Clinical anatomy

Imaging in Cardiology

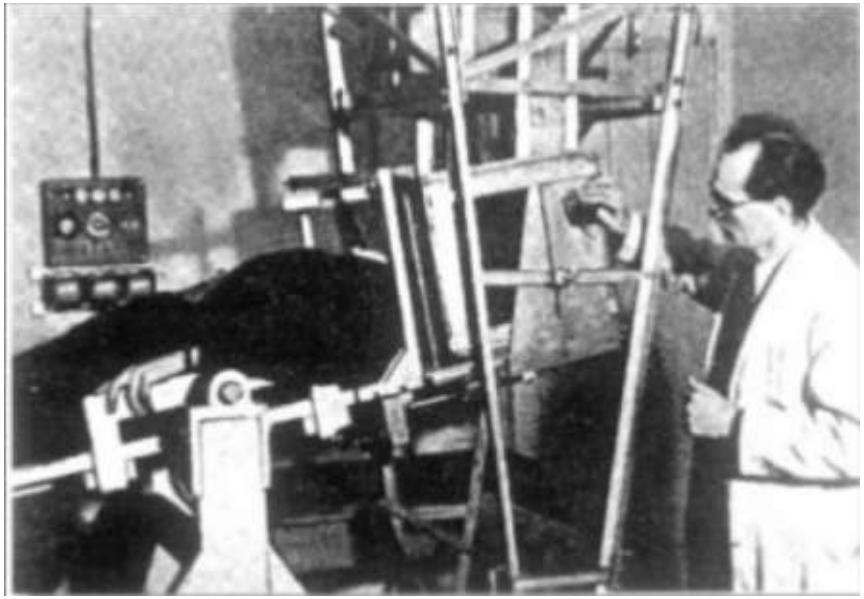
Radka Kočková

History of US imaging

- **Dussik KT in Australia in 1941**

  US brain imaging
- **Keidel WD in Germany in 1950**

  US heart imaging

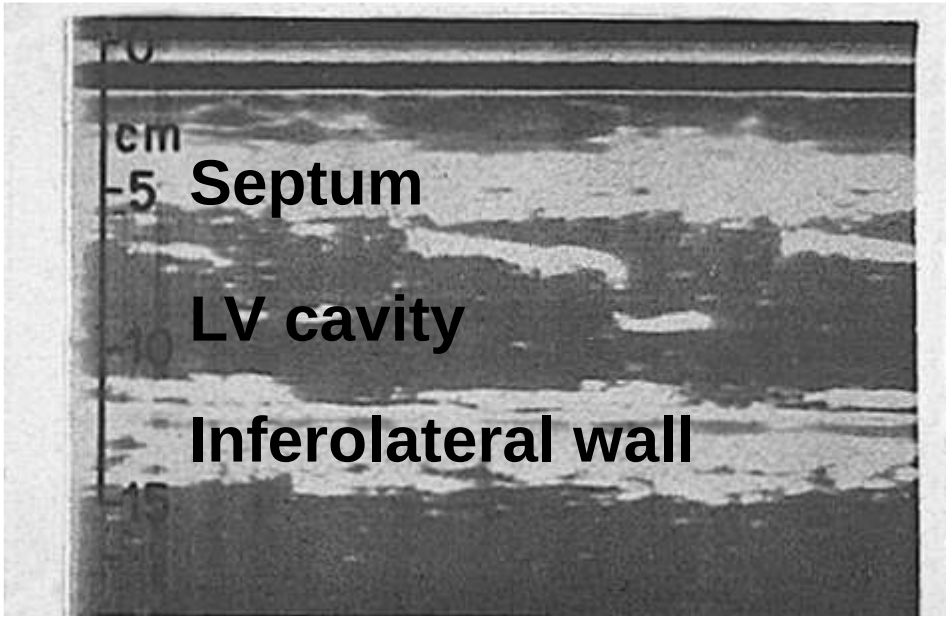


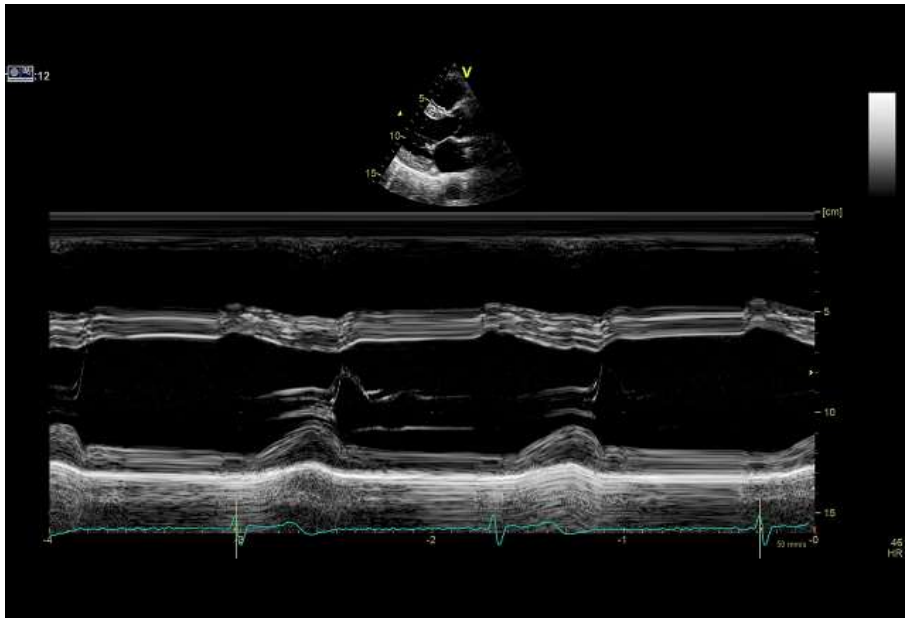
J. R. T. C. RoelandtEur J Echocardiography (2000) 1, 8–11
www.ob-ultrasound.net/dusikbio.html

High-end modern ultrasounds

Handheld utrasound

M-mode US imaging

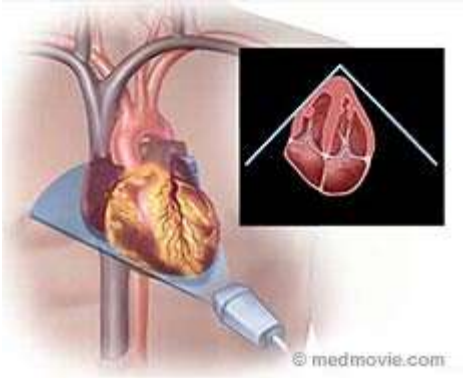




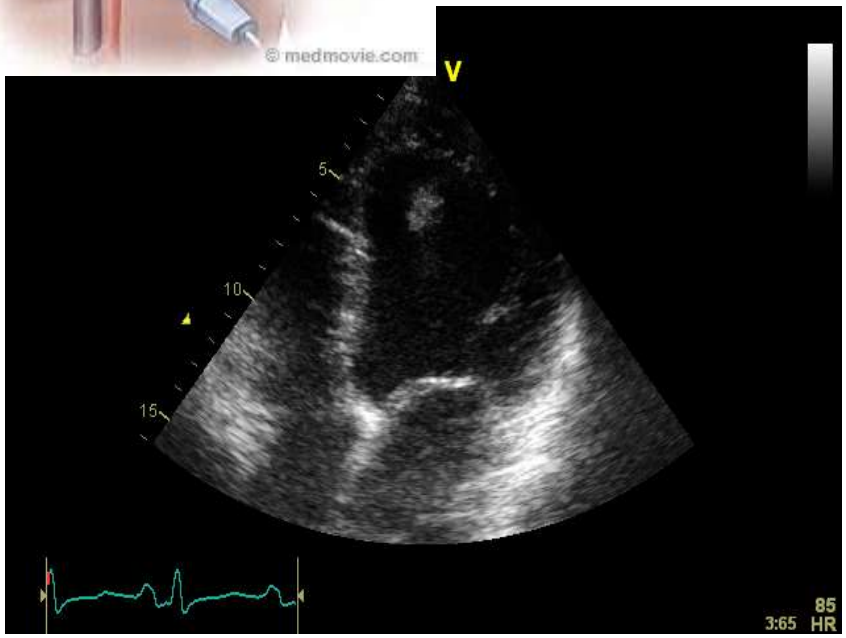
1953 – Edler a Hertz

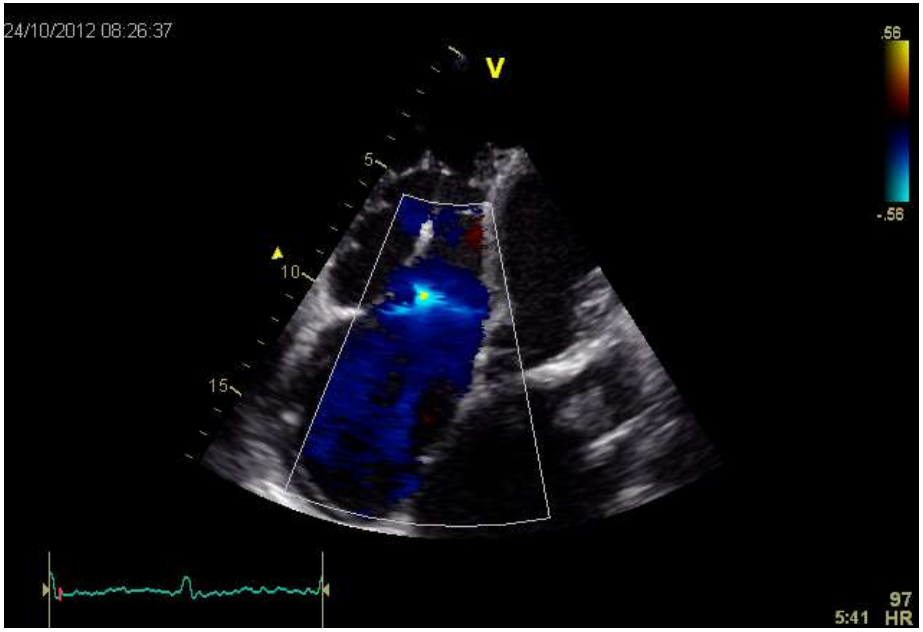
2022

2D (2 dimensional imaging)
TTE (transthoracic echocardiography)



