CURRENT UPDATE OF CARDIOVASCULAR DISEASE IN EMERGENCY

Dr. Eka Ginanjar, SpPD, KKV, FINASIM, FACP, FICA

Division of Cardiology, Cipto Mangunkusumo Hospital & University of Indonesia, Jakarta

Abstract

Cardiovascular diseases remain a major cause of health loss and a leading cause of death for all regions of the world. There were 12.59 million deaths due to CVD in 1990, increasing to 17 million deaths in 2013 and 17.92 million deaths in 2015. The 10 most common global causes of CVD-related death were ischemic heart disease (IHD), ischemic stroke, hemorrhagic and other stroke, atrial fibrillation, peripheral arterial disease (PAD), aortic aneurysm, cardiomyopathy and myocarditis, hypertensive heart disease, endocarditis, rheumatic heart disease (RHD), and a category for other CVD conditions. Ischemic heart disease was the leading cause of CVD health lost globally, as well as in each world region, followed by stroke.

Ischemic heart disease (IHD) will cause death in many way, one of them appear as acute coronary syndrome. The major symptom of patients with suspected acute coronary syndromes (ACS) is chest pain. Additional symptoms such as sweating, nausea, abdominal pain, dyspnoea and syncope may be present. In some cases, there is atypical presentation of ACS such as epigastric pain, indigestion-like symptoms and isolated dyspnoea. Firstline diagnostic tool in the assessment of patients with suspected ACS is the resting 12-lead ECG, followed by cardiac biomarkers such as troponin, rule in and rule out algorithm, and non-invasive imaging (echocardiography or multidetector computed tomography. Management of acute coronary syndrome in emergency room should begin with Initial evaluation and pathway, followed by diagnosis validation, risk assessment and rhythm monitoring, antithrombotic treatment, invasive strategy, revascularization modalities and post-discharge management.

Acute heart failure 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. The diagnostic workup needs to be started in the pre-hospital setting and continued in the emergency department in order to establish the diagnosis in a timely manner and initiate appropriate management. The early phase

management of acute heart failure should be done with oxygen therapy and pharmacological therapy such as diuretic, vasodilator, vasopressor, thromboembolism prophylaxis or digoxin.

Cardiogenic shock (CS) is defined as a state of critical end organ hypoperfusion due to reduced cardiac output. Notably, CS forms a spectrum that ranges from mild hypoperfusion to profound shock. Established criteria for the diagnosis of CS are low systolic blood pressure, pulmonary congestion or elevated left-ventricular filling pressures and signs of impaired organ perfusion with at least one of the following criteria altered mental status, cold and clammy skin, oliguria and increased serum-lactate. Basic treatment for cardiogenic shock include initial stabilization with volume expansion to obtain euvolaemia, vasopressors, and inotropes plus additional therapy for the prevention or treatment of multiorgan system dysfunction (MODS). In the case of cardiogenic shock complicating AMI, early revascularization is the most important treatment. In current guidelines, early revascularization by either percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG) is a class 1B recommendation. Mechanical circulatory support can be use in consideration to overcome the limitations of inotropes and vasopressors with limited effects to maintain adequate perfusion pressure, prevent or reverse MODS to improve haemodynamics and outcome.

BACKGROUND

Cardiovascular diseases remain a major cause of health loss and a leading cause of death for all regions of the world. In 2015, there were an estimated 422.7 million cases of CVD. There were 12.59 million deaths due to CVD in 1990, increasing to 17 million deaths in 2013 and 17.92 million deaths in 2015. [(1)]

The highest CVD mortality shifted from women to men.[(1)] In 2013, the probability of premature death between the ages of 30 and 70 attributable to CVD was 10.8% for men and 6.7% for women globally. [(2)] CVD mortality decreased sharply for both sexes in countries with an high sociodemography index. Regional differences in CVD are likely a result of variation in exposure to modifiable risk factors, as well as access to effective health care interventions [(1)] The number of life years lost to premature CVD deaths is increasing in low- and middle-income regions. The largest increase in premature mortality attributable to CVD over the past 20 years was in East, South, and Southeast Asia, and parts of Latin America, as well. [(2)]

