How to use strain in daily clinical practice

Stephen Glen

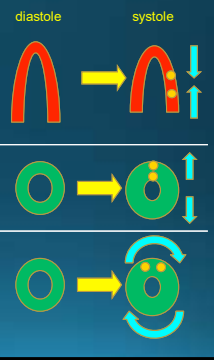
Strain

- I don't understand it
- It's just more numbers
- Other cardiologists don't understand it
- Only echo specialists understand it
- It takes too long


A Test in Context:
Myocardial Strain Measured by Speckle-Tracking Echocardiography

What's the alternative?

2D strain



Longitudinal is negative [apical]
normal - 20 %
subendocardial fibres

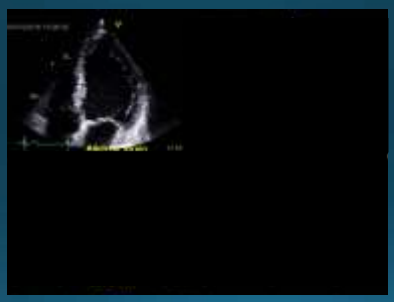
Radial is positive [short axis]
normal + 35 to + 45 %
subepicardial fibres

Circumferential is negative [short axis]
normal -18 to -22 %
also subepicardial fibres

Speckle tracking

Speckle tracking measures strain directly

Angle independent



Longitudinal strain most commonly used in clinical practice

Normal average peak longitudinal strain

Normal more negative than -18%

Borderline between -16% and -18%

Abnormal less negative than -16 %

Bellavia D et al; Am J Cardiol 2008;101(7);1039-45

ASE 2015 guidelines

Meta-analysis of 2597 normal studies, -19.7% mean

GE Echopac BT 12	-21% (2.0%) mean (SD)
Philips Q Lab 7.1	-19% (2.5%)
Toshiba Ultra extend	-20% (2.4%)
Siemens VVI	-20% (4.6%)

A peak GLS in the range of -20% can be expected in a healthy person, and the lower the absolute value of strain is below this value, the more likely it is to be abnormal.

Note these are endocardial measurements, not whole wall thickness (more commonly used)

Clinical applications

- Quantitative regional wall motion analysis
- Quantitative global LV assessment
- Predicting prognosis
- Clarifying diagnosis

Ando T et al Am J Cardiovasc Dis 2015;5:119-26

Lo Iudice F et al Eur Heart J Cardiovasc Imaging 2016 (epub)

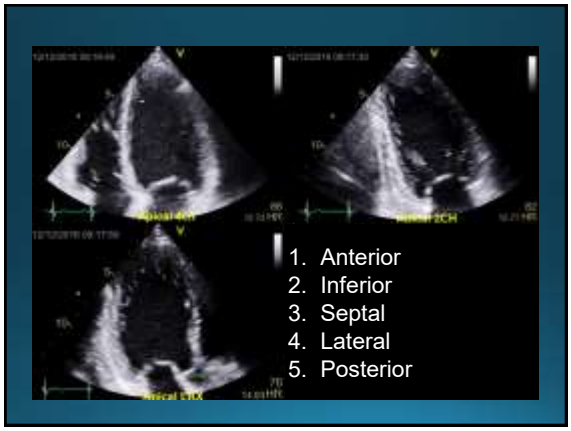
Marwick et al 2009;J Am Coll Cardiol Img 2009;2:80-84

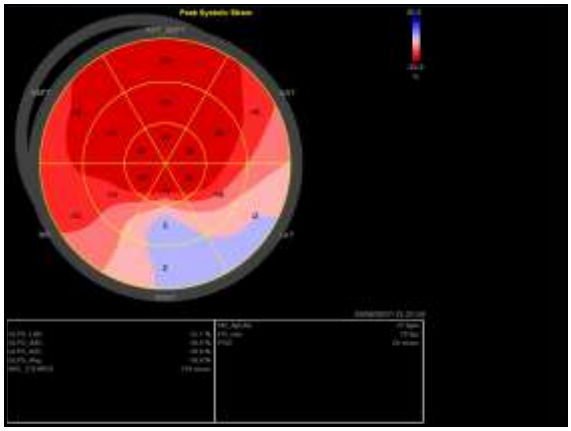
Reference Ranges and Regional Patterns of Left Ventricular Strain and Strain Rate Using Two-Dimensional Speckle-Tracking Echocardiography in a Healthy Middle-Aged Black and White Population: The CARDIA Study

