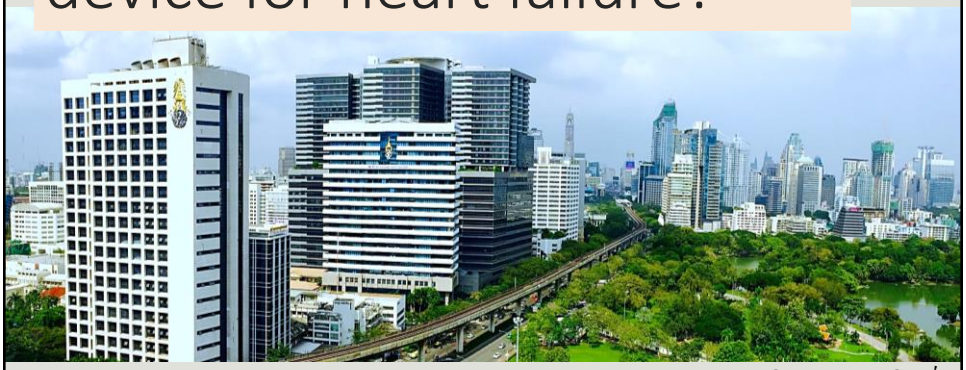
September 30th, 2016

What's new in general and device for heart failure?



เอกราช อริยะชัยพาณิชย์

King Chulalongkorn Memorial Hospital

aekarach.a@chula.ac.th

Disclosure

Speaker, CME service:

Merck, Otsuka, Servier, Berlin, Menarini

Consultant, non-CME service:

Novartis

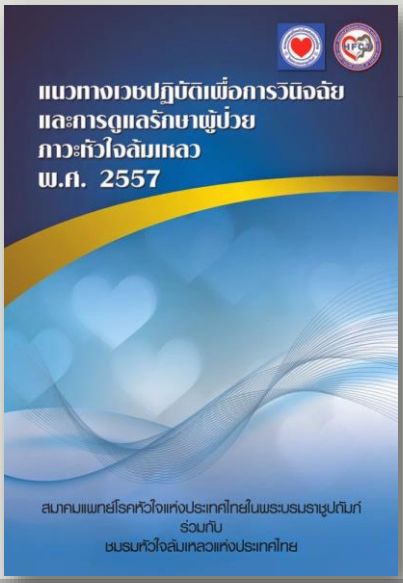
Agenda

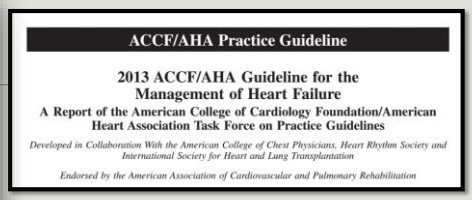
1. New guideline update
2. Preamble
3. Definition of HF and HFmrEF
4. Diagnosis of HF in a non-acute setting
5. Diagnosis of HF in an acute setting
6. Management of asymptomatic LV dysfunction
7. Recommendation regarding use of ICD
8. Recommendation regarding use of CRT

Agenda

1. New guideline update

2. Preamble
3. Definition of HF and HFmrEF
4. Diagnosis of HF in a non-acute setting
5. Diagnosis of HF in an acute setting
6. Management of asymptomatic LV dysfunction
7. Recommendation regarding use of ICD
8. Recommendation regarding use of CRT



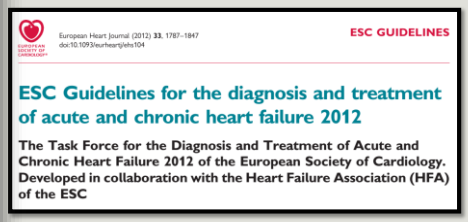

ACCF/AHA Practice Guideline

2013 ACCF/AHA Guideline for the Management of Heart Failure

A Report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines

Developed in Collaboration With the American College of Chest Physicians, Heart Rhythm Society and International Society for Heart and Lung Transplantation

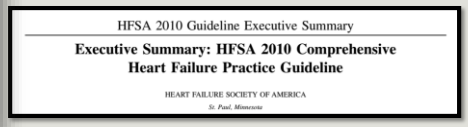
Endorsed by the American Association of Cardiovascular and Pulmonary Rehabilitation


European Heart Journal (2012) 33, 1787–1847
doi:10.1093/eurheartj/ehs104

ESC GUIDELINES

ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure 2012

The Task Force for the Diagnosis and Treatment of Acute and Chronic Heart Failure 2012 of the European Society of Cardiology. Developed in collaboration with the Heart Failure Association (HFA) of the ESC

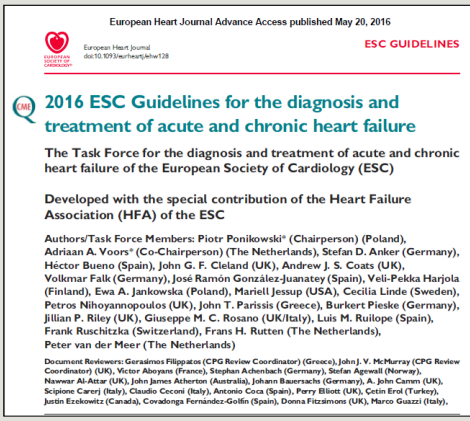

HFSA 2010 Guideline Executive Summary

Executive Summary: HFSA 2010 Comprehensive Heart Failure Practice Guideline

HEART FAILURE SOCIETY OF AMERICA

St. Paul, Minnesota

2016 ESC HF Guidelines
2016 ACC/AHA/HFSA Focused Updates


European Heart Journal Advance Access published May 20, 2016

European Heart Journal
doi:10.1093/eurheartj/ehw128

ESC GUIDELINES

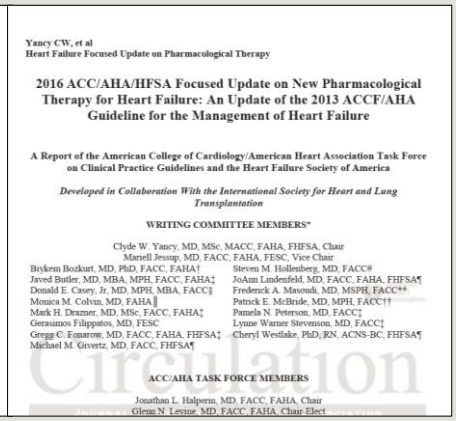
2016 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure

The Task Force for the diagnosis and treatment of acute and chronic heart failure of the European Society of Cardiology (ESC)

Developed with the special contribution of the Heart Failure Association (HFA) of the ESC

Authors/Task Force Members: Piotr Ponikowski* (Chairperson) (Poland), Adriaan A. Voors* (Co-Chairperson) (The Netherlands), Stefan D. Anker (Germany), Héctor Bueno (Spain), John G. F. Cleland (UK), Andrew J. S. Coats (UK), Volkmar Falk (Germany), José Ramón González-Juanatey (Spain), Veli-Pekka Harjola (Finland), Ewa A. Jankowska (Poland), Mariell Jessup (USA), Cecilia Linde (Sweden), Petros Nihoyannopoulos (UK), John T. Parissis (Greece), Burkert Pieske (Germany), Jillian P. Riley (UK), Giuseppe M. C. Rosano (UK/Italy), Luis M. Ruilope (Spain), Frank Ruschitzka (Switzerland), Frans H. Rutten (The Netherlands), Peter van der Meer (The Netherlands)