The 10 most common global causes of CVD-related death were ischemic

heart disease (IHD), ischemic stroke, hemorrhagic and other stroke, atrial fibrillation, peripheral arterial disease (PAD), aortic aneurysm, cardiomyopathy and myocarditis, hypertensive heart disease, endocarditis, rheumatic heart disease (RHD), and a category for other CVD conditions. Ischemic heart disease was the leading cause of CVD health lost globally, as well as in each world region, followed by stroke. [1]

Table 1. Causes of CVD Estimated for the Global Burden of Disease 2013 Study

Cause	Deaths in 2013	95% Uncertainty Interval
Ischemic heart disease	8 139 852	(7 322 942–8 758 490)
Ischemic stroke	3 272 924	(2 812 654–3 592 562)
Hemorrhagic and other nonischemic stroke	3 173 951	(2 885 717–3 719 684)
Hypertensive heart disease	1 068 585	(849 758–1 242 160)
Other cardiovascular and circulatory diseases	554 588	(499 143–654 152)
Cardiomyopathy and myocarditis	443 297	(370 111–511 997)
Rheumatic heart disease	275 054	(222 622–353 938)
Aortic aneurysm	151 493	(124 201–179 954)
Atrial fibrillation and flutter	112 209	(97 716–126 677)
Endocarditis	65 036	(48 593–79 435)
Peripheral vascular disease	40 492	(35 487–44 883)

In 2015, IHD was the leading cause of all health loss globally, as well as in each world region. IHD was the summation of 4 distinct disease sequels: acute myocardial infarction, chronic stable angina, chronic IHD, and heart failure due to IHD. There were an estimated 7.29 million acute myocardial infarctions and 110.55 million prevalent cases of IHD in 2015. There were an estimated 10.88 million prevalent cases of IHD) among persons 50 to 54 years of age, which is more than 3-fold the number of cases for persons 40 to 44 years of age. There were an estimated 8.92 million deaths (due to IHD in 2015, making IHD the leading cause of death in the world. The estimated age-standardized IHD death rate was highest in Central Asia and Eastern Europe. [1]

CURRENT UPDATE OF ACUTE CORONARY SYNDROME

Sign and symptom of Acute Coronary Syndrome

The major symptom that initiates the diagnostic and therapeutic cascade in patients with suspected acute coronary syndromes (ACS) is chest pain. [3]

1. Typical chest pain is characterized by a retrosternal sensation of pressure or heaviness (angina) radiating to the left arm (less frequently to both arms or to the right arm), neck or jaw, which may be intermittent (usually lasting several minutes) or persistent. Additional symptoms such as sweating, nausea, abdominal pain, dyspnoea and syncope may be present.
2. Atypical presentations include epigastric pain, indigestion-like symptoms and isolated dyspnoea. Atypical complaints are more often observed in the elderly, in women and in patients with diabetes, chronic renal disease or dementia. [4,5,6]

Physical examination may identify signs of non-coronary causes of chest pain (e.g. pulmonary embolism, acute aortic syndromes, myopericarditis, aortic stenosis) or extra cardiac pathologies (e.g. pneumothorax, pneumonia or musculoskeletal diseases) but it is frequently unremarkable in patients with suspected NSTE-ACS. Cardiac auscultation may reveal a systolic murmur due to ischaemic mitral regurgitation, which is associated with poor prognosis, or aortic stenosis (mimicking ACS). [7] Rarely, a systolic murmur may indicate a mechanical complication (i.e. papillary muscle rupture or ventricular septal defect) of a sub acute and possibly undetected MI. [6-8]