4 – chamber view

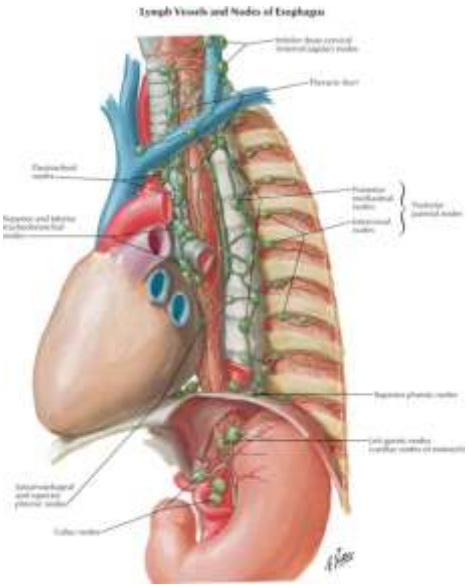




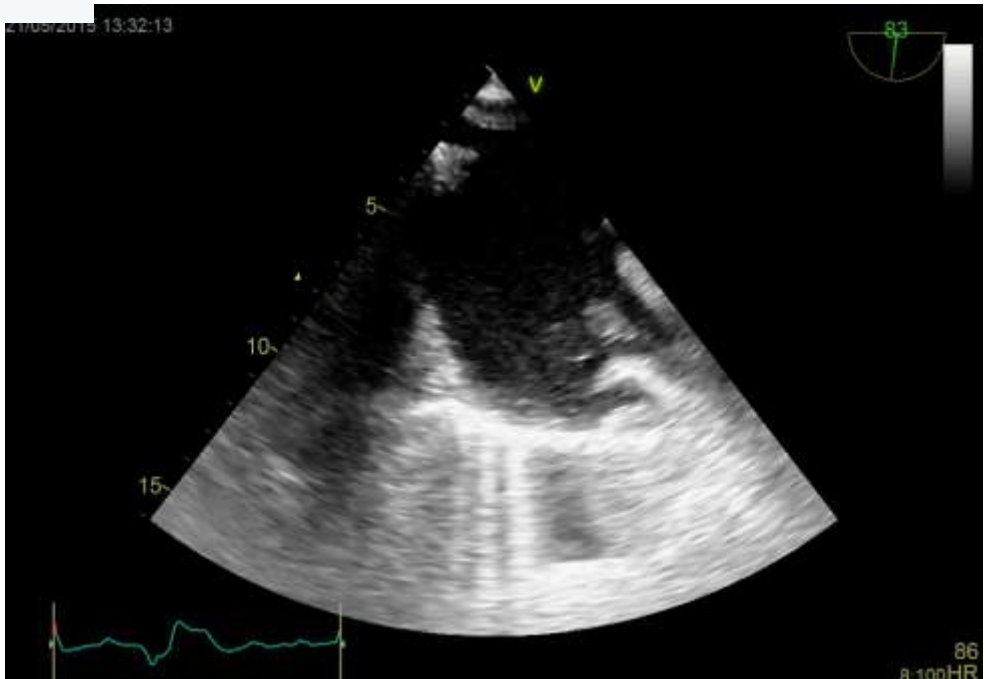
2D – TTE

Colour doppler TTE

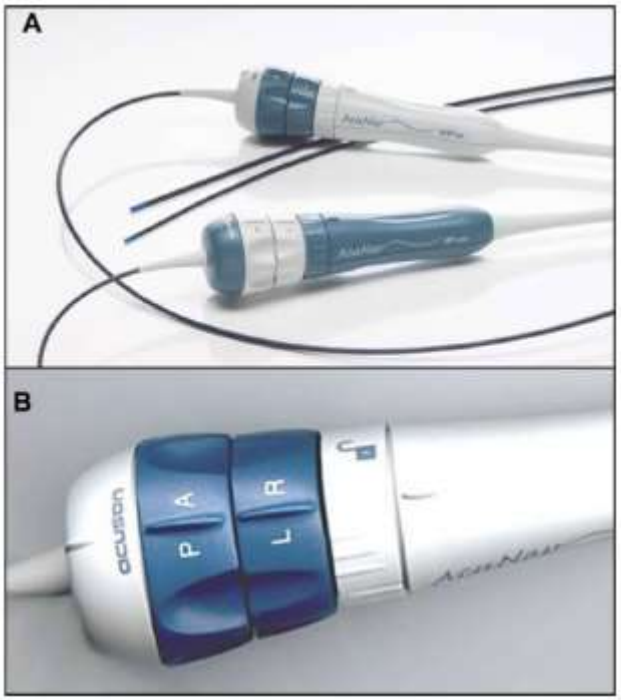
TEE – transesophageal echocardiography



TEE
Infective endocarditis

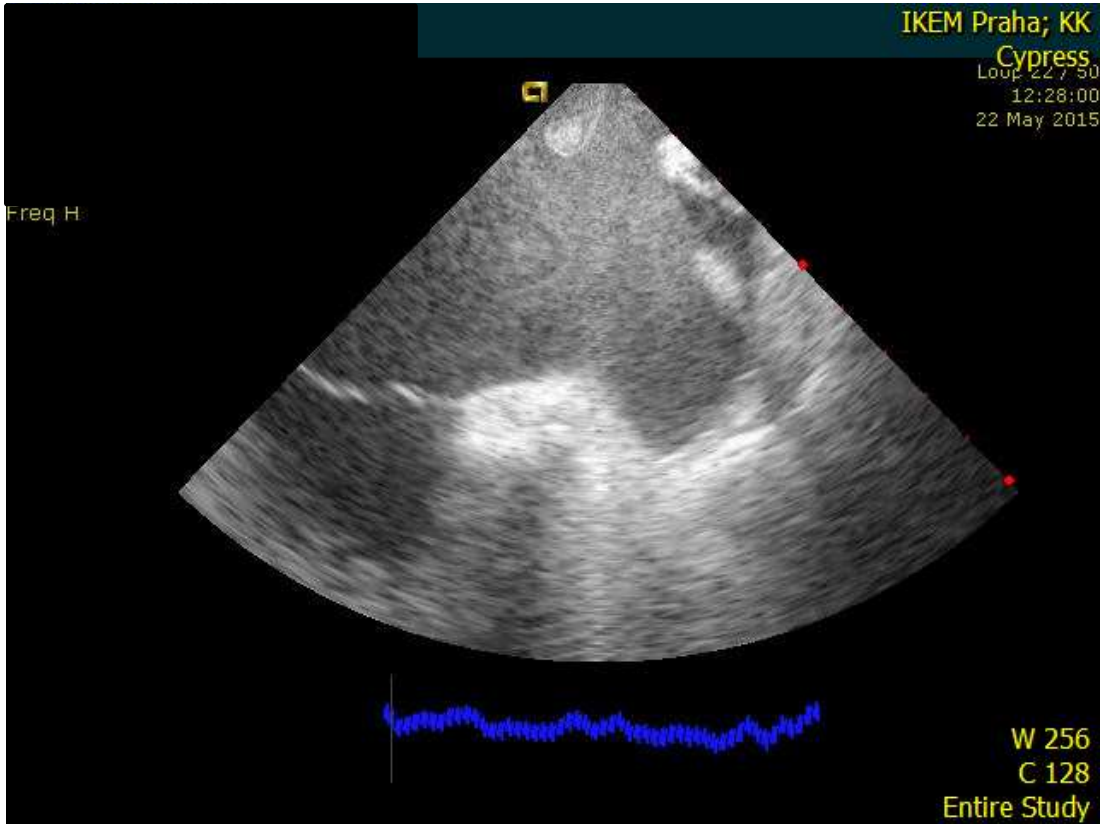


Intracardiac echocardiography



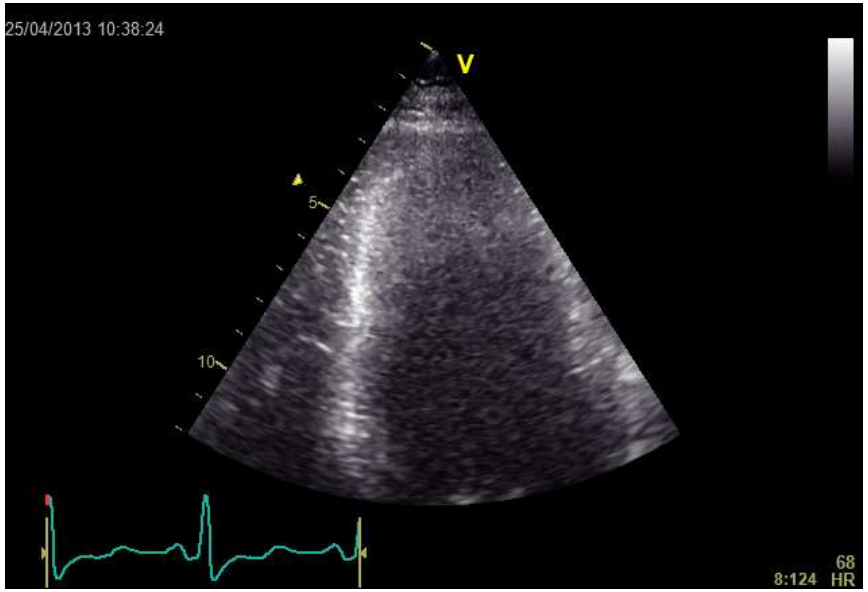
https://www.dovepress.com/cr_data/article_fulltext/s49000/49567/img/fig1.jpg

Infective endocarditis

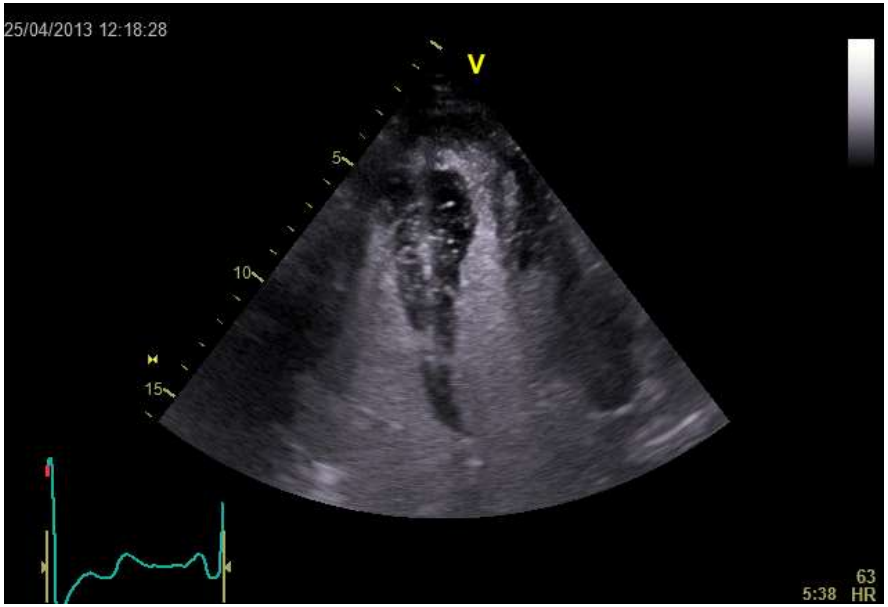


Contrast US imaging

Gramiak R and Shah PM discovered in 1968



Native TTE

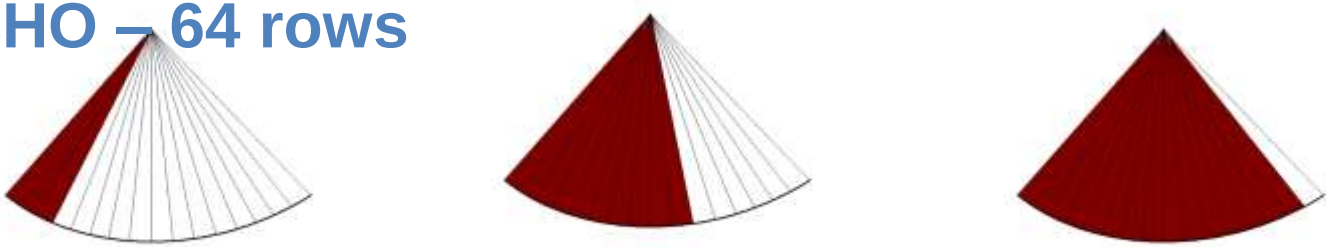


Contrast TTE

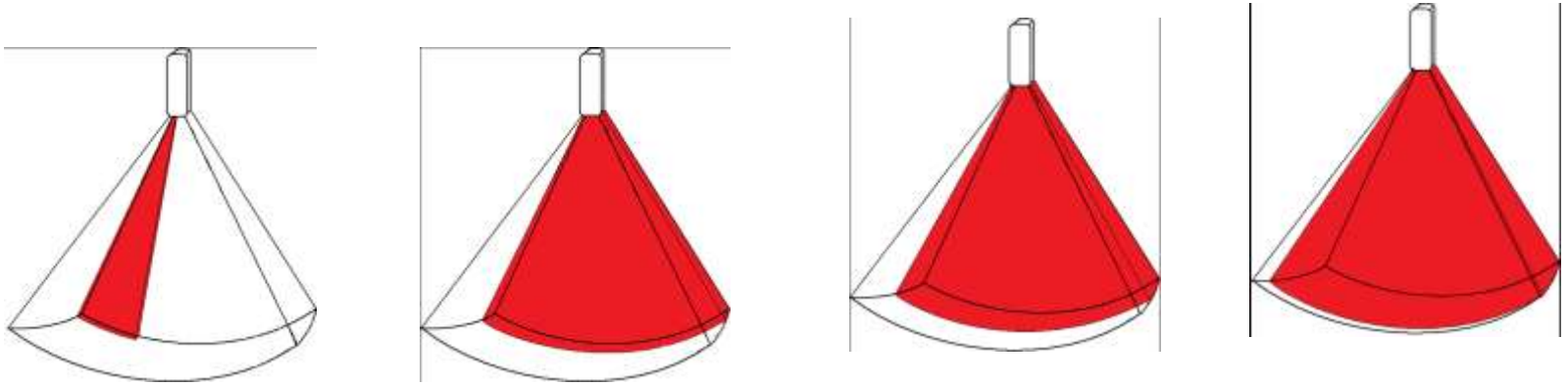
3D ECHO

- 1973 – Tom Brown
- Rapid PC and US probe technology development (3000 piezoelectric crystals in matrix)