Document Reviewers: Gerasimos Filippatos (CPG Review Coordinator) (Greece), John J. V. McMurray (CPG Review Coordinator) (UK), Victor Aboyans (France), Stephan Achenbach (Germany), Stefan Agewall (Norway), Nawwar Al-Attar (UK), John James Atherton (Australia), Johann Bauersachs (Germany), A. John Camm (UK), Scipione Carerj (Italy), Claudio Ceconi (Italy), Antonio Coca (Spain), Perry Elliott (UK), Çetin Erol (Turkey), Justin Ezekowitz (Canada), Covadonga Fernández-Golfín (Spain), Donna Fitzsimons (UK), Marco Guazzi (Italy),


Yancy CW, et al
Heart Failure Focused Update on Pharmacological Therapy

2016 ACC/AHA/HFSA Focused Update on New Pharmacological Therapy for Heart Failure: An Update of the 2013 ACCF/AHA Guideline for the Management of Heart Failure

A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines and the Heart Failure Society of America

Developed in Collaboration With the International Society for Heart and Lung Transplantation

WRITING COMMITTEE MEMBERS*

Clyde W. Yancy, MD, MSc, MACC, FAHA, FHFSA, Chair
Mariell Jessup, MD, FACC, FAHA, FESC, Vice Chair
Biykem Bozkurt, MD, PhD, FACC, FAHA†
Javed Butler, MD, MBA, MPH, FACC, FAHA‡
Donald E. Casey, Jr, MD, MPH, MBA, FACC§
Monica M. Colvin, MD, FAHA‖
Mark H. Drazner, MD, MSc, FACC, FAHA‡
Gerasimos Filippatos, MD, FESC
Gregg C. Fonarow, MD, FACC, FAHA, FHFSA‡
Michael M. Givertz, MD, FACC, FHFSA¶
Steven M. Hollenberg, MD, FACC#
JoAnn Lindenfeld, MD, FACC, FAHA, FHFSA¶
Frederick A. Masoudi, MD, MSPH, FACC**
Patrick E. McBride, MD, MPH, FACC††
Pamela N. Peterson, MD, FACC‡
Lynne Warner Stevenson, MD, FACC‡
Cheryl Westlake, PhD, RN, ACNS-BC, FHFSA¶

Circulation

ACC/AHA TASK FORCE MEMBERS

Jonathan L. Halperin, MD, FACC, FAHA, Chair
Glenn N. Levine, MD, FACC, FAHA, Chair-Elect

Ponikowski et al. Eur Heart J. 21 May 2016. doi:10.1093/eurheartj/ehw128
Yancy et al. *J Am Coll Cardiol*. Published 21 May 2016. doi:10.1016/j.jacc.2016.05.011;

Agenda

1. New guideline update
2. **Preamble**
3. Definition of HF and HFmrEF
4. Diagnosis of HF in a non-acute setting
5. Diagnosis of HF in an acute setting
6. Management of asymptomatic LV dysfunction
7. Recommendation regarding use of ICD
8. Recommendation regarding use of CRT

Preamble

Classes of recommendations	Definition	Suggested wording to use
Class I	Evidence and/or general agreement that a given treatment or procedure is beneficial, useful, effective.	Is recommended/is indicated
Class II	Conflicting evidence and/or a divergence of opinion about the usefulness/efficacy of the given treatment or procedure.	
Class IIa	*Weight of evidence/opinion is in favour of usefulness/efficacy.*	Should be considered
Class IIb	*Usefulness/efficacy is less well established by evidence/opinion.*	May be considered
Class III	Evidence or general agreement that the given treatment or procedure is not useful/effective, and in some cases may be harmful.	Is not recommended

Table 1.2 Level of evidence

Level of evidence A	Data derived from multiple randomized clinical trials or meta-analyses.
Level of evidence B	Data derived from a single randomized clinical trial or large non-randomized studies.
Level of evidence C	Consensus of opinion of the experts and/or small studies, retrospective studies, registries.

Guidelines summarize and evaluate all available evidence at the time of the writing process. The aim of assisting health professionals.

for an individual patient with a given condition, taking into account the impact on outcome, as well as the riskbenefit ratio of particular diagnostic or therapeutic means. Guidelines and recommendations should help health professionals to make decisions in their daily practice. However, the final decisions concerning an individual patient must be made by the responsible health professional(s) in consultation with the patient and caregiver as appropriate.

The aim of this document is to provide practical, evidence-based guidelines for the diagnosis and treatment of HF. The principal changes from the 2012 guidelines relate to:

1. 'HF with midrange EF (HFmrEF)'
2. Clear recommendations on the diagnostic criteria
   - Dx in non-acute setting
3. Recommendations for asymptomatic LV dysfunction
4. sacubitril/valsartan (ARNIs);
5. Modified indications for CRT
6. time to therapy in AHF
7. Warm wet cold dry

Agenda

1. New guideline update
2. Preamble
3. **Definition of HF and HFmrEF**
4. Diagnosis of HF in a non-acute setting
5. Diagnosis of HF in an acute setting
6. Management of asymptomatic LV dysfunction
7. Recommendation regarding use of ICD
8. Recommendation regarding use of CRT

3.1 Definition of heart failure

HF is a clinical syndrome characterized by typical symptoms (e.g. breathlessness, ankle swelling and fatigue) that may be accompanied by signs (e.g. elevated jugular venous pressure, pulmonary crackles and peripheral oedema) caused by a structural and/or functional cardiac abnormality, resulting in a reduced cardiac output and/or elevated intracardiac pressures at rest or during stress.

~~ภาวะที่ supply~~ ไม่เพียงพอต่อ ~~demand~~

Table 3.1 Definition of heart failure with preserved (HFpEF), mid-range (HFmrEF) and reduced ejection fraction (HFrEF)

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).

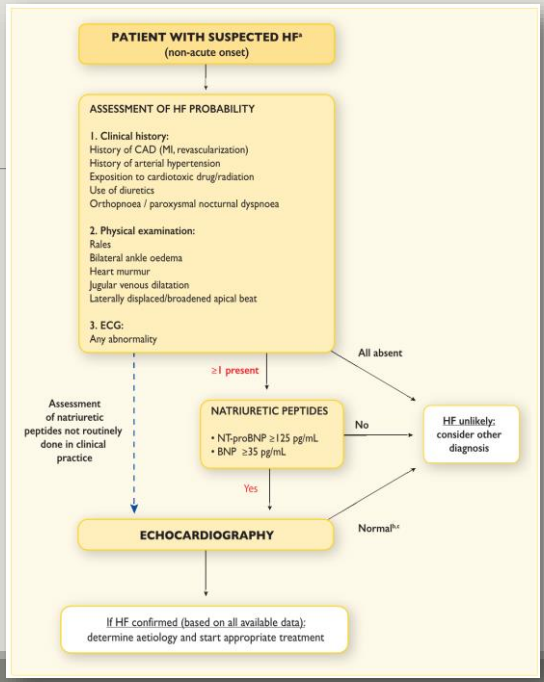
BNP = B-type natriuretic peptide; HF = heart failure; HFmrEF = heart failure with mid-range ejection fraction; HFpEF = heart failure with preserved ejection fraction; HFrEF = heart failure with reduced ejection fraction; LAE = left atrial enlargement; LVEF = left ventricular ejection fraction; LVH =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

