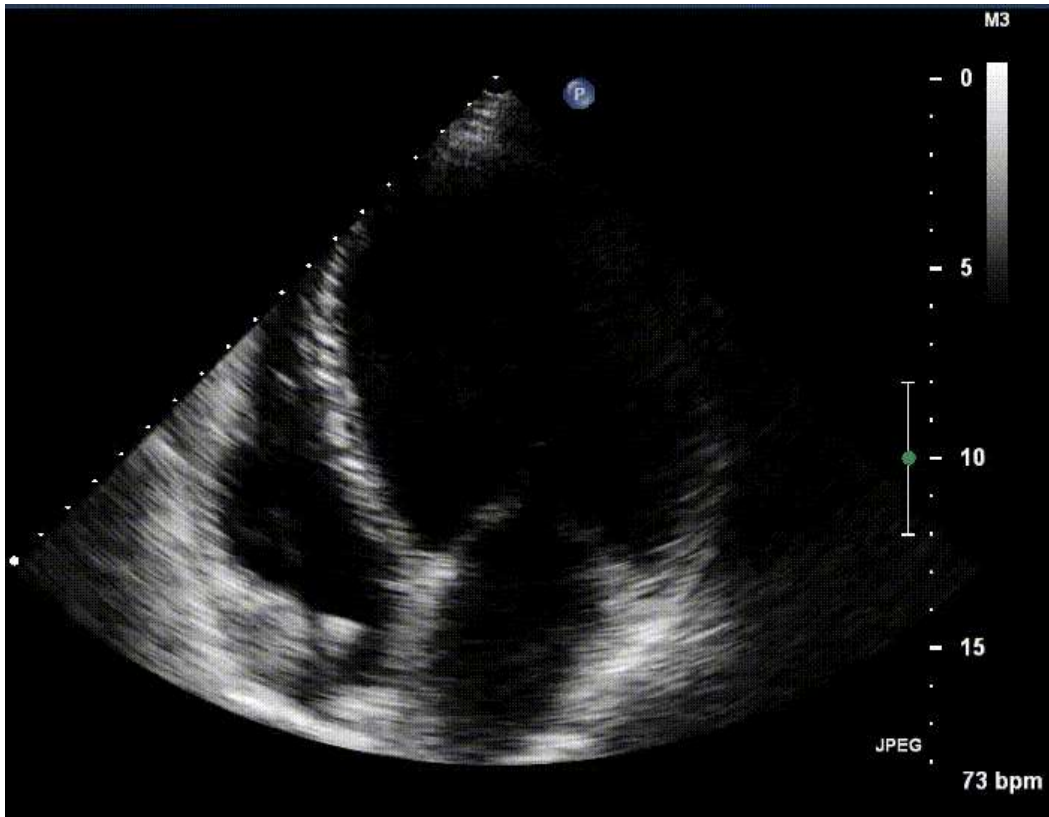
SERVIZIO SANITARIO REGIONALE
EMILIA-ROMAGNA
Azienda Ospedaliero - Universitaria di Parma

LO SCOMPENSO CARDIACO:

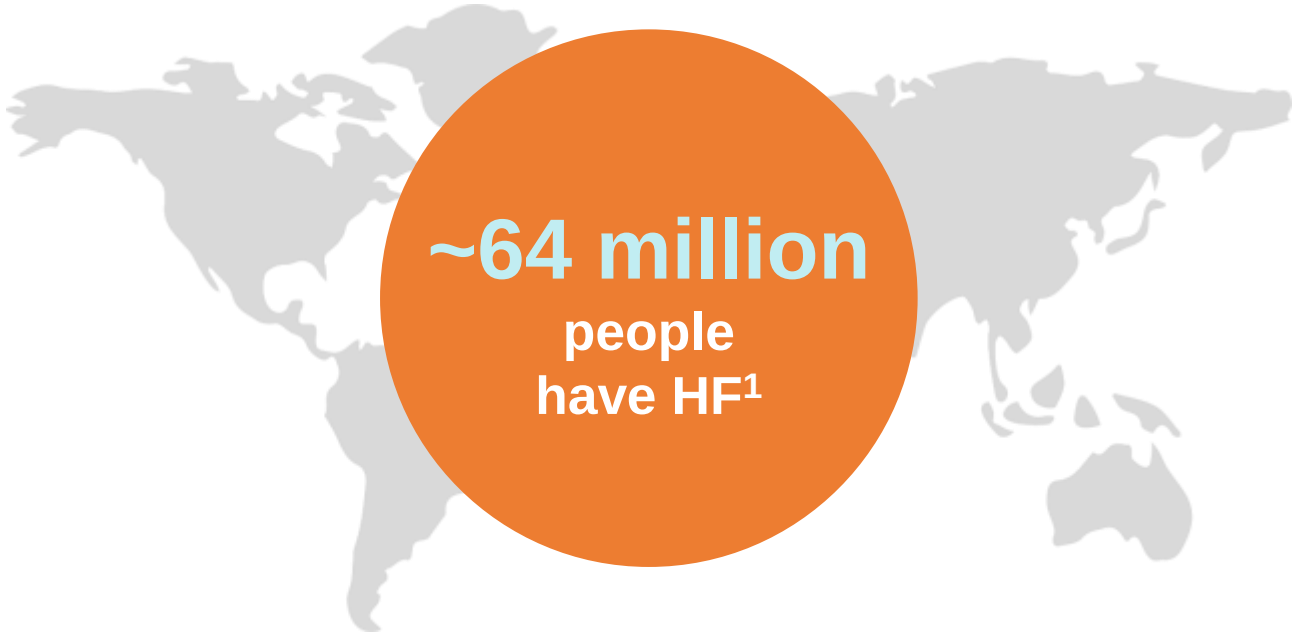
Inquadramento eziologico e percorso diagnostico nello scompenso cardiaco



Dott. Federico Barocelli

U.O. CARDIOLOGIA, AZIENDA OSPEDALIERO-UNIVERSITARIA DI PARMA

Heart Failure Is a Major Public Health Problem Worldwide



- Projected **~24% rise in cases** between 2012 and 2030[2]
- 5-year **mortality rate ~50%**[3]
- HF **mortality risk is similar** to some of the common cancers in both men and women[4]
- Economic burden **~350 billion US dollars**[2]

Number one cause of hospitalizations in people over 65 years of age[1,a]

Number one cause of unplanned hospital readmission[2]

US Data

HF = heart failure; HFpEF = heart failure with preserved ejection fraction; US = United States.

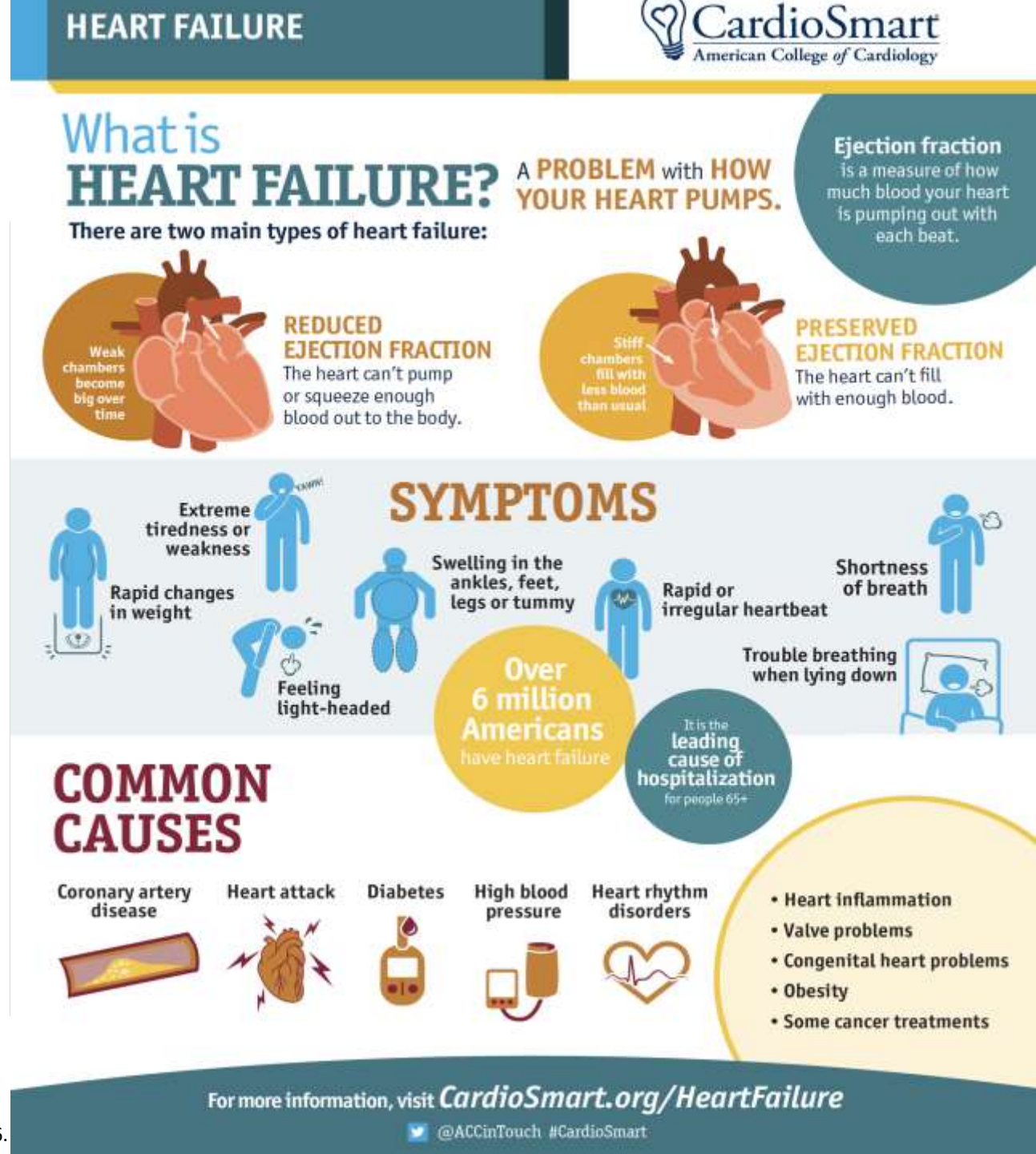
1. GBD 2017 Disease and Injury Incidence and Prevalence Collaborators. *Lancet.* 2018;392:1789-1858; 2. Lippi G et al. *AME Med J.* 2020;5:15; 3. Jones NR et al. *Eur J Heart Fail*. 2019;21:1306-1325; 4. Mamas AM et al. *Eur J Heart Fail*. 2017;19:1095-1104; 5. Omote K et al. Online ahead of print. *Annu Rev Med.* 2021.

What is heart failure?

Definition by Braunwald:
«A clinical syndrome caused by the inability of the heart to supply blood to the tissues commensurate to the metabolic needs of that tissue
or only at the expense of elevated filling pressures»

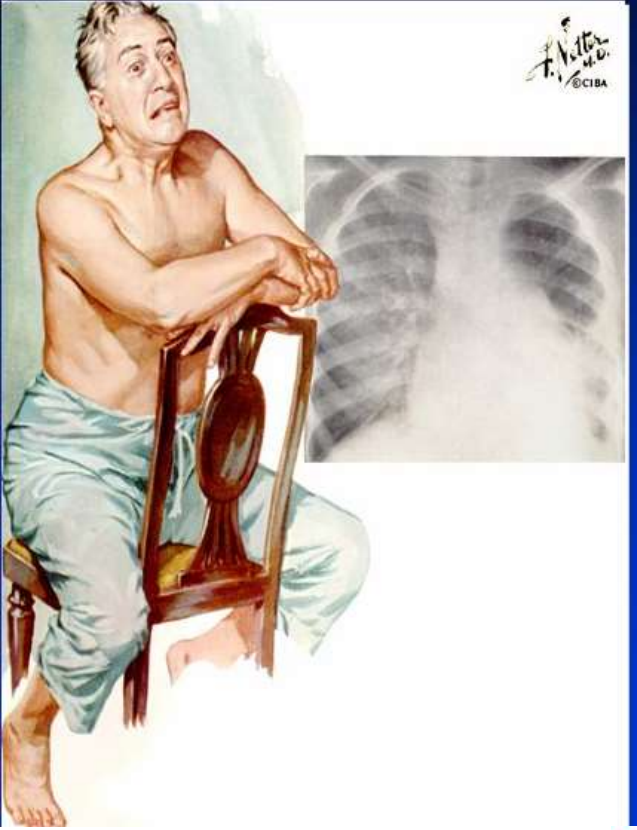
Proposed Universal Definition of HF[1]

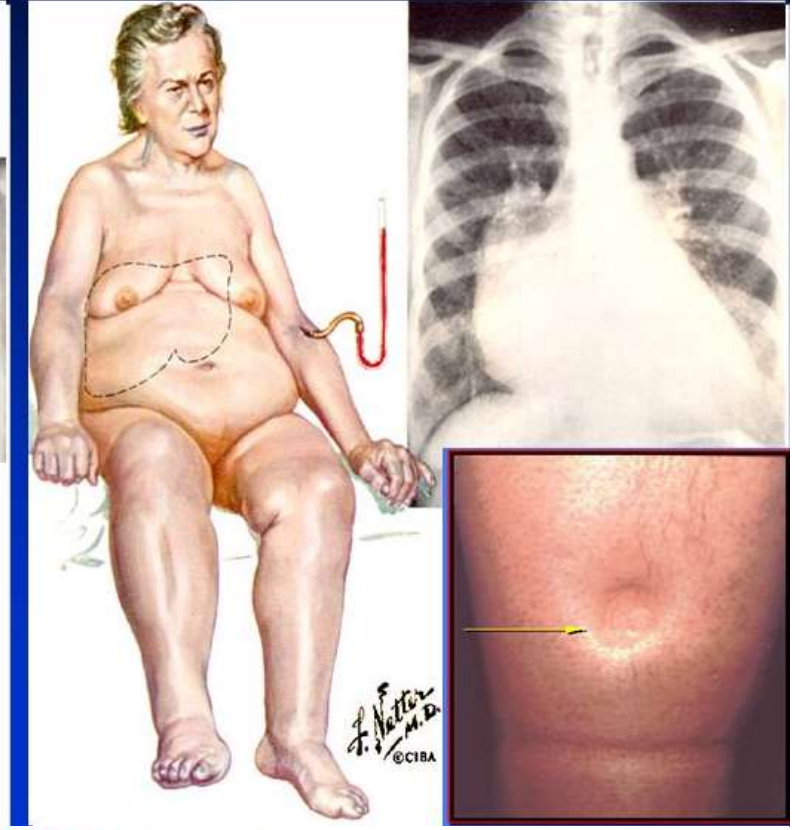
Clinical syndrome with symptoms and/or signs caused by a structural and/or functional cardiac abnormality and corroborated by elevated natriuretic peptide levels and/or objective evidence of pulmonary or systemic congestion.



EF = ejection fraction; HF = heart failure; LVEF = left ventricular ejection fraction.

1. Bozkurt B et al. *Eur J Heart Fail*. 2021;23:352-380; 2. McDonagh TA et al. *Eur Heart J*. 2021;42:3599-3726.

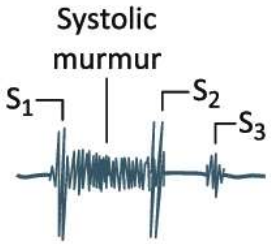




Heart failure signs and symptoms

Left-Sided Cardiac Heart Failure

Cardiac auscultation for third heart sounds (S_3) and murmurs should be performed in standard positions, including that with the patient sitting forward.



Chest auscultation reveals bilateral rales and pleural effusions (when CHF is chronic).

Cyanosis of lips and nail beds may be present if the patient is hypoxic.

Patients with left-sided CHF may be uncomfortable lying down.

NYHA Functional Classification

Table 4 New York Heart Association functional classification based on severity of symptoms and physical activity

Class I	No limitation of physical activity. Ordinary physical activity does not cause undue breathlessness, fatigue, or palpitations.
Class II	Slight limitation of physical activity. Comfortable at rest, but ordinary physical activity results in undue breathlessness, fatigue, or palpitations.
Class III	Marked limitation of physical activity. Comfortable at rest, but less than ordinary activity results undue breathlessness, fatigue, or palpitations.
Class IV	Unable to carry on any physical activity without discomfort. Symptoms at rest can be present. If any physical activity is undertaken, discomfort is increased.

ESC European Society of Cardiology

McDonagh T.A. et al. *2021 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure*, EHJ 2020

Universal definition and classification of heart failure: a report of the Heart Failure Society of America, Heart Failure Association of the European Society of Cardiology, Japanese Heart Failure Society and Writing Committee of the Universal Definition of Heart Failure

European Journal of Heart Failure (2021) **23**, 352–380
doi:10.1002/ejhf.2115

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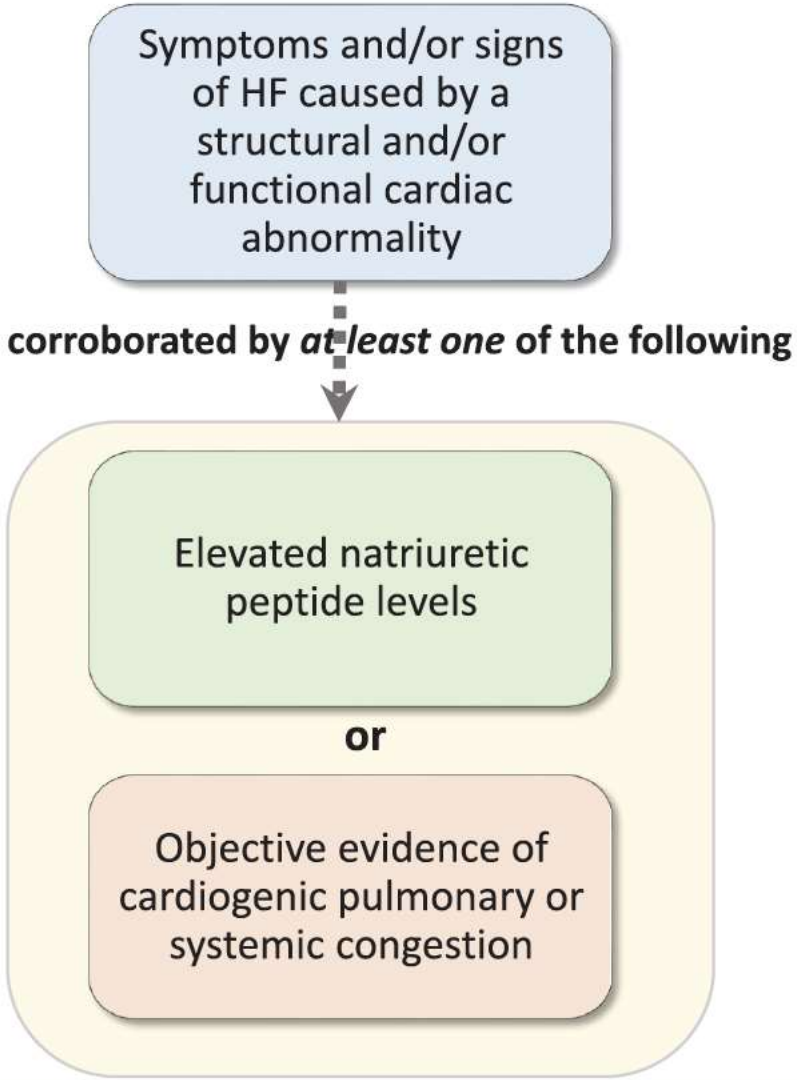


Table 6 Symptoms and signs of heart failure

Symptoms of heart failure	
Typical	Breathlessness
	Orthopnoea[a]
	Paroxysmal nocturnal dyspnoea[a]
	Reduced exercise tolerance[a]
	Fatigue, tiredness[b]
	Ankle swelling[a]
	Inability to exercise[a]
	Swelling of parts of the body other than ankles
	Bendopnoea
Less typical	Nocturnal cough
	Wheezing
	Bloated feeling[c]
	Postprandial satiety[c]
	Loss of appetite
	Decline in cognitive function, confusion (especially in the elderly)[b]
	Depression
	Dizziness, syncope[b]
Signs of heart failure	
More specific	Elevated jugular venous pressure[a]
	Third heart sound[a]
	Summation gallop with third and fourth heart sounds
	Cardiomegaly, laterally displaced apical impulse
	Hepatojugular reflux
	Cheyne–Stokes respiration in advanced heart failure[b]
Less specific	Peripheral oedema (ankle, sacral, scrotal)
	Pulmonary rales[a]
	Unintentional weight gain (>2 kg/week)
	Weight loss (in advanced heart failure) with muscle wasting and cachexia
	Cardiac murmur
	Reduced air entry and dullness to percussion at lung bases suggestive of pleural effusion
	Tachycardia, irregular pulse
	Tachypnoea
	Hepatomegaly/ascites
	Cold extremities[b]
	Oliguria
	Narrow pulse pressure

Table 7 Natriuretic peptide levels supporting definition of heart failure

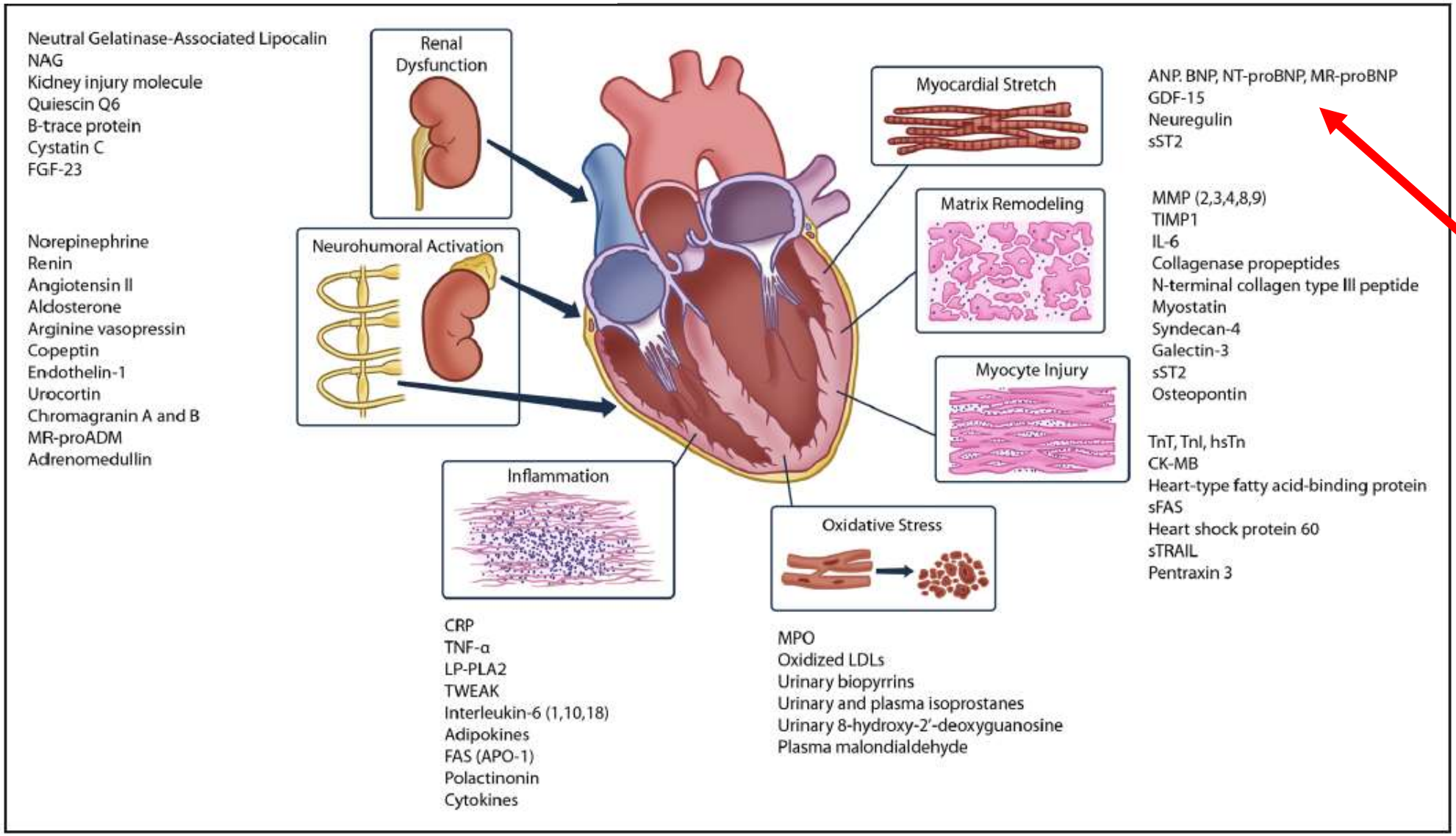
	Ambulatory	Hospitalized/ decompensated
BNP, pg/ml	≥35	≥ 100
NT-proBNP, pg/ml	≥ 125	≥ 300

Causes of elevated natriuretic peptide levels other than primary diagnosis of heart failure	
Cardiovascular causes	Acute coronary syndrome, myocardial infarction
	Pulmonary embolism
	Myocarditis
	Hypertrophic cardiomyopathy
	Valvular heart disease
	Congenital heart disease
	Atrial or ventricular arrhythmias
	Heart contusion, cardiac infiltration or malignancy
	Cardioversion, ICD shock
	Pericardial disease
	Invasive or surgical procedures involving th heart
	Pulmonary hypertension, right ventricular failure
	Infiltrative cardiomyopathies
Non-cardiovascular causes	Advanced age
	Kidney disease
	Critical illnesses including sepsis syndrome, cytokine syndrome
	Ischaemic or haemorrhagic stroke
	Pulmonary disease (pneumonia, chronic obstructive pulmonary disease)
	Liver disease
	Severe anaemia
	Severe metabolic and hormone abnormalities (e.g. thyrotoxicosis, diabe ketoacidosis, severe burns)
Causes of lower natriuretic peptide levels	
	Obesity, or increased BMI
	Pericardial disease[a]

Established and Emerging Roles of Biomarkers in Heart Failure

Nasrien E. Ibrahim, James L. Januzzi Jr

Circulation Research is available at https://www.ahajournals.org/journal/res
DOI: 10.1161/CIRCRESAHA.118.312706



Myocardial Stretch Biomarkers: BNP and NT-proBNP.
Left ventricular wall stress is the most potent trigger for release of natriuretic peptides

Figure. Various pathophysiologic pathways contributing to the development and progression of heart failure and biomarkers representative the various pathways. ANP indicates atrial natriuretic peptide; APO, apolipoprotein; BNP, B-type natriuretic peptide; CK-MB, creatinine kinase-muscle/brain; CRP, C-reactive protein; FAS, Fas cell surface death receptor; GDF, growth differentiation factor; hsTn, high-sensitivity troponin; IL, interleukin; LDL, low-density lipoprotein; LP-PLA2, lipoprotein-associated phospholipase A2; MMP, matrix metalloproteinases; MPO, myeloperoxidase; MR-proADM, midregional proadrenomedullin; MR-proBNP, midregional pro-B-type natriuretic peptide; NT-proBNP, N-terminal pro-B-type natriuretic peptide; sFAS, soluble Fas cell surface death receptor; sST2, soluble ST2; sTRAIL, soluble TNF-related apoptosis-inducing ligand; TIMP, tissue inhibitors of metalloproteinases; TNF, tumor necrosis factor; TnI, troponin I; and TnT, troponin T.

ESC European Society of Cardiology
European Heart Journal (2021) 42, 3599–3726
doi:10.1093/eurheartj/ehab368

McDonagh T.A. et al.

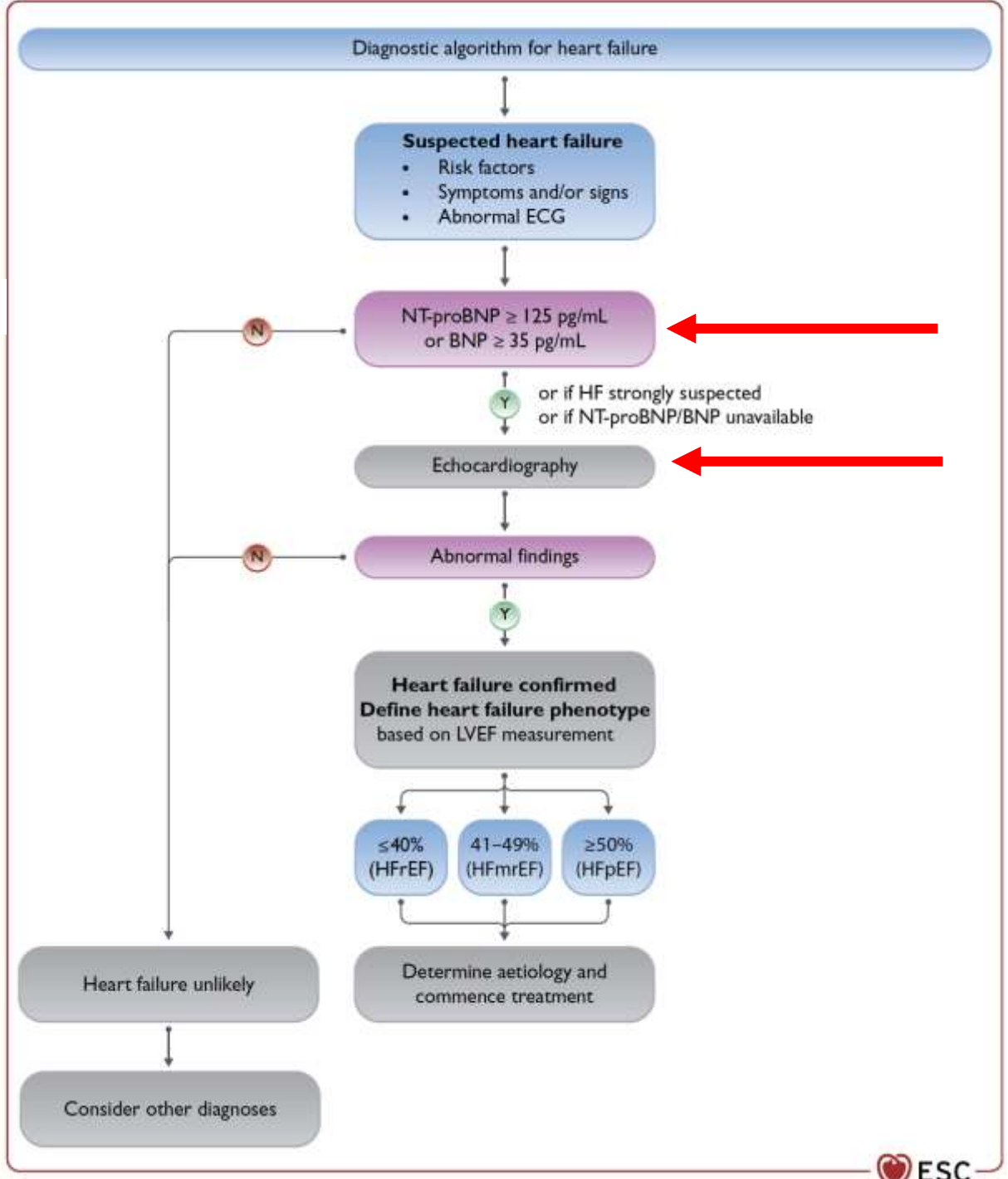
2021 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure

The diagnostic algorithm for heart failure

Recommended diagnostic tests in all patients with suspected chronic heart failure

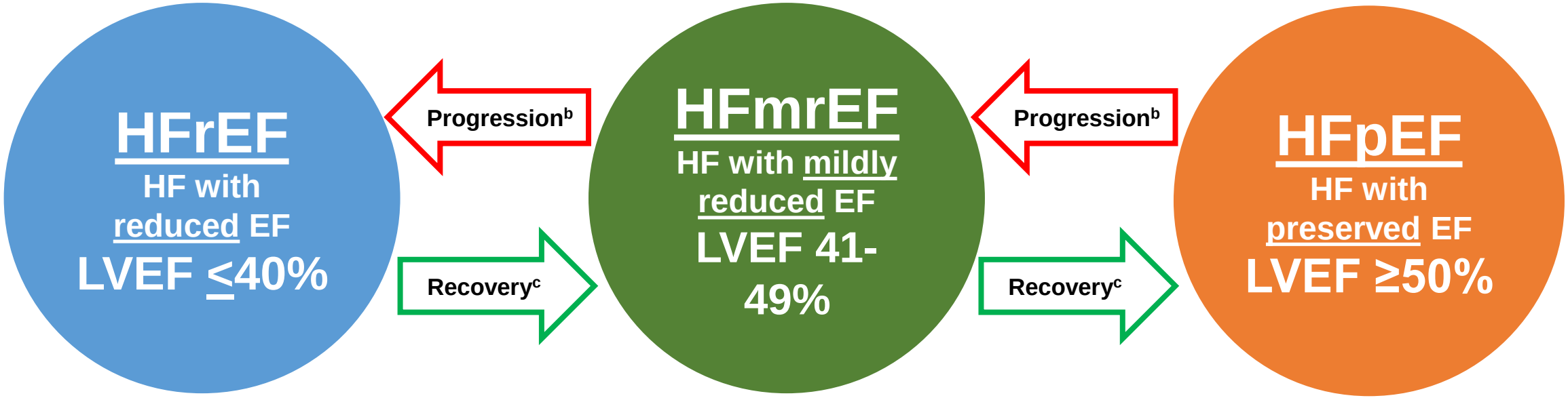
Recommendations	Class[a]	Level[b]
BNP/NT-proBNP[c]	I	B
12-lead ECG	I	C
Transthoracic echocardiography	I	C
Chest radiography (X-ray)	I	C
Routine blood tests for comorbidities, including full blood count, urea and electrolytes, thyroid function, fasting glucose and HbA1c, lipids, iron status (TSAT and ferritin)	I	C

BNP = B-type natriuretic peptide; ECG = electrocardiogram; HbA1c = glycated haemoglobin; NT-proBNP = N-terminal pro-B-type natriuretic peptide; TSAT = transferrin saturation. (a) Class of recommendation. (b) Level of evidence. (c) References are listed in section 4.2 for this item.



Changes in LVEF Occur Over Time and Are Associated With Specific Patient Characteristics

HF Categories According to LVEF [1,2]



Factors associated with progression[a]:

Diabetes, ischemic heart disease, lack of specialized HF follow-up, higher NT-proBNP levels

Factors associated with recovery[b]:

Younger age, female, lower HF severity, shorter HF duration, fewer comorbidities

Data from patients with ≥2 EF measurements in the SwedeHF study (N=4942) between May 2000 and December 2012.

[a]EF decrease; [b]EF increase. 1. Bozkurt B et al. *Eur J Heart Fail*. 2021;23:352-380; 2. McDonagh TA et al. *Eur Heart J*. 2021;42:3599-3726.

