HYPERTROPHY: Behind the curtain

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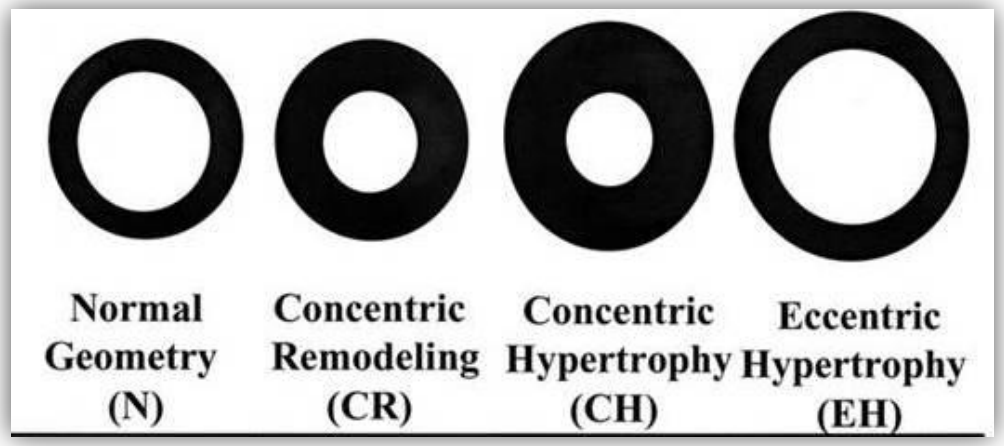
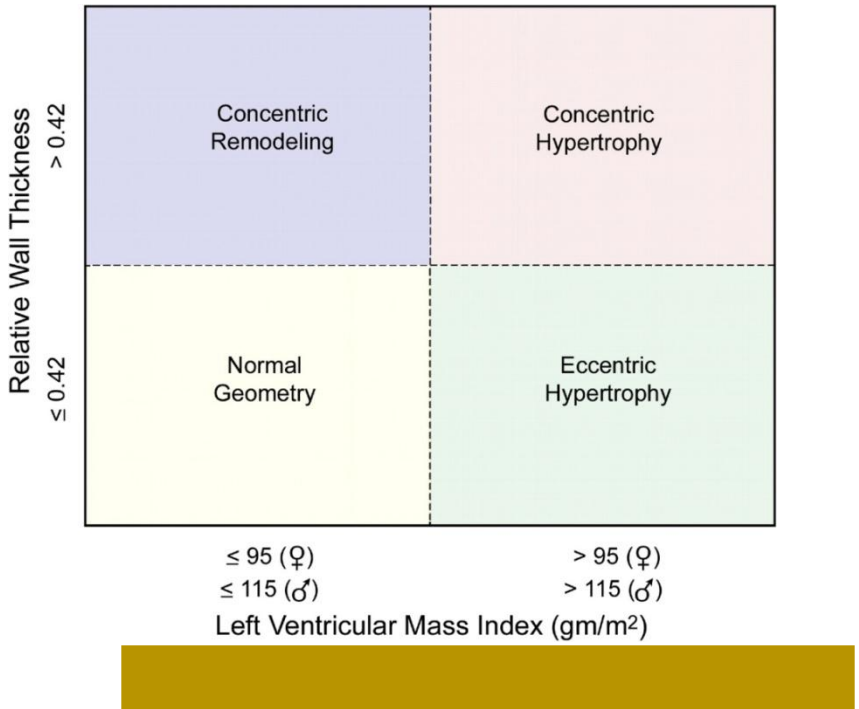
Disclosure of interest: none

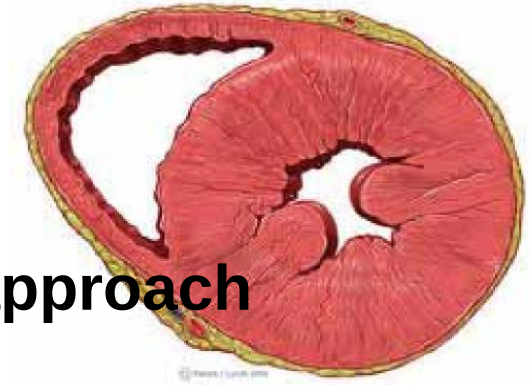


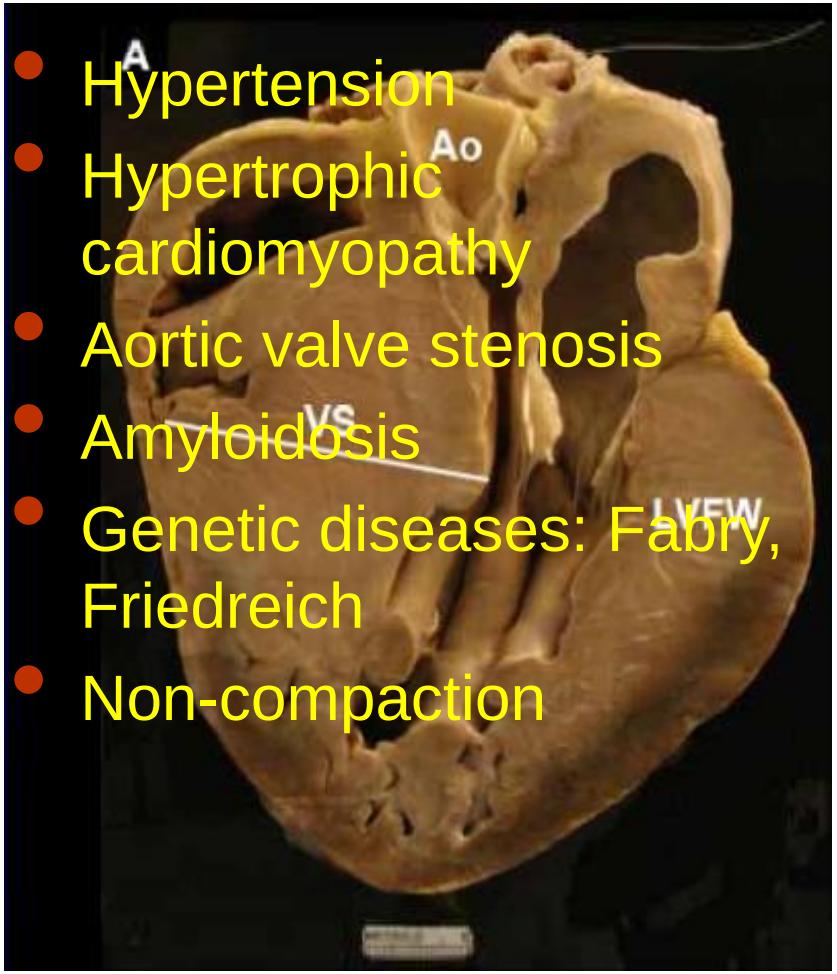
Relative wall thickness (cm)	M	*0.22–0.42*	*0.43–0.47*	*0.48–0.52*	*≥0.53*
	F	0.24–0.42	0.43–0.46	0.47–0.51	≥0.52



Left ventricular hypertrophy is defined as an increase in the mass of the left ventricle, which can be secondary to an increase in wall thickness, an increase in cavity size, or both.

Too simple to be enough !





- Hypertension
- Hypertrophic cardiomyopathy
- Aortic valve stenosis
- Amyloidosis
- Genetic diseases: Fabry, Friedreich
- Non-compaction

Systemic approach

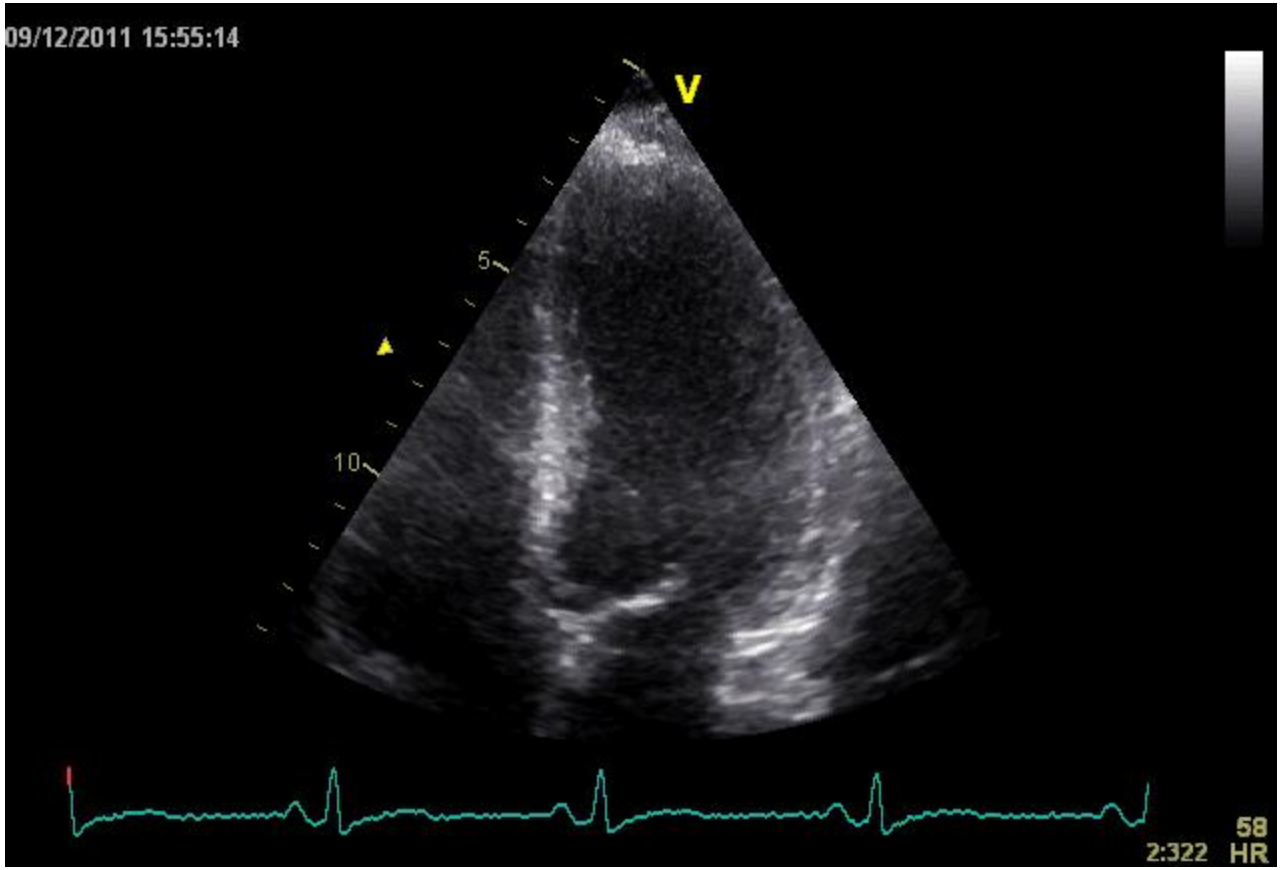
- The type of LV remodeling
- Systolic function:
  global (EF)/regional
- Diastolic function:
  global/regional
- Special features of specific diseases

Role of echocardiography

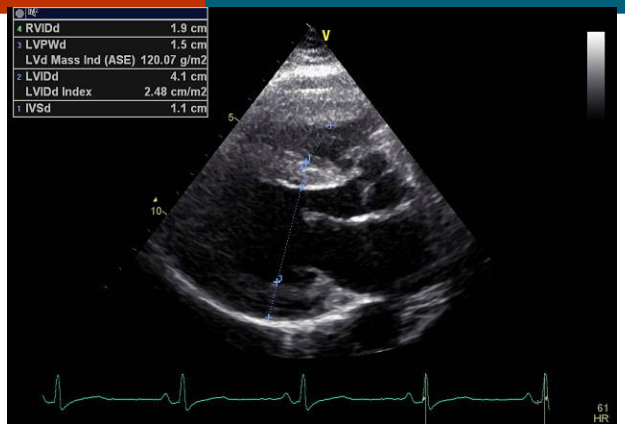
- Echocardiography is a reliable method to visualize the specific patterns of LV hypertrophy,

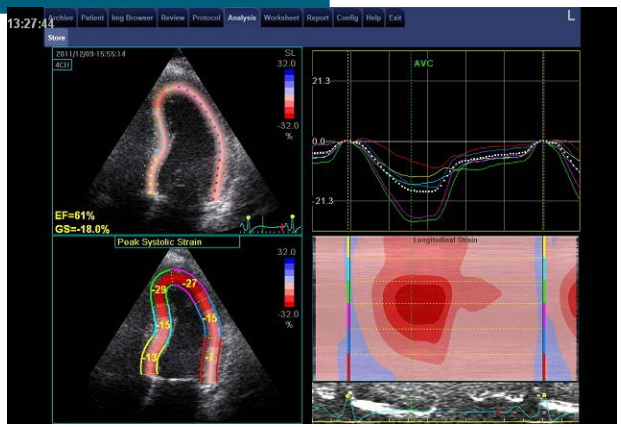
  and quantify the systolic and diastolic function.
- New techniques in echocardiography have provided insight into regional myocardial motion and deformation.
- Tissue Doppler imaging, as well as grayscale 2D speckle tracking, provides more sensitive markers of early myocardial dysfunction compared with standard echocardiography.

