HeFSSA Practitioners Program 2018
"Back to basics on heart failure treatment?"

- Co-morbidity in heart failure
- Arrhythmias in heart failure
- Special investigations in heart failure
- Heart failure with preserved EF, what is new?"

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Introduction

- Full evaluation of the patient with heart failure involves more than stating whether the syndrome is present or not; it requires consideration of the **underlying abnormality** of the heart, the **severity** of the syndrome, the **aetiology**, **precipitating** and **exacerbating** factors, identification of concomitant disease relevant to the management, and an estimation of prognosis

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CASE STUDY: Mrs BL

Special investigations in heart failure

Patients with heart failure commonly present with shortness of breath, oedema or fatigue, but these symptoms can overlap with other medical conditions, making accurate diagnosis challenging

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"Heart failure is more common in older patients with multiple morbidities, which may further complicate the clinical picture"

- 71-year-old female patient was admitted from home with progressive increase in breathlessness, orthopnoea and ankle swelling over the previous 2 weeks
- Her family doctor was away and a locum prescribed oral antibiotics and Burinex 1 mg daily
- She had suffered from dyspepsia, increasing over recent weeks, and the general practitioner had noted a murmur and Pantoprozole was prescribed
- Mrs BL said she had never been diagnosed with a murmur before

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The detailed history

A detailed history should always be obtained. HF is unusual in an individual with no relevant medical history (e.g. a potential cause of cardiac damage), whereas certain features, particularly previous myocardial infarction, greatly increase the likelihood of HF in a patient with appropriate symptoms and signs.[42–45]

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Difficulties with diagnosis

- Patients often present to primary care clinicians and there is evidence to suggest diagnosis may be inaccurate, with only 50% of patients with a clinical label of heart failure having a confirmed diagnosis after formal assessment according to diagnostic criteria
- The lack of confidence of primary care physicians in establishing an accurate diagnosis, limited diagnostic provisions, concerns about use of polypharmacy in older, frail patients and poor interaction between primary and secondary care are possible barriers to accurate diagnosis and effective management

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Other conditions that may present with symptoms similar to those of heart failure

- Obesity.
- Chest disease – including lung, diaphragm or chest wall.
- Venous insufficiency in lower limbs.
- Drug-induced ankle swelling (eg dihydropyridine calcium channel blockers).
- Drug-induced fluid retention (eg NSAIDs).
- Hypoalbuminaemia.
- Intrinsic renal or hepatic disease.
- Pulmonary embolic disease.
- Depression and/or anxiety disorders.
- Severe anaemia or thyroid disease.
- Bilateral renal artery stenosis.

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Clinical features

- 37.2 C
- Tachypnoeic (28 breaths / minute)
- Low volume pulse, peripheral pitting oedema
- 116/86 mm Hg sitting, JVP raised 6 cm
- Apex beat in 6ICS, 3 cm lateral to MCL
- Prominent parasternal lift with 2 components
- 3/6 PSM was heard, with an audible S3 gallop
- Bilateral basal lung crepitations and audible wheeze

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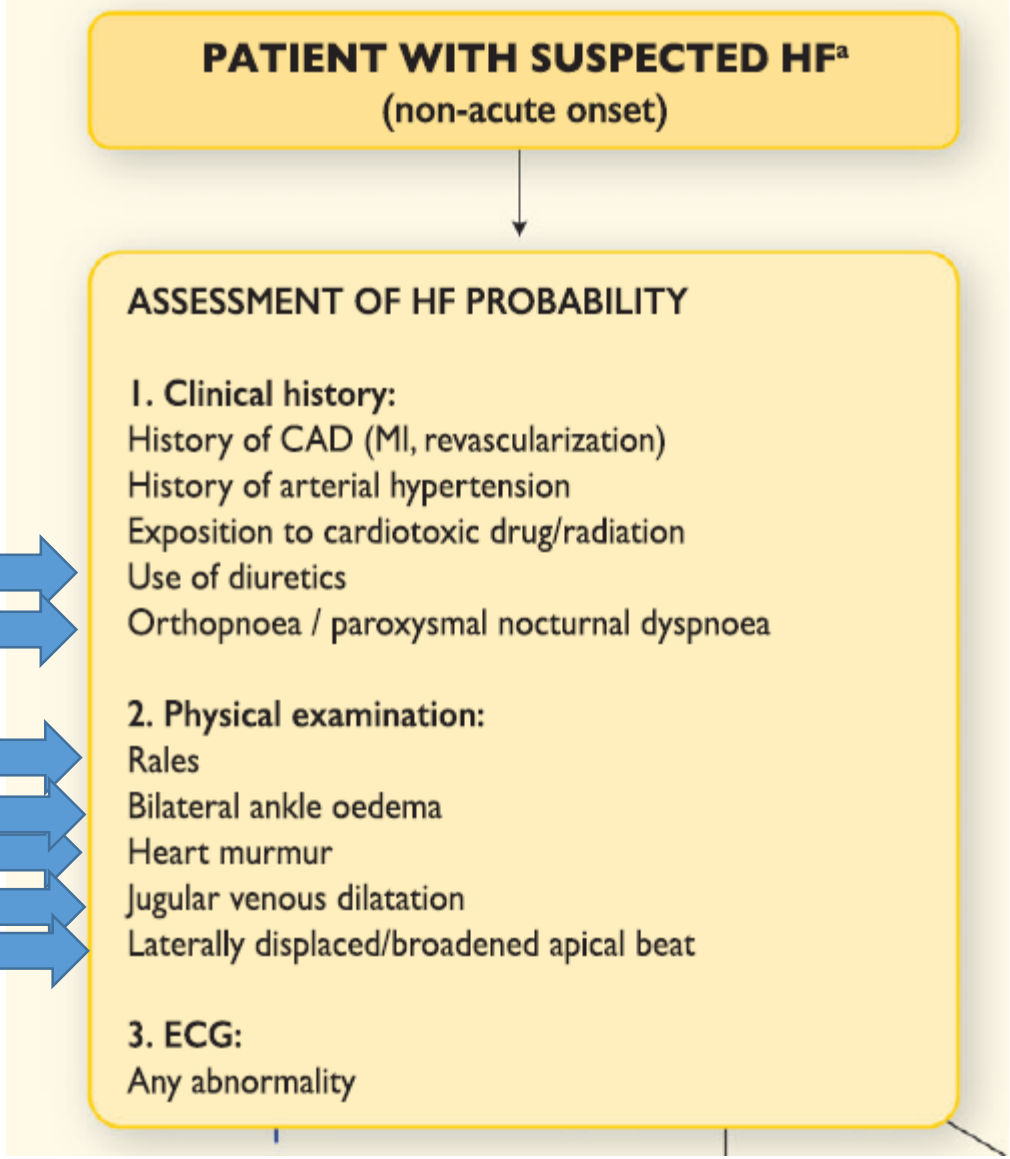
The approach



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Reliability of symptoms and signs

- Patients with heart failure often present with gradual-onset symptoms of breathlessness, fatigue and ankle swelling.
- Reviews have found that the sensitivity and specificity of clinical features of heart failure are highly variable

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Sensitivity and specificity

- Symptoms such as orthopnoea or added heart sounds have a high specificity, which means patients with suspected heart failure who have these symptoms are likely to have the condition.
- However, sensitivity for both of these symptoms is low, which means their absence does not rule out the diagnosis

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Sensitivity and specificity

- Dyspnoea has a sensitivity of 87%, the highest sensitivity of the symptoms and signs examined, suggesting this is a common symptom in patients with heart failure
- But, 13% of patients with a diagnosis of heart failure may not have these symptoms, which means a significant number may be misdiagnosed if the absence of dyspnoea is used to rule out the condition

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Chest X Ray

- A CXR may show features of heart failure such as an increased cardiothoracic ratio, lung interstitial oedema or bilateral pleural effusions
- Estimating the accuracy of an abnormal CXR : Sensitivity was 68%, specificity 83%
- An abnormal CXR may be suggestive of heart failure, but a normal CXR cannot rule out the diagnosis
- A CXR can be valuable to rule out other pathology that may be responsible for symptoms, such as breathlessness