Diagnostic test for Acute Coronary Syndrome

1. Electrocardiography

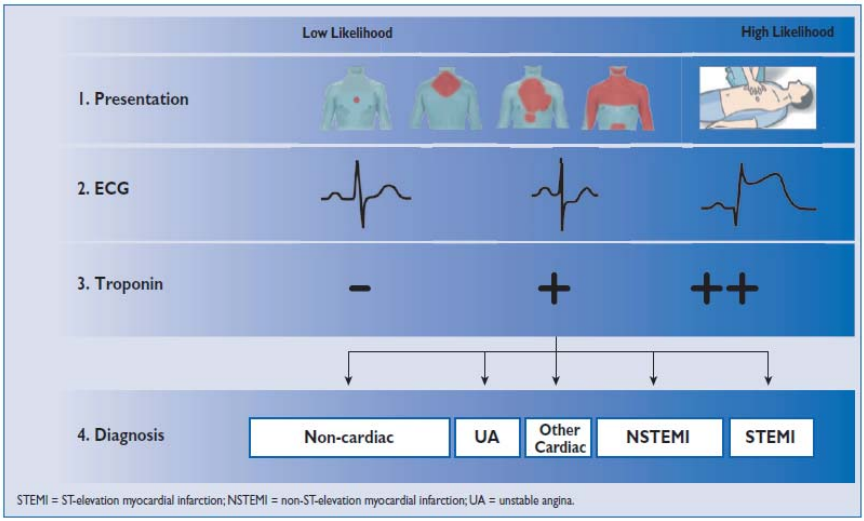
The resting 12-lead ECG is the first-line diagnostic tool in the assessment of patients with suspected ACS. It is recommended to obtain it within 10 minute of the patient's arrival in the emergency room or, ideally, at first contact with emergency medical services in the prehospital setting and to have it immediately interpreted by a qualified physician. [9]

While the ECG in the setting of NSTE-ACS may be normal in more than one-third of patients, characteristic abnormalities include ST depression, transient ST elevation and T-wave changes.[10,11] It is recommended to obtain additional 12-lead ECGs in the case of persistent or recurrent symptoms or diagnostic uncertainty. In patients with bundle branch block or paced rhythm, ECG is of no help for the diagnosis of NSTE-ACS. [3]

2. Biomarker

Biomarkers complement clinical assessment and 12-lead ECG in the diagnosis, risk stratification and treatment of patients with suspected

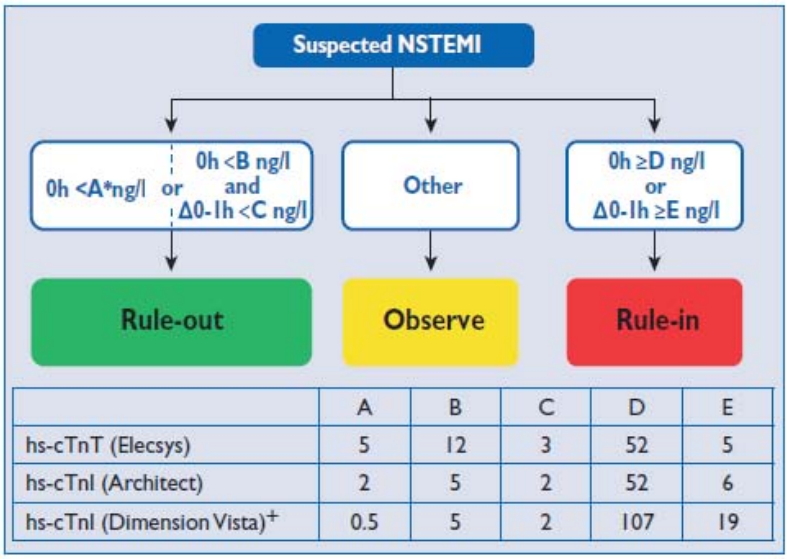
NSTE-ACS. Measurement of a biomarker of cardiomyocyte injury, preferably high-sensitivity cardiac troponin, is mandatory in all patients with suspected NSTE-ACS.[12-14] Cardiac troponins are more sensitive and specific markers of cardiomyocyte injury than creatine kinase (CK), its MB isoenzyme (CK-MB) and myoglobin.[13]



Pic. 1. Diagnostic test for ACS

3. Rule in and Rule out algorithms

0 h/1 h rule-in and rule-out algorithms using high sensitivity cardiac troponins (hs-cTn) assays in patients presenting with suspected non-ST-elevation myocardial infarction (NSTEMI) to the emergency department. 0 h and 1 h refer to the time from first blood test. NSTEMI can be ruled-out already at presentation, if the hs-cTn concentration is very low. NSTEMI can also be ruled out by the combination of low baseline levels and the lack of a relevant increase within 1 h. Those algorithms should always be integrated with a detailed clinical assessment and 12-lead ECG and repeat blood sampling is mandatory in case of ongoing or recurrent chest pain. [3]



