Heart Failure – Part 1

According to 2021 ESC guidelines

Jacek Kubica
Collegium Medicum
Nicolaus Copernicus University

Definition of heart failure with reduced ejection fraction, mildly reduced ejection fraction and preserved ejection fraction

Type of HF		HFrEF	HFmrEF	HFpEF
CRITERIA	1	Symptoms ± Signs[a]	Symptoms ± Signs[a]	Symptoms ± Signs[a]
	2	LVEF ≤40%	LVEF 41–49%[b]	LVEF ≥50%
	3	-	-	Objective evidence of cardiac structural and/or functional abnormalities consistent with the presence of LV diastolic dysfunction/raised LV filling pressures, including raised natriuretic peptides[c]

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; LV = left ventricle; LVEF = left ventricular ejection fraction.

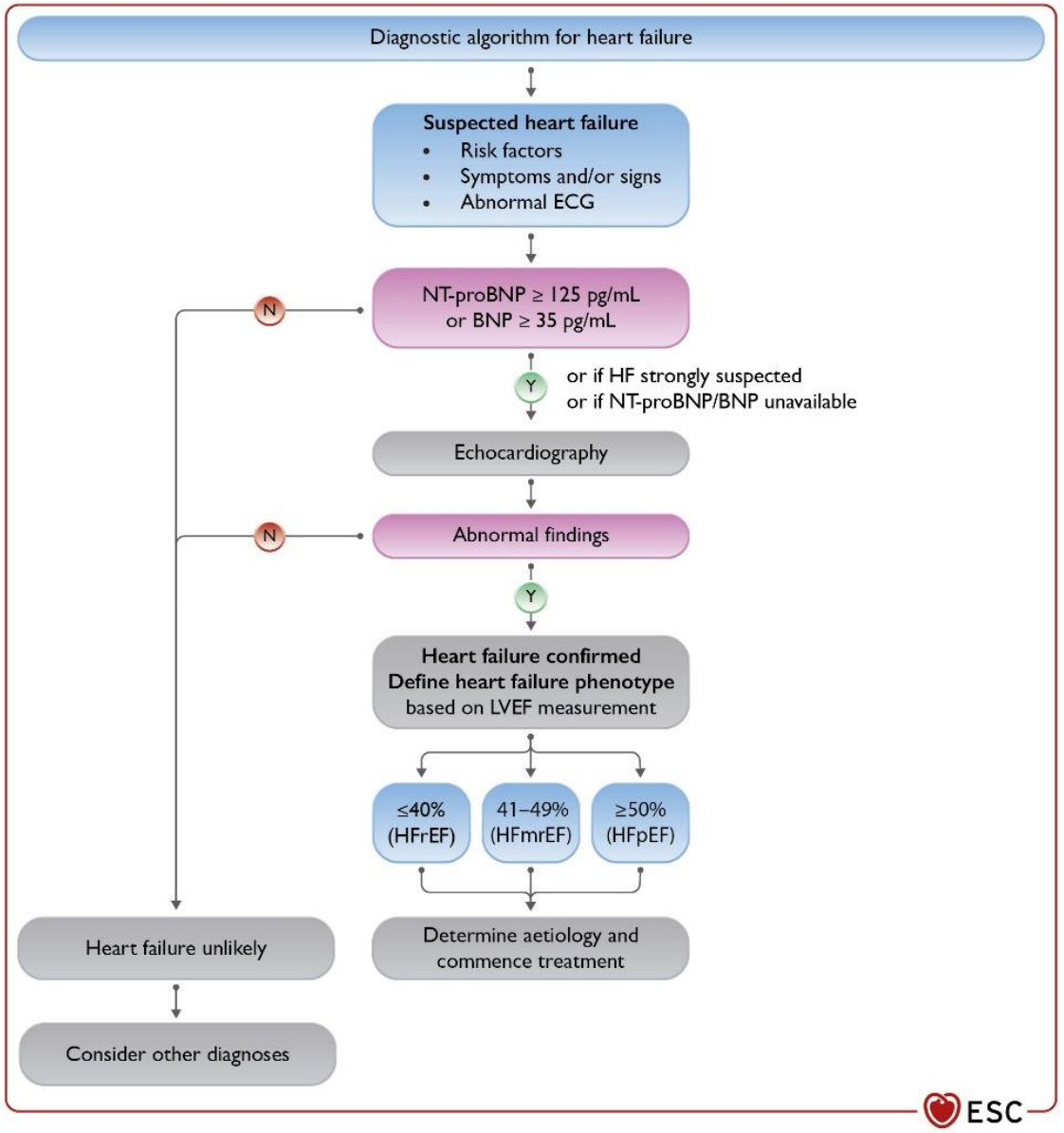
[a]Signs may not be present in the early stages of HF (especially in HFpEF) and in optimally treated patients.