EF = ejection fraction; HF = heart failure; HFmrEF = heart failure with mildly reduced ejection fraction; HFpEF = heart failure with preserved ejection fraction; HFrEF = heart failure with reduced ejection fraction; LVEF = left ventricular ejection fraction; NT-proBNP = N-terminal pro-B-type natriuretic peptide.

Savarese G et al. *JACC Heart Fail*. 2019;7:306-317.

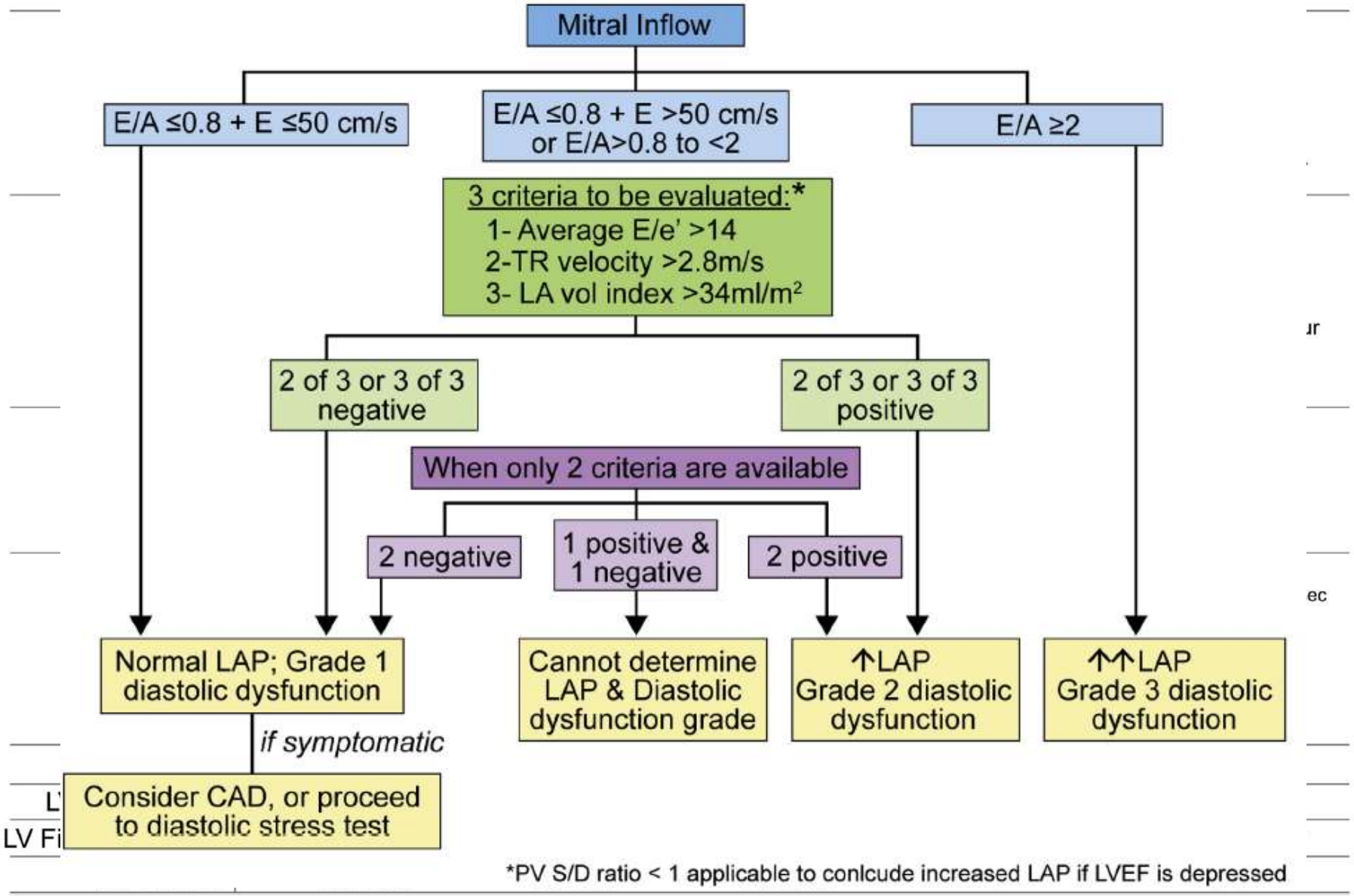
Pathophysiology and Echocardiographic Diagnosis of Left Ventricular Diastolic Dysfunction

Jeffrey J. Silbiger, MD, New York, New York

Journal of the American Society of Echocardiography
Volume 32 Number 2 February 2019

Characteristic hemodynamic pressure and Doppler echocardiographic findings seen with different LV filling patterns

Estimating LAP in Patients with Diastolic Dysfunction



ORIGINAL RESEARCH ARTICLE

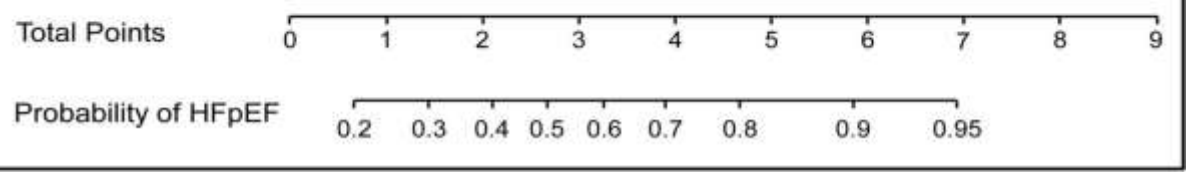
A Simple, Evidence-Based Approach to Help Guide Diagnosis of Heart Failure With Preserved Ejection Fraction

Circulation

Reddy Y.N.V. et al.

Circulation. 2018;138:861–870. DOI: 10.1161/CIRCULATIONAHA.118.034646

	Clinical Variable	Values	Points
H_2	**H**eavy	Body mass index > 30 kg/m²	2
	Hypertensive	2 or more antihypertensive medicines	1
F	Atrial **F**ibrillation	Paroxysmal or Persistent	3
P	**P**ulmonary Hypertension	Doppler Echocardiographic estimated Pulmonary Artery Systolic Pressure > 35 mmHg	1
E	**E**lder	Age > 60 years	1
F	**F**illing Pressure	Doppler Echocardiographic E/e' > 9	1
H_2FPEF score			Sum (0-9)



ESC European Society of Cardiology
European Heart Journal (2019) 40, 3297–3317
doi:10.1093/eurheartj/ehz641

Pieske B. et al.

How to diagnose heart failure with preserved ejection fraction: the HFA–PEFF diagnostic algorithm: a consensus recommendation from the Heart Failure Association (HFA) of the European Society of Cardiology (ESC)

	Functional	Morphological	Biomarker (SR)	Biomarker (AF)
Major	septal e' < 7 cm/s or lateral e' < 10 cm/s or Average E/e' ≥ 15 or TR velocity > 2.8 m/s (PASP > 35 mmHg)	LAVI > 34 ml/m² or LVMI ≥ 149/122 g/m² (m/w) and RWT > 0,42 #	NT-proBNP > 220 pg/ml or BNP > 80 pg/ml	NT-proBNP > 660 pg/ml or BNP > 240 pg/ml
Minor	Average E/e' 9 -14 or GLS < 16 %	LAVI 29-34 ml/m² or LVMI > 115/95 g/m² (m/w) or RWT > 0,42 or LV wall thickness ≥ 12 mm	NT-proBNP 125-220 pg/ml or BNP 35-80 pg/ml	NT-proBNP 365-660 pg/ml or BNP 105-240 pg/ml

Major Criteria: 2 points

Minor Criteria: 1 point

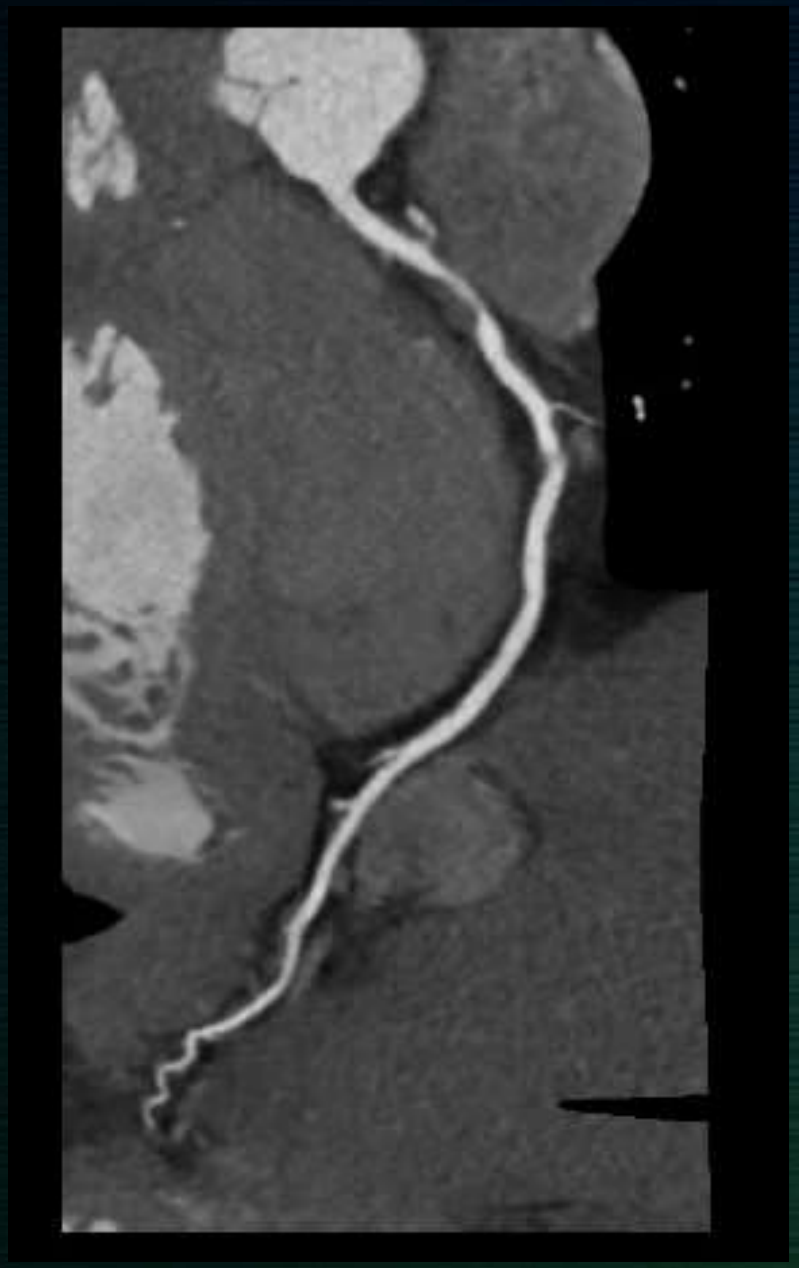
≥ 5 points: HFpEF

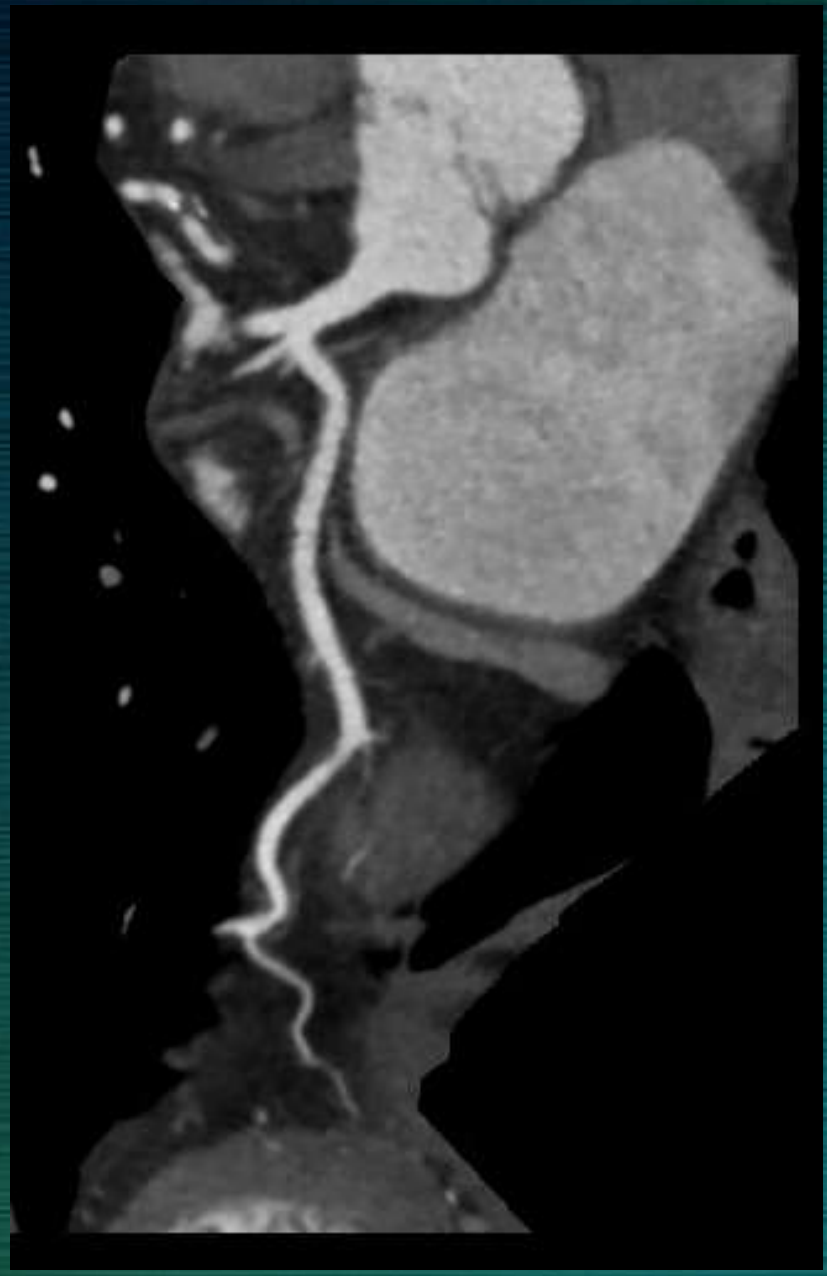
2-4 points: Diastolic Stress Test or Invasive Haemodynamic Measurements

HFpEF diagnosis

Advanced diagnostic tests: computed tomography (CT)

Critical stenosis with remodeled plaque on RCA (right coronary artery)



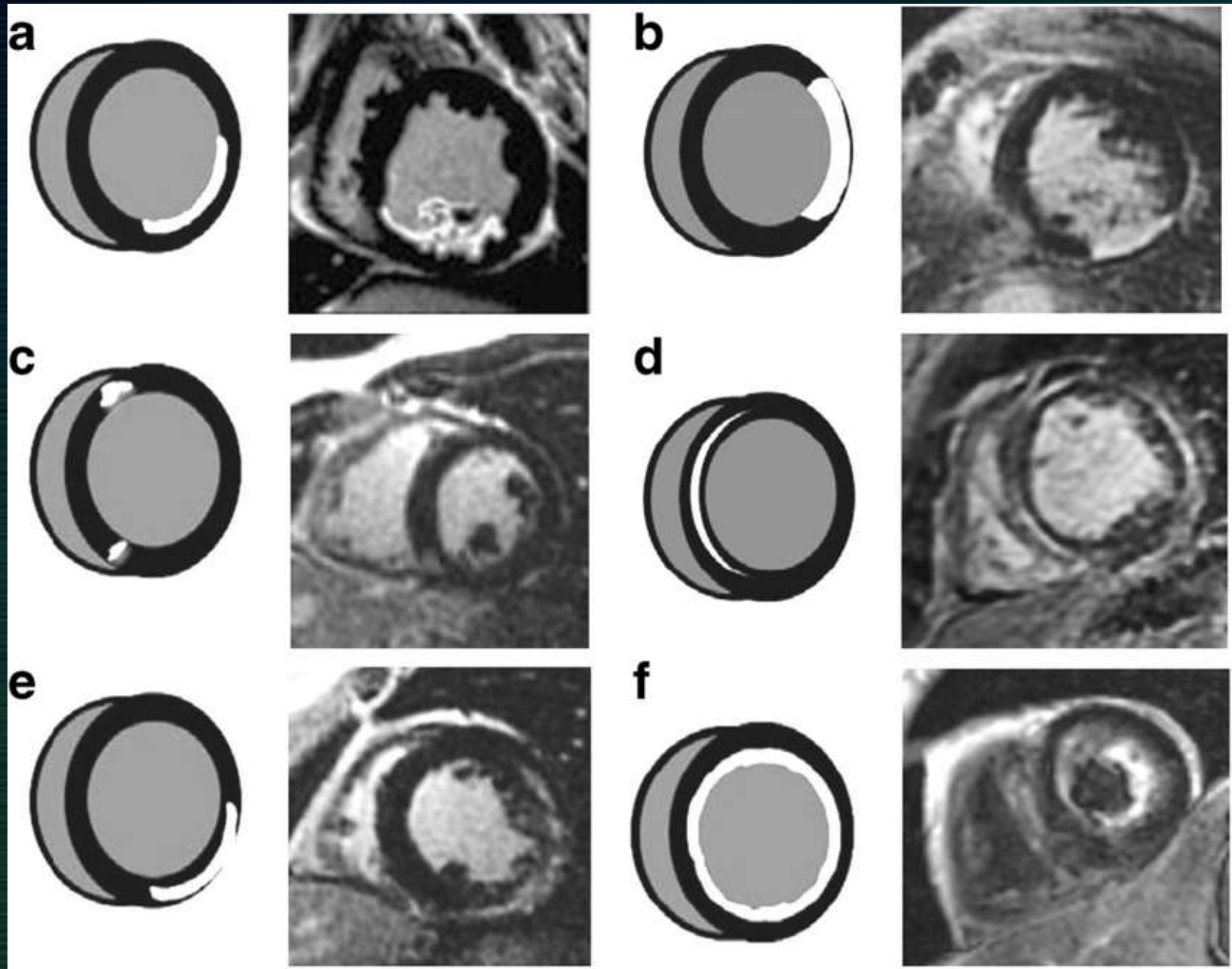


Advanced diagnostic tests

Cardiac Magnetic Resonance Imaging (CMR)

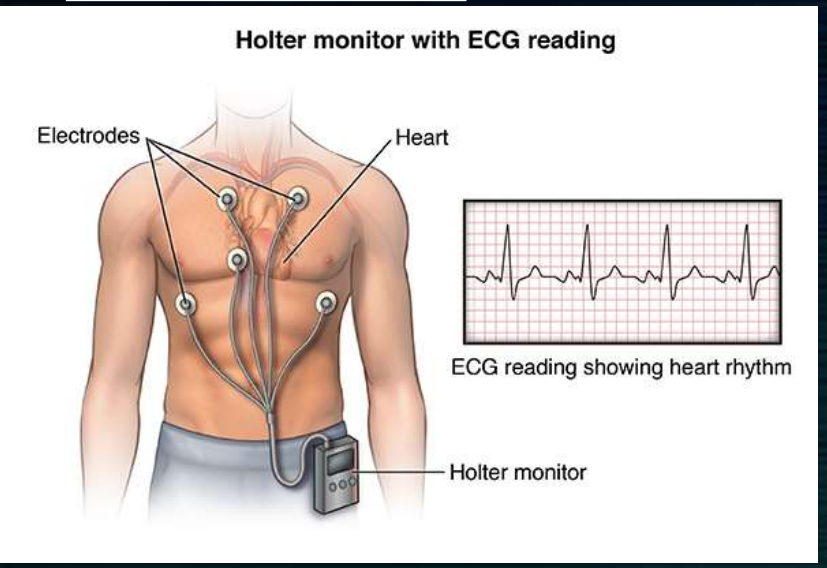
CMR represents the "gold standard" for the evaluation of cardiac morphology, function, and mass and is extremely useful for obtaining additional information for diagnostic, therapeutic, and prognostic purposes. It is the only non-invasive method at our disposal for tissue characterization, particularly through the assessment of the presence of "late gadolinium enhancement" (LGE), an increase in signal caused by the contrast medium lingering in the interstitial tissue, mostly attributable to fibrotic replacement.
The distribution of LGE in the myocardium provides diagnostic indications (non-ischemic patterns: "mid-wall" and/or subepicardial) useful in differentiation from ischemic forms, and its detection has significant prognostic implications, in terms of distribution site and percentage compared to healthy myocardium.

New promising MRI techniques include the evaluation of "**T1-mapping**" and **extracellular volume**, allowing for the quantification of unorganized fibrosis not visible through standard post-contrast methods.

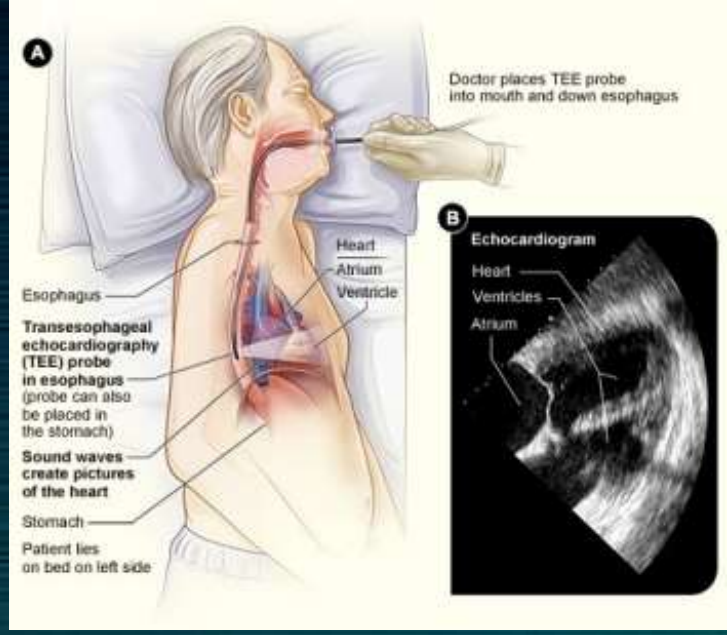


Advanced diagnostic tests

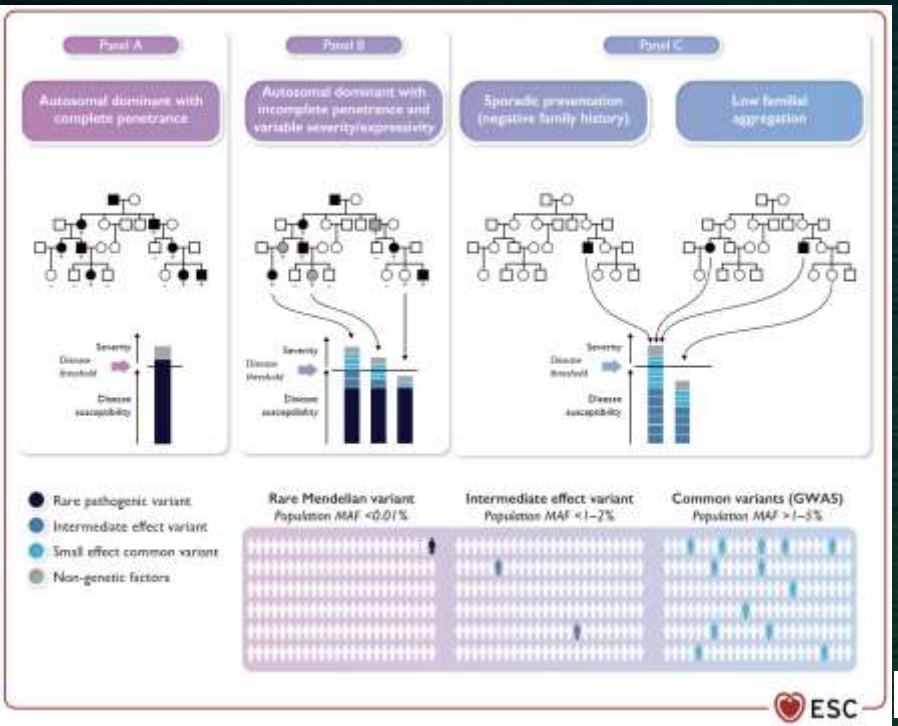
24-Hour Holter ECG/ 48-Hour Holter ECG



Transesophageal echocardiogram



Genetic analysis



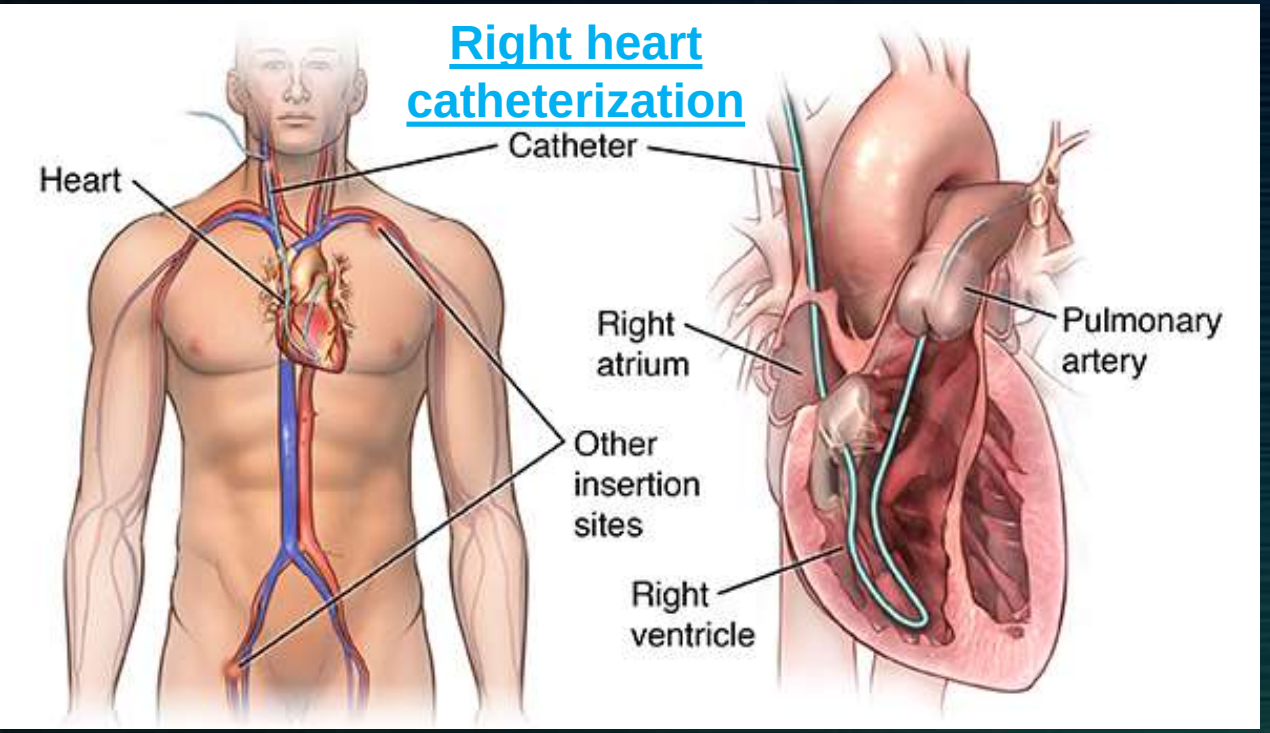
2023 ESC Guidelines for the management of cardiomyopathies

2023 ESC Guidelines for the management of cardiomyopathies (European Heart Journal; 2023 – doi:10.1093/eurheartj/ehad 194)

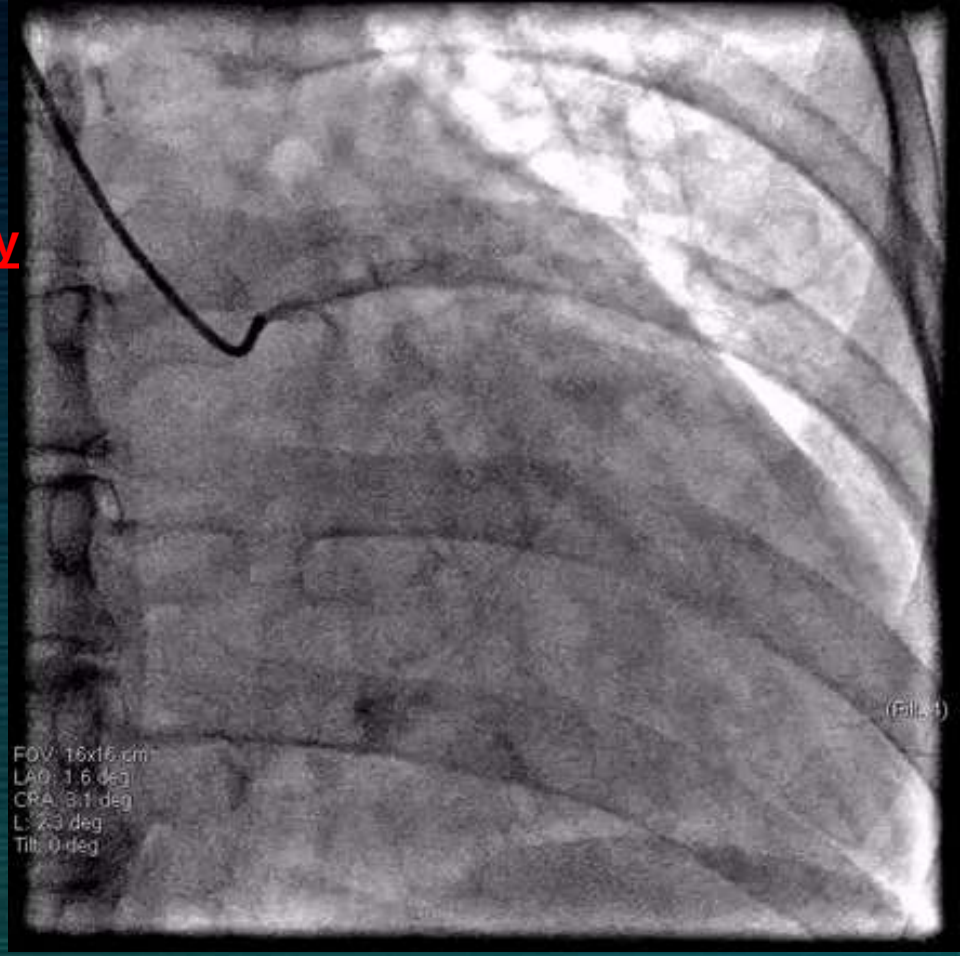
Cardiopulmonary Exercise Test (CPET).

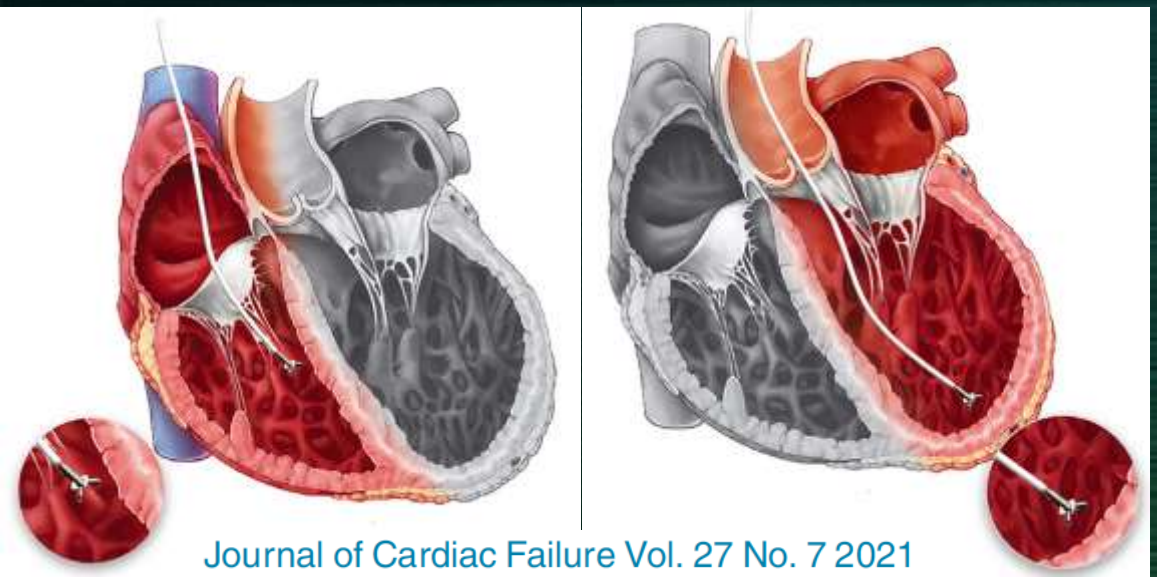
Advanced diagnostic tests

Right heart catheterization



Coronary angiography





Journal of Cardiac Failure Vol. 27 No. 7 2021

Endomyocardial Biopsy (EMB)

It is reasonable to consider endomyocardial biopsy (EMB) indicated in cases of severe, newly onset, unexplained, and refractory to conventional therapy heart failure, especially if associated with absent or mild left ventricular remodeling, and in cases presenting with life-threatening unexplained tachyarrhythmias or advanced atrioventricular blocks associated with left ventricular dysfunction. Moreover, EMB can be useful in cases of unclear etiology or in suspicion of storage or infiltrative diseases.

La diagnosi
nello scompenso cardiaco:
non fermiamoci al livello «letterale»

Dante col libro della Commedia, tre regni e la città di Firenze,
Domenico di Michelino e Alesso Baldovinetti, 1465, Santa Maria del Fiore, Firenze

ESC European Society of Cardiology
European Heart Journal (2021) 42, 3599 – 3726
doi:10.1093/eurheartj/ehab368

McDonagh T.A. et al.