(*Table 3.1*). Patients with an LVEF in the range of 40–49% represent a 'grey area', which we now define as HFmrEF (*Table 3.1*). Differentiation of patients with HF based on LVEF is important due to different underlying aetiologies, demographics, co-morbidities and response to therapies.[6] Most clinical trials published after 1990 se-

BNP > 35 pg/mL
NT-proBNP > 125 pg/mL

Acute setting
BNP > 100 pg/mL
NT-proBNP > 300 pg

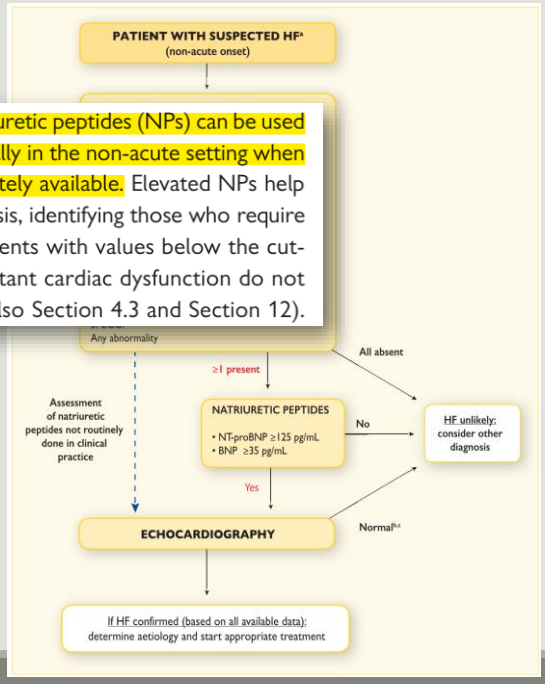
NPV 94 – 98%
PPV 50-65%



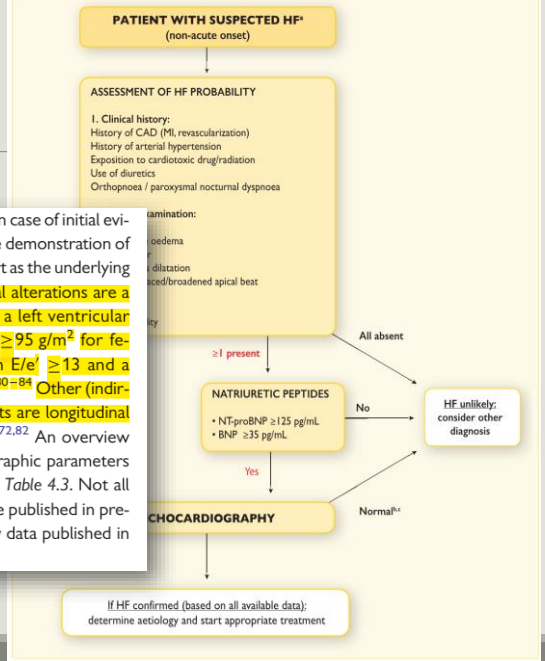
The plasma concentration of natriuretic peptides (NPs) can be used as an initial diagnostic test, especially in the non-acute setting when echocardiography is not immediately available. Elevated NPs help establish an initial working diagnosis, identifying those who require further cardiac investigation; patients with values below the cut-point for the exclusion of important cardiac dysfunction do not require echocardiography (see also Section 4.3 and Section 12).

Chronic setting
BNP > 35 pg/mL
NT-proBNP > 125 pg/mL
Acute setting
BNP > 100 pg/mL
NT-proBNP > 300 pg

NPV 94 – 98%
PPV 50-65%



The next step comprises an advanced workup in case of initial evidence of HFpEF/HFmrEF and consists of objective demonstration of structural and/or functional alterations of the heart as the underlying cause for the clinical presentation. Key structural alterations are a left atrial volume index (LAVI) $\geq$34 mL/m^2 or a left ventricular mass index (LVMI) $\geq$115 g/m^2 for males and $\geq$95 g/m^2 for females.[65,67,72] Key functional alterations are an E/e' $\geq$13 and a mean e' septal and lateral wall <9 cm/s.[65,67,70,72,80–84] Other (indirect) echocardiographically derived measurements are longitudinal strain or tricuspid regurgitation velocity (TRV).[72,82] An overview of normal and abnormal values for echocardiographic parameters related to diastolic function is presented in *Web Table 4.3*. Not all of the recommended values are identical to those published in previous guidelines, because of the inclusion of new data published in recent reports, in particular by Cabarello *et al.*[70]



Agenda

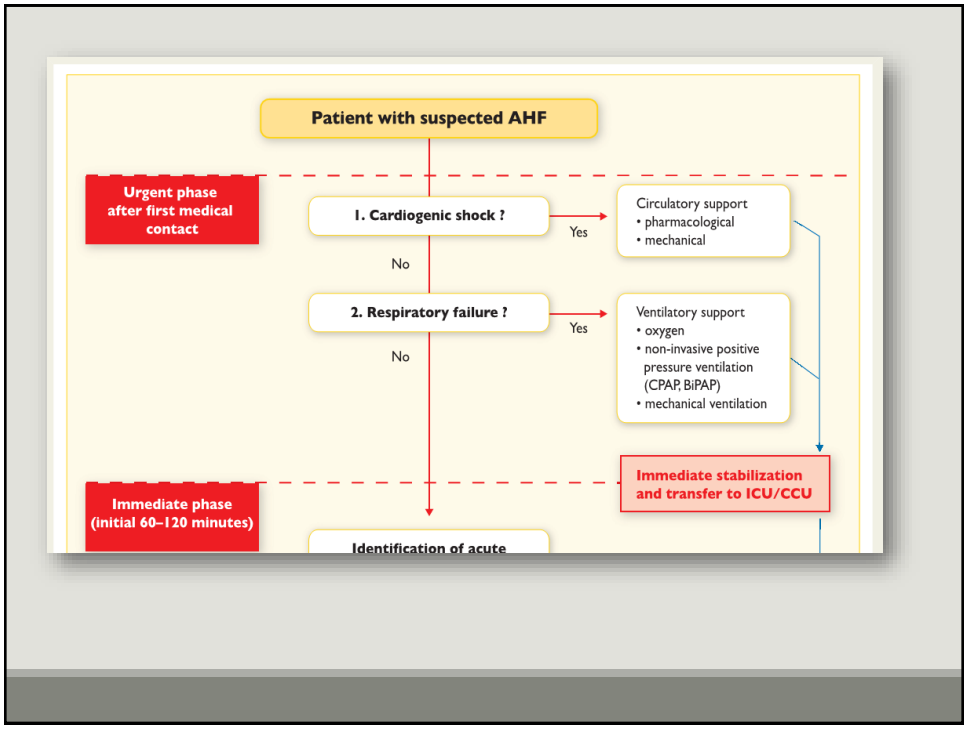
1. New guideline update
2. Preamble
3. Definition of HF and HFmrEF
4. Diagnosis of HF in a non-acute setting
5. **Diagnosis of HF in an acute setting**
6. Management of asymptomatic LV dysfunction
7. Recommendation regarding use of ICD
8. Recommendation regarding use of CRT

12. Acute heart failure

12.1 Definition and classification

AHF refers to rapid onset or worsening of symptoms and/or signs of HF. It is a life-threatening medical condition requiring urgent evaluation and treatment, typically leading to urgent hospital admission.