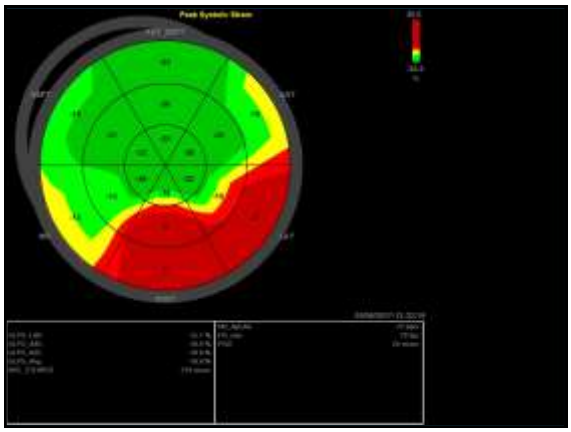
White women show the highest reference ranges…, and the lowest values are found in black men.

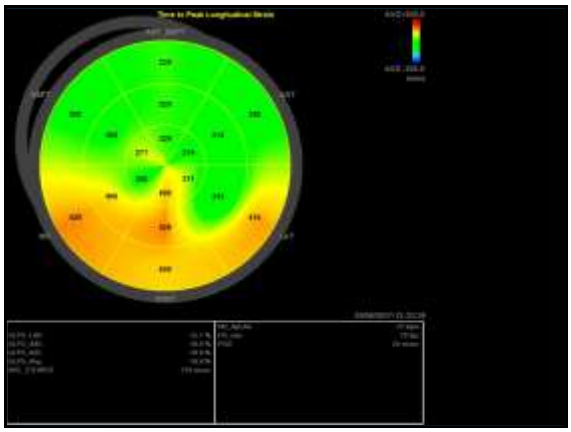
J Am Soc Echo, 2017 (in press)

Regional wall motion analysis


1. Anterior
2. Inferior
3. Septal
4. Lateral
5. Posterior

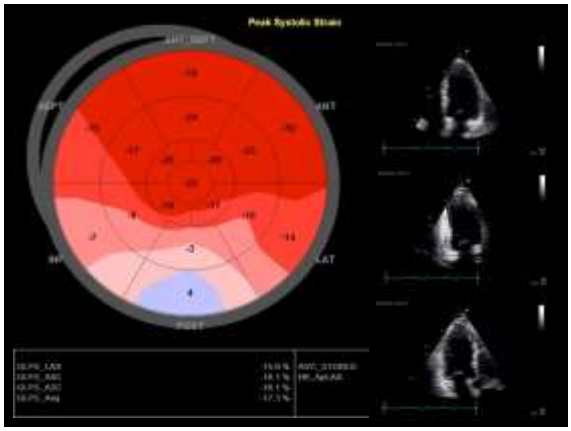






Is there a regional wall motion abnormality?