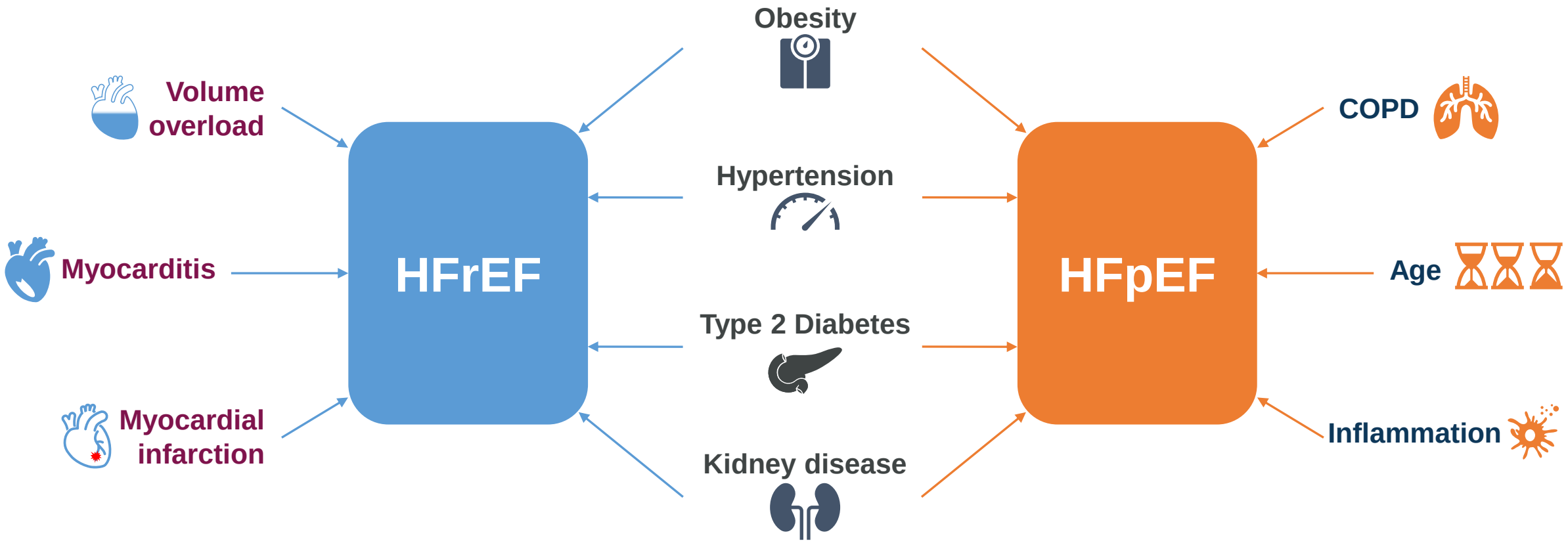
2021 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure

Causes of heart failure, common modes of presentation and specific investigations

Cause	Examples of presentations	Specific investigations
CAD	Myocardial infarction Angina or "angina-equivalent" Arrhythmias	Invasive coronary angiography CT coronary angiography Imaging stress tests (echo, nuclear, CMR)
Hypertension	Heart failure with preserved systolic function Malignant hypertension/acute pulmonary oedema	24 h ambulatory BP Plasma metanephrines, renal artery imaging Renin and aldosterone
Valve disease	Primary valve disease e.g., aortic stenosis Secondary valve disease, e.g. functional regurgitation Congenital valve disease	Echo – transoesophageal/stress
Arrhythmias	Atrial tachyarrhythmias Ventricular arrhythmias	Ambulatory ECG recording Electrophysiology study, if indicated
CMPs	All Dilated Hypertrophic Restrictive ARVC Peripartum Takotsubo syndrome Toxins: alcohol, cocaine, iron, copper	CMR, genetic testing Right and left heart catheterization CMR, angiography Trace elements, toxicology, LFTs, GGT
Congenital heart disease	Congenitally corrected/repaired transposition of great arteries Shunt lesions Repaired tetralogy of Fallot Ebstein's anomaly	CMR
Infective	Viral myocarditis Chagas disease HIV Lyme disease	CMR, EMB Serology
Drug-induced	Anthracyclines Trastuzumab VEGF inhibitors Immune checkpoint inhibitors Proteasome inhibitors RAF+MEK inhibitors	
Infiltrative	Amyloid Sarcoidosis Neoplastic	Serum electrophoresis and serum free light chains, Bence Jones protein, bone scintigraphy, CMR, CT-PET, EMB Serum ACE, CMR, FDG-PET, chest CT, EMB CMR, EMB
Storage disorders	Haemochromatosis Fabry disease Glycogen storage diseases	Iron studies, genetics, CMR (T2* imaging), EMB α-galactosidase A, genetics, CMR (T1 mapping)
Endomyocardial disease	Radiotherapy Endomyocardial fibrosis/eosinophilia Carcinoid	CMR EMB 24 h urine 5-HIAA
Pericardial disease	Calcification Infiltrative	Chest CT, CMR, right and left heart catheterization
Metabolic	Endocrine disease Nutritional disease (thiamine, vitamin B1 and selenium deficiencies) Autoimmune disease	TFTs, plasma metanephrines, renin and aldosterone, cortisol Specific plasma nutrients ANA, ANCA, rheumatology review
Neuromuscular disease	Friedreich's ataxia Muscular dystrophy	Nerve conduction studies, electromyogram, genetics CK, electromyogram, genetics

5-HIAA = 5-hydroxyindoleacetic acid; ACE = angiotensin-converting enzyme; ANA= anti-nuclear antibody; ANCA= anti-nuclear cytoplasmic antibody; ARVC = arrhythmogenic right ventricular cardiomyopathy; BP = blood pressure; CAD= coronary artery disease; CMP = cardiomyopathy; CMR= cardiac magnetic resonance; CK = creatinine kinase; CT = computed tomography; ECG = electrocardiogram; Echo = echocardiography; EMB = endomyocardial biopsy; FDG = fluorodeoxyglucose; GGT= gamma-glutamyl transferase; HIV = human immunodeficiency virus; h = hour; LFT = liver function test; LGE = late gadolinium enhancement; MEK =mitogen-activated protein kinase; PET = positron emission tomography; TFT = thyroid function test; VEGF = vascular endothelial growth factor

HFrEF and HFpEF Share Many Comorbidities and Risk Factors, While Others Differ



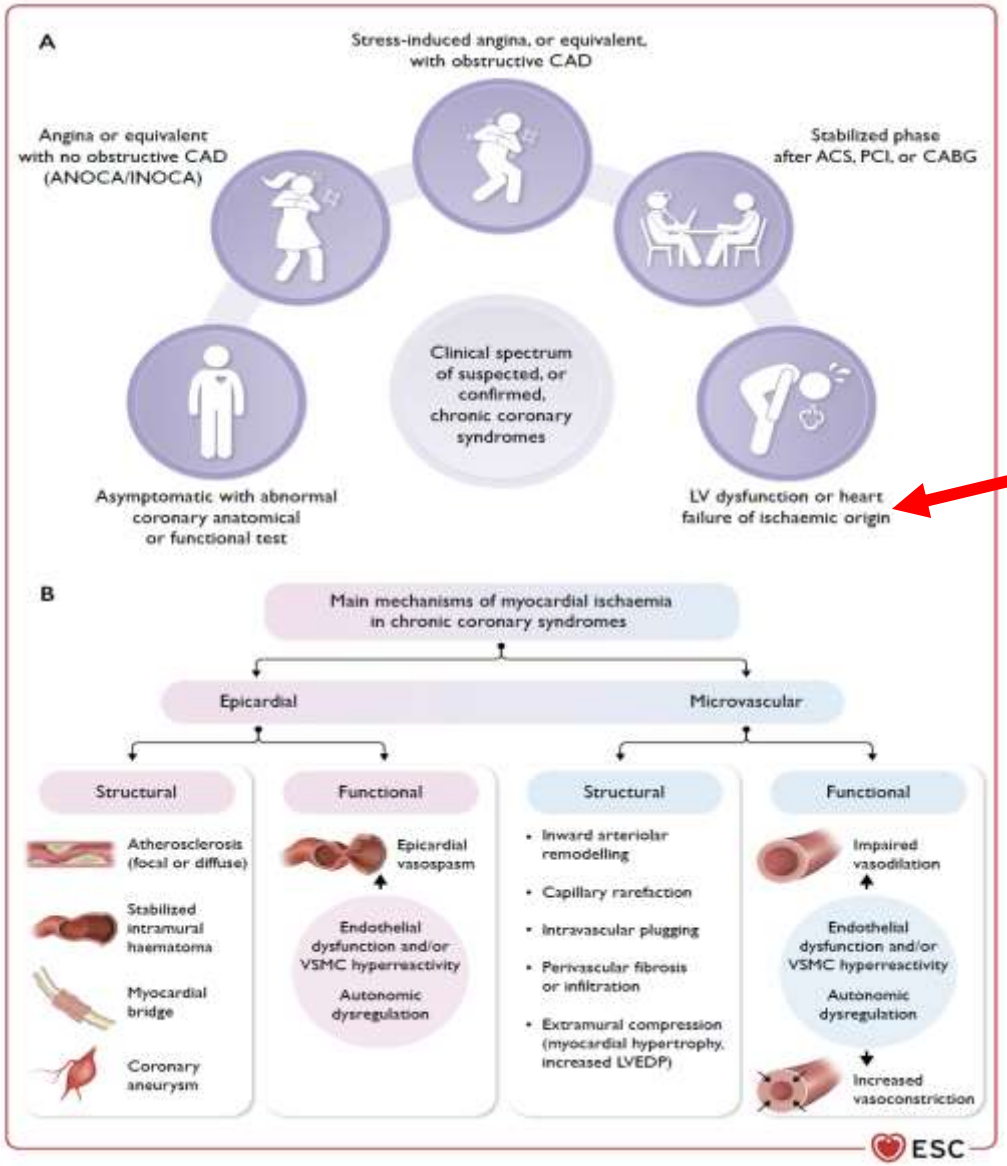
COPD = chronic obstructive pulmonary disease; HFpEF = heart failure with preserved ejection fraction; HFrEF = heart failure with reduced ejection fraction.

Simmonds SJ et al. *Cells*. 2020;9:242.

Heart failure, a central and current issue

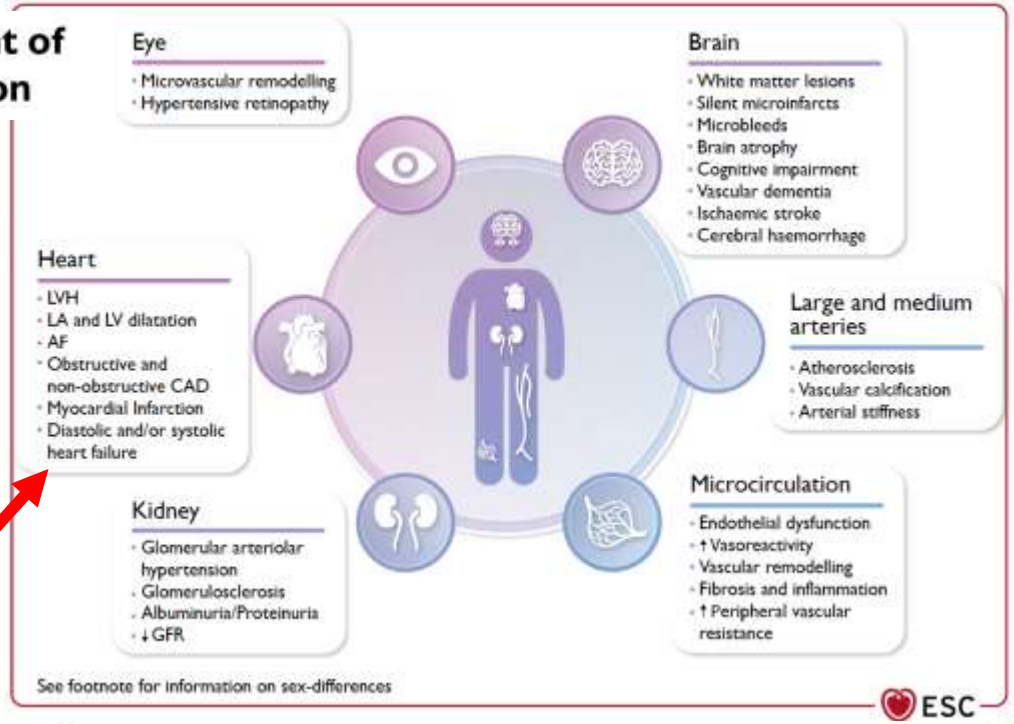
ESC European Society of Cardiology
European Heart Journal (2024) 00, 1–123
https://doi.org/10.1093/eurheartj/ehae177

2024 ESC Guidelines for the management of chronic coronary syndromes



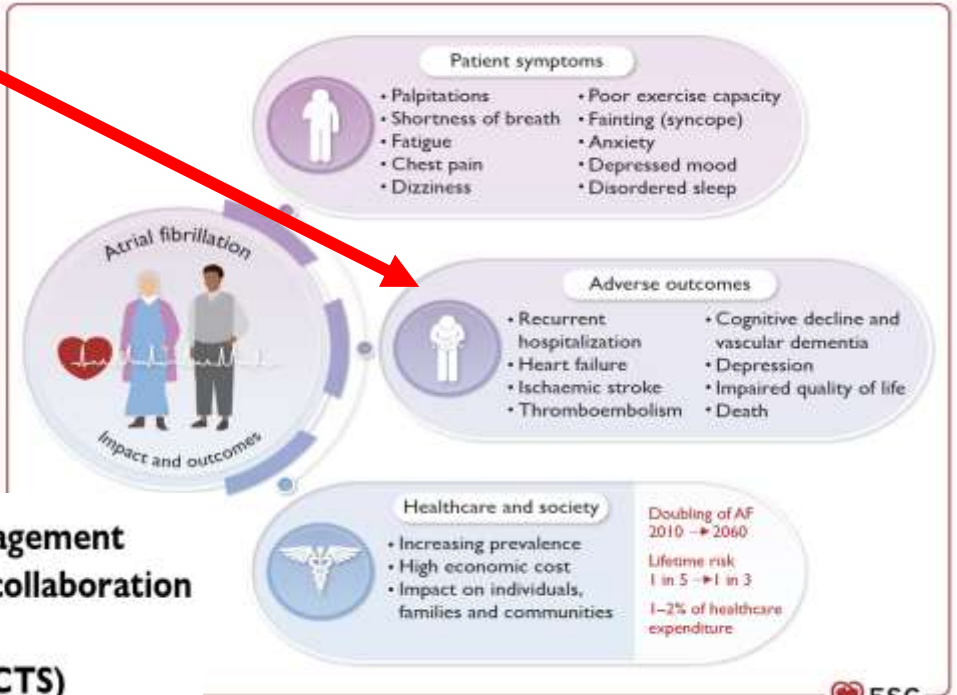
2024 ESC Guidelines for the management of elevated blood pressure and hypertension

ESC European Society of Cardiology
European Heart Journal (2024) 00, 1–107
https://doi.org/10.1093/eurheartj/ehae178



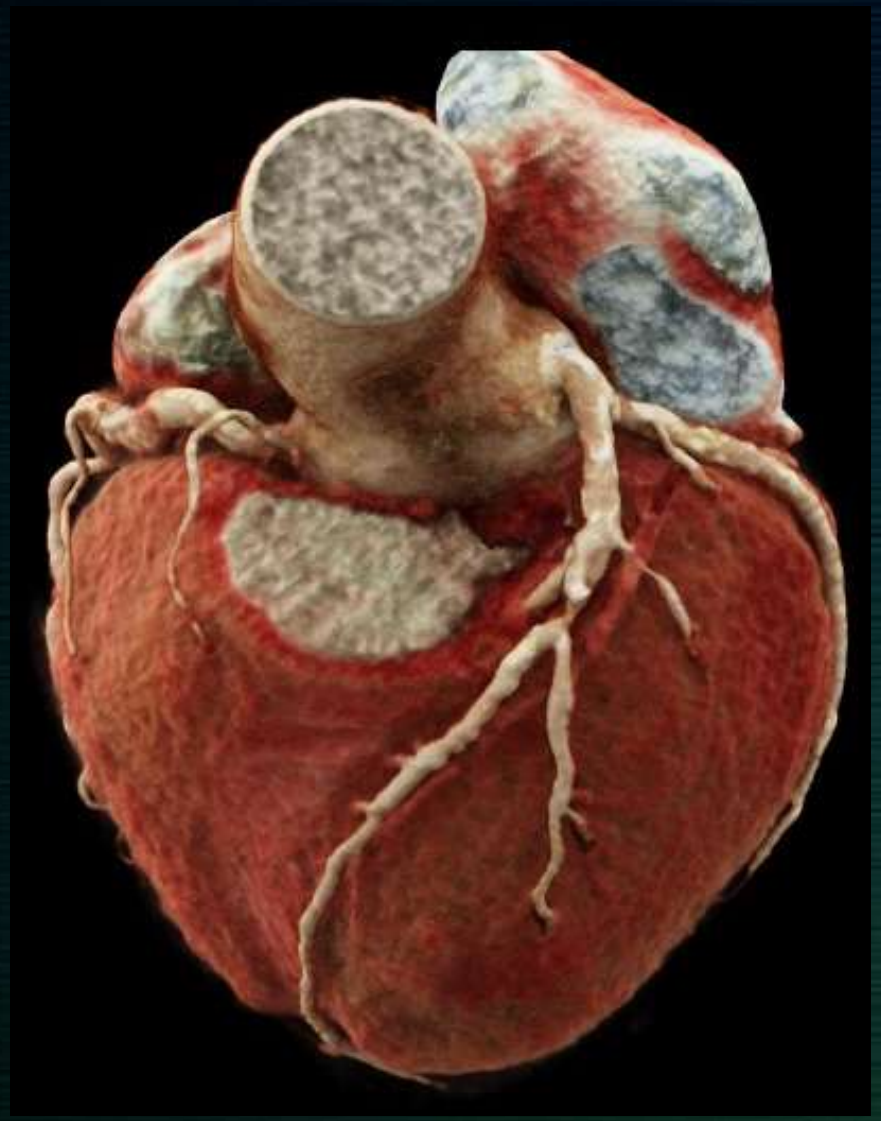
ESC European Society of Cardiology
European Heart Journal (2024) 00, 1–101
https://doi.org/10.1093/eurheartj/ehae176

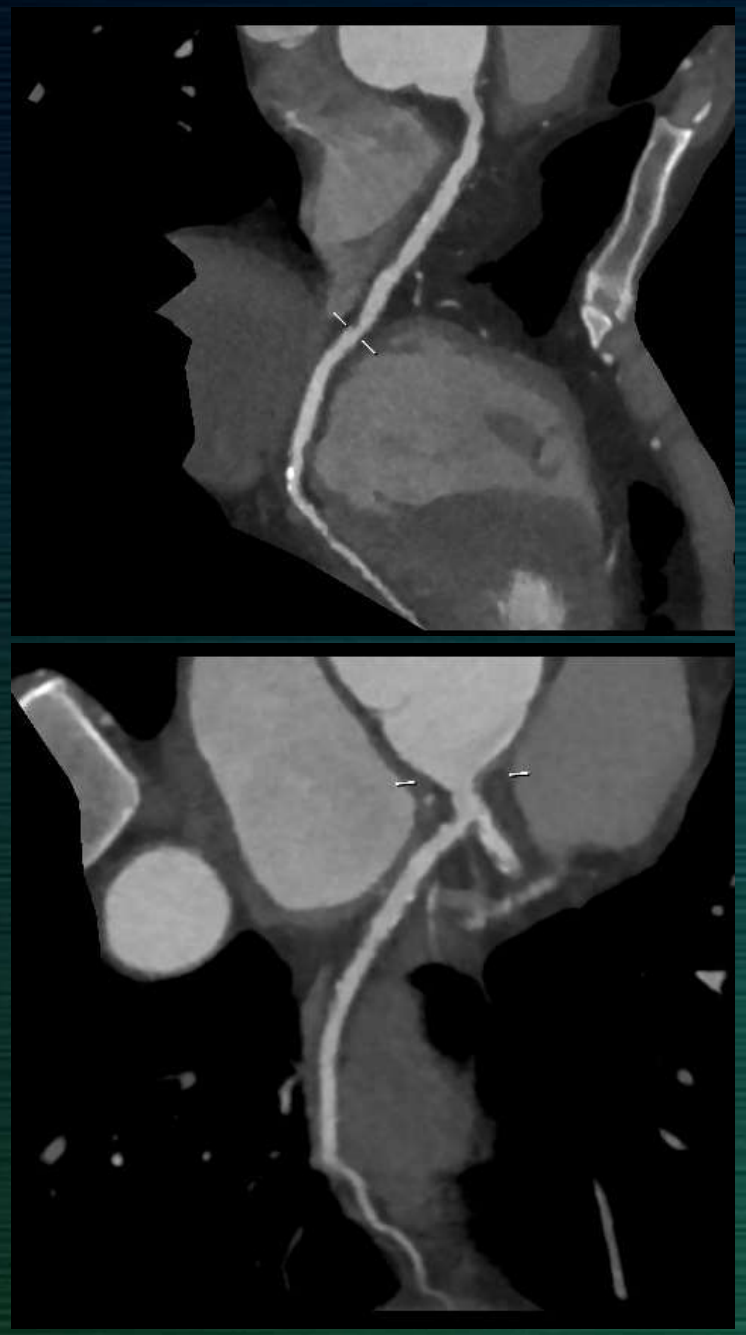
2024 ESC Guidelines for the management of atrial fibrillation developed in collaboration with the European Association for Cardio-Thoracic Surgery (EACTS)



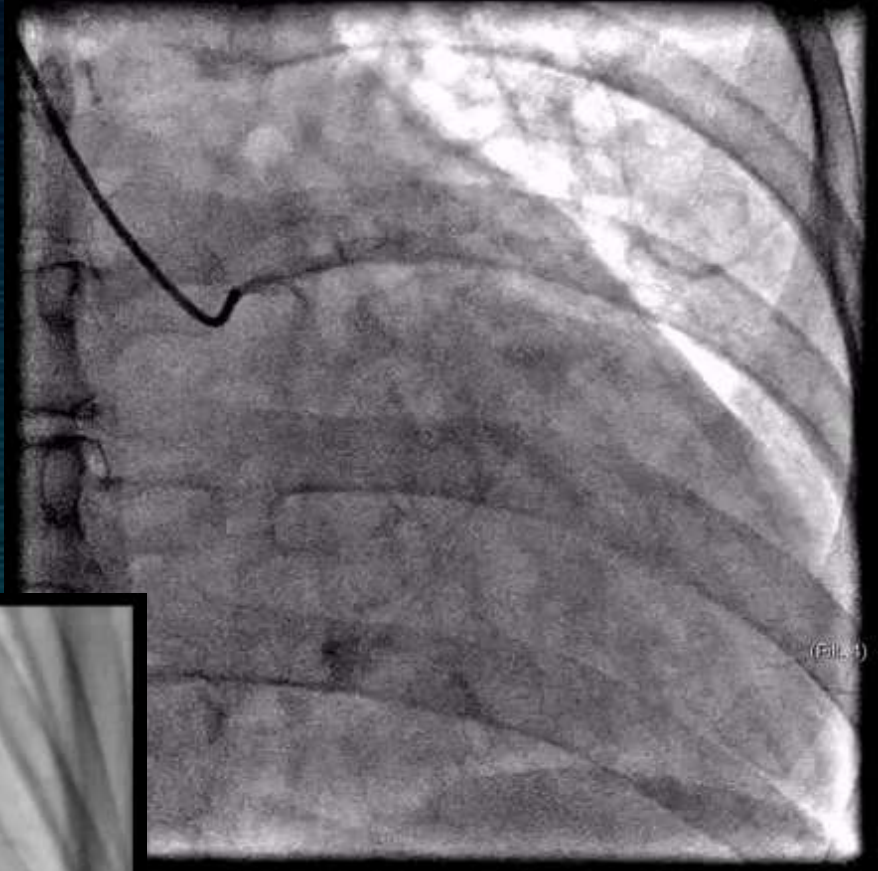
Advanced diagnostic tests: computed tomography (CT)

Critical stenosis in LAD (left anterior descending artery)



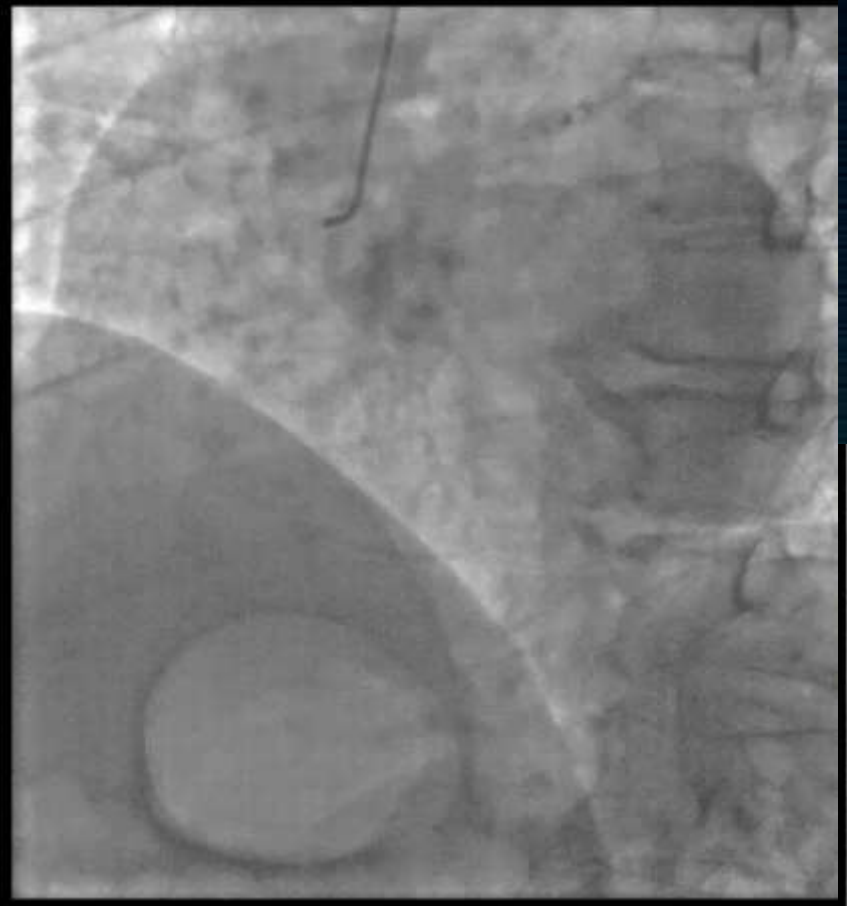


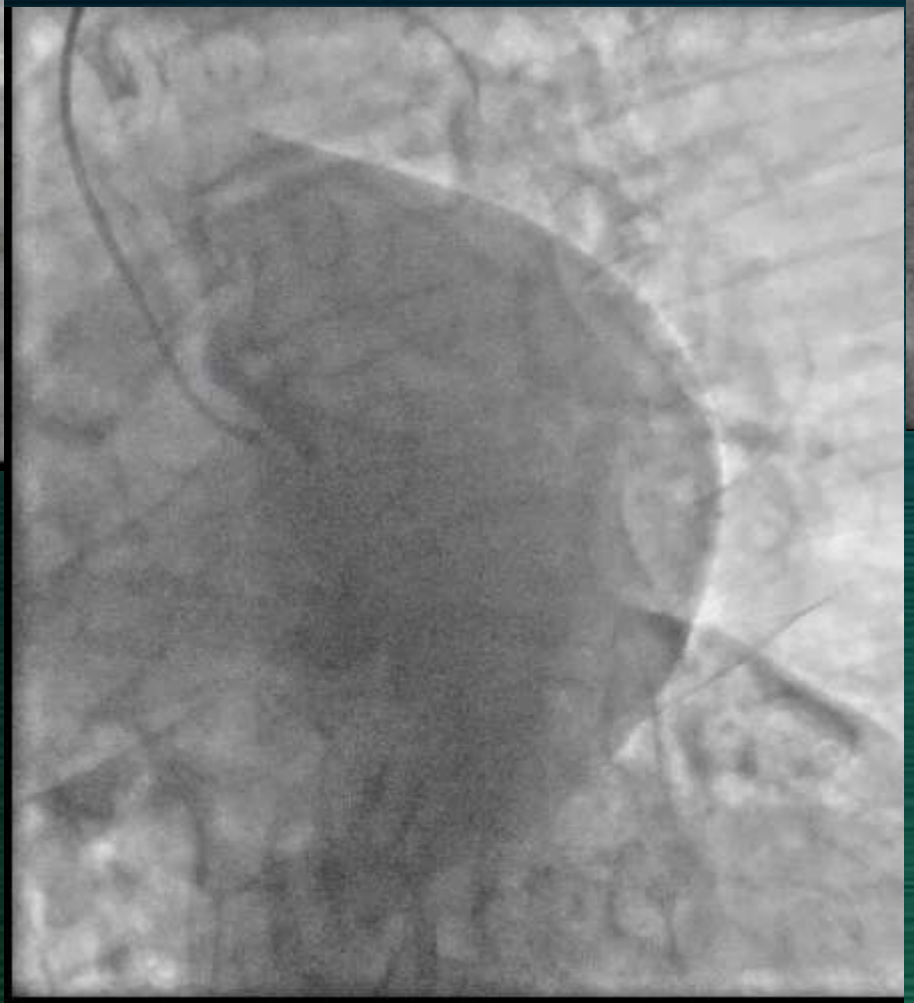
Coronary angiography

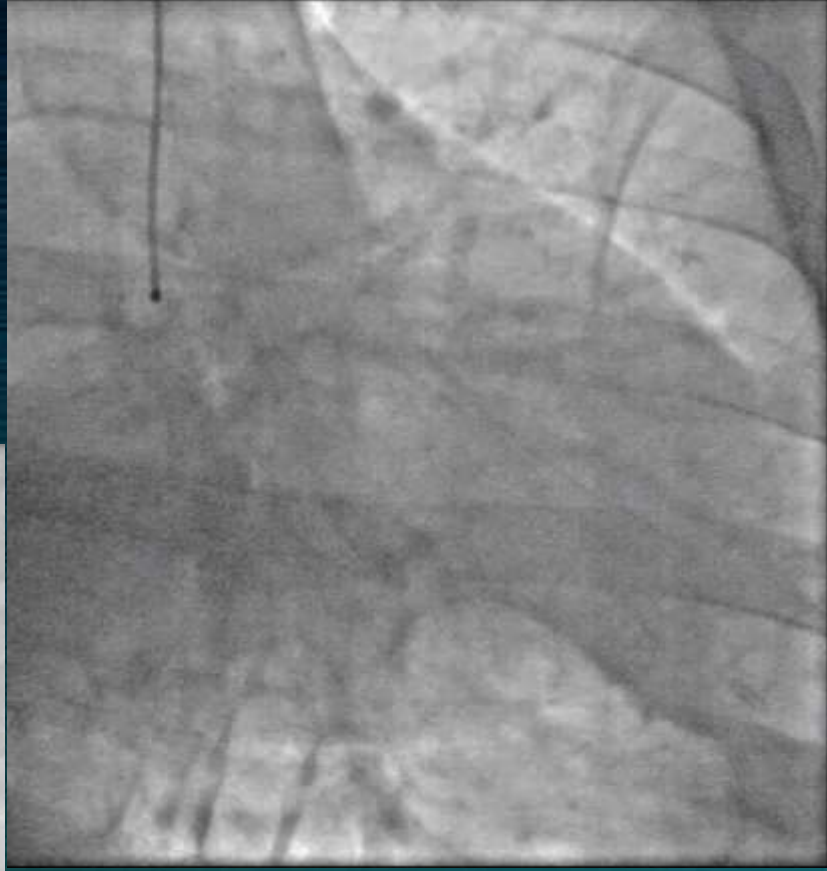


Normal

Coronary angiography:



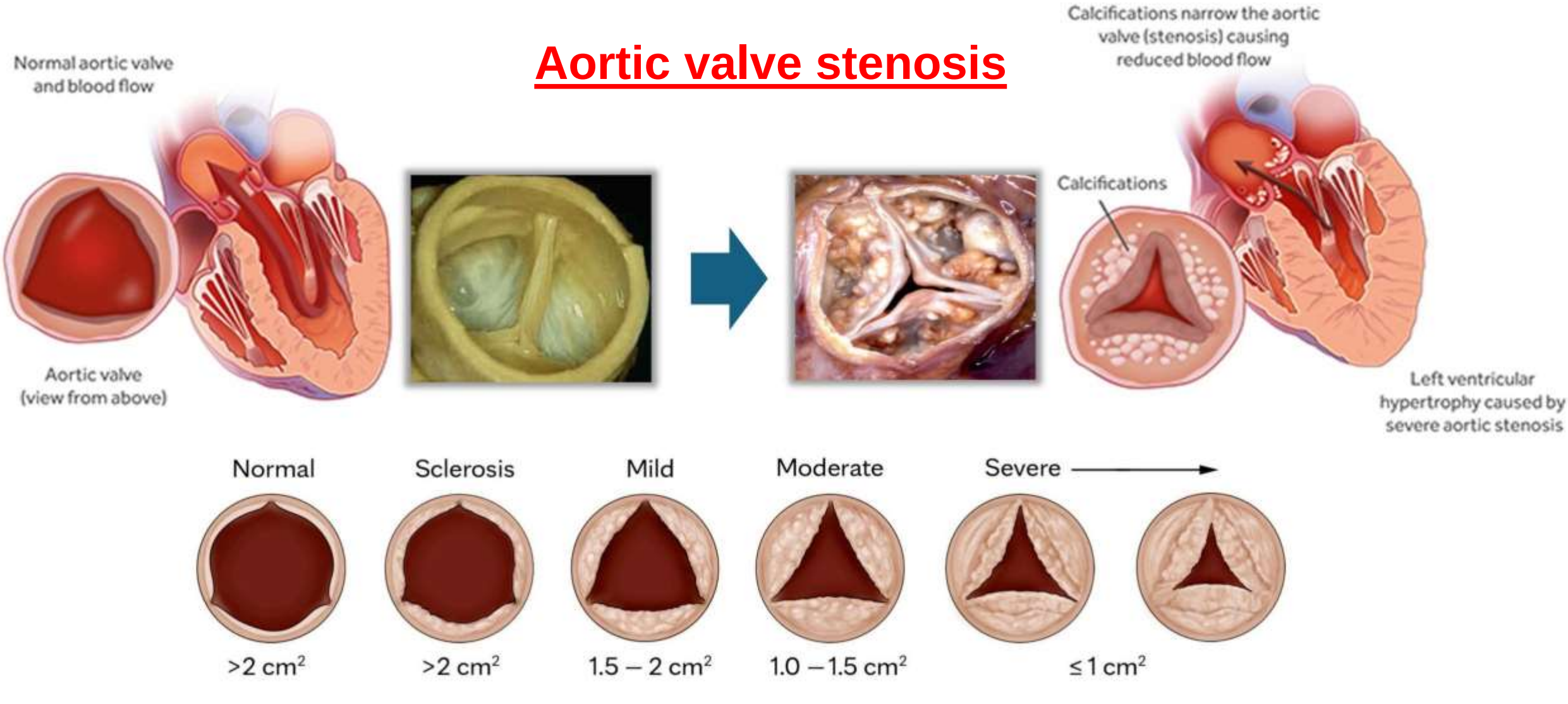




Three-vessel coronary artery disease with left main disease and chronically collateralized occlusion of the dominant right coronary artery