2D ECHO – 64 rows

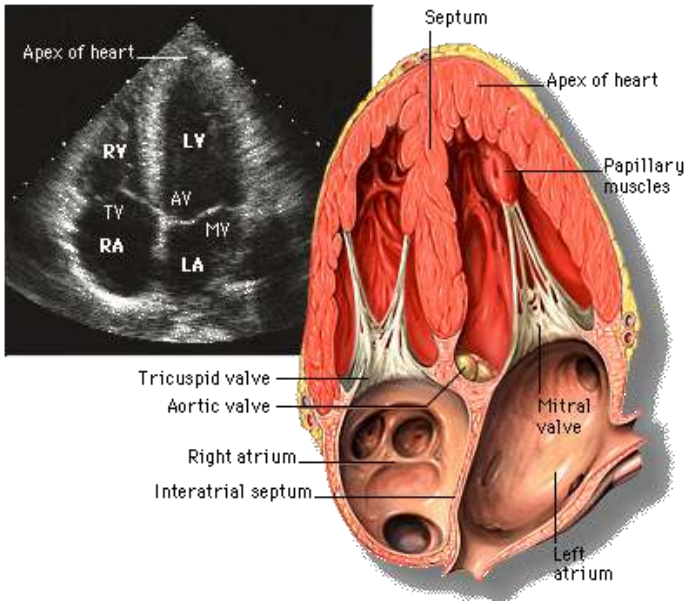


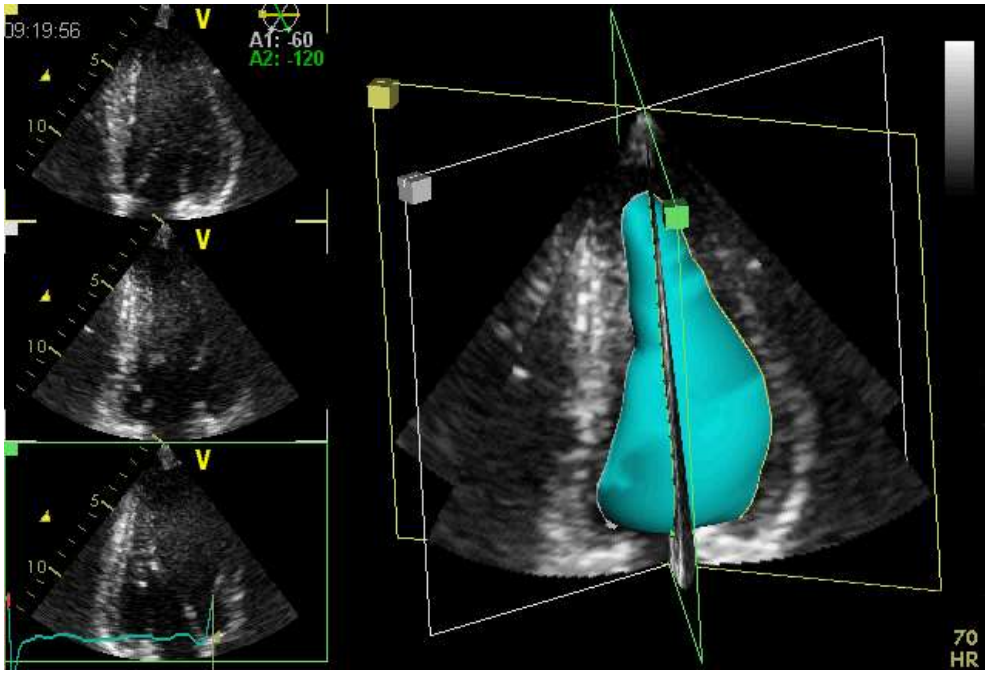
3D ECHO - 64 x 64 = 4096 rows



http://folk.ntnu.no

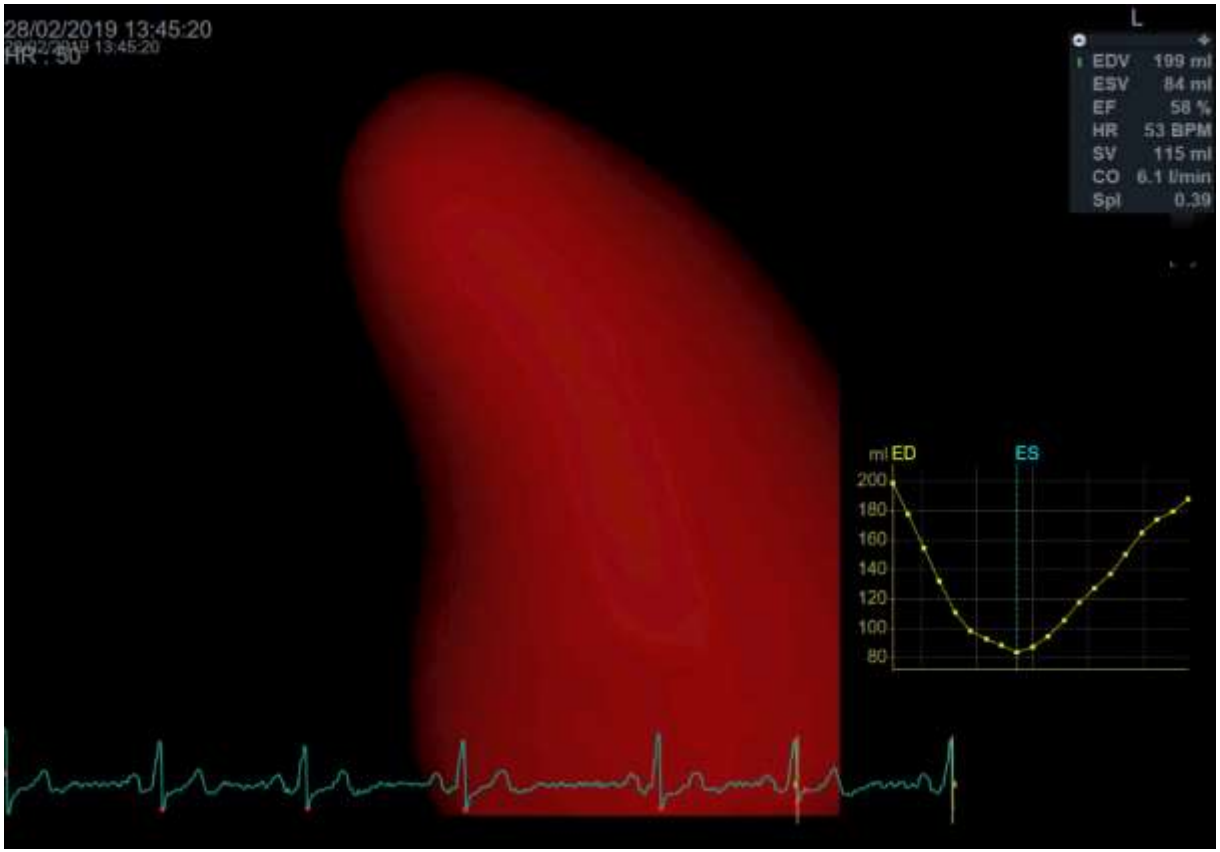
3D – LV volumes and systolic function





Dr Vencatesan MD

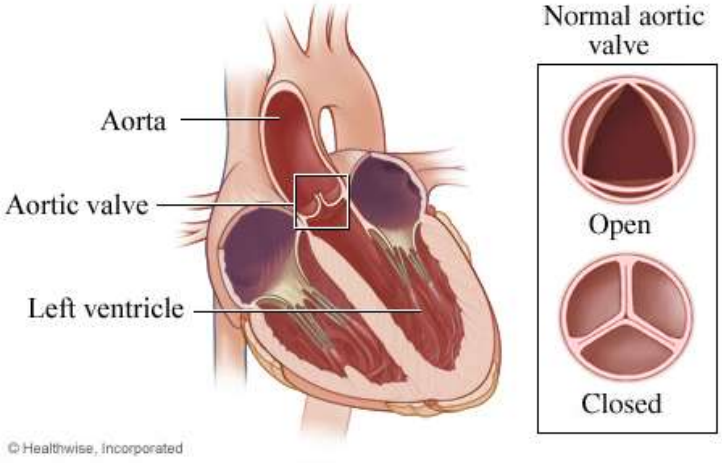
3D LV volumes and ejection fraction



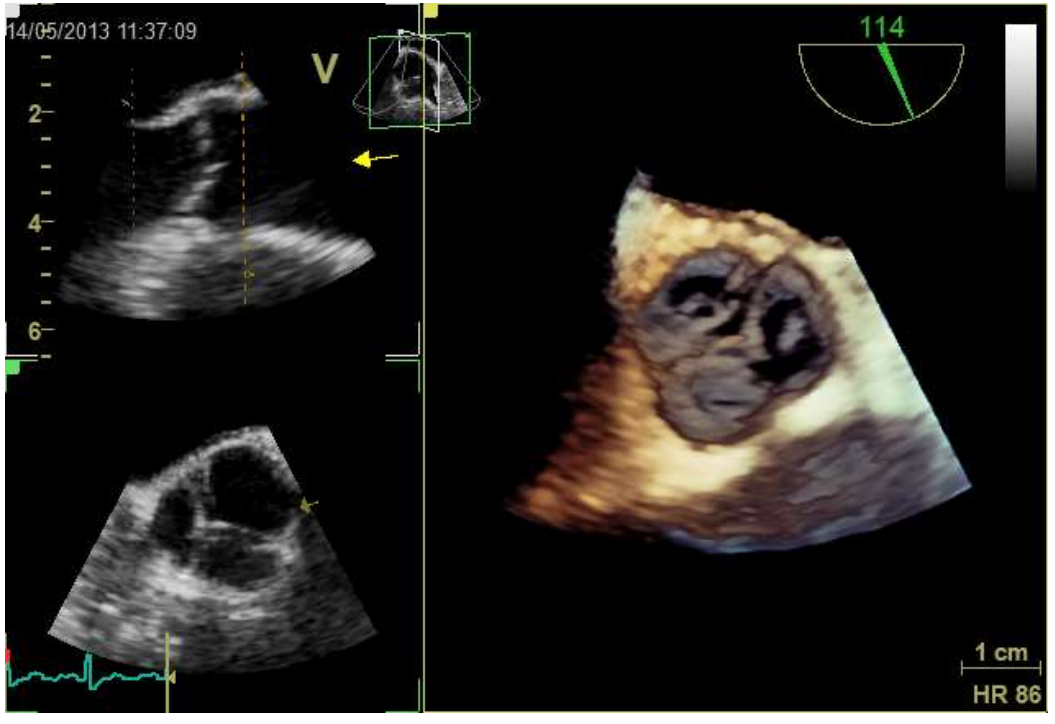
EF = volume $_{diastole}$ – volume $_{systole}$ / volume $_{diastole}$

EF > 52% is normal

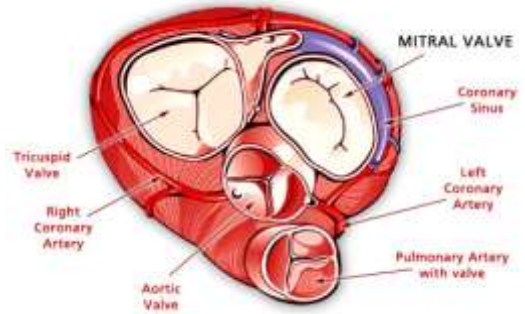
3D – aortic valve

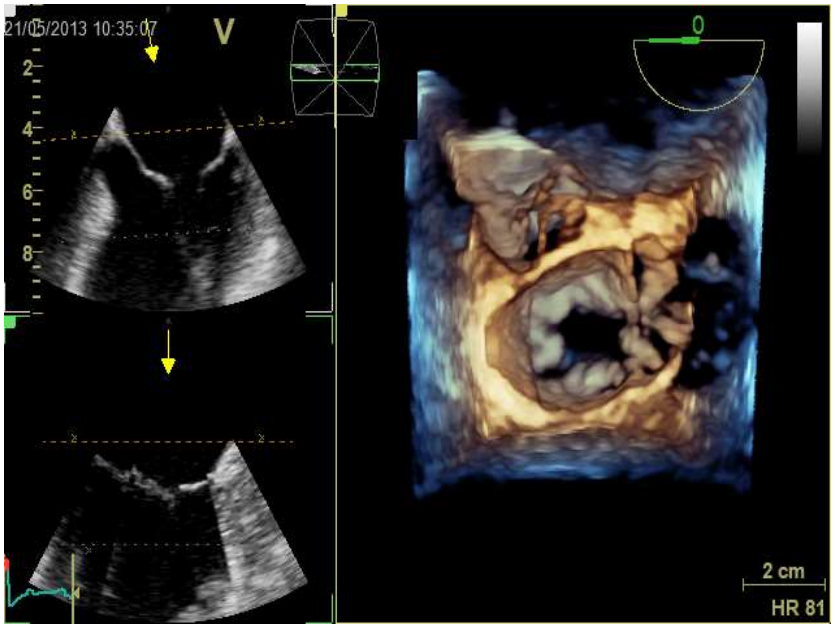


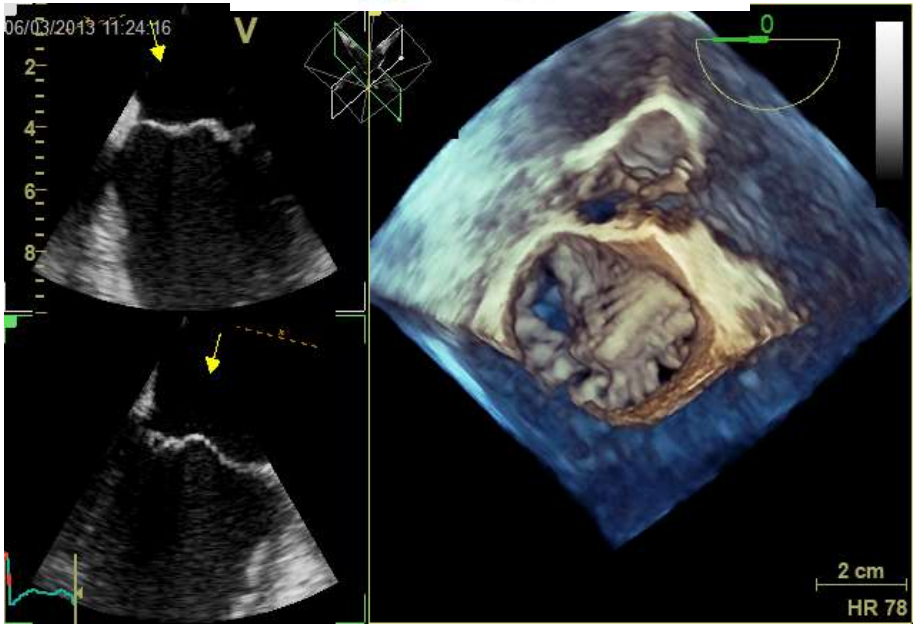
http://www.webmd.com/heart-disease/heart-failure/aortic-valve



3D mitral valve



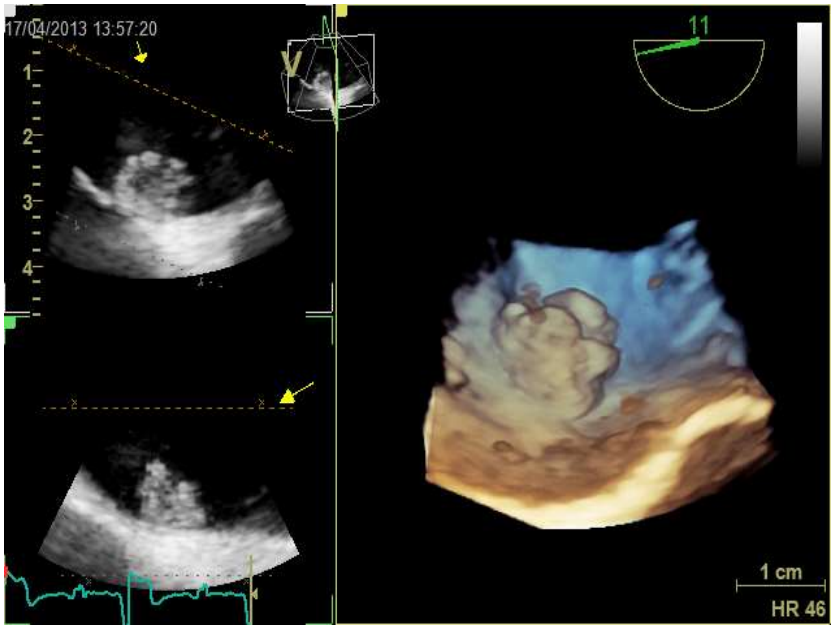




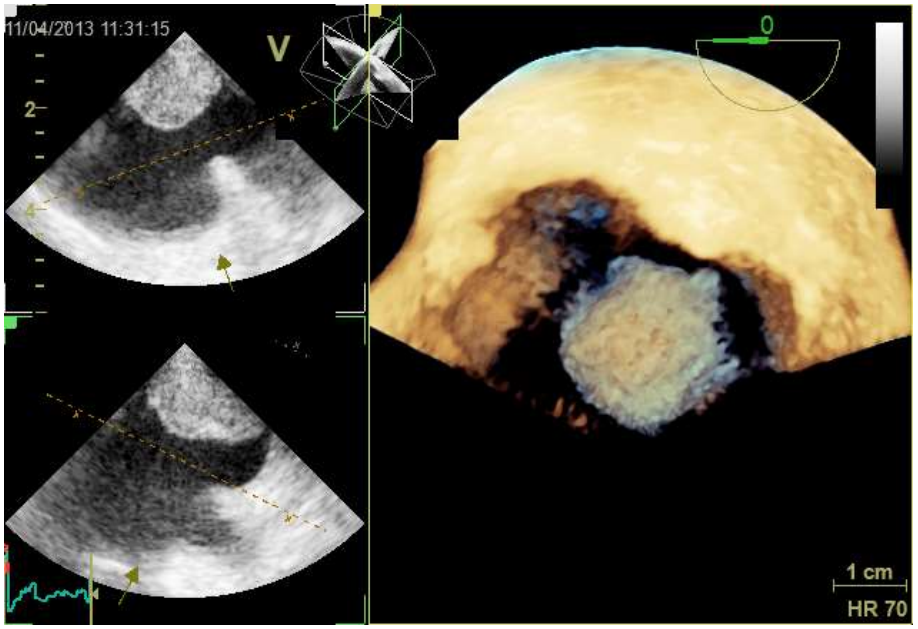
Normal mitral valve

Mitral valve prolaps

3D – intracardiac mass

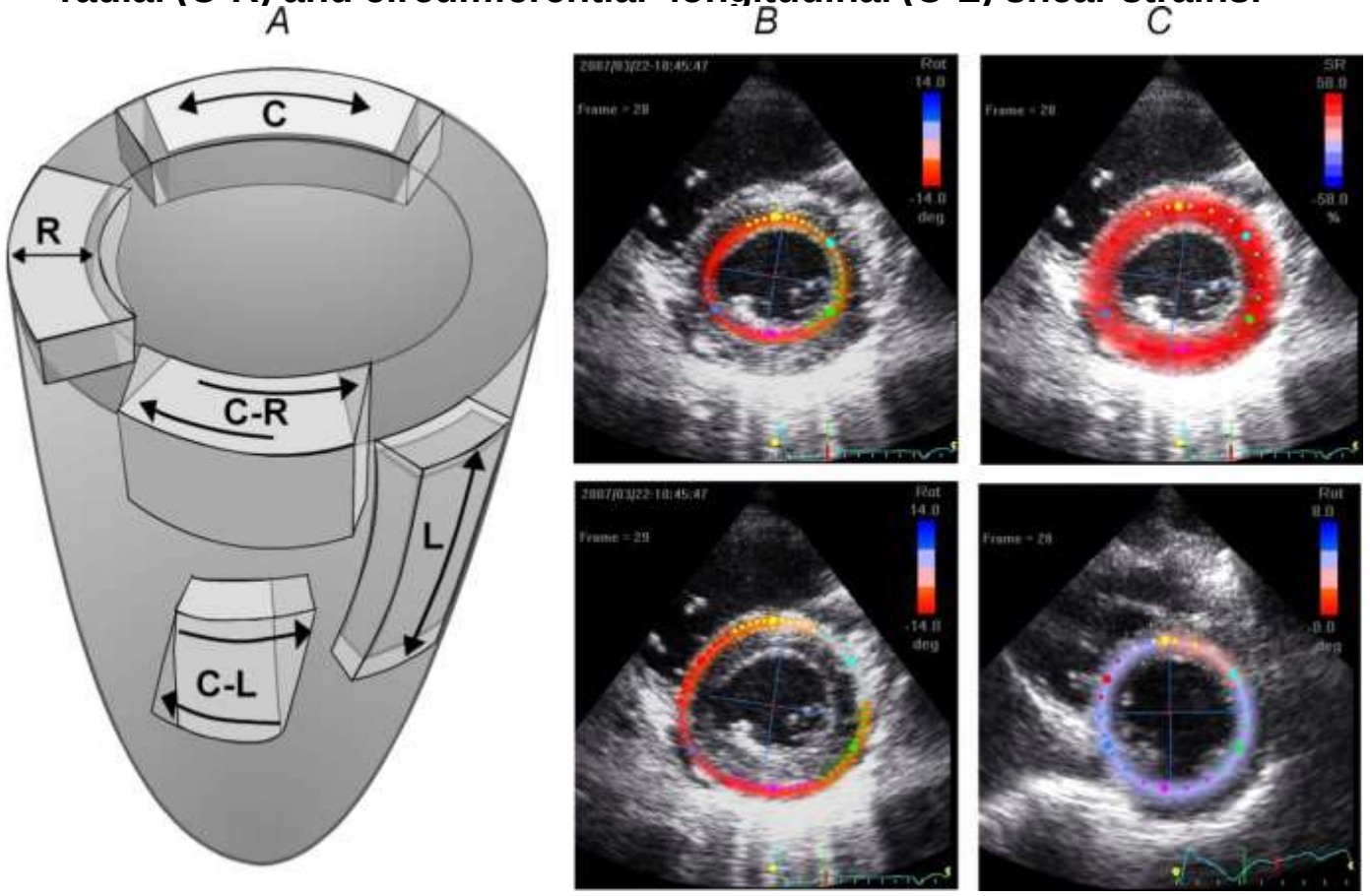


Myxoma in fossa ovalis



Left atrial thrombus

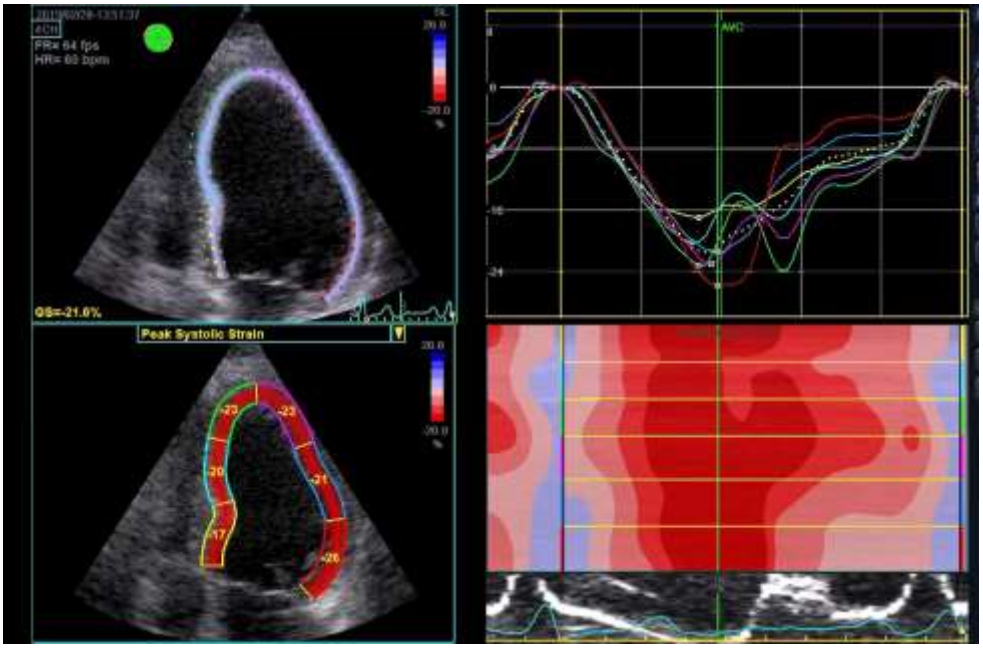
Figure 1 Directions of normal and shear strains A, illustration of the systolic strains evaluated in the study: longitudinal (L), radial and circumferential (C) strains; circumferential–radial (C-R) and circumferential–longitudinal (C-L) shear strains.

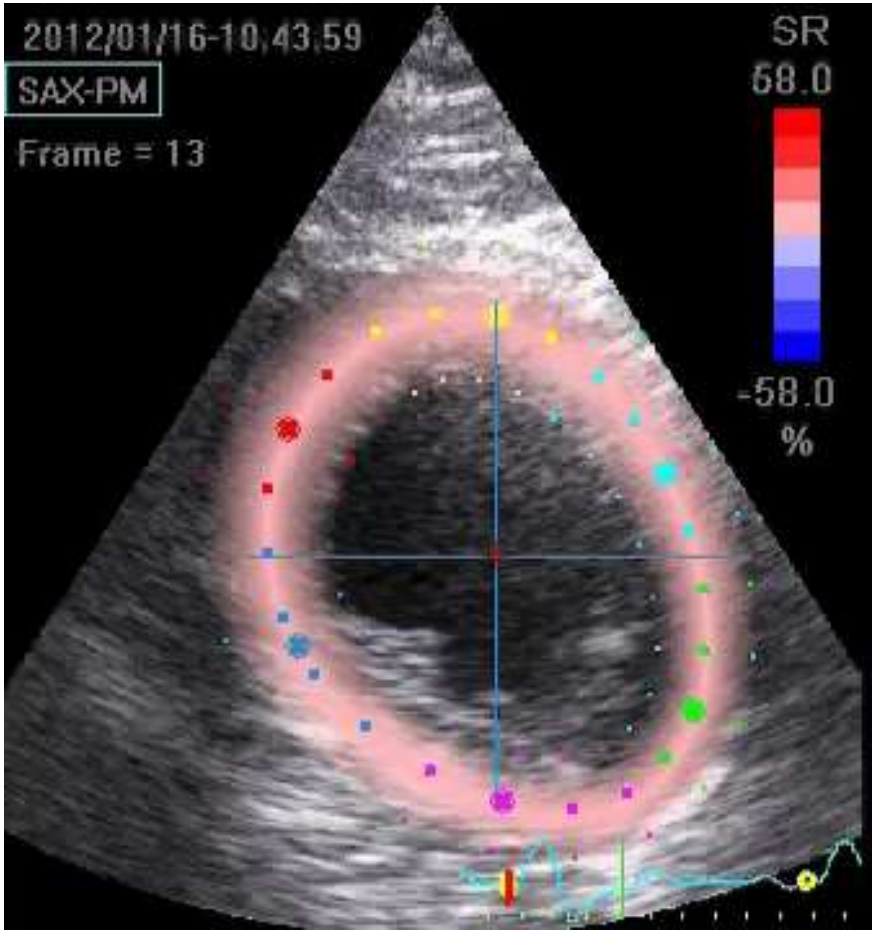


Nottin S et al. J Physiol 2008;586:4721-4733

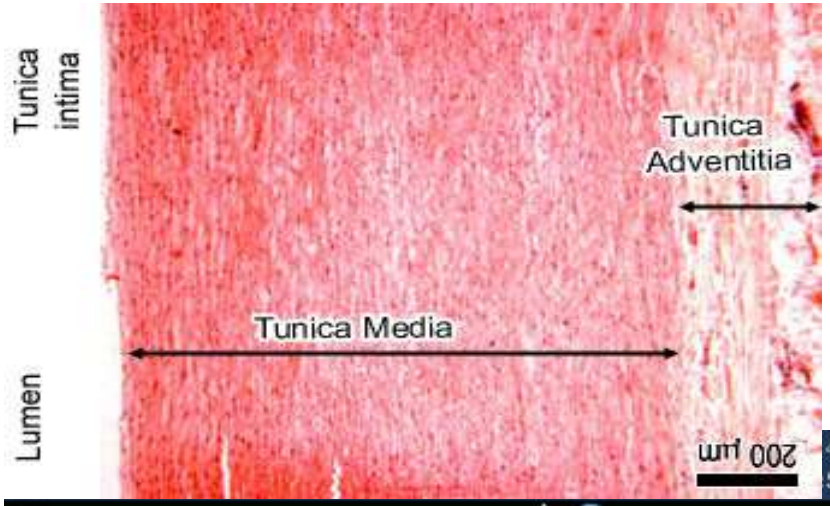
The Journal of Physiology

Speckle tracking



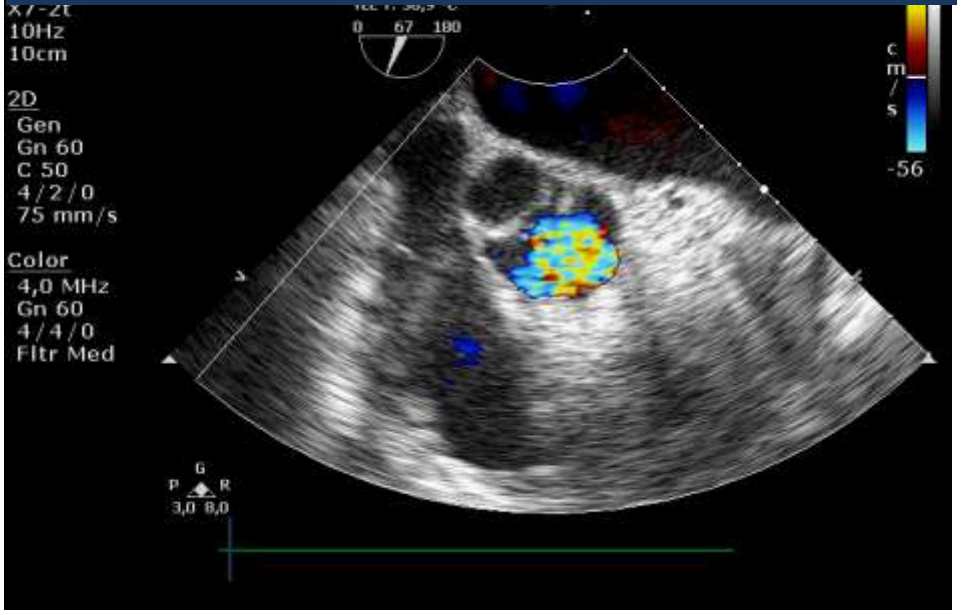


Aortic dissection



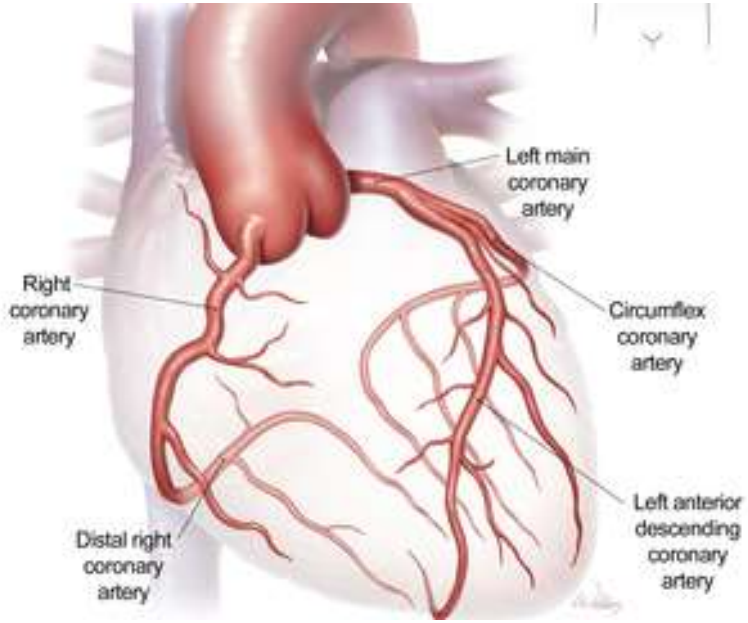
www.pinterest.com

Severe aortic regurgitation



Acute myocardial infartion imaging

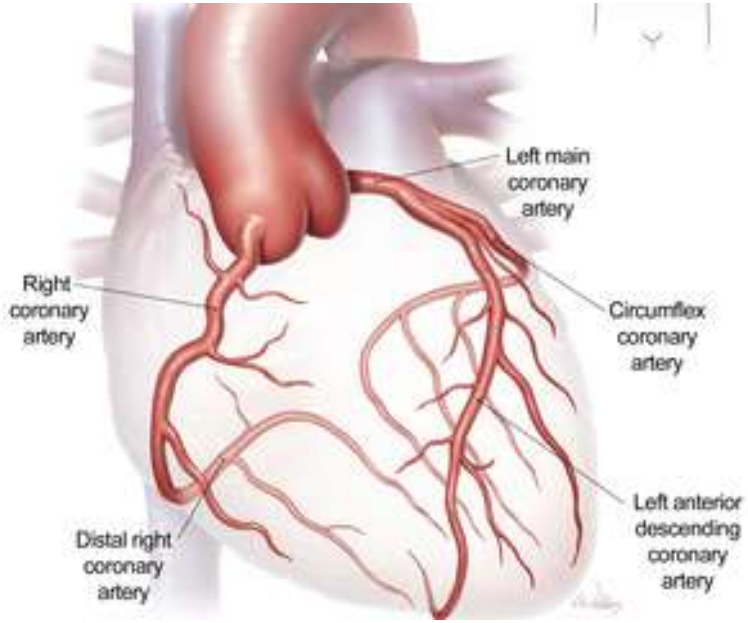
Left coronary artery – invasive coronary angiography



http://sphweb.bumc.bu.edu

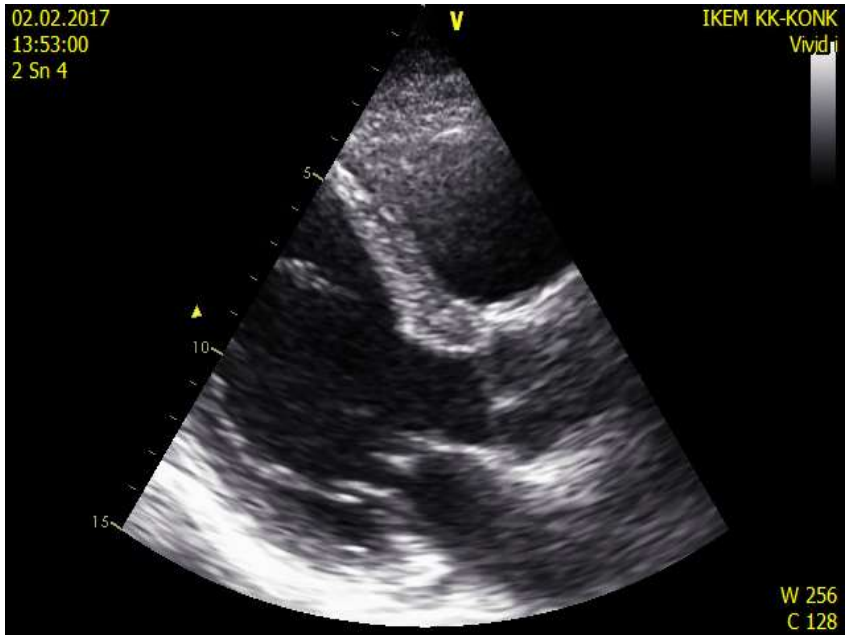
Acute myocardial infartion imaging

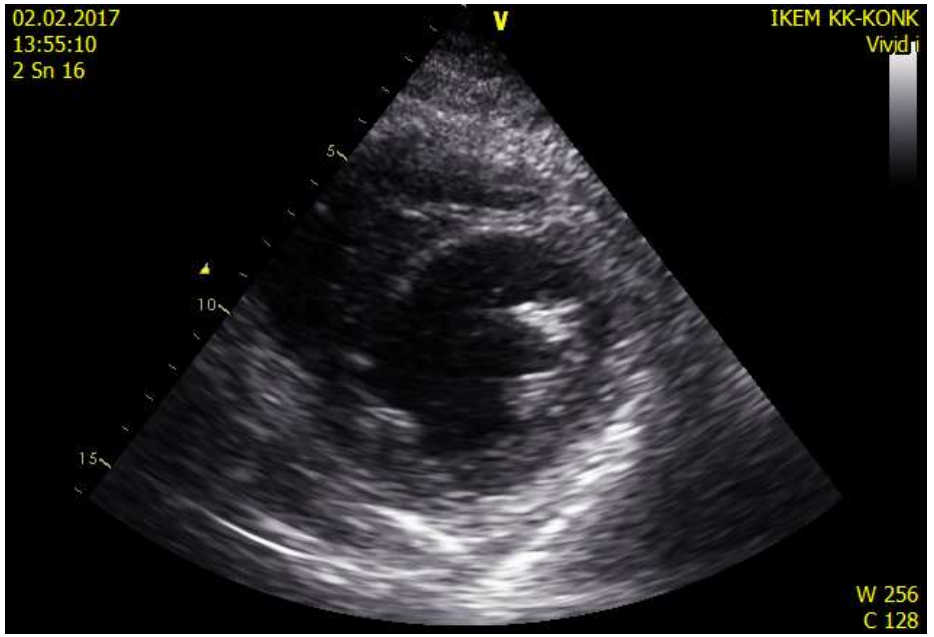
Right coronary artery – invasive coronary angiography