A large number of overlapping classifications of AHF based on different criteria have been proposed.[510–513] In practice the most useful classifications are those based on clinical presentation at admission, allowing clinicians to identify patients at high risk of complications and to direct management at specific targets, which creates a pathway for personalized care in the AHF setting. In most cases, patients with AHF present with either preserved (90–140



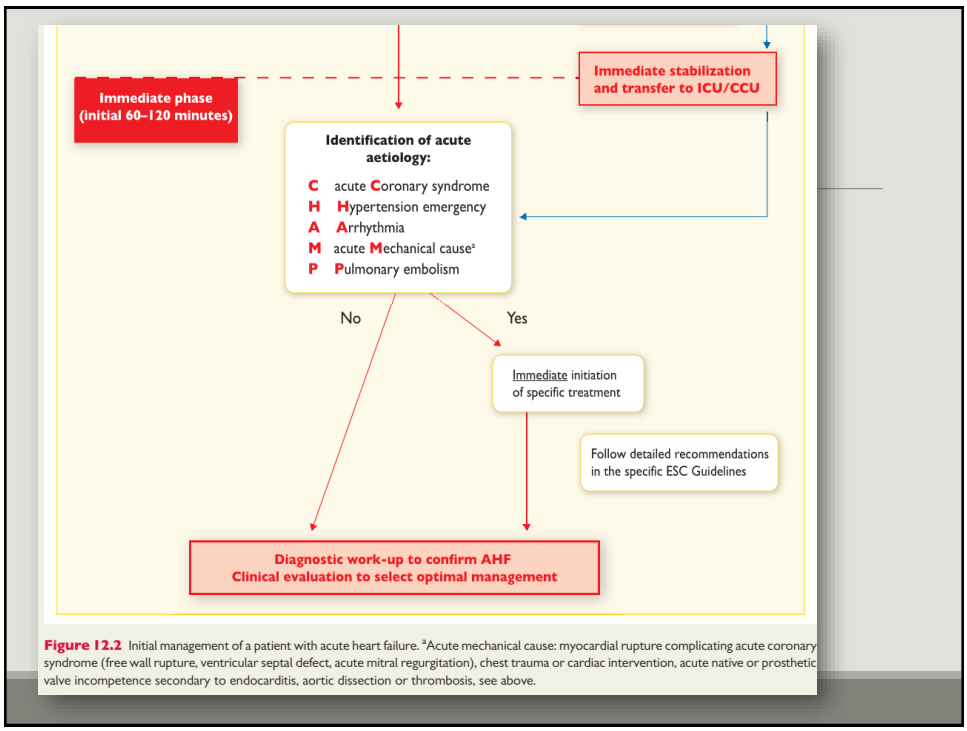
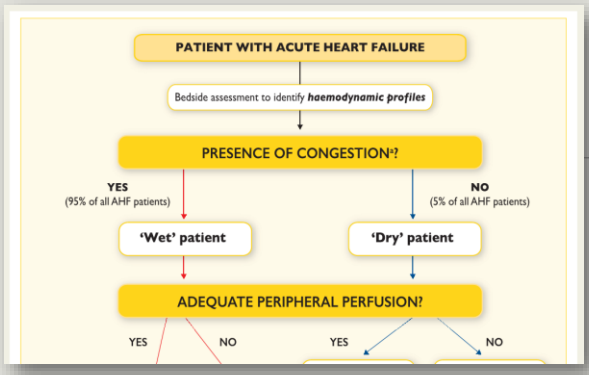
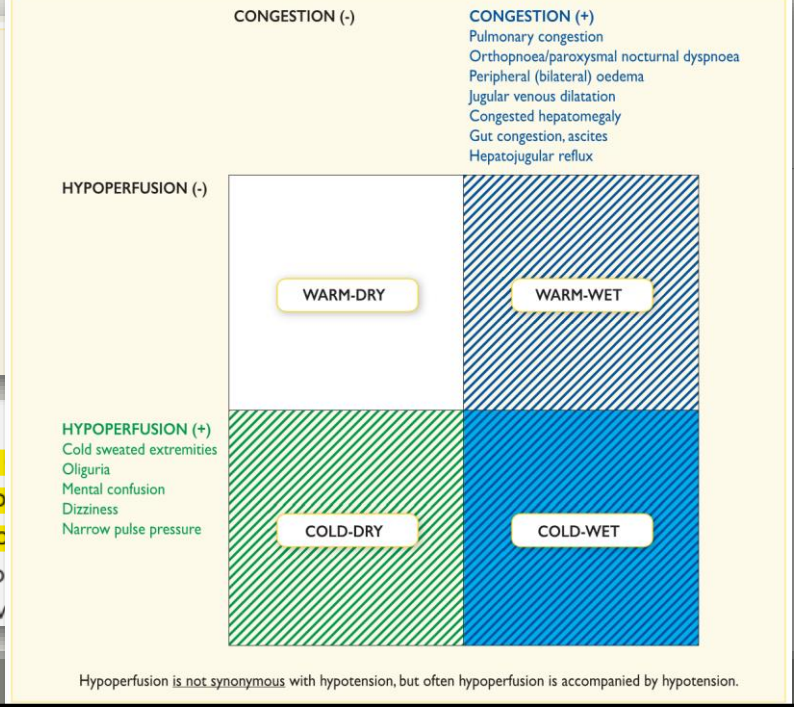
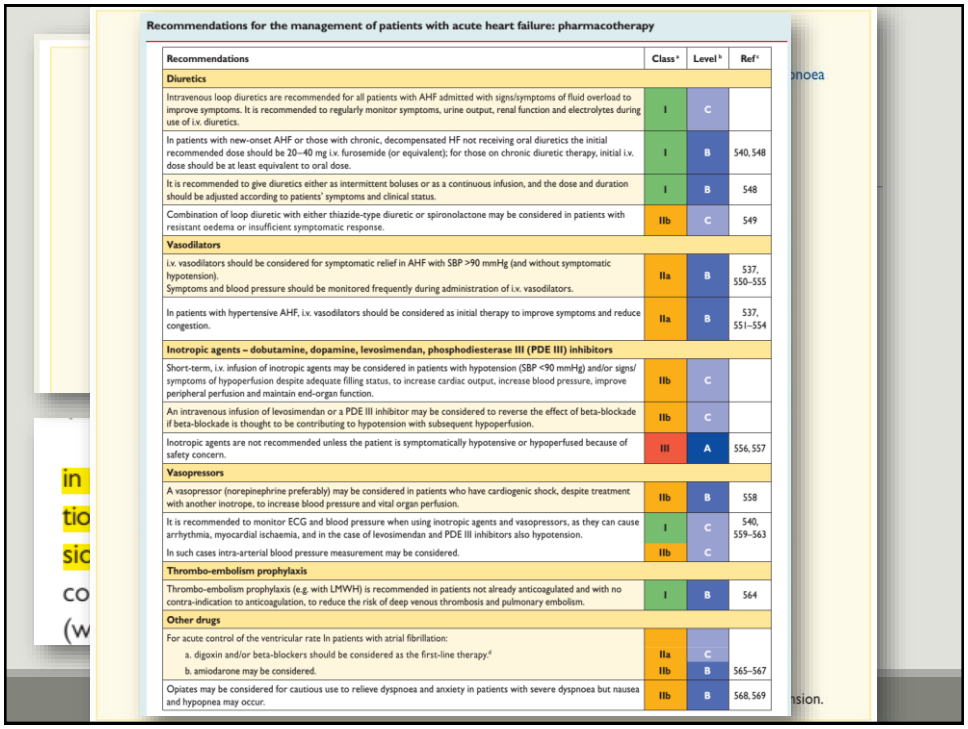