	A	B	C	D	E
hs-cTnT (Elecsys)	5	12	3	52	5
hs-cTnI (Architect)	2	5	2	52	6
hs-cTnI (Dimension Vista)+	0.5	5	2	107	19

Pic 2. Rule in and rule out Algorithms

4. Non-invasive imaging

a. Functional Evaluation

Transthoracic echocardiography should be routinely available in emergency rooms and chest pain units and performed/interpreted by trained physicians in all patients during hospitalization for NSTE-ACS. This imaging modality is useful to identify abnormalities suggestive of myocardial ischaemia or necrosis (i.e. segmental hypokinesia or akinesia). Moreover, echocardiography can help in detecting alternative pathologies associated with chest pain, such as acute aortic dissection, pericardial effusion, aortic valve stenosis, hypertrophic cardiomyopathy or right ventricular dilatation suggestive of acute pulmonary embolism. Similarly, echocardiography is the diagnostic tool of choice for patients with haemodynamic instability of suspected cardiac origin.[15]

b. Anatomical Evaluation

Multidetector computed tomography (MDCT) allows for visualization of the coronary arteries and a normal scan excludes CAD. A meta-analysis of nine studies has reported overall high negative predictive values to exclude ACS (by excluding CAD)

and excellent outcome in patients presenting to the emergency department with low to intermediate pre-test probability for ACS and a normal coronary CT angiogram.[16]

Current Update Management of Acute Coronary Syndrome in Emergency Room [3]

Step 1: Initial evaluation and pathway

Chest pain or other atypical symptoms prompt the patient to seek medical attention. All patients with suspected NSTE-ACS must be admitted to an emergency department and evaluated rapidly by a qualified physician. The delay between first medical contact and ECG should be ≤10 min.

The initial treatment measure should include nitrates (sublingual or i.v.) if there is persisting chest pain, hypertension or heart failure. Oxygen therapy should be applied in the presence of a blood oxygen saturation ,90% or respiratory distress. Morphine (i.v. or s.c.) or alternative opiates are reserved for patients with persisting severe chest pain. In patients with ongoing chest pain and inconclusive ECG, consider immediate echocardiography to exclude alternative diagnoses (if appropriate in conjunction with CT angiography) such as pulmonary embolism, pericarditis or aortic dissection and at the same time to reinforce the suspicion of NSTE-ACS (i.e. by identifying a focal wall motion abnormality).

Step 2: Diagnosis validation, risk assessment and rhythm monitoring

Once the initial clinical assessment, complemented by the 12-lead ECG and the first cardiac troponin measurement, has substantiated the diagnosis of NSTE-ACS, antithrombotic treatment (as described in step 3) as well as anti-anginal treatment (i.e. betablockers and nitrates) should be started.

Rhythm monitoring up to 24 hours or PCI (whichever comes first) should be considered in NSTEMI patients at low risk for cardiac arrhythmias (i.e. with none of the following criteria: haemodynamically unstable, major arrhythmias, LVEF ,40%, failed reperfusion, additional critical coronary stenoses or complications related to PCI). Rhythm monitoring for .24 hours should be considered in NSTEMI patients at intermediate to high-risk for cardiac arrhythmias (i.e. if one or more of the above criteria are present).

Step 3: Antithrombotic treatment

The choice of the antithrombotic regimen in NSTE-ACS should be based on the selected management strategy as well as the chosen revascularization modality. Aspirin and parenteral anticoagulation are recommended. In patients intended for a conservative treatment and not at high bleeding risk, ticagrelor (preferred over clopidogrel) is recommended once the NSTEMI diagnosis is established. In patients intended for an invasive strategy, the optimal timing of the administration of ticagrelor (preferred over clopidogrel) has not been adequately investigated, while prasugrel is recommended only after coronary angiography prior to PCI.

Step 4: Invasive strategy

Radial access for coronary angiography and, if needed, revascularization is recommended. The timing of angiography (calculated from first medical contact) can be classified into four categories based on the risk profile of the individual patient: immediate invasive strategy (<2 h) for patients with ongoing ischaemia, early invasive strategy (<24 h) for patients who respond to the initial pharmacological treatment but are at increased risk and need early angiography followed by revascularization, invasive strategy (<72 h) for patients without recurrence of symptoms but with at least one intermediate-risk criterion, and selective invasive strategy for Patients with no recurrence of chest pain, no signs of heart failure, no abnormalities in the initial or subsequent ECG and no increase in (preferably high-sensitivity) cardiac troponin level.