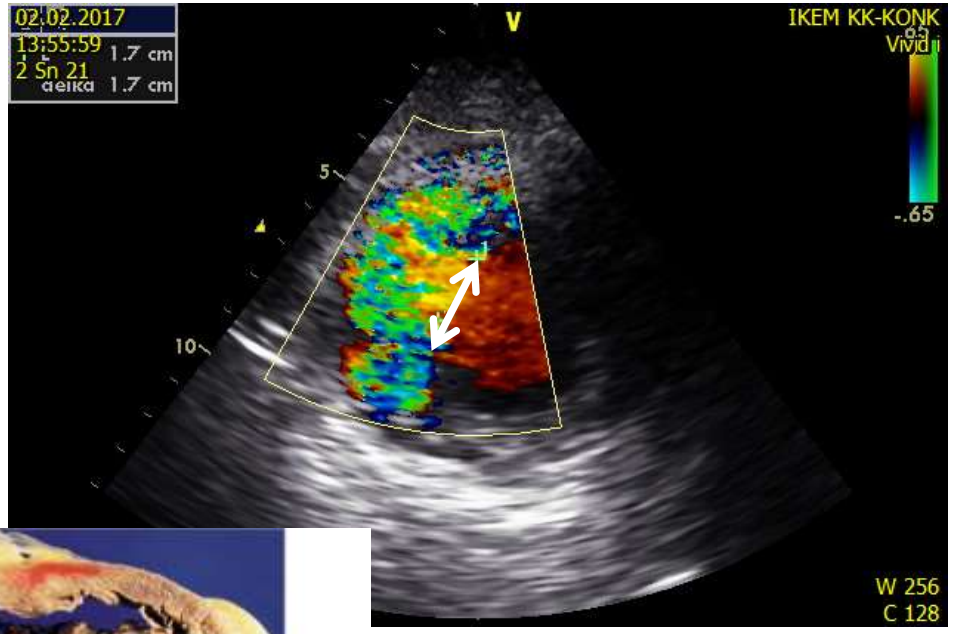
http://sphweb.bumc.bu.edu

Akinetic septum secondary to left anterior descending artery occlusion

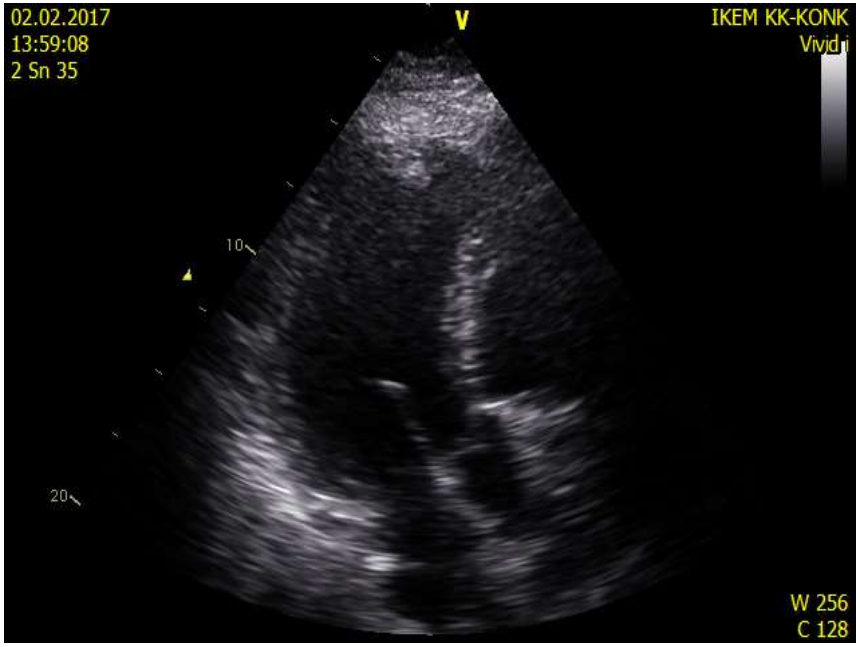


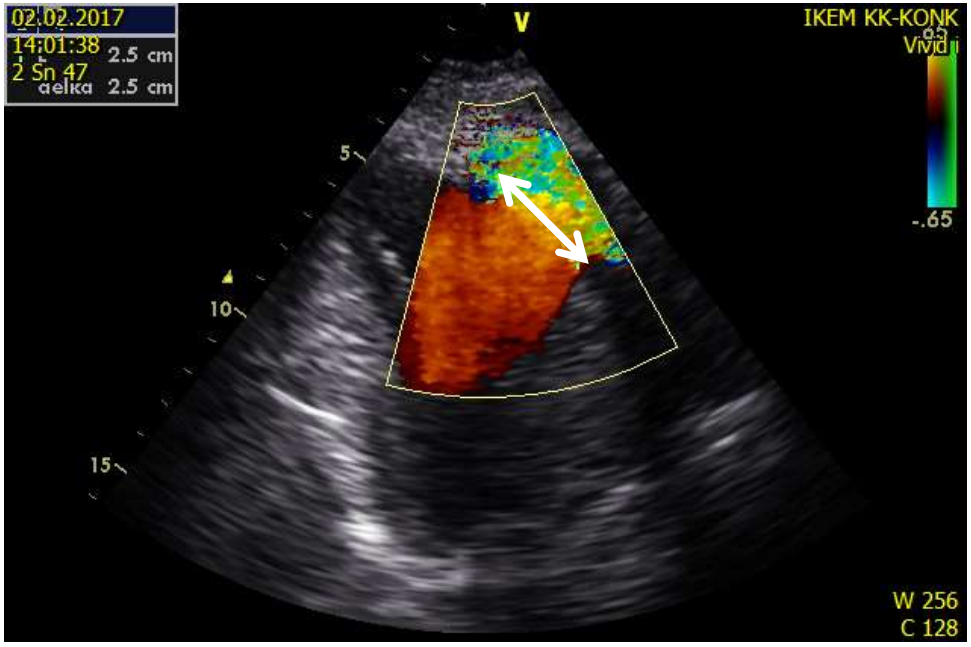


Large septal defect secondary to left anterior descending artery occlusion



Large septal defect secondary to left anterior descending artery occlusion





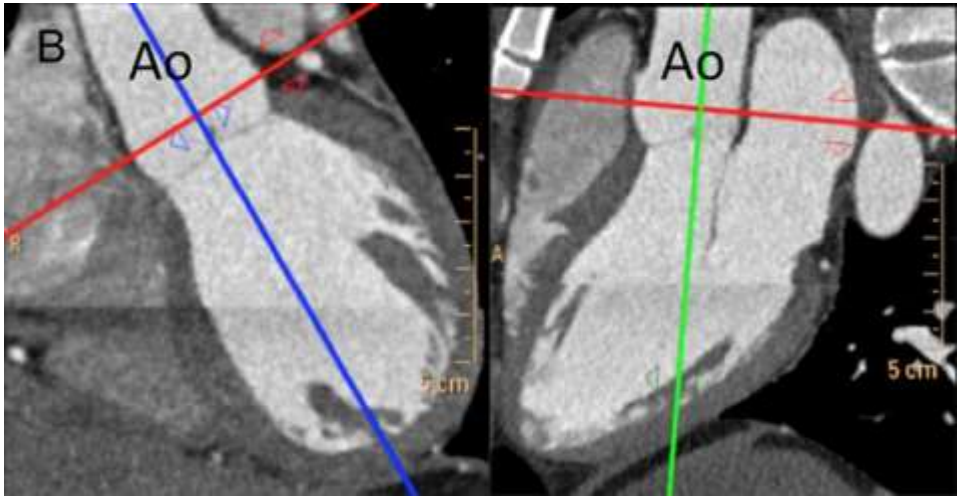
MRI
magnetic resonance imaging

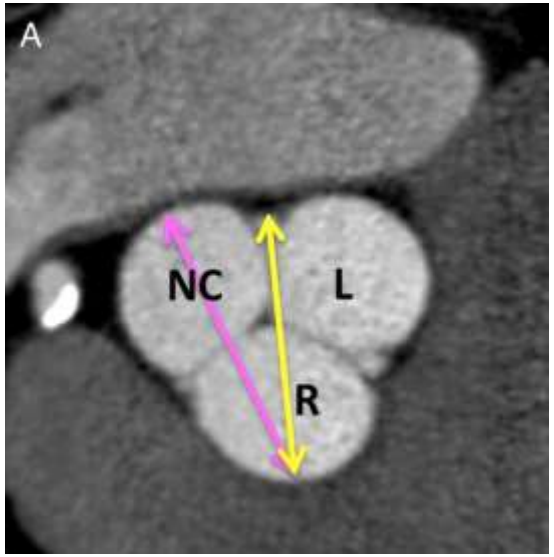
CT
computed tomography

CT X MRI

Cadiac CT	Cardiac MRI
10 minutes	30-90 minutes
CPR in the scanner - YES	CPR in the scanner - NO
Radiation - YES	Radiation – NO = safe
Contrast agent – > 90%	Contrast agent – 60% = safe
Spacial resolution < 1 mm	Spacial resolution < 1-2 mm
Tissue characteristics – limited	Tissue characteristics - excellent

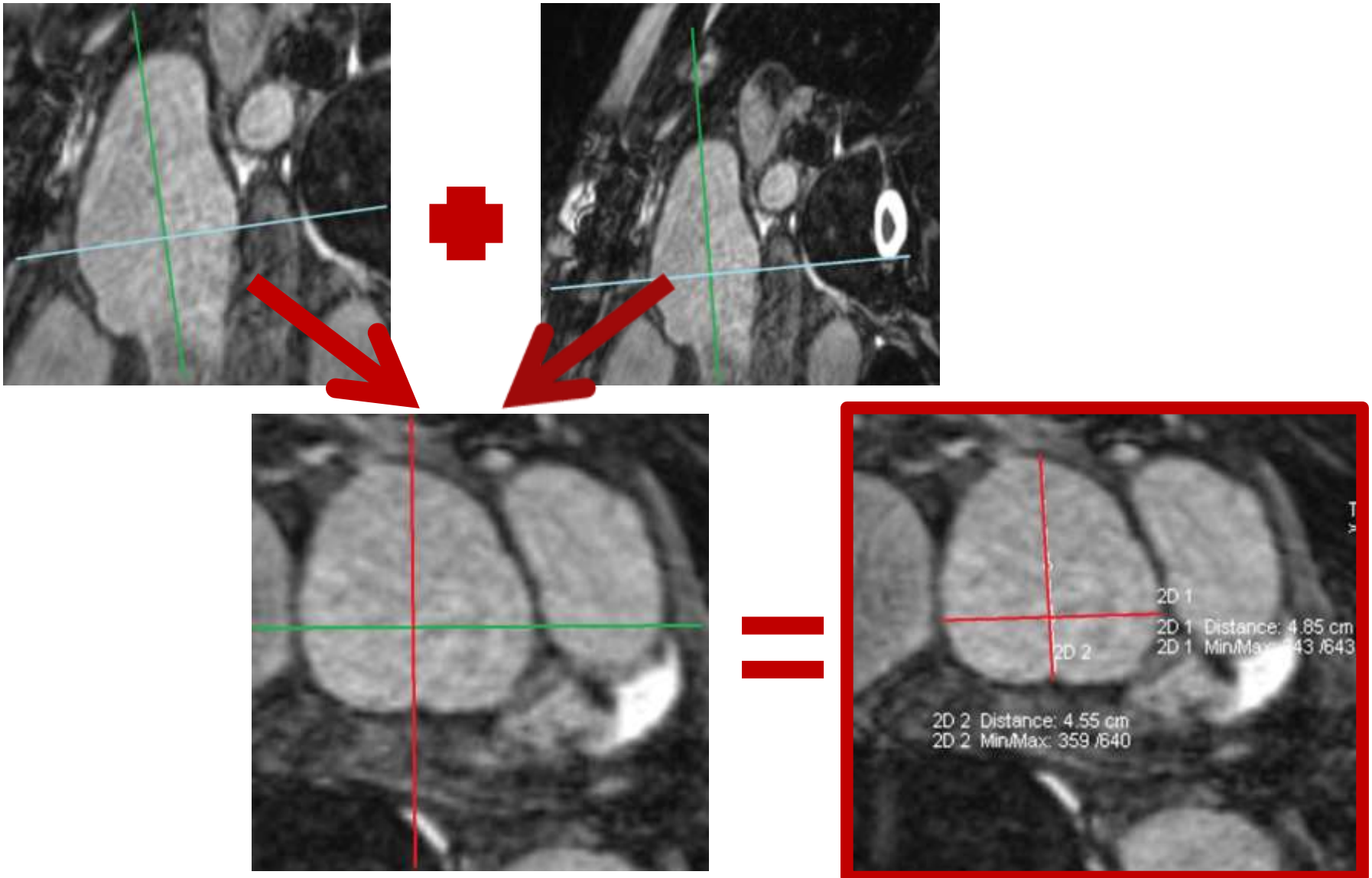
Computed tomography – CT
Aortic root size





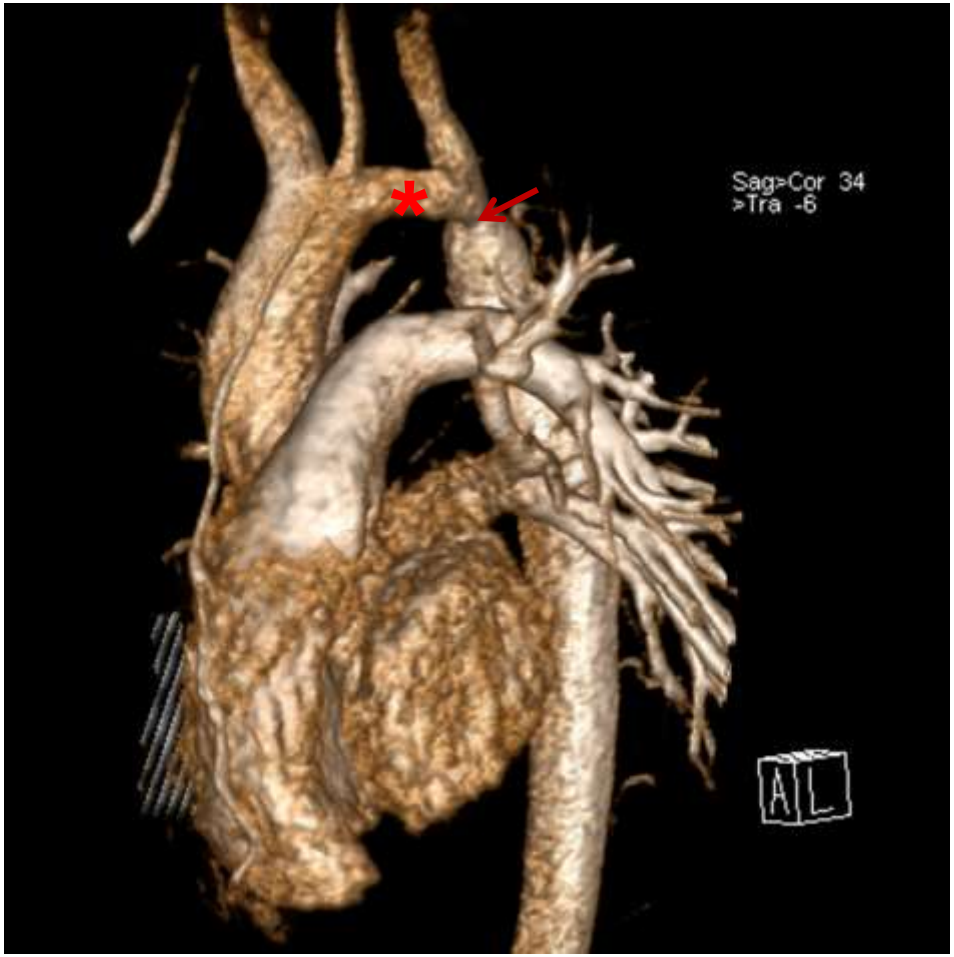
Lang e al. JCVI 2015

Native MRI = Aortic root size



Aortic coartation

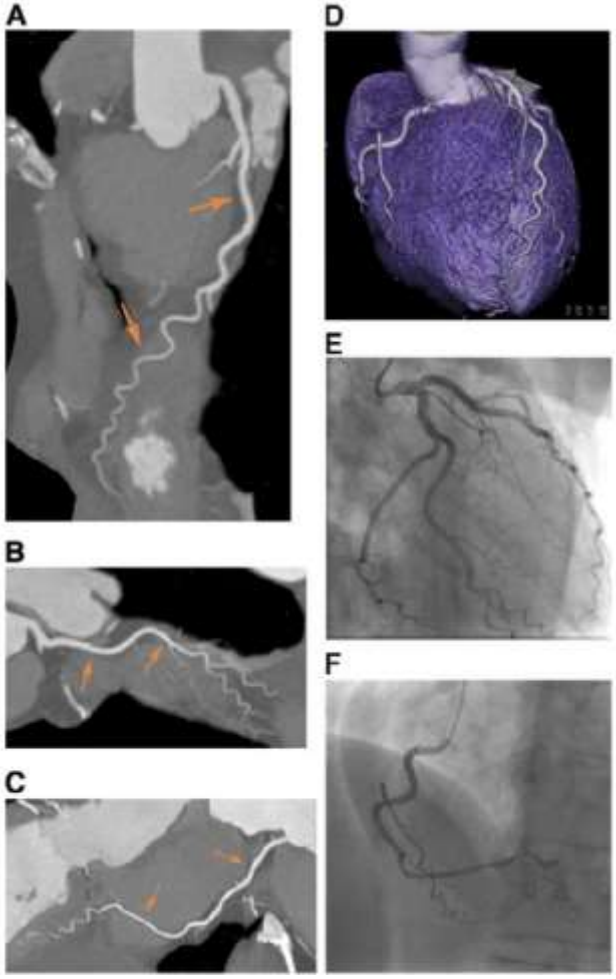
Hypoplastic aortic arch and coartation – MRI *with contrast*