Figure 12.2 Initial management of a patient with acute heart failure. [a]Acute mechanical cause: myocardial rupture complicating acute coronary syndrome (free wall rupture, ventricular septal defect, acute mitral regurgitation), chest trauma or cardiac intervention, acute native or prosthetic valve incompetence secondary to endocarditis, aortic dissection or thrombosis, see above.



Clinical classification can be based on bedside physical examination in order to detect the presence of clinical symptoms/signs of congestion ('wet' vs. 'dry' if present vs. absent) and/or peripheral hypoperfusion ('cold' vs. 'warm' if present vs. absent) (*Figure 12.1*).[514,515] The combination of these options identifies four groups: warm and wet (well perfused and congested) —most commonly present; cold and





Recommendations for the management of patients with acute heart failure: pharmacotherapy

Recommendations	Class[a]	Level[b]	Ref[c]
Diuretics			
Intravenous loop diuretics are recommended for all patients with AHF admitted with signs/symptoms of fluid overload to improve symptoms. It is recommended to regularly monitor symptoms, urine output, renal function and electrolytes during use of i.v. diuretics.	I	C	
In patients with new-onset AHF or those with chronic, decompensated HF not receiving oral diuretics the initial recommended dose should be 20–40 mg i.v. furosemide (or equivalent); for those on chronic diuretic therapy, initial i.v. dose should be at least equivalent to oral dose.	I	B	540, 548
It is recommended to give diuretics either as intermittent boluses or as a continuous infusion, and the dose and duration should be adjusted according to patients' symptoms and clinical status.	I	B	548
Combination of loop diuretic with either thiazide-type diuretic or spironolactone may be considered in patients with resistant oedema or insufficient symptomatic response.	IIb	C	549
Vasodilators			
i.v. vasodilators should be considered for symptomatic relief in AHF with SBP >90 mmHg (and without symptomatic hypotension). Symptoms and blood pressure should be monitored frequently during administration of i.v. vasodilators.	IIa	B	537, 550–555
In patients with hypertensive AHF, i.v. vasodilators should be considered as initial therapy to improve symptoms and reduce congestion.	IIa	B	537, 551–554
Inotropic agents – dobutamine, dopamine, levosimendan, phosphodiesterase III (PDE III) inhibitors			
Short-term, i.v. infusion of inotropic agents may be considered in patients with hypotension (SBP <90 mmHg) and/or signs/symptoms of hypoperfusion despite adequate filling status, to increase cardiac output, increase blood pressure, improve peripheral perfusion and maintain end-organ function.	IIb	C	
An intravenous infusion of levosimendan or a PDE III inhibitor may be considered to reverse the effect of beta-blockade if beta-blockade is thought to be contributing to hypotension with subsequent hypoperfusion.	IIb	C	
Inotropic agents are not recommended unless the patient is symptomatically hypotensive or hypoperfused because of safety concern.	III	A	556, 557
Vasopressors			
A vasopressor (norepinephrine preferably) may be considered in patients who have cardiogenic shock, despite treatment with another inotrope, to increase blood pressure and vital organ perfusion.	IIb	B	558
It is recommended to monitor ECG and blood pressure when using inotropic agents and vasopressors, as they can cause arrhythmia, myocardial ischaemia, and in the case of levosimendan and PDE III inhibitors also hypotension.	I	C	540, 559–563
In such cases intra-arterial blood pressure measurement may be considered.	IIb	C	
Thrombo-embolism prophylaxis			
Thrombo-embolism prophylaxis (e.g. with LMWH) is recommended in patients not already anticoagulated and with no contra-indication to anticoagulation, to reduce the risk of deep venous thrombosis and pulmonary embolism.	I	B	564
Other drugs			
For acute control of the ventricular rate in patients with atrial fibrillation:			
a. digoxin and/or beta-blockers should be considered as the first-line therapy.[d]	IIa	C	
b. amiodarone may be considered.	IIb	B	565–567
Opiates may be considered for cautious use to relieve dyspnoea and anxiety in patients with severe dyspnoea but nausea and hypopnea may occur.	IIb	B	568, 569

Agenda

1. New guideline update
2. Preamble
3. Definition of HF and HFmrEF
4. Diagnosis of HF in a non-acute setting
5. Diagnosis of HF in an acute setting
6. **Management of asymptomatic LV dysfunction**
7. Recommendation regarding use of ICD
8. Recommendation regarding use of CRT

Recommendations to prevent or delay the development of overt heart failure or prevent death before the onset of symptoms

Recommendations	Class [a]	Level [b]	Ref [c]
Treatment of hypertension is recommended to prevent or delay the onset of HF and prolong life.	I	A	126, 129, 150, 151
Treatment with statins is recommended in patients with or at high-risk of CAD whether or not they have LV systolic dysfunction, in order to prevent or delay the onset of HF and prolong life.	I	A	137–140, 152
Counselling and treatment for smoking cessation and alcohol intake reduction is recommended for people who smoke or who consume excess alcohol in order to prevent or delay the onset of HF.	I	C	131–134
Treating other risk factors of HF (e.g. obesity, dysglycaemia) should be considered in order to prevent or delay the onset of HF.	IIa	C	130, 141, 153–155
Empagliflozin should be considered in patients with type 2 diabetes in order to prevent or delay the onset of HF and prolong life.	IIa	B	130
ACE-I is recommended in patients with asymptomatic LV systolic dysfunction and a history of myocardial infarction in order to prevent or delay the onset of HF and prolong life.	I	A	5, 144, 145
ACE-I is recommended in patients with asymptomatic LV systolic dysfunction without a history of myocardial infarction, in order to prevent or delay the onset of HF.	I	B	5
ACE-I should be considered in patients with stable CAD even if they do not have LV systolic dysfunction, in order to prevent or delay the onset of HF.	IIa	A	142
Beta-blocker is recommended in patients with asymptomatic LV systolic dysfunction and a history of myocardial infarction, in order to prevent or delay the onset of HF or prolong life.	I	B	146
ICD is recommended in patients: a) with asymptomatic LV systolic dysfunction (LVEF ≤30%) of ischaemic origin, who are at least 40 days after acute myocardial infarction, b) with asymptomatic non-ischaemic dilated cardiomyopathy (LVEF ≤30%), who receive OMT therapy, in order to prevent sudden death and prolong life.	I	B	149, 156–158

Agenda

1. New guideline update
2. Preamble
3. Definition of HF and HFmrEF
4. Diagnosis of HF in a non-acute setting
5. Diagnosis of HF in an acute setting
6. Management of asymptomatic LV dysfunction
7. **Recommendation regarding use of ICD**
8. Recommendation regarding use of CRT

A high proportion of deaths among patients with HF, especially those with milder symptoms, occur suddenly and unexpectedly. Many of these are due to electrical disturbances, including ventricular arrhythmias, bradycardia and asystole, although some are

Mild HF ≠ low risk of dying

Consider patient's view and their quality of life.