Step 5: Revascularization modalities

In patients with single-vessel disease, PCI with stenting of the culprit lesion is the first choice. In patients with multivessel disease, the decision for PCI or CABG should be individualized through consultation with the Heart Team.

Step 6: Hospital discharge and post-discharge management

Intense risk factor modification and lifestyle changes are warranted in all patients following NSTE-ACS, and enrolment in a cardiac rehabilitation programme after discharge can enhance patient adherence to the medical regimen, may be supportive of risk factor modification and is associated with improved outcomes

Prognosis and Outcome of Acute Coronary Syndrome

At 1 year, the rates of death, MI and recurrent ACS in contemporary NSTE-ACS registries are 10%. While early events are related to ruptured coronary plaques and associated thrombosis, the majority of later events may be the result of coronary and systemic atherosclerosis progression.[17,18]

Challenge of Preventing Acute Coronary Syndrome

Secondary prevention of CV events, including optimal medical therapy, other strategies for risk factor modification and lifestyle changes such as diet, exercise and smoking cessation, is of paramount importance because after an ACS episode, patients remain at high risk for recurrent ischaemic events. Secondary prevention has been shown to have a major impact on long-term outcome in these patients.[3,19]

Recommendations for long-term management after non-ST-elevation acute coronary syndromes

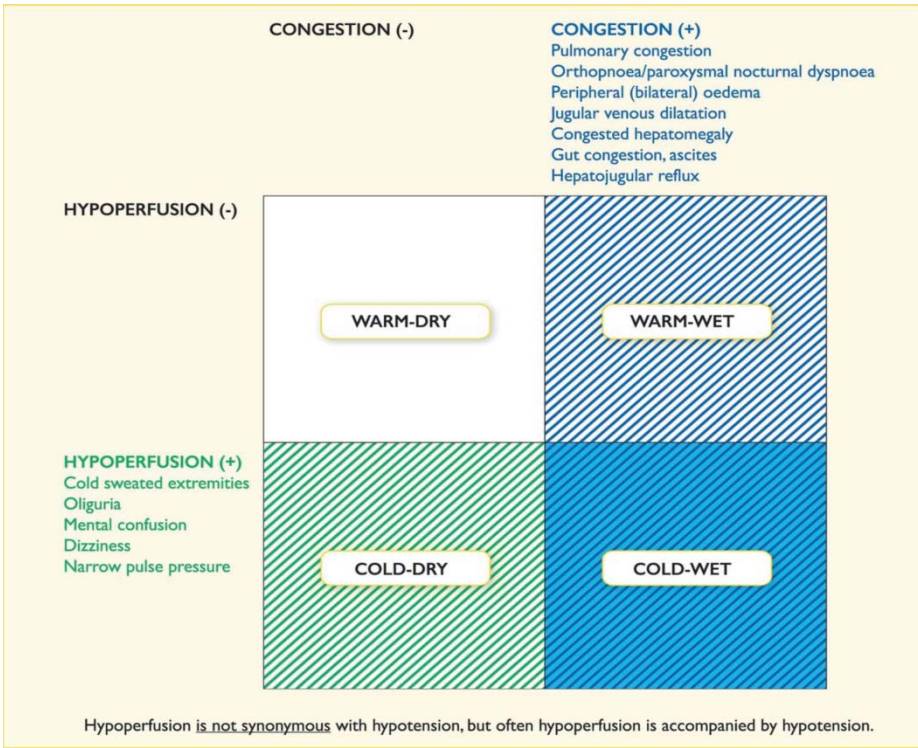
Recommendations (for the recommendations on antithrombotic treatment, see sections 5.2.9 and 5.3.3)	**Class**[a]	**Level**[b]	**Ref.**[c]
It is recommended to advise all patients on lifestyle changes (including smoking cessation, regular physical activity and a healthy diet).	I	A	536, 537
It is recommended to start high-intensity statin therapy as early as possible, unless contraindicated, and maintain it long term.	I	A	522, 527, 528
An ACE inhibitor is recommended in patients with LVEF ≤40% or heart failure, hypertension or diabetes, unless contraindicated. An ARB provides an alternative, particularly if ACE inhibitors are not tolerated.	I	A	478–481, 530, 531, 538
Beta-blocker therapy is recommended in patients with LVEF ≤40%, unless contraindicated.	I	A	482–486
Mineralocorticoid receptor antagonists, preferably eplerenone, are recommended in patients with LVEF ≤35% and either heart failure or diabetes after NSTE-ACS but no significant renal dysfunction or hyperkalaemia.[d]	I	A	487, 488, 525
A diastolic blood pressure goal of <90 mmHg is recommended (<85 mmHg in diabetic patients).	I	A	539, 540