CT coronary angiography

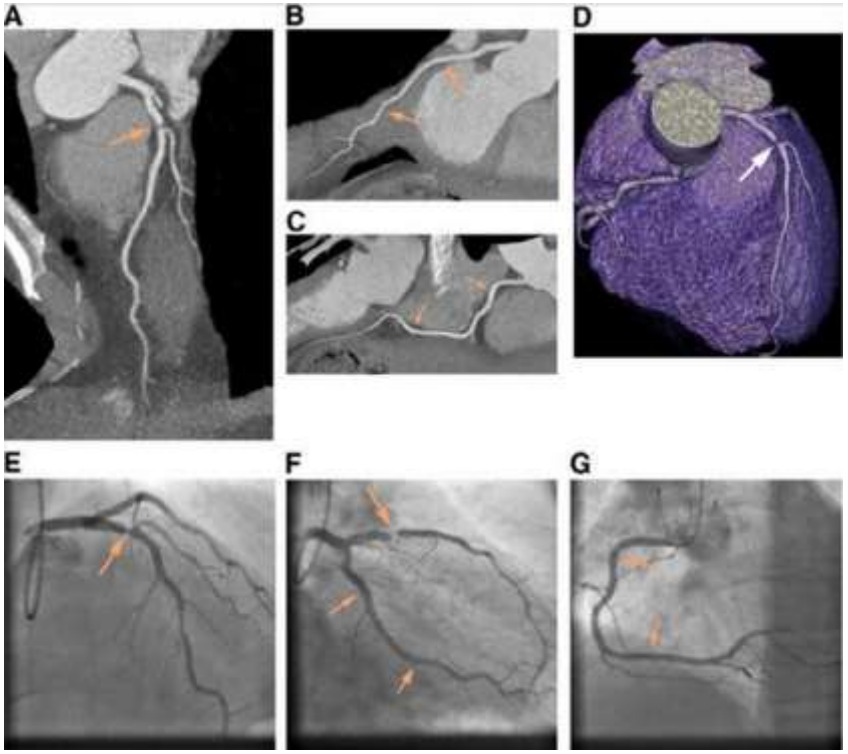
Normal finding

Female 54 kg, HR 56/min, 0.87 mSv



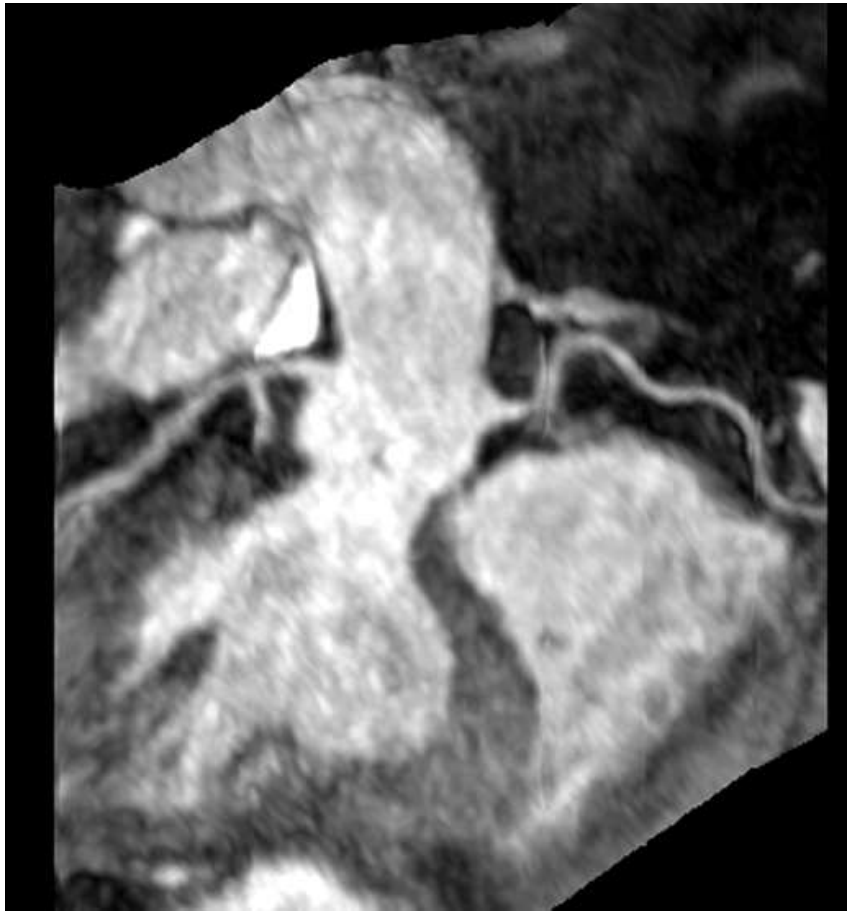
Severe LAD stenosis

Male 98 kg, HR 54/min 0.81 mSv

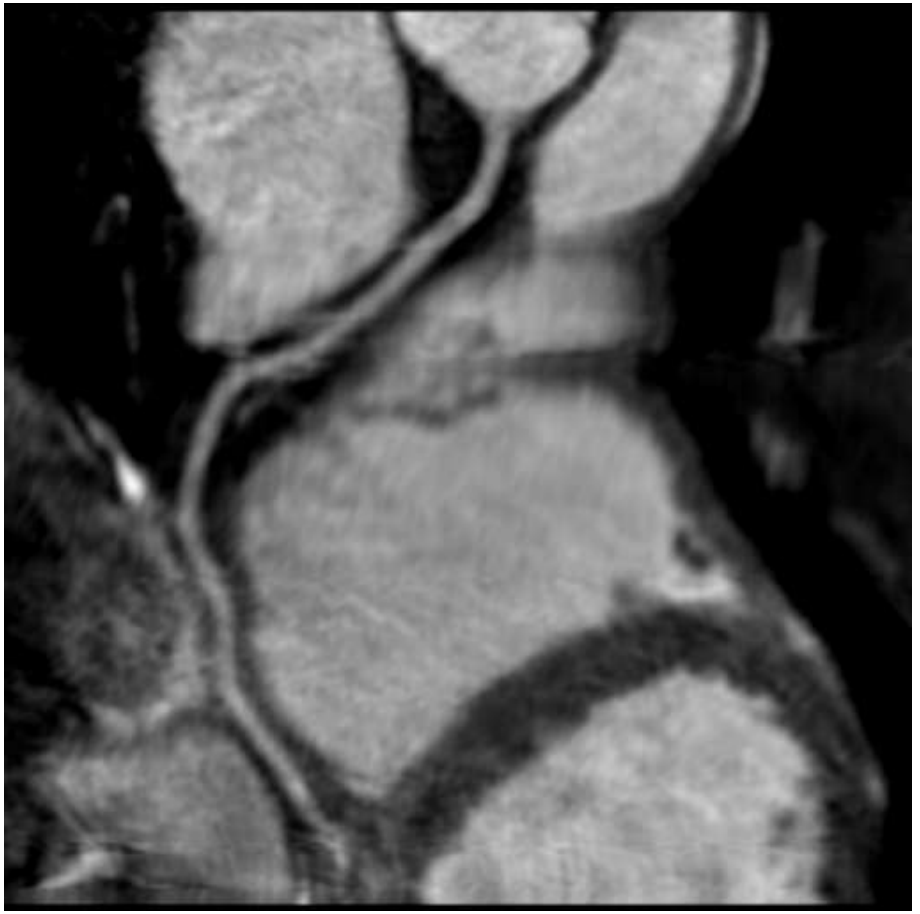


Achenbach, JACC Imaging 2011

MR coronary angiography



Right and left coronary art.

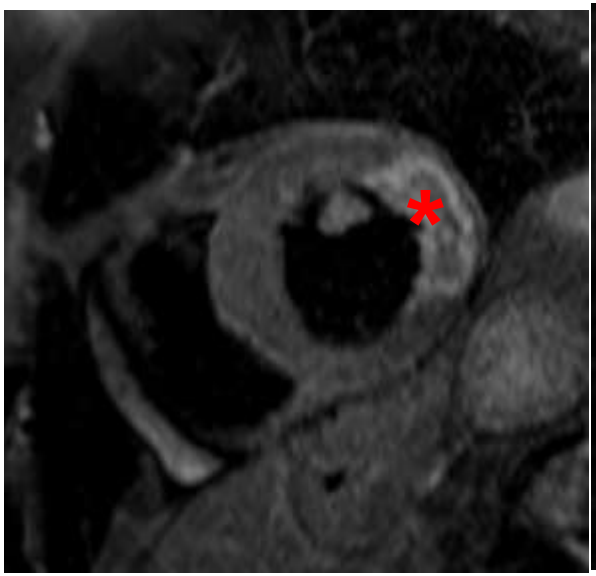


Right coronary art.