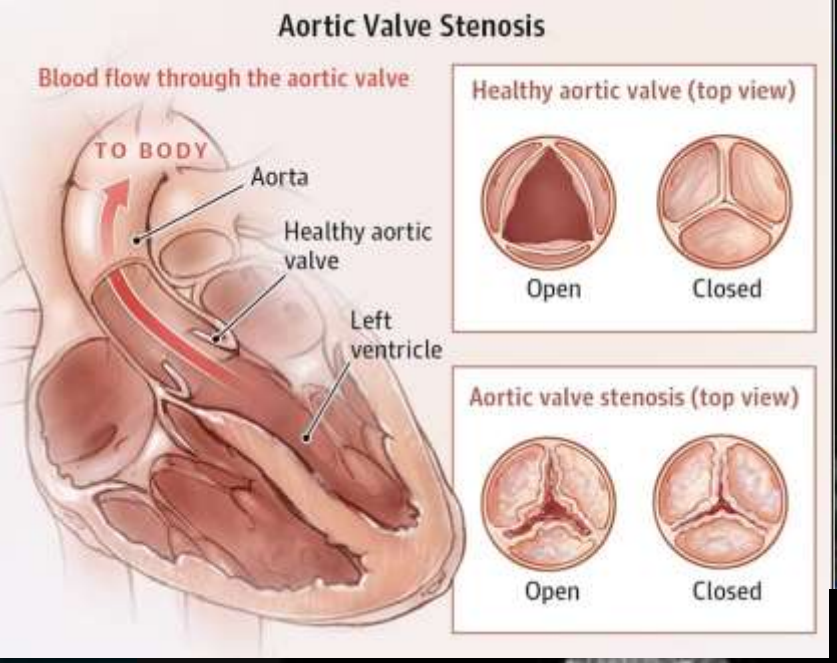
Valvular diseases

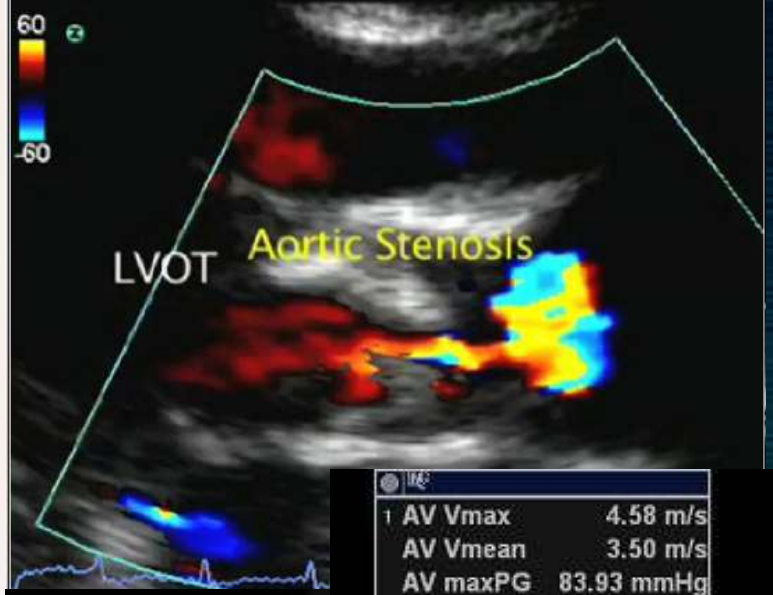
Aortic valve stenosis

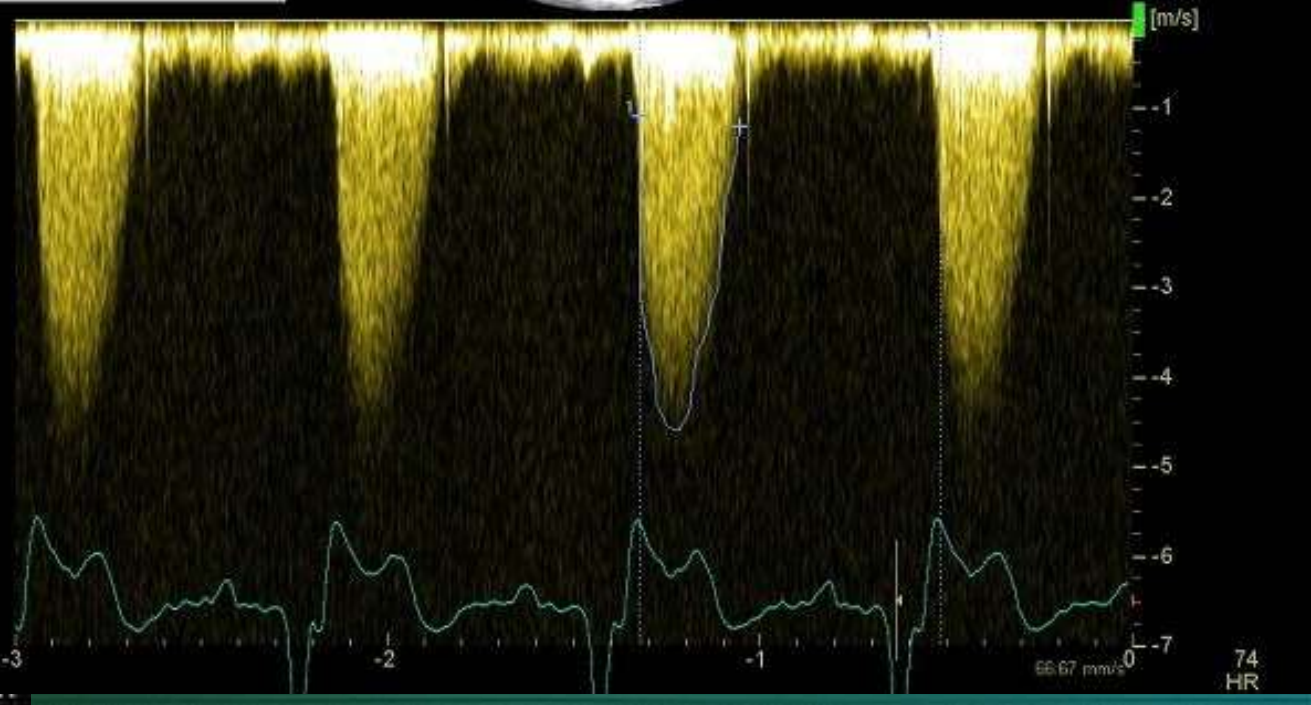


Valvular diseases

Aortic valve stenosis

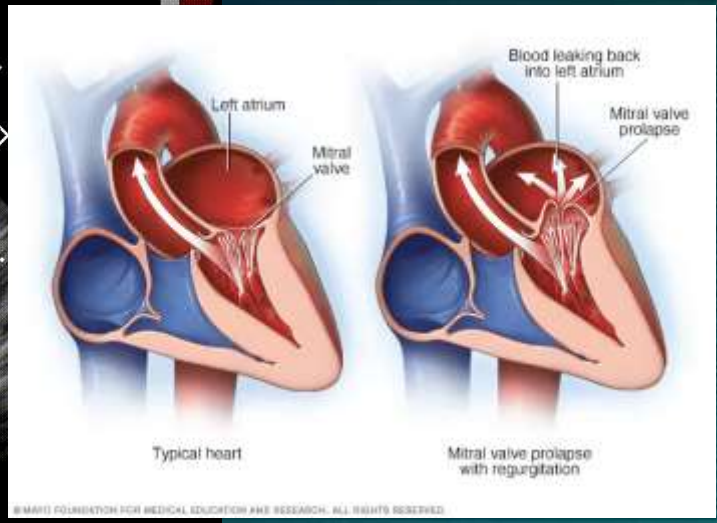






Valvular diseases

Mitral regurgitation

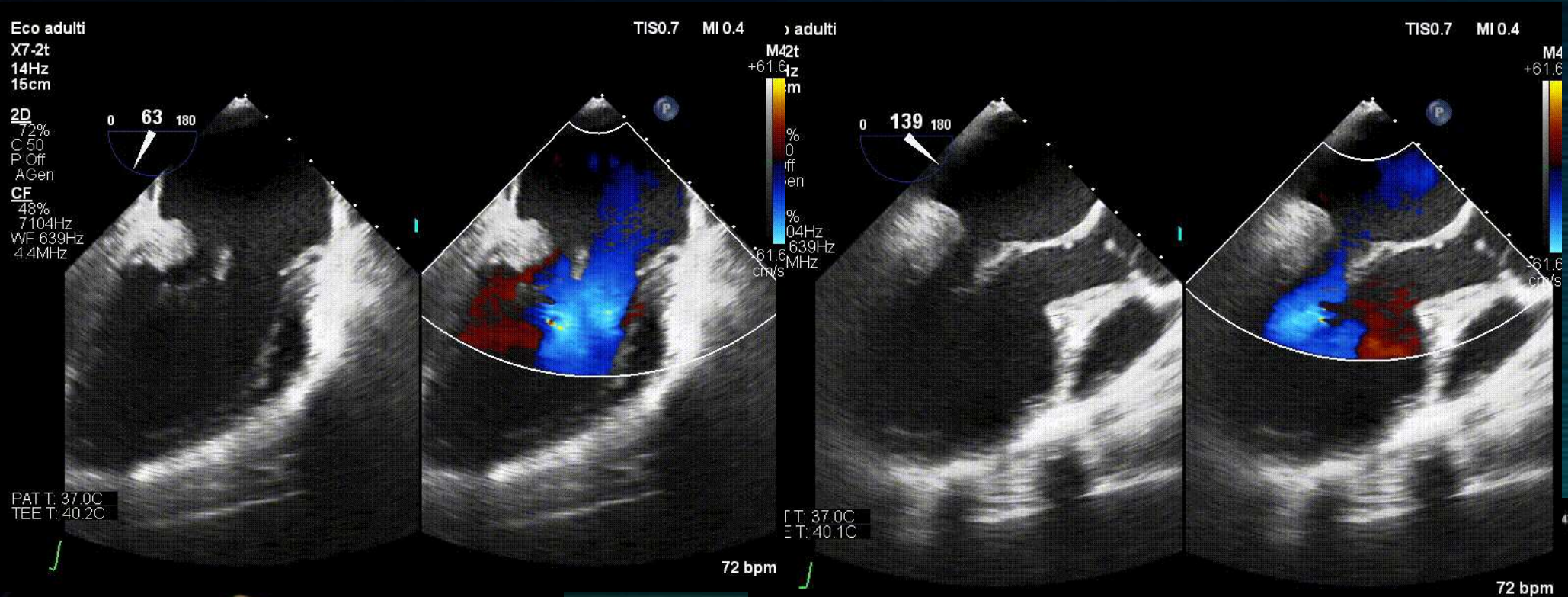


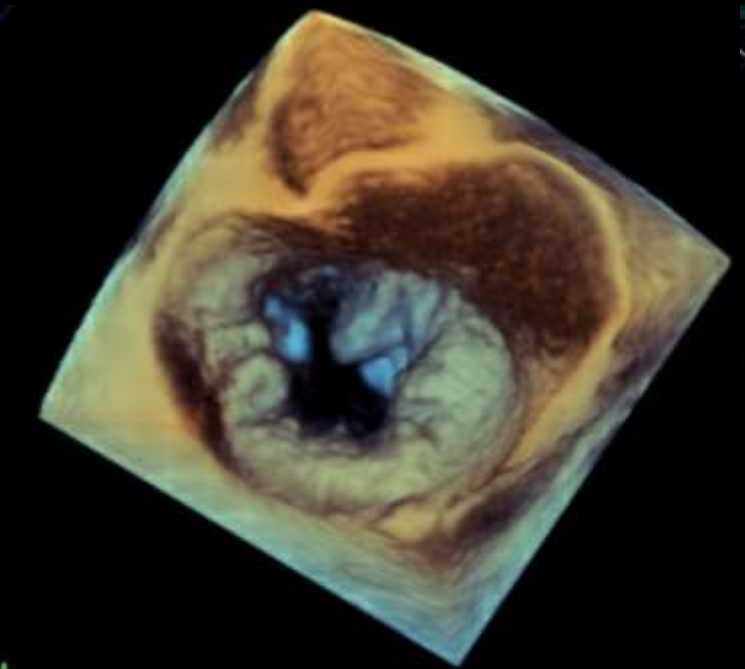
ECO-TT
(transthoracic echocardiography)

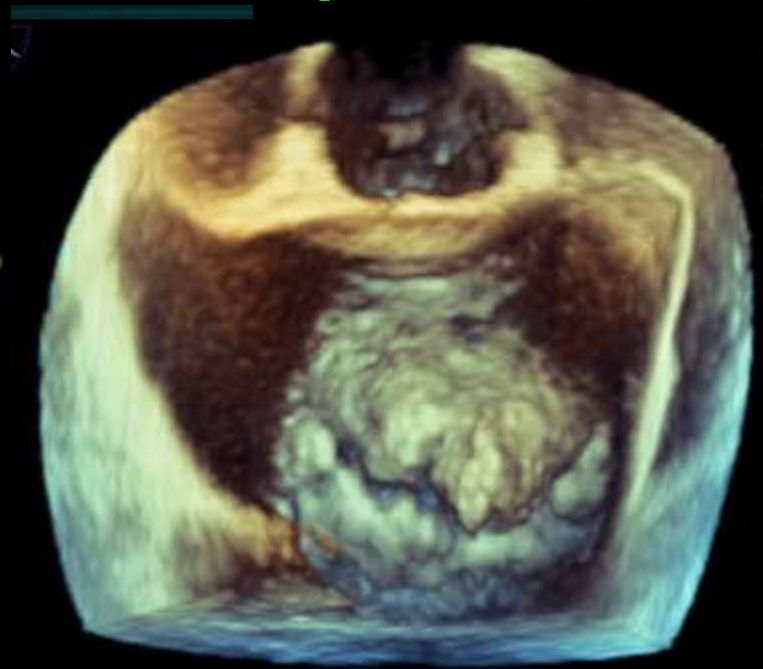
Valvular diseases

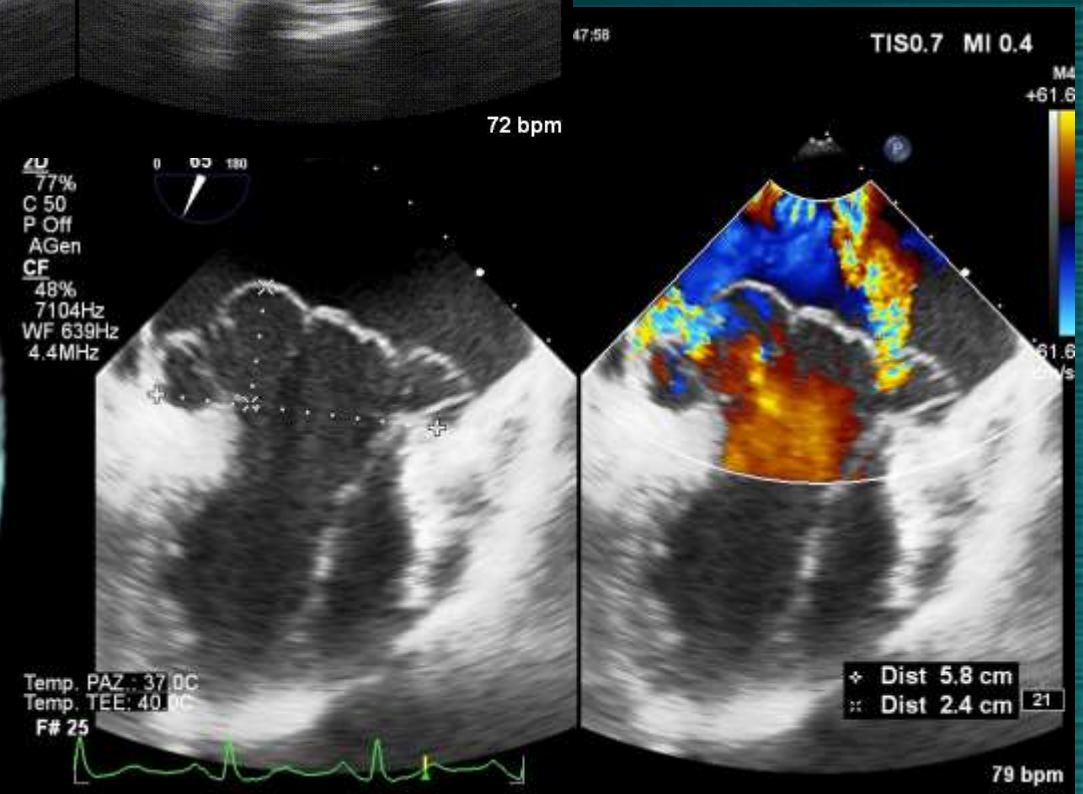
Mitral regurgitation

ECO-TE (transesophageal echocardiography)



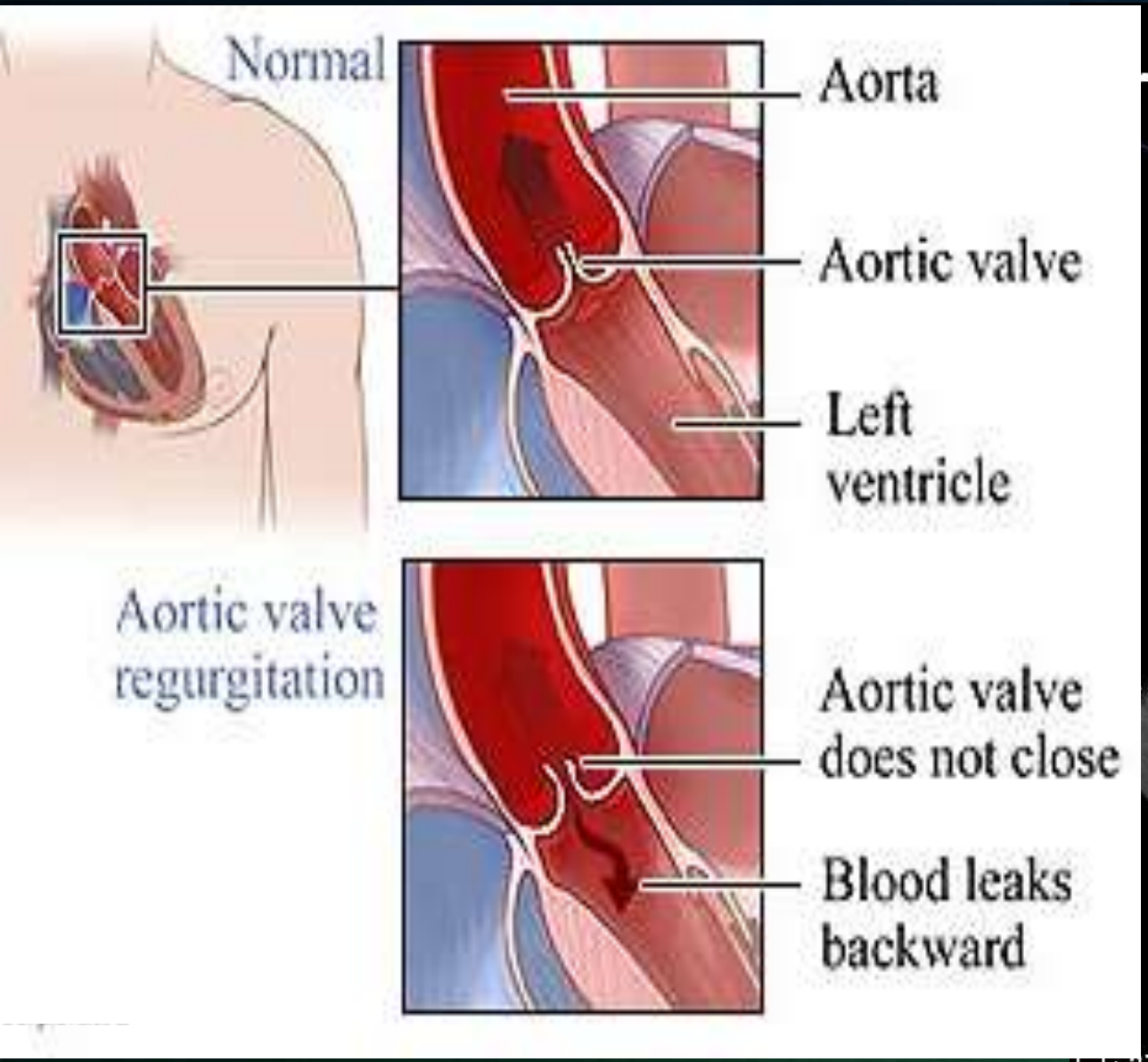


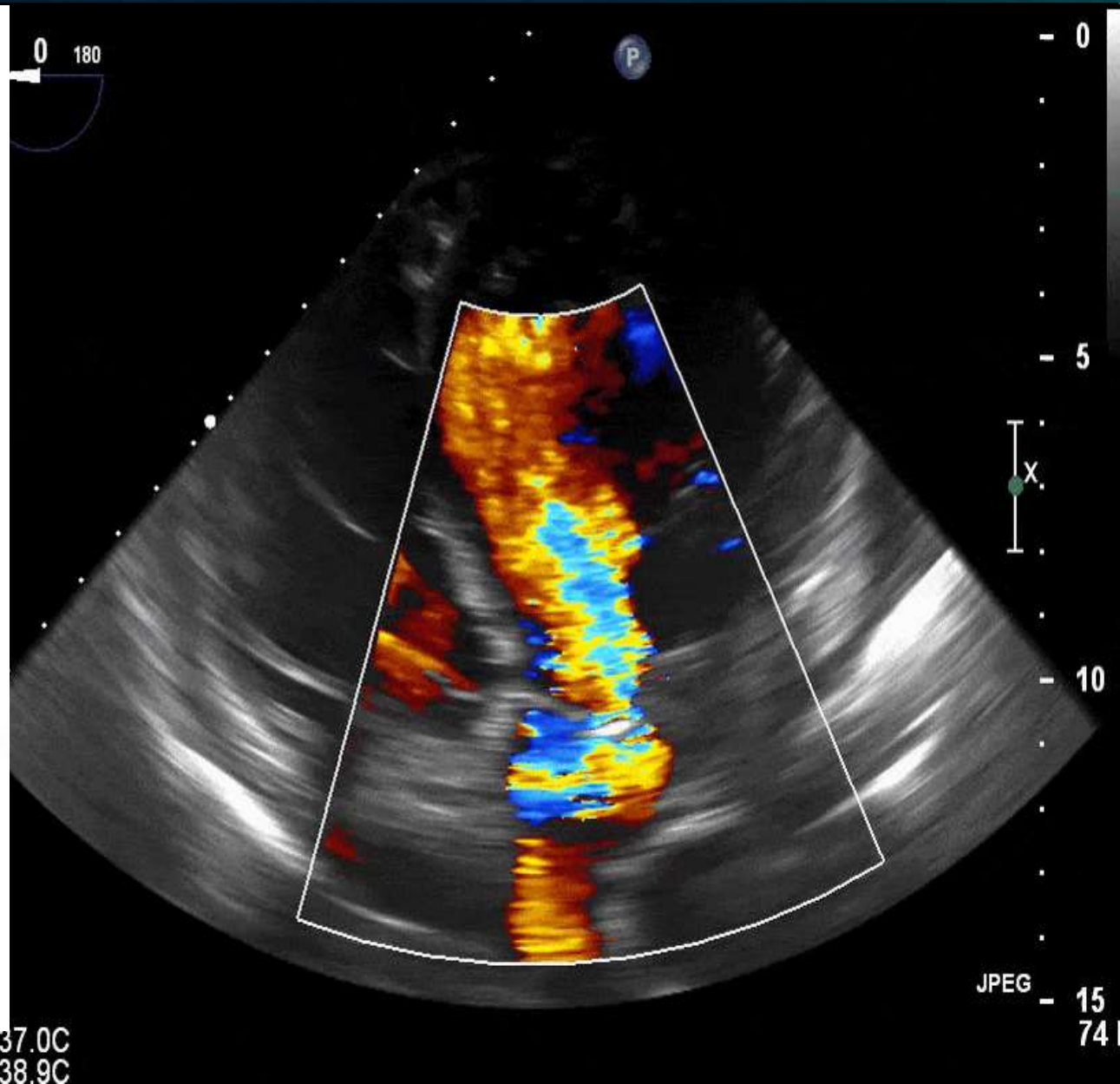




Valvular diseases

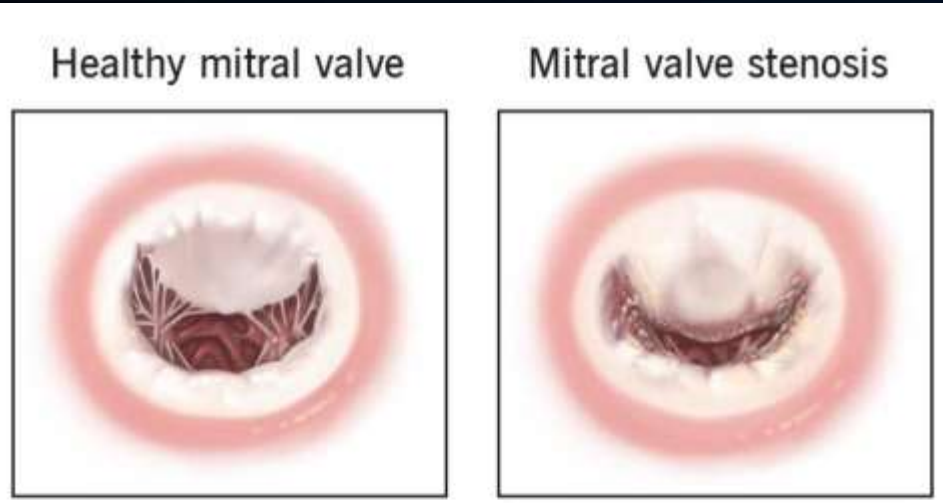
Aortic valve regurgitation

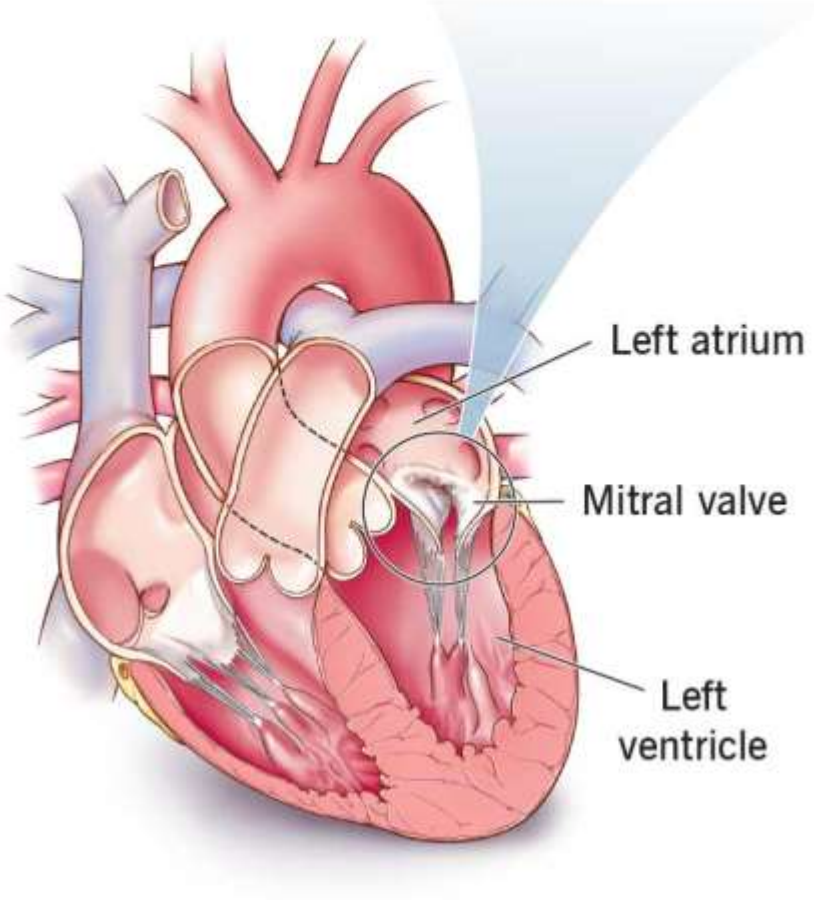




Valvular diseases

Mitral valve stenosis





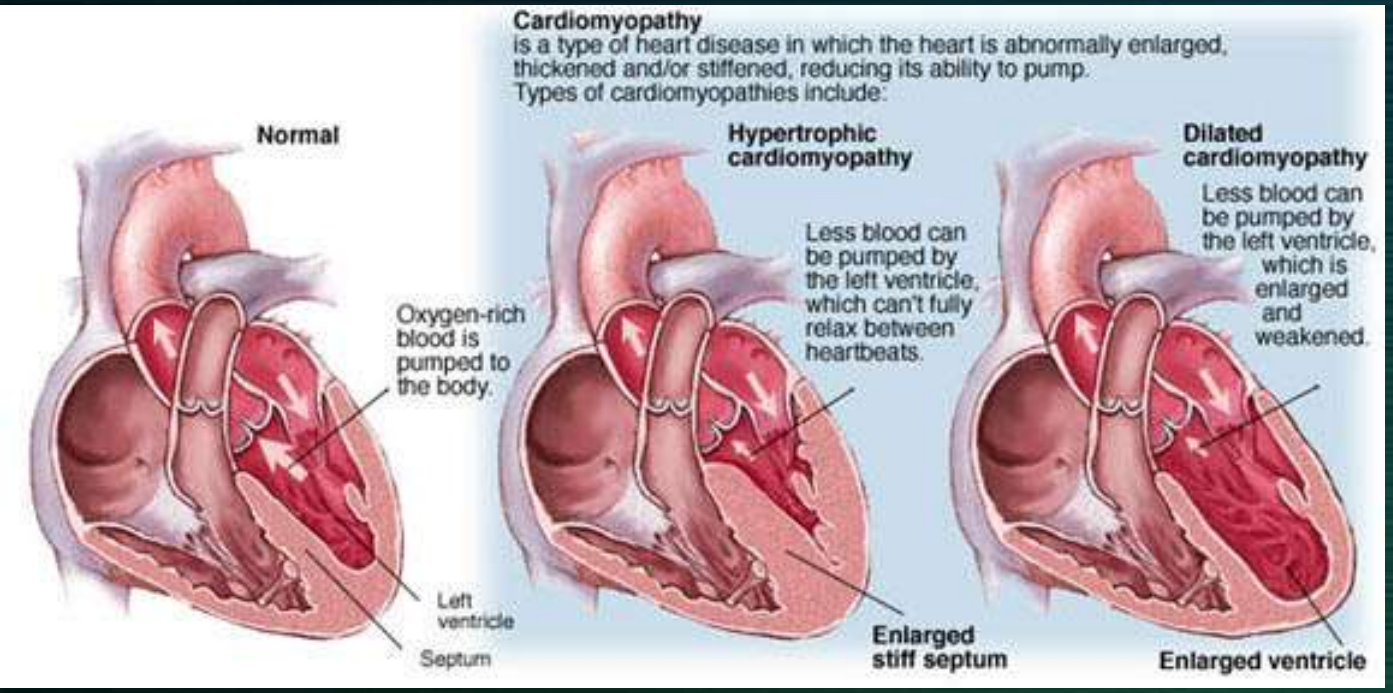
Doming

2023 ESC Guidelines for the management of cardiomyopathies

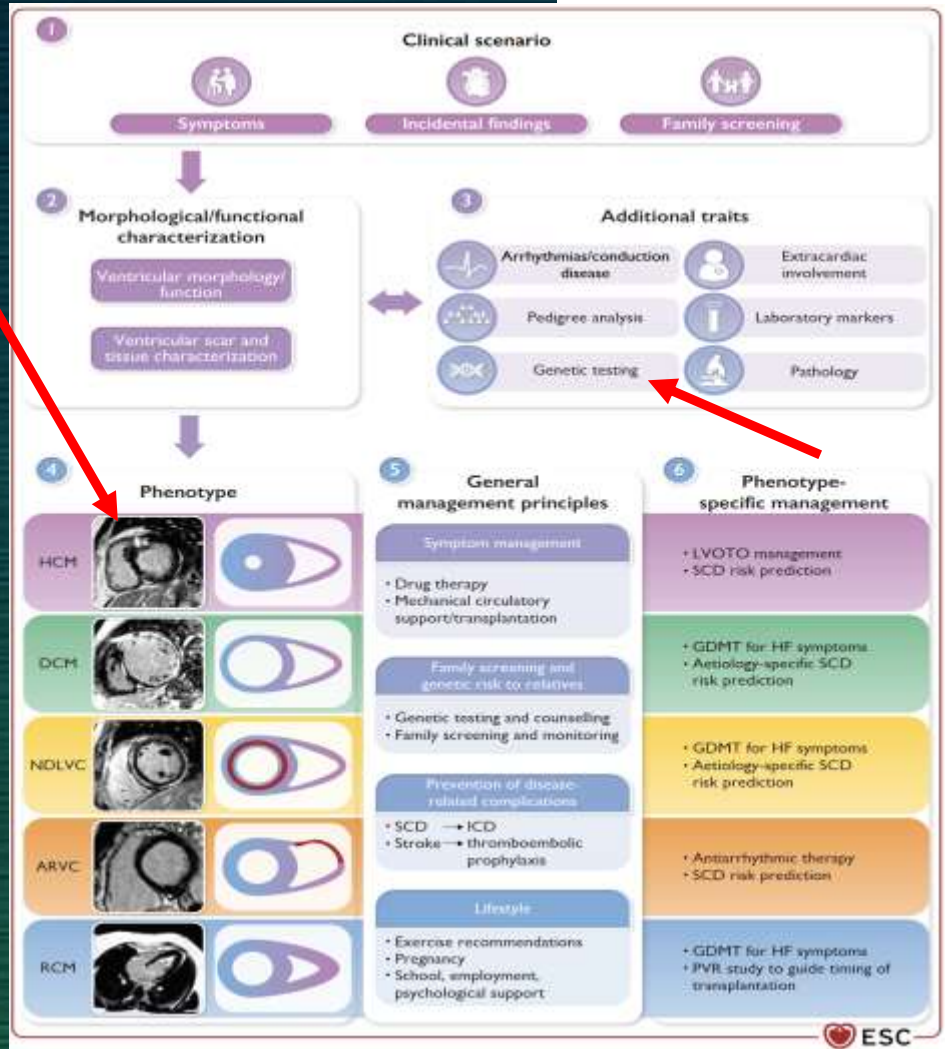
CARDIOMYOPATHIES

Cardiomyopathy is disease of the heart muscle.

