Sheba Medical Center
Dept. of Cardiology

Acute Heart Failure

Aetiology

Investigation

Management

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Definition

- Rapid onset of symptoms and signs secondary to abnormal cardiac function.
- Related to
  - Systolic or diastolic dysfunction
  - Abnormalities in cardiac rhythm
  - Preload and afterload mismatch
- Often life-threatening and requires urgent treatment
- Presentation
  - Acute de novo
  - Acute decompensation of CHF

Classification of severity

- New York Heart Association (NYHA) classification for heart failure
  - Class I: no limitation of physical activity
  - Class II: slight limitation of physical activity
  - Class III: marked limitation of physical activity
  - Class IV: symptoms at rest and unable to carry out any physical activity without discomfort

Signs and symptoms

- The diagnosis of acute decompensated heart failure (ADHF) should be based primarily on signs and symptoms.
  - Dyspoea
  - Peripheral oedema
  - Cough
  - Orthopnoea
  - Chest pain
  - Nocturnal dyspnoea
  - Fatigue
  - Palpitations
- When diagnosis is unclear, check BNP in patients being evaluated for dyspnoea with signs of heart failure (should not be interpreted in isolation

Hospital Admission

- Hospital admission is recommended in the presence of:
- Evidence of severely decompensated HF, incl.
  - Hypotension
  - Worsening renal failure
  - Altered mentation
- Dyspnoea at rest
  - Typically reflected by resting tachypnoea
  - Less commonly reflected by O2 sats. <90%
- Haemodynamically significant arrhythmia
  - Incl. new onset rapid AF

- Hospital admission should be considered in the presence of:
- Worsened congestion
  - Even without dyspnoea
- Signs and symptoms of pulmonary or systemic congestion
  - Even in the absence of weight gain
- Major electrolyte disturbance
- Associated comorbid conditions
  - Pneumonia, PE, DKA, symptoms suggestive of TIA or stroke
- Repeated ICD firings
- Previously undiagnosed HF with S&S of systemic or pulmonary congestion

Treatment Goals

- Treatment goals
  - Improve symptoms, esp. congestion and low output symptoms
  - Restore normal oxygenation
  - Optimize volume status
  - Identify aetiology
  - Identify and address precipitating factors
  - Optimize chronic oral therapy
  - Minimise side effects
  - Identify patients who might benefit from revascularisation or device therapy
  - Identify risk of thromboembolism and need for anticoagulant therapy
  - Educate patients concerning medications and self assessment of HF
  - Consider and, where possible, initiate a disease management program

Patient Monitoring

Frequency	Value	Specifics
At least daily	Weight	Determine after voiding in the morning Account for possible increased food intake due to improved appