CLINICAL UPDATE IN CARDIAC IMAGING

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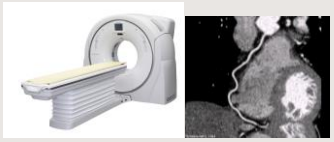
Cardiology Tasmania

Contents

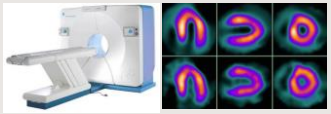
Available Cardiac Imaging Modalities

Cardiac MRI



Cardiac CT

Echocardiography



Others – PET / sestamibi

Cardiac imaging **decision making paradigm**

- What is the clinical question
- Which is the best modality to answer the question
- Is the patient suitable for the test
- What are the risks

	Echo	MRI	CT	Catheter Angio
Spatial resolution	0.5-2 mm	1 mm	0.5-0.6 mm	0.2 mm
Temporal resolution	<5-20 ms	20-50 ms	83-135 ms	1-10 ms
Contrast resolution	Low to moderate	High	Moderate	Moderate
Radiation	Nil	Nil	1-3 mSv *	8-10 mSv
Cost	$	$$$	$$	$$
Utility	Structure and function Valvular function	Tissue characterisation Structure and function	Anatomy (intra and extra-luminal pathology)	Anatomy (lumen-o-gram)

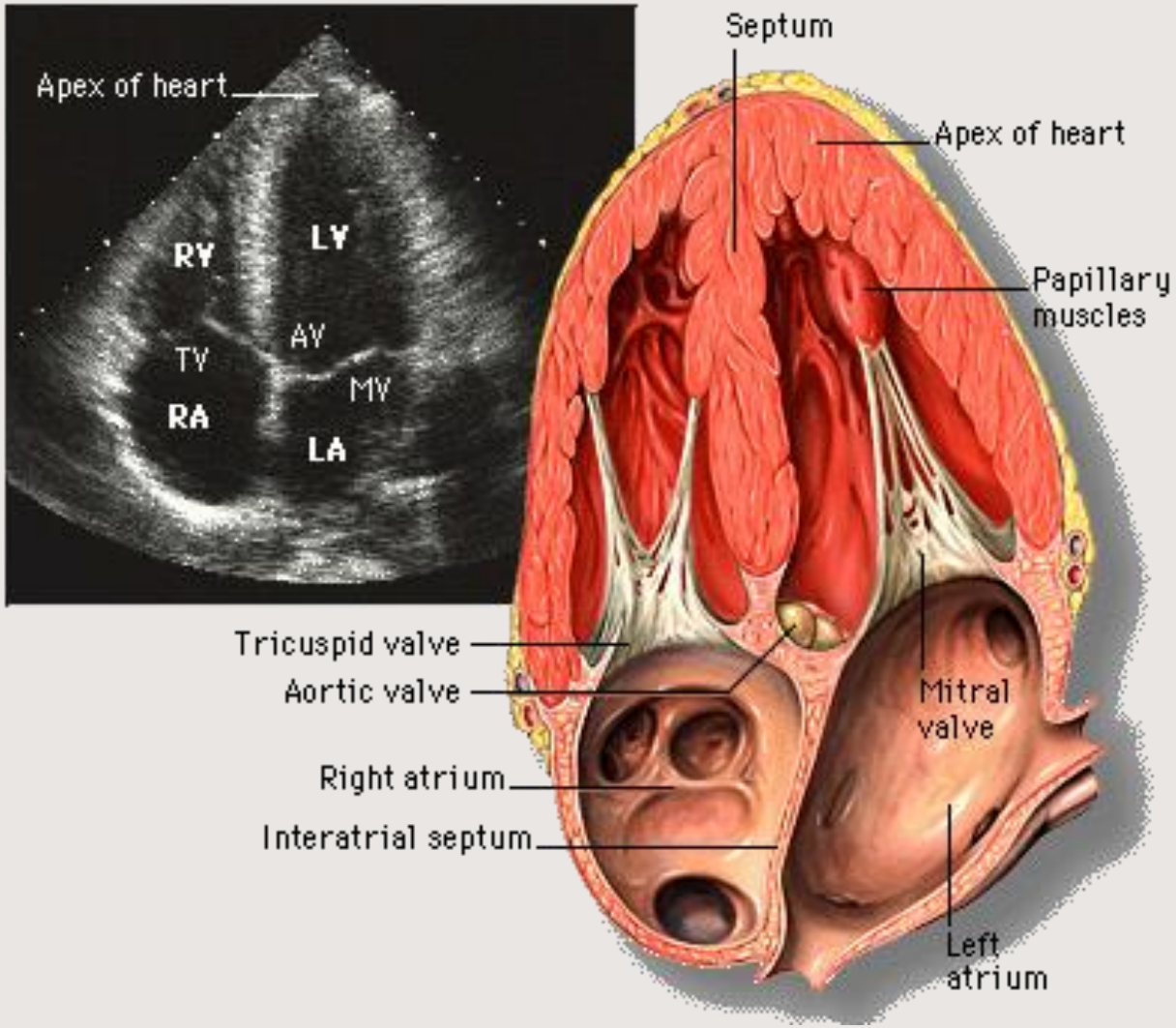
* Overall radiation dose depends on patient body habitus and heart rate

Natural background radiation dose in Australia = 2.4 mSv / year

Contents

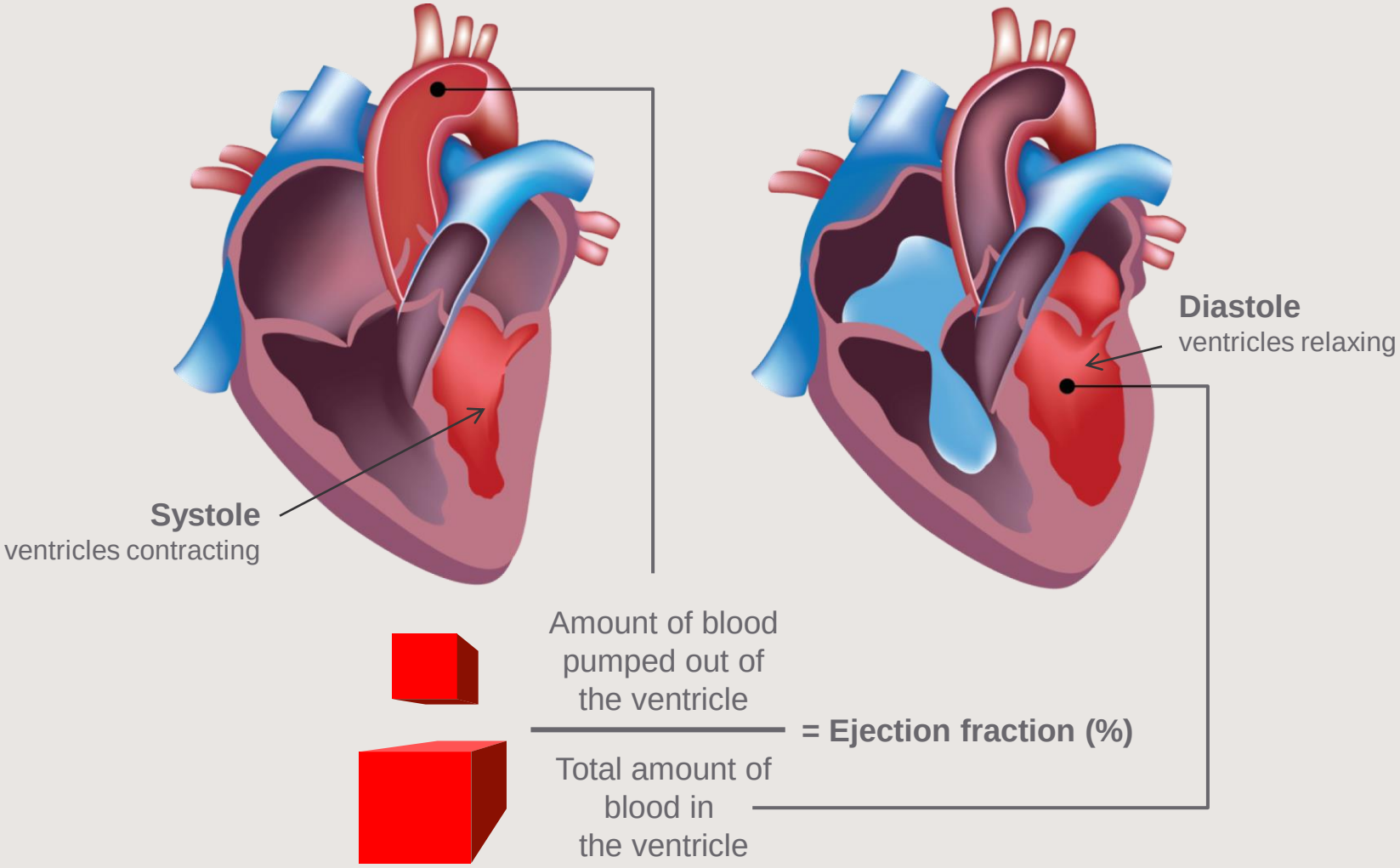
Role of Echo - Indications

- Quantification of ventricular and atrial size
- Measurement of left and right ventricular systolic function
- Detection of regional wall motion abnormalities (which may indicate underlying ischaemic heart disease)
- Assessment of wall thickness i.e. left ventricular hypertrophy or infiltration
- Detection of features of diastolic dysfunction including estimation of left atrial pressure
- Estimation of pulmonary artery systolic pressure
- Assessment of the aetiology of a murmur
- Assessment of valvular lesions (including their mechanism and severity)
- Detection and quantification of intra-cardiac shunts


Apex of heart
RV
LV
AV
TV
MV
RA
LA
Septum
Apex of heart
Papillary muscles
Tricuspid valve
Aortic valve
Mitral valve
Right atrium
Interatrial septum
Left atrium


Octave
Freq.: 1.7 MHz/3.3 MHz
Proc.: -2.0/54.0/0.0/2.1/2.3
Power: 0 dB
FPS: 48.2/
Depth: 13.0 cm
5
10
74
HR

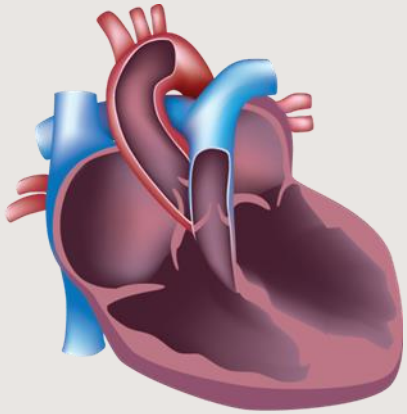
Left ventricular ejection fraction



McMurray et al. Eur Heart J 2012;33:1787–847; Dickstein et al. Eur Heart J 2008;29:2388–442

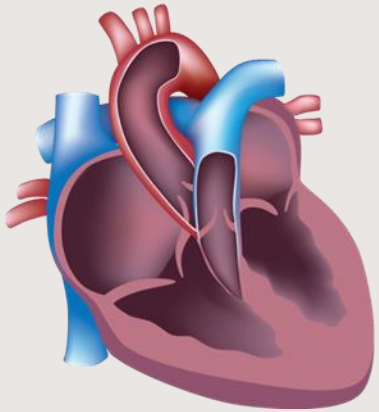
What is a normal LVEF?

Systolic dysfunction



HFrEF
EF<50%

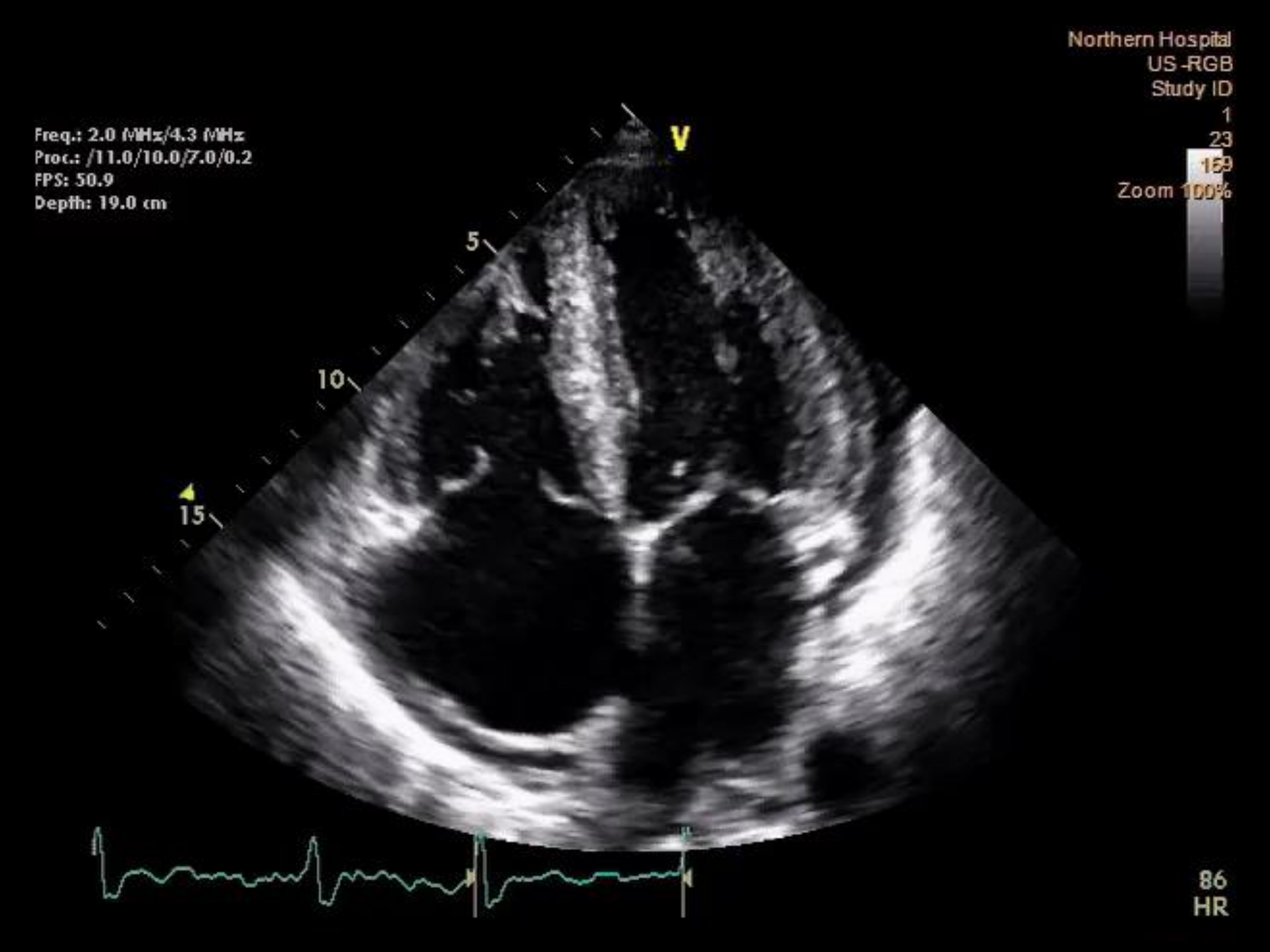
More than just “Diastolic dysfunction”



HFpEF
EF>50%

Echocardiography is a useful method for evaluating left ventricular ejection fraction

HFpEF: heart failure with preserved ejection fraction
McMurray et al. Eur Heart J 2012;33:1787–847; Dickstein et al. Eur Heart J 2008;29:2388–442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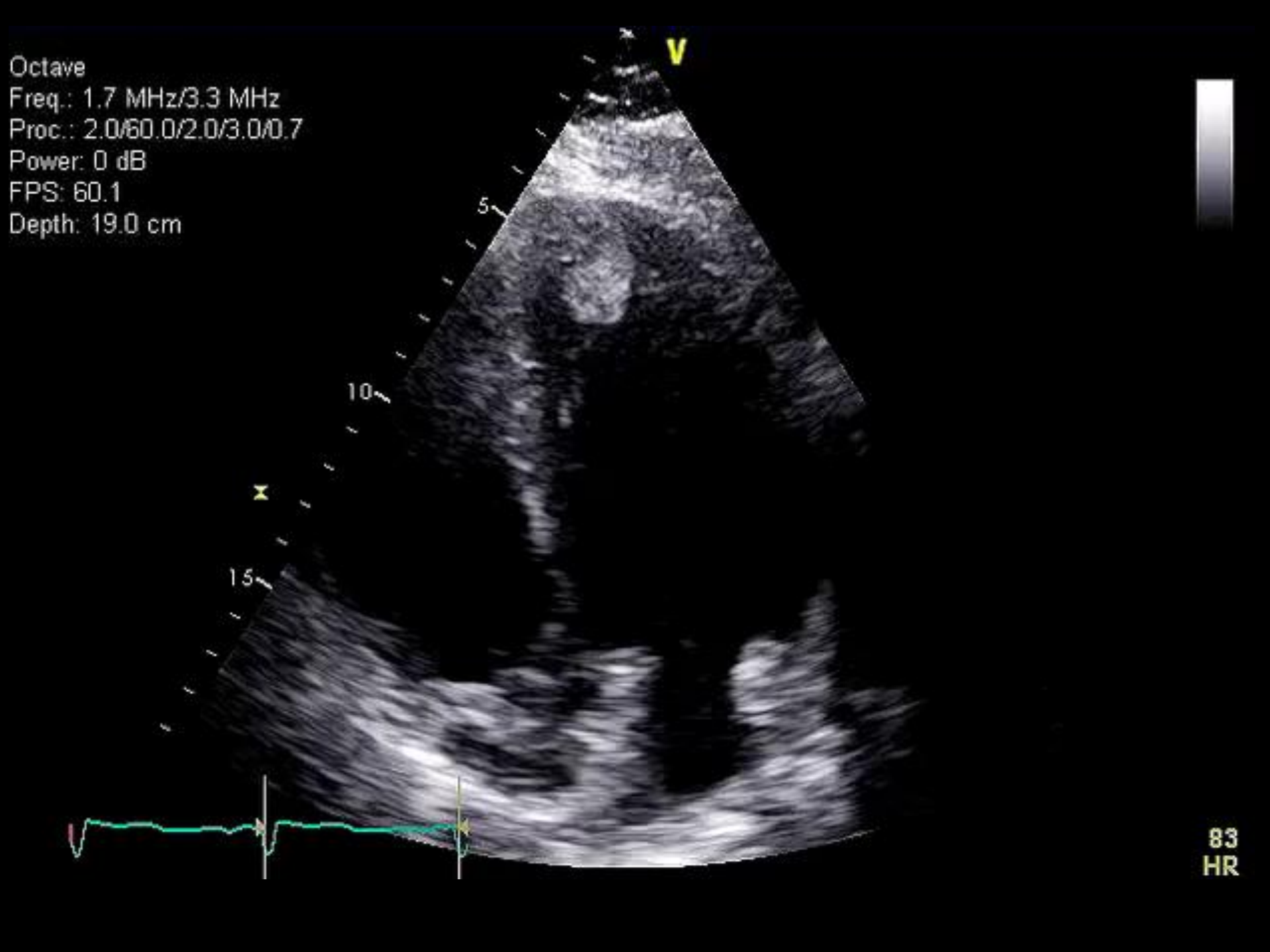
Proc.: /11.0/10.0/7.0/0.2
FPS: 50.9
Depth: 19.0 cm
Northern Hospital
US-RGB
Study ID
1
23
169
Zoom 100%
V
5
10
15
86
HR


Octave
Freq.: 1.7 MHz/3.3 MHz
Proc.: 10.0/60.0/2.0/3.0/0.7
Power: 0 dB
FPS: 43.7
Depth: 20.0 cm
V
10
0
61
HR


Octave
Freq.: 1.7 MHz/3.3 MHz
Proc.: 2.0/60.0/2.0/3.0/0.7
Power: 0 dB
FPS: 60.1
Depth: 19.0 cm
5
10
15
83
HR