[b]For the diagnosis of HFmrEF, the presence of other evidence of structural heart disease (e.g. increased left atrial size, LV hypertrophy or echocardiographic measures of impaired LV filling) makes the diagnosis more likely.

[c]For the diagnosis of HFpEF, the greater the number of abnormalities present, the higher the likelihood of HFpEF.

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

The diagnostic algorithm for heart failure



ECG = electrocardiogram; 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.
The abnormal echocardiographic findings are described in more detail in the respective sections onHFrEF (section 5), HFmrEF (section 7), and HFpEF (section 8).

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

Causes of heart failure, common modes of presentation and specific investigations (1)

Cause	Examples of presentations	Specific investigations
CAD	Myocardial infarction Angina or "angina-equivalent" Arrhythmias	Invasive coronary angiography CT-coronary angiogram 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

ARVC = arrhythmogenic right ventricular cardiomyopathy; BP = blood pressure; CAD= coronary artery disease; CMP = cardiomyopathy; CMR= cardiac magnetic resonance; ECG = electrocardiogram; GGT= gamma-glutamyl transferase; LFT = liver function test.

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

Causes of heart failure, common modes of presentation and specific investigations (2)

Cause	Examples of presentations	Specific investigations
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 Check Point 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

ACE = angiotensin-converting enzyme; CMR= cardiac magnetic resonance; CK = creatinine kinase; CT = computed tomography; ECG = electrocardiogram; Echo = echocardiography; EMB = endomyocardial biopsy; FDG = fluorodeoxyglucose; HIV = human immunodeficiency virus; h = hour; MEK =mitogen-activated protein kinase; PET = positron emission tomography; VEGF = vascular endothelial growth factor

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

Causes of heart failure, common modes of presentation and specific investigations (3)

Cause	Examples of presentations	Specific investigations
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 & 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; ANA = anti-nuclear antibody; ANCA = anti-nuclear cytoplasmic antibody; CK = creatinine kinase; CMR = cardiac magnetic resonance; CT = computed tomography; EMB = endomyocardial biopsy TFT = thyroid function test.

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

Recommended diagnostic tests in all patients with suspected chronic heart failure

Recommendations	Class	Level
BNP/NT-proBNP[a]	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 an 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]References are listed in section 4.2 for this item.

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

Recommendations for specialised diagnostic tests for selected patients with chronic heart failure to detect reversible/treatable causes of heart failure (1)

Recommendations	Class	Level
CMR		
CMR is recommended for the assessment of myocardial structure and function in those with poor echocardiogram acoustic windows.	I	C
CMR is recommended for the characterization of myocardial tissue in suspected infiltrative disease, Fabry disease, inflammatory disease (myocarditis), LV non-compaction, amyloid, sarcoidosis, iron overload/haemochromatosis.	I	C
CMR with LGE should be considered in DCM to distinguish between ischaemic and non-ischaemic myocardial damage.	IIa	C

CMR = cardiac magnetic resonance; DCM = dilated cardiomyopathy; LGE = late gadolinium enhancement; LV = left ventricular.