A cardiomyopathy is defined as 'a myocardial disorder in which the heart muscle is structurally and functionally abnormal, in the absence of coronary artery disease (CAD), hypertension, valvular disease, and congenital heart disease (CHD) sufficient to cause the observed myocardial abnormality



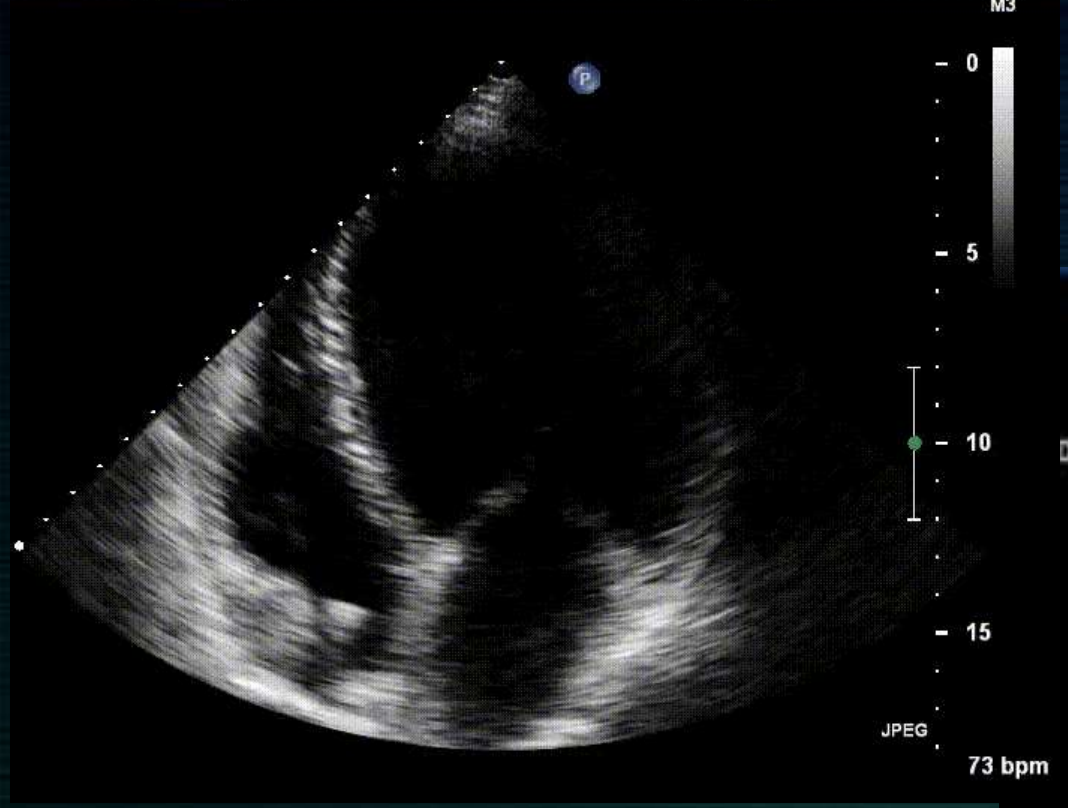
Key aspects in the evaluation and management of cardiomyopathies

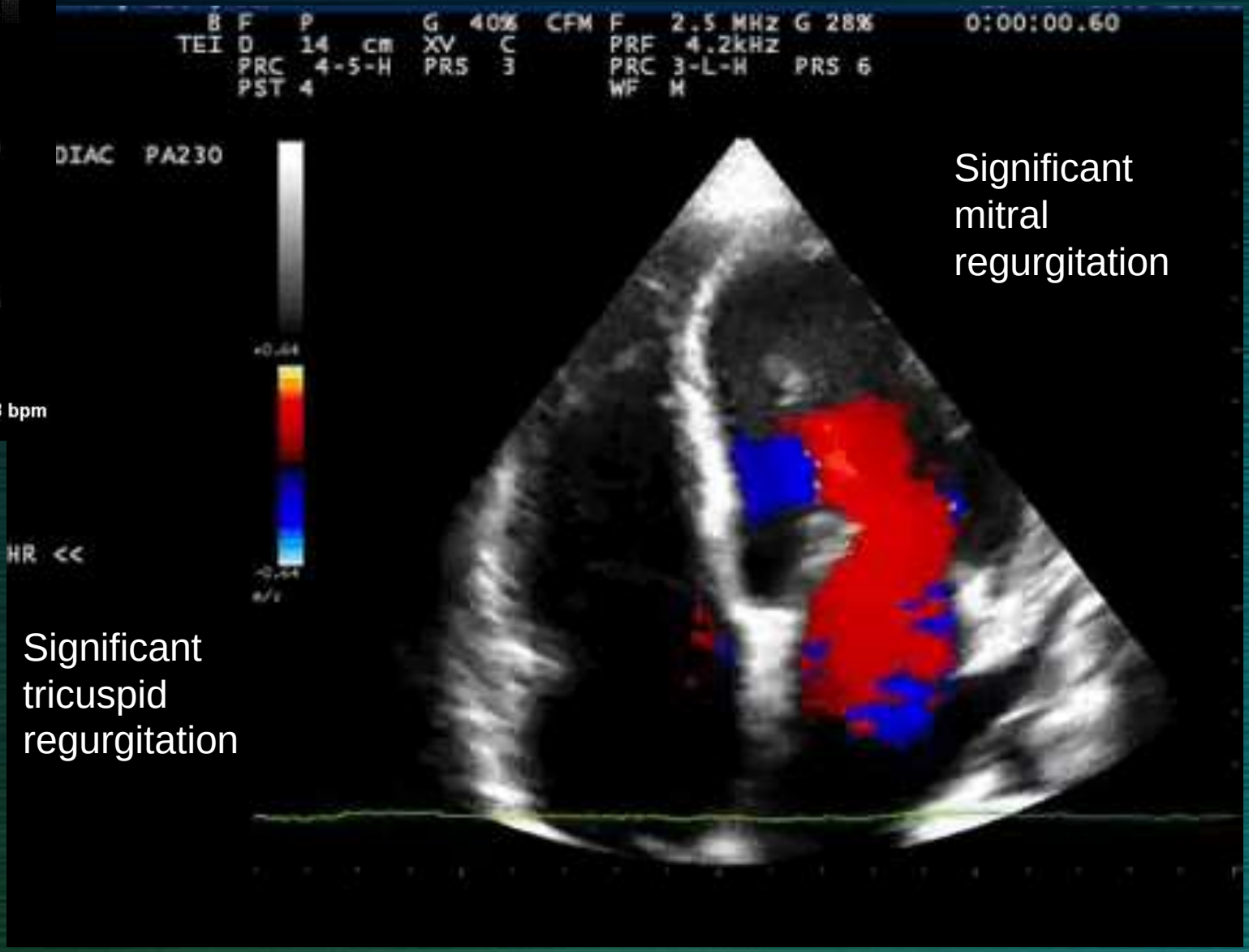


2023 ESC Guidelines for the management of cardiomyopathies
(European Heart Journal; 2023 – doi:10.1093/eurheartj/ehad 194)

DILATED CARDIOMYOPATHY

Transthoracic Echocardiogram



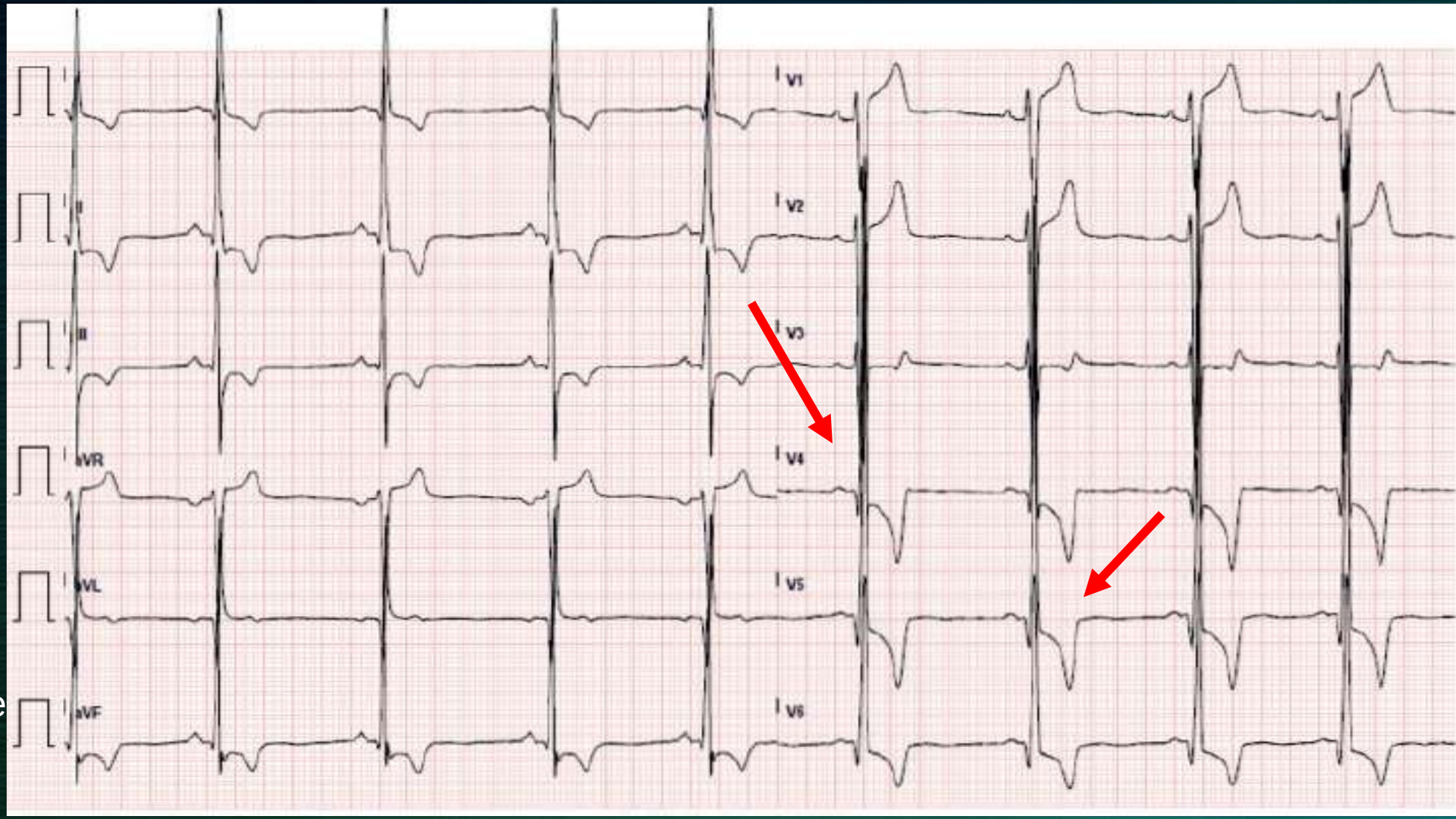


Significant mitral regurgitation

Significant tricuspid regurgitation

HYPERTROPHIC CARDIOMYOPATHY

ECG of a young patient with incidental findings of hypertrophic cardiomyopathy, presenting with a syncopal episode.



ECG is characterized by:

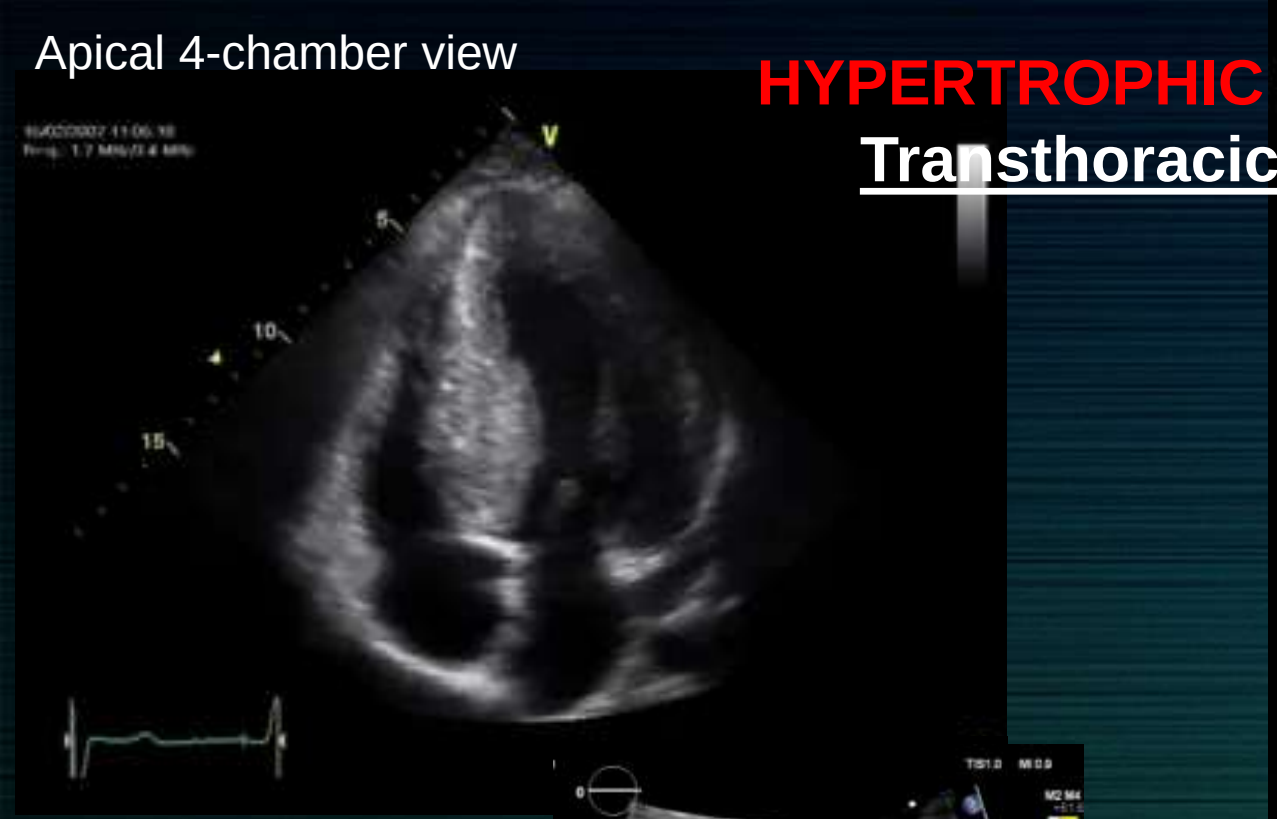
- high QRS voltages, indicating increased ventricular mass,
- pseudonecrosis Q waves,
- and deep negative T waves, particularly in the inferior-lateral leads.

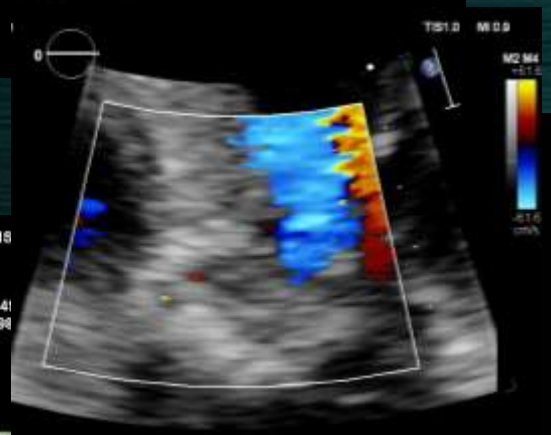
Apical 4-chamber view

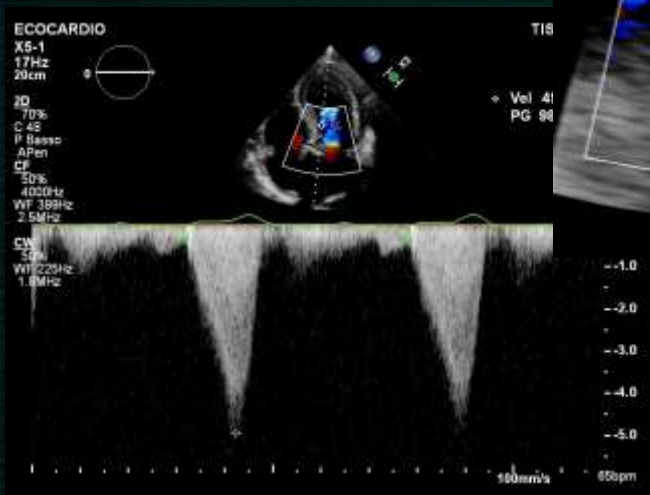
HYPERTROPHIC CARDIOMYOPATHY

Transthoracic Echocardiogram

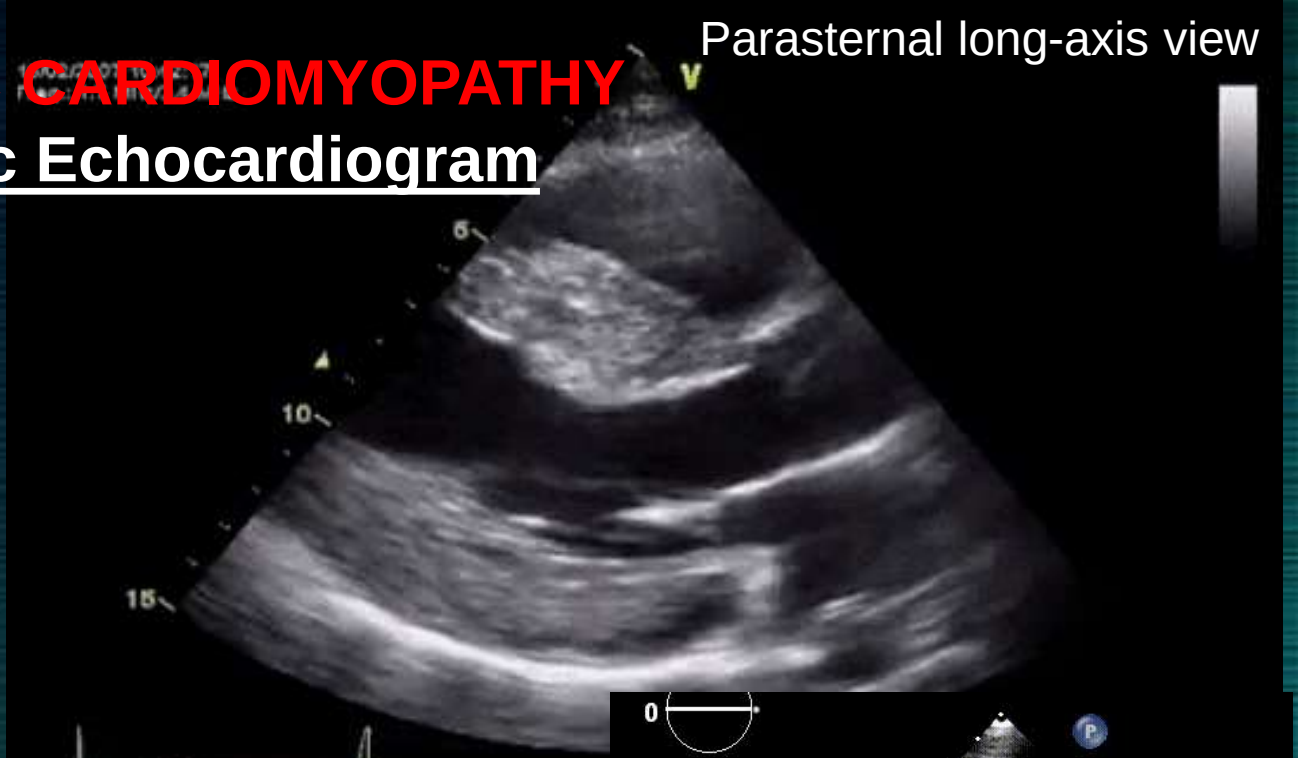
Parasternal long-axis view

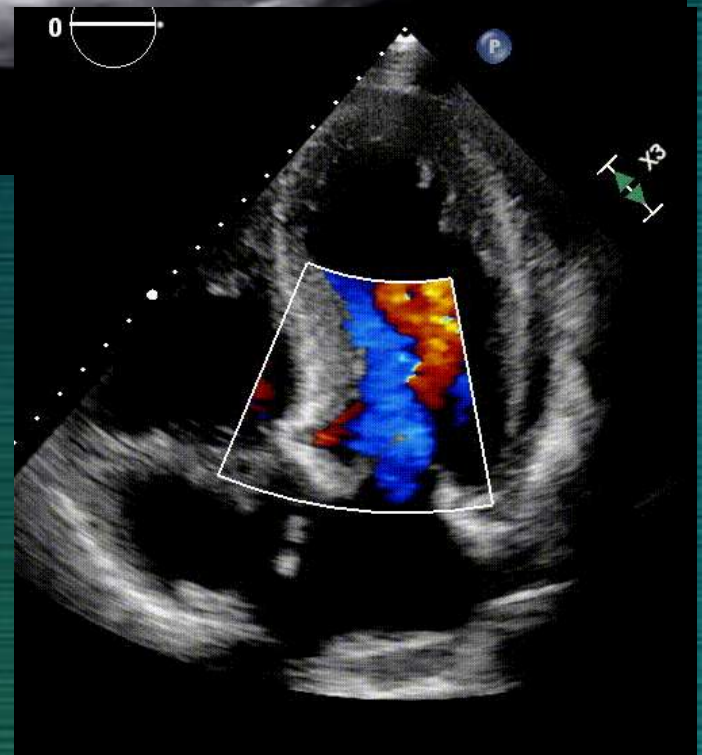






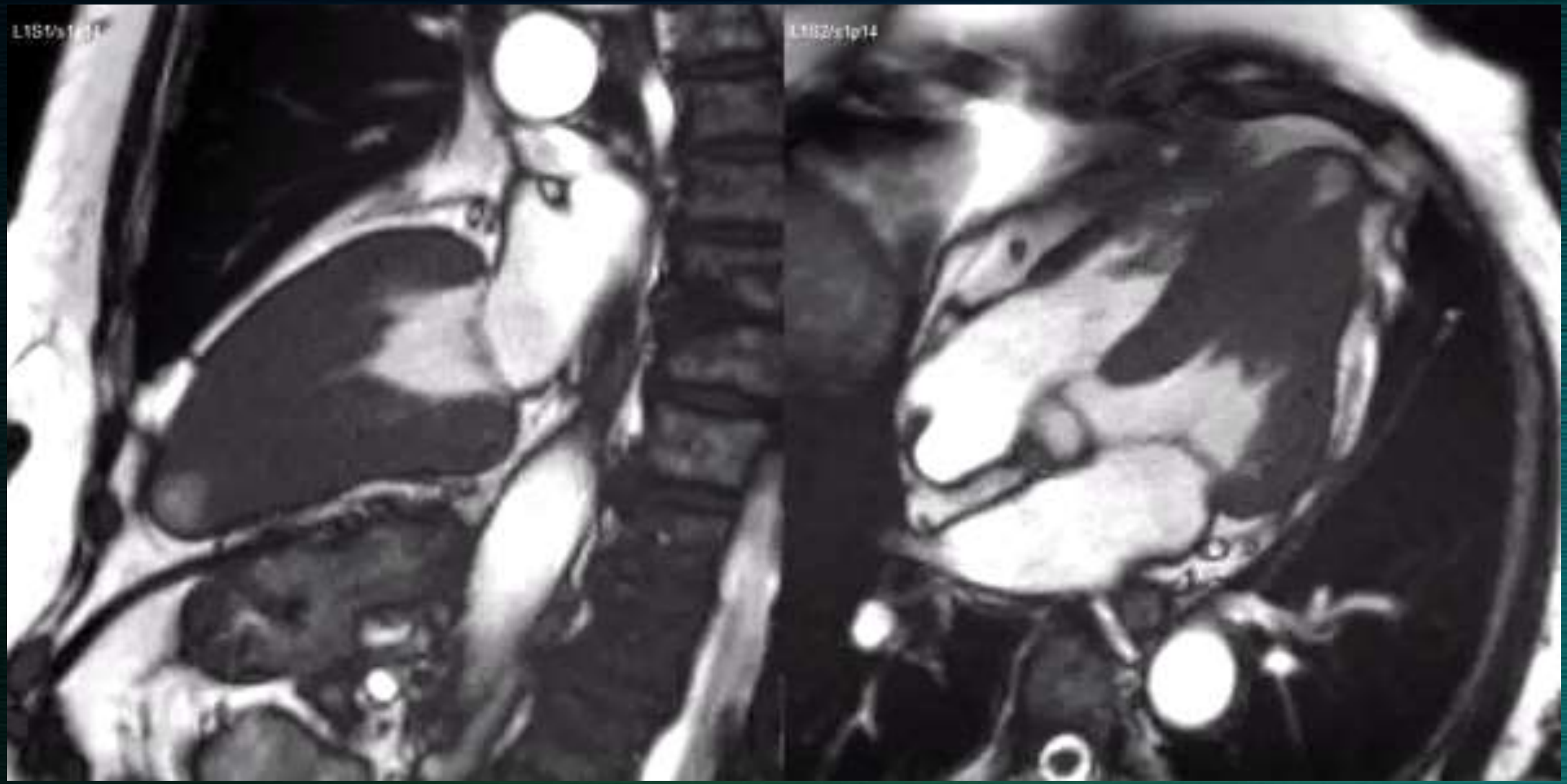
SAM (Systolic anterior motion of the mitral valve)





HYPERTROPHIC CARDIOMYOPATHY

CMR



Restrictive heart diseases

Restrictive heart diseases

Intrinsic myocyte dysfunction

Genetic

- Primary RCM
- Variants in sarcomeric, cytoskeletal, nuclear envelope, filamin, titin genes

Storage

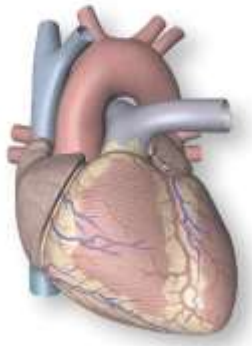
- Desmin
- AFD
- Danon
- Glycogenoses
- *PRKAG2* variants
- Iron overload/storage disorders

Non-genetic

- Drugs (e.g. chloroquine)

Endomyocardial disorders

- Endomyocardial fibrosis
- Hypereosinophilia
- Carcinoid
- Endocardial fibroelastosis
- Endocardial neoplasms
- Iatrogenic/drug toxicity



Myocardial extracellular matrix disorders

Infiltrative

- Hyperoxaluria
- Amyloidosis
- Sarcoidosis

Fibrosis

- Radiation
- Chemotherapy
- Systemic sclerosis
- Inflammatory/granulomatous
- Diabetic heart disease

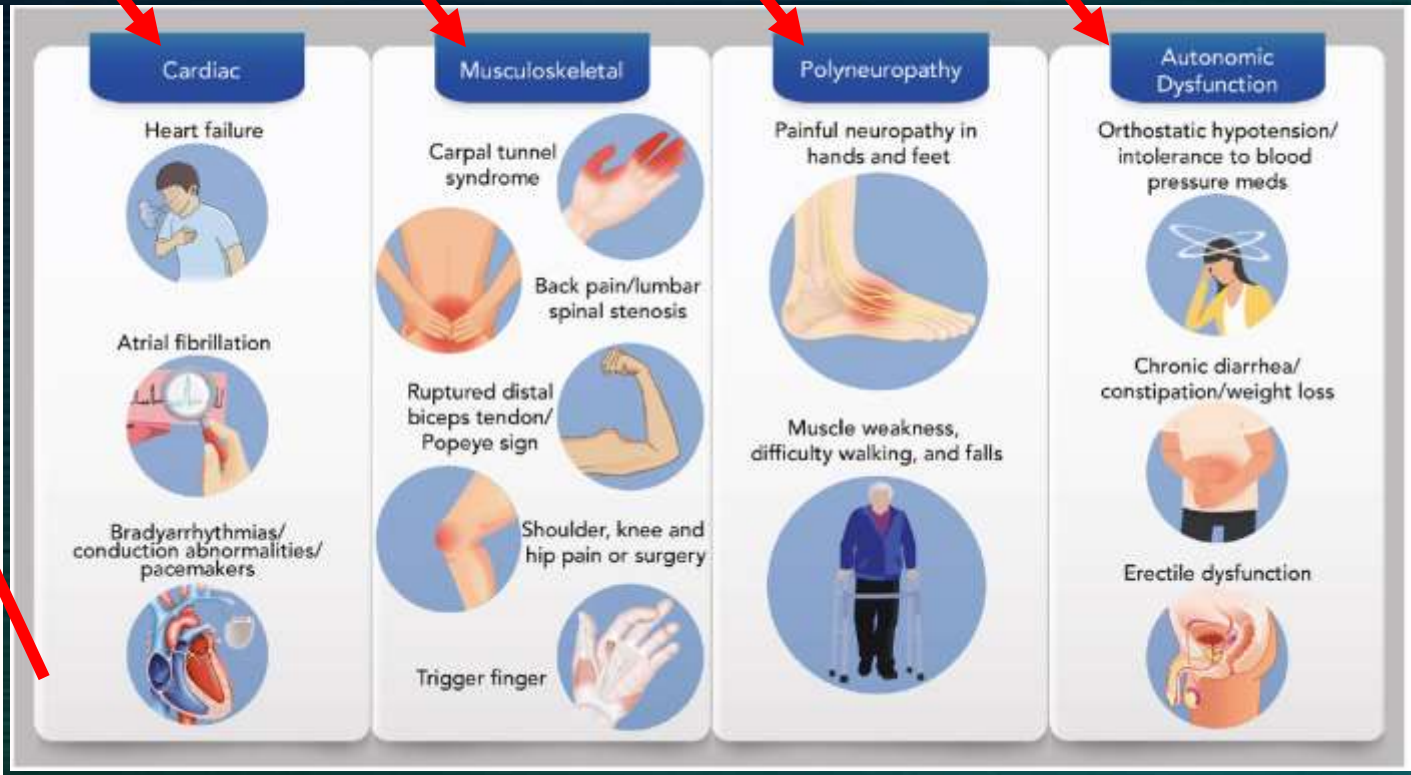
RCM

Myocardial diseases with occasional restrictive physiology, often in the context of LVH

2023 ESC Guidelines for the management of cardiomyopathies
(European Heart Journal; 2023 – doi:10.1093/eurheartj/ehad 194)

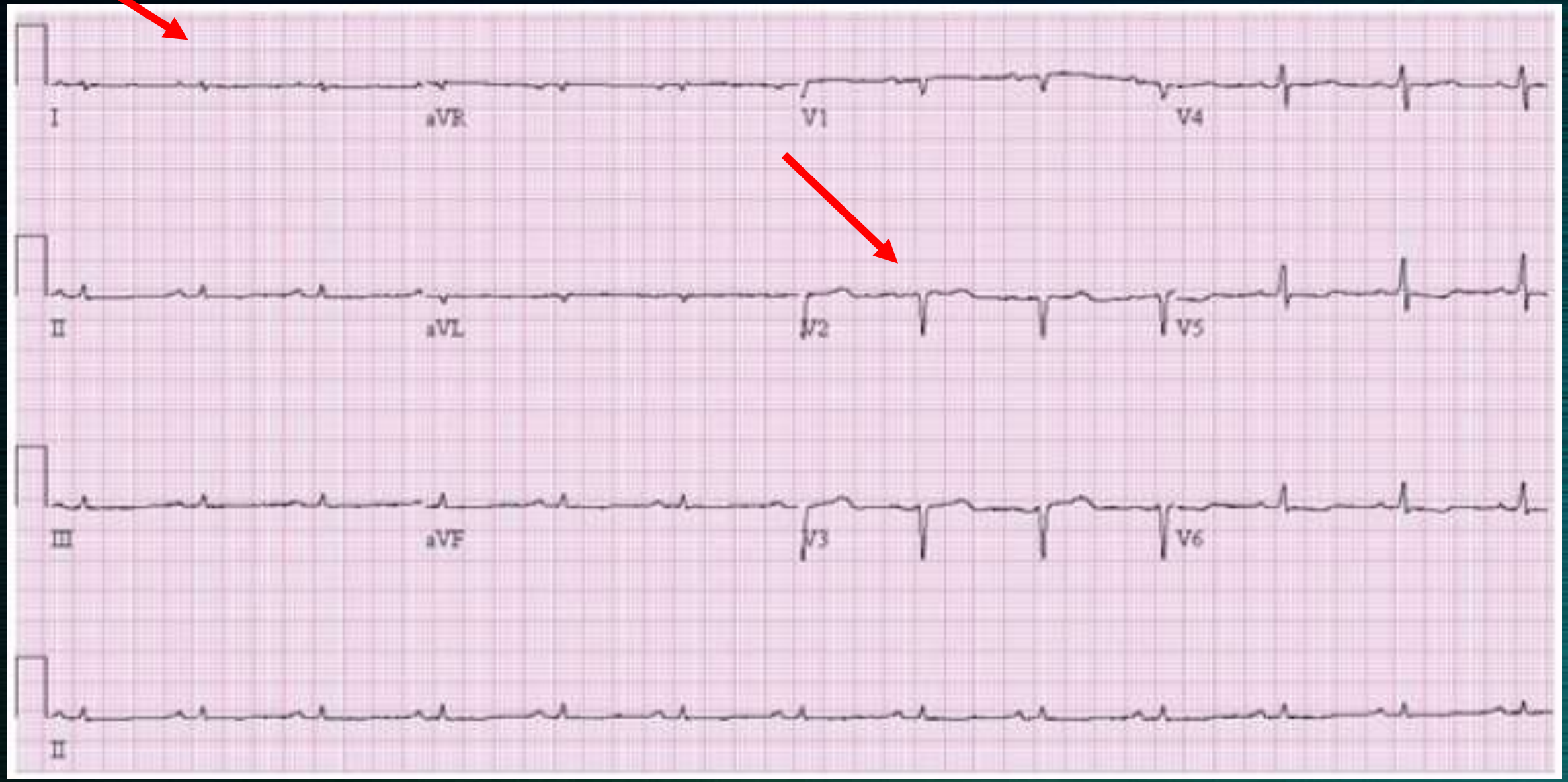
ESC

Screening for ATTR amyloidosis in the clinic: overlapping disorders, misdiagnosis, and multiorgan awareness



Heart Failure Reviews (2022) 27:785–793
https://doi.org/10.1007/s10741-021-10080-2

CARDIAC AMYLOIDOSIS, ECG

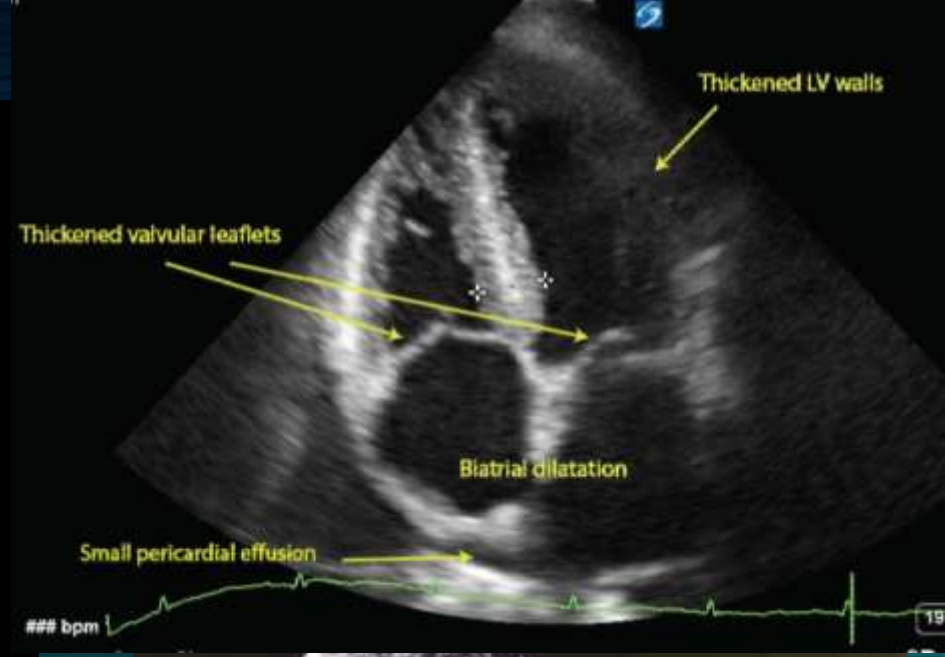


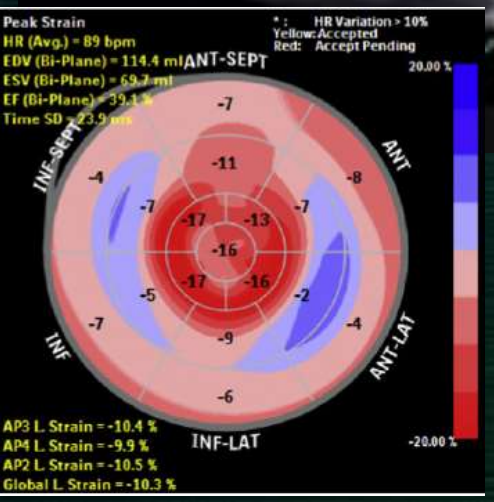
Typical electrocardiogram (ECG) in a patient with cardiac amyloidosis. Low QRS voltages in peripheral leads, Pathologic Q waves.

