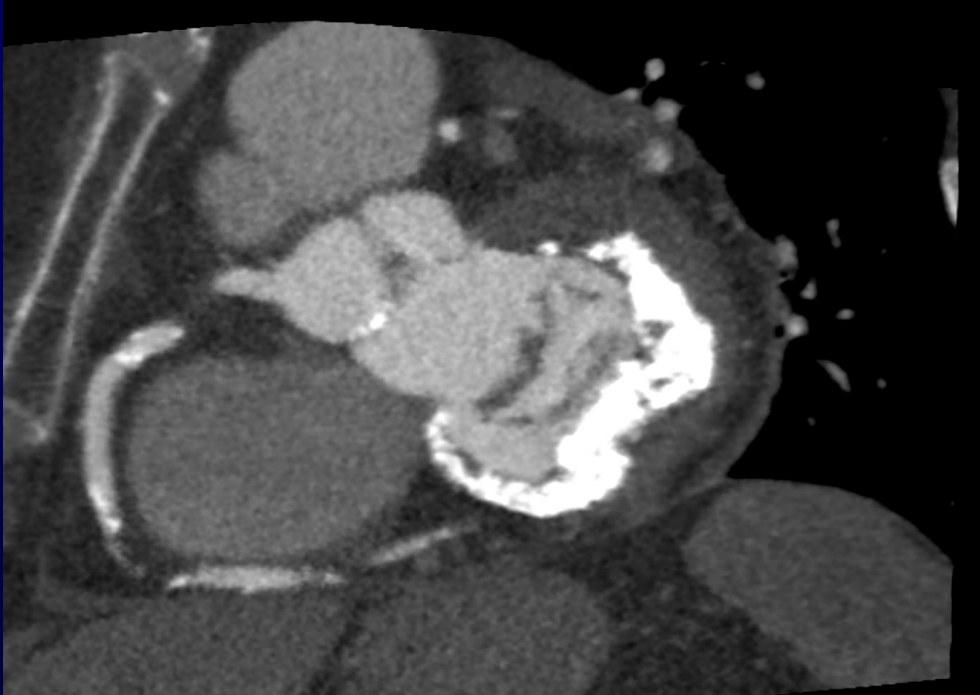
LV function, size and shape

– Echo, MRI / MSCT

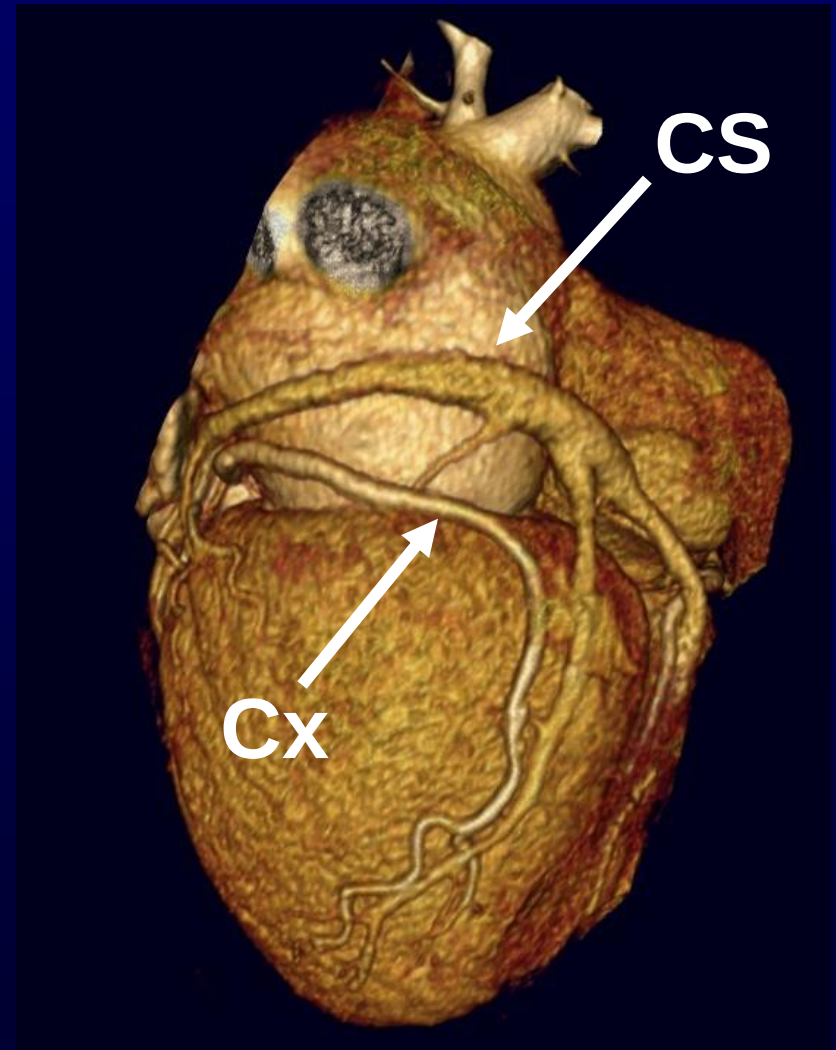


MV/MR: information needed on..

1. MV anatomy
2. MR etiology - primary vs secondary
3. MR severity – quantification
4. Annulus and subvalvular apparatus
5. LV function, size and shape
6. LCX (percut MVR)?



Percutaneous approach feasible?



68% LCX between CS and MVA – could create problems

Imaging to select for MitraClip

Ideal valve morphology	Unsuitable valve morphology
• Mitral regurgitation originating from the mid portion of the valve (degenerative or functional etiology)	• Perforated mitral leaflets or clefts, lack of primary and secondary chordal support
• Lack of calcification in the grasping area	• Severe calcification in the grasping area
• Mitral valve area >4cm²	• Hemodynamically relevant mitral stenosis
• Length of posterior leaflet ≥10 mm	• Length of posterior leaflet <7mm
• Non-rheumatic or endocarditic valve disease	• Rheumatic valve disease (restriction in systole and diastole) or endocarditic valve disease
• Flail width <15 mm, flail gap <10 mm • Sufficient leaflet tissue for mechanical coaptation: coaptation depth <11 mm, coaptation length >2mm	