Recommendations for specialised diagnostic tests for selected patients with chronic heart failure to detect reversible/treatable causes of heart failure (2)

Recommendations	Class	Level
Invasive coronary angiography (in those who are considered eligible for potential coronary revascularization)		
Invasive coronary angiography is recommended in patients with angina despite pharmacological therapy or symptomatic ventricular arrhythmias.	I	B
Invasive coronary angiography may be considered in patients with HFrEF with an intermediate to high pre-test probability of CAD and the presence of ischaemia in non-invasive stress tests.	IIb	B

CAD = coronary artery disease; HFrEF = heart failure with reduced ejection fraction.

Recommendations for specialised diagnostic tests for selected patients with chronic heart failure to detect reversible/treatable causes of heart failure (3)

Recommendations	Class	Level
Non-invasive testing		
CTCA should be considered in patients with a low to intermediate pre-test probability of CAD or those with equivocal non-invasive stress tests in order to rule out coronary artery stenosis.	IIa	C
Non-invasive stress imaging (CMR, stress echocardiography, SPECT, PET) may be considered for the assessment of myocardial ischaemia and viability in patients with CAD who are considered suitable for coronary revascularization.	IIb	B
Exercise testing may be considered to detect reversible myocardial ischaemia and investigate the cause of dyspnoea.	IIb	C

CAD = coronary artery disease; CMR = cardiac magnetic resonance; CTCA = computed tomography coronary angiography;; PET = positron emission tomography; SPECT = single-photon emission computed tomography.

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

Recommendations for specialised diagnostic tests for selected patients with chronic heart failure to detect reversible/treatable causes of heart failure (4)

Recommendations	Class	Level
Cardiopulmonary exercise testing		
Cardiopulmonary exercise testing is recommended as a part of the evaluation for heart transplantation and/or MCS.	I	C
Cardiopulmonary exercise testing should be considered to optimize prescription of exercise training.	IIa	C
Cardiopulmonary exercise testing should be considered to identify the cause of unexplained dyspnoea and/or exercise intolerance.	IIa	C

MCS = mechanical circulatory support.

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

Recommendations for specialised diagnostic tests for selected patients with chronic heart failure to detect reversible/treatable causes of heart failure (5)

Recommendations	Class	Level
Right heart catheterization		
Right heart catheterization is recommended in patients with severe HF being evaluated for heart transplantation or MCS.	I	C
Right heart catheterization should be considered in patients where HF is thought to be due to constrictive pericarditis, restrictive cardiomyopathy, congenital heart disease, and high output states.	IIa	C
Right heart catheterization should be considered in patients with probable pulmonary hypertension, assessed by echo in order to confirm the diagnosis and assess its reversibility before the correction of valve/structural heart disease.	IIa	C
Right heart catheterization may be considered in selected patients with HFpEF to confirm the diagnosis.	IIb	C

HF = heart failure; MCS = mechanical circulatory support.