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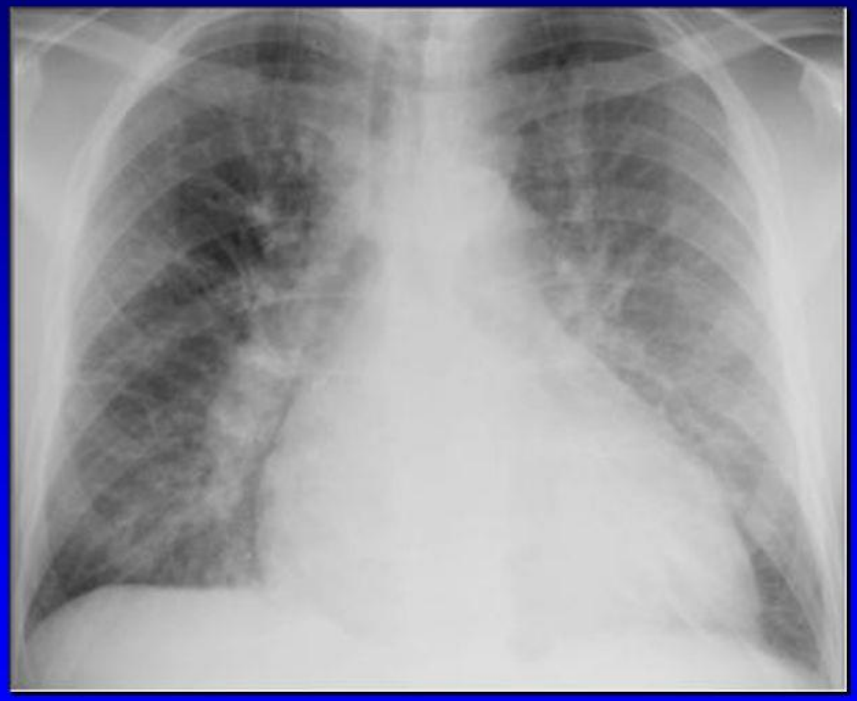
Chest x-ray



Note the size and shape of the cardiac silhouette

Pulmonary venous hypertension (PVH) may be divided into 3 grades on an upright CXR:

- **Grade I PVH** redistribution of blood flow to the nondependent portions of the lungs and the upper lobes.
- **Grade II PVH**, interstitial edema with ill-defined vessels and peribronchial cuffing, as well as interlobular septal thickening.
- **Grade III PVH**, perihilar and lower-lobe airspace filling, with features typical of consolidation (eg, confluent opacities, air bronchogram and the inability to see pulmonary vessels in the area of abnormality). The airspace edema tends to spare the periphery in the mid and upper lung

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CXR

- In patients with chronic LV failure, higher pulmonary capillary pressures may be accommodated with fewer clinical and radiologic signs, presumably because of enhanced lymphatic drainage

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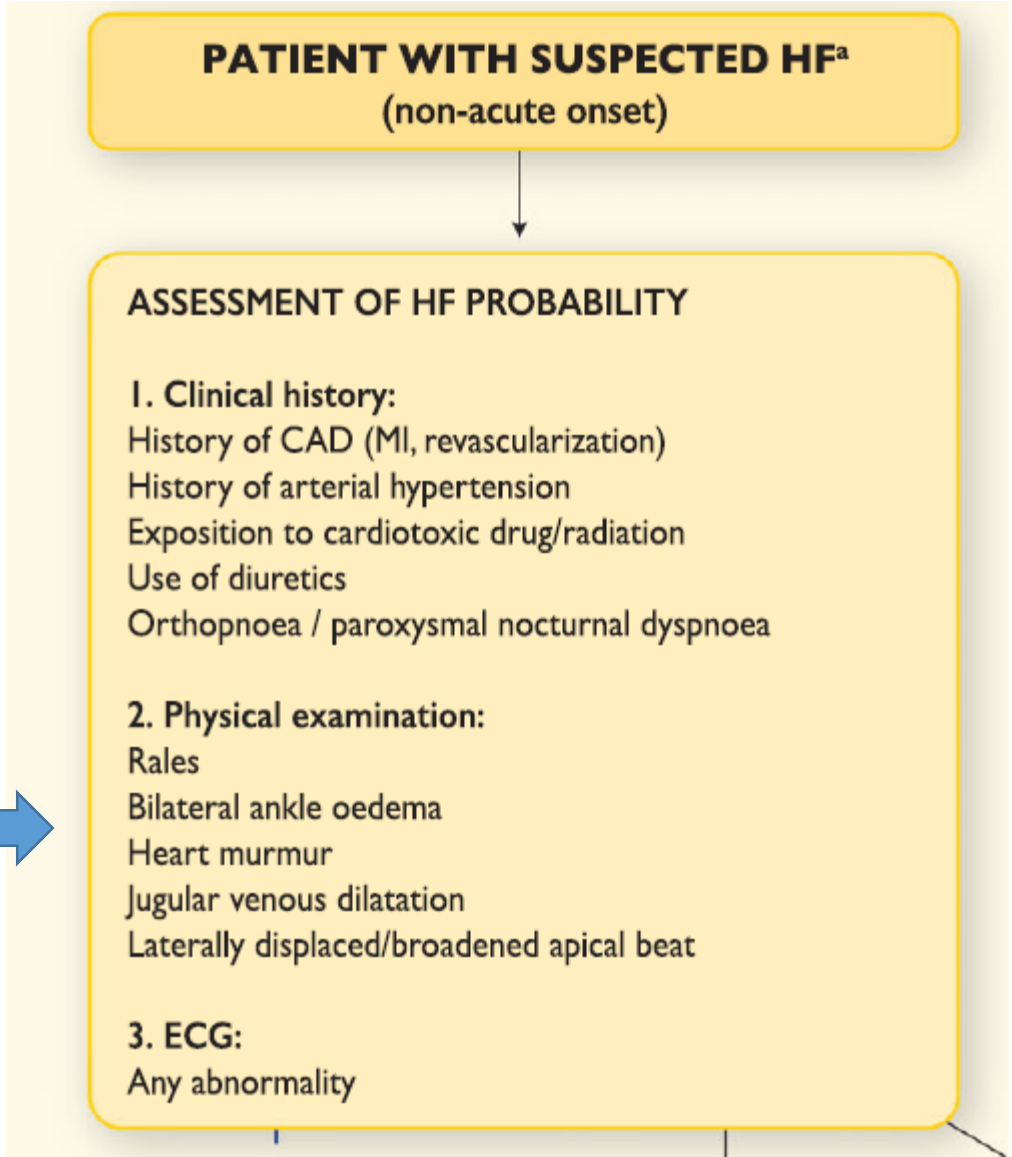
Patient with Suspected HF[a]



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ECG

- Guidelines suggest all patients with suspected heart failure should have an electrocardiogram
- An abnormal ECG has a relatively high sensitivity for a diagnosis of heart failure of 89%
- An abnormal ECG has a moderate specificity of 56%
- Suggesting, that heart failure is quite unlikely in the presence of a normal ECG; however, abnormalities on ECG may be associated with a diagnosis other than heart failure