CARDIAC AMYLOIDOSIS

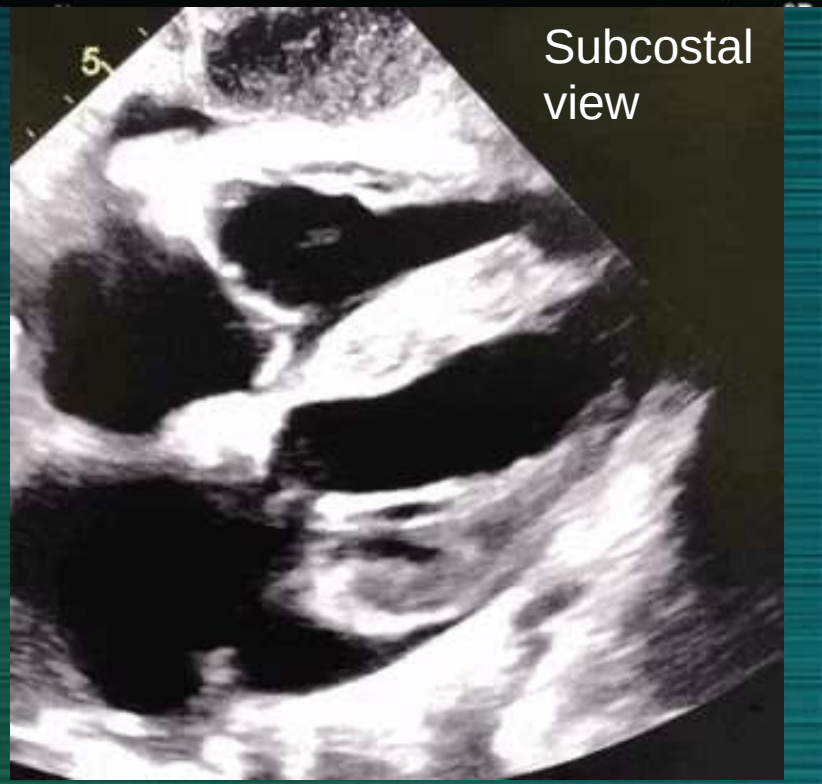
Transthoracic Echocardiogram

Apical 4-chamber view





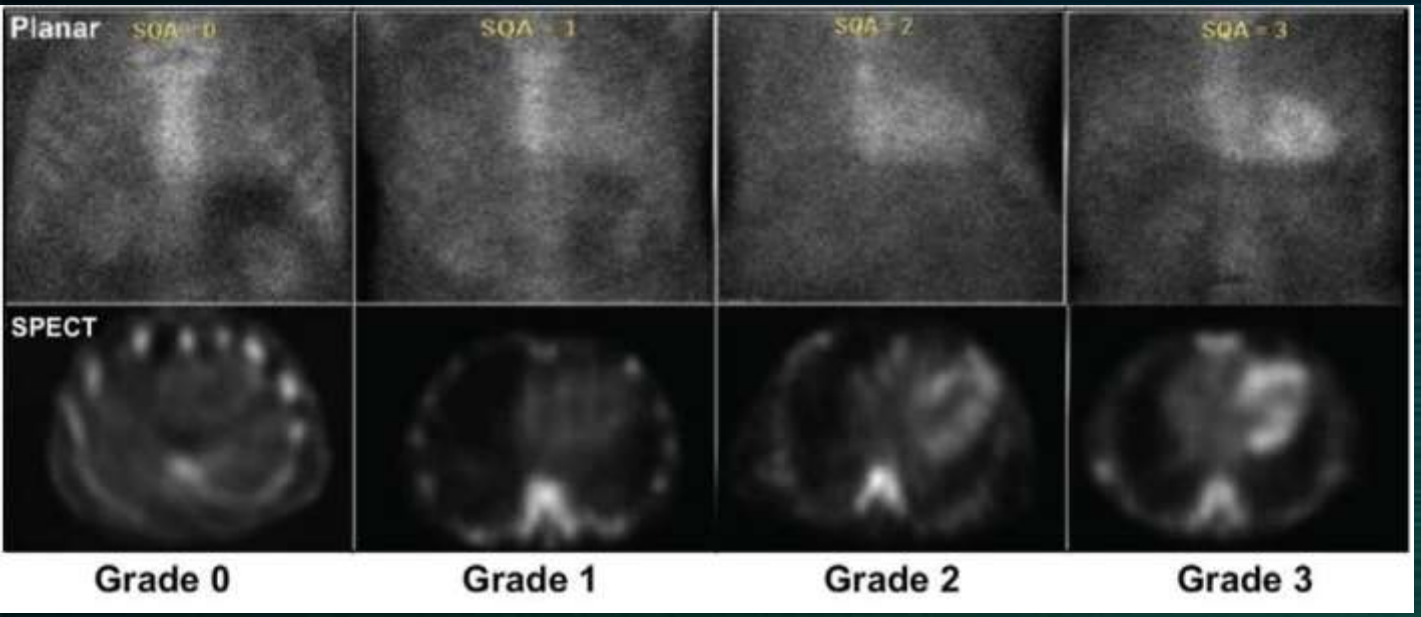
Longitudinal **strain** presents with a typical pattern that distinguishes it from other cardiomyopathies: a severe reduction in deformation values at the base of the left ventricle with apical sparing (>2:1 apical/basal ratio or “cherry on top”) pattern.



Subcostal view

CARDIAC AMYLOIDOSIS, bone scintigraphy

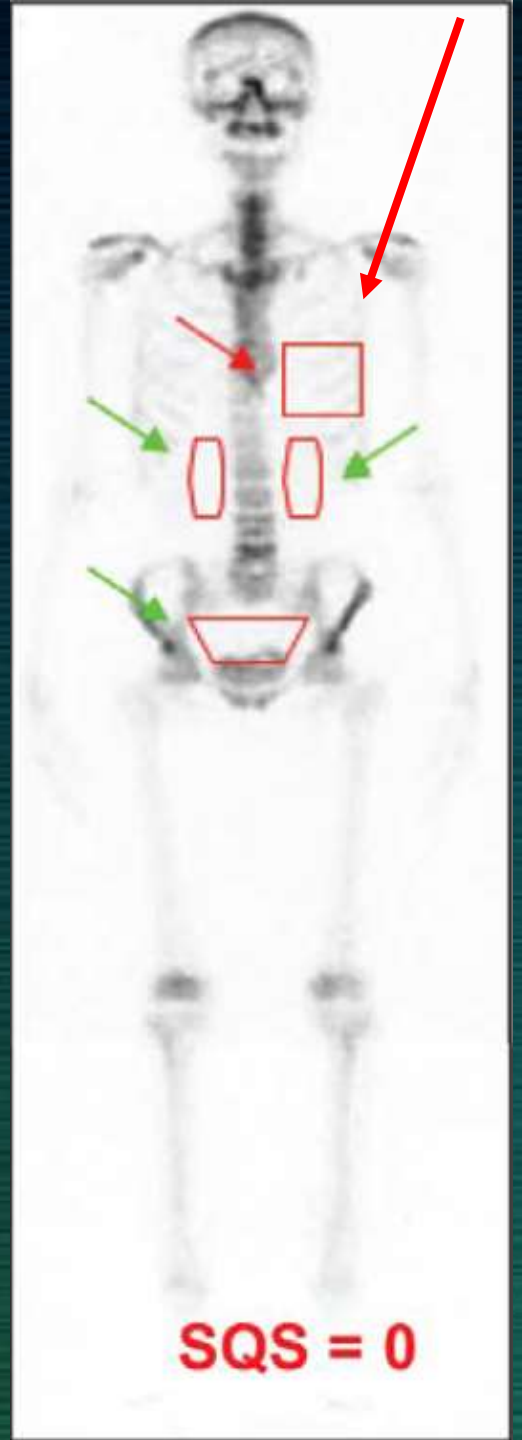
Bone tracers, in particular, 99mTc-3,3-diphosphono-1,2-propanodicarboxylic acid (99mTc-DPD) has been documented to have the ability to bind to TTR deposits but not to AL deposits. Therefore, the method allows, within certain limits, the differential diagnosis between the two etiological forms

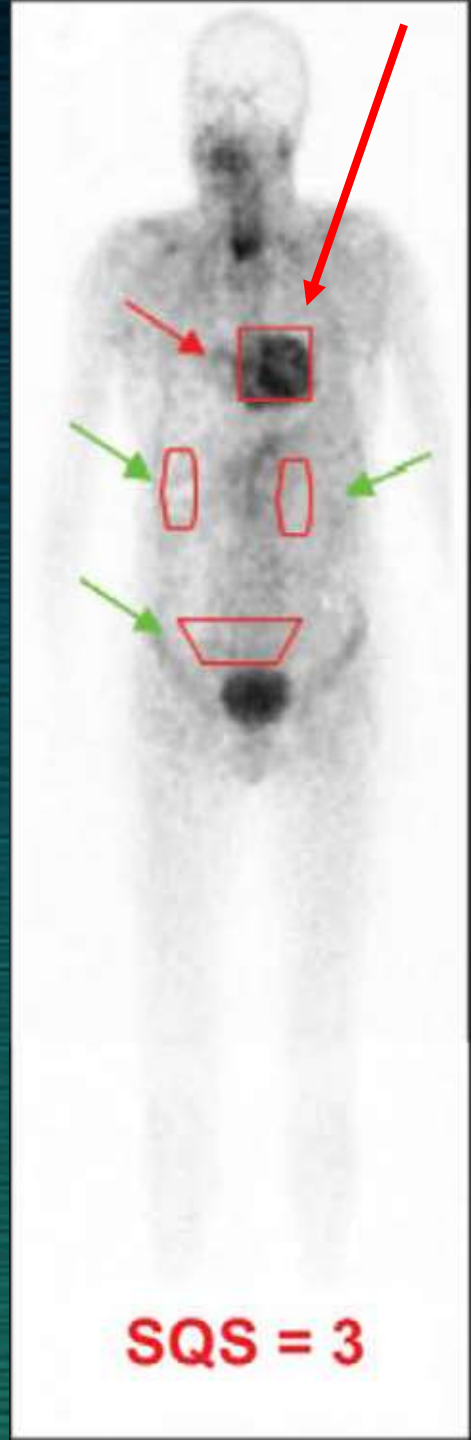


99mTechnetium imaging procedures for cardiac amyloidosis. SPECT imaging to identify myocardial retention of technetium-based isotopes

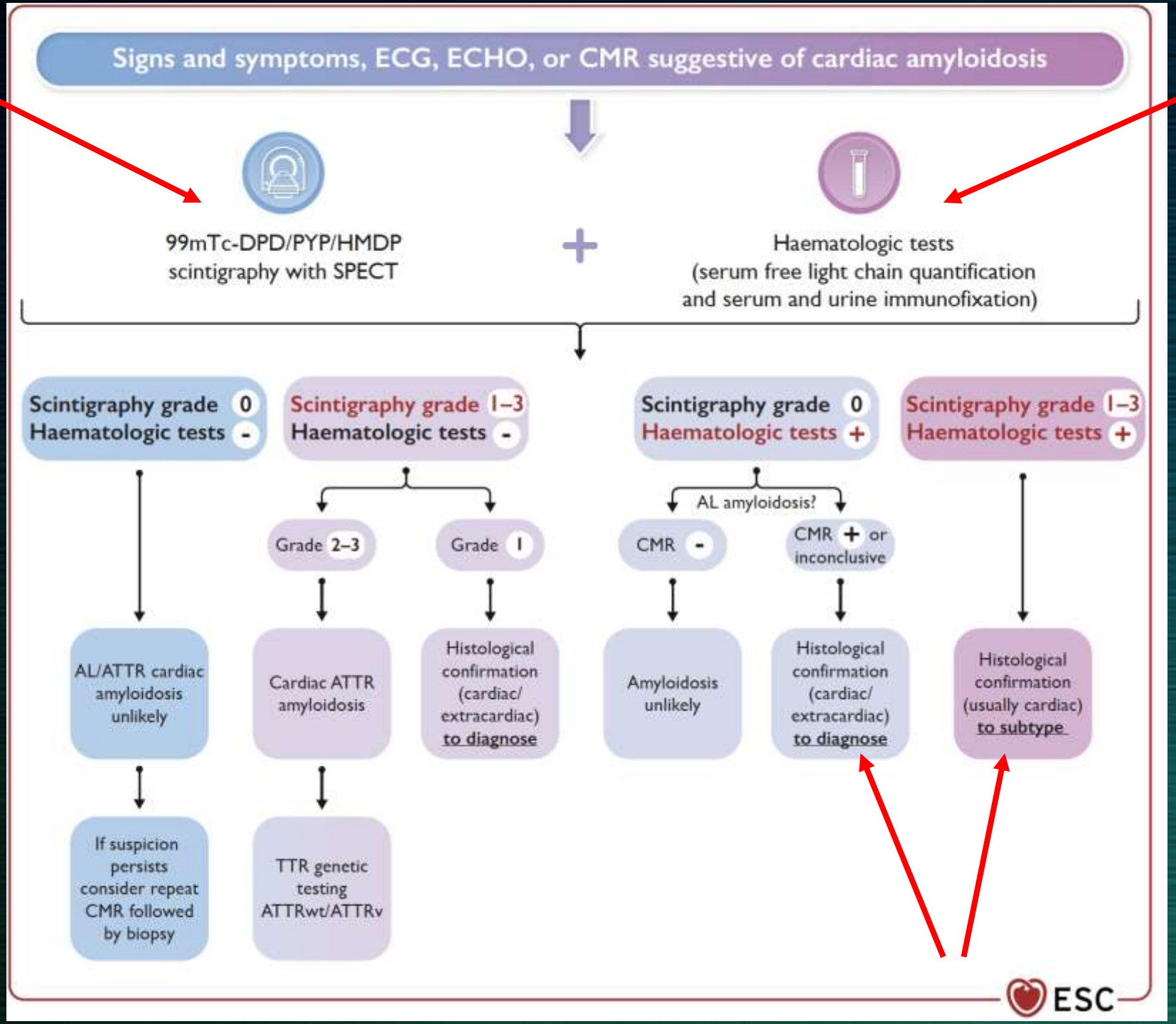
Perugini grading scale:

- Strong uptake (2-3),
- weak uptake (1), a
- bsent uptake (0))



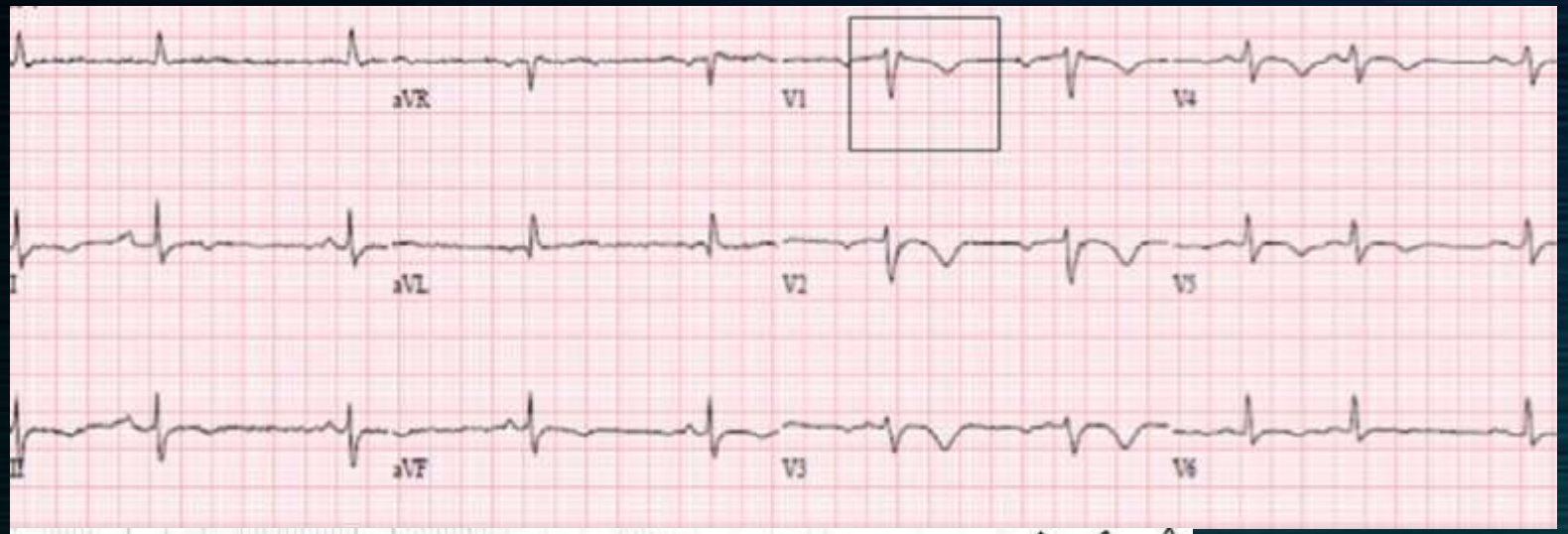


Diagnosis of cardiac amyloidosis

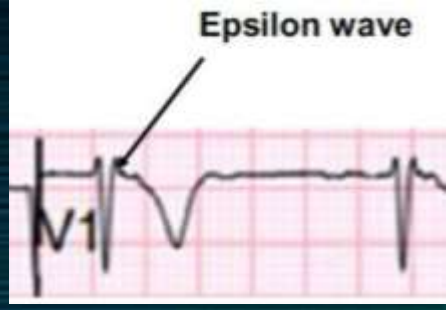


2023 ESC Guidelines for the management of cardiomyopathies (European Heart Journal; 2023 – doi:10.1093/eurheartj/ehad 194)

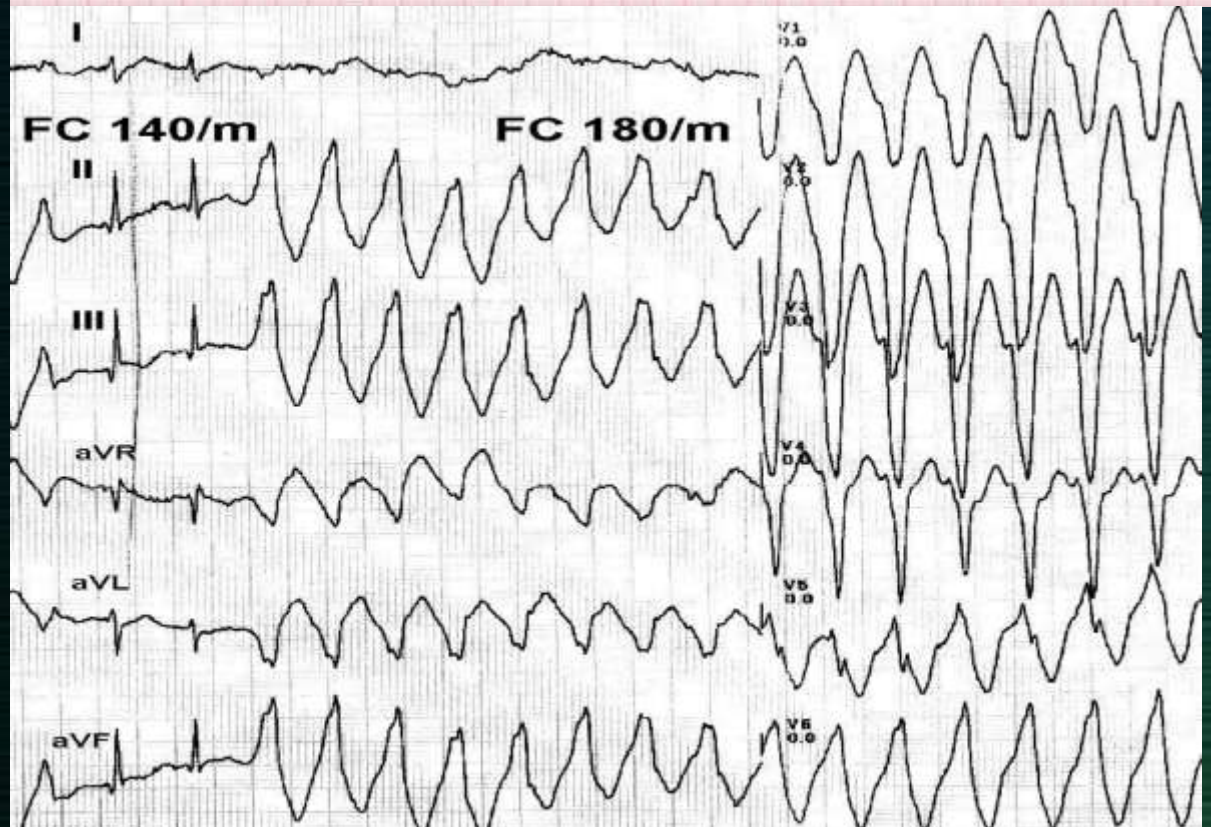
ARRHYTHMOGENIC CARDIOMYOPATHY, ECG



ECG in ARVC patient (PKP2 mutation). Inversion of T-waves in V1-V6 leads and epsilon wave in V1.



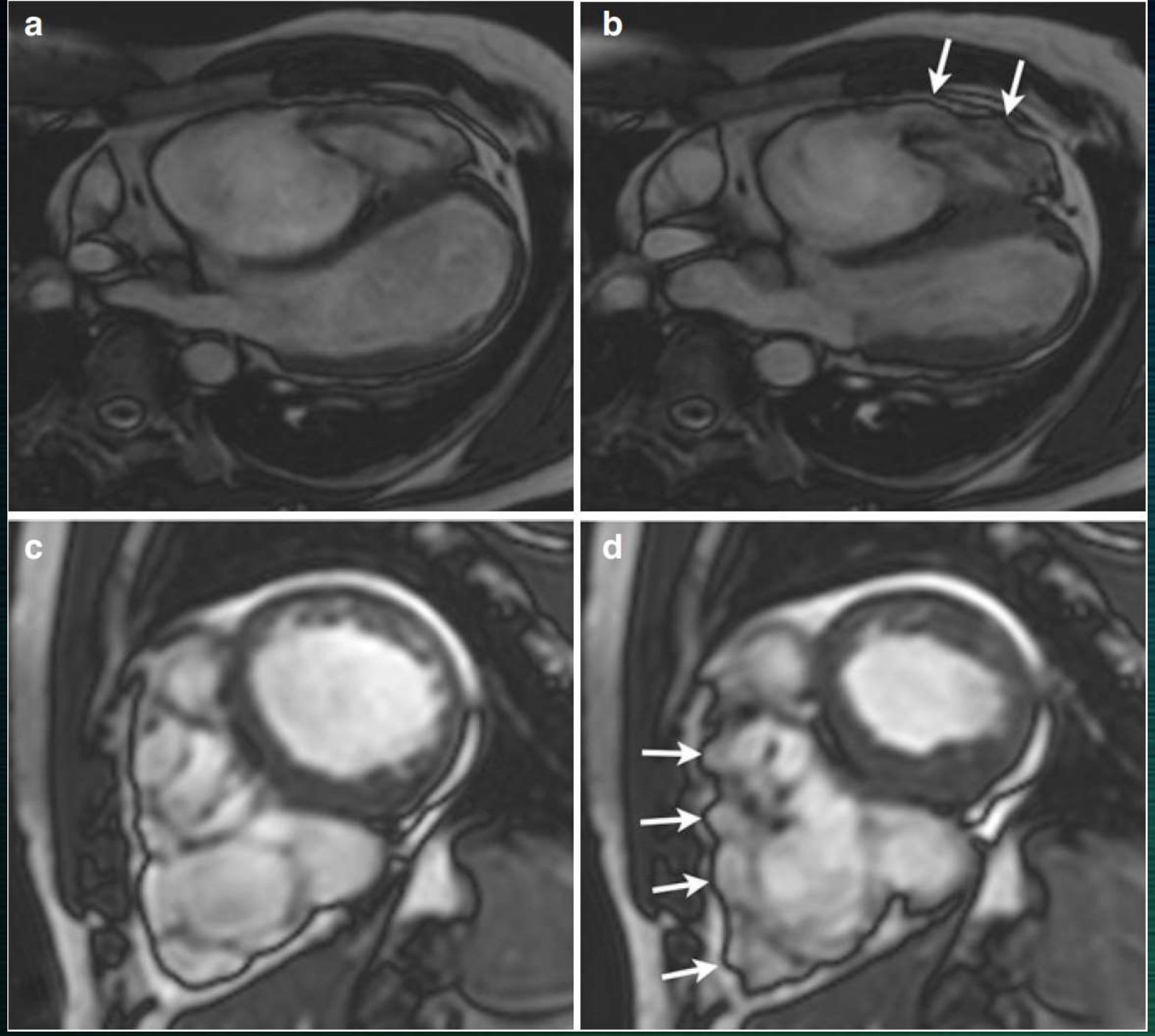
nadir-to-end of S-wave interval >55 msec



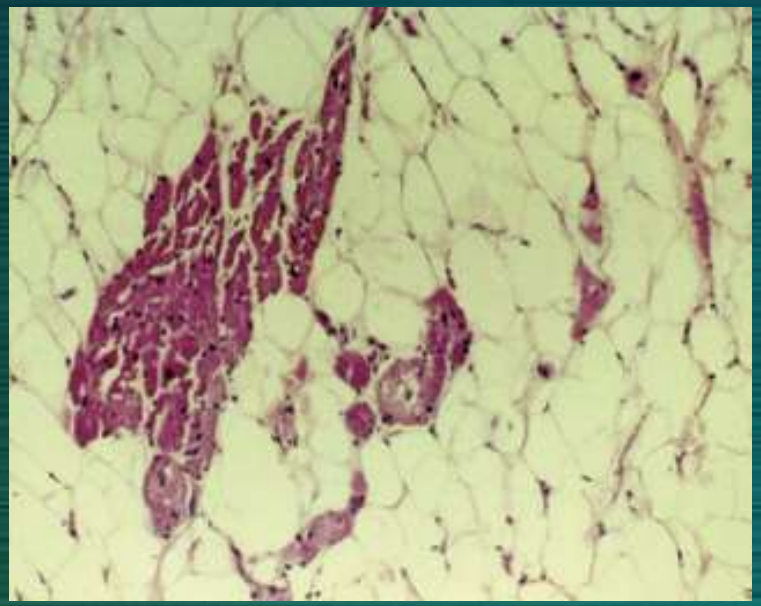
ECG during exercise-induced ventricular tachycardia (VT) in a patient with arrhythmogenic right ventricular cardiomyopathy (ARVC). Morphology of VT resembling a left bundle branch block (LBBB) pattern with a lower axis, delayed transition, wide QRS, and the presence of notches in the QRS complexes.

The echocardiogram in arrhythmogenic right ventricular cardiomyopathy (ARVC).

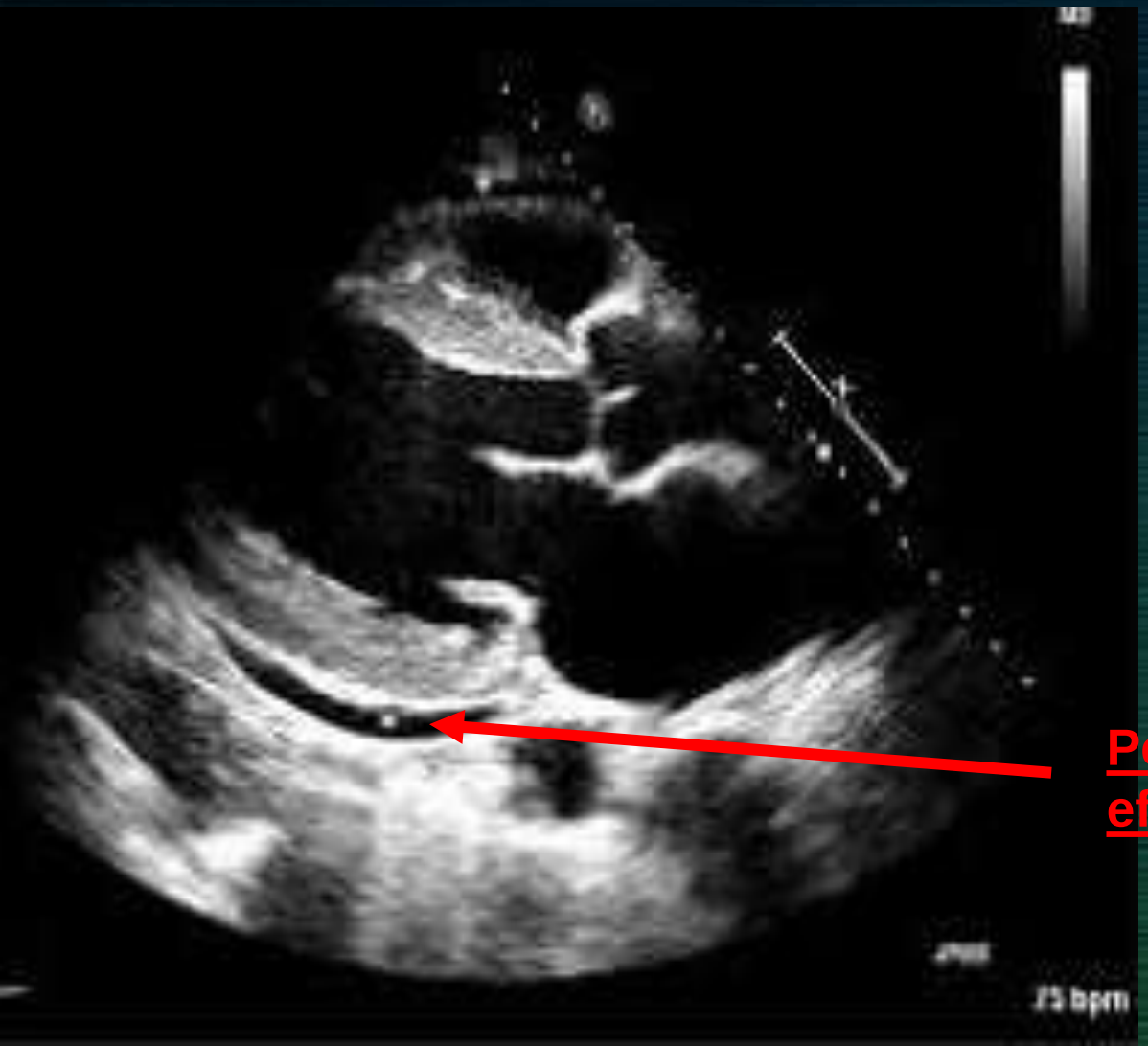
ARRHYTHMOGENIC CARDIOMYOPATHY, CMR

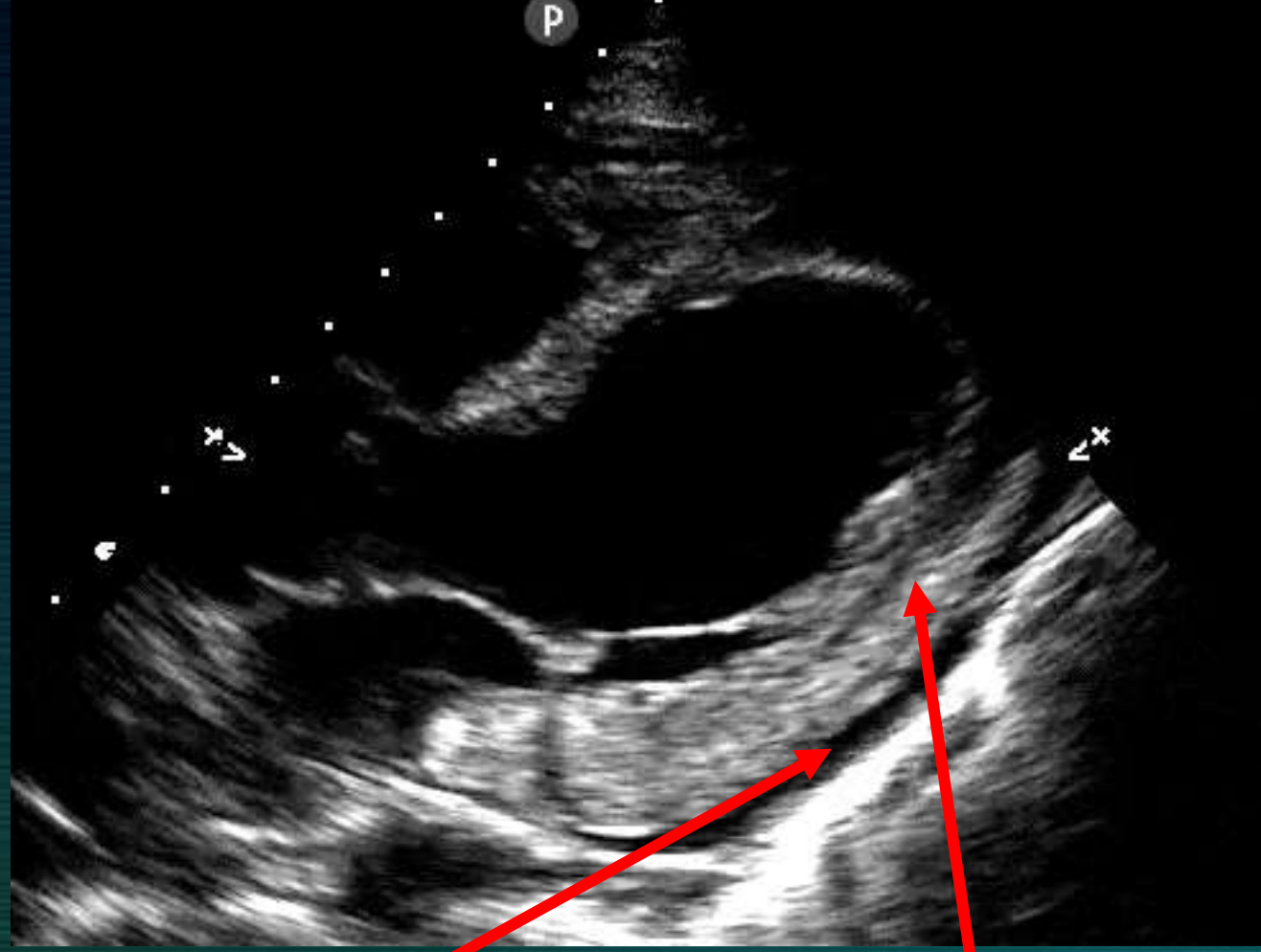


Biventricular wall motion abnormalities (WMA) in a patient with arrhythmogenic right ventricular cardiomyopathy (ARVC) and left ventricular (LV) involvement seen at steady-state free precession (SSFP) imaging. End-diastole (a , c), end-systole (b , d). Four-chamber off-axis (a , b), and short-axis (c , d) slices. Note RV end-systolic bulging areas in b and d (arrows). Apical LV hypokinesis is also present



MYOCARDITIS and MYOPERICARDITIS DIAGNOSIS: Troponin and Echocardiogram





Pericardial effusion

Depression of the kinetics of the left ventricle

MYOCARDITIS, DIAGNOSIS

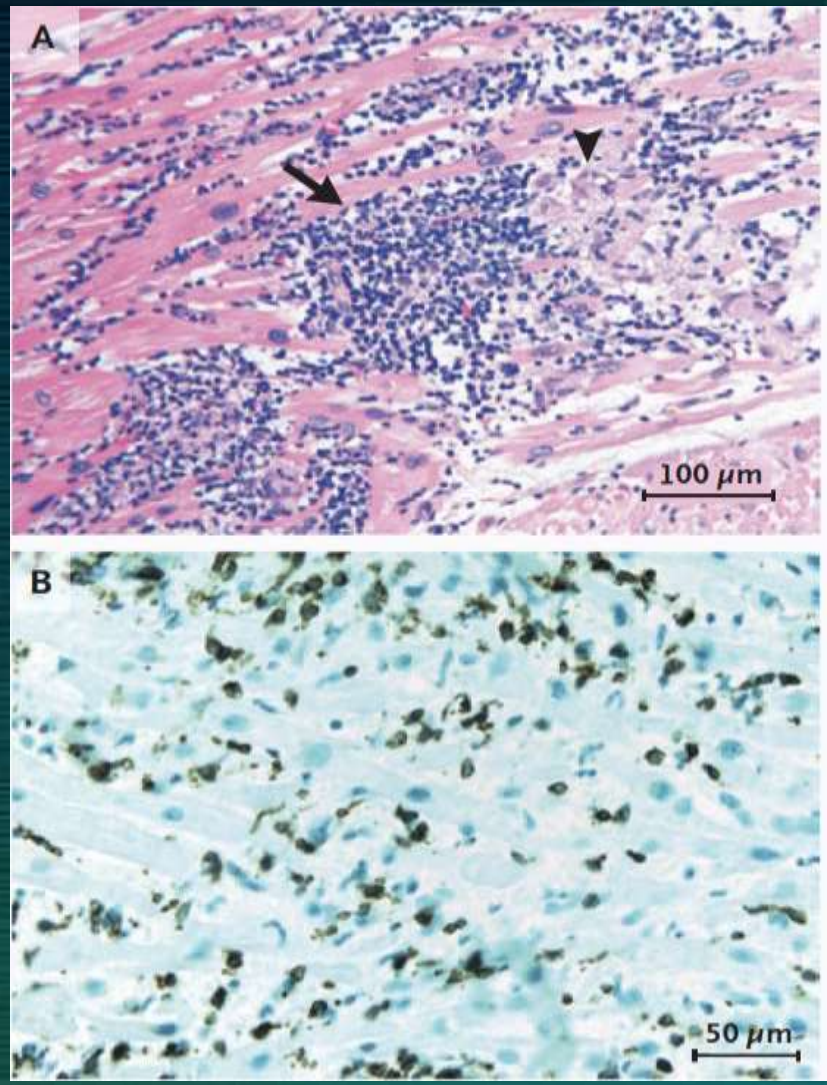
Cardiac Magnetic Resonance Imaging (CMR)

2018 Lake Louise Criteria		CMR Image Examples			
Main Criteria	Myocardial Edema (T2-mapping or T2W images)	Regional or global increase of native T2		or	Regional or global increase of T2 signal intensity
	Non-ischemic Myocardial Injury (Abnormal T1, ECV, or LGE)	Regional or global increase of native T1		or	Regional or global increase of ECV
				or	Regional LGE signal increase
Supportive Criteria	Pericarditis (Effusion in cine images or abnormal LGE, T2, or T1)	Pericardial effusion			Regional or global hypokinesis
	Systolic LV Dysfunction (Regional or global wall motion abnormality)				

Ferreira, V.M. et al. J Am Coll Cardiol. 2018;72(24):3158-76.