The absence of other diseases likely to cause death

Amiodarone does not reduce mortality in patients with HFrEF

Recommendations for implantable cardioverter-defibrillator in patients with heart failure

Recommendations	Class [a]	Level [b]	Ref [c]
Secondary prevention An ICD is recommended to reduce the risk of sudden death and all-cause mortality in patients who have recovered from a ventricular arrhythmia causing haemodynamic instability, and who are expected to survive for >1 year with good functional status.	I	A	223–226
Primary prevention An ICD is recommended to reduce the risk of sudden death and all-cause mortality in patients with symptomatic HF (NYHA Class II–III), and an LVEF ≤35% despite ≥3 months of OMT, provided they are expected to survive substantially longer than one year with good functional status, and they have:			
• IHD (unless they have had an MI in the prior 40 days – see below).	I	A	149, 156, 227
• DCM.	I	B	156, 157, 227
ICD implantation is not recommended within 40 days of an MI as implantation at this time does not improve prognosis.	III	A	158, 228
ICD therapy is not recommended in patients in NYHA Class IV with severe symptoms refractory to pharmacological therapy unless they are candidates for CRT, a ventricular assist device, or cardiac transplantation.	III	C	229–233
Patients should be carefully evaluated by an experienced cardiologist before generator replacement, because management goals and the patient's needs and clinical status may have changed.	IIa	B	234–238
A wearable ICD may be considered for patients with HF who are at risk of sudden cardiac death for a limited period or as a bridge to an implanted device.	IIb	C	239–241

Subcutaneous defibrillators may be as effective as conventional ICDs with a lower risk from the implantation procedure.[256,257] They may be the preferred option for patients with difficult access or who require ICD explantation due to infection. Patients must be carefully selected, as they have limited capacity to treat serious bradyarrhythmia and can deliver neither antitachycardia pacing nor CRT. Substantial RCTs with these devices and more data on safety and efficacy are awaited.[258,259]

Agenda

1. New guideline update
2. Preamble
3. Definition of HF and HFmrEF
4. Diagnosis of HF in a non-acute setting
5. Diagnosis of HF in an acute setting
6. Management of asymptomatic LV dysfunction
7. Recommendation regarding use of ICD
8. **Recommendation regarding use of CRT**

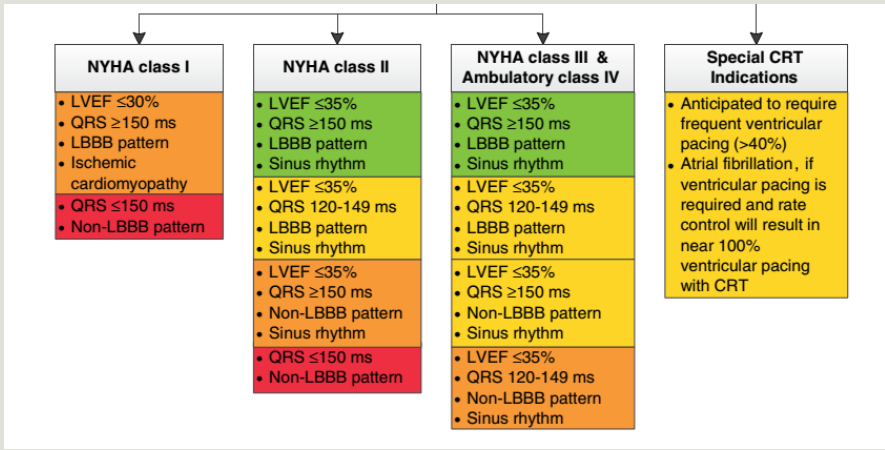
Q: Who should get CRT
A: Dyssynchrony

After optimal medical Rx

- **Wide QRS (> 120-150 msec)**
- LVEF < 35%
- LBBB
- HF stable class II-IV
- Sinus rhythm

MUSTIC, MIRACLE, CONTAK, CARE-HF, COMPANION

2013 ACC/AHA Guidelines for Management of HF: :CRT



Yancy CW. ACC/AHA HF guideline. Circ 2013;128:e240-e327.

Recommendations for cardiac resynchronization therapy implantation in patients with heart failure

Recommendations	Class [a]	Level [b]	Ref [c]
CRT is recommended for symptomatic patients with HF in sinus rhythm with a QRS duration ≥150 msec and LBBB QRS morphology and with LVEF ≤35% despite OMT in order to improve symptoms and reduce morbidity and mortality.	I	A	261–272
CRT should be considered for symptomatic patients with HF in sinus rhythm with a QRS duration ≥150 msec and non-LBBB QRS morphology and with LVEF ≤35% despite OMT in order to improve symptoms and reduce morbidity and mortality.	IIa	B	261–272
CRT is recommended for symptomatic patients with HF in sinus rhythm with a QRS duration of 130–149 msec and LBBB QRS morphology and with LVEF ≤35% despite OMT in order to improve symptoms and reduce morbidity and mortality.	I	B	266, 273
CRT may be considered for symptomatic patients with HF in sinus rhythm with a QRS duration of 130–149 msec and non-LBBB QRS morphology and with LVEF ≤35% despite OMT in order to improve symptoms and reduce morbidity and mortality.	IIb	B	266, 273
CRT rather than RV pacing is recommended for patients with HFrEF regardless of NYHA class who have an indication for ventricular pacing and high degree AV block in order to reduce morbidity. This includes patients with AF (see Section 10.1).	I	A	274–277
CRT should be considered for patients with LVEF ≤35% in NYHA Class III–IV[d] despite OMT in order to improve symptoms and reduce morbidity and mortality, if they are in AF and have a QRS duration ≥130 msec provided a strategy to ensure bi-ventricular capture is in place or the patient is expected to return to sinus rhythm.	IIa	B	275, 278–281
Patients with HFrEF who have received a conventional pacemaker or an ICD and subsequently develop worsening HF despite OMT and who have a high proportion of RV pacing may be considered for upgrade to CRT. This does not apply to patients with stable HF.	IIb	B	282
CRT is contra-indicated in patients with a QRS duration < 130 msec.	III	A	266, 283–285

Recommendations for cardiac resynchronization therapy implantation in patients with heart failure

Recommendations	Class [a]	Level [b]	Ref [c]
CRT is recommended for symptomatic patients with HF in sinus rhythm with a QRS duration ≥150 msec and LBBB QRS morphology and with LVEF ≤35% despite OMT in order to improve symptoms and reduce morbidity and mortality.	I	A	261–272
CRT should be considered for symptomatic patients with HF in sinus rhythm with a QRS duration ≥150 msec and non-LBBB QRS morphology and with LVEF ≤35	IIa	B	261–272
CRT is recommended for symptomat morphology and with LVEF ≤35% des			
CRT may be considered for symptom QRS morphology and with LVEF ≤35			
CRT rather than RV pacing is recomm pacing and high degree AV block in or			
CRT should be considered for patien reduce morbidity and mortality, if they are in AF and have a QRS duration ≥130 msec provided a strategy to ensure bi-ventricular capture is in place or the patient is expected to return to sinus rhythm.	IIa	B	278–281
Patients with HFrEF who have received a conventional pacemaker or an ICD and subsequently develop worsening HF despite OMT and who have a high proportion of RV pacing may be considered for upgrade to CRT. This does not apply to patients with stable HF.	IIb	B	282
CRT is contra-indicated in patients with a QRS duration < 130 msec.	III	A	266, 283–285