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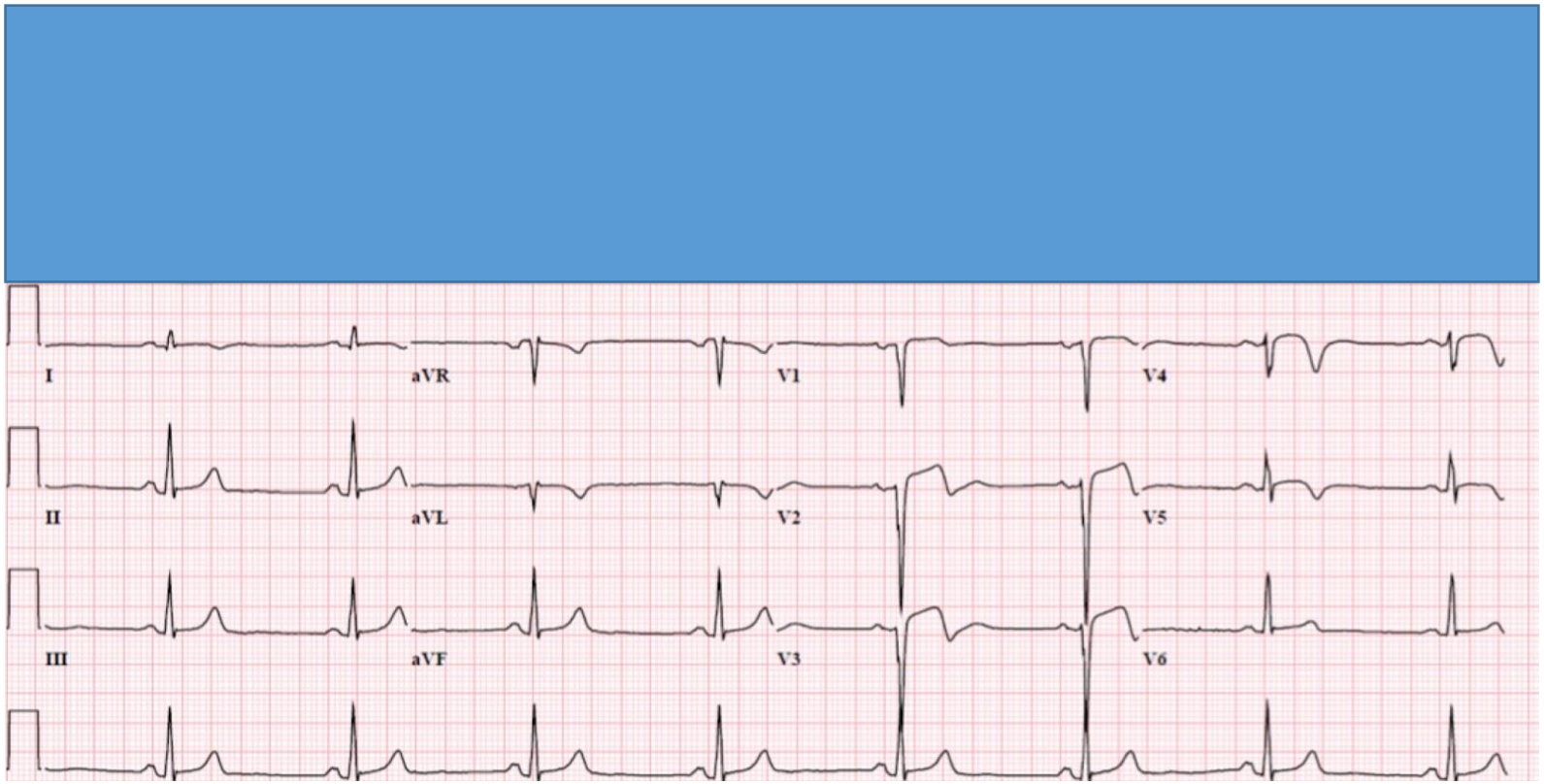
Mrs BL



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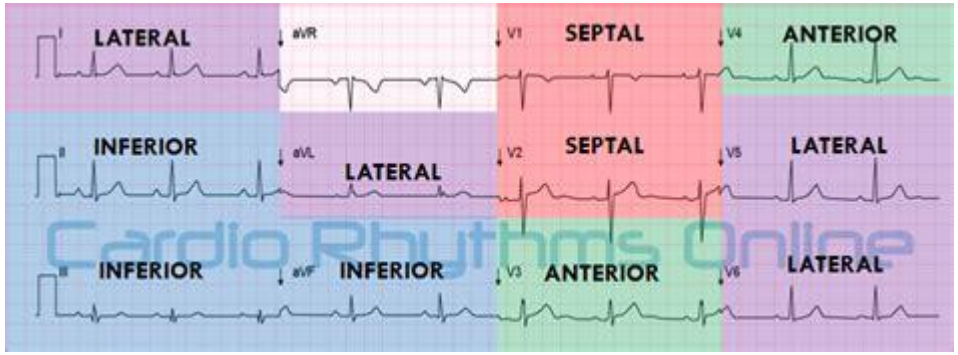

Sites

Leads	Localization	Coronary artery
V1 _V6	Anterior MI	LAD
V1 _V4	Anteroseptal MI	LAD
V4 _V6	Anterolateral MI	LAD
V1_V6, lead1,aVL	Extensive anterior MI	LMCA
lead1,aVL,V5,V6	Lateral MI	LCX
lead1 , aVL	high lateral MI	LCX
lead2,lead 3,avf	inferior MI	RCA
ST depression & prominent R in V1 -V4	posterior MI	RCX

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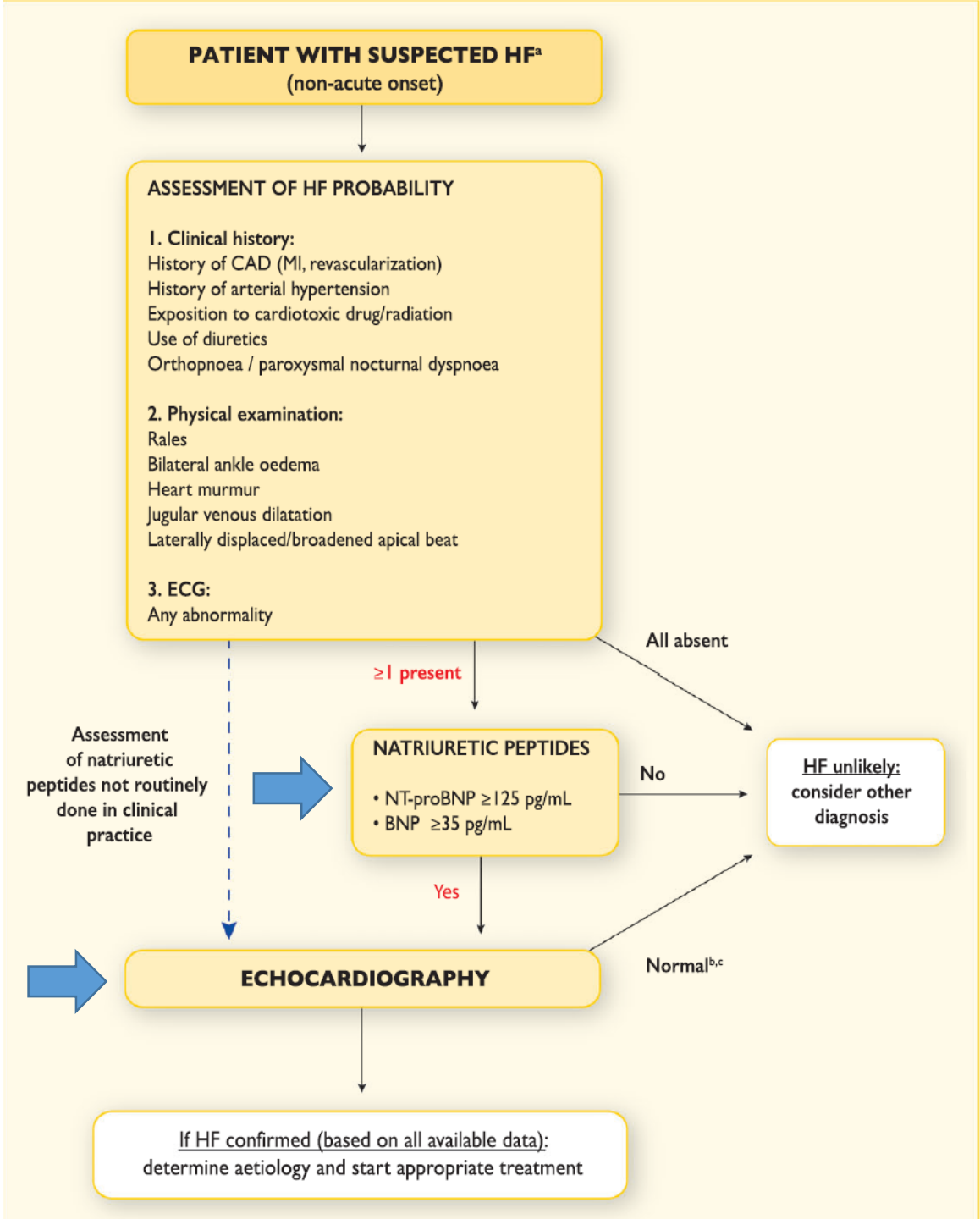
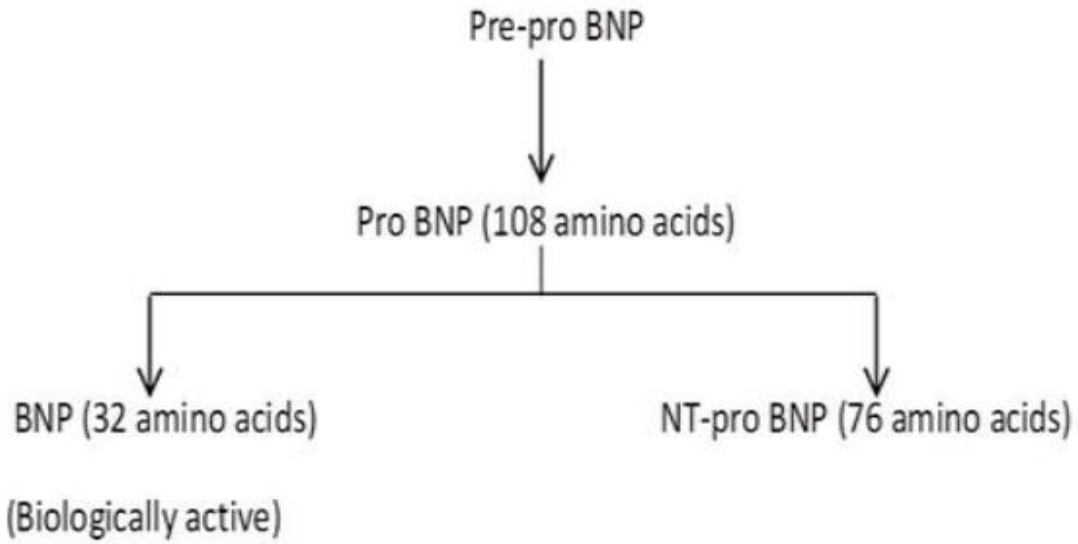