ECV . extracellular volume; LGE . late gadolinium enhancement; T2W . T2-weighted.

Histology:



Lymphocytic and Histiocytic Infiltrate and T Lymphocytes in Heart-Tissue.
Sections from Patients with Acute Myocarditis.
Panel A shows acute myocarditis with widespread lymphocytic and histiocytic infiltrate (arrow) and associated myocyte damage (arrowhead) (hematoxylin and eosin).
Panel B shows CD3 immunostaining of T lymphocytes
in a patient with acute myocarditis

The definitions for PH are based on haemodynamic assessment by **right heart catheterization (RHC).**

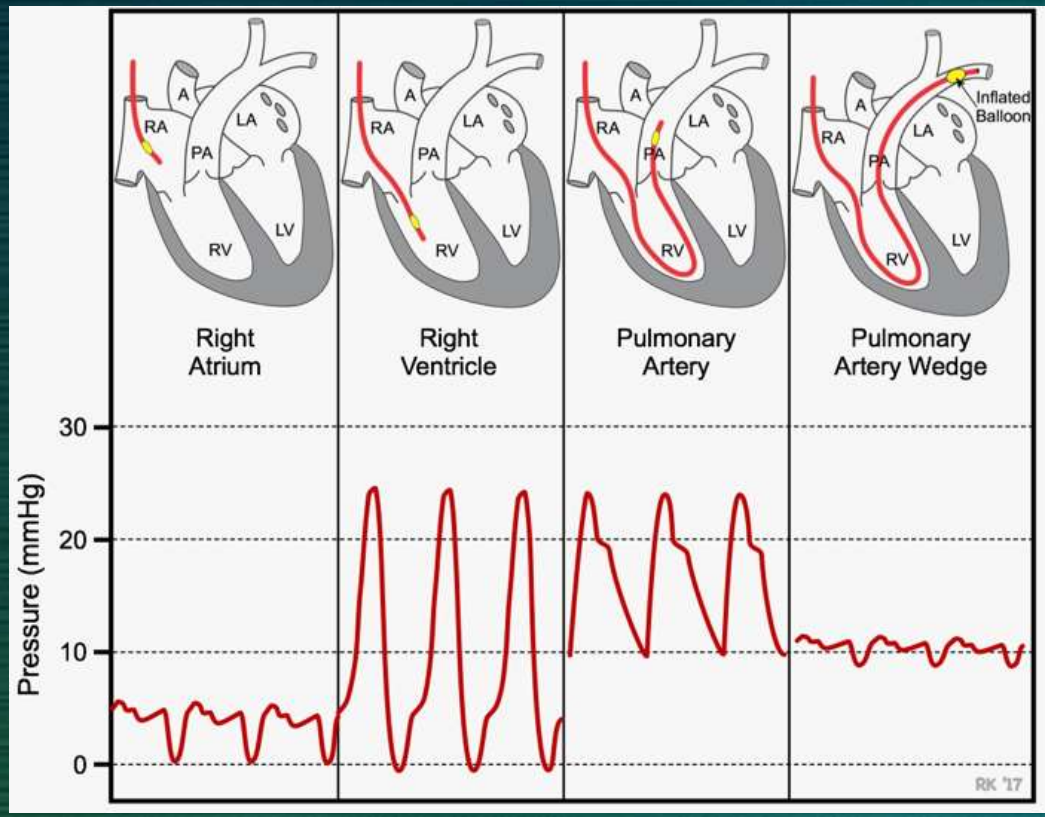
Although haemodynamics represent the central element of characterizing PH, the **final diagnosis** and **classification** should reflect the whole clinical context and consider the results of all investigations.

Pulmonary hypertension :
a mean pulmonary arterial pressure (mPAP) > 20 mmHg at rest

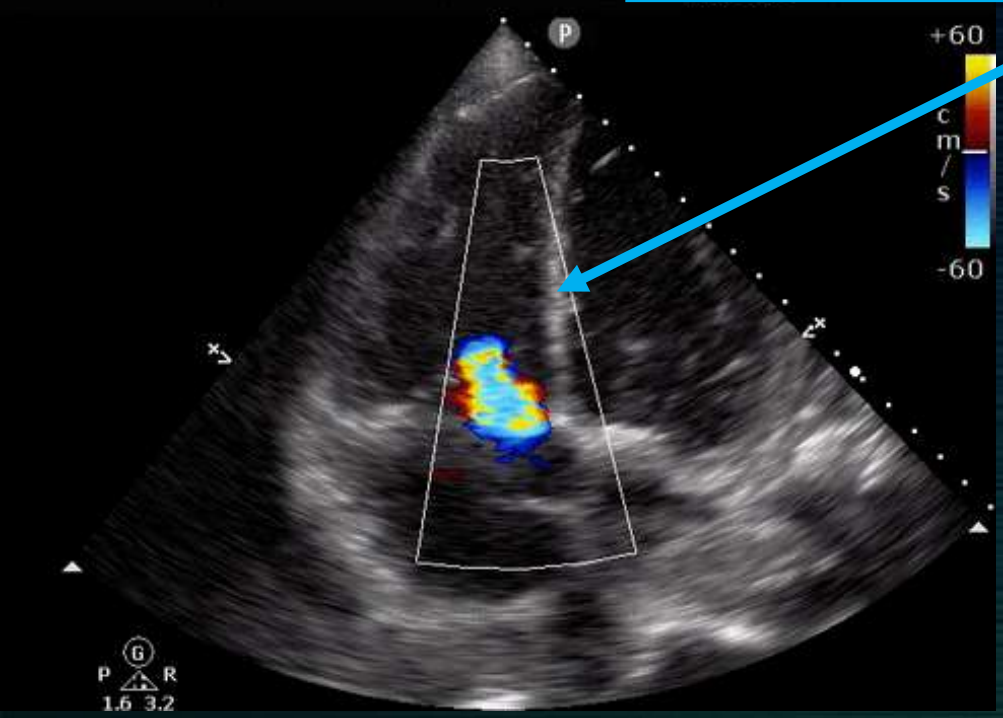
It is essential to include

- Pulmonary Vascular Resistance (PVR)
- and Pulmonary Arterial Wedge Pressure (PAWP)

in the definition of pre-capillary PH

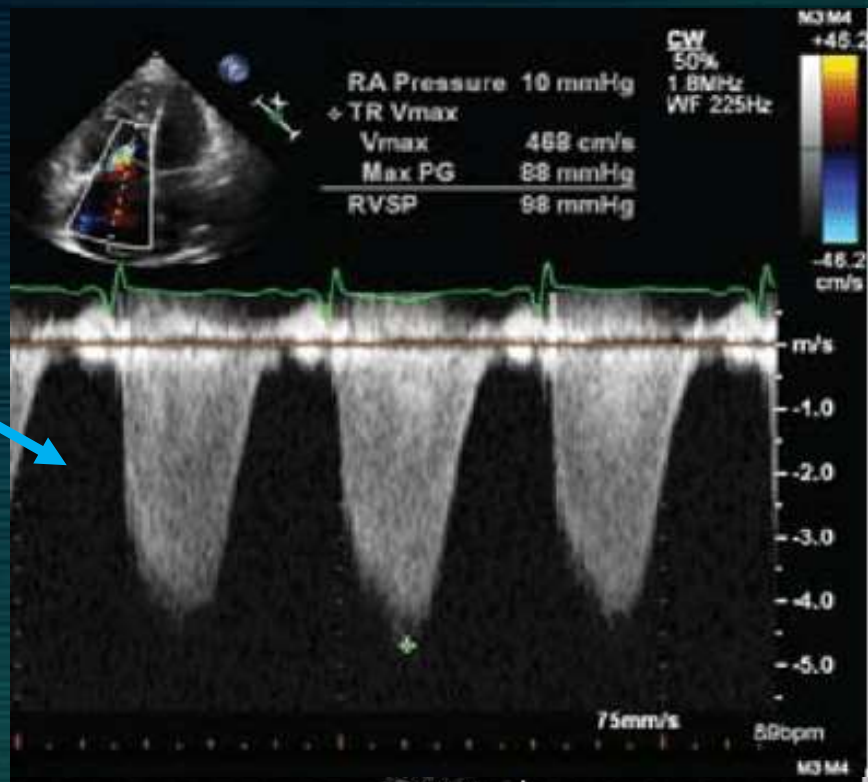


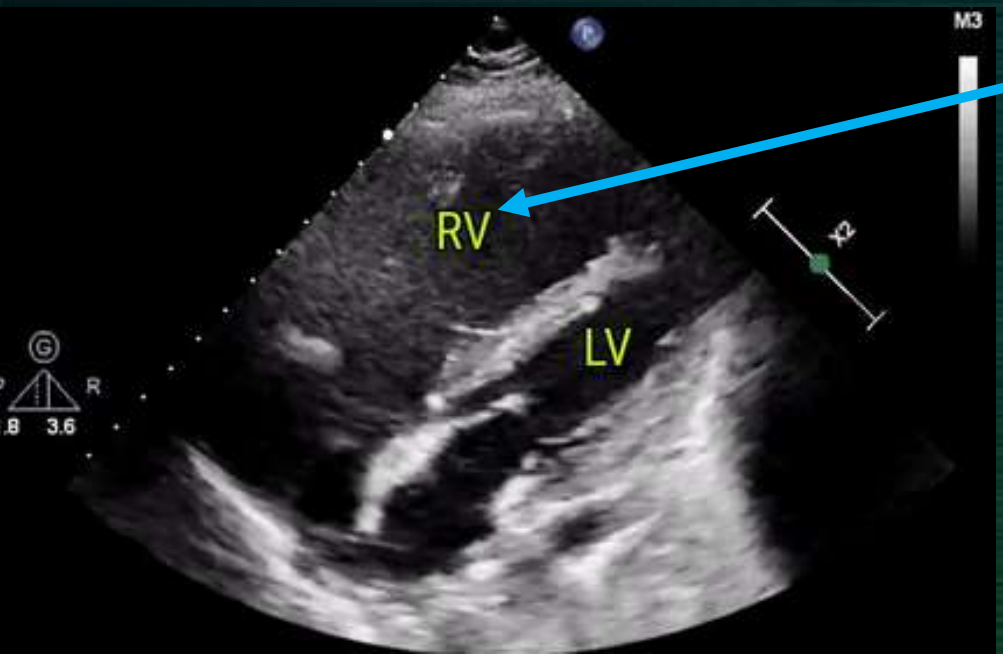
Pulmonary Hypertension: TransThoracic Echocardiography



Tricuspid regurgitation seen with color doppler flow

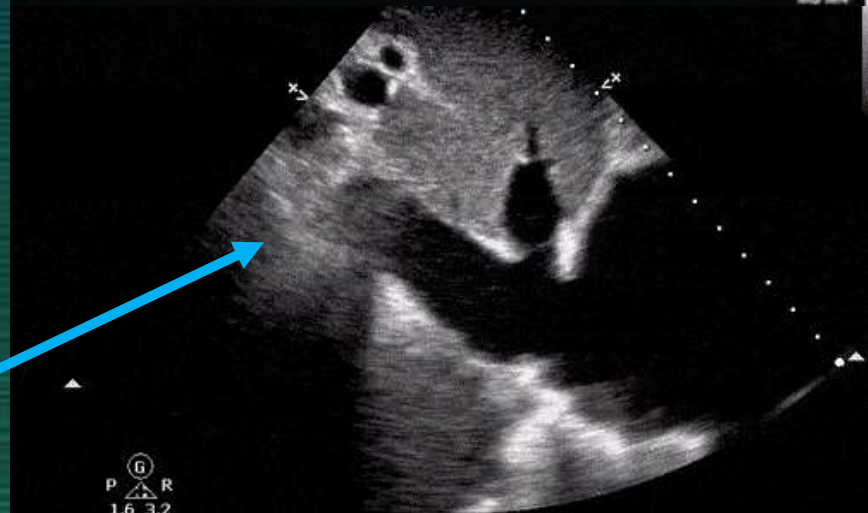
Increase systolic peak tricuspid regurgitation velocity (peak TRV), measured with continuous wave Doppler



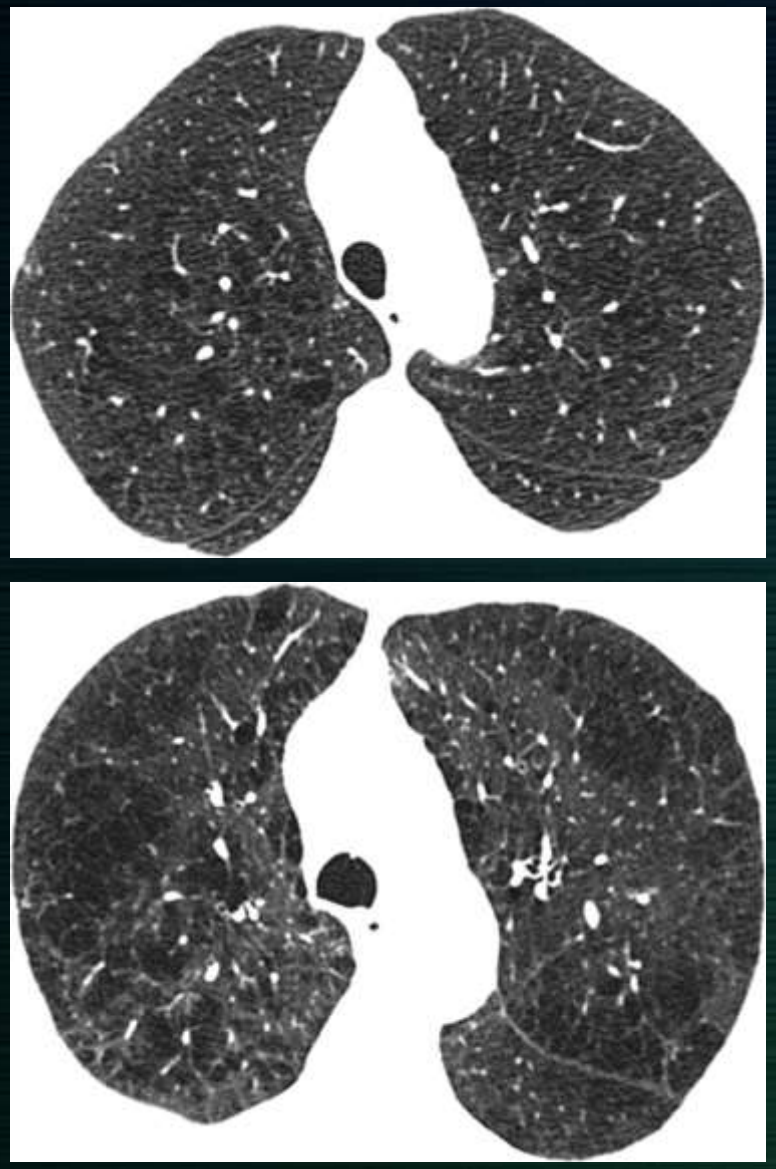


A case of severely dilated right ventricle (RV size more than that of LV) in a patient with severe pulmonary hypertension.

Subcostal view: distended inferior vena cava with diminishing inspiratory collapsibility

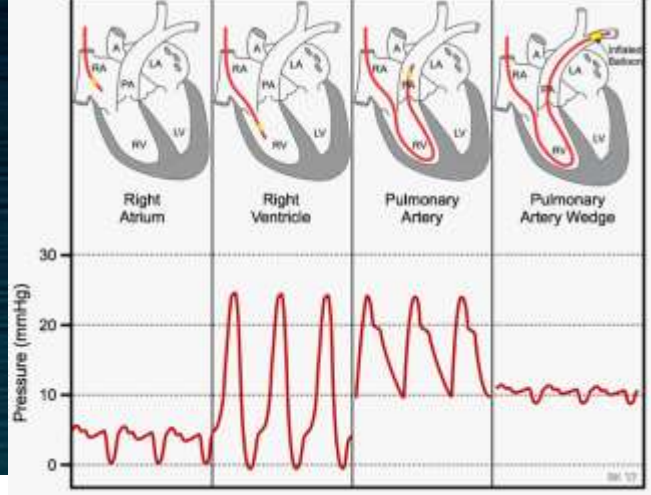


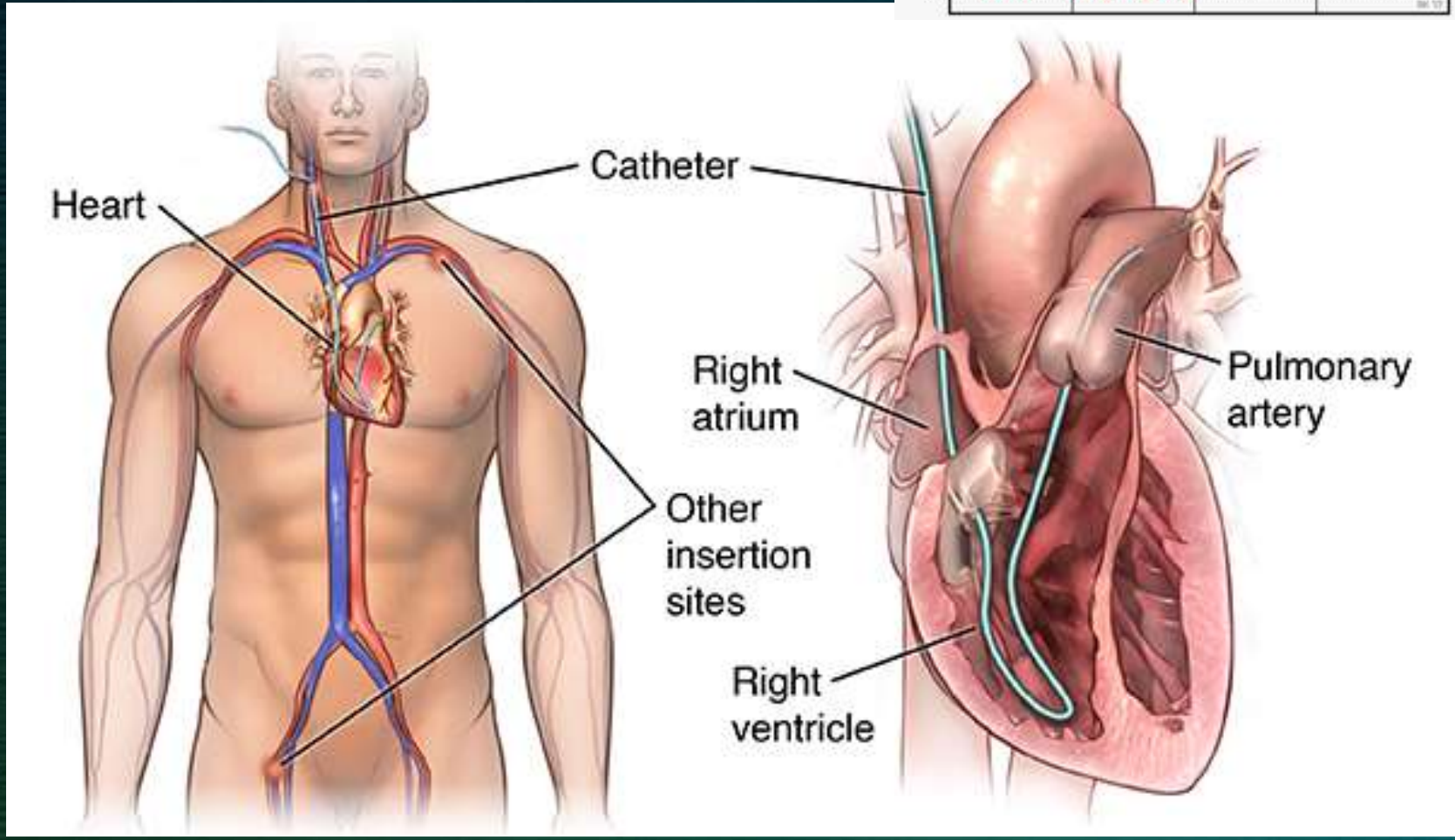
DIAGNOSIS of PH.
PULMONARY FUNCTION AND LUNG IMAGING



Figures: Axial CT images show severity grades of parenchymal emphysema

DIAGNOSIS : INVASIVE CARDIOPULMONARY HEMODYNAMICS: Right Heart Catheterization (RHC).

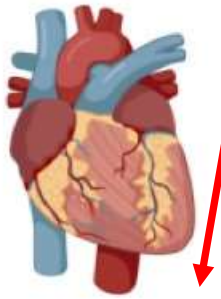




2022 ESC/ERS Guidelines for the Diagnosis and Treatment of PH

Central Illustration

Clinical Classification



1 Pulmonary arterial hypertension (PAH)	2 PH associated with left heart disease	3 PH associated with lung disease	4 PH associated with pulmonary artery obstructions	5 PH with unclear and/or multifactorial mechanisms
▪ Idiopathic/ heritable ▪ Associated conditions	▪ IpcPH ▪ CpcPH	▪ Non-severe PH ▪ Severe PH	▪ CTEPH ▪ Other pulmonary obstructions	▪ Hematologic disorders ▪ Systemic disorders
Rare	Very common	Common	Rare	Rare

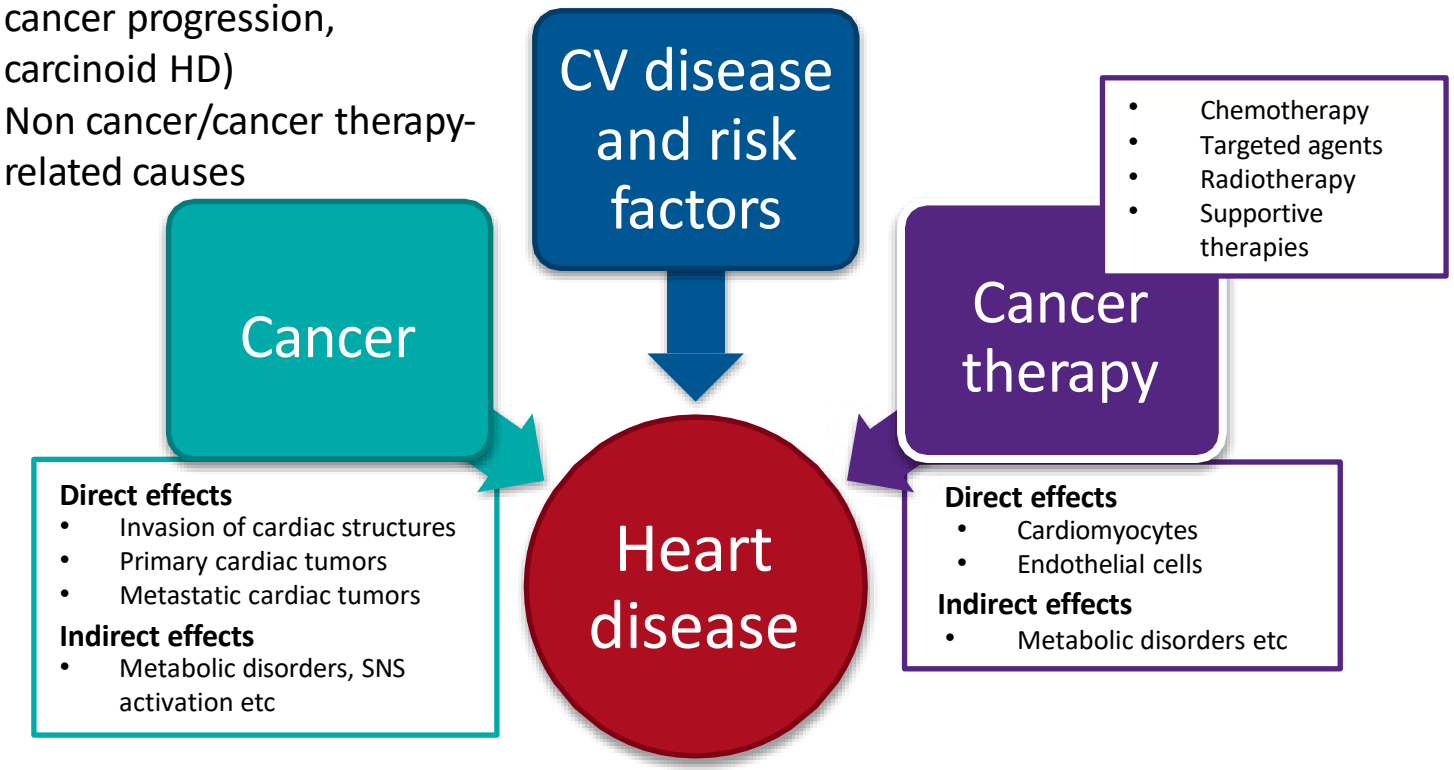
CTEPH, chronic thrombo-embolic pulmonary hypertension; CpcPM, combined postcapillary and precapillary pulmonary hypertension; IpcPH, isolated postcapillary pulmonary hypertension.

Humbert M, et al. Eur Heart J. 2022:ehac237.

Causes of acute/sub-acute CVD in active cancer

Differential diagnosis

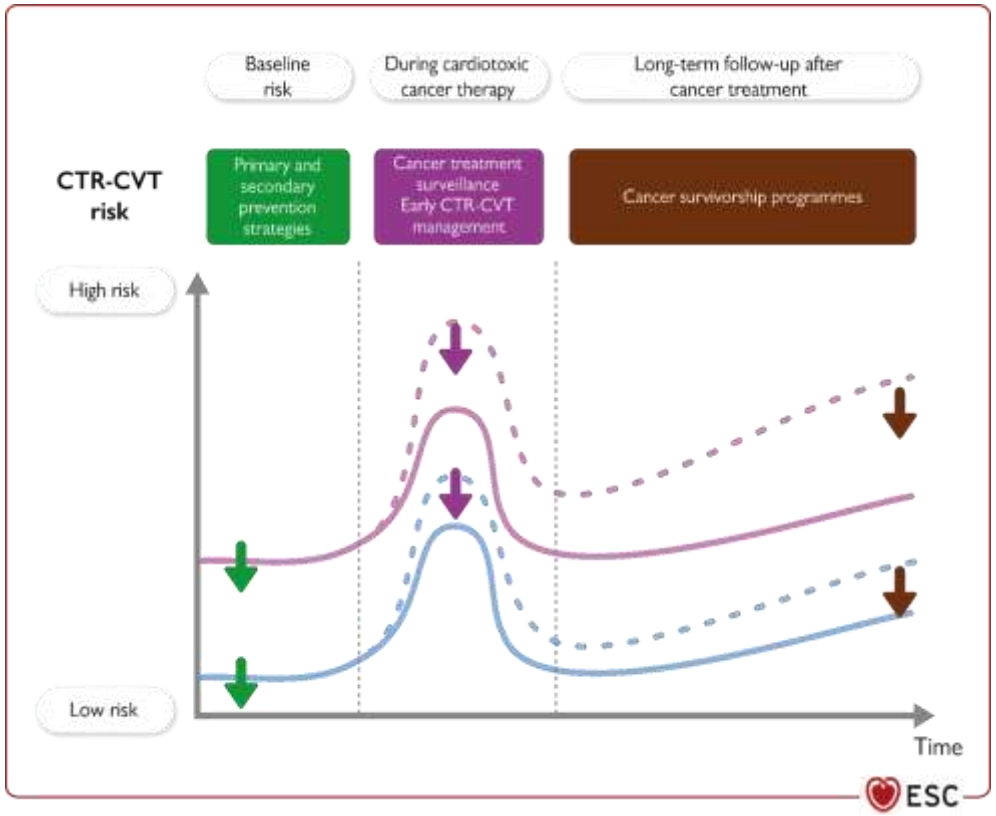
- Cardiotoxicity
- Cancer (eg. cardiac tumors, cancer progression, carcinoid HD)
- Non cancer/cancer therapy-related causes



Farmakis et al. Eur J Heart Fail 2018

Dynamics of CV toxicity risk

CTR-CVT:
cancer therapy-related cardiovascular toxicity

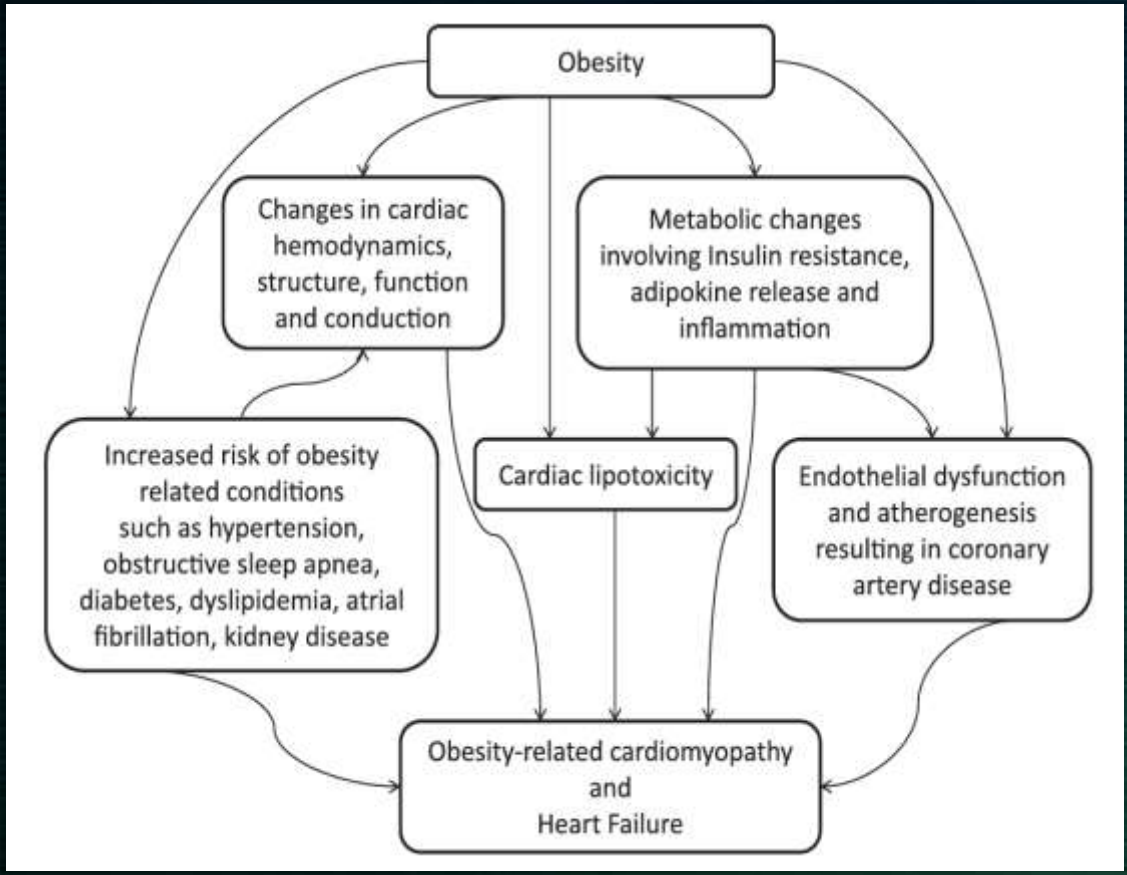


2022 ESC Guidelines on cardio-oncology (*European Heart Journal*; 2022 – doi: 10.1093/eurheartj/ehac244)

Obesity Research & Clinical Practice (2014) 8, e540–e548

Mechanisms of heart failure in obesity

Imo A. Ebong[a,*], David C. Goff Jr.[b], Carlos J. Rodriguez[c,d], Haiying Chen[e], Alain G. Bertoni[c,d]