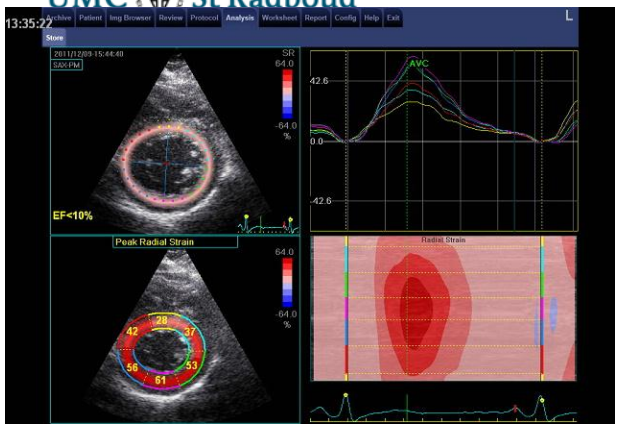
Arterial Hypertension

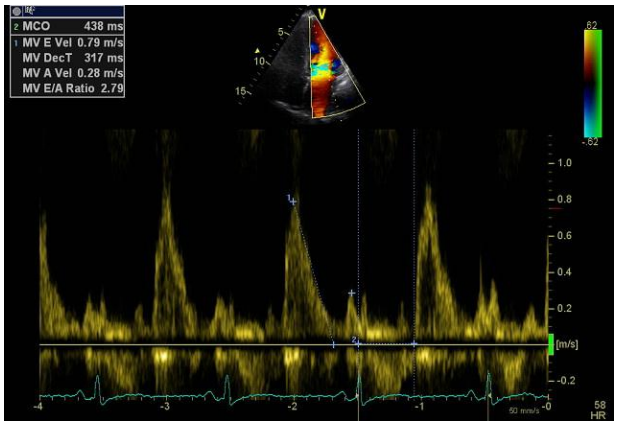


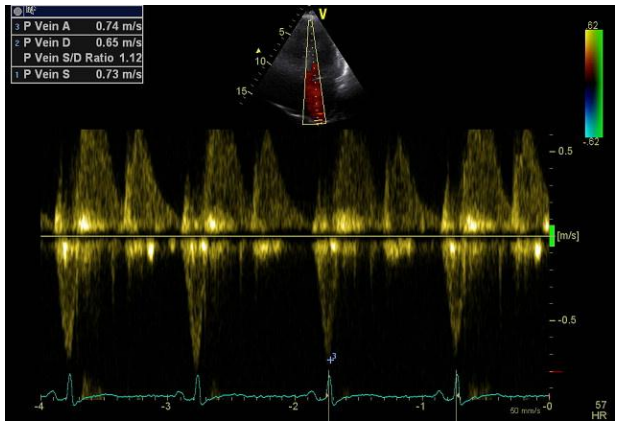
Arterial Hypertension

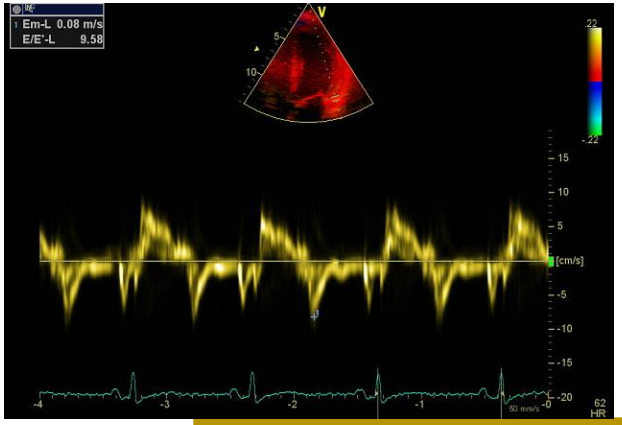


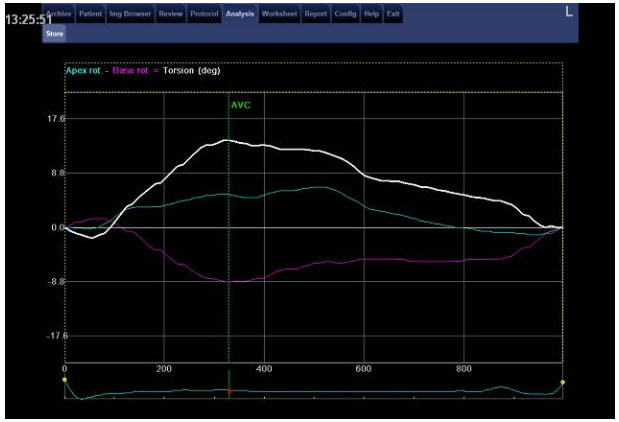




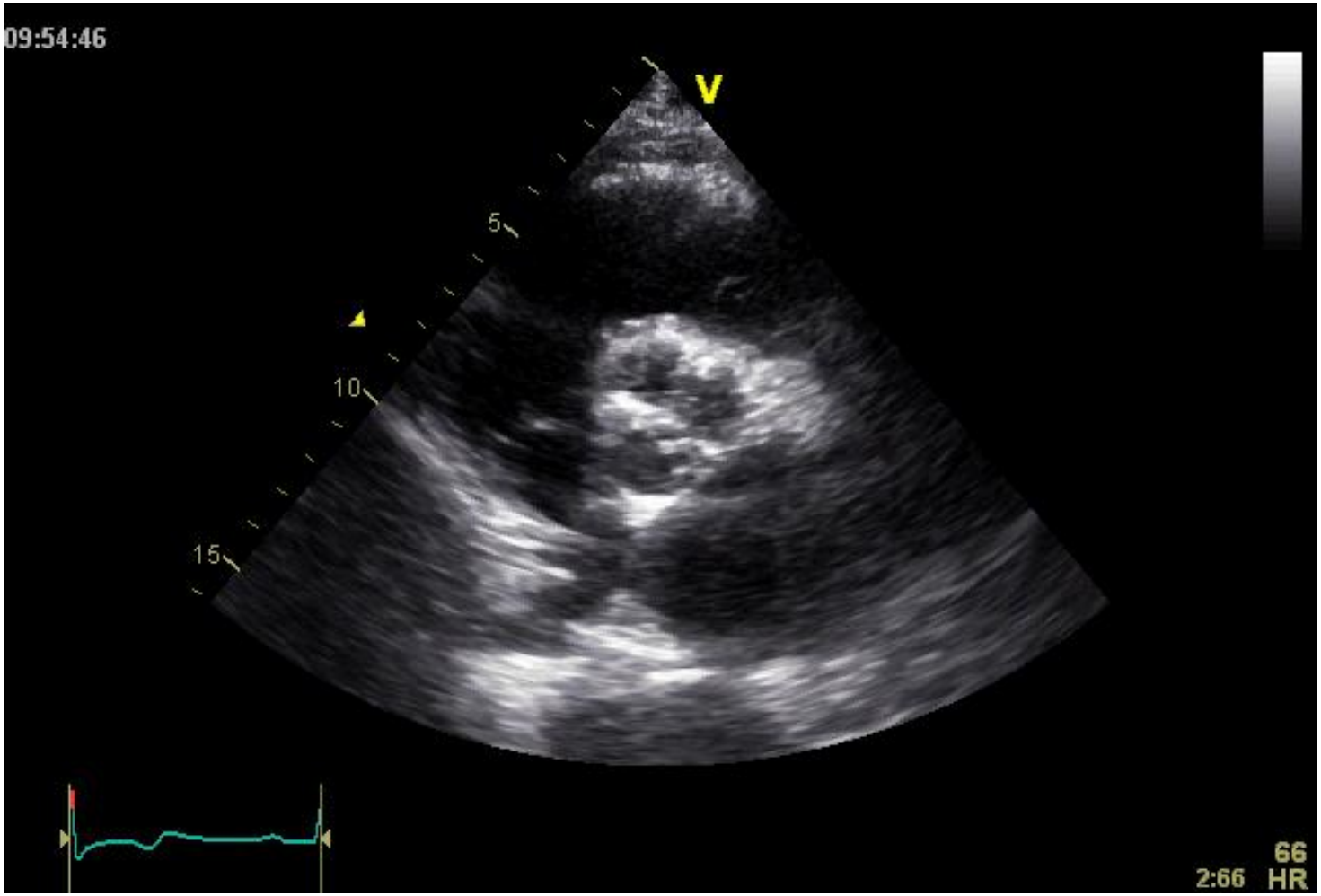




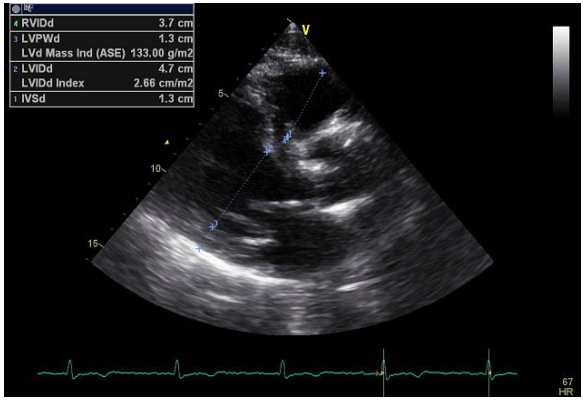


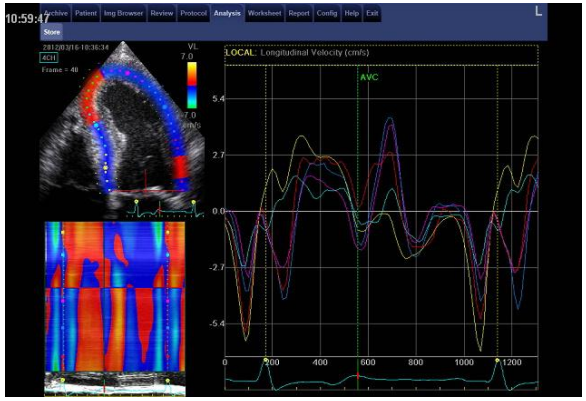


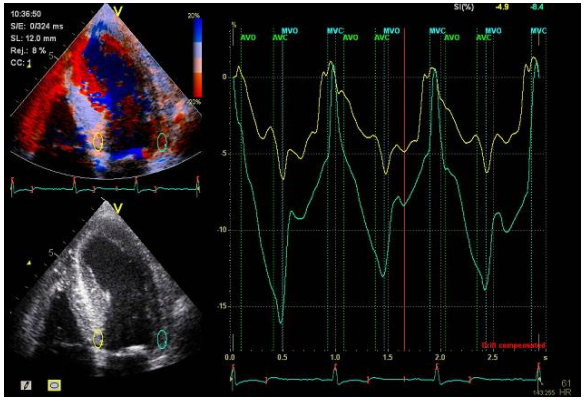
Aortic stenosis

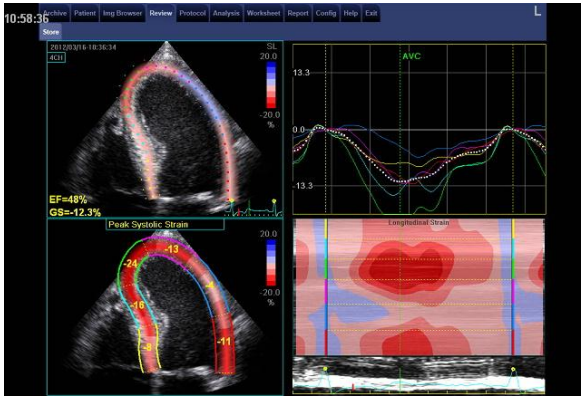


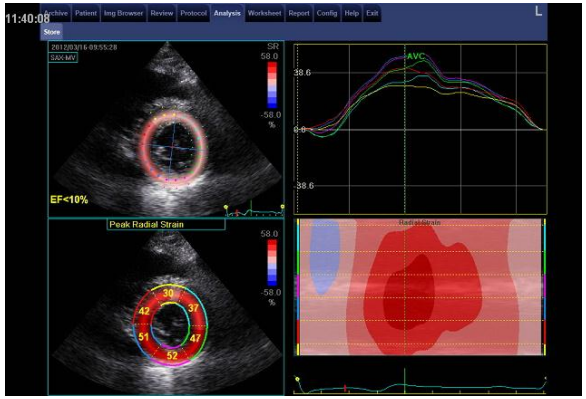
Aortic stenosis

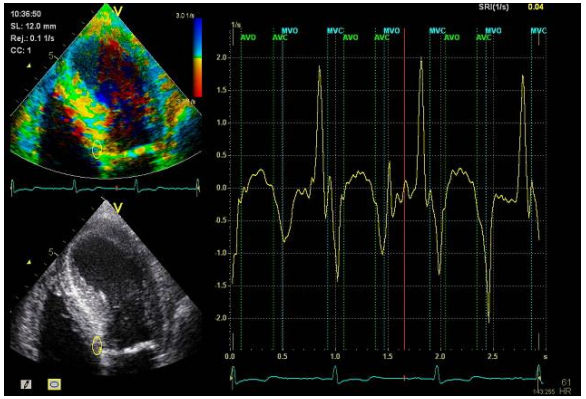


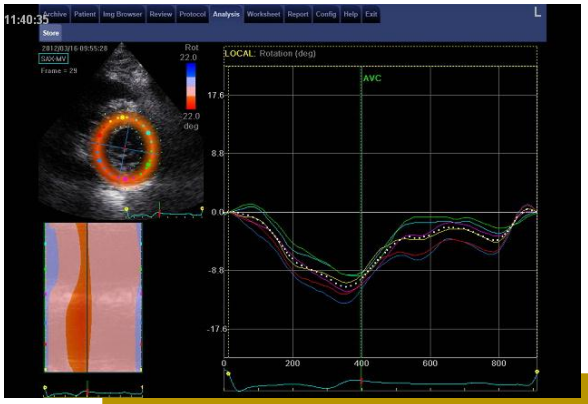