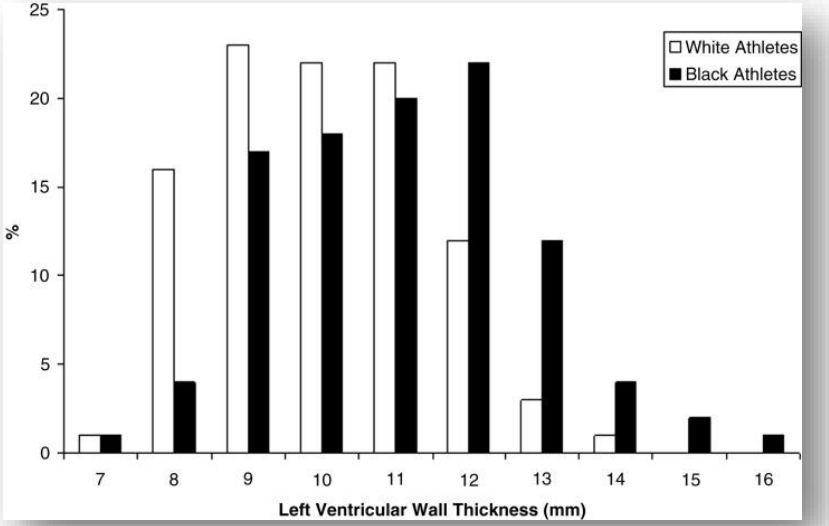
Limitations of LV ejection fraction

- Poor image quality may prevent accurate measurement
- Visual estimate is unreliable (~10% inter-observer variability)
- Does not assess regional wall motion abnormalities
- Does not reflect absolute stroke volume

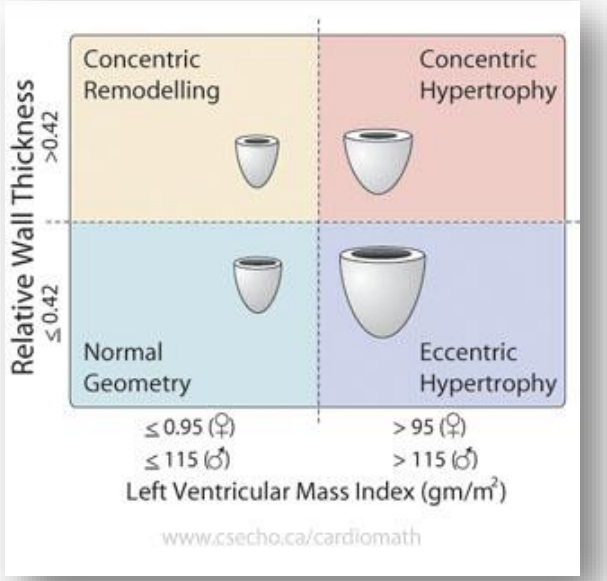
Normal ejection fraction
DOES NOT EQUAL
normal systolic function

Reporting - LV Size and thickness

- **Cavity size**
  - LV end-diastolic and **end-systolic** diameters
  - LV end-diastolic volume
  - **Important for putting the ejection fraction in perspective**

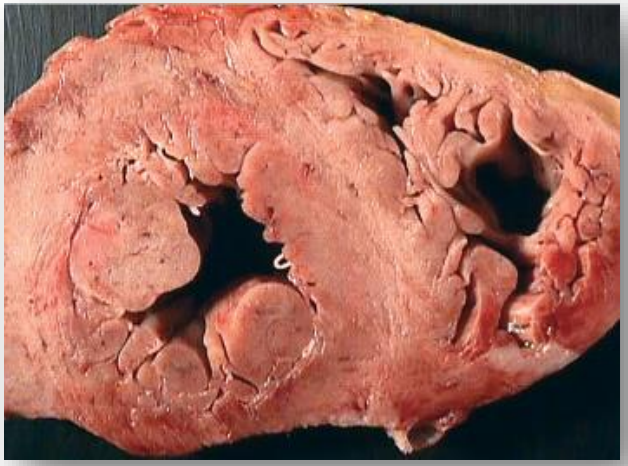


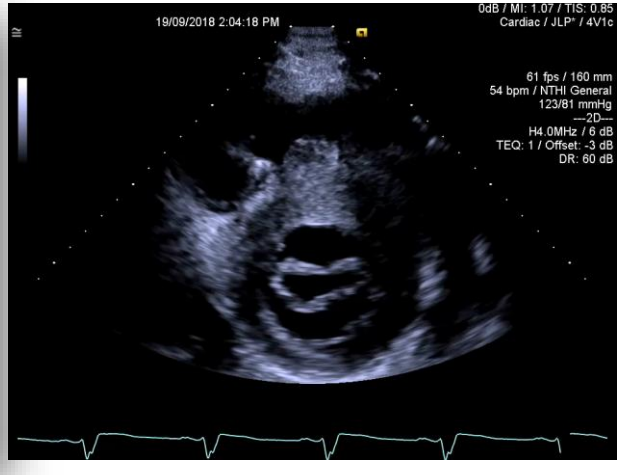
- **Wall thickness** and papillary muscles
  - Asymmetric vs concentric
  - Ratio of wall thickening to LV cavity size
  - Mechanism of thickening

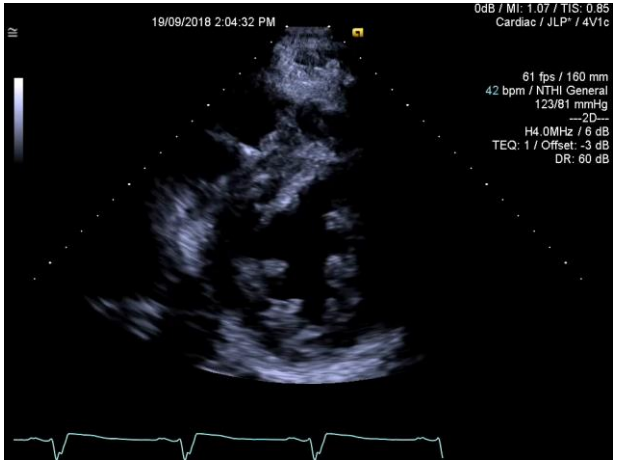


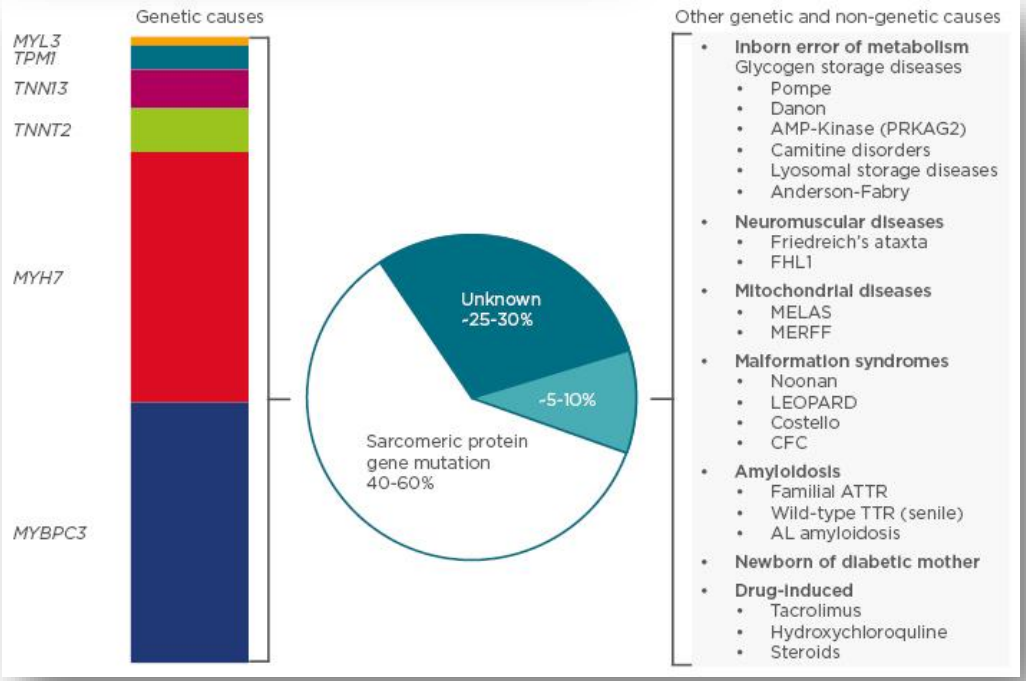
Cellular expansion (physiological vs pathological)
Extracellular expansion

Why do we care about wall thickening?







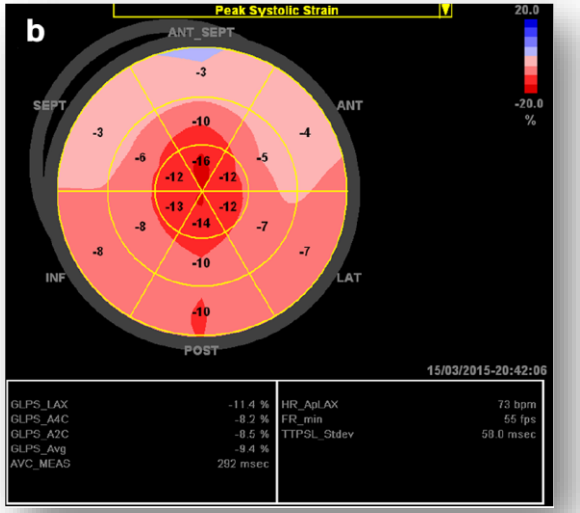


Genetic Hypertrophic Cardiomyopathy

- Most common heritable cardiomyopathy
  - Affects ~1/500 (possibly an underestimate)
- >1000 genetic mutations in >14 genes
- Diagnosis can be challenging due to phenotypic heterogeneity

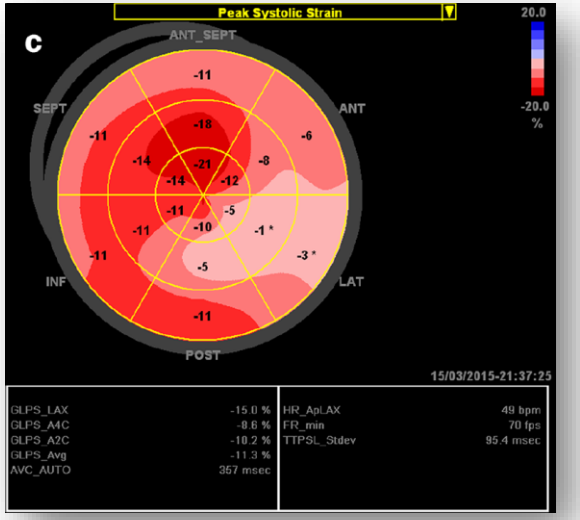
Elliott. Eur Heart J. 2014; 35(39): 2733-79

Pattern of Global Longitudinal Strain



Cardiac amyloidosis

- Multiple types: most common are wild-type TTR (senile) or light-chain (AL) amyloid
- Conventional echocardiographic features include:
  - Concentric left and right ventricular thickening
  - Dilated atria, often with thickening of the interatrial septum and atrial roof
  - Pericardial effusion
- Pattern:
  - Relative apical sparing “Bull’s-eye”



Fabry’s disease

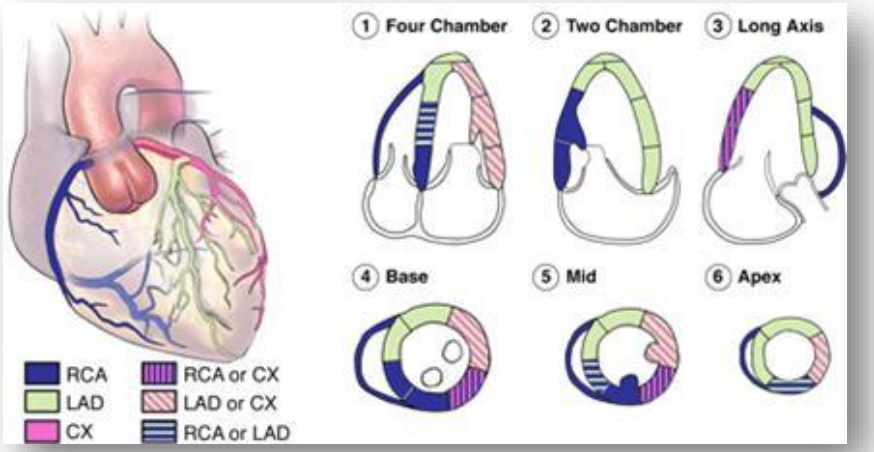
- Inherited X-linked disease with deficiency in alpha galactosidase A
- Abnormal glycolipid storage in the myocardium
  - Progressive LVH and systolic dysfunction
  - Advanced stages = replacement fibrosis
- Pattern:
  - Marked regional reduction in strain in the basal to mid infero-lateral and antero-lateral segments

Reporting - LV Function

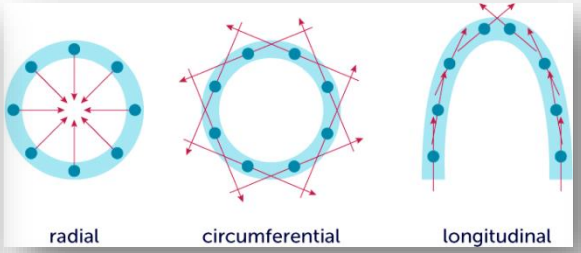
- **Systolic function**
  - Many different methods to quantify:
    - **Ejection fraction**
    - Fractional shortening
    - **Average global longitudinal peak systolic strain (GLPSS)**
    - Others (mitral annular velocities, MR dP/dT, estimated cardiac output)

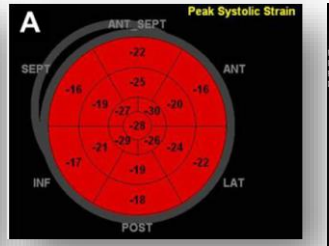
3 planes of myocardial motion:
- Circumferential
- Longitudinal
- Radial

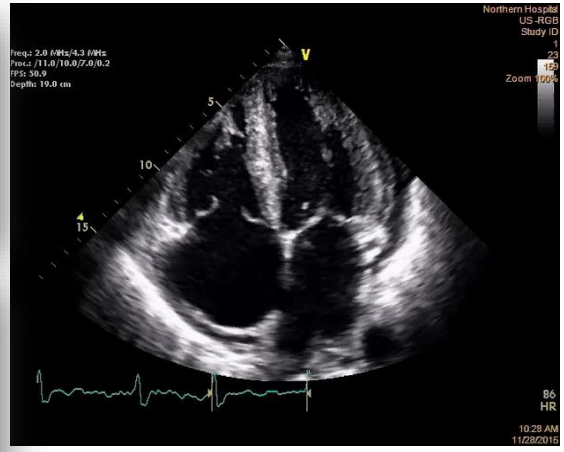
- **Wall motion**
  - Ischaemic
  - Non-ischaemic i.e. bundle-branch block

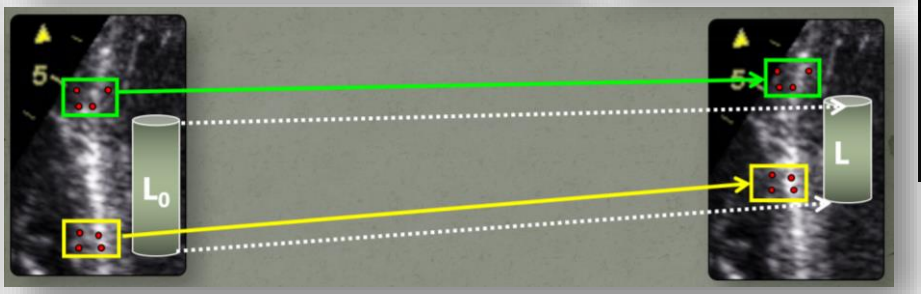


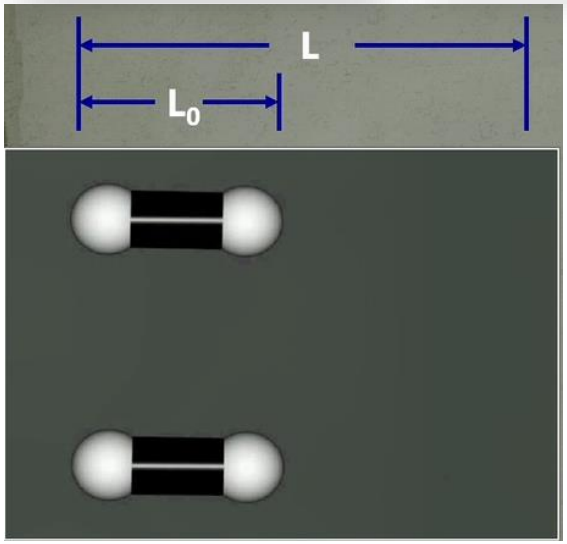
Global Longitudinal Strain











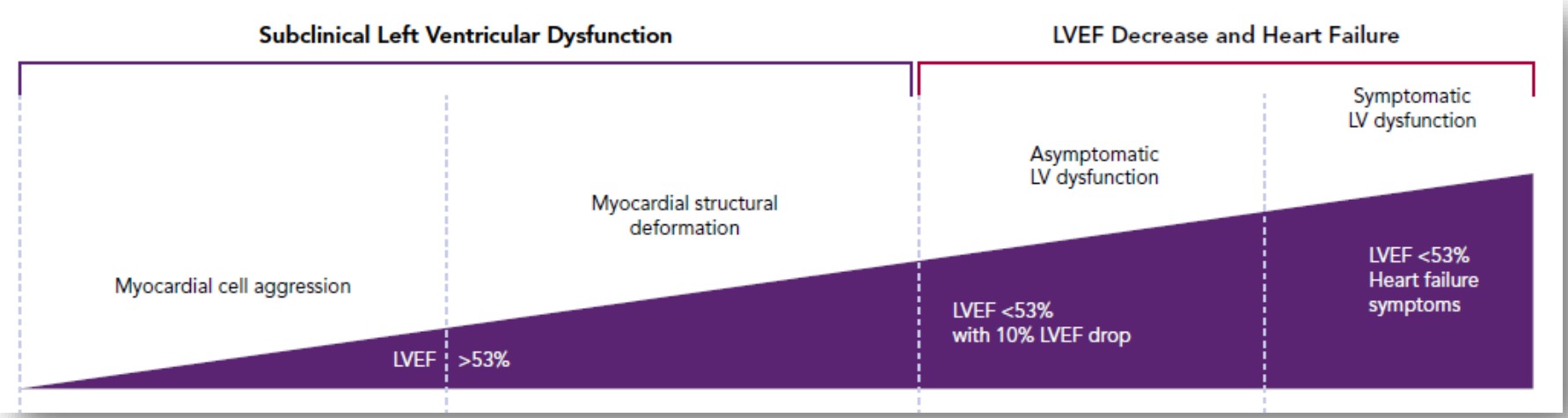
Fractional change in length of a myocardial segment relative to its baseline length (deformation)

- $\varepsilon = \Delta L / L_0$ (expressed as a percentage)