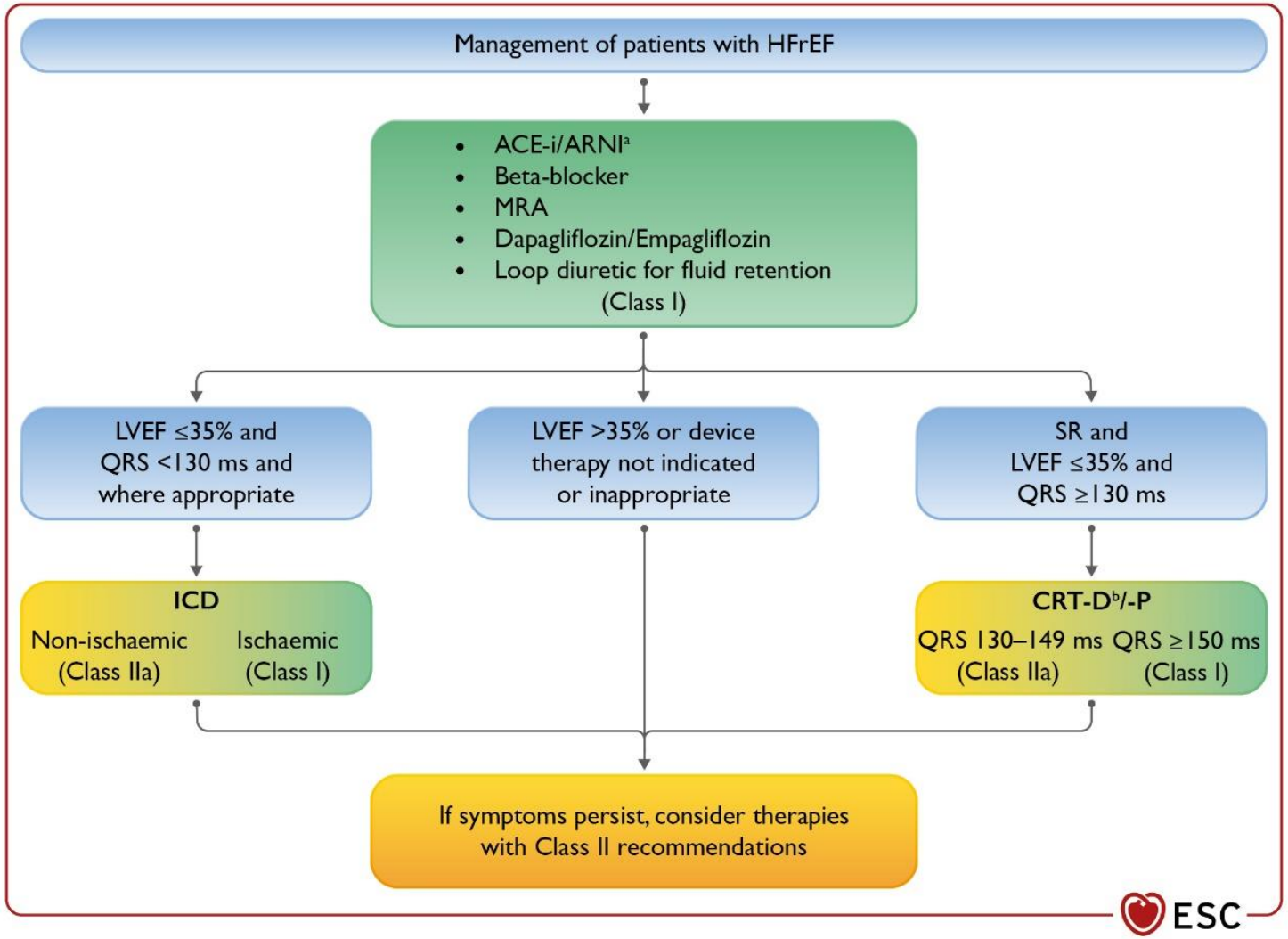
2021 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure
(European Heart Journal 2021 – doi:10.1093/eurheartj/ehab368)

Recommendations for specialised diagnostic tests for selected patients with chronic heart failure to detect reversible/treatable causes of heart failure (6)

Recommendations	Class	Level
EMB		
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.	IIa	C

EMB = endomyocardial biopsy; HF = heart failure; HFpEF = heart failure with preserved ejection fraction.

Therapeutic algorithm of Class I Therapy Indications for a patient with heart failure with reduced ejection fraction



ACE-I = angiotensin-converting enzyme inhibitor; ARNI = angiotensin receptor-neprilysin inhibitor; CRT-D = cardiac resynchronization therapy with defibrillator; CRT-P = cardiac resynchronization therapy pacemaker; ICD = implantable cardioverter-defibrillator; HFrEF = heart failure with reduced ejection fraction; MRA = mineralocorticoid receptor antagonist; QRS = Q, R, and S waves of an ECG; SR = sinus rhythm.

[a]As a replacement for ACE-I.

[b]Where appropriate. Class I=green. Class IIa=Yellow.

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