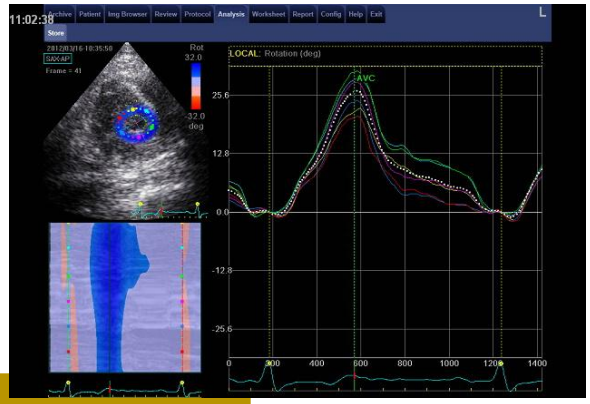


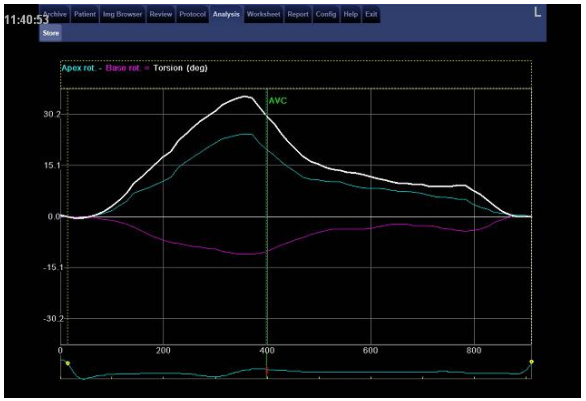








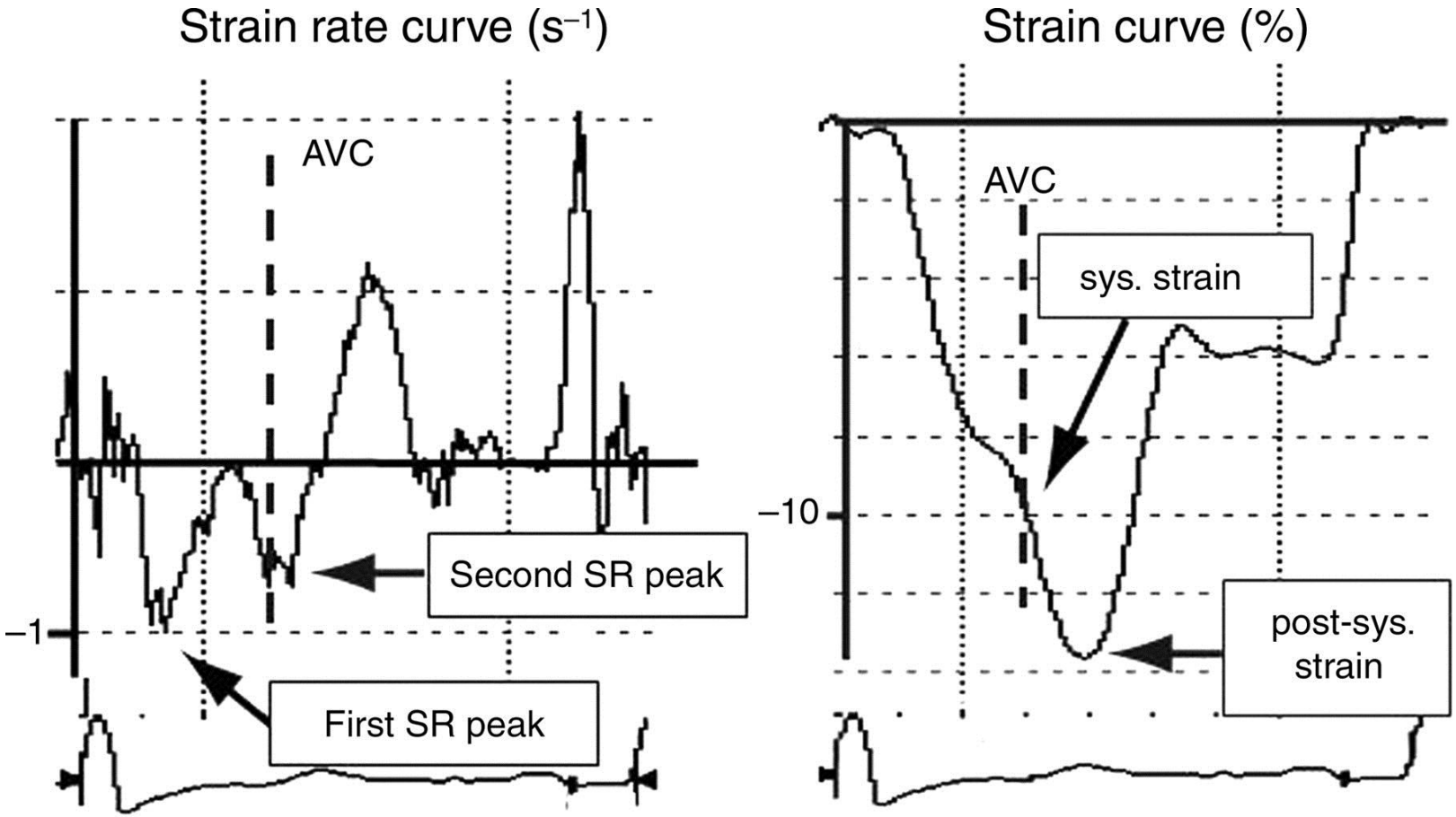




Rotational mechanics are clearly increased in all pressure overload pathologies. This observation results from the changing interaction between the endocardial and epicardial fibers, which induces LV torsion.

Endocardial function is partially lost, therefore, and epicardial torsion becomes even more dominant, resulting in increased overall torsion.

The deformation indices are strongly related to the amount of fibrosis



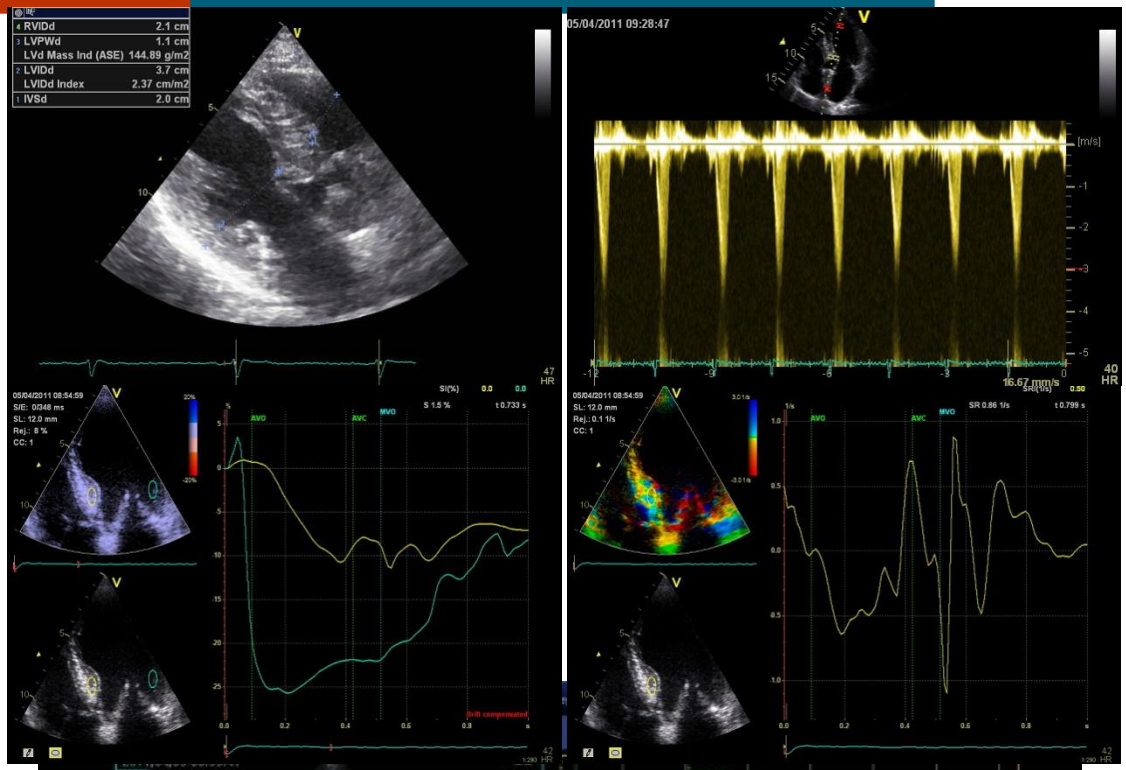
Longitudinal deformation in an LE postive segment