L_0 = 1 cm, L = 2 cm
Strain = (2-1) / 1 = 1 = **100%**

L_0 = 1 cm, L = 1 cm
Strain = (1-1) / 1 = 0 = **0%**

Utility of Global Longitudinal Strain

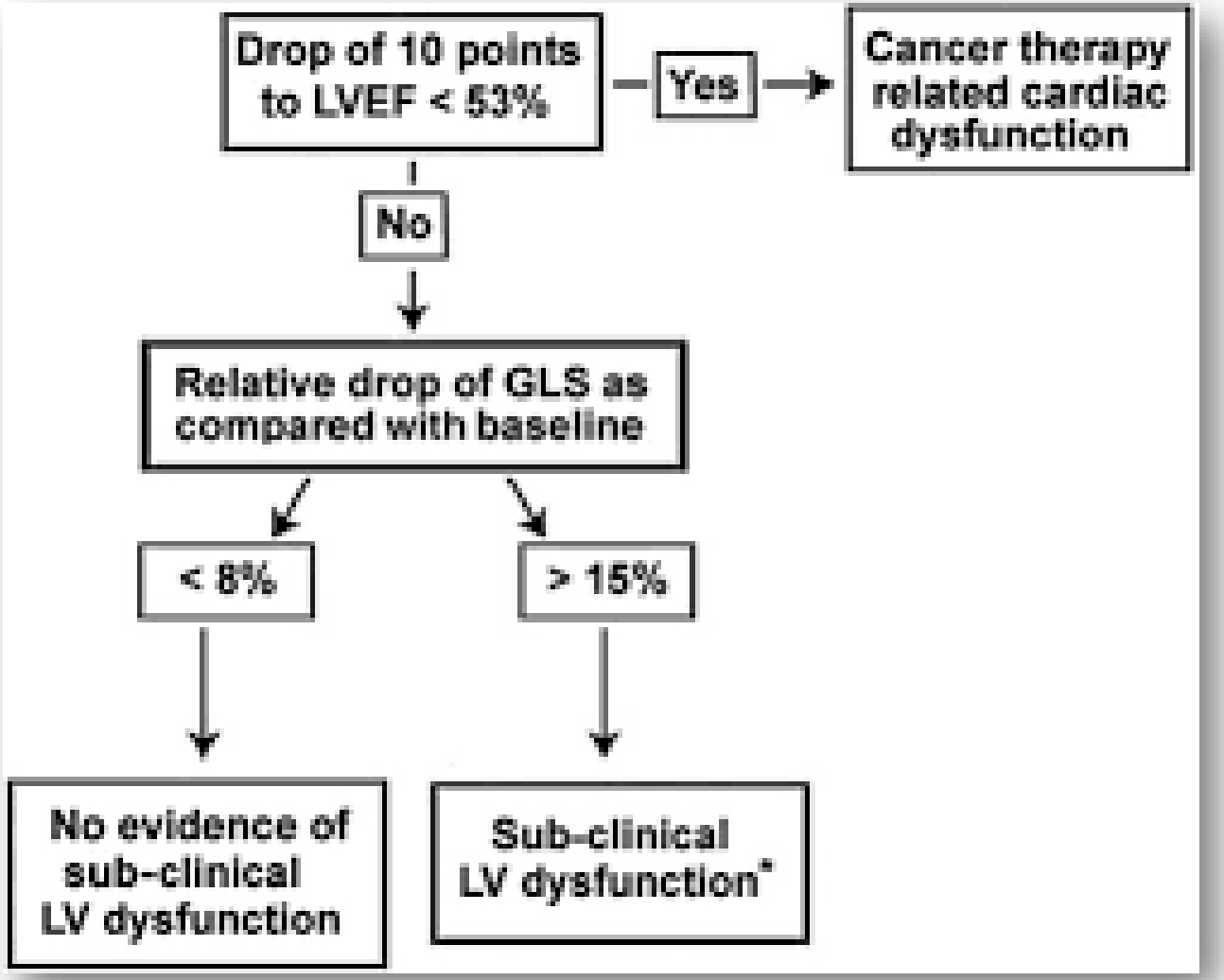


GLS is superior to LVEF in predicting clinical outcomes in many cardiac conditions

GLS is more sensitive than LVEF to detect myocardial dysfunction

GLS can provide clues as to the underlying aetiology

Global Longitudinal Strain in Chemotherapy



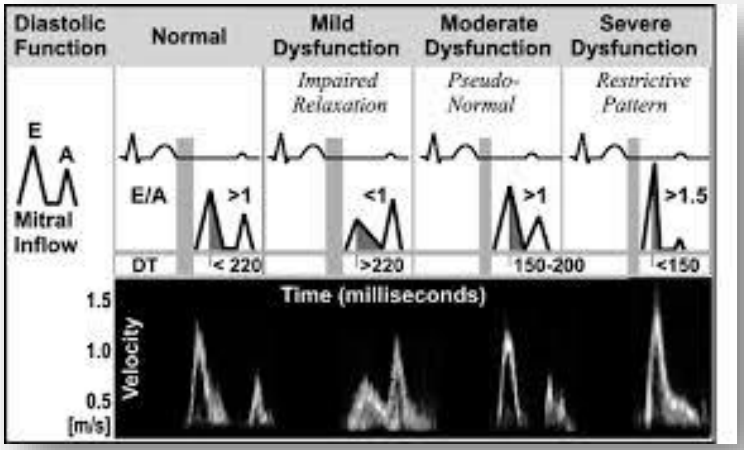
Example

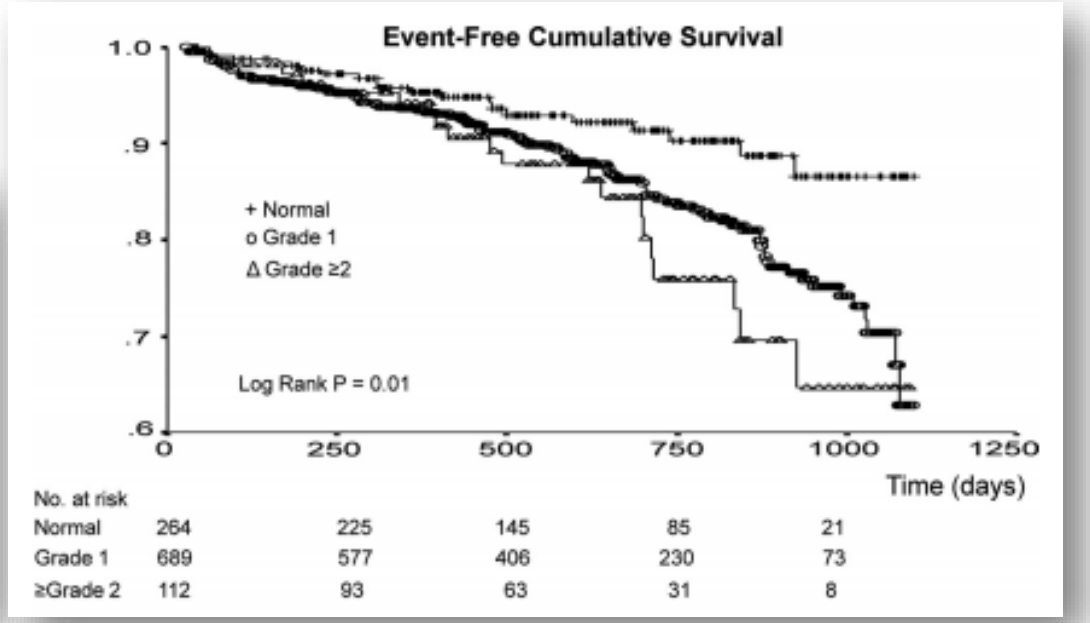
Baseline
GPLSS = 22%

3 month Follow-up
GLPSS = 17%

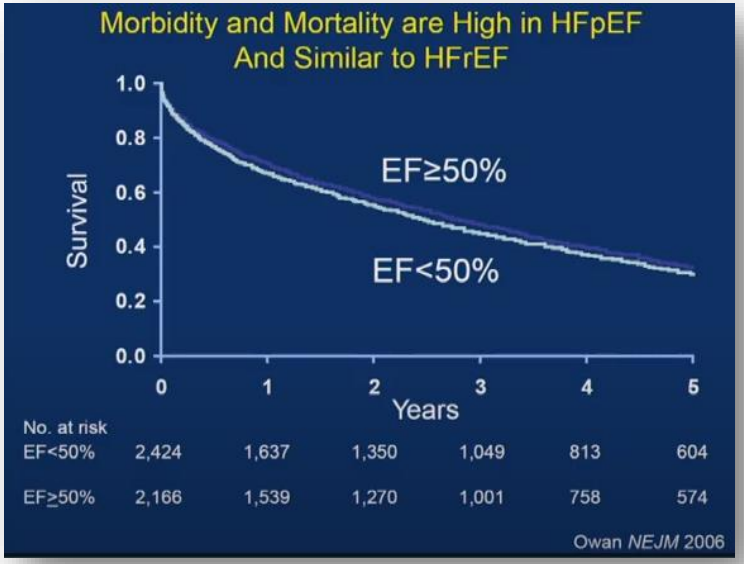
>20% decrease

Diastolic Function

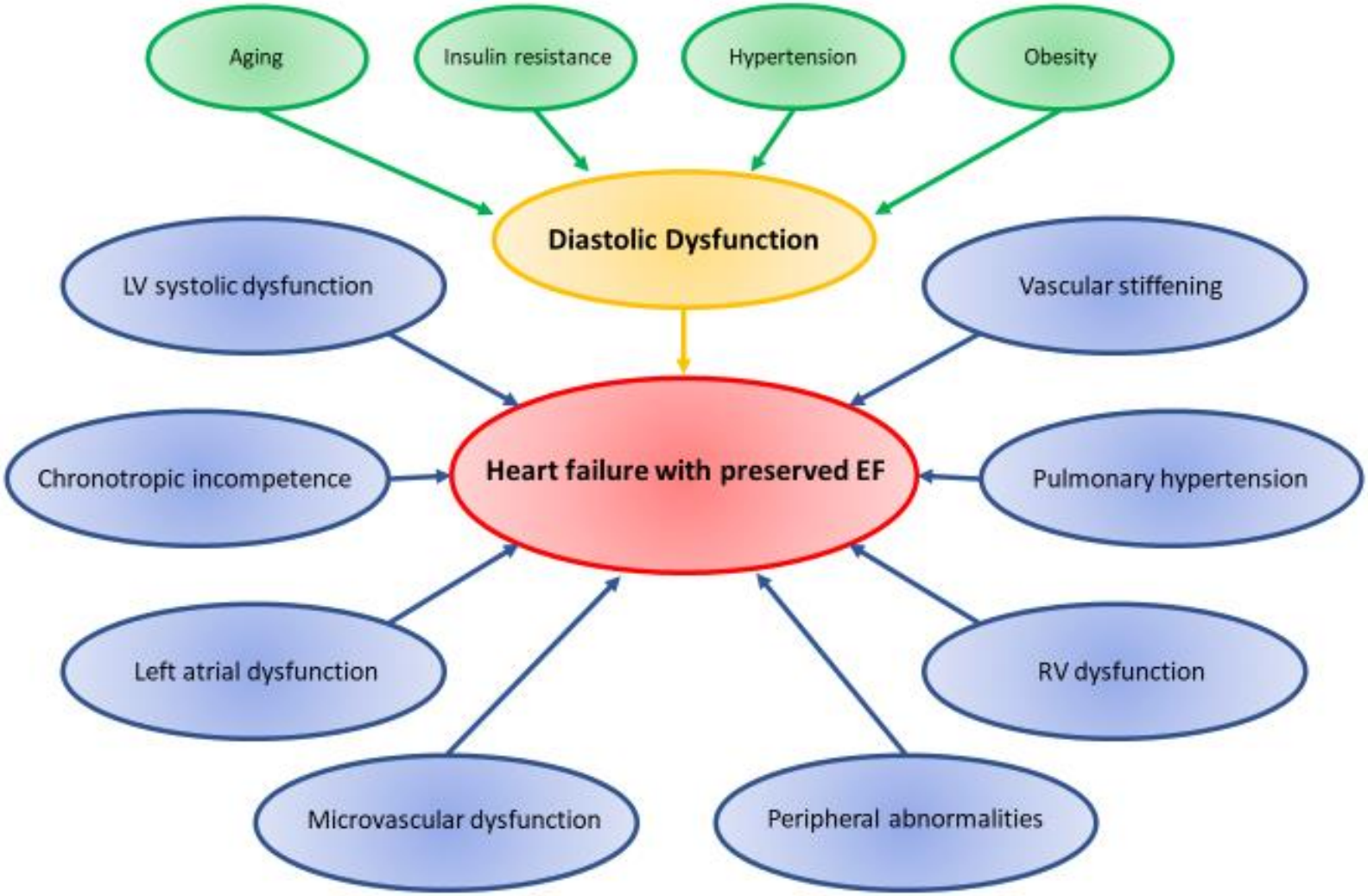




- Normal
- **1** - Impaired Relaxation
  - LV loses diastolic 'suck'
- **2** – Pseudonormal
  - ↑ LV stiffness leads to a compensatory increase in LA filling pressure
- **3** – Restrictive
  - Further increase in LA filling pressure, **"fixed stroke volume"**
- **4** - Irreversible Restrictive



In patients with baseline normal LVEF, worsening diastolic function is an independent predictor of mortality


Aging
Insulin resistance
Hypertension
Obesity
Diastolic Dysfunction
LV systolic dysfunction
Vascular stiffening
Chronotropic incompetence
Heart failure with preserved EF
Pulmonary hypertension
Left atrial dysfunction
RV dysfunction
Microvascular dysfunction
Peripheral abnormalities

Utility of Echo for heart failure in the setting of a normal LVEF?

- **Wall thickness**
  - Clue to underlying pathology
    - Wall thickness >15 mm is almost never due to HTN
    - Consider infiltrative / inflammatory causes

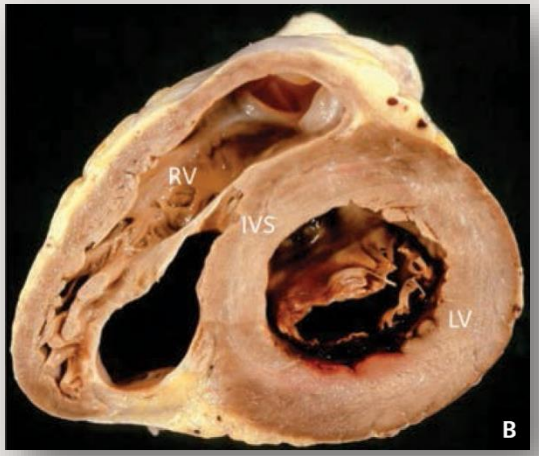
- **Sub-clinical systolic dysfunction**
  - Strain imaging or age-appropriate Doppler tissue velocities

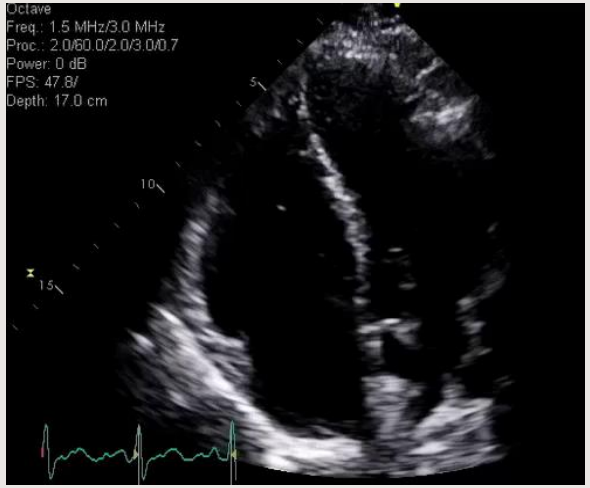
- **Assess diastolic function**
  - Severity of diastolic function can be graded, but most important is the LA filling pressure
    - **E/e' >13** is generally regarded as abnormal (age-dependent thresholds – not in routine clinical practice)

- **Atrial size**
  - Chronicity of elevated LA filling pressure (not reliable in chronic AF)
  - Risk of atrial arrhythmias

Importance of the right ventricle

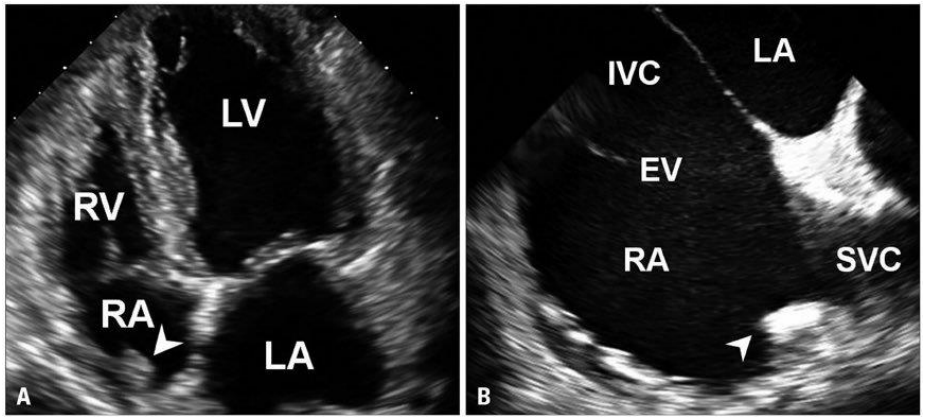
- Can get isolated right heart failure:
  - Pulmonary hypertension
  - Primary right ventricular cardiomyopathies or RV infarction
- Clues to underlying pathology of left-sided dysfunction
- Prognosis





Your heart can only pump as well as its worst chamber

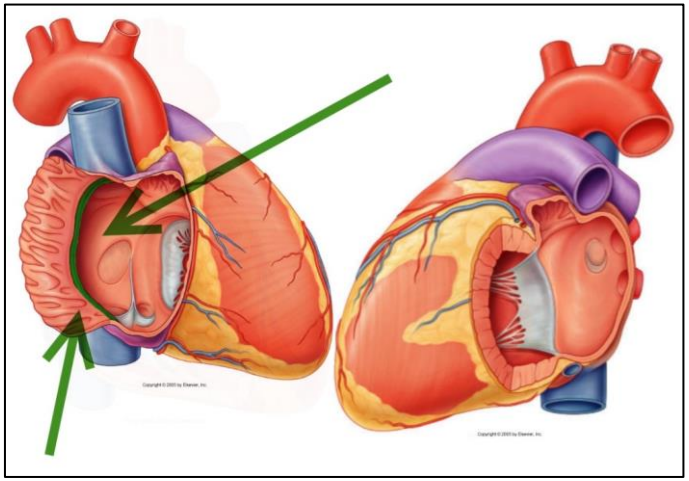
Reporting - Atria



- **Left atrium**
  - LA area (normal < 20 cm^2)
  - LA volume (normal < 34 mL/m^2)

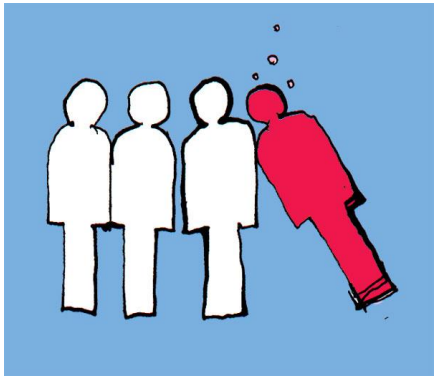
- **Right atrium**
  - RA area (normal < 18 cm^2)
  - Anatomical variants

Eustachian
Valve
Chiari network
Crista terminalis



- **Inter-atrial septum**
  - Atrial level shunt or PFO
  - Lipomatous infiltration

Bubble Study



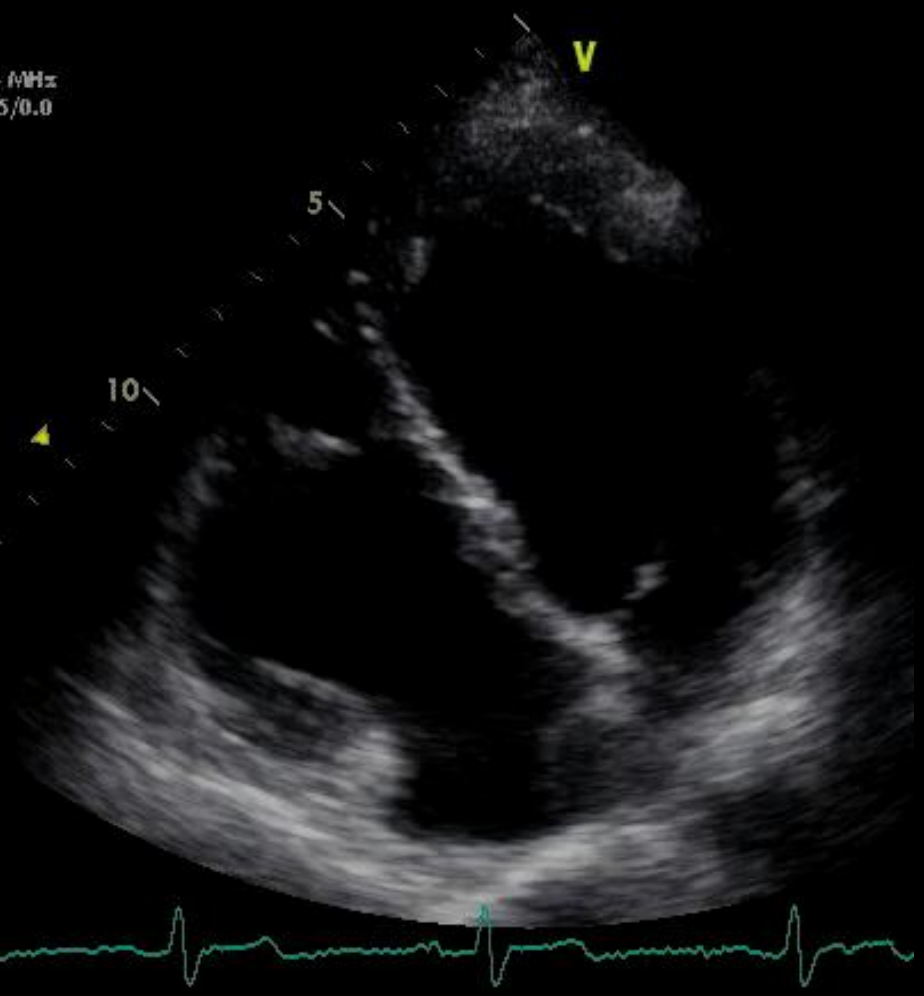
- Assessment of an interatrial communication (PFO / ASD)

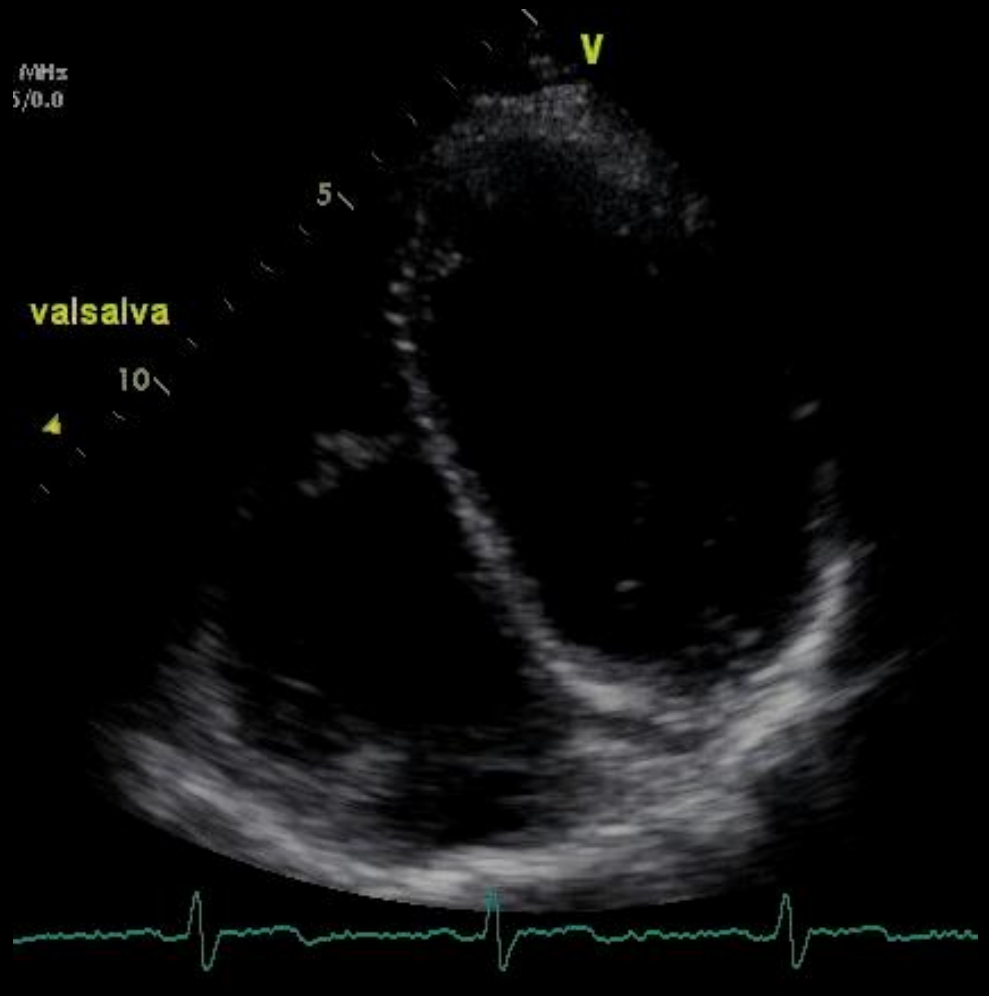
- During foetal life lungs do not receive blood flow
- Oxygenated blood (placental) returning to RA shunted to LA via foramen ovale

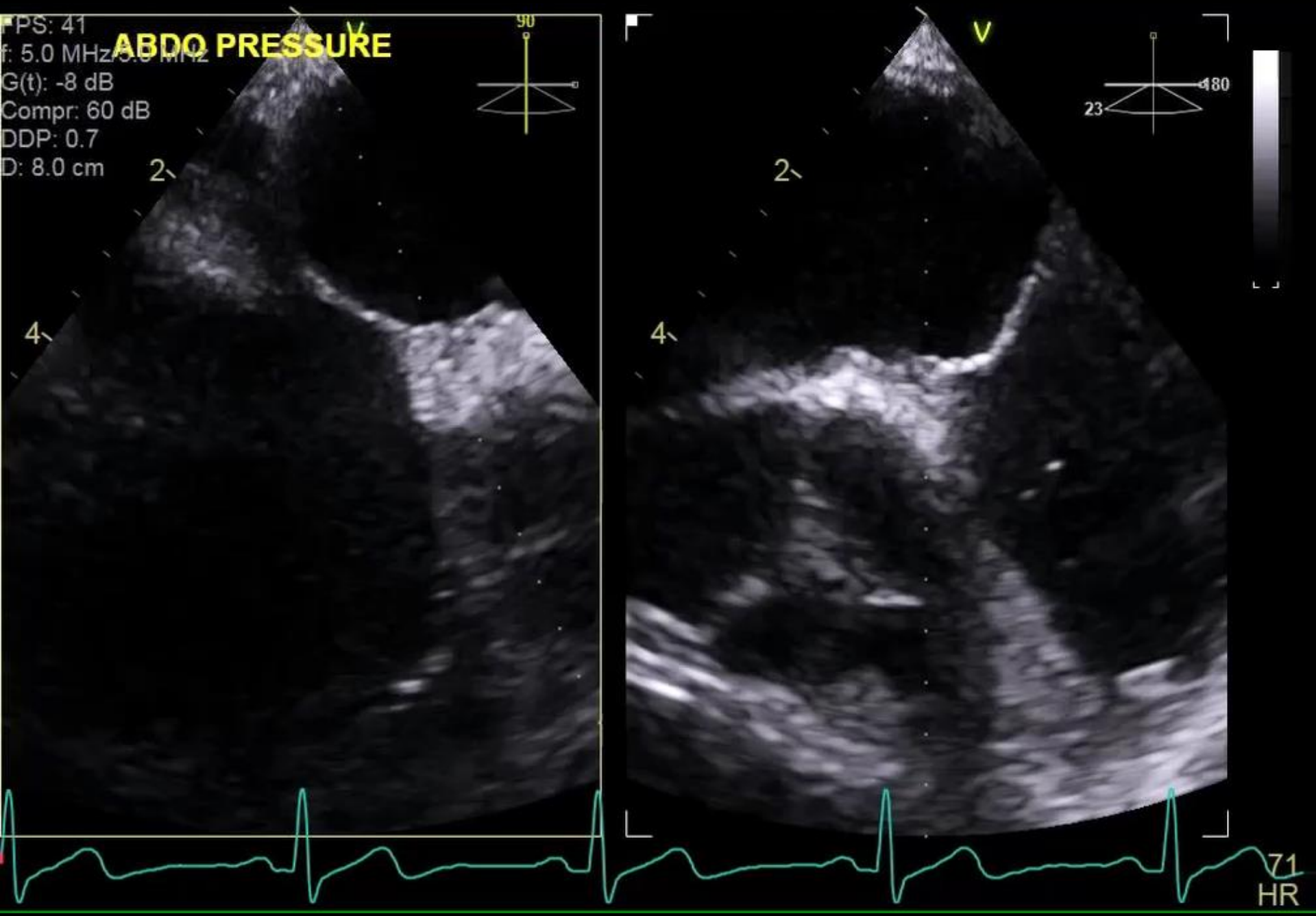
- **PFO present in 25% of the population**
- Usually haemodynamically insignificant

- Size of PFO (number of bubbles crossing the IAS – look for >25 in a single frame)
- Atrial septal aneurysm (extremely hypermobile septum ~15 mm total phasic excursion)
- Prominent Eustachian valve (directs blood to fossa ovalis) and Chiari network
- Haemodynamic alterations (increase RA pressure)

PFO – Importance of provocation



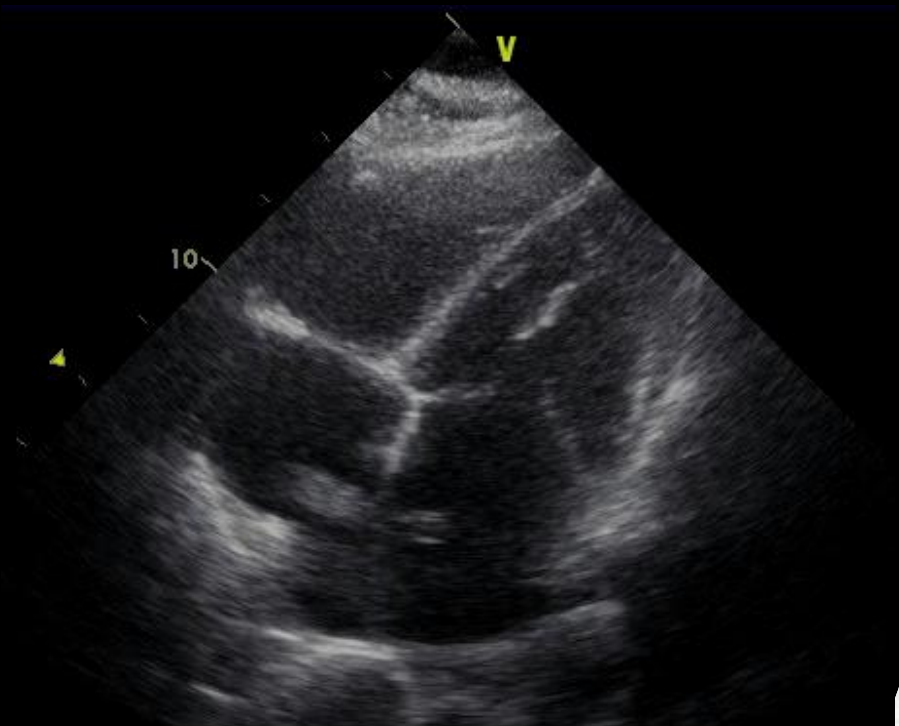


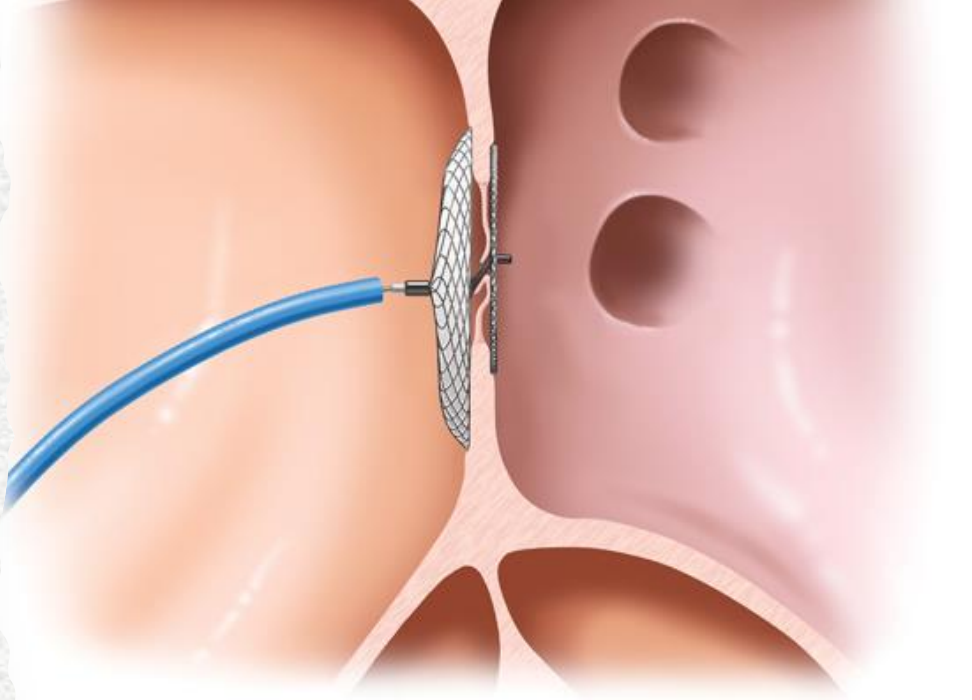

FPS: 41
f: 5.0 MHz/5.0 MHz
G(t): -8 dB
Compr: 60 dB
DDP: 0.7
D: 8.0 cm
ABDO PRESSURE
90
180
23
71
HR

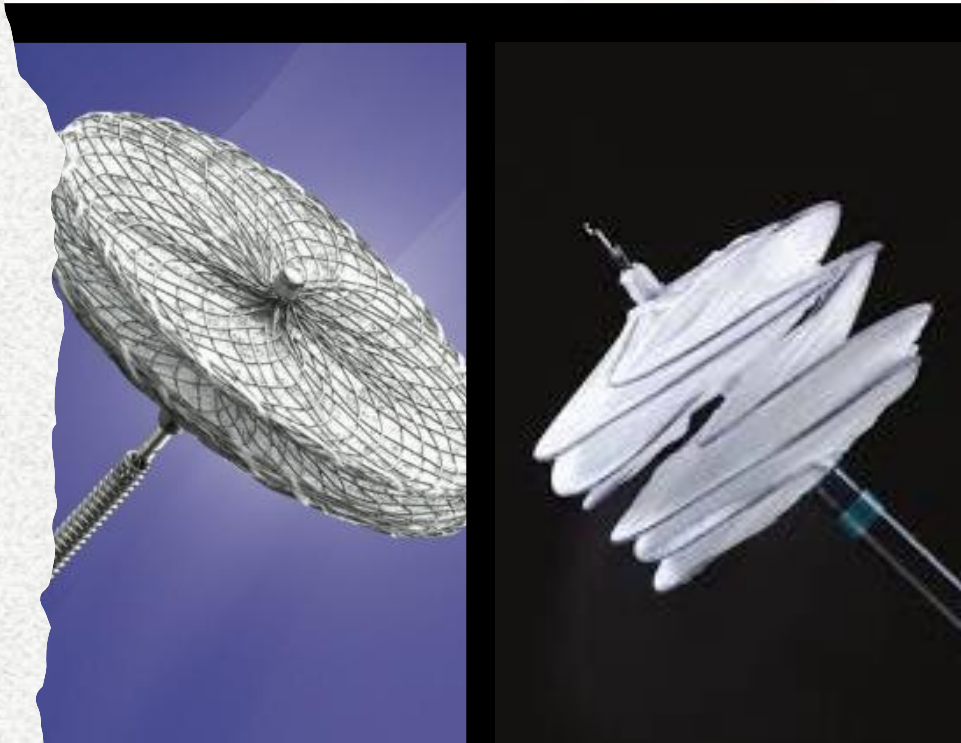
PFO Occlusion Devices

Indications:

- Cryptogenic Stroke
- Paradoxical embolization
- Neurological decompression syndromes
- Refractory migraines with aura



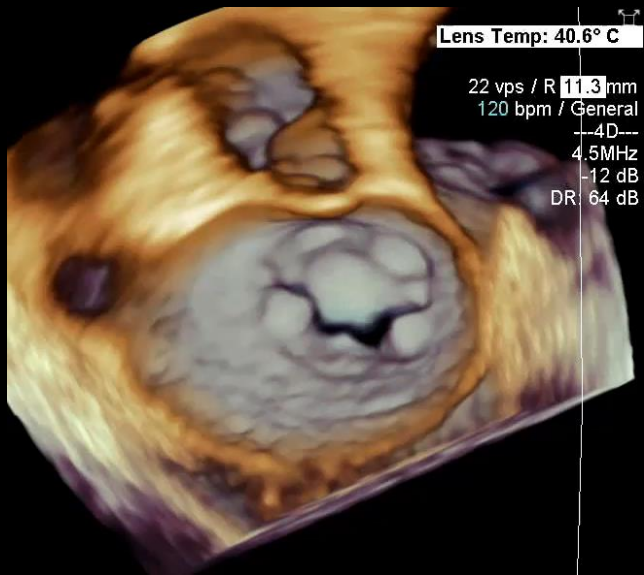




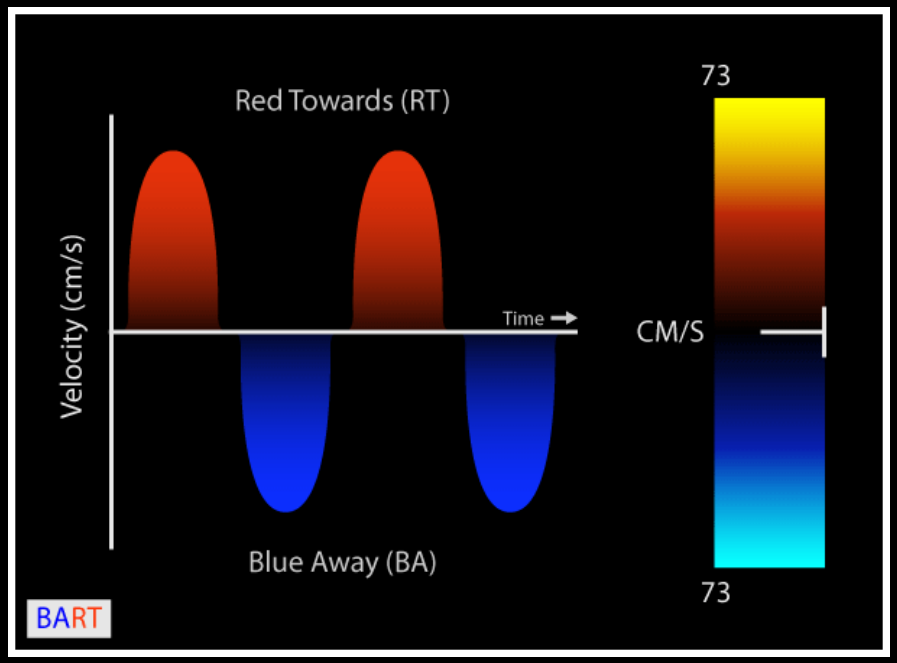
Reporting - Valves

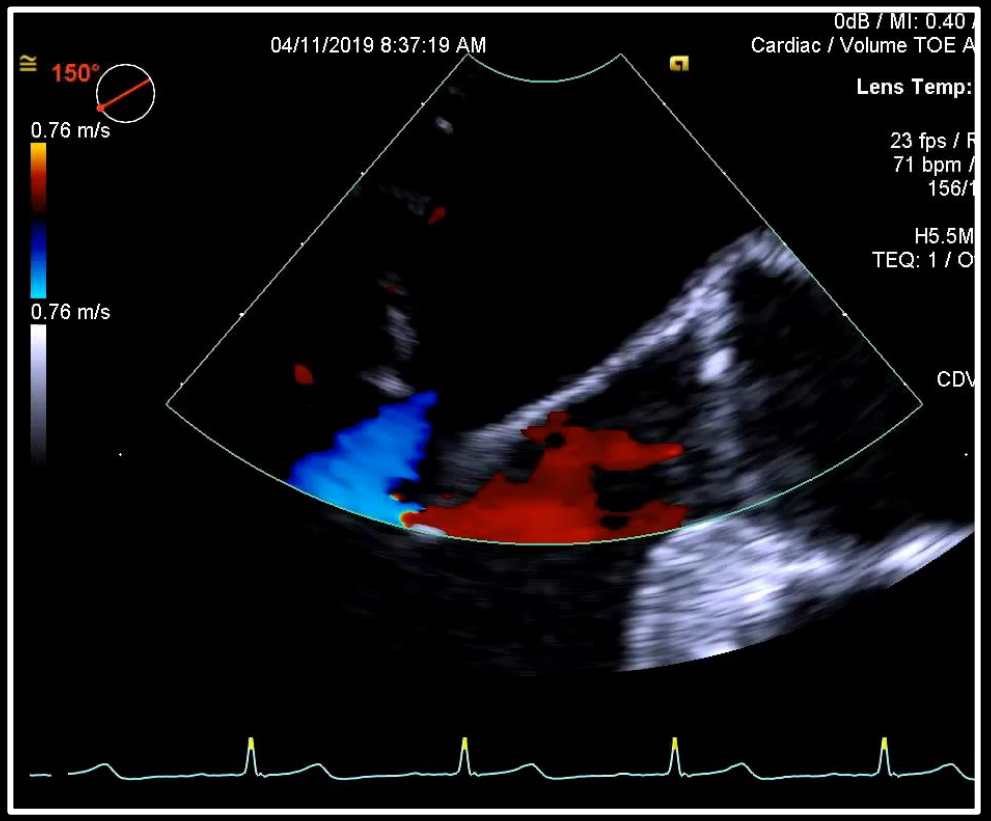
- Assess the valvular structure
  - Leaflet thickness
  - Presence of calcification, rheumatic changes, prolapse, flail