Pic 3. Recommendation for Long Term Management After Non ST-Elevation ACS

CURRENT UPDATE MANAGEMENT OF ACUTE DECOMPENSATED HEART FAILURE WITH LUNG EDEMA IN EMERGENCY ROOM

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. Acute myocardial dysfunction (ischaemic, inflammatory or toxic), acute valve insufficiency or pericardial tamponade are among the most frequent acute primary cardiac causes of AHF. [20] The diagnostic workup needs to be started in the pre-hospital setting and continued in the emergency department (1) in order to establish the diagnosis in a timely manner and initiate appropriate management. [20]

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). [20]



Pic 4. Clinical profiles of patients with acute heart failure based on the presence/absence of congestion and/or hypoperfusion [20]

Management of the early phase

1. Oxygen therapy and/or ventilatory support

In AHF, oxygen should not be used routinely in non-hypoxaemic patients, as it causes vasoconstriction and a reduction in cardiac output. [21,22]

2. Pharmacological therapy

a. Diuretic

The initial approach to congestion management involves i.v. diuretics with the addition of vasodilators for dyspnoea relief if blood pressure allows. To enhance diuresis or overcome diuretic resistance, options include dual nephron blockade by loop diuretics (i.e. furosemide) with thiazide diuretics or natriuretic doses of MRAs.[23,24] However, this combination requires careful monitoring to avoid hypokalaemia, renal dysfunction and hypovolaemia.

b. Vasodilator

Intravenous vasodilators are the second most often used agents in AHF for symptomatic relief; however, there is no robust evidence confirming their beneficial effects. They have dual benefit by decreasing venous tone (to optimize preload) and arterial tone (decrease afterload). Consequently, they may also increase stroke volume. Vasodilators are especially useful in patients with hypertensive AHF, whereas in those with SBP <90 mmHg (or with symptomatic hypotension) they should be avoided. [20]

c. Vasopressor

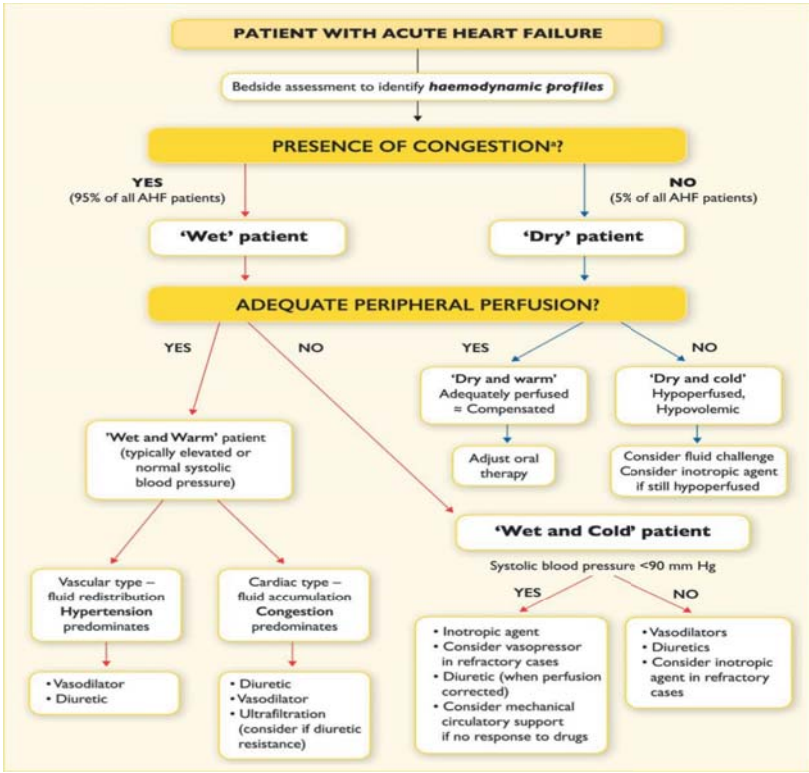
Drugs with prominent peripheral arterial vasoconstrictor action such as norepinephrine or dopamine in higher doses (>5 μg/kg/min) are given to patients with marked hypotension. These agents are given to raise blood pressure and redistribute blood to the vital organs. However, this is at the expense of an increase in LV afterload. [20]