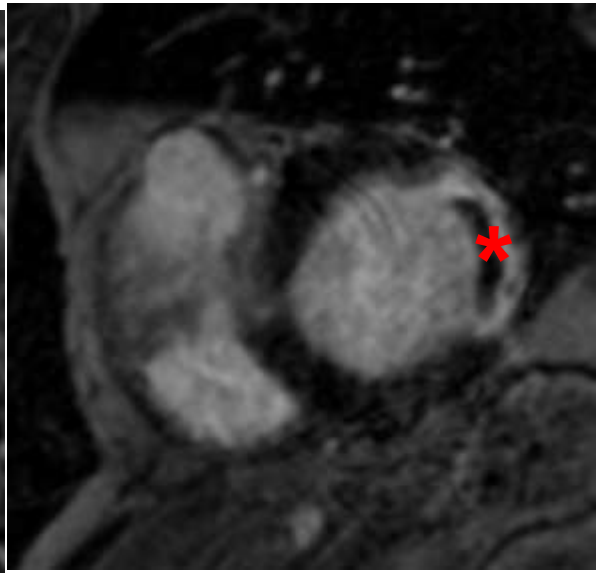
Tissue characteristic

CT ***contrast***

MRI ***T2 native***



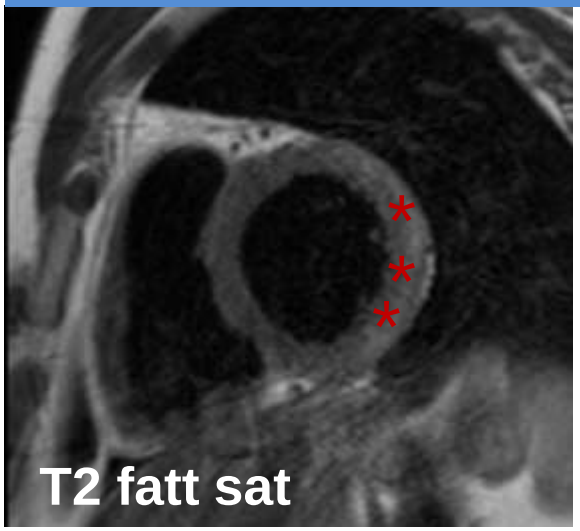
MRI ***LGE contrast***

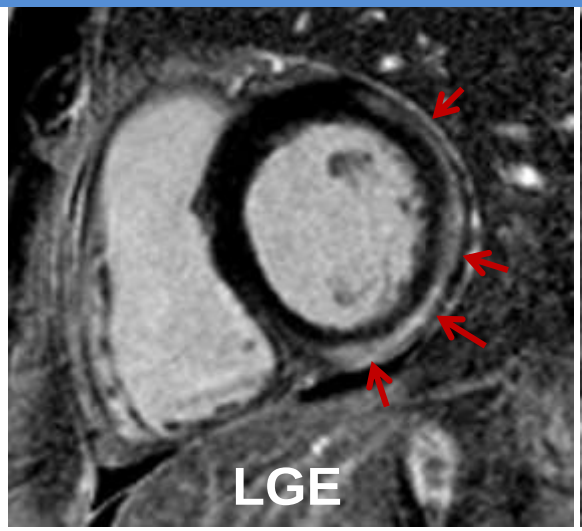


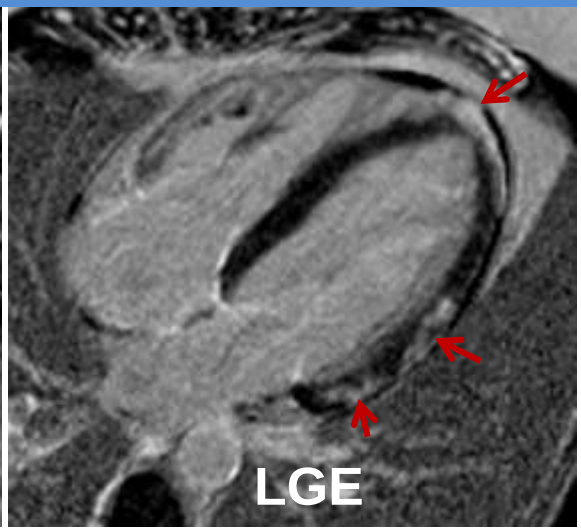
Subacute myocardial infarction

MRI – tissue characteristics

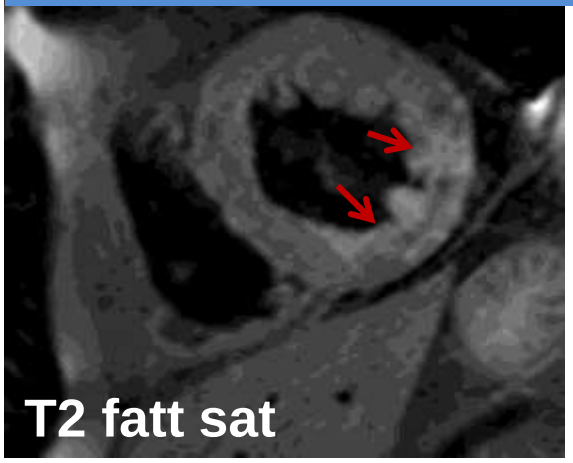
Acute perimyocarditis

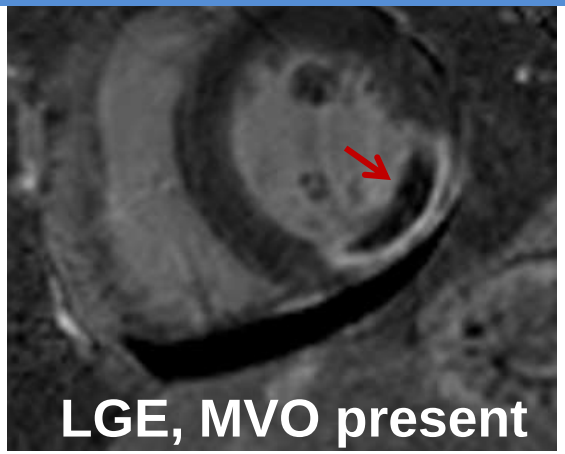


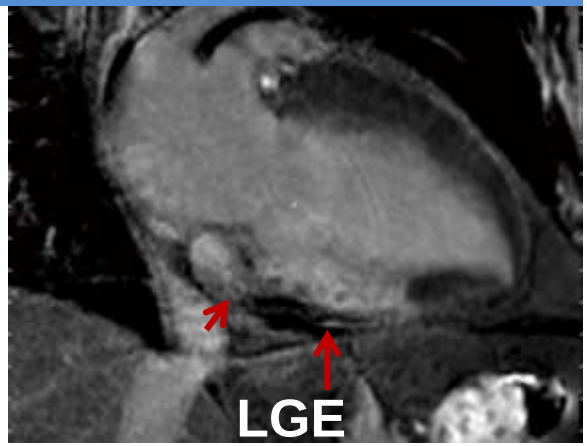




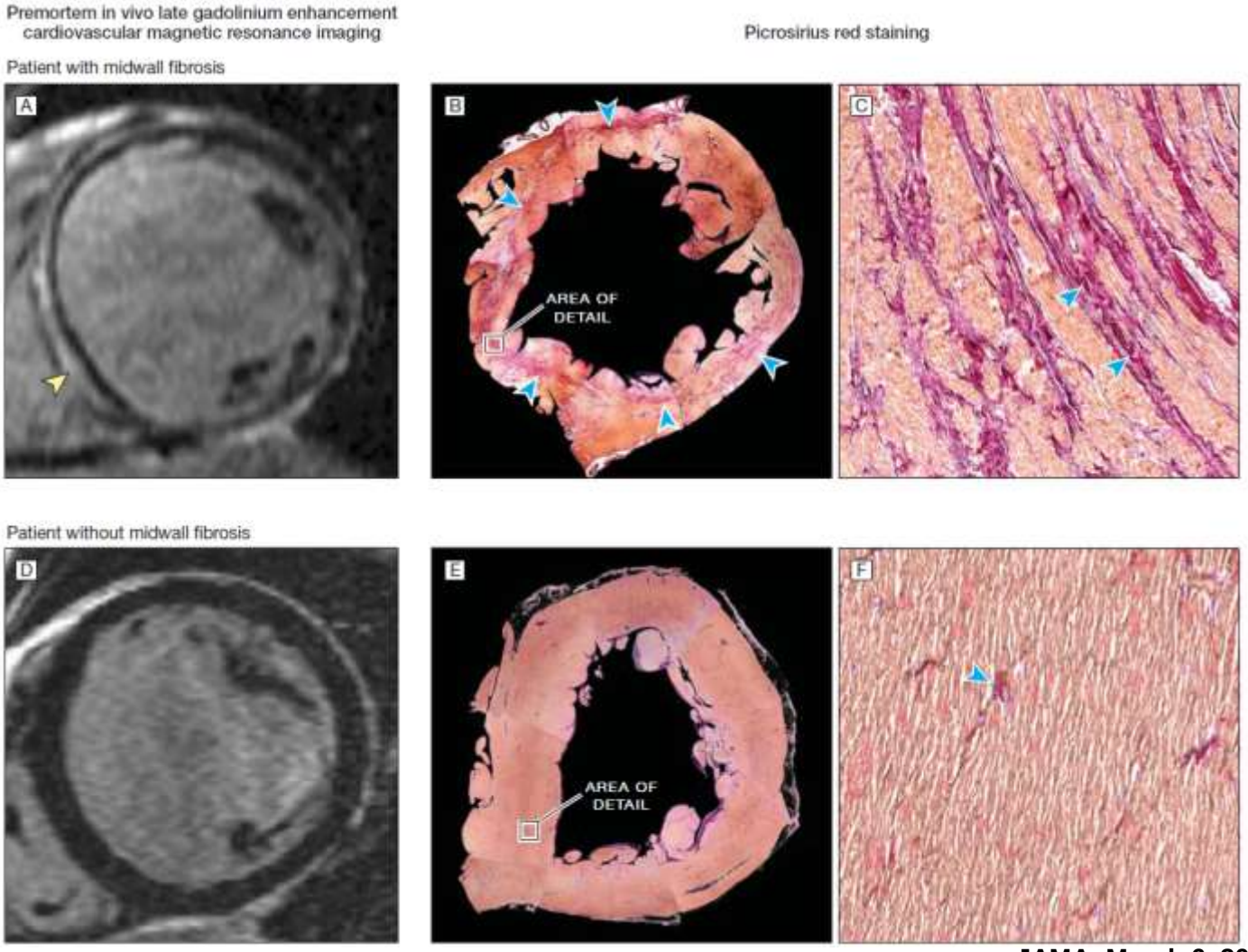
Acute myocardial infarction







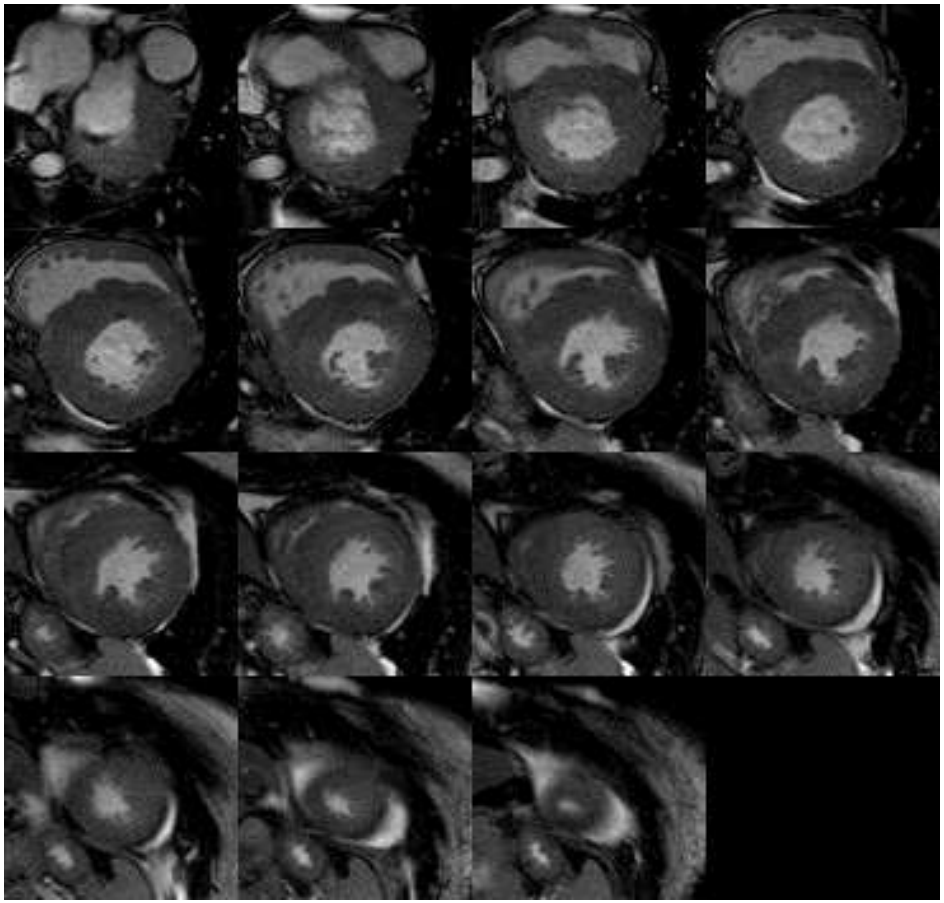
MRI – tissue characteristic
Midwall fibrosis