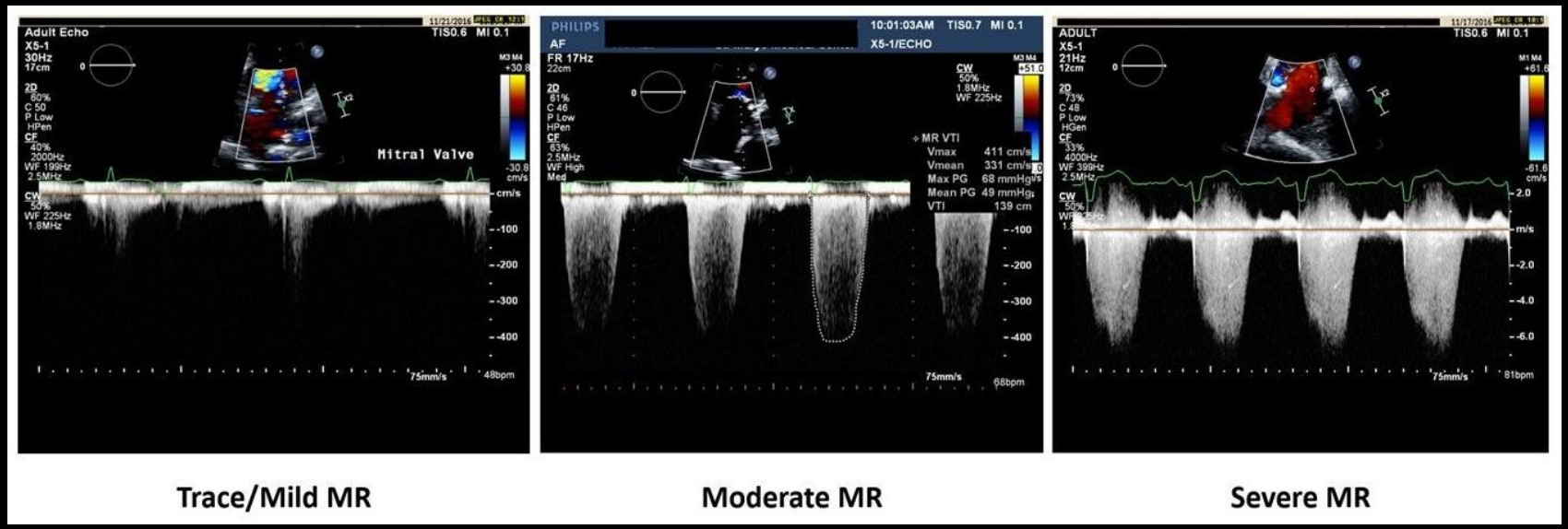
- Assess the valvular function
  - Stenosis – mean gradient, valve area, dimensionless performance index
  - Regurgitation – regurgitant orifice area, volume, distal flow reversal



Colour Doppler – Visualise jet and direction of flow
Spectral Doppler – Quantify jet (velocity over time)

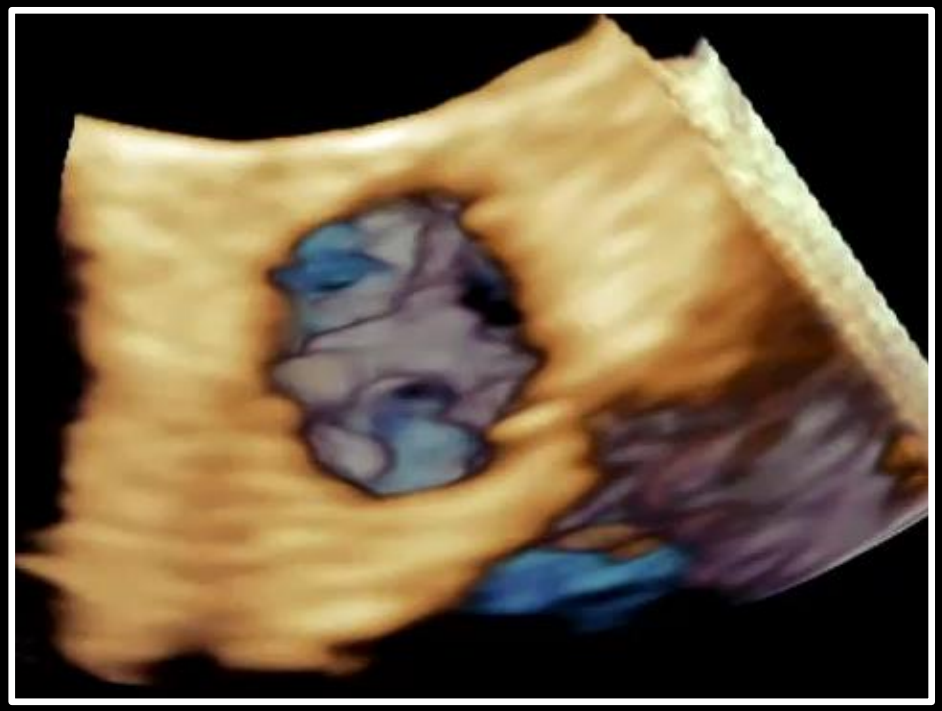




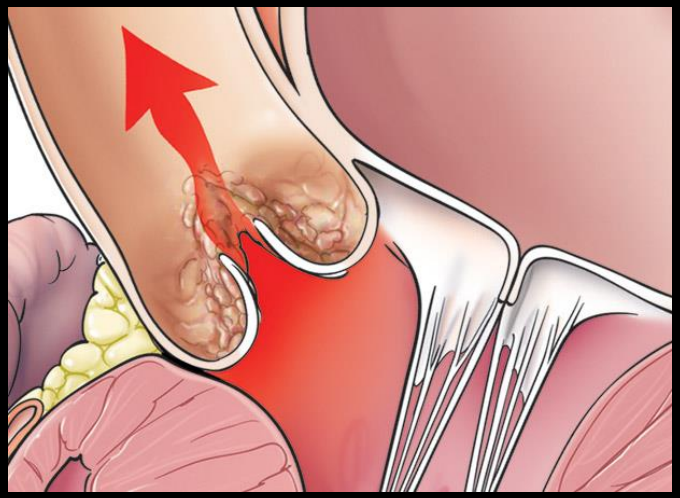


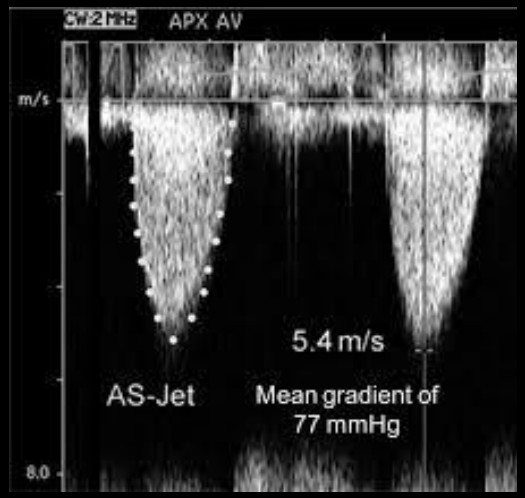
Aortic stenosis

- ~2% of population > 65 years
- Calcific aortic stenosis
  - Disease process similar to atherosclerosis
  - Occur in tricuspid or bicuspid
- Rheumatic aortic stenosis
  - Repeated bouts of inflammation with subsequent fibrosis
- Congenital



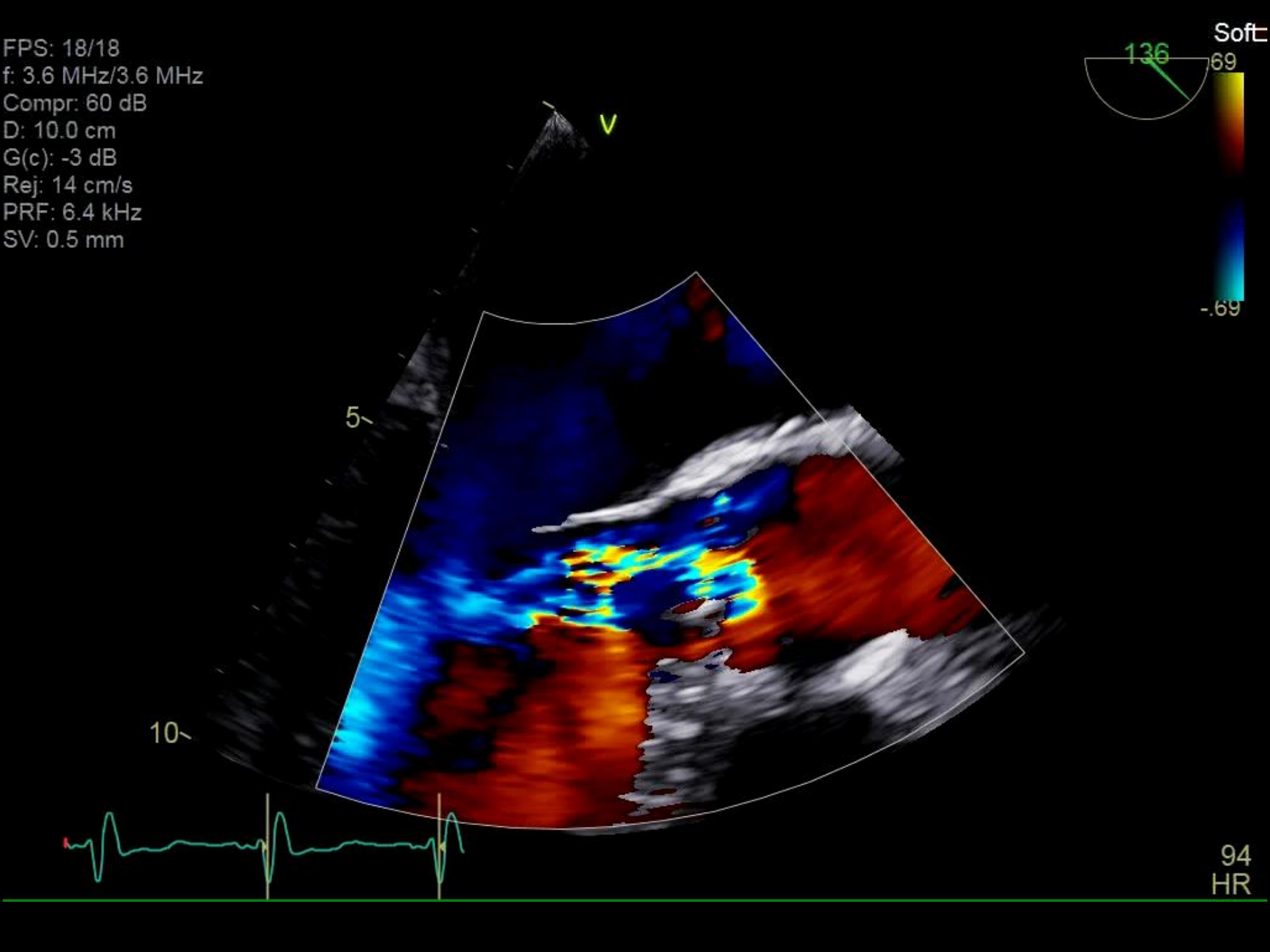
- Symptoms important in determining prognosis
- Severity based on **haemodynamic assessment** (echo / cath)
- Aortic valve area decreases ~0.1 cm^2 / year

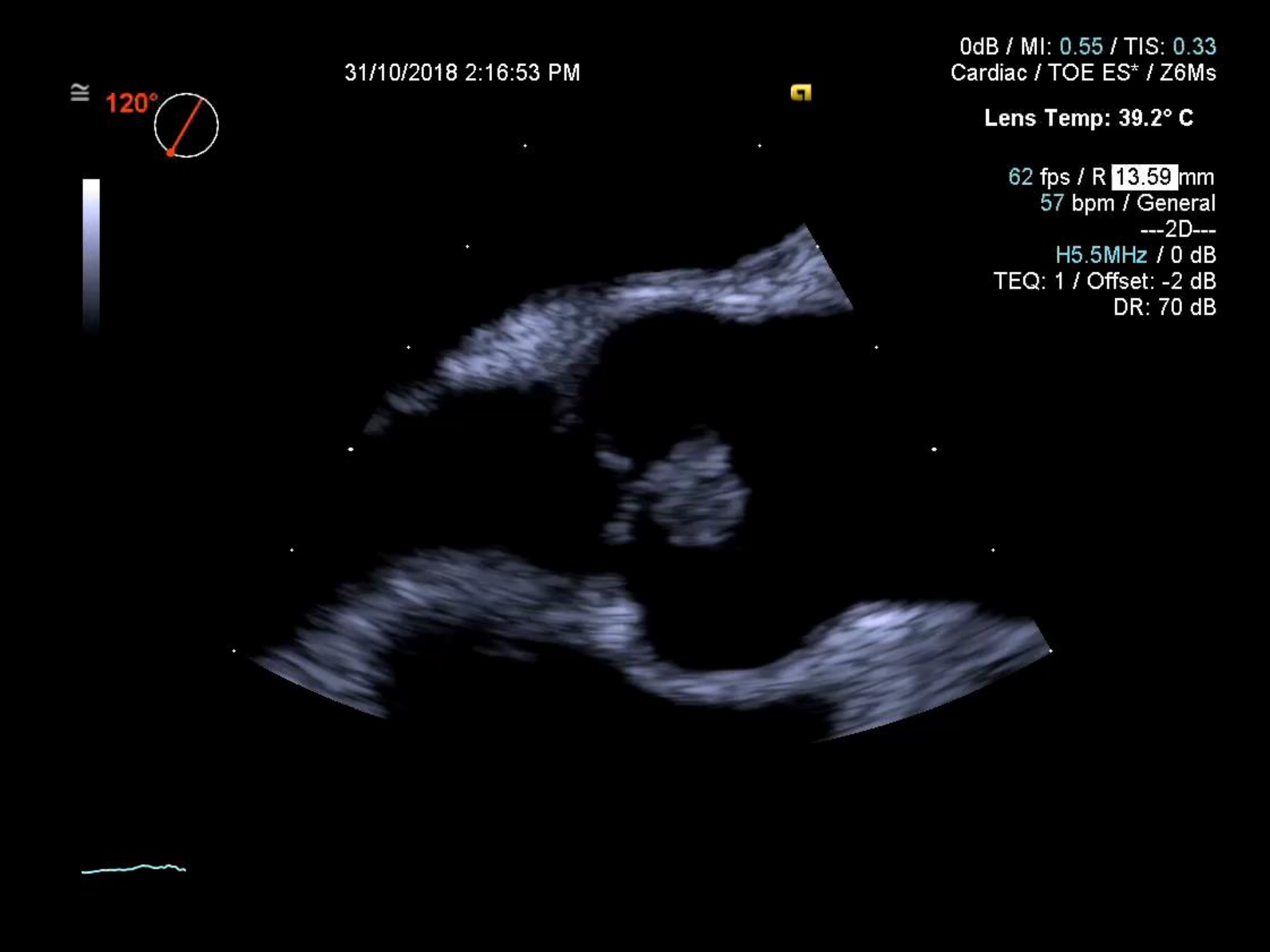




	Mild	Moderate	Severe
Peak velocity (m/s)	2–2.9	3–4	>4
Mean gradient (mmHg)	<20	20–40	>40
Valve area (cm^2)	>1.5	1–1.5	<1
Indexed valve area (cm^2/m^2)	>0.85	0.60–0.85	<0.60
Velocity ratio	>0.50	0.25–0.5	<0.25


FPS: 97
f: 5.0 MHz/5.0 MHz
G(t): -10 dB
Compr: 60 dB
D: 10.0 cm
140
V
5
10
84
HR

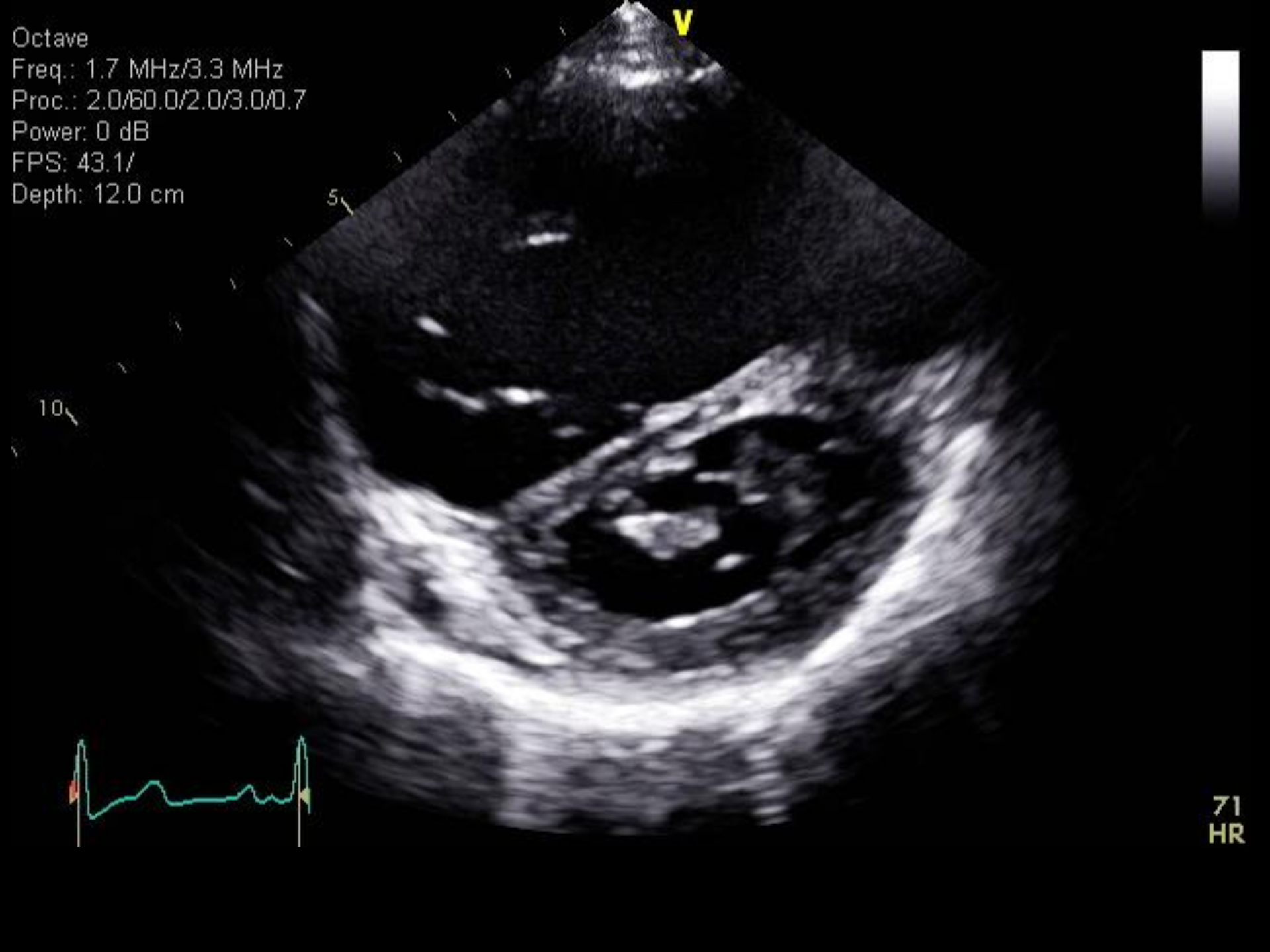

FPS: 18/18
f: 3.6 MHz/3.6 MHz
Compr: 60 dB
D: 10.0 cm
G(c): -3 dB
Rej: 14 cm/s
PRF: 6.4 kHz
SV: 0.5 mm
Soft
136
69
-.69
V
5
10
94
HR