d. Thromboembolism prophylaxis

Thromboembolism prophylaxis with heparin or another anticoagulant is recommended unless contraindicated or unnecessary (because of existing treatment with oral anticoagulants). [20]

e. Digoxin

Digoxin is mostly indicated in patients with AF and rapid ventricular rate (>110 bpm) and given in boluses of 0.25–0.5 mg i.v. if not used previously (0.0625–0.125 mg may be an adequate dose in patients with moderate to severe renal dysfunction). [20]

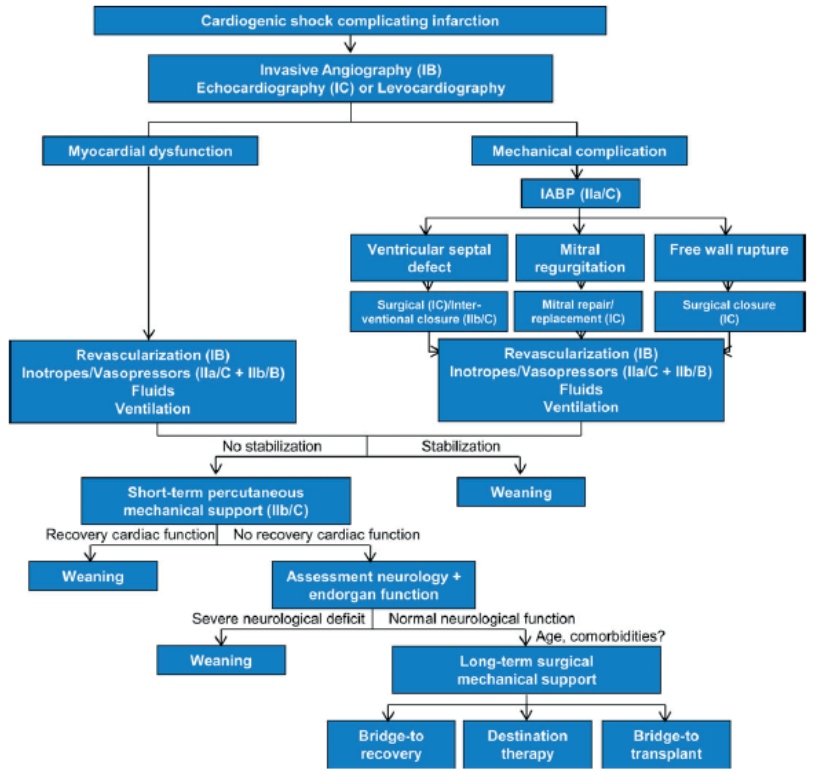


Pic. 5 Management of patients with acute heart failure based on clinical profile during an early phase [20]

CURRENT UPDATE MANAGEMENT OF CARDIOGENIC SHOCK IN EMERGENCY SETTING

Cardiogenic shock (CS is defined as a state of critical end organ hypoperfusion due to reduced cardiac output. Notably, CS forms a spectrum that ranges from mild hypoperfusion to profound shock. Established criteria for the diagnosis of CS are: (i) systolic blood pressure ,90 mmHg for 30 min or vasopressors required to achieve a blood pressure ≥90 mmHg; (ii) pulmonary congestion or elevated left-ventricular filling pressures; (iii) signs of impaired

organ perfusion with at least one of the following criteria: (a) altered mental status; (1) cold, clammy skin; (1) oliguria; (d) increased serum-lactate. [25]



Pic. 6. Treatment algorithm for patients with cardiogenic shock complicating acute myocardial infarction

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