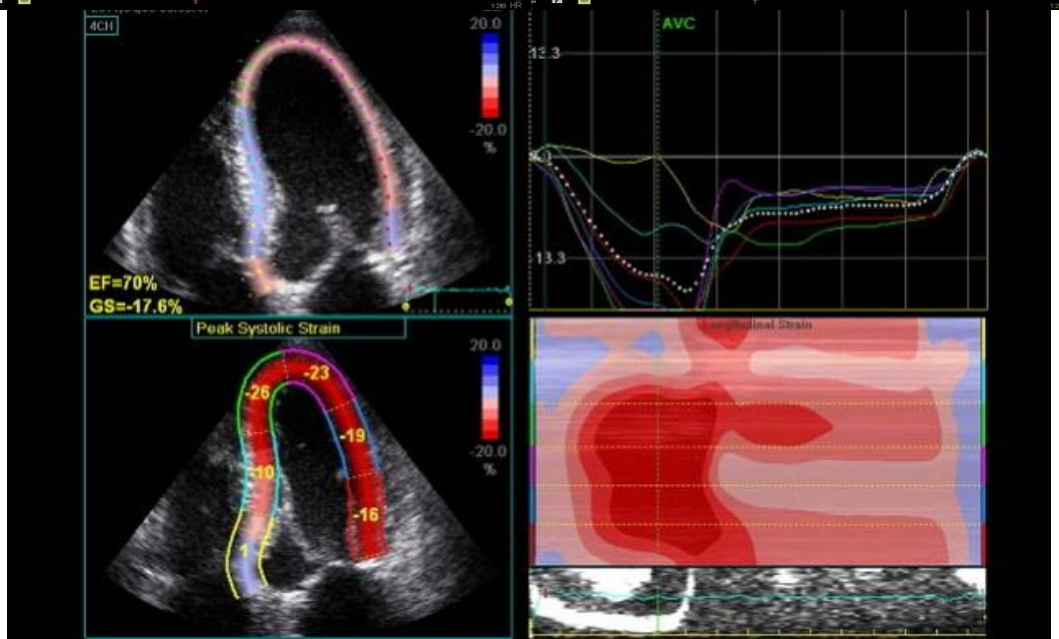
Weidemann F et al. Eur Heart J 2007;28:3020-3026

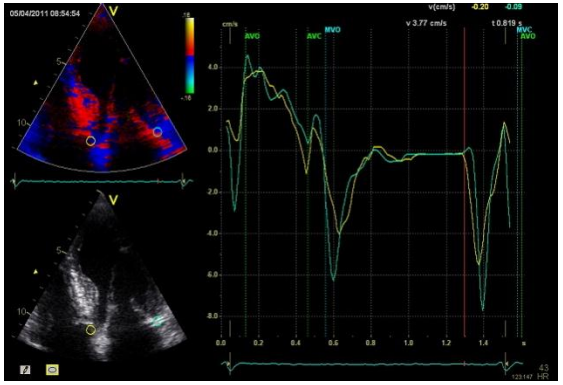
UMC St Radboud

HCM & HOCM

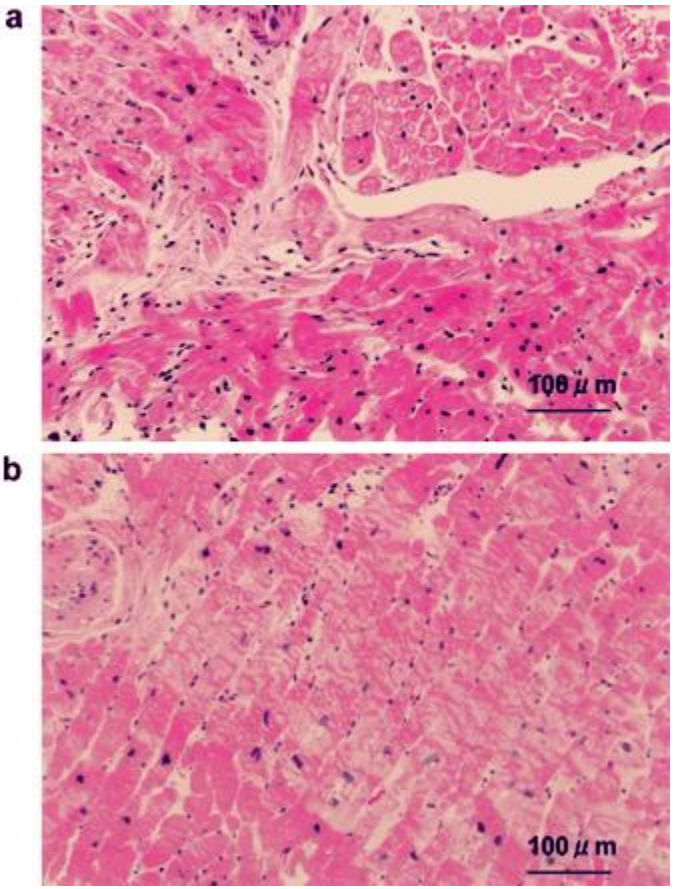
An unexplained enddiastolic LV wall thickness > 15 mm in **any myocardial segment** accompanied by a normal wall thickness (<12 mm) in other segments and a nondilated left ventricle is suspicious for the diagnosis of idiopathic HCM.

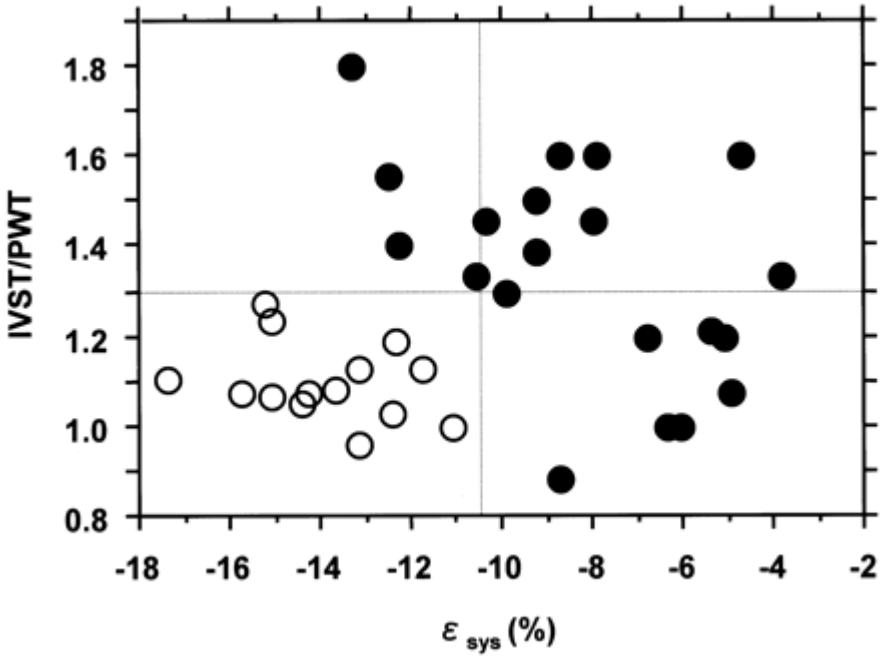






Hypertension vs NHCM

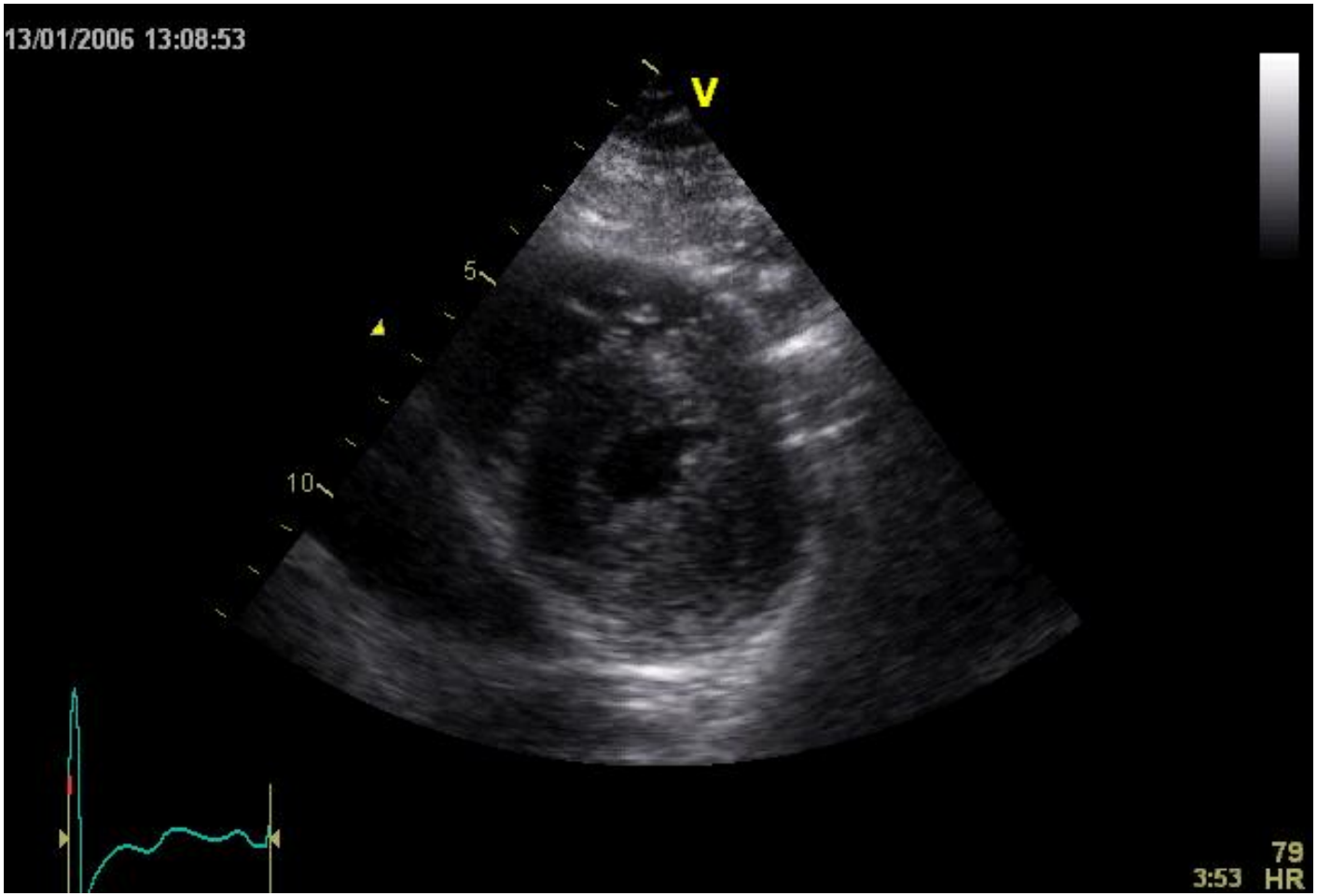




The combination of the IVST/PWT ratio > 1.3 and systolic strain of -10.6% was able to discriminate HCM from H-LVH with a predictive accuracy of 96.1%.