31/10/2018 2:16:53 PM
120°
0dB / MI: 0.55 / TIS: 0.33
Cardiac / TOE ES* / Z6Ms
Lens Temp: 39.2° C
62 fps / R 13.59 mm
57 bpm / General
---2D---
H5.5MHz / 0 dB
TEQ: 1 / Offset: -2 dB
DR: 70 dB

Papillary Fibroelastoma

- **Epidemiology**
  - 10% of primary cardiac tumours
  - 2nd most common benign cardiac tumour
- **Histology**
  - Branching avascular papillae, composed of collagen covered by endothelium
- **Imaging**
  - Mobile mass attached to an endocardial surface (85% valvular surface)
  - Round, oval or irregular
  - Approximately 50% have stalks
  - Aortic > mitral > tricuspid > pulmonary
  - Equal frequency on the ventricular and aortic aspect of the valve


Octave
Freq.: 1.7 MHz/3.3 MHz
Proc.: 2.0/60.0/2.0/3.0/0.7
Power: 0 dB
FPS: 43.1
Depth: 13.0 cm
V
5
10
71
HR


Octave
Freq.: 1.7 MHz/3.3 MHz
Proc.: 2.0/60.0/2.0/3.0/0.7
Power: 0 dB
FPS: 43.1/
Depth: 12.0 cm
5
10
71
HR

Transthoracic Echo – Frequency of Repetition

Indication	When to test
Murmurs	Baseline
Native valvular stenosis	Depends on severity: - Mild ~3-5 yearly - Moderate ~1-2 yearly - Severe 6-12 monthly
Native valvular regurgitation	Depends on severity: - Mild ~3-5 yearly - Moderate ~1-2 yearly - Severe 6-12 monthly
Prosthetic valve assessment	Baseline (4-6 weeks post surgery), then 1-2 yearly
Infective endocarditis	At time of suspicion, surveillance depends on findings
Ischaemic heart disease (known or suspected)	At time of suspicion, surveillance depends on findings
Cardiomyopathy – systolic or diastolic	At time of suspicion, assess response after 3 months of OMT for LVD
Pericardial disease	At time of suspicion, surveillance depends on findings
Arrhythmia (i.e. AF), syncope, palpitations	At time of diagnosis, when considering ablation / PPM
Hypertension	At time of diagnosis
Aortic dilatation	Baseline (if suspected) Surveillance depends on findings degree of dilatation - <45 mm ~2 yearly - >45 mm ~1 yearly - Approaching surgery 6-12 monthly

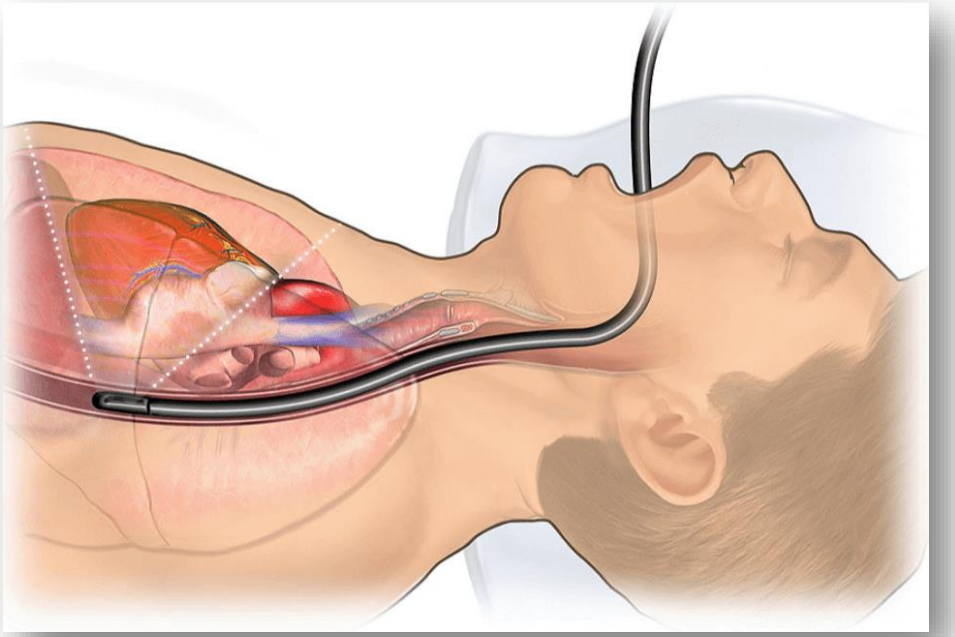
Transoesophageal Echo - Indications

- Valvular abnormalities
  - Assess severity and mechanism of native valvular disease
  - Prosthetic valve dysfunction i.e. thrombus / pannus
  - Suspected endocarditis

- Assess for intracardiac shunts
  - ASD / PFO
  - Abnormal pulmonary vein drainage

- Exclude LA appendage thrombus

- Intracardiac masses



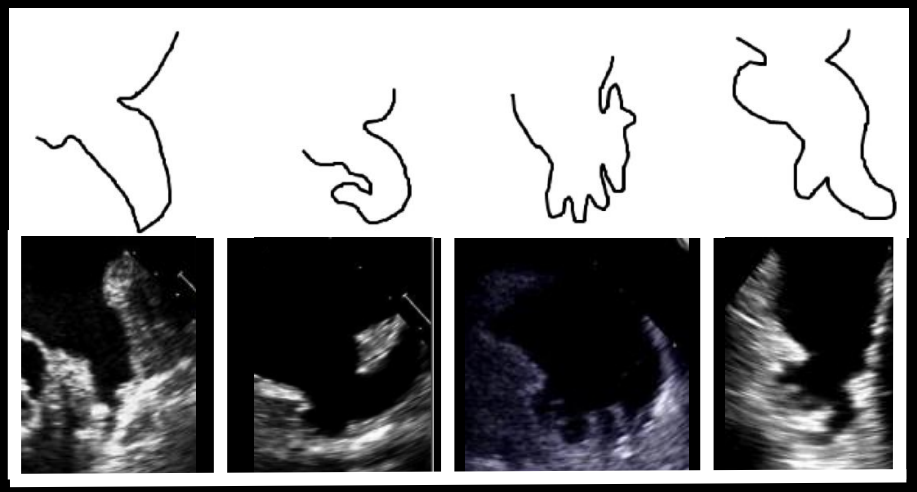
Complications

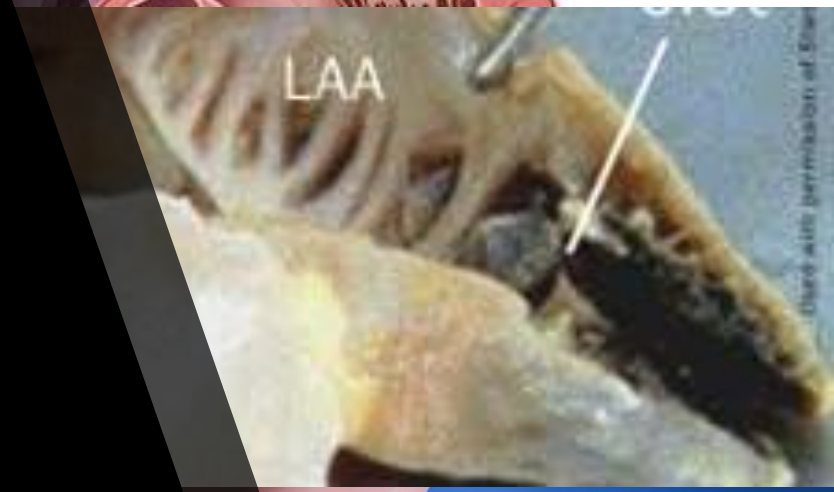
Table 7 List of complications reported with TEE and the incidence of these complications during diagnostic TEE and intraoperative TEE[7,24-31]

Complication	Diagnostic TEE	Intraoperative TEE
Overall complication rate	0.18-2.8% (refs 24,25)	0.2% (ref 7)
Mortality	<0.01-0.02% (refs 24,25,27)	0% (ref 7)
Major morbidity	0.2% (ref 27)	0-1.2% (refs 7,28,29)
Major bleeding	<0.01% (ref 24)	0.03-0.8% (refs 7,28)
Esophageal perforation	<0.01 (ref 24)	0-0.3% (refs 7,28,29)
Heart failure	0.05% (ref 28)	
Arrhythmia	0.06-0.3% (refs 7,28,30)	
Tracheal intubation	0.02% (ref 30)	
Endotracheal tube malposition		0.03% (ref 7)
Laryngospasm	0.14% (ref 27)	
Bronchospasm	0.06-0.07% (refs 24,30)	
Dysphagia	1.8 % (ref 31)	
Minor pharyngeal bleeding	0.01-0.2% (refs 24,25,27)	0.01% (ref 7)
Severe odynophagia		0.1% (ref 7)
Hoarseness	12% (ref 31)	
Lip injury	13% (ref 31)	
Dental injury	0.1% (ref 31)	0.03% (ref 7)

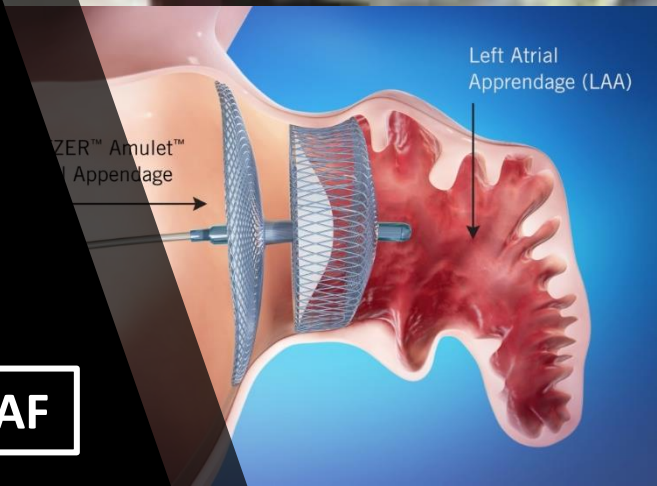
Left Atrial Appendage

- Thin-walled muscular pouch
  - Various shapes and sizes
    - Chicken wing
    - Cauliflower
    - Cactus
    - Windsock

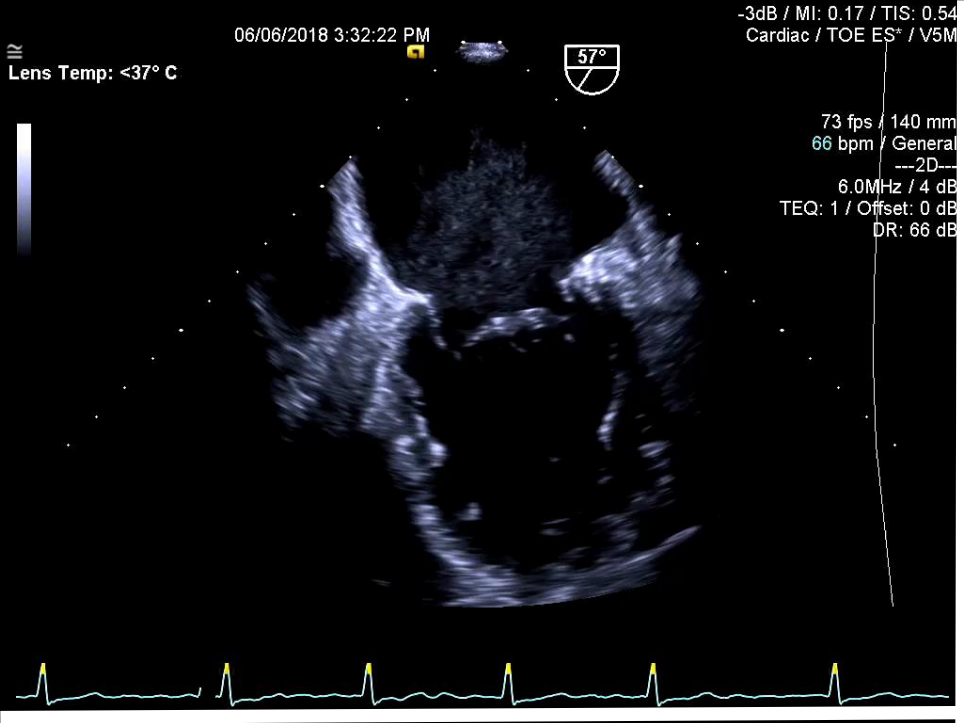


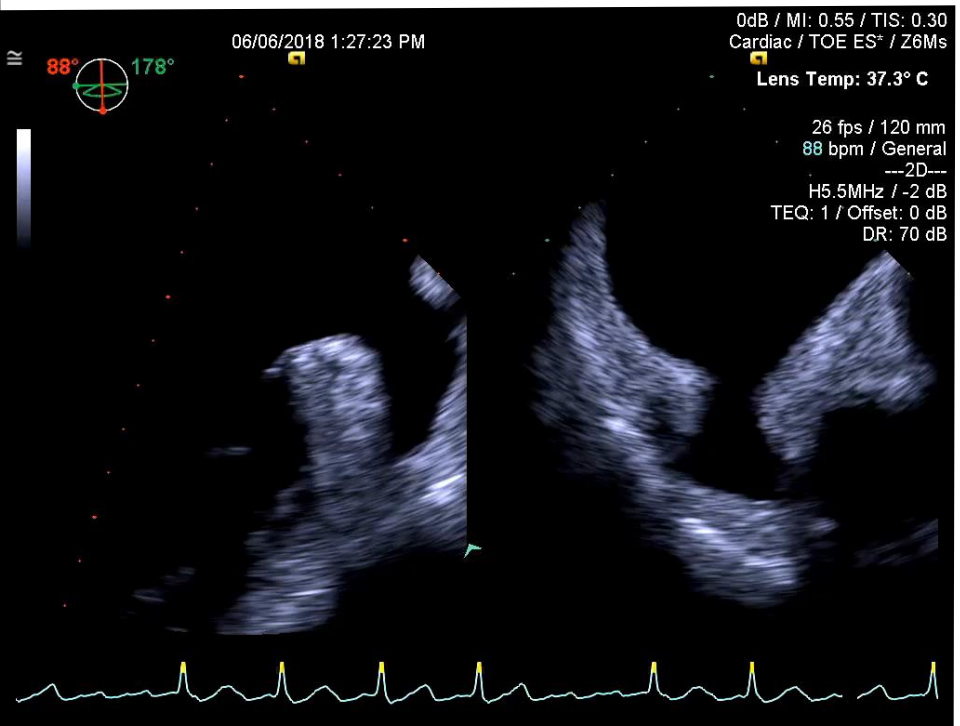


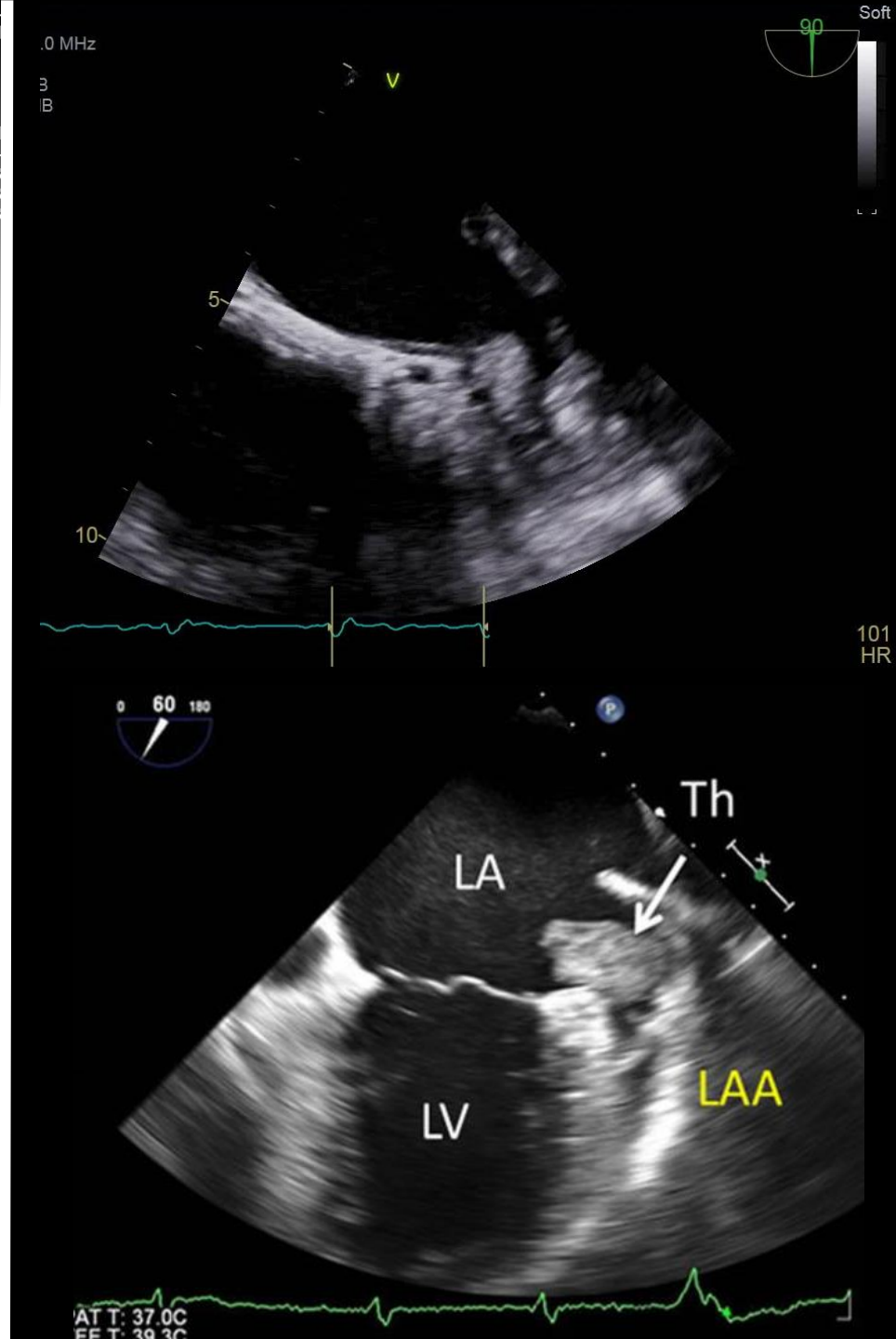
- Functions as a decompression chamber
  - During ventricular systole
  - Other instances of increased LA pressure



Responsible for >90% of atrial thrombi in non-valvular AF


06/06/2018 3:32:22 PM
Lens Temp: <37° C
-3dB / MI: 0.17 / TIS: 0.54
Cardiac / TOE ES* / V5M
57°
73 fps / 140 mm
66 bpm / General
---2D---
6.0MHz / 4 dB
TEQ: 1 / Offset: 0 dB
DR: 66 dB


06/06/2018 1:27:23 PM
88°
178°
0dB / MI: 0.55 / TIS: 0.30
Cardiac / TOE ES* / Z6Ms
Lens Temp: 37.3° C
26 fps / 120 mm
88 bpm / General
---2D---
H5.5MHz / -2 dB
TEQ: 1 / Offset: 0 dB
DR: 70 dB