1. No
2. Septal
3. Inferior
4. Lateral
5. Posterior

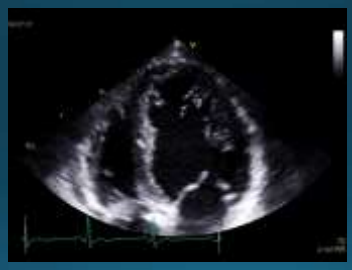


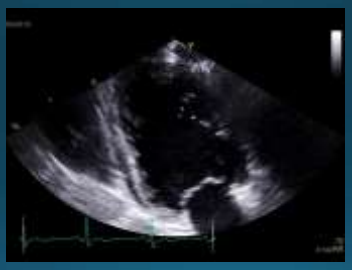
Tethering

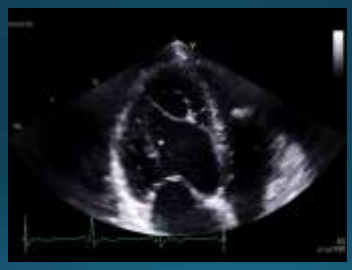
Strain to help diagnose

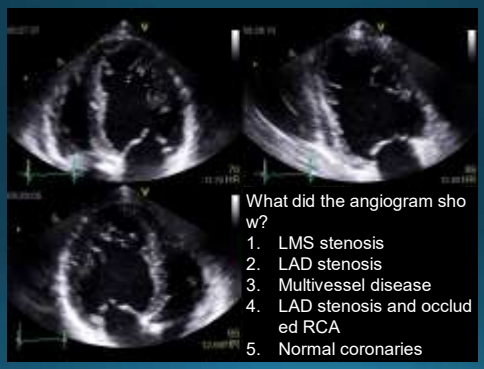
61 yrs,female

- Usually active, good exercise capacity
- Difficulties with her neighbour
- Severe central chest discomfort
- ECG – anteroseptal ST elevation, resolved with GTN spray









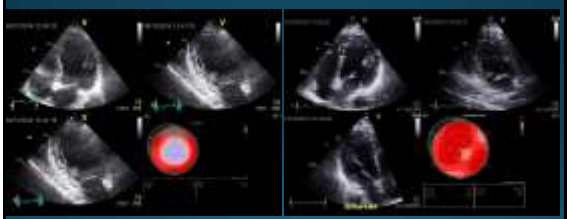
What did the angiogram show?

1. LMS stenosis
2. LAD stenosis
3. Multivessel disease
4. LAD stenosis and occluded RCA
5. Normal coronaries

Takotsubo syndrome

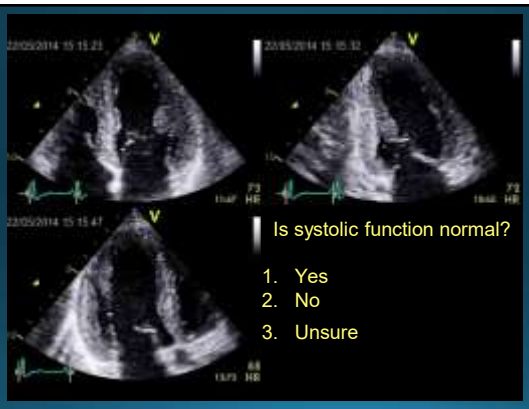
- Stress cardiomyopathy / broken heart syndrome
- Chest pain, anterior ST elevation
- Apical ballooning
- 85% due to physically or emotional stressful event
- More common in post-menopausal women
- ? Microvascular dysfunction / abnormal catecholamine reaction

Takotsubo recovery



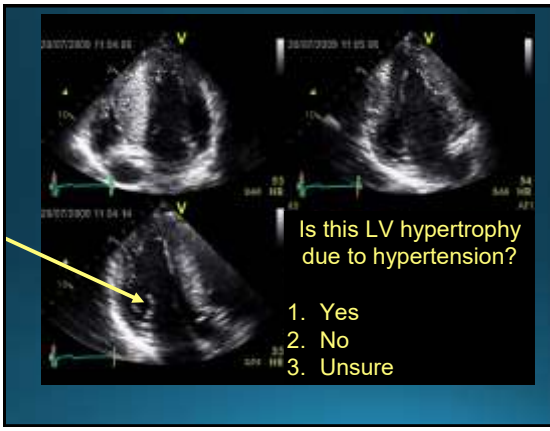
Case

- 29 yrs, female
- Family history of MELAS / MIDD syndrome
- Asymptomatic
- Genotype positive