Kato et al., Circulation 2004;110:3808

Apical CMP



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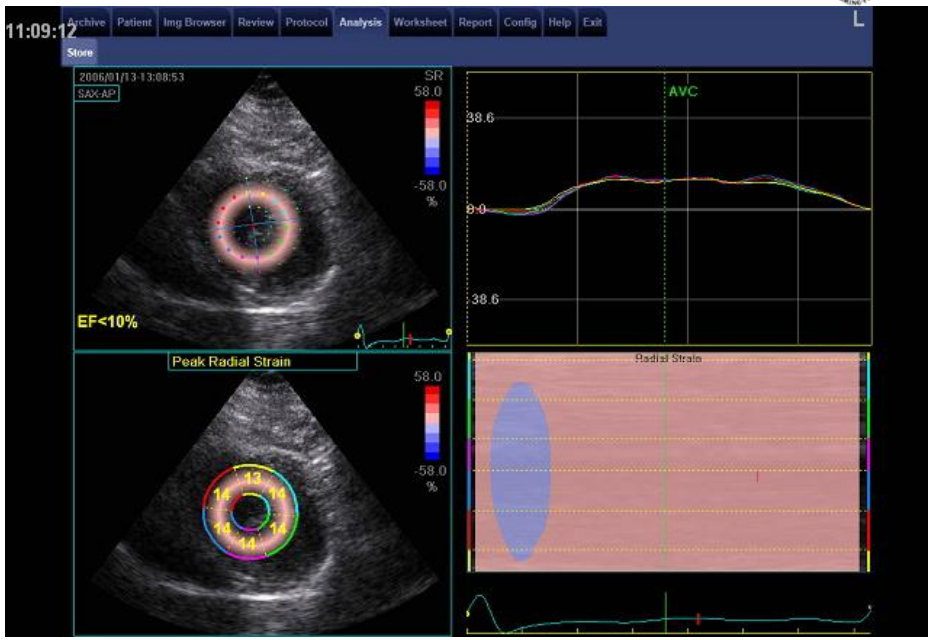
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AVC
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Peak Radial Strain
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-58.0
%
13
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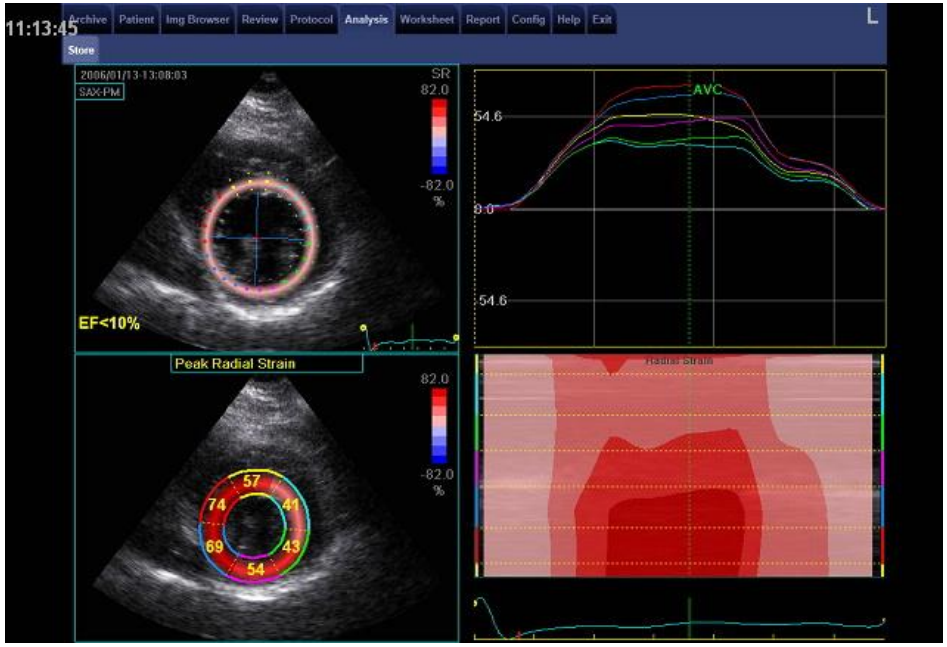
14
Radial Strain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%
EF<10%
AVC
54.6
0.0
54.6
Peak Radial Strain
82.0
-82.0
%
57
74
41
69
43
54
Radial Strain

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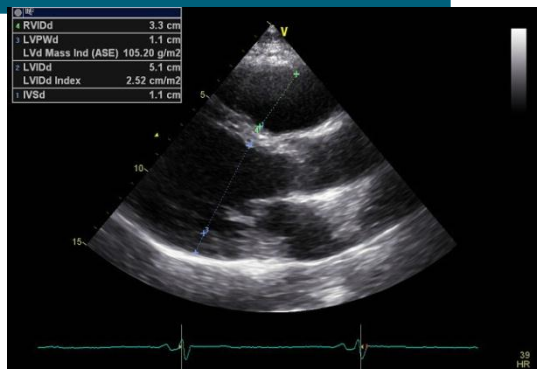
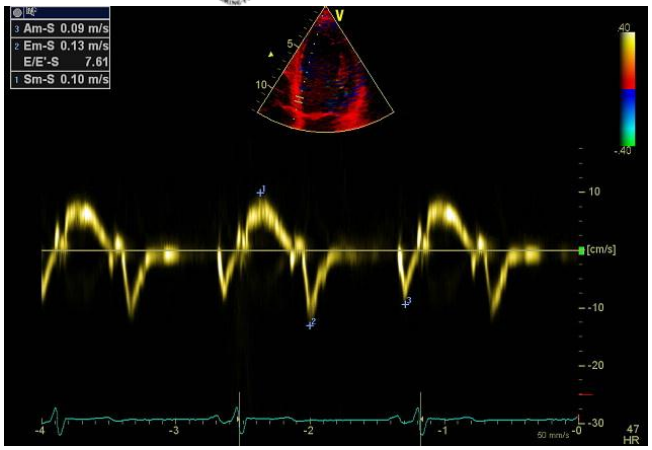
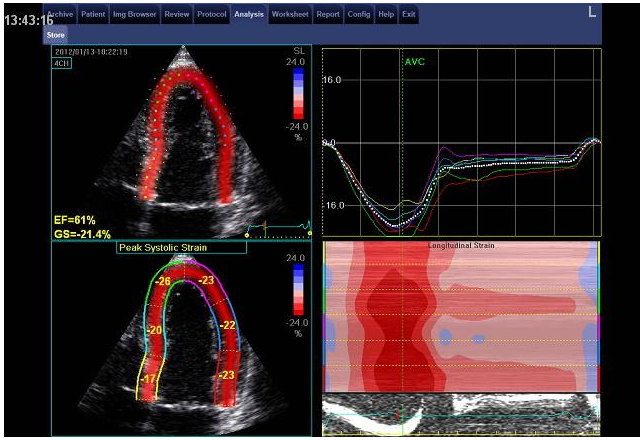
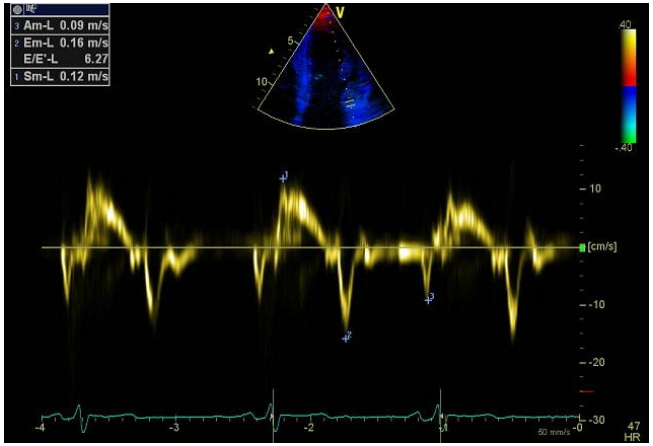
Athlete´s heart



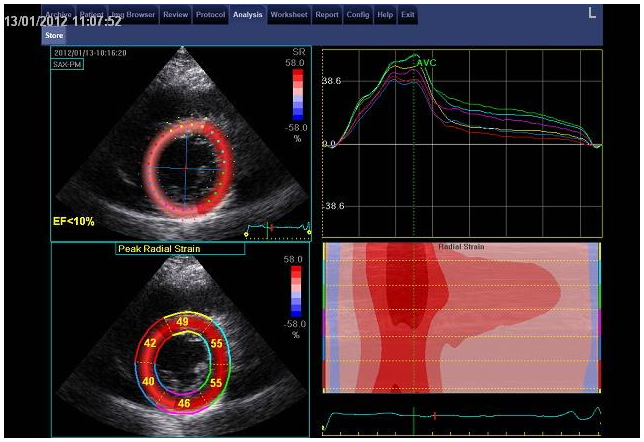


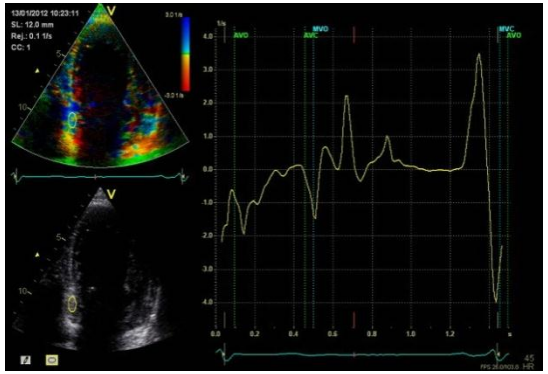


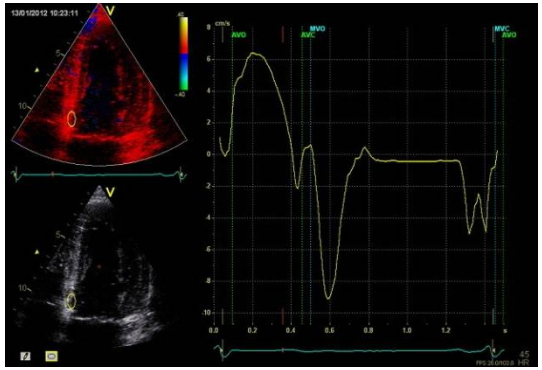
No replacement fibrosis



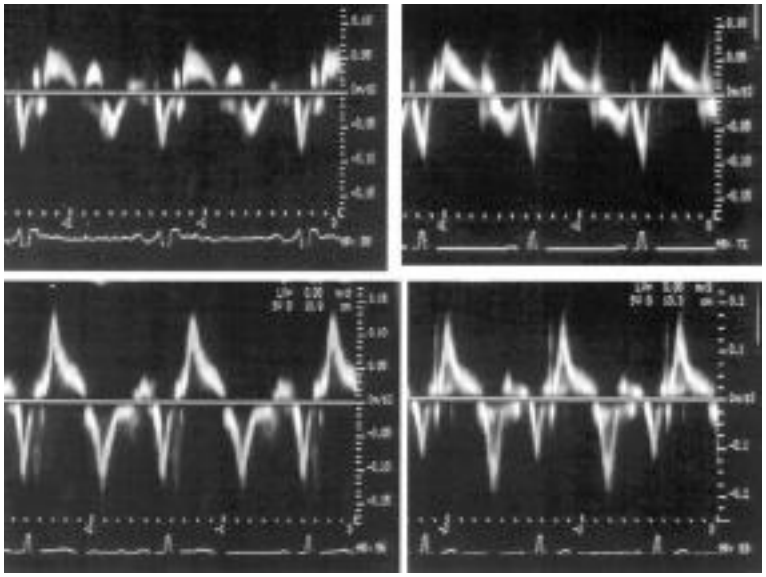
No fiber disarray

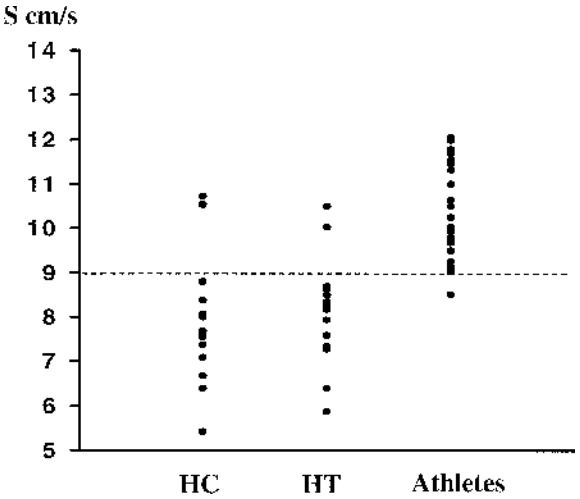




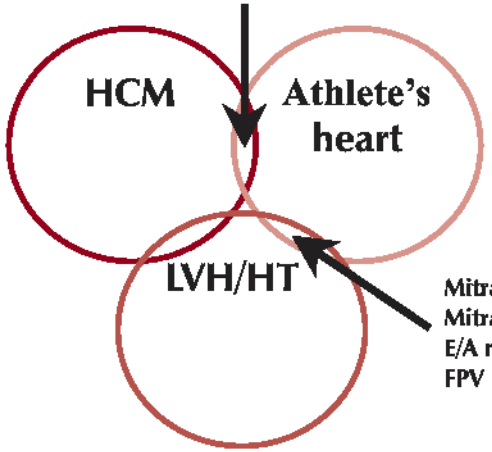


Physiologic vs Pathologic Hypertrophy





Mitral S TDI< 9 cm/s	87%	97%
Mitral E TDI< 9 cm/s	87%	97%
Diast radial strain < 7 s^{-1}	89%	95%
Tricuspid E TDI< 16 cm/s	89%	93%
Sys radial strain < 4 s^{-1}	80%	62%
IVS > 16 mm	73%	93%
FPV < 50 cm/s	73%	83%
E/A ratio < 1	47%	87%



Mitral S TDI< 9 cm/s	87%	97%
Mitral E TDI< 9 cm/s	60%	97%
E/A ratio < 1	33%	87%
FPV < 50 cm/s	64%	83%

Mean (± SD) systolic velocities.