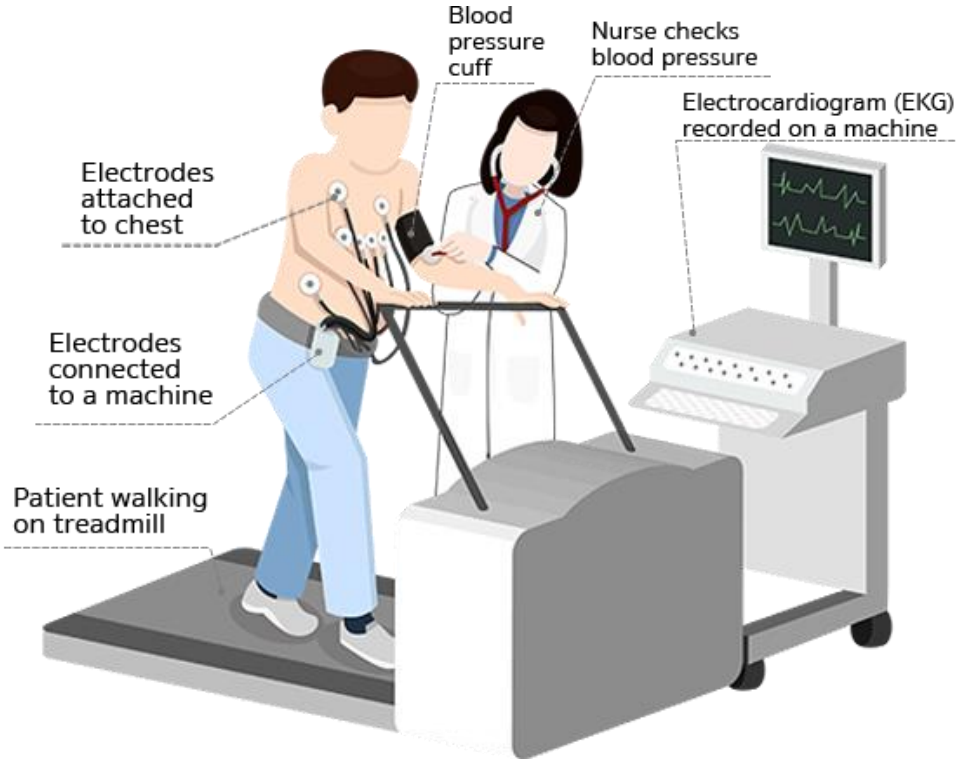

.0 MHz
Soft
90
5
10
101
HR
0
60
180
Th
LA
LV
LAA
AT T: 37.0C

Importance of anticoagulation

A TOE is required to exclude an LA or LA appendage thrombus if the patient has not had at least 4 weeks of anticoagulation prior to the DCR

All patients require therapeutic anticoagulation for a **minimum of 4 weeks** following a DCR

Stress Echo



- **Modalities**
  - Exercise
    - Treadmill
    - Recumbent bicycle
  - Dobutamine

- **Indications:**
  - Chest pain
  - Exertional dyspnoea without a clear cause
  - Assess haemodynamic response to exercise – HCM
  - Assessment of complications / severity of left-sided valve disease

Stress Echo – information provided

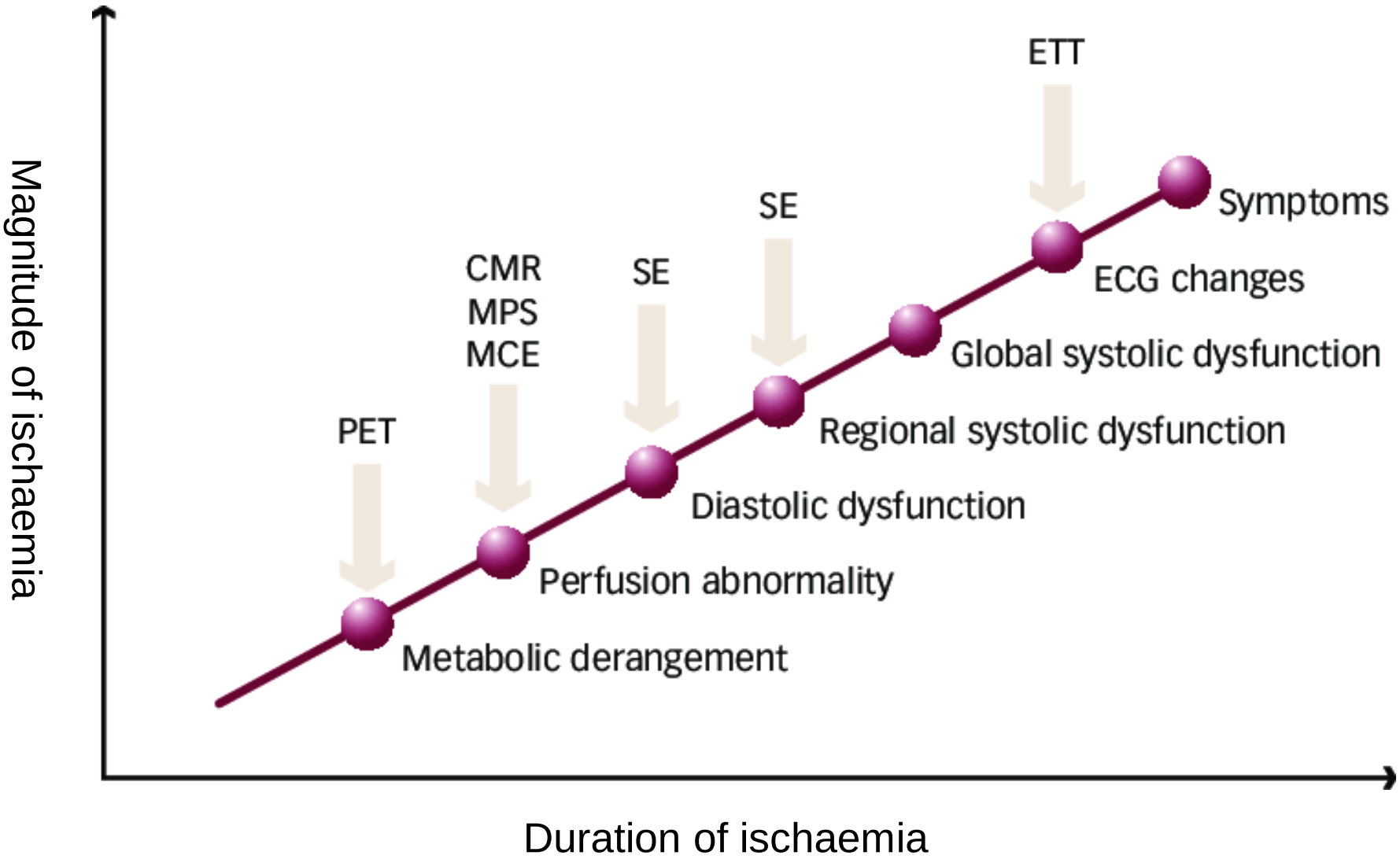
- Heart rate response and rhythm
- Blood pressure response
- Oxygen saturation

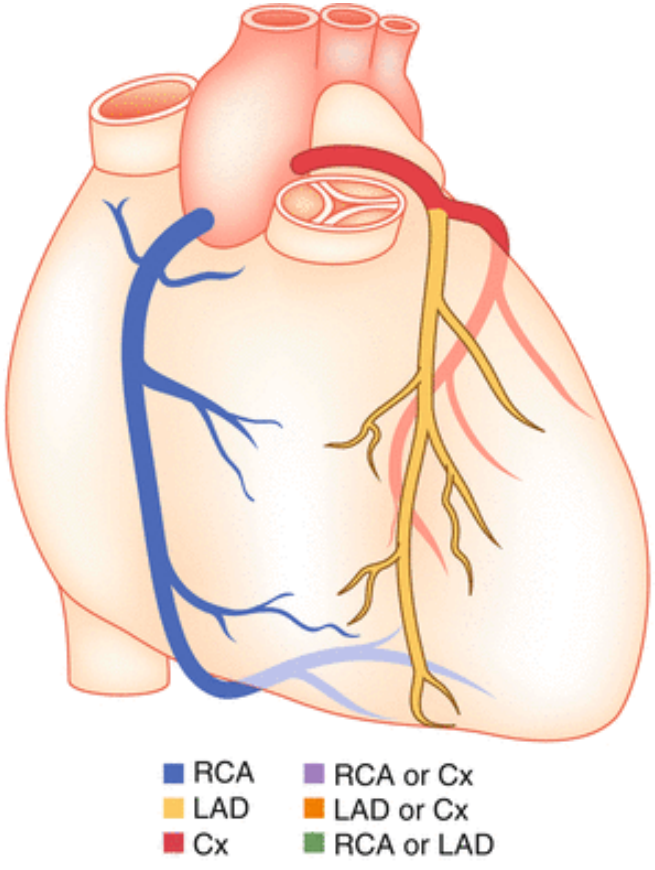
Compared to coronary angiography
Sensitivity = 83%
Specificity = 84%

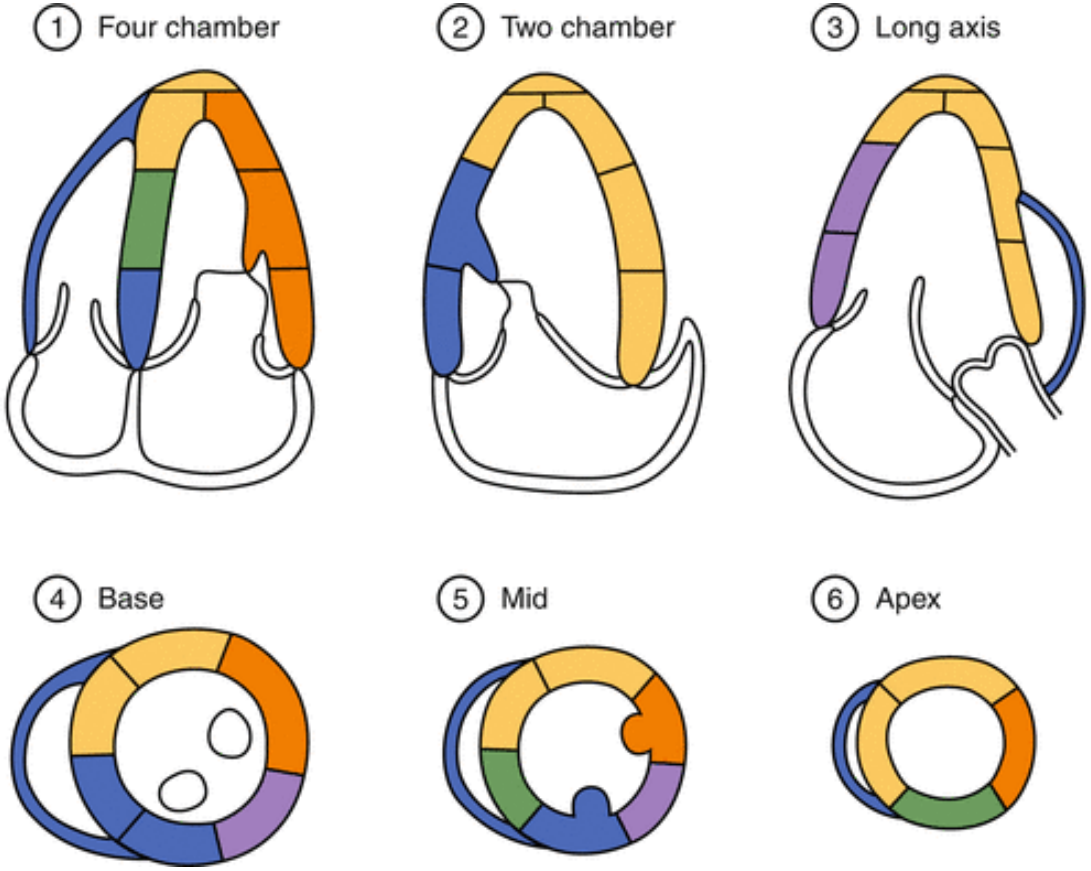
Images obtained within the first 60-90 seconds after finishing exercise

- LV function and regional wall analysis
- Pulmonary pressure
- Diastolic function

- Assessment is dependent on:
  - Heart rate achieved (need to obtain >85% age-predicted maximal HR
  - Time taken to acquire images (need to obtain images in <90 seconds)


Magnitude of ischaemia
ETT
SE
CMR
MPS
MCE
SE
Symptoms
ECG changes
Global systolic dysfunction
Regional systolic dysfunction
PET
Diastolic dysfunction
Perfusion abnormality
Metabolic derangement
Duration of ischaemia





Each wall corresponds to a particular coronary artery


ACE
Baseline : 4-ch
T1: 1:59
FPS: 75
f: 1.4 MHz/2.8 MHz
P: 0 dB
DDP: 1.4
D: 13.0 cm
Soft
5
10
68
HR


PEAK :
T1: 18:33
21/220
Soft
5
10
145
HR


ACE
Baseline : APLAX
T1: 2:24
FPS: 75
f: 1.4 MHz/2.8 MHz
P: 0 dB
DDP: 1.4
D: 13.0 cm
Sol
5
10
HF


PEAK :
T1: 19:06
94/220
Soft
5
10
127
HR

Limitations of Stress Echo

Conditions that prevent adequate workload / target heart rate:

- Concomitant beta-blockers / calcium channel blockers
- Severe joint disease
- Severe gait instability

Conditions that decrease the sensitivity for detection of CAD:

- Elevated BMI – can make it difficult to visualise the walls
- Significant LVH – can miss subtle wall motion abnormality
- Severe airways disease – often have poor image quality

Contents

CT Coronary Angiography

- Non-invasive coronary angiogram

- **Requirements:**
  - Ideally resting heart rate ≤60 bpm
    - Use either metoprolol or ivabradine (except if in AF)
  - Be able to lay supine
  - Weight <180 kg

- **Risks:**
  - Radiation ~2-3 mSv (sometimes <1 mSv in appropriate patients)
  - Contrast reaction (CT calcium score does not require contrast)
  - IV site infection

- **Indications:**
  - Chest pain with low to intermediate pre-test probability of coronary artery disease (CAD)
  - Chest pain with uninterpretable or equivocal stress test or imaging results
  - Normal stress test results but continued or worsening symptoms
  - Suspected coronary or great vessel anomalies
  - Evaluation of coronary artery bypass grafts (with symptoms)
  - Exclude coronary artery disease in new onset left bundle branch block or heart failure

Coronary Artery Calcium Scoring

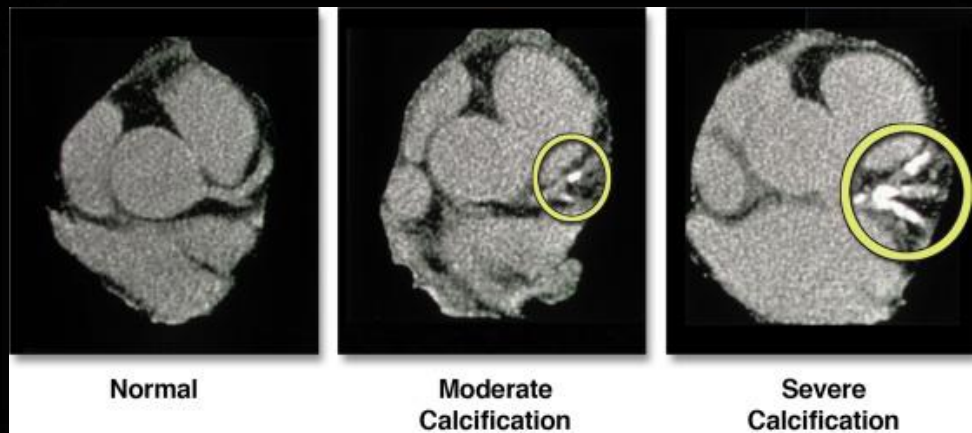
Interpretation of CAC	
CAC = 0.	A zero score confers a **very low** risk of death, <1% at 10 years.
CAC = 1-100.	**Low risk**, <10%
CAC = 101-400.	**Intermediate** risk, 10-20%
CAC = 101-400 & >75th centile.	**Moderately high** risk, 15-20%
CAC > 400.	**High** risk, >20%

MESA Risk Score

- Provides prognostic information beyond traditional (Framingham) risk models
  - Asymptomatic patients with a **CA score of 0** have a very favourable prognosis – **mortality <1% at 10 years** [2]

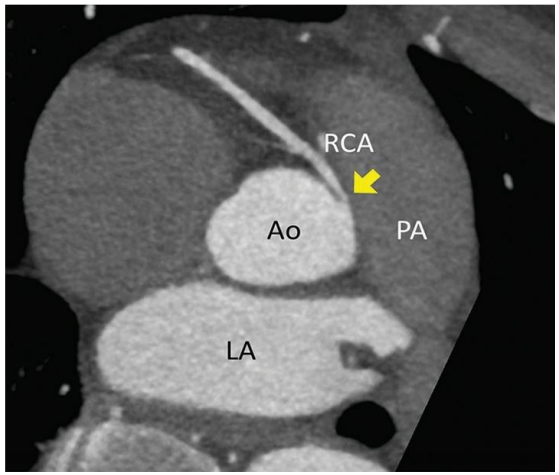
- **Intermediate risk group** (absolute 10-year risk = 10-20%)
  - Asymptomatic (or atypical symptoms) without known CAD, and aged 45-75
    - Has the ability to **reclassify these patients (>50%)** into low or higher risk groups
      - MESA = 16% higher risk and 39% lower risk [3]

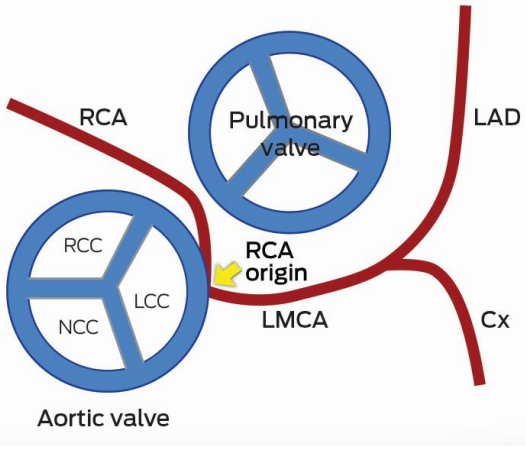
- **Considered in lower risk patients** (absolute 10-year risk = 6-10%)
  - Particularly in those where traditionally risk scores under-estimate risk
    - Strong family history of premature CVD
    - Diabetes aged 40 to 60

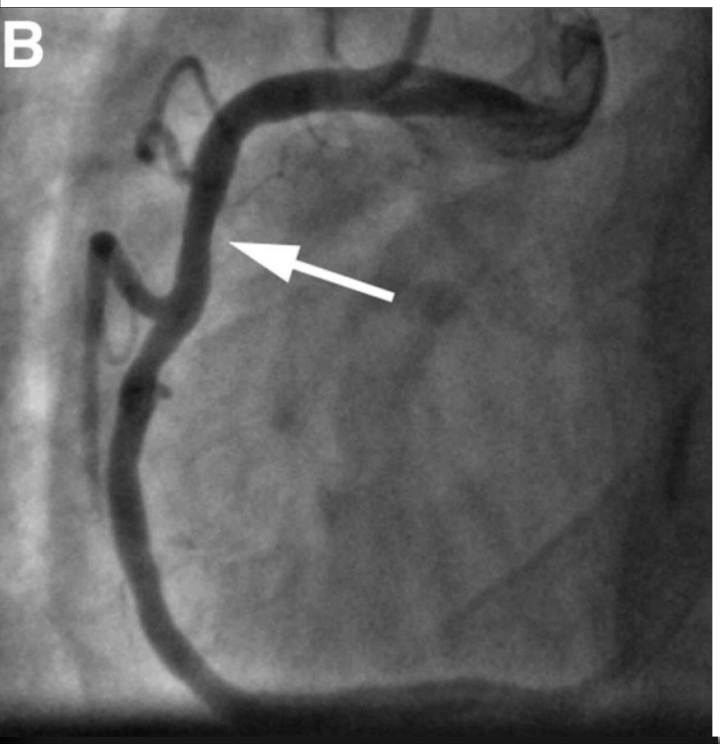


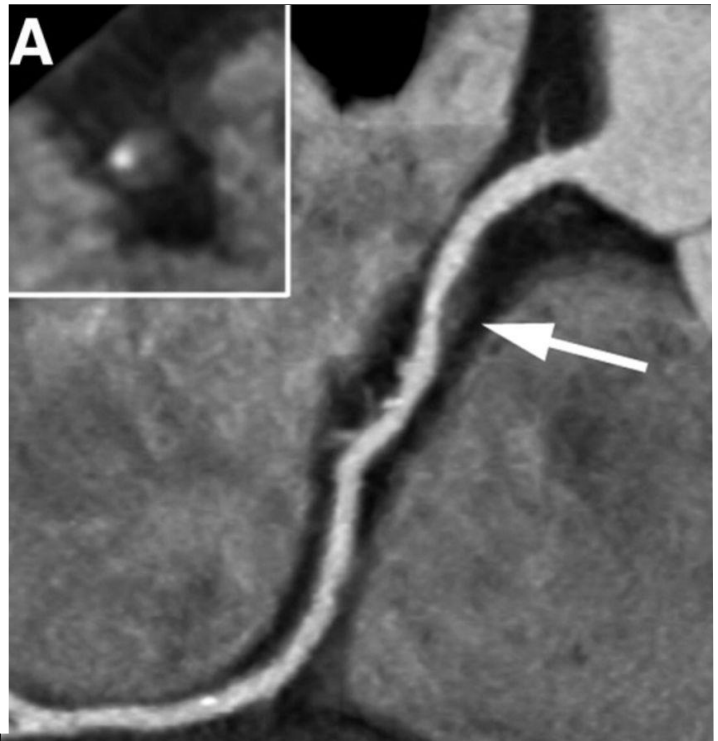
1. CSANZ Position Statement 2017
2. Blaha. JACC CVI. 2009
3. Polonsky. JAMA. 2010