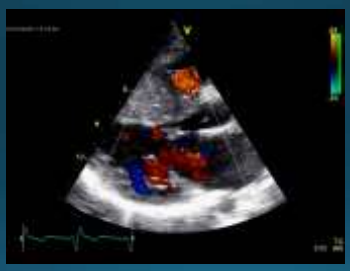
48 yrs, male

- Asymptomatic
- Company medical
- Blood pressure 168/84, p68/min
- ECG - left ventricular hypertrophy
- Echocardiography requested



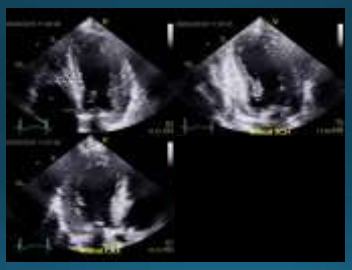
Reduced global longitudinal and circumferential strain predicts adverse cardiovascular outcomes in HOCM

Ozawa K er al. Int J Cardiol 2017;228:1015-21

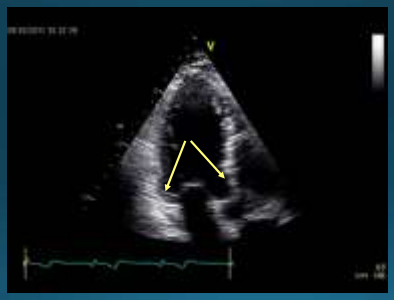


76yrs, male

- Progressive dypnoea and fatigue
- Ankle oedema
- Bilateral sensorineural deafness
- Bilateral carpal tunnel syndrome
- Mild renal impairment

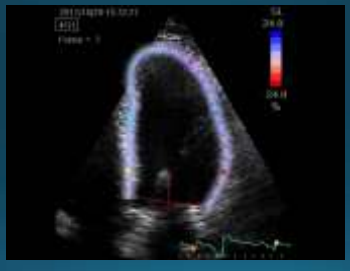


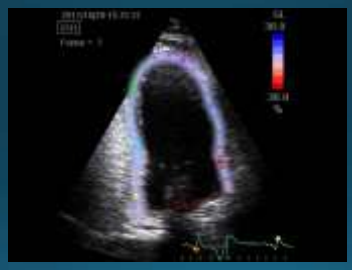
Step by step practical guide to speckle tracking

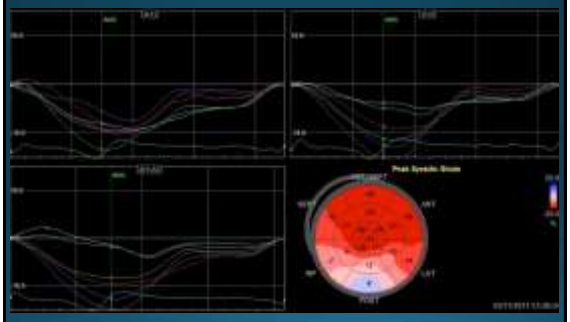


Avoid placing points below annulus or in LVOT

Aortic valve closure







Tips

Optimise frame rates

2D frame rate
40-80 fps

Choose best cardiac cycle

100 msec before and after R wave should be stored

Watch for heart rate variability (3D)

Twisting

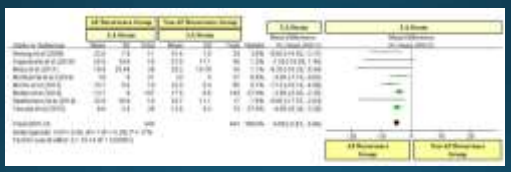
- Wringing out a dishtowel
- Base twists clockwise (a little)
- Apex twists anticlockwise (more obvious)
- Torsion is basal minus apical twist

Left atrial strain

Camelli M et al. Heart Fail Rev 2016;21:68-76

International Journal of Cardiology

Left atrial strain: A useful index in atrial fibrillation



Ma X et al, Echocardiography 2016;33:724-33

Right ventricular strain, not just for congenital heart disease

Strain

- I don't understand it
- It's just a number
- Cardiologists don't understand it
- Only specialists understand it
- It takes just the briefest of moments….