Most studies of CRT have specified that the LVEF should be <35%, but RAFT[267] and MADIT-CRT[268,269] specified an LVEF <30%, while REVERSE[270–272] specified <40% and BLOCK-HF[274] <50%. Relatively few patients with an LVEF of 35–40% have been randomized, but an individual participant data (IPD) meta-analysis suggests no diminution of the effect of CRT in this group.[266]

Recommendations for cardiac resynchronization therapy implantation in patients with heart failure

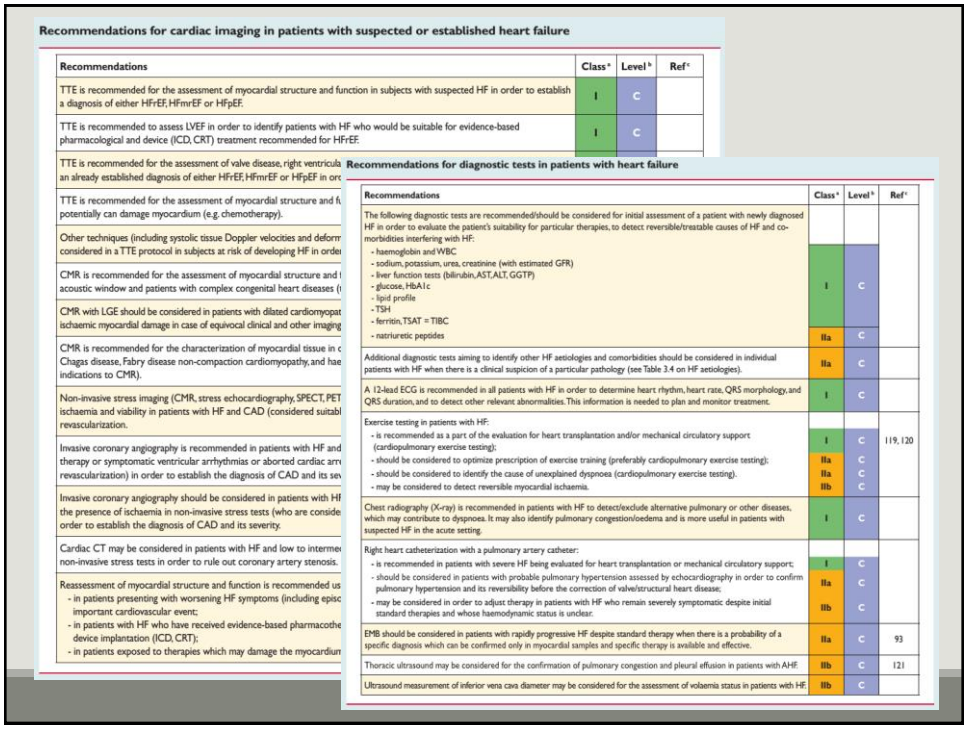
Recommendations	Class [a]	Level [b]	Ref [c]
CRT is recommended for symptomatic patients with HF in sinus rhythm with a QRS duration ≥150 msec and LBBB QRS morphology and with LVEF ≤35% despite OMT in order to improve symptoms and reduce morbidity and mortality.	I	A	261–272
CRT should be considered for symptomatic patients with HF in sinus rhythm with a QRS duration ≥150 msec and non-LBBB QRS morphology and with LVEF ≤35% despite OMT in order to improve symptoms and reduce morbidity and mortality.	IIa	B	261–272
CRT is recommended for symptomatic patients with HF in sinus rhythm with a QRS duration of 130–149 msec and LBBB QRS morphology and with LVEF ≤35% despite OMT in order to improve symptoms and reduce morbidity and mortality.	I	B	266, 273
CRT may be considered for symptomatic patients with HF in sinus rhythm with a QRS duration of 120–149 msec and non-LBBB QRS morphology			73
CRT rather than pacing and high d			77
CRT should be c reduce morbidity capture is in plac			81
Patients with HFr and who have a high proportion of RV pacing may be considered for upgrade to CRT. This does not apply to patients with stable HF.	IIb	B	282
CRT is contra-indicated in patients with a QRS duration < 130 msec.	III	A	266, 283–285

The Echo-CRT[283,284] trial and an IPD meta-analysis[266] suggest possible harm from CRT when QRS duration is <130 ms, thus implantation of CRT is not recommended if QRS duration is <130 ms.[266,283,284]

Thank you

Aekarach.a@chula.ac.th

Back up slide

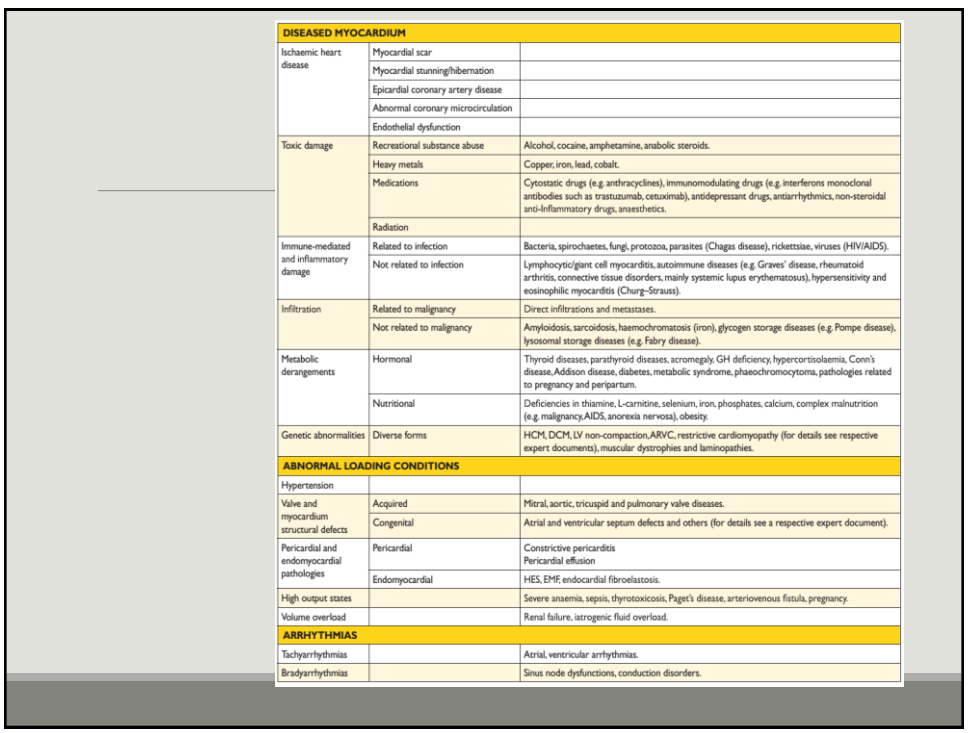


Recommendations for cardiac imaging in patients with suspected or established heart failure