PATIENT WITH SUSPECTED HF[a]
(non-acute onset)
ASSESSMENT OF HF PROBABILITY
1. Clinical history:
History of CAD (MI, revascularization)
History of arterial hypertension
Exposition to cardiotoxic drug/radiation
Use of diuretics
Orthopnoea / paroxysmal nocturnal dyspnoea
2. Physical examination:
Rales
Bilateral ankle oedema
Heart murmur
Jugular venous dilatation
Laterally displaced/broadened apical beat
3. ECG:
Any abnormality
All absent
≥1 present
Assessment of natriuretic peptides not routinely done in clinical practice
NATRIURETIC PEPTIDES
• NT-proBNP ≥125 pg/mL
• BNP ≥35 pg/mL
No
HF unlikely: consider other diagnosis
Yes
Normal[b,c]
ECHOCARDIOGRAPHY
If HF confirmed (based on all available data):
determine aetiology and start appropriate treatment

The Role of Natriuretic Peptides

- **BNP** and N-terminal pro-BNP (**NT-proBNP**) are released by the ventricles of the heart in response to volume and pressure overload
- **NT-proBNP** is an inactive fragment of the cleaved pro-BNP molecule. **NT-proBNP** and **BNP** assays have been found to be equally reliable for diagnostic use in heart failure **(except with ARNI use)**



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The Role of Natriuretic Peptides

- Natriuretic peptides have a **high sensitivity** for heart failure, meaning a negative result makes heart failure unlikely
- If natriuretic peptide is raised, further investigation with echocardiogram is required to confirm the diagnosis
- **Several conditions** are associated with raised NP levels : LVH, ischaemia, tachycardia, RV overload, hypoxaemia (including pulmonary embolism), renal dysfunction, sepsis, age >70 yrs, and cirrhosis of the liver.
- **Female gender** increase baseline levels of natriuretic peptides

Natriuretic peptides are synthesized and released in response to ventricular stress and very little is stored in the forms of granules. Thus, in acute decompensation, a lag often occurs between the appearance of the natriuretic peptides and the onset of clinical deterioration

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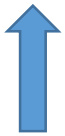
BNP : NTproBNP

Diagnostic accuracy of NT-proBNP compared with a clinical diagnosis

Setting (no. of studies)	Sensitivity (95%CI)	Specificity (95%CI)
Overall (N=16)	0.93 (0.88 to 0.96)	0.65 (0.56 to 0.74)
General Practice (N=8)	0.90 (0.81 to 0.96)	0.60 (0.50 to 0.70)



(0.66–0.67).[54,56–61] Therefore, the use of NPs is recommended not to establish the diagnosis.

The test can be drawn at any time during the day. The patient does not need to be fasting and no specific preparation from the patient's side is required.

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Referral for echocardiogram is based on the natriuretic test result : Another approach

- Female without ankle oedema – refer if BNP >210–360pg/ml depending on local availability of echocardiography (or NT-proBNP >620–1,060pg/ml)
- Male without ankle oedema – refer if BNP >130–220pg/ml (or NT-proBNP >390–660pg/ml)
- Female with ankle oedema – refer if BNP >100–180pg/ml (or NT-proBNP >190–520pg/ml)

"Patients presenting with symptoms such as **breathlessness, fatigue or ankle swelling** where a diagnosis of heart failure is suspected should be referred directly to echocardiography if they have any of the following three features: **male with ankle oedema or history of myocardial infarction or basal crepitations"**

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Age related approach

- NT-proBNP
- < 300 pg/mL - HF unlikely
- Age < 50 years, NT-proBNP >450 pg/mL - HF likely
- Age 50-75 years, NT-proBNP >900 pg/mL – HF likely
- Age >75 years, NT-proBNP >1800 pg/mL – HF likely

Grey Zone Age-Related Values for BNP and NT-proBNP

BNP	NT-proBNP
100-400 pg/mL	< 50 years – 300-450 pg/mL 50-75 years – 300-900 pg/mL >75 years – 300-1800 pg/mL

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Mrs BL

- A BNP assessment was not required in Mrs BL
- The diagnosis of heart failure was clearly made after the clinical presentation, CXR, and ECG
- Natriuretic peptides may have a, as yet undefined, role in prognostication and assessment of response to therapy
- An echocardiogram was then performed

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Echocardiogram

- Investigation of choice to provide objective evidence of cardiac abnormality
- Echocardiography is the most useful, widely available test in patients with suspected HF to establish the diagnosis
- It provides immediate information on chamber volumes, ventricular systolic and diastolic function, wall thickness, valve function and pulmonary hypertension

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Definition of heart failure

Type of HF		HFrEF	HFmrEF	HFpEF
CRITERIA	1	Symptoms ± Signs[a]	Symptoms ± Signs[a]	Symptoms ± Signs[a]
	2	LVEF <40%	LVEF 40–49%	LVEF ≥50%
	3	–	1. Elevated levels of natriuretic peptides[b]; 2. At least one additional criterion: a. relevant structural heart disease (LVH and/or LAE), b. diastolic dysfunction (for details see Section 4.3.2).	1. Elevated levels of natriuretic peptides[b]; 2. At least one additional criterion: a. relevant structural heart disease (LVH and/or LAE), b. diastolic dysfunction (for details see Section 4.3.2).

BNP = B-type natriuretic peptide; HF = heart failure; HFmrEF = heart failure with mid-range ejection fraction; HFpEF = heart failure with preserved ejection fraction; HFrEF = heart failure with reduced ejection fraction; LAE = left atrial enlargement; LVEF = left ventricular ejection fraction; LVH = left ventricular hypertrophy; NT-proBNP = N-terminal pro-B type natriuretic peptide.

[a]Signs may not be present in the early stages of HF (especially in HFpEF) and in patients treated with diuretics.