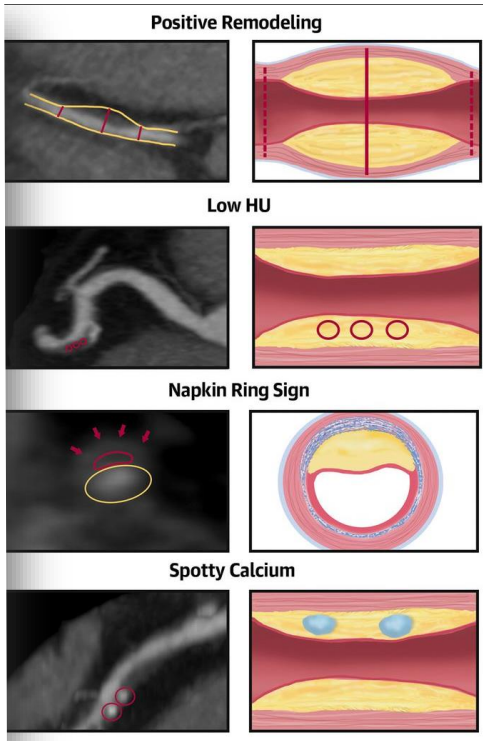
CT Coronary Angiography - Examples











CT Coronary Angiography - Summary

- **Benefits:**
  - **Excellent 'rule-out' test – sensitivity approaching 100%**
  - Superior risk stratification for future events compared with other modalities
  - Superior assessment of coronary anatomy – i.e. aberrant courses of coronary arteries, high risk plaque features
  - Imaging of other thoracic structures

- **Limitations:**
  - Stents – usually only if stent is ≥3.0 mm in width – smaller the stent the more likely to miss in-stent re-stenosis
  - Modest positive predictive value (60-90% - depending on the prevalence of disease and study
    - Overestimation of luminal narrowing with heavy burdens of calcification
  - Negative chronotropic agents may not be suitable for some patients
  - Tachycardia / tachyarrhythmias

Contents

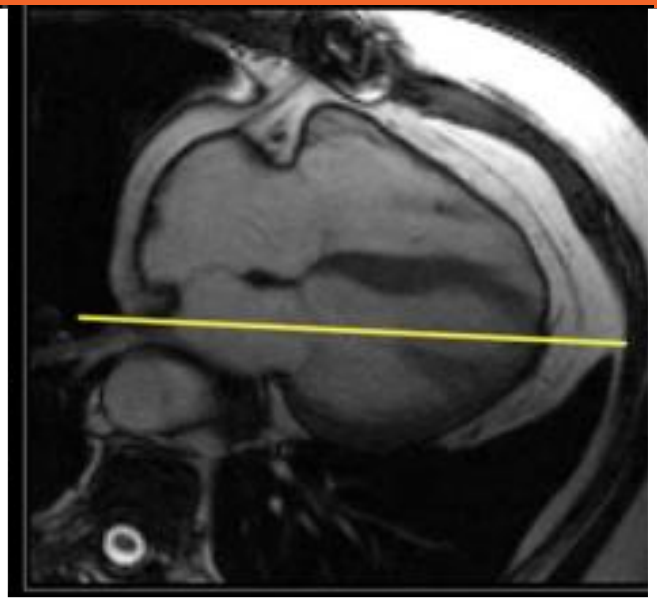
Cardiac MRI

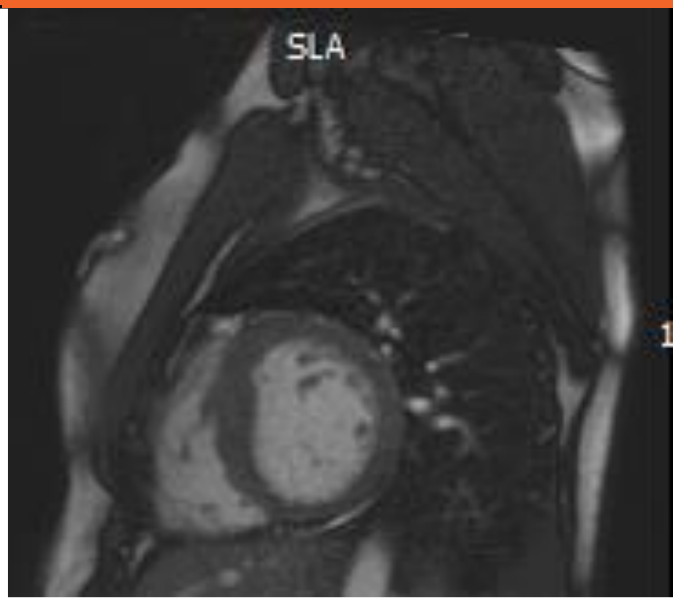
- Uses magnetic field and radiofrequency waves to generate detailed pictures of the heart

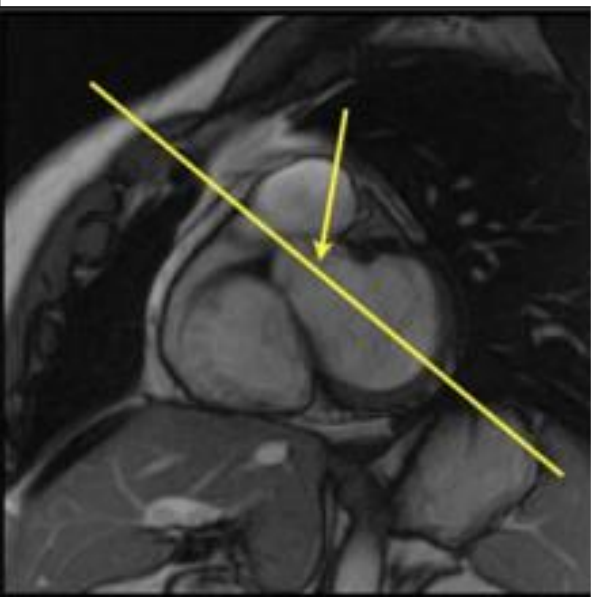
- **Requirements:**
  - Ideally a regular rhythm ≤100 bpm
    - Use either metoprolol or ivabradine (except if in AF)
  - Be able to lay supine
  - Waist circumference restrictions

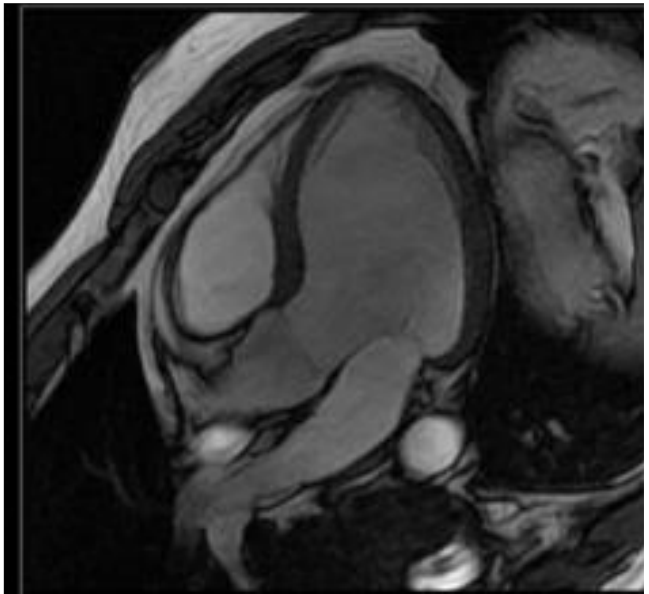
- **Indications:**
  - Accurate assessment of ventricular size and function when not optimally seen via echo
  - Assessment of severity of AR and MR in cases where echo is unable to clarify severity
  - Assessment of myocardial scar / fibrosis / viability
  - Assessment for infiltrative disorders (amyloid / sarcoid)
  - Evaluation of cardiac masses
  - Pericardial disease
  - Aortic pathology

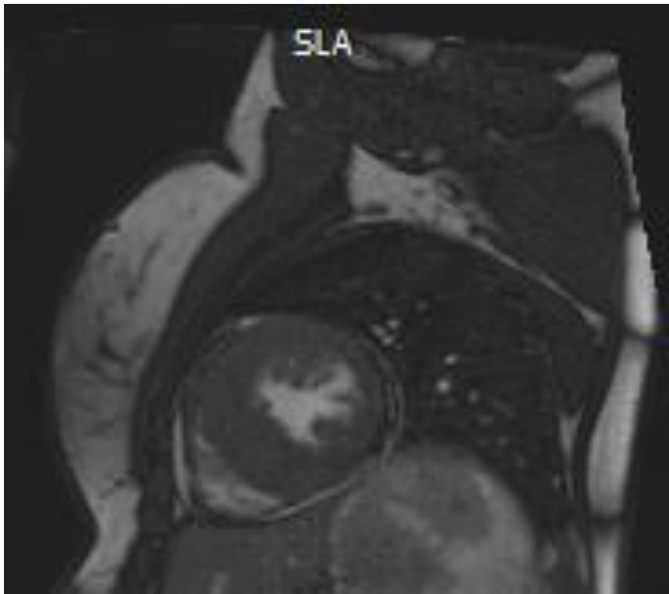
Cardiac MRI



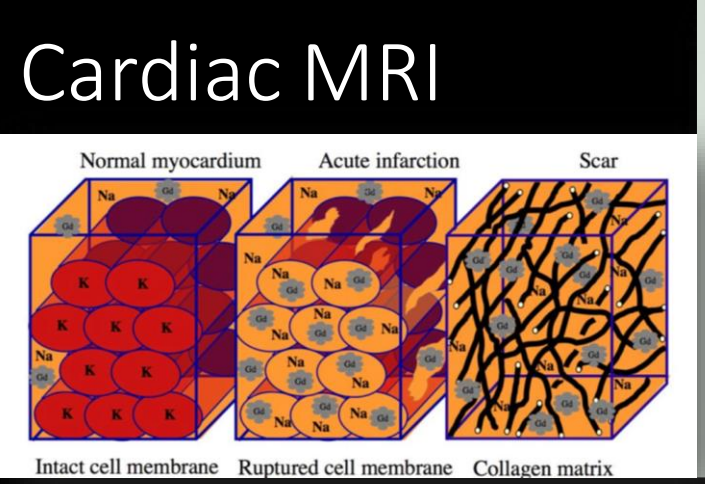


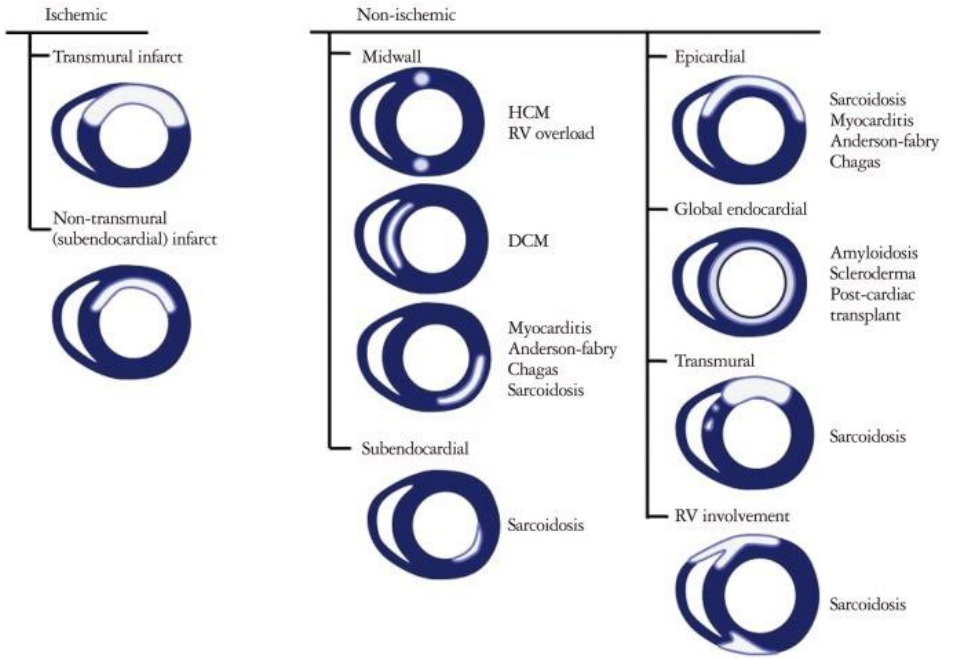




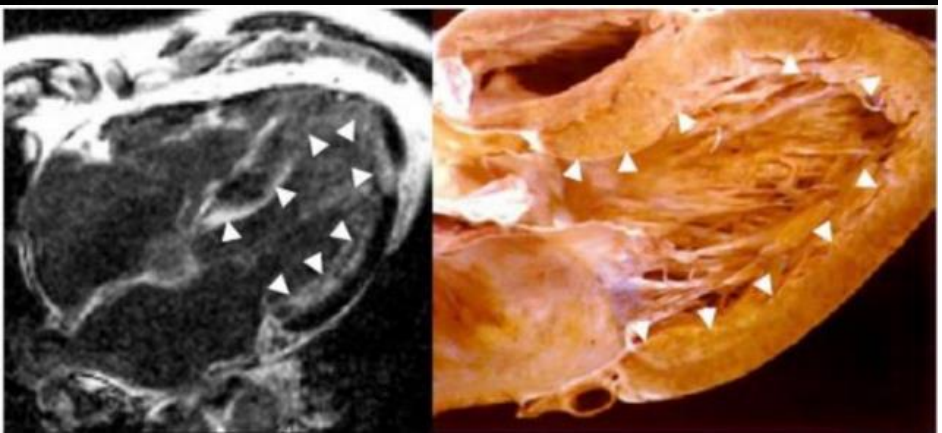


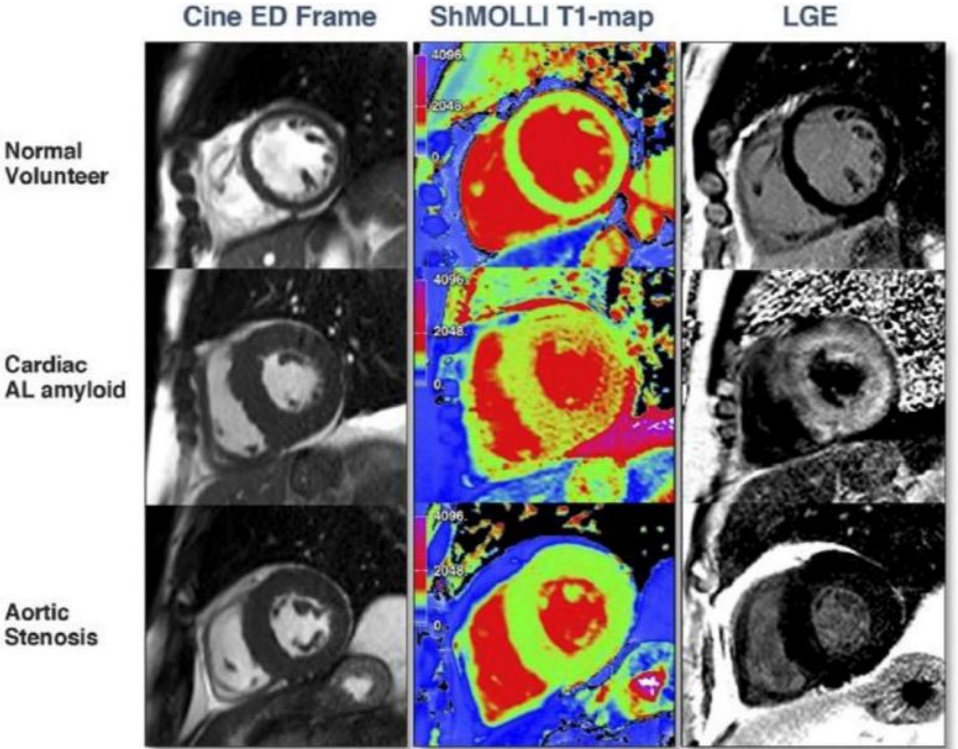
Cardiac MRI





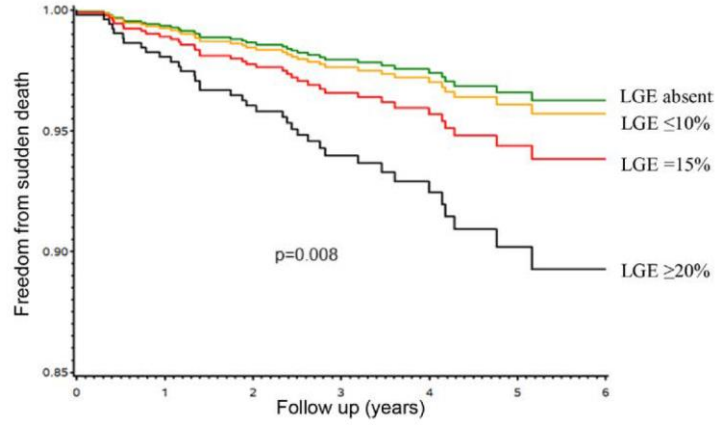
- Free Gadolinium is toxic, but it is chelated (unable to get into cells)
- Accumulates in the extracellular space
  - **marker of inflammation / fibrosis**

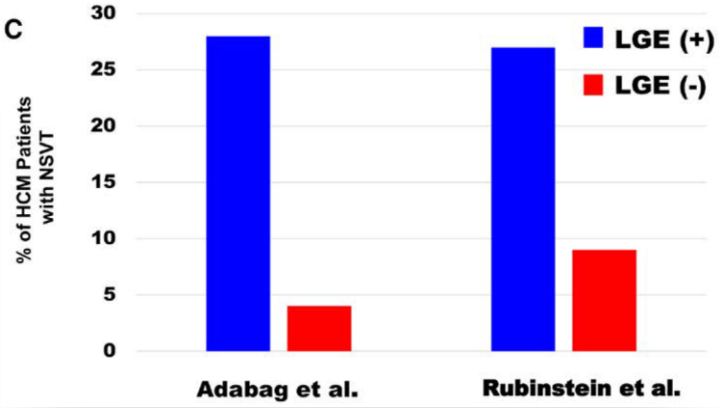




Late Gadolinium Enhancement in HCM

- Seen in ~60% of patients with clinical HCM
  - Reflects fibrosis
- Diverse pattern - most commonly at the RV insertion points and areas of LVH
- **Extent** (> presence) of LGE is a significant predictor of risk
  - ≥15% = 2-fold increase in SCD events at 5 years





Chan. Circulation. 2014; 130: 484-495

Summary

- Right test for the right patient
- Clear clinical question is paramount – we may do things differently
- Normal LVEF **does not** = normal systolic function
- Risk stratification can be improved by addition of CT calcium score
- Cardiac MRI is excellent for tissue characterisation
- Don’t be afraid to call to ask for advice / clarification

Outreach Echo Service

Cardiology Tasmania

- **Provide timely access to high quality echo within local communities**
  - Some centres operate on a Saturday
  - Minimal wait list time
- **Reduced strain on public system**
  - Minimise number of appointments at RHH
  - Come to clinic pre-worked up, facilitating an earlier diagnosis
- **Reduce cost to patient**
  - All echocardiograms are 100% Bulk-billed
  - Travel expenses to and from city
- **Improved communication to GPs**
  - Standardised high quality reports without jargon
  - Reports with 24 business hours

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