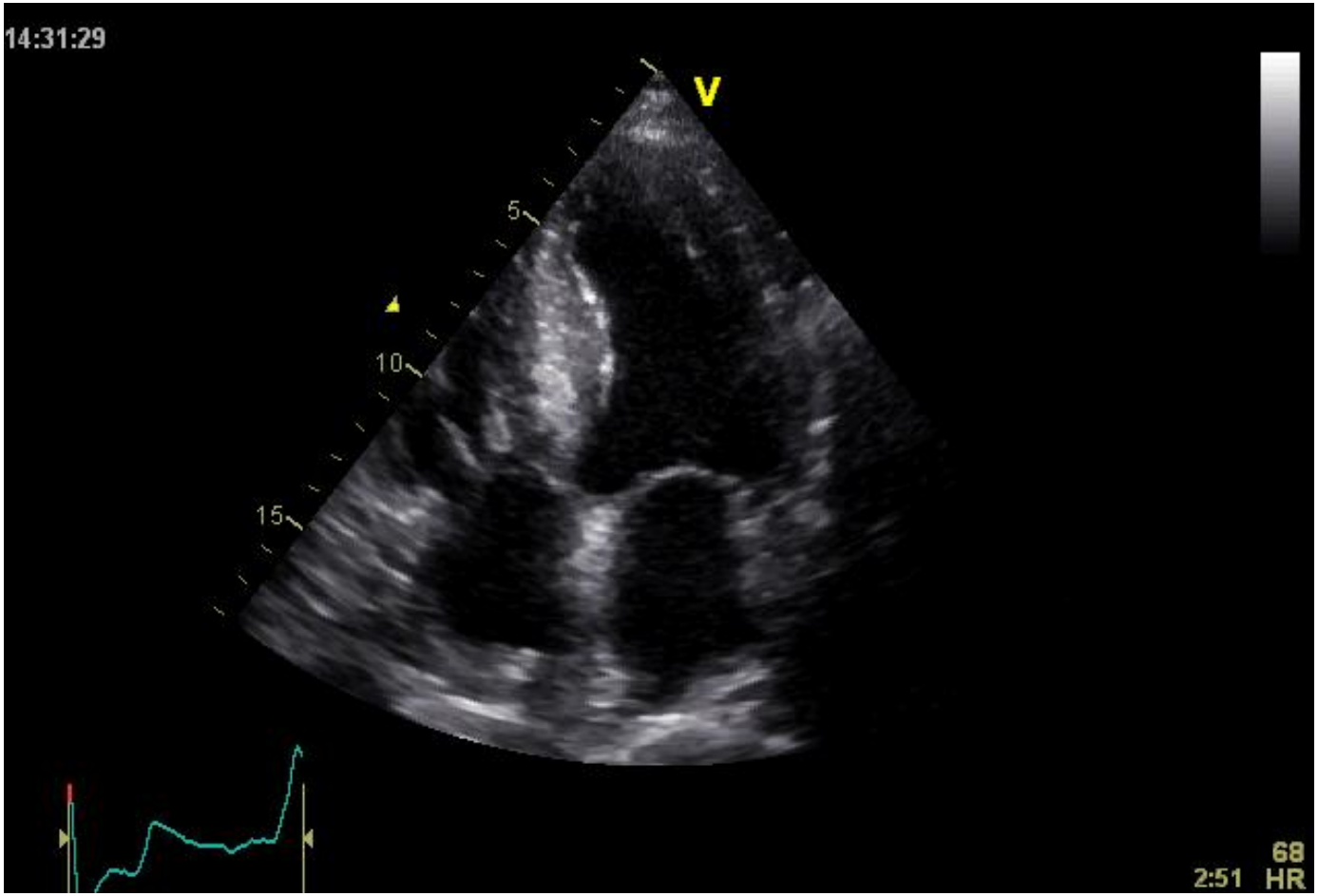
Cut-off 9 cm/sec. p <0.01

HCM or systemic hypertension versus athletes or normal subjects.

•Vinereanu et al.Am J Cardiol 2001;88:53–58

•Floresku et al.Mædica A Journal of Clinical Medicine, Vol1 No.3 2006

Fabri CMP



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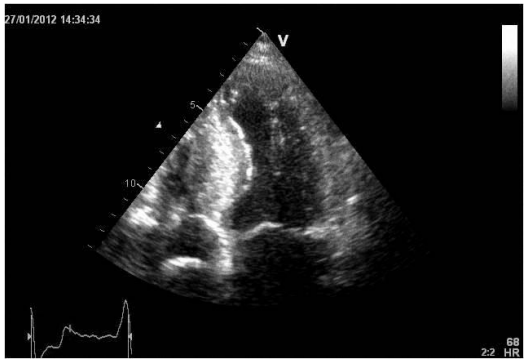
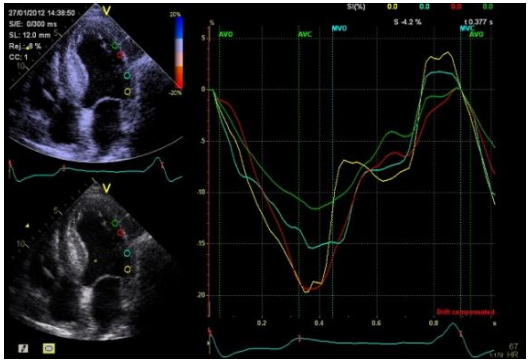
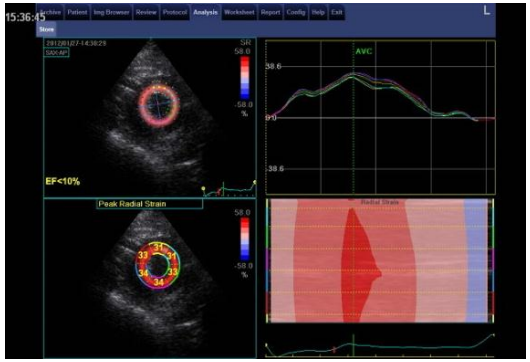
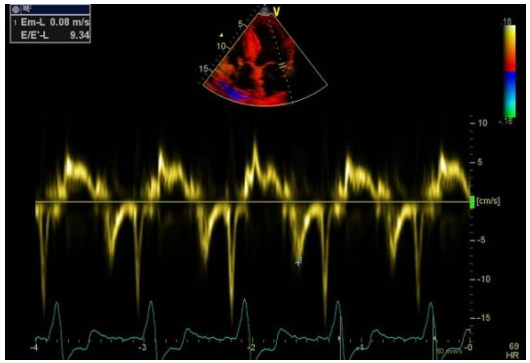
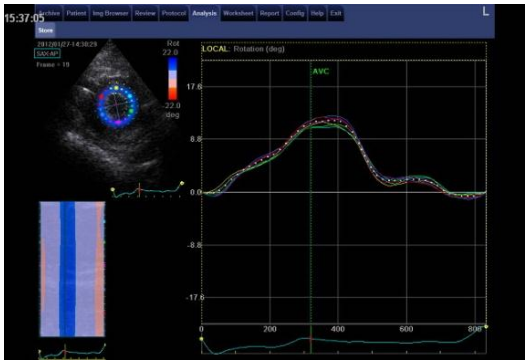


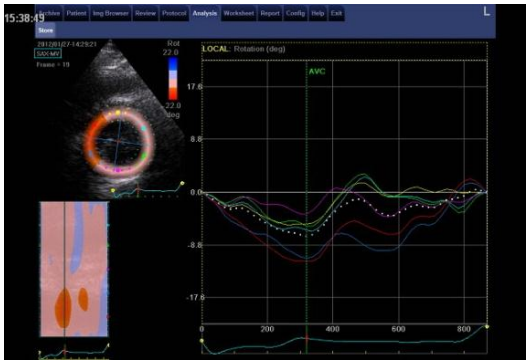


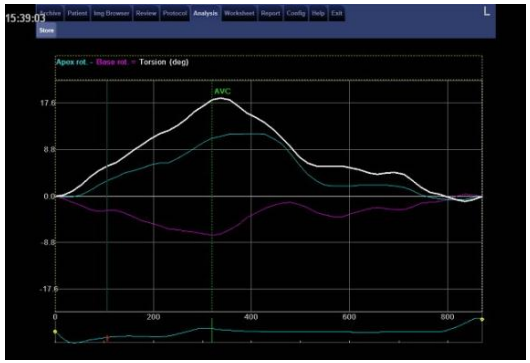


Concentric hypertrophy up to 16 mm
No LVOT obstruction
Prominence of the lateral papillary muscle



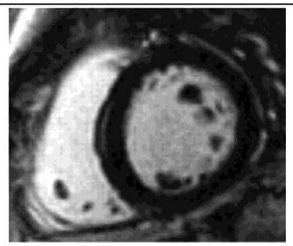




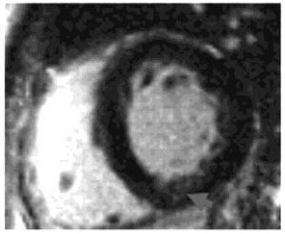


MRI of 3 typical Fabry patients at baseline.

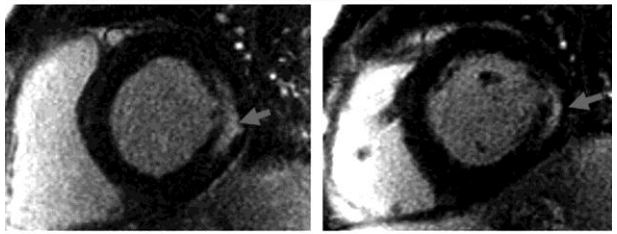
Patient: "*No Fibrosis*"



Patient: "*Mild Fibrosis*"



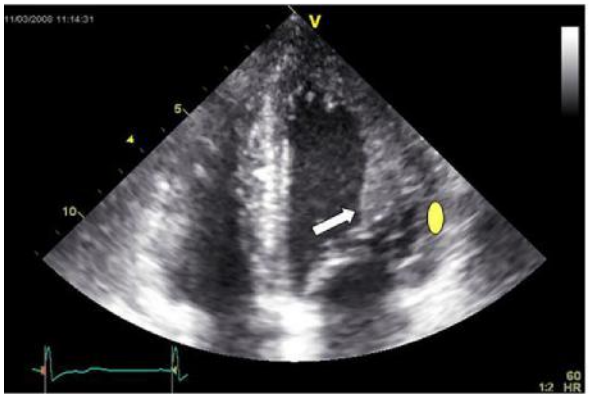
Patient: "*Severe Fibrosis*"

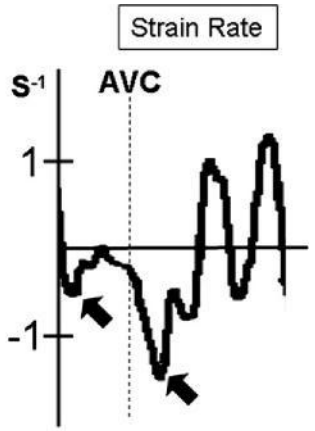


Basal
Short Axis View

Mid
Short Axis View

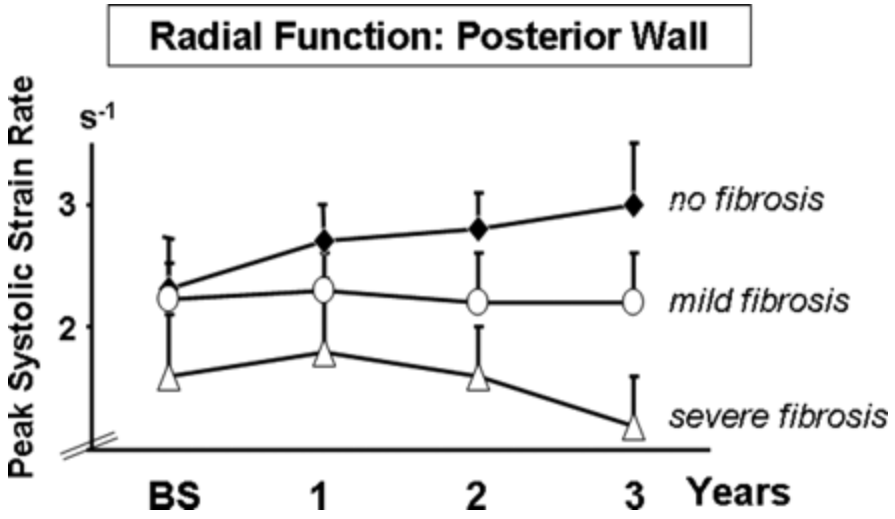
An additional typical feature in Fabry cardiomyopathy is the development of replacement fibrosis in the basal posterolateral segments.