[b]BNP>35 pg/ml and/or NT-proBNP>125 pg/mL

Natriuretic peptides can not differentiate heart failure with preserved left ventricular ejection fraction from heart failure due to left ventricular systolic dysfunction

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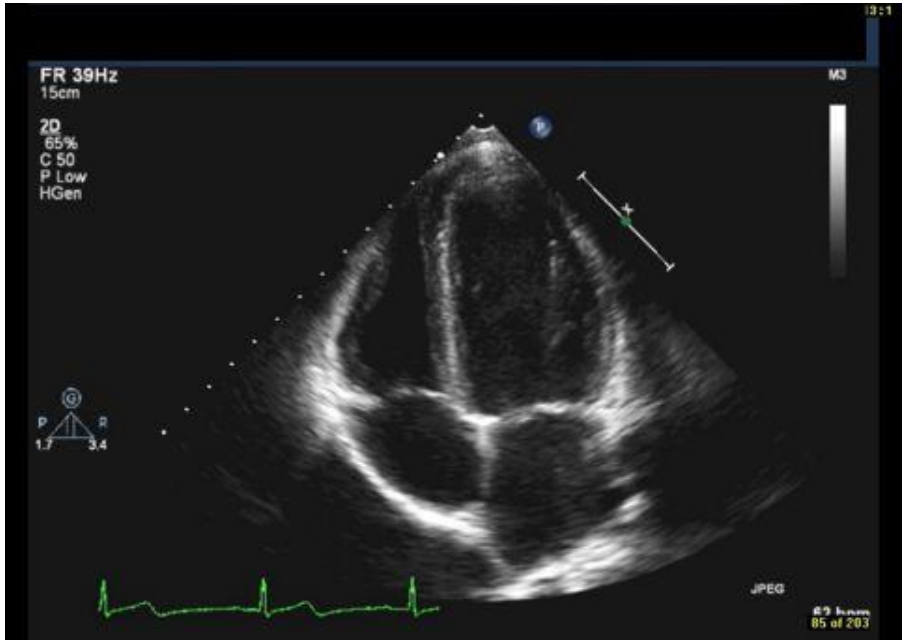
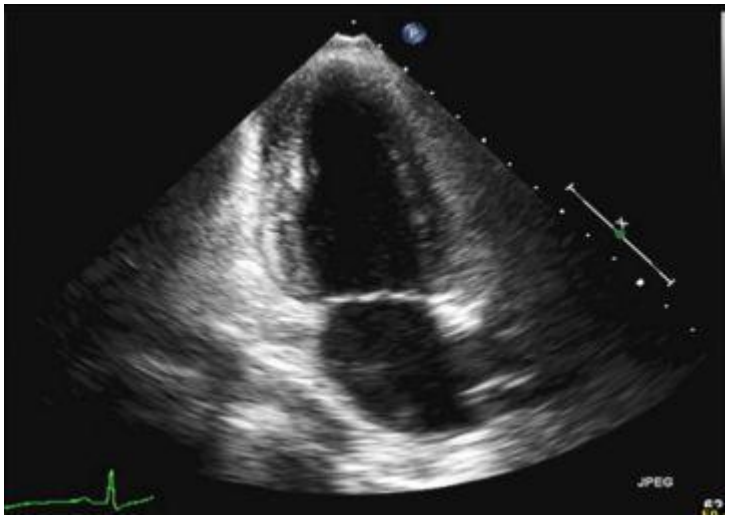
Echocardiography

For measurement of LVEF, the modified biplane Simpson's rule is recommended. LV end diastolic volume (LVEDV) and LV end systolic volume (LVESV) are obtained from

apical four and **two-chamber** views.





This method relies on accurate tracing of endocardial borders

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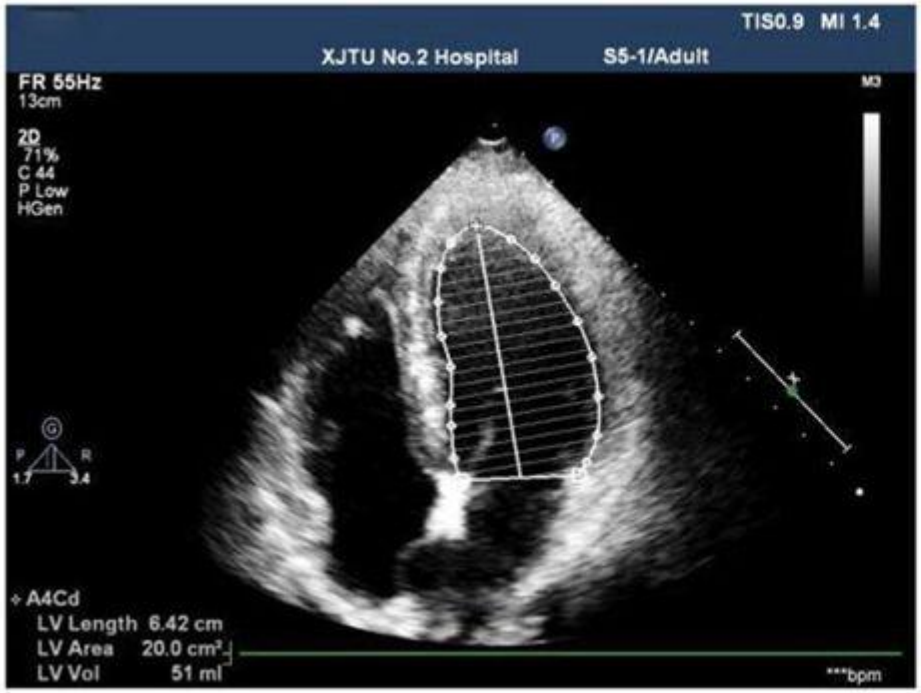