Recommendations	Class [a]	Level [b]	Ref [c]
TTE is recommended for the assessment of myocardial structure and function in subjects with suspected HF in order to establish a diagnosis of either HFrEF, HFmrEF or HFpEF.	I	C	
TTE is recommended to assess LVEF in order to identify patients with HF who would be suitable for evidence-based pharmacological and device (ICD, CRT) treatment recommended for HFrEF.	I	C	
TTE is recommended for the assessment of valve disease, right ventricula			
an already established diagnosis of either HFrEF, HFmrEF or HFpEF in orc			
TTE is recommended for the assessment of myocardial structure and fu potentially can damage myocardium (e.g. chemotherapy).			
Other techniques (including systolic tissue Doppler velocities and deform considered in a TTE protocol in subjects at risk of developing HF in order			
CMR is recommended for the assessment of myocardial structure and f acoustic window and patients with complex congenital heart diseases (			
CMR with LGE should be considered in patients with dilated cardiomyopat ischaemic myocardial damage in case of equivocal clinical and other imaging			
CMR is recommended for the characterization of myocardial tissue in c Chagas disease, Fabry disease non-compaction cardiomyopathy, and hae indications to CMR).			
Non-invasive stress imaging (CMR, stress echocardiography, SPECT, PET ischaemia and viability in patients with HF and CAD (considered suitabl revascularization.			
Invasive coronary angiography is recommended in patients with HF and therapy or symptomatic ventricular arrhythmias or aborted cardiac arr revascularization) in order to establish the diagnosis of CAD and its se			
Invasive coronary angiography should be considered in patients with HF the presence of ischaemia in non-invasive stress tests (who are conside order to establish the diagnosis of CAD and its severity.			
Cardiac CT may be considered in patients with HF and low to intermec non-invasive stress tests in order to rule out coronary artery stenosis.			
Reassessment of myocardial structure and function is recommended us - in patients presenting with worsening HF symptoms (including episc important cardiovascular event; - in patients with HF who have received evidence-based pharmacothe device implantation (ICD, CRT); - in patients exposed to therapies which may damage the myocardiur			

Recommendations for diagnostic tests in patients with heart failure

Recommendations	Class [a]	Level [b]	Ref [c]
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	I	C	
- natriuretic peptides	IIa	C	
Additional diagnostic tests aiming to identify other HF aetiologies and comorbidities should be considered in individual patients with HF when there is a clinical suspicion of a particular pathology (see Table 3.4 on HF aetiologies).	IIa	C	
A 12-lead ECG is recommended in all patients with HF in order to determine heart rhythm, heart rate, QRS morphology, and QRS duration, and to detect other relevant abnormalities. This information is needed to plan and monitor treatment.	I	C	
Exercise testing in patients with HF:			
- is recommended as a part of the evaluation for heart transplantation and/or mechanical circulatory support (cardiopulmonary exercise testing);	I	C	119, 120
- should be considered to optimize prescription of exercise training (preferably cardiopulmonary exercise testing);	IIa	C	
- should be considered to identify the cause of unexplained dyspnoea (cardiopulmonary exercise testing).	IIa	C	
- may be considered to detect reversible myocardial ischaemia.	IIb	C	
Chest radiography (X-ray) is recommended in patients with HF to detect/exclude alternative pulmonary or other diseases, which may contribute to dyspnoea. It may also identify pulmonary congestion/oedema and is more useful in patients with suspected HF in the acute setting.	I	C	
Right heart catheterization with a pulmonary artery catheter:			
- is recommended in patients with severe HF being evaluated for heart transplantation or mechanical circulatory support;	I	C	
- should be considered in patients with probable pulmonary hypertension assessed by echocardiography in order to confirm pulmonary hypertension and its reversibility before the correction of valve/structural heart disease;	IIa	C	
- may be considered in order to adjust therapy in patients with HF who remain severely symptomatic despite initial standard therapies and whose haemodynamic status is unclear.	IIb	C	
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	93
Thoracic ultrasound may be considered for the confirmation of pulmonary congestion and pleural effusion in patients with AHF.	IIb	C	121
Ultrasound measurement of inferior vena cava diameter may be considered for the assessment of volaemia status in patients with HF.	IIb	C	



DISEASED MYOCARDIUM		
Ischaemic heart disease	Myocardial scar	
	Myocardial stunning/hibernation	
	Epicardial coronary artery disease	
	Abnormal coronary microcirculation	
	Endothelial dysfunction	
Toxic damage	Recreational substance abuse	Alcohol, cocaine, amphetamine, anabolic steroids.
	Heavy metals	Copper, iron, lead, cobalt.
	Medications	Cytostatic drugs (e.g. anthracyclines), immunomodulating drugs (e.g. interferons monoclonal antibodies such as trastuzumab, cetuximab), antidepressant drugs, antiarrhythmics, non-steroidal anti-inflammatory drugs, anaesthetics.
	Radiation	
Immune-mediated and inflammatory damage	Related to infection	Bacteria, spirochaetes, fungi, protozoa, parasites (Chagas disease), rickettsiae, viruses (HIV/AIDS).
	Not related to infection	Lymphocytic/giant cell myocarditis, autoimmune diseases (e.g. Graves' disease, rheumatoid arthritis, connective tissue disorders, mainly systemic lupus erythematosus), hypersensitivity and eosinophilic myocarditis (Churg–Strauss).
Infiltration	Related to malignancy	Direct infiltrations and metastases.
	Not related to malignancy	Amyloidosis, sarcoidosis, haemochromatosis (iron), glycogen storage diseases (e.g. Pompe disease), lysosomal storage diseases (e.g. Fabry disease).
Metabolic derangements	Hormonal	Thyroid diseases, parathyroid diseases, acromegaly, GH deficiency, hypercortisolaemia, Conn's disease, Addison disease, diabetes, metabolic syndrome, phaeochromocytoma, pathologies related to pregnancy and peripartum.
	Nutritional	Deficiencies in thiamine, L-carnitine, selenium, iron, phosphates, calcium, complex malnutrition (e.g. malignancy, AIDS, anorexia nervosa), obesity.
Genetic abnormalities	Diverse forms	HCM, DCM, LV non-compaction, ARVC, restrictive cardiomyopathy (for details see respective expert documents), muscular dystrophies and laminopathies.
ABNORMAL LOADING CONDITIONS		
Hypertension		
Valve and myocardium structural defects	Acquired	Mitral, aortic, tricuspid and pulmonary valve diseases.
	Congenital	Atrial and ventricular septum defects and others (for details see a respective expert document).
Pericardial and endomyocardial pathologies	Pericardial	Constrictive pericarditis Pericardial effusion
	Endomyocardial	HES, EMF, endocardial fibroelastosis.
High output states		Severe anaemia, sepsis, thyrotoxicosis, Paget's disease, arteriovenous fistula, pregnancy.
Volume overload		Renal failure, iatrogenic fluid overload.
ARRHYTHMIAS		
Tachyarrhythmias		Atrial, ventricular arrhythmias.
Bradyarrhythmias		Sinus node dysfunctions, conduction disorders.