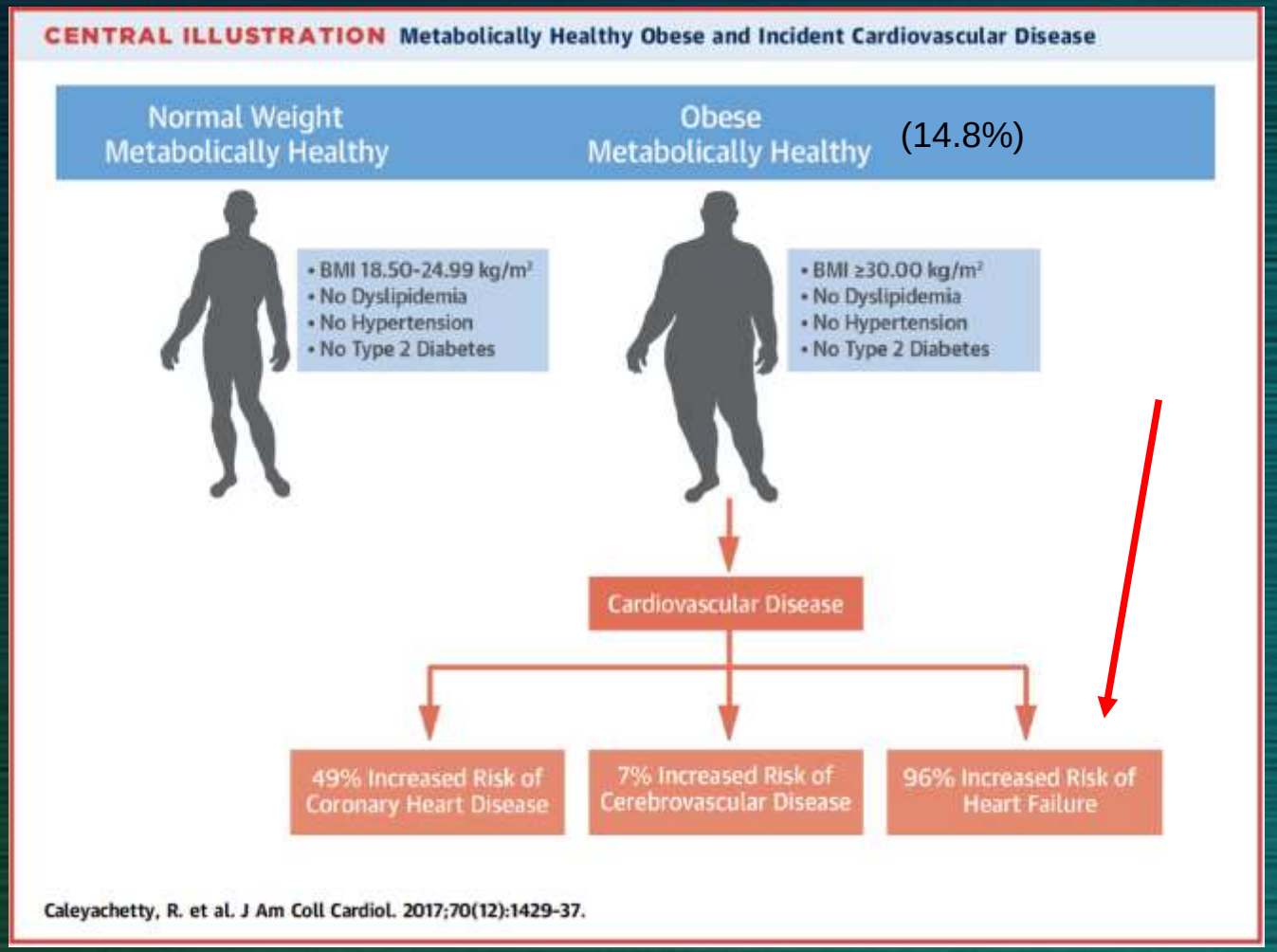


An illustration of the mechanisms of heart failure in obesity

JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY
VOL. 70, NO. 12, 2017
ISSN 0735-1097/$36.00
http://dx.doi.org/10.1016/j.jacc.2017.07.763

Metabolically Healthy Obese and Incident Cardiovascular Disease Events Among 3.5 Million Men and Women

Rishi Caleyachetty, MBBS, PhD,[a] G. Neil Thomas, PhD,[a] Konstantinos A. Toulis, MD, PhD,[a,b] Nuredin Mohammed, PhD,[a] Krishna M. Gokhale, MSc,[a] Kumarendran Balachandran, MBBS, MD,[a,c] Krishnarajah Nirantharakumar, MPH, MD[a]



Caleyachetty, R. et al. J Am Coll Cardiol. 2017;70(12):1429-37.

ESC European Society of Cardiology
European Heart Journal (2024) 45, 2294–2305
https://doi.org/10.1093/eurheartj/ehae362

Alcoholic cardiomyopathy: an update

Fernando Domínguez [1,2], Eric Adler [3], and Pablo García-Pavía [1,2]*

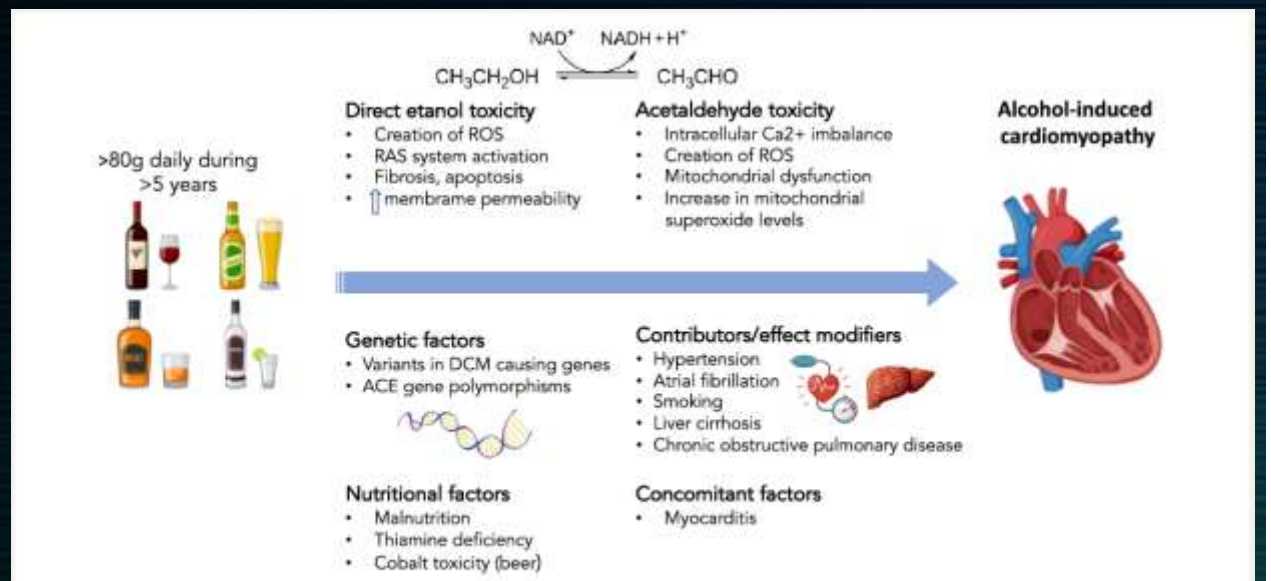


Figure 1 Pathogenic mechanisms of alcohol-induced cardiomyopathy. ACE, angiotensin-converting enzyme; DCM, dilated cardiomyopathy; RAS, renin–angiotensin system; ROS, reactive oxygen species

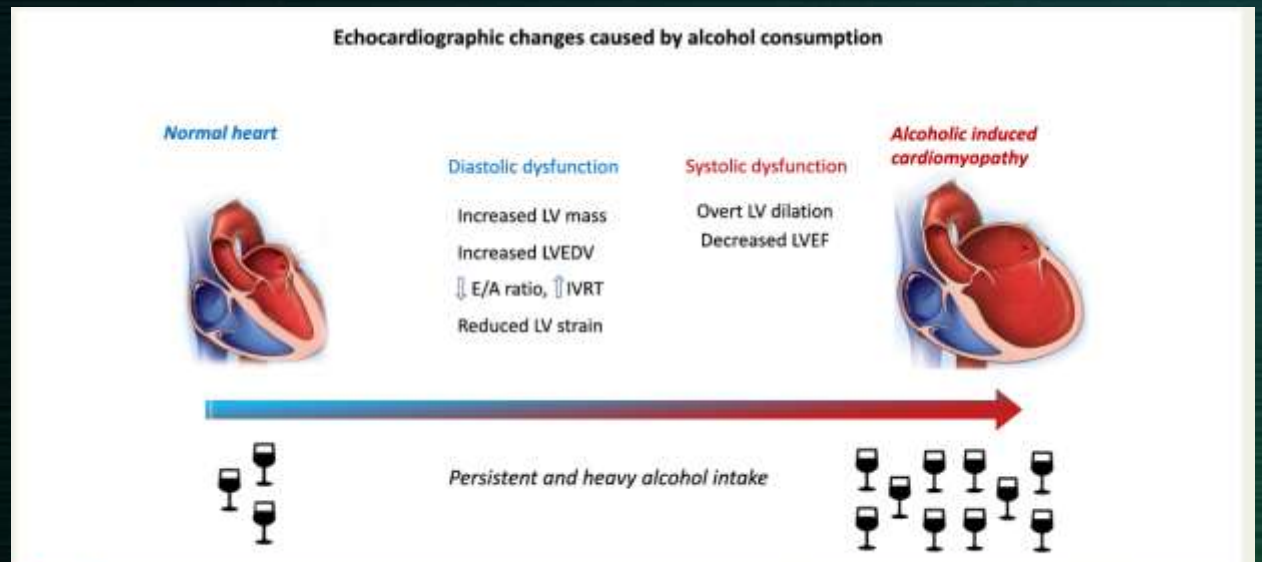
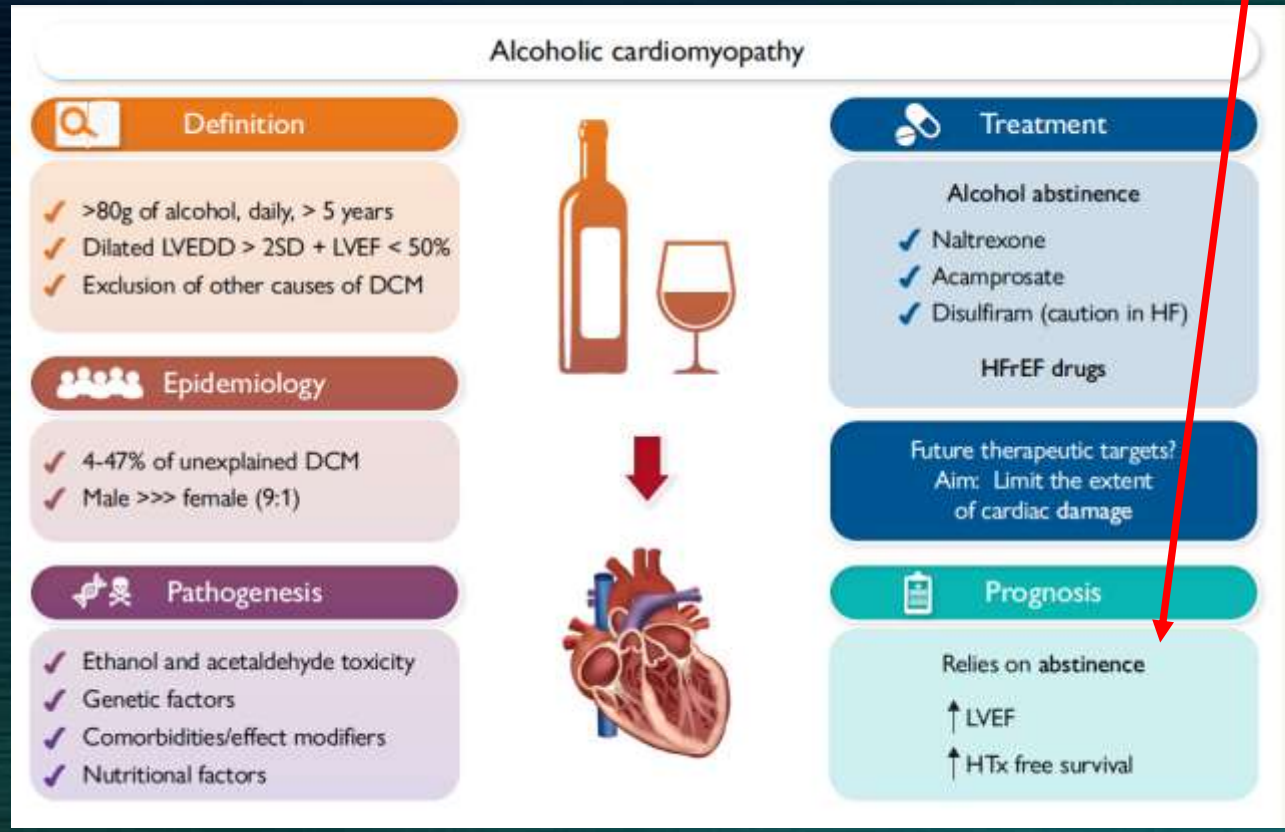


Figure 2 Echocardiographic consequences of heavy and persistent alcohol consumption. IVRT, isovolumic relaxation time; LVEDV, left ventricular

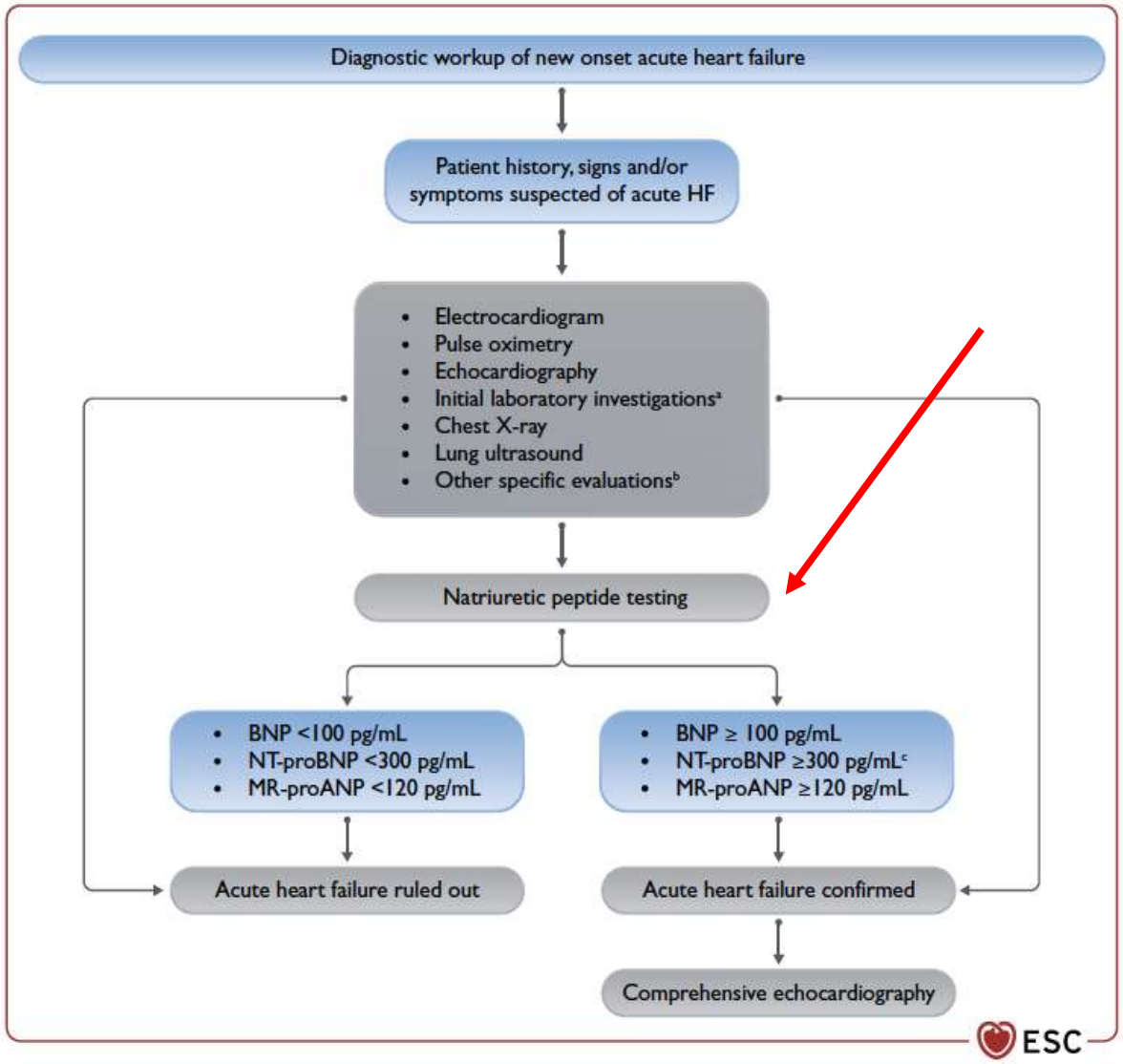


Clinical overview, pathogenesis, treatment and prognosis of alcoholic cardiomyopathy. DCM, dilated cardiomyopathy; HF, heart failure; HFrEF, heart failure with reduced ejection fraction; HTx, heart transplant; LVEDD, left ventricular end-diastolic diameter; LVEF, left ventricular ejection fraction; SD, standard deviation

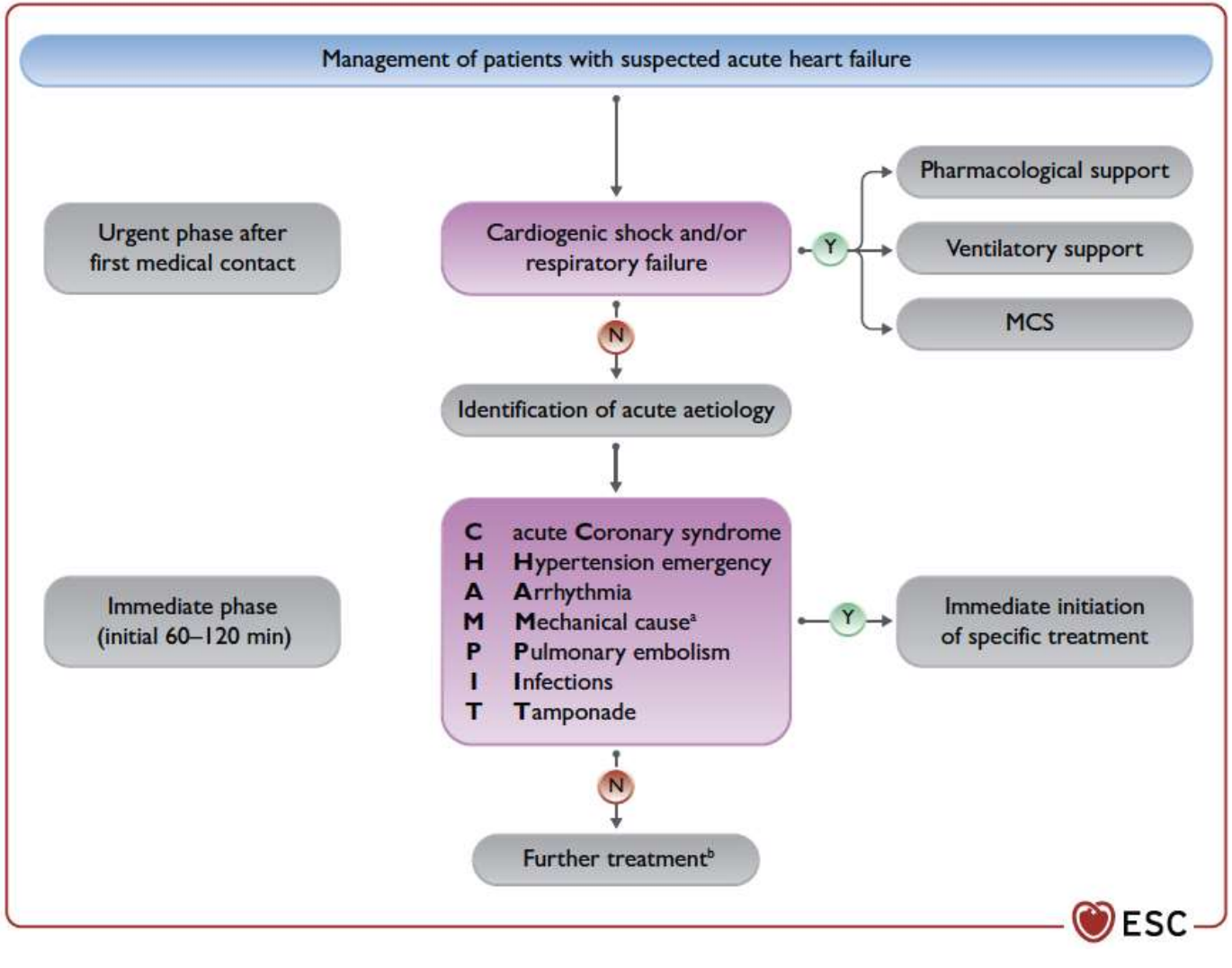
Alcohol-induced cardiomyopathy (AC) is an **acquired** form of dilated cardiomyopathy (DCM) caused by prolonged and heavy alcohol intake in the absence of other causes.

2021 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure
(European Heart Journal 2021 – doi:10.1093/eurheartj/ehab368)

Acute heart failure



Diagnostic workup of new onset acute heart failure. ACS = acute coronary syndrome; BNP=B-type natriuretic peptide; CT=computed tomography; HF=heart failure; MR-proANP=mid-regional pro-atrial natriuretic peptide; NT-proBNP=N-terminal pro-B-type natriuretic peptide; TSH =thyroid-stimulating hormone. aInitial laboratory exams include troponin, serum creatinine, electrolytes, blood urea nitrogen or urea, TSH, liver function tests as well as D-dimer and procalcitonin when pulmonary embolism or infection are suspected, arterial blood gas analysis in case of respiratory distress, and lactate in case of hypoperfusion. bSpecific evaluation includes coronary angiography, in case of suspected ACS, and CT in case of suspected pulmonary embolism. cRule-in values for the diagnosis of acute HF: >450 pg/mL if aged <55 years, >900 pg/mL if aged between 55 and 75 years and >1800 pg/mL if aged >75 years.433,434

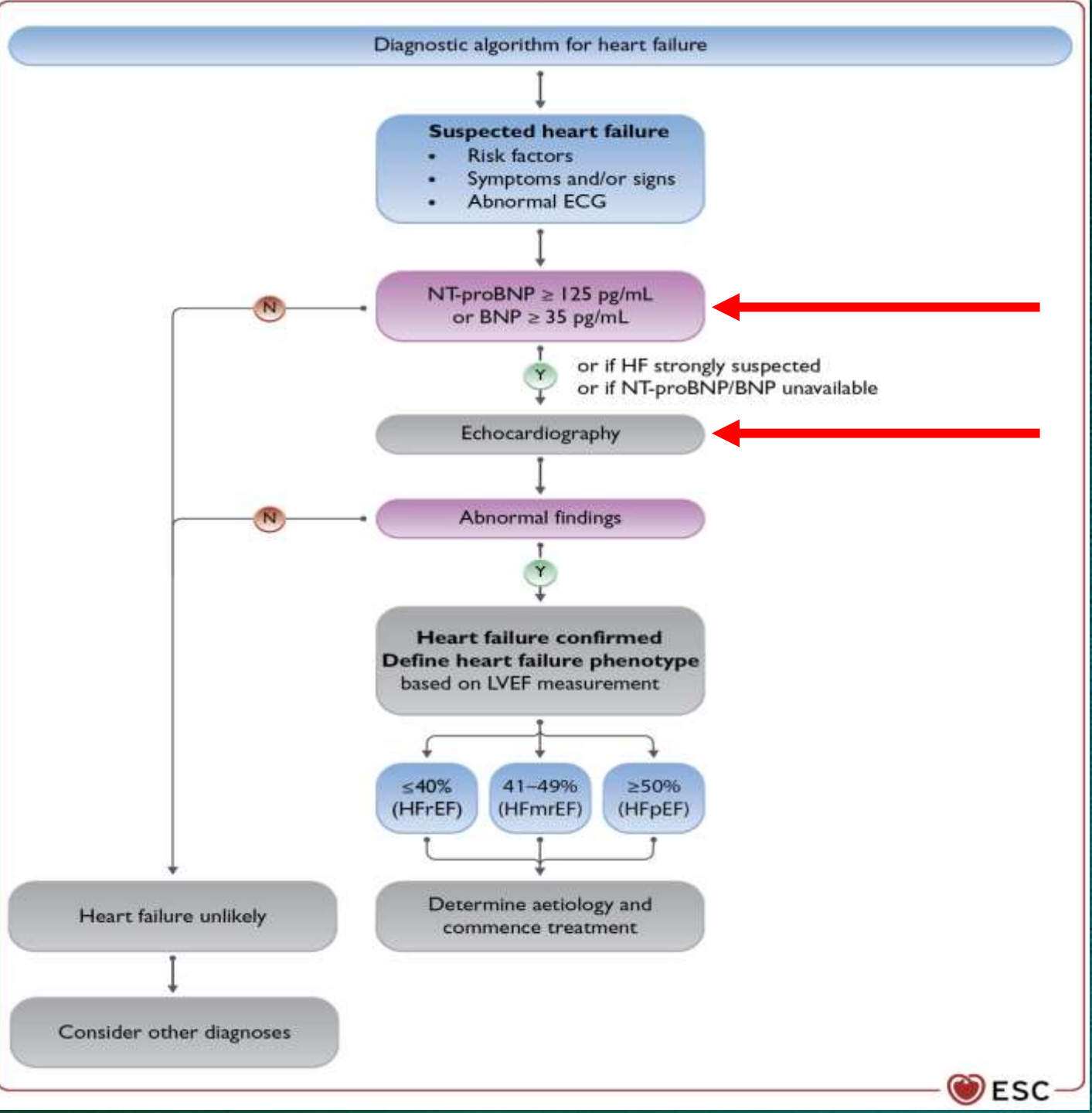


Initial management of acute heart failure. MCS=mechanical circulatory support. aAcute mechanical cause: myocardial rupture complicating acute coronary syndrome (free wall rupture, ventricular septal defect, acute mitral regurgitation), chest trauma or cardiac intervention, acute native or prosthetic valve incompetence secondary to endocarditis, aortic dissection or thrombosis. bSee Figures 7 10 for specific treatments according to different clinical presentations

TAKE-HOME MESSAGE

2021 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure

McDonagh T.A. et al.



ESC European Society of Cardiology
European Heart Journal (2021) 42, 3599–3726
doi:10.1093/eurheartj/ehab368

TAKE-HOME MESSAGE

Prime valutazioni in sospetto scompenso cardiaco

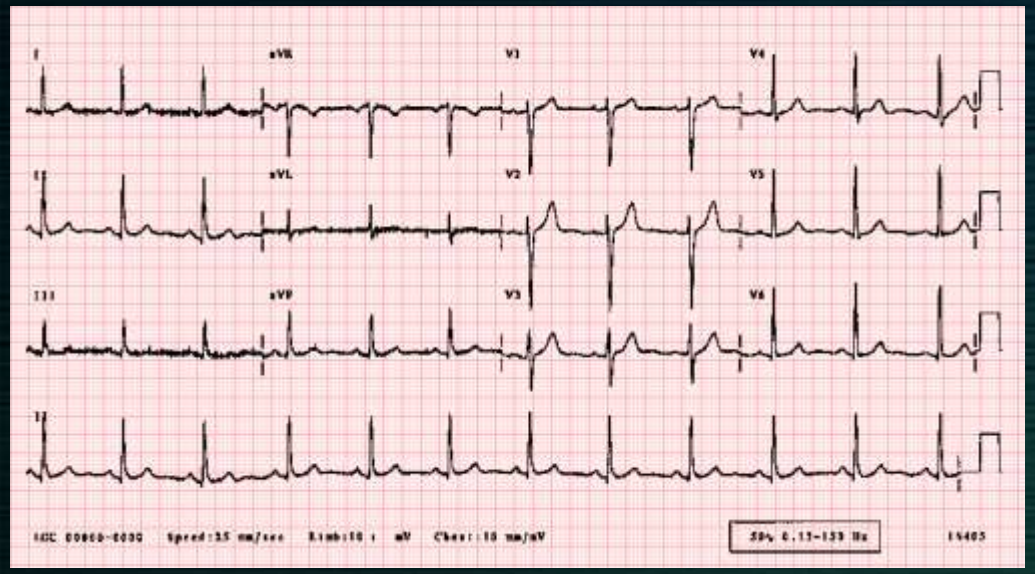
1. Esami di laboratorio:

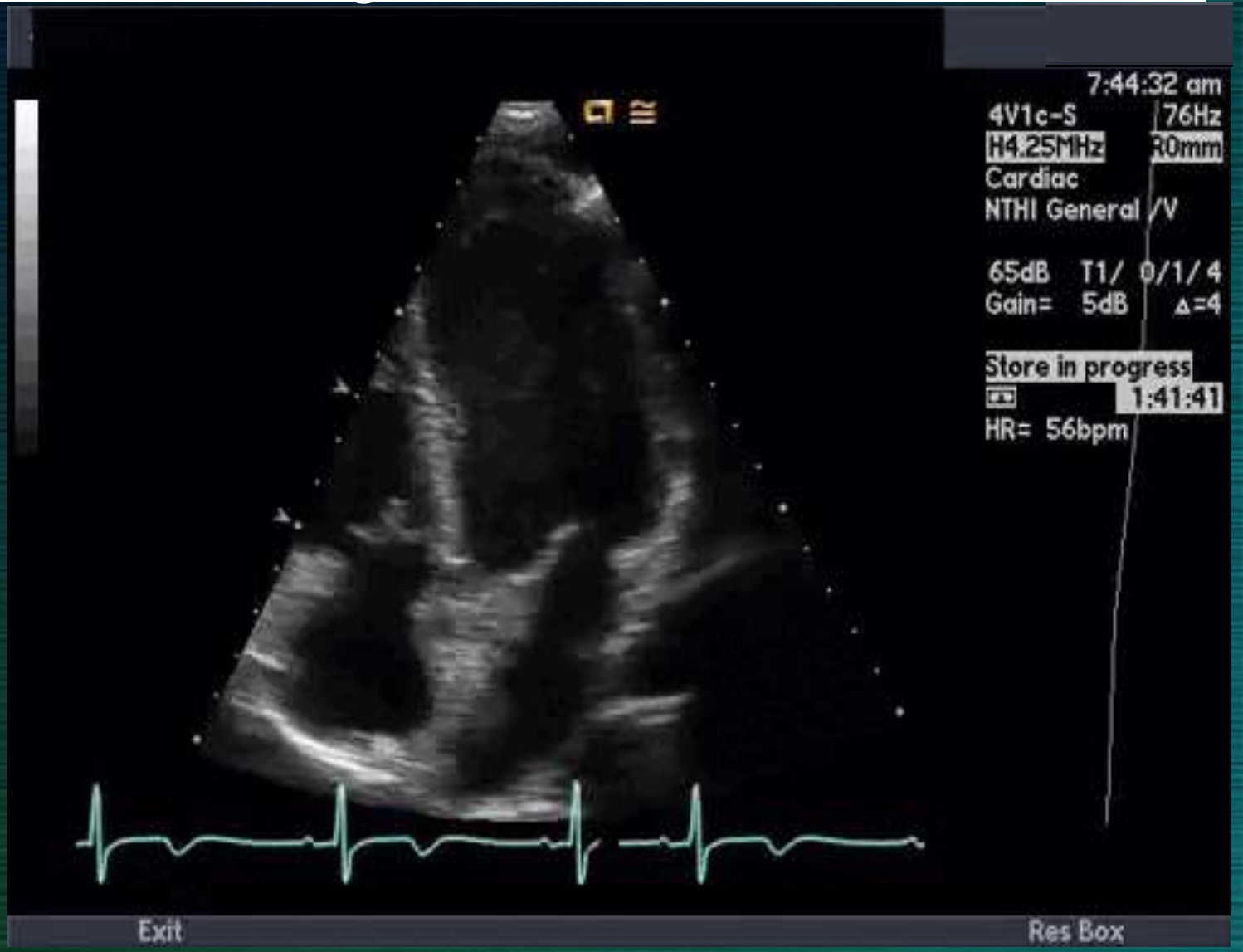
- **EMOCROMO**: WBC, **Hb**, PLT.
- **Funzionalità renale ed elettroliti**: **Creatinina (GFR),** Urea, K+, Na +, Acido urico
- **BNP o NT-proBNP**
- Proteine totali, albumina, **AST, ALT**, fosfatasi alcalina, gamma-GT, LDH, CPK, Elettroforesi delle sieroproteine. Bilirubina totale.
- **Profilo lipidico**: Colesterolo totale, **LDL**, HDL, Trigliceridi.
- **Emoglobina glicata (HbA1c) e glicemia**.
- **Funzionalità tiroidea (TSH reflex).**
- **Assetto marziale:**
  - **Ferro,**
  - **Ferritina,**
  - Indice di saturazione,
  - Transferrina.

TAKE-HOME MESSAGE

Prime valutazioni in sospetto scompenso cardiaco

2. Visita cardiologica con ECG ed ecocardio:





TAKE-HOME MESSAGE

3. DAY HOSPITAL CARDIOLOGICO

PDTA SCOMPENSO, ambulatorio scompenso


PROPOSTA DI RICOVERO
Unità Operativa di Cardiologia

HEART FAILURE, A GIANT TO DEFEAT

Francisco Goya *(1746-1828), The Giant, The Colossus*

Grazie per l'attenzione!!!