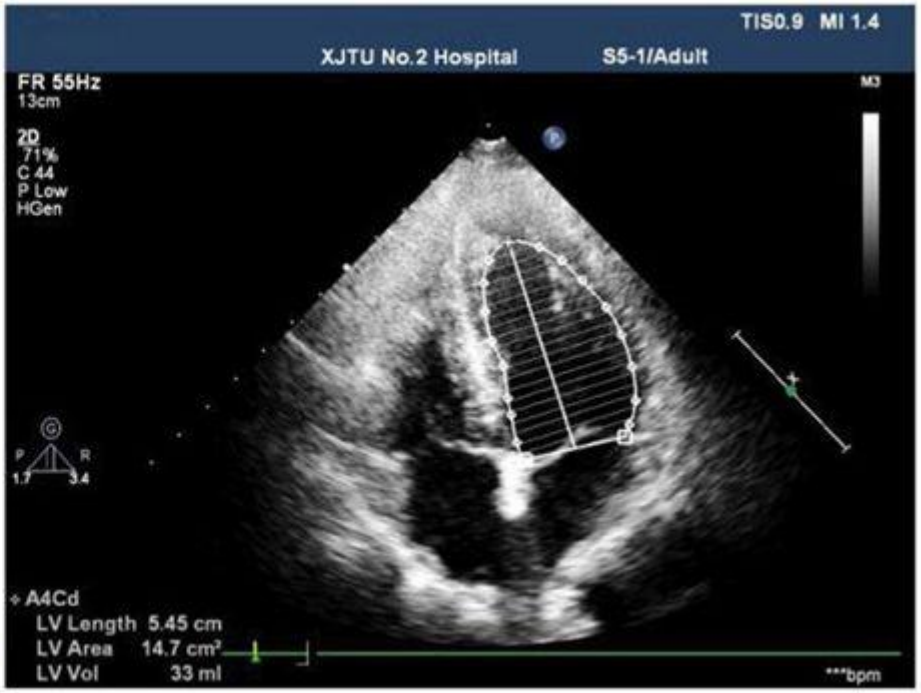

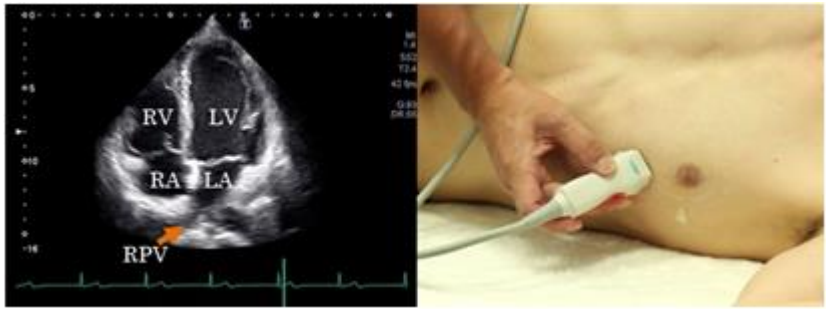

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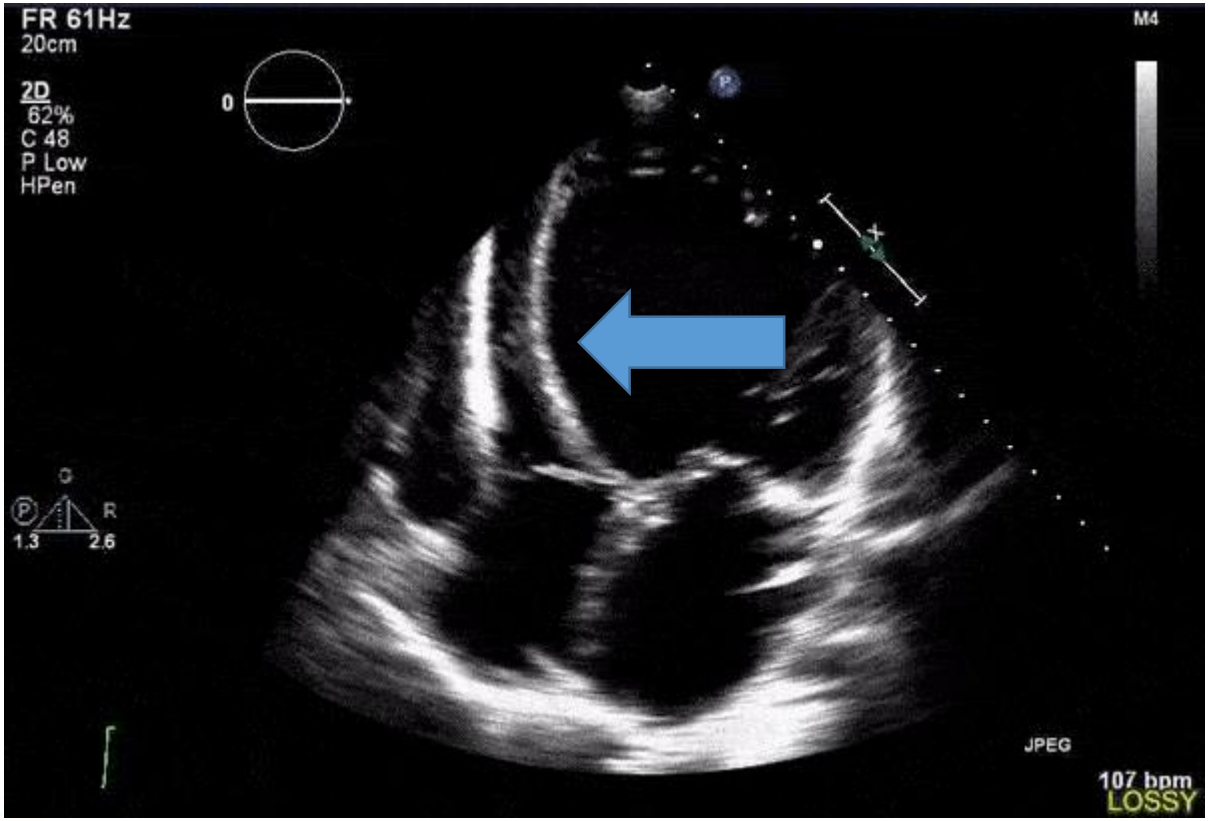
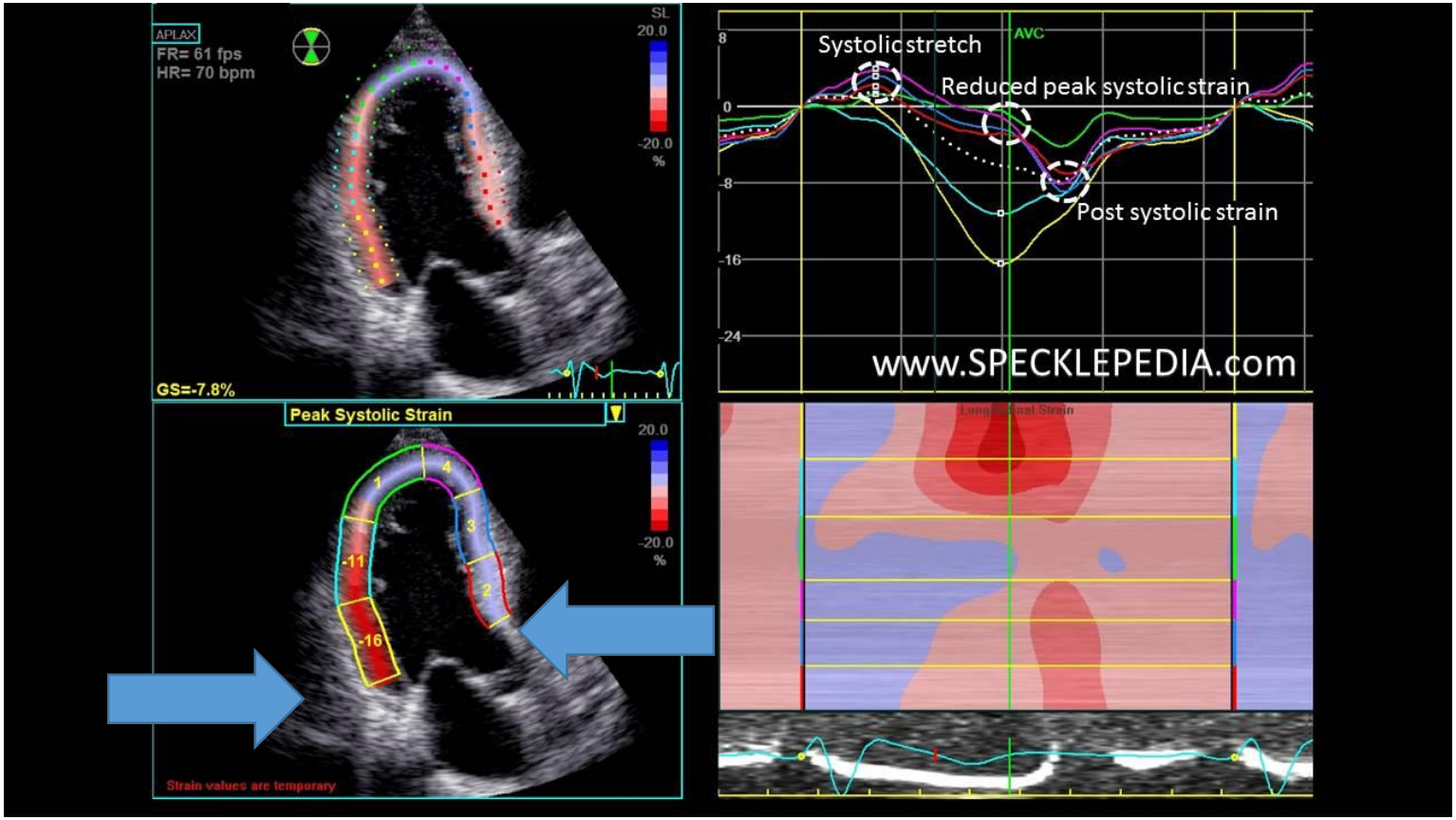
Mrs BL