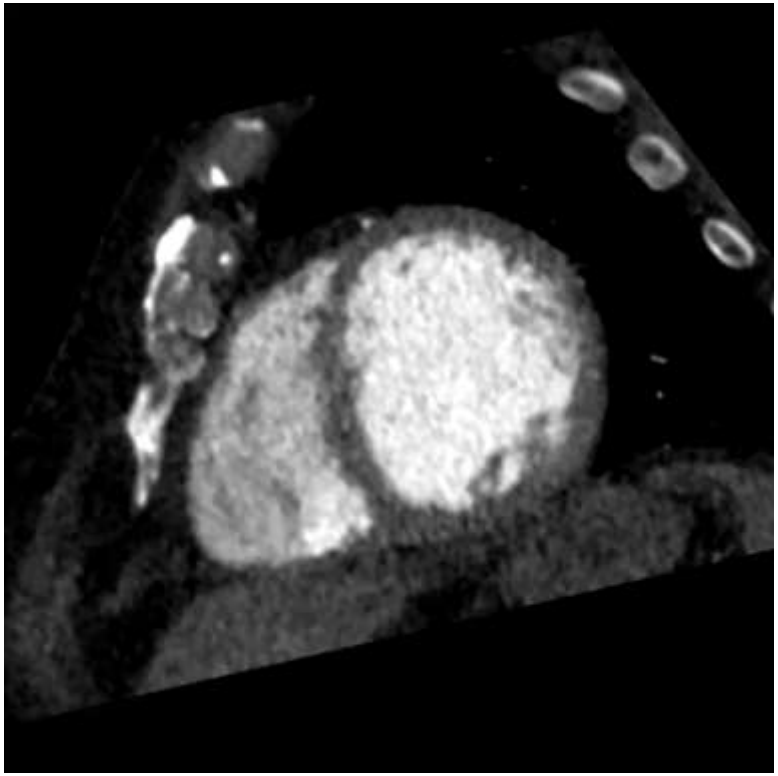
JAMA, March 6, 2013—Vol 309, No. 9

Ventricular function

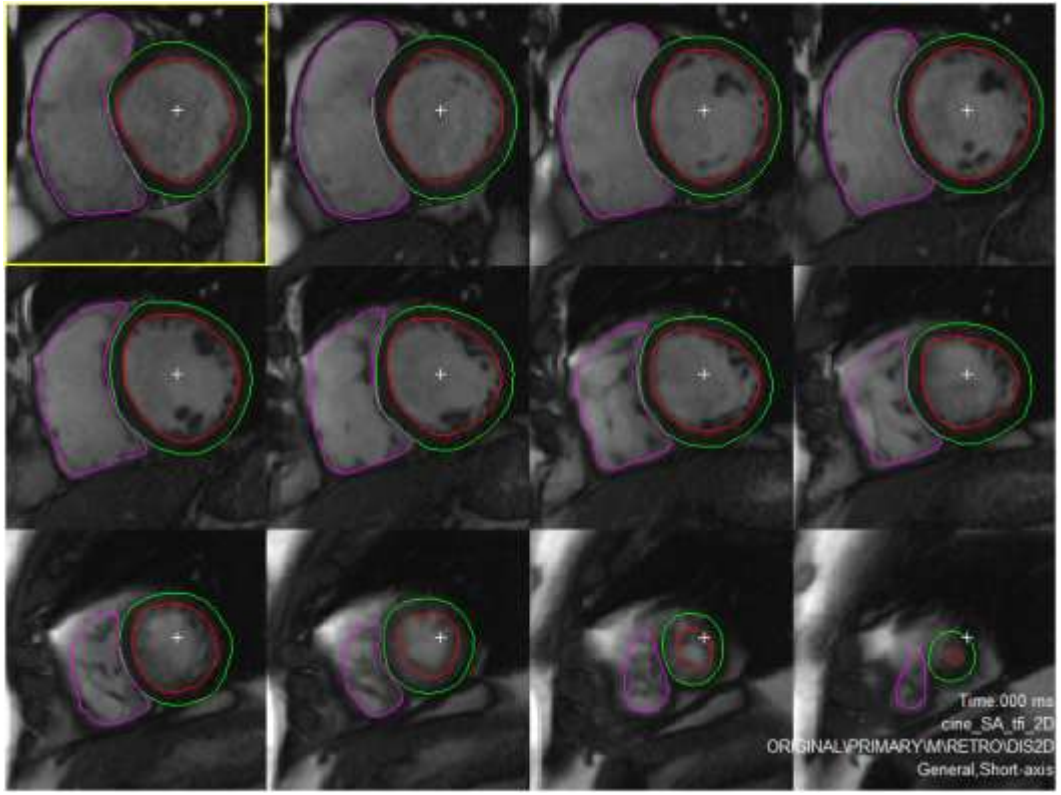
MRI – the gold standard



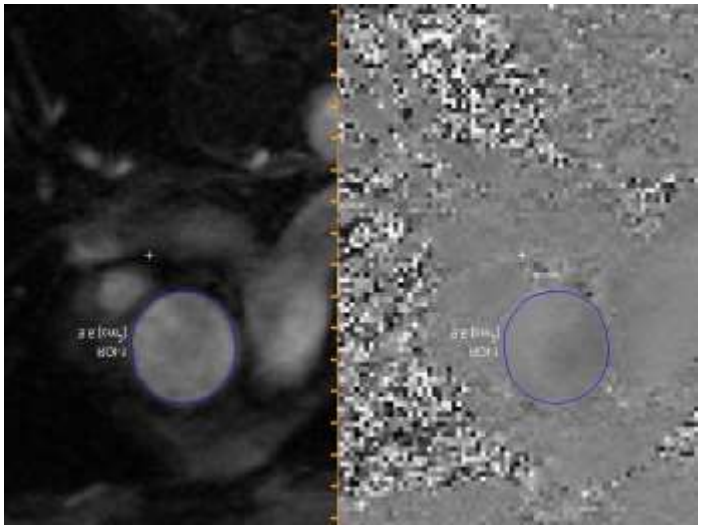
CT

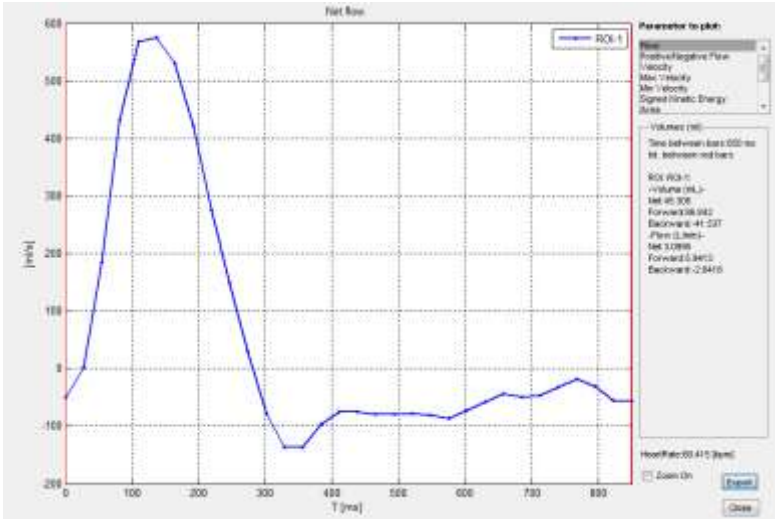


MRI - Left and right ventricular function



MRI - Valve function
Aortic regurgitation

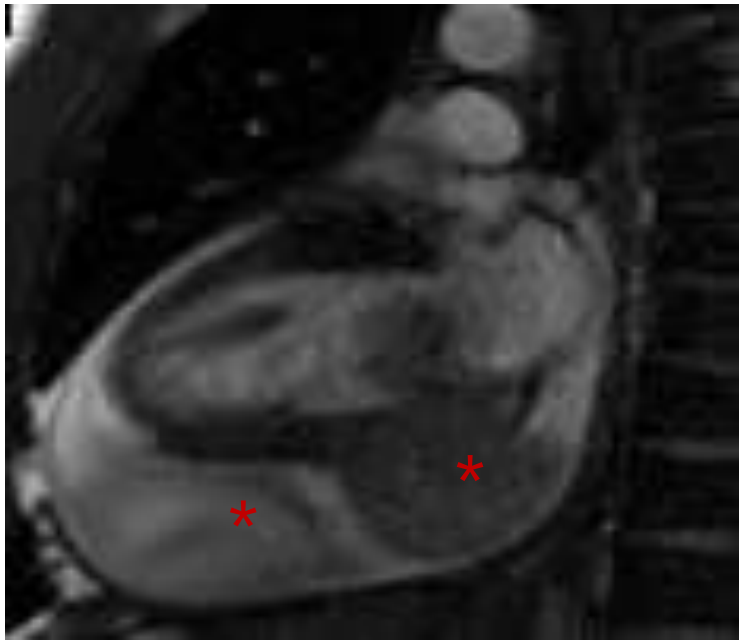




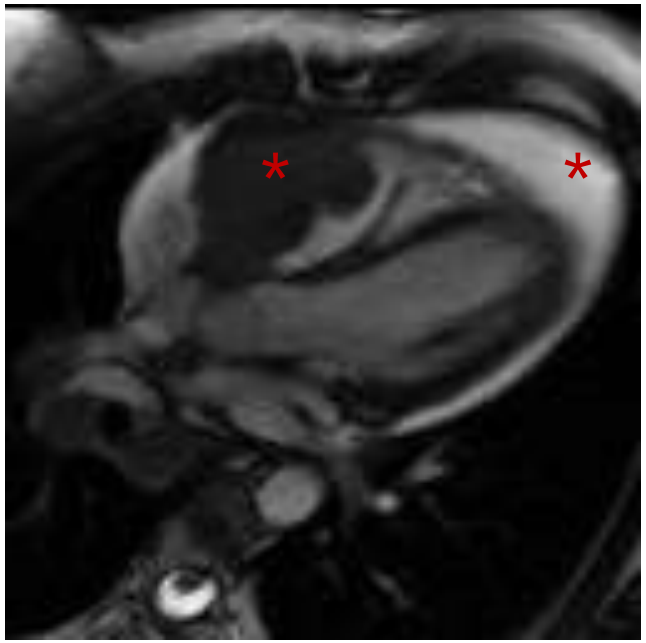
Forward flow 87 ml
Backward flow 45 ml
RF 48% - severe
Aortic regurgitation

Cardiac tumors malignant

Differential diagnosis, complications, invasive grow

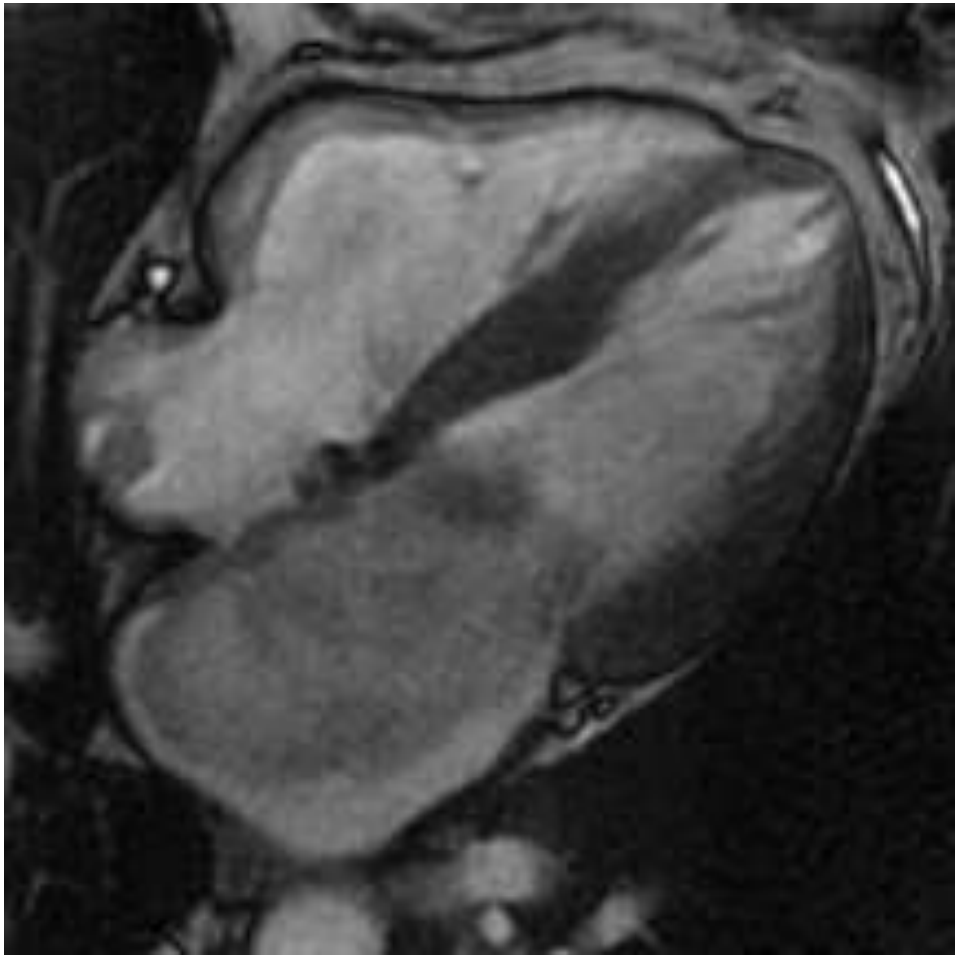


Sarkoma

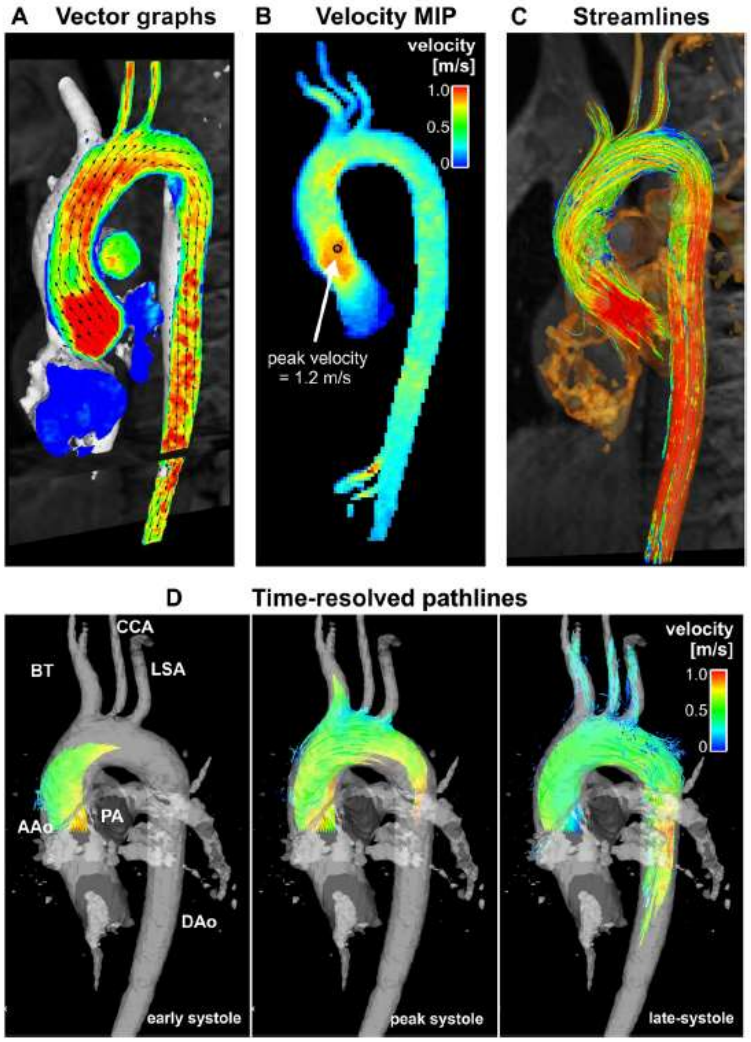


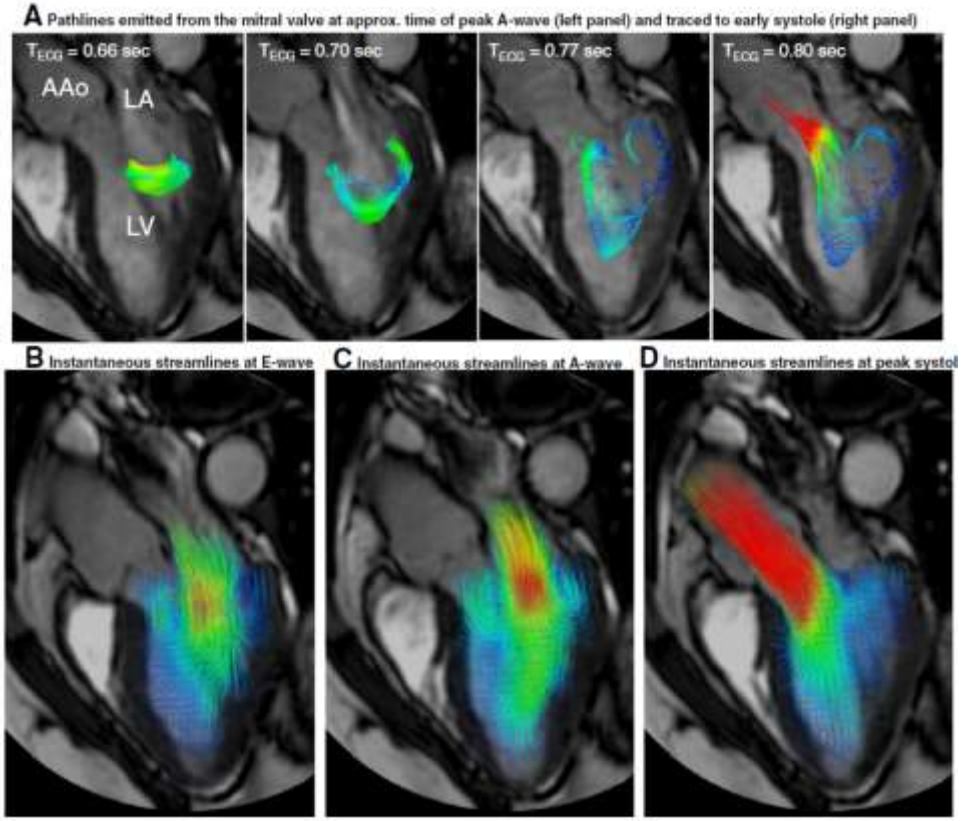
Brest Ca - metastasis

Cardiac tumors
benign - myxoma



4D flow CMR





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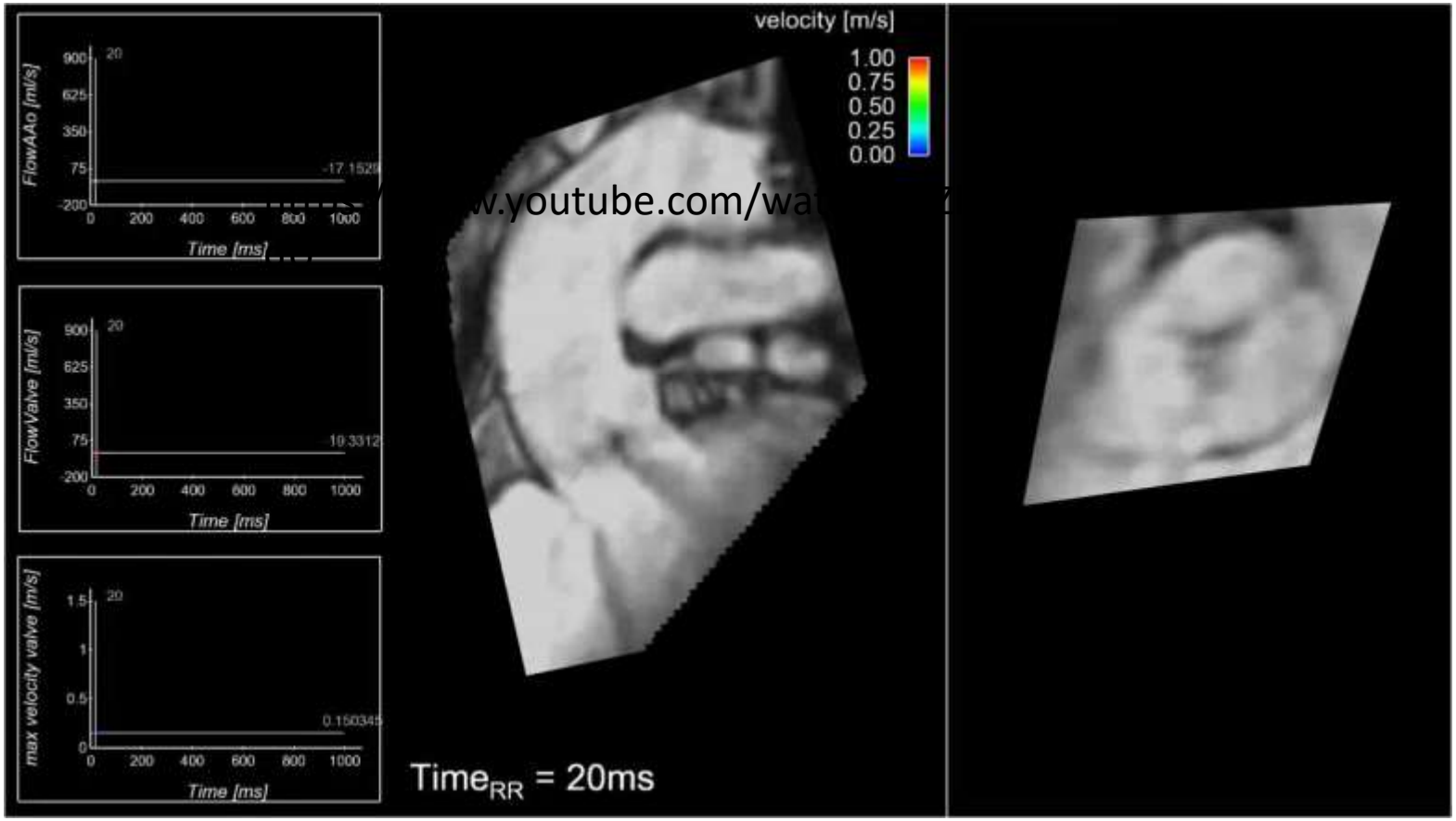
4D flow CMR

- **video**



www.youtube.com/watch?v=fqbjInQJtzU

4D flow CMR

www.youtube.com/watch?v=NJzoVFkcdnA

Thank you for your attention