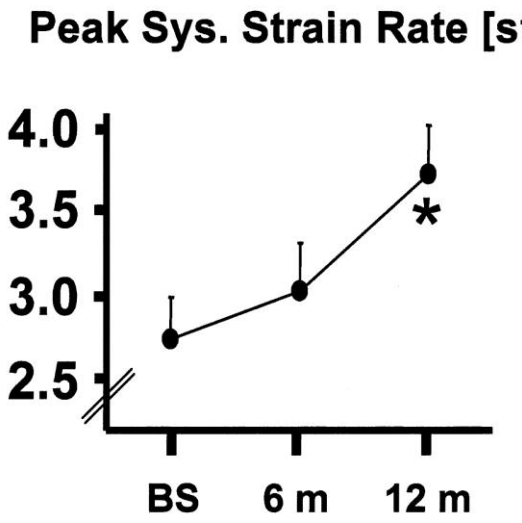


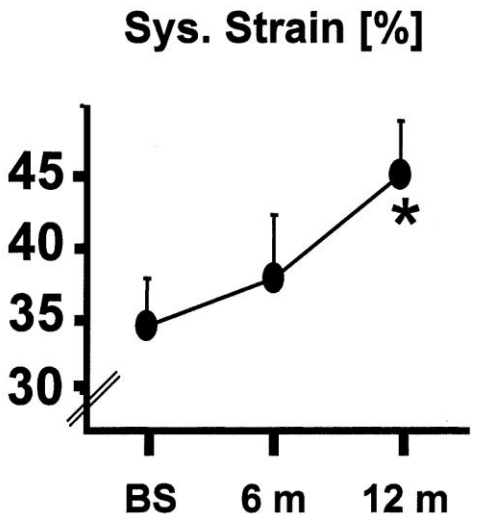
Weidemann F et al. Circulation 2009;119:524-529

- Myocardial segments demonstrating late enhancement showed no functional improvement during enzyme-replacement therapy, which suggests that early disease detection and initiation of treatment is crucial.

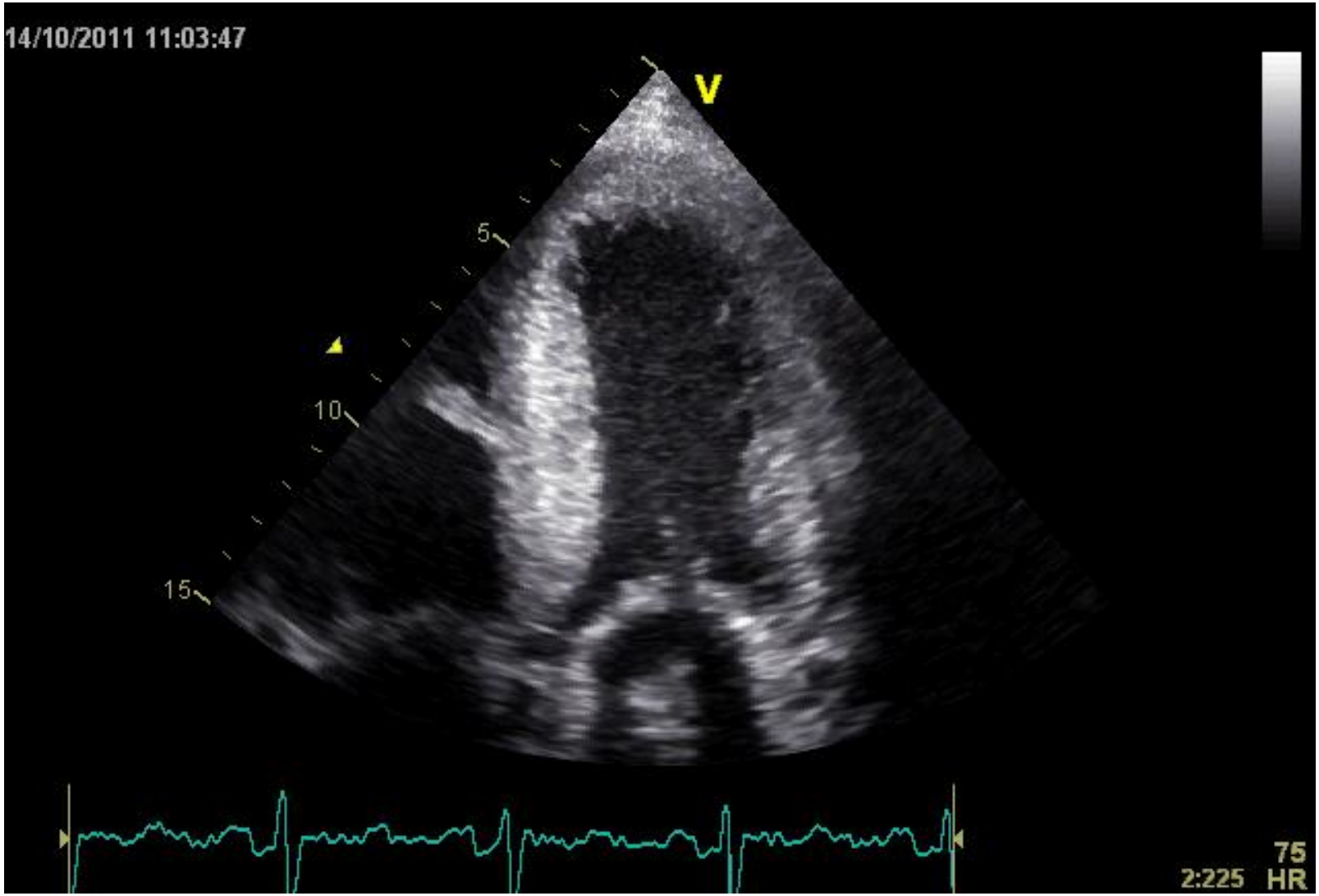


LV Radial Function





Weidemann Circulation 2009;119:524


14/10/2011 11:03:47
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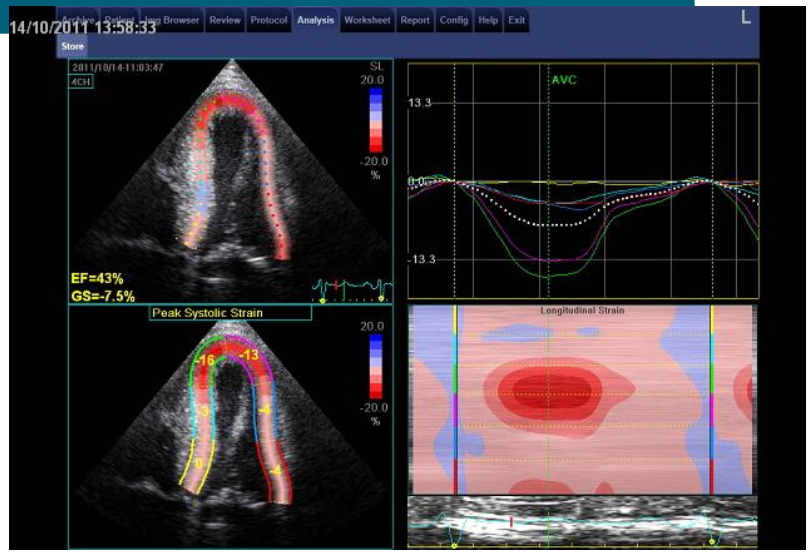
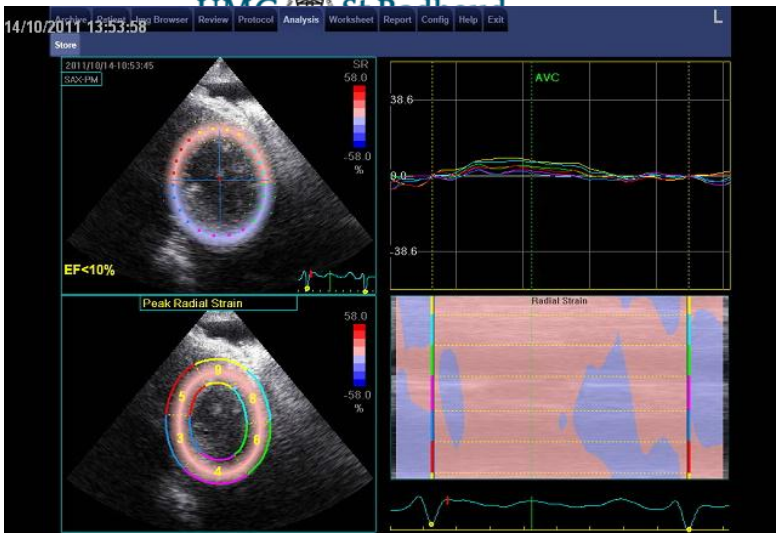




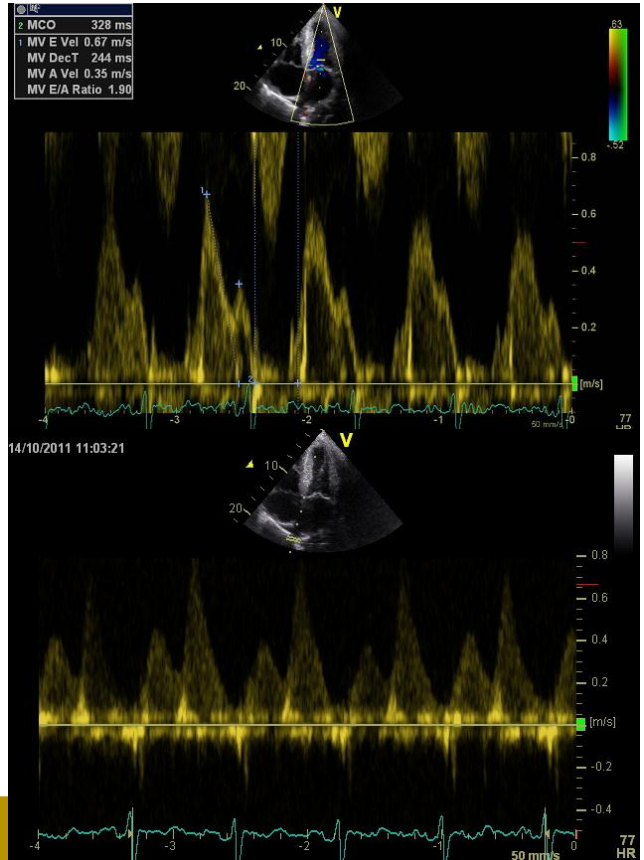
Concentric hypertrophy up to 15 mm.

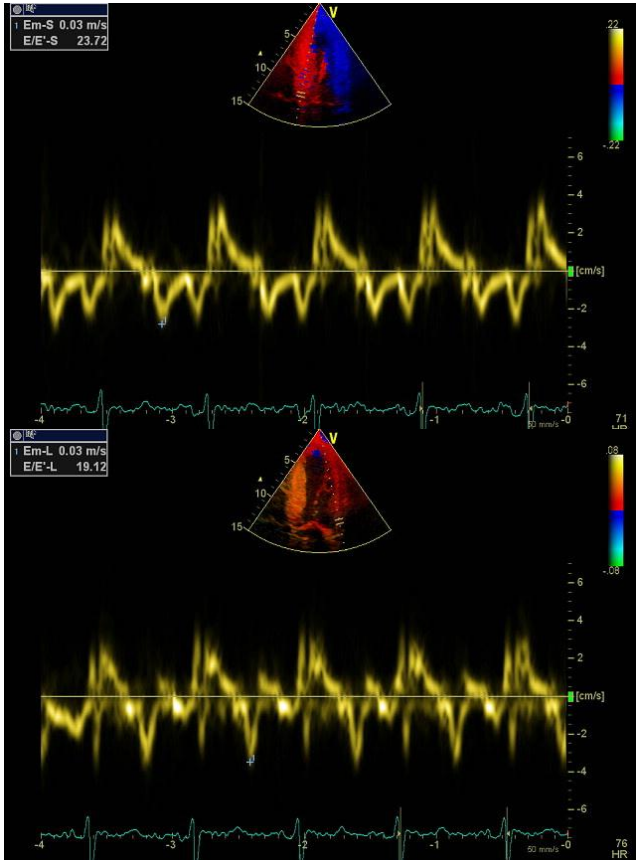
Never LVOT obstruction

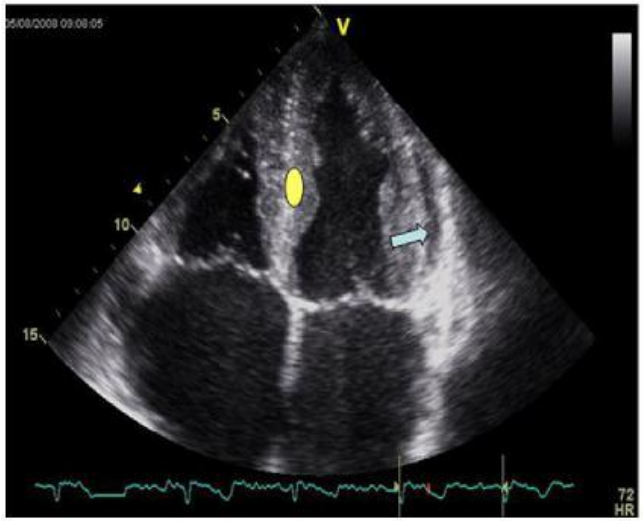
Pericardial effusions

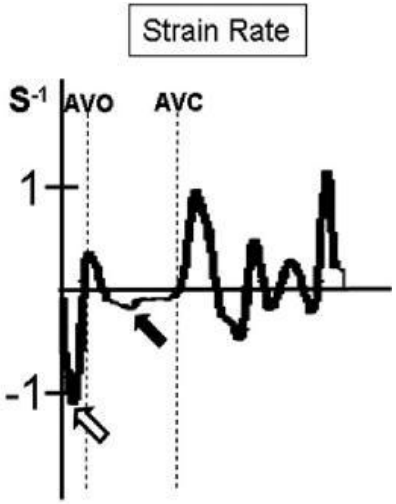
IAS, RV

“Stiff Heart”







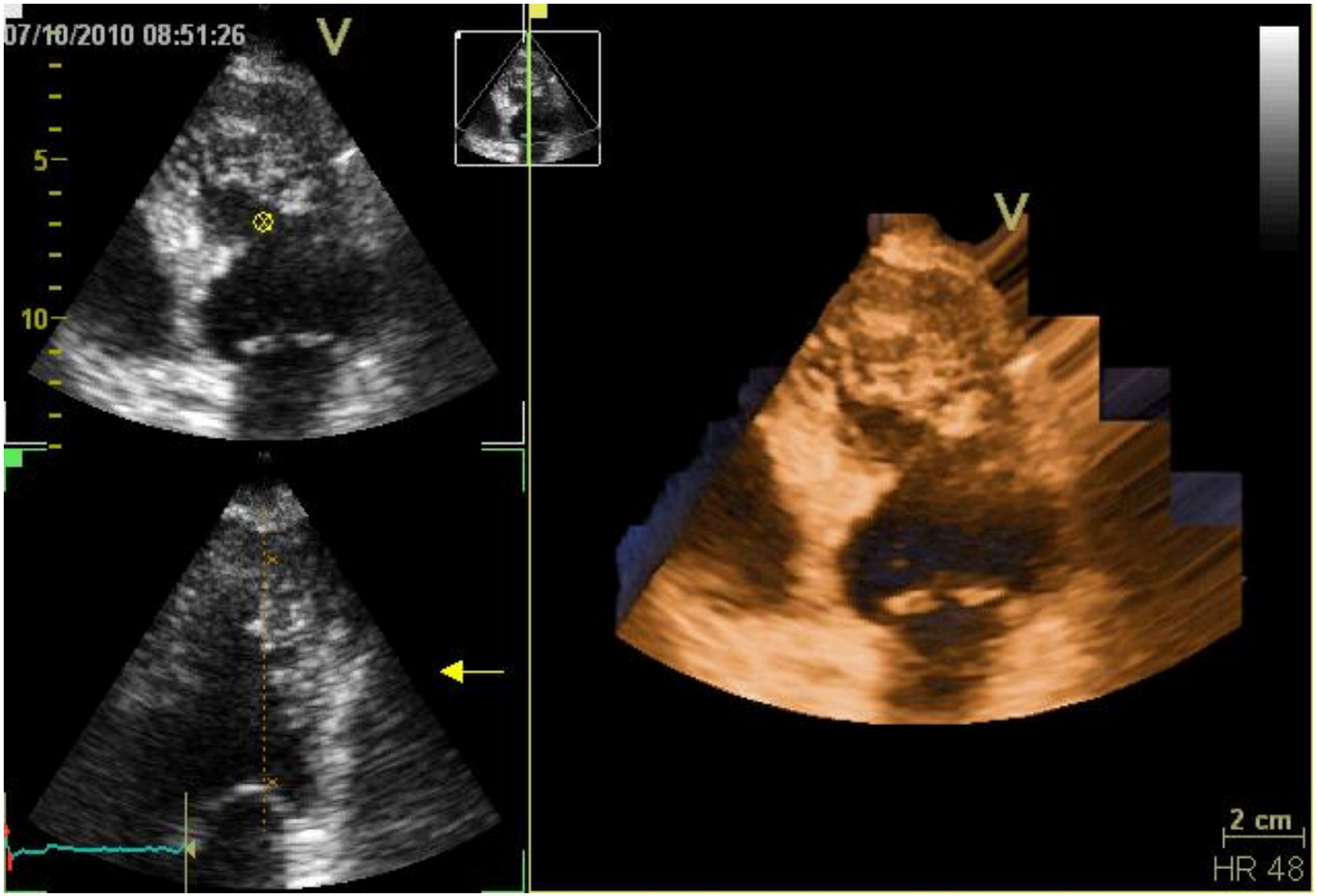


Wiedemann et al. J Am Soc Echocardiogr 2010;23:793-801.)

- Cardiac amyloidosis is the disease in which longitudinal function is most homogeneously reduced and long. strain is usually <10%
- Mean LV basal strain is an independent predictor of both cardiac and overall deaths.

Obama J, JACC Cardiovasc Imaging 2010;3:333-42.

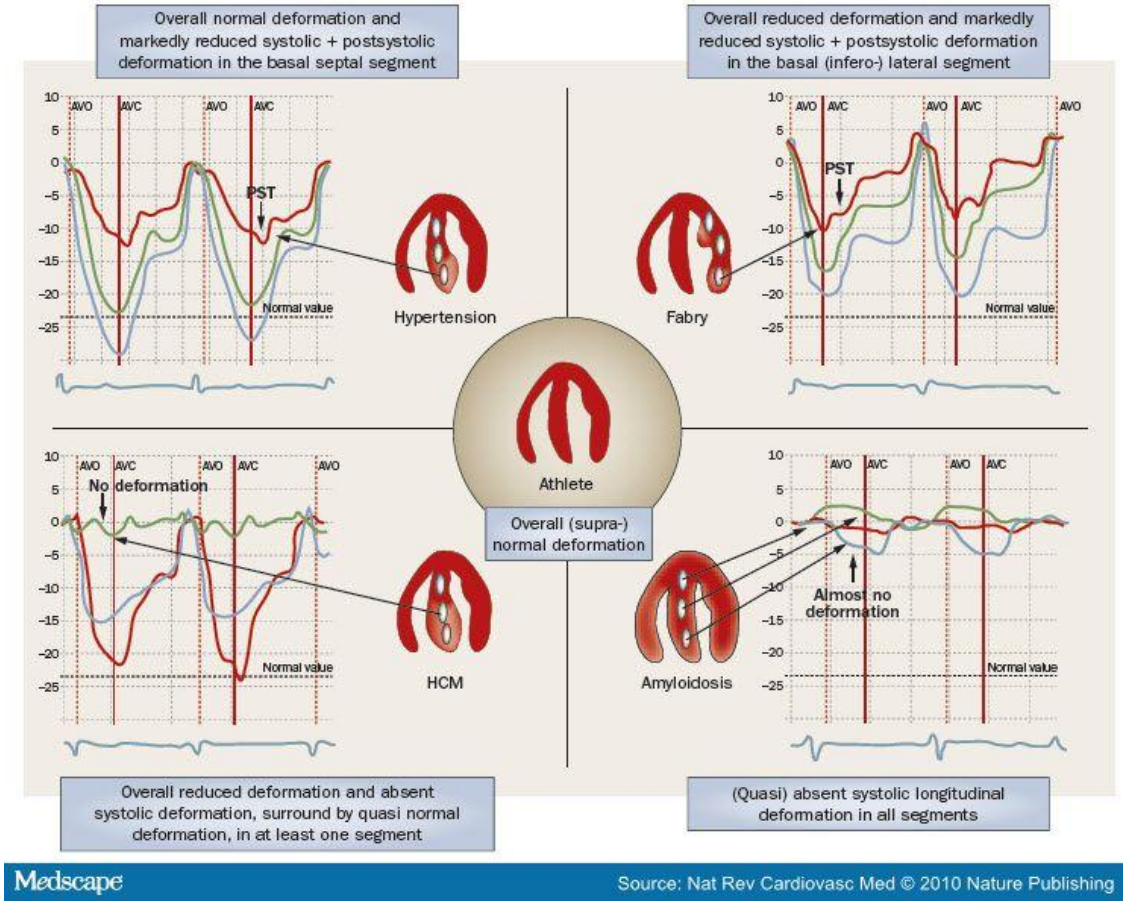
Noncompaction CMP



Noncompaction CMP

The most important echo criterion is the typical 2-layered structure of the myocardium, with a thin, compacted epicardial band and a much thicker, noncompacted mid and endocardial band with deep endocardial recesses.

Typical echocardiographic features of the left ventricle in different hypertrophic hearts



Maja Cikes et al.

Message

For the clinic:

- Stay informed: Doppler myocardial imaging and speckle tracking are more-sensitive imaging modalities than conventional echocardiography.
- This enable the detection of hypertrophic myopathies at an earlier stage.

For the Echolab:

- In some patients, the correct diagnosis can be achieved only by obtaining additional history information or laboratory tests:

✓ Age of clinical expression
✓ Mode of inheritance (genealogical tree)
✓ Rate of progression
✓ Non cardiac features (phenotypic red flags):
Skin-hair-e**y**es-facies
Pectus, back, skeletal muscles)
Neurological/mental status

Thank you

Aelbert Cuyp, View from Dordrecht, 1660