Ant mi speckled tracking systolic strain



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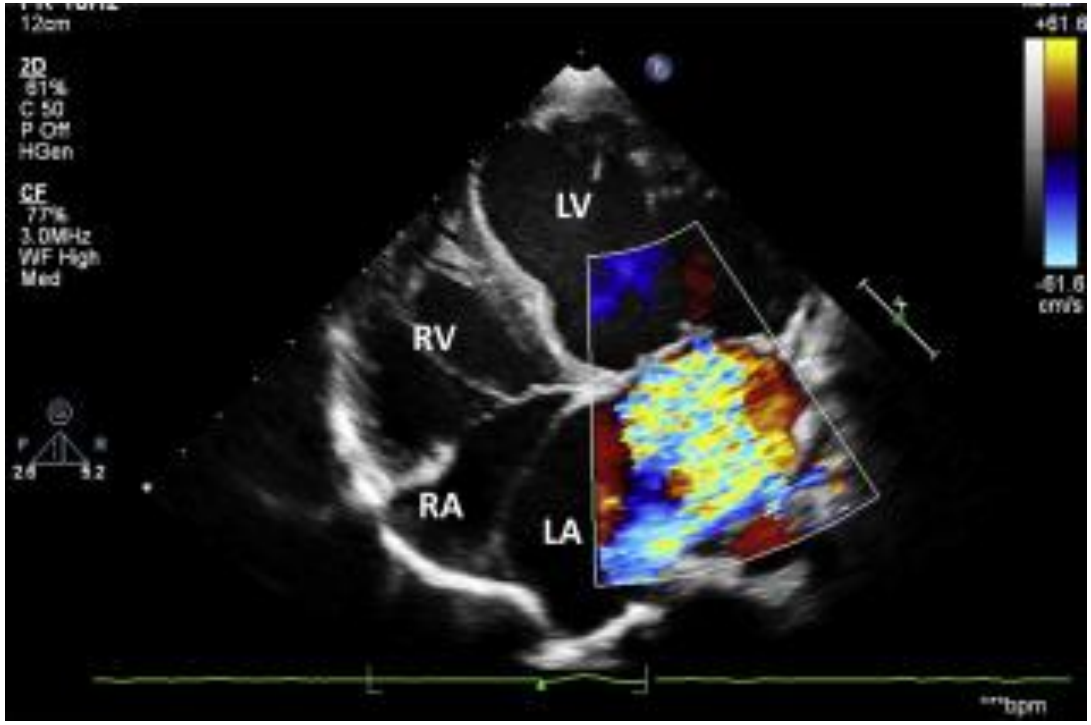
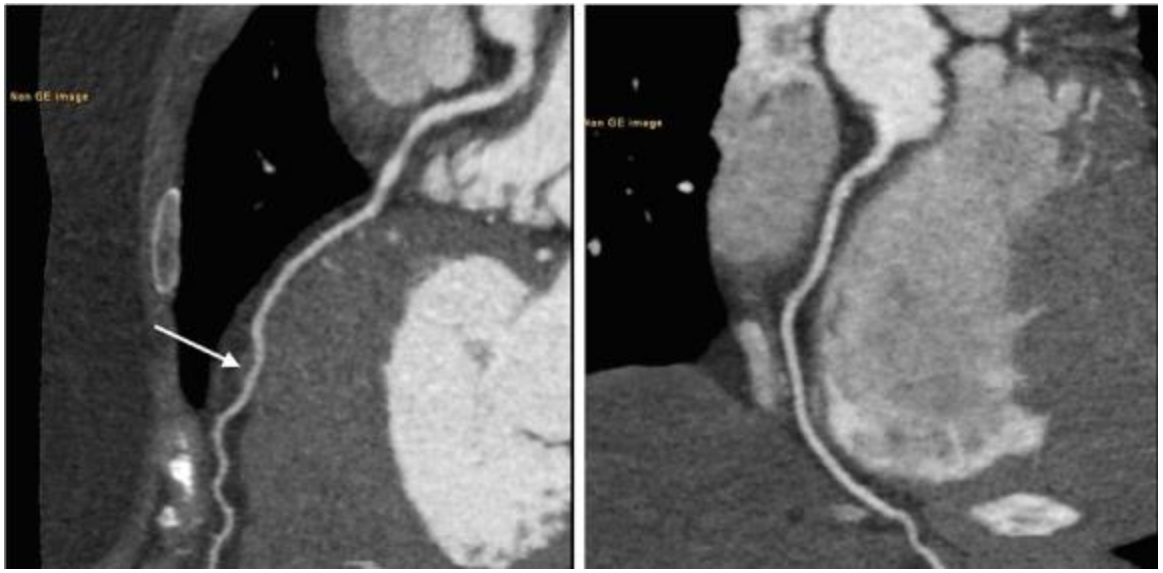
Severe MR seen on echo (Mrs BL)



CT Angiography



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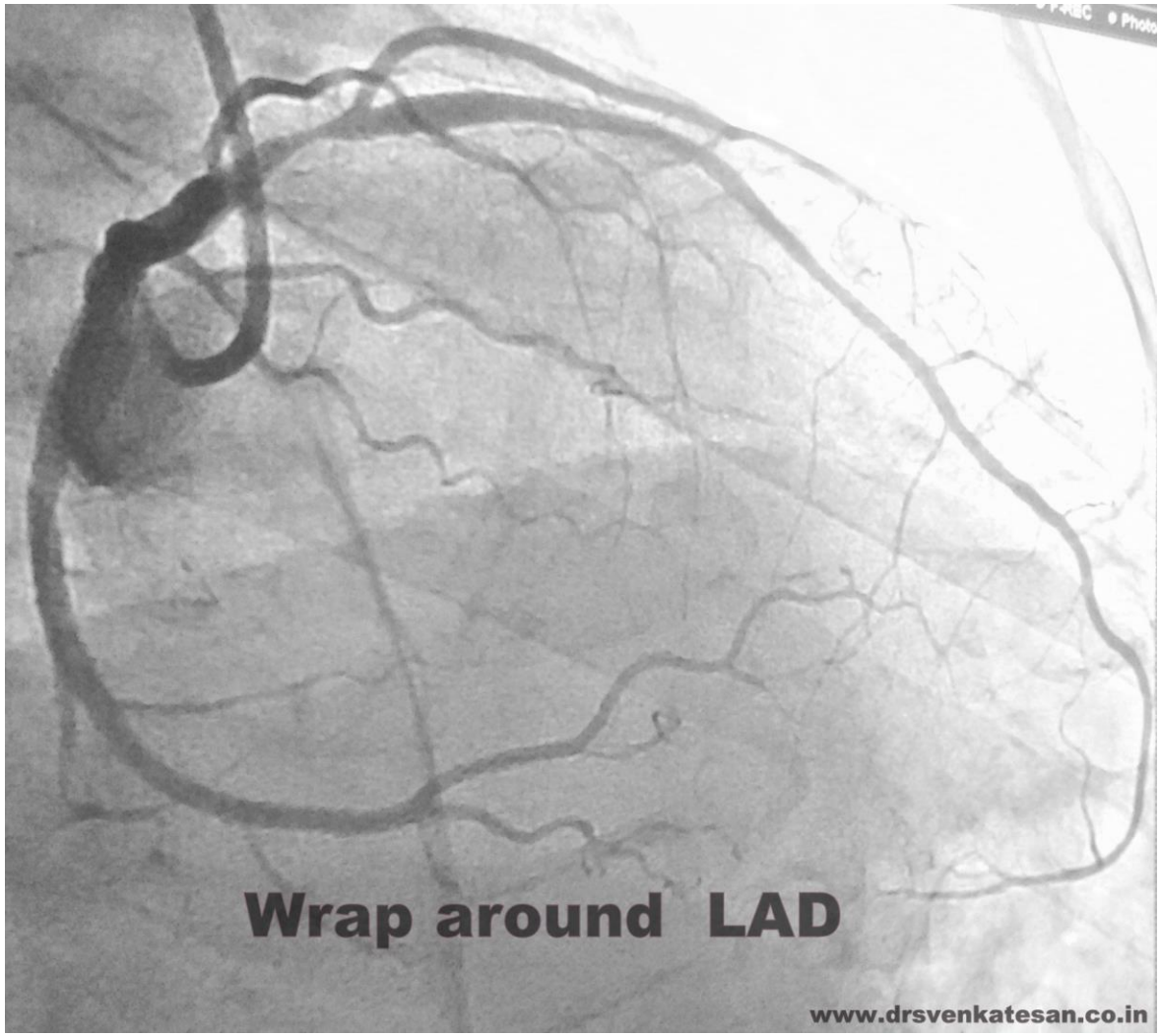
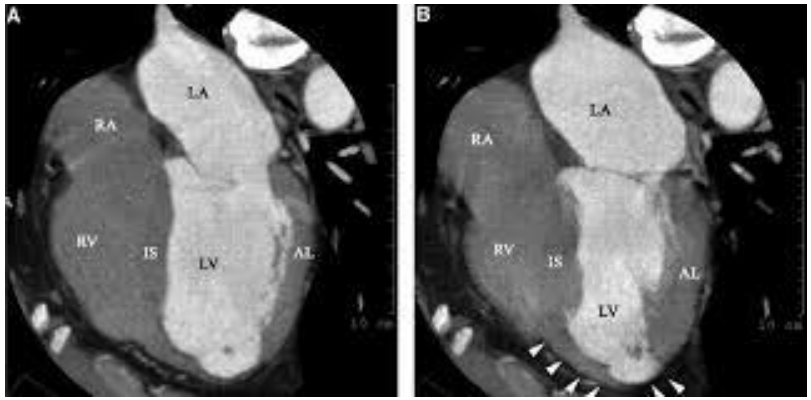
Coronary angiography



Cardiac MRI



Because of the widespread acceptance of echocardiography, MRI is used only infrequently in the workup of patients with CHF. Its main use involves delineation of congenital cardiac abnormalities and assessment of valvular heart disease; it is also used in patients with other more rare **infiltrative cardiomyopathy** conditions

Viability and fibrosis imaging can assist in identification of aetiology and assess prognosis

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Other diagnostic tests

The following diagnostic tests are recommended/should be considered for initial assessment of a patient with newly diagnosed HF in order to evaluate the patient's suitability for particular therapies, to detect reversible/treatable causes of HF and co-morbidities interfering with HF: - haemoglobin and WBC - sodium, potassium, urea, creatinine (with estimated GFR) - liver function tests (bilirubin, AST, ALT, GGTP) - glucose, HbA1c - lipid profile - TSH - ferritin, TSAT = TIBC - natriuretic peptides	I	C
	IIa	C

•urinalysis
•peak flow or spirometry.

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Iron studies

- An assessment for iron deficiency should be considered; about one third of heart failure patients are also iron deficient, which is associated with poor cardiac function and can worsen outcomes in these individuals.
- Iron deficiency appears to impair contractility of human cardiomyocytes by impairing mitochondrial respiration and reducing contractility and relaxation; these effects can be reversed by restoring intracellular iron levels
- Serum Ferritin and % Saturation Transferrin

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Endomyocardial biopsy

EMB should be considered in patients with rapidly progressive HF despite standard therapy when there is a probability of a specific diagnosis which can be confirmed only in myocardial samples and specific therapy is available and effective.	IIa	C

Endomyocardial biopsy is indicated only when a specific diagnosis is suspected that would influence therapy in patients presenting with heart failure

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Conclusions: Recommendations for diagnosing heart failure

- Take a careful and detailed history, and perform a clinical examination and tests to confirm the presence of heart failure
- **Refer patients with suspected heart failure and previous myocardial infarction urgently**, to have transthoracic Doppler 2D echocardiography and specialist assessment, preferably as early as possible

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Recommendations for diagnosing heart failure

- Because very high levels of serum natriuretic peptides carry a poor prognosis, refer patients with suspected heart failure and a BNPlevel above 400 pg/ml (116 pmol/litre) or an NTproBNPlevel above 2000 pg/ml (236 pmol/litre) urgently, to have transthoracic Doppler 2D echocardiography and specialist assessment
- Be aware that: obesity or treatment with diuretics, (ACE) inhibitors, beta-blockers, (ARBs) and aldosterone antagonists can reduce levels of serum natriuretic peptides

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Recommendations for diagnosing heart failure

- Perform transthoracic Doppler 2D echocardiography to exclude important valve disease, assess the systolic (and diastolic) function of the (left) ventricle, and detect intracardiac shunts
- Consider alternative methods of imaging the heart (for example, radionuclide angiography, cardiac magnetic resonance imaging or transoesophageal Doppler 2D echocardiography) when a poor image is produced by transthoracic Doppler 2D echocardiography

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Recommendations for diagnosing heart failure

- A serum BNP level less than 100 pg/ml (29 pmol/litre) or an NTproBNP level less than 400 pg/ml (47 pmol/litre) in an untreated patient makes a diagnosis of heart failure unlikely
- The level of serum natriuretic peptide does not differentiate between heart failure due to left ventricular systolic dysfunction and heart failure with preserved left ventricular ejection fraction

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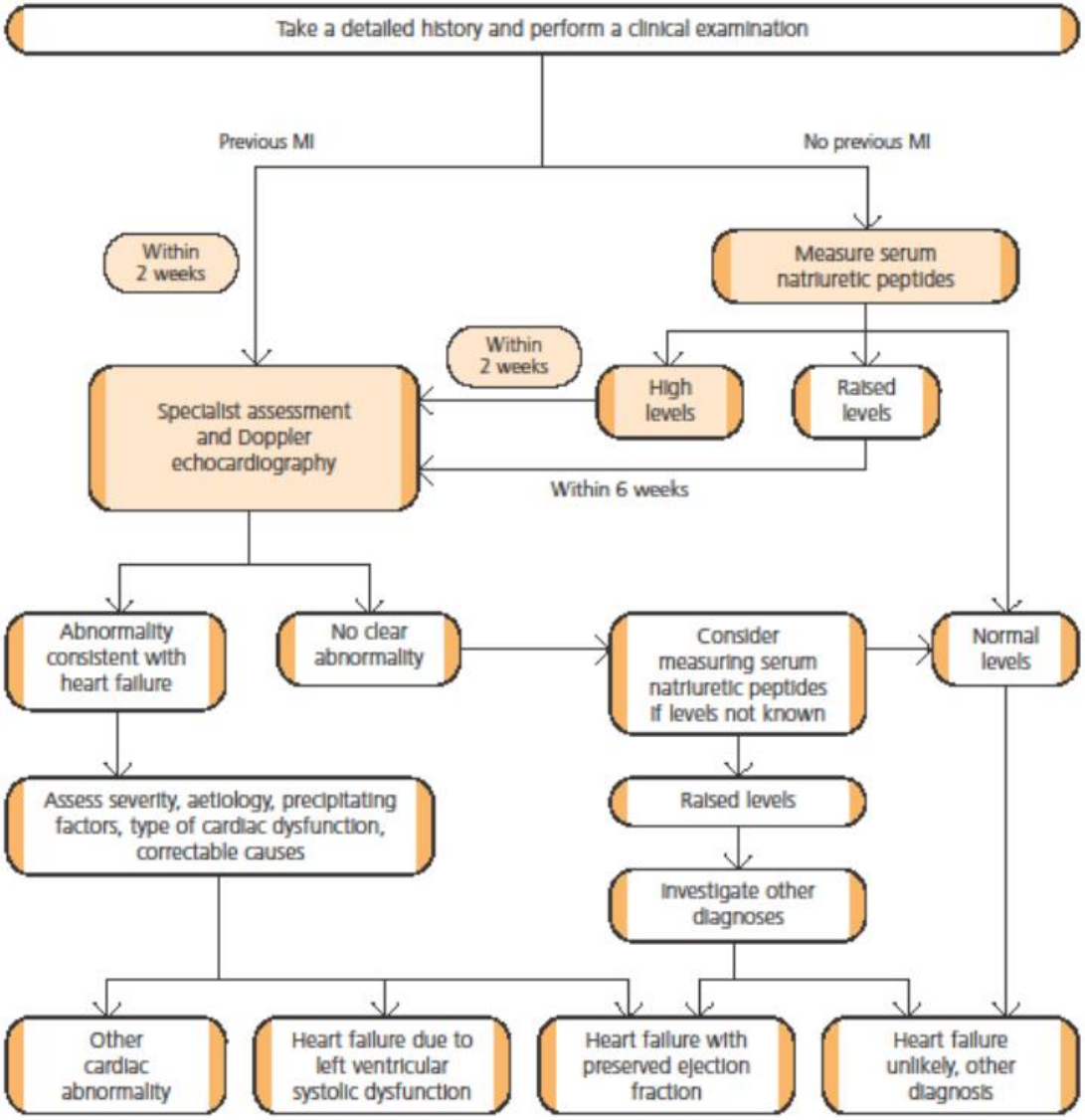
Diagnosing heart failure



Serum natriuretic peptides
High levels – BNP > 400 pg/ml (116 pmol/litre) or NTproBNP > 2000 pg/ml (236 pmol/litre)
Raised levels – BNP 100–400 pg/ml (29–116 pmol/litre) or NTproBNP 400–2000 pg/ml (47–236 pmol/litre)
Normal levels – BNP < 100 pg/ml (29 pmol/litre) or NTproBNP < 400 pg/ml (47 pmol/litre)

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Genetic testing in heart failure

- It is thought that approximately 20-50% of idiopathic dilated cardiomyopathy may have a genetic basis
- HCM, caused by mutation in one of the genes currently known to encode different components of the sarcomere, is characterized by LV hypertrophy in the absence of predisposing cardiac conditions
- Molecular genetic testing of any of the 14 genes currently known to encode different components of the sarcomere is clinically available

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Genetic testing in heart failure

- Autosomal dominant arrhythmogenic right ventricular dysplasia/cardiomyopathy is characterized by progressive fibrofatty replacement of the myocardium that predisposes to ventricular tachycardia
- It primarily affects the RV; with time, it may also involve the LV
- The mean age at diagnosis is 31 years
- Molecular genetic testing is available on a clinical basis

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End slide

- 71 year old woman
- “Silent” extensive anterior MI
- Complicated by severe MR
- Presentation in FC IV HF
- Diagnosed clinically , plus ECG and CXR
- Echocardiography and coronary angiography employed to give a comprehensive diagnosis
- Treated medically initially, then CABG and MVR
- Post operation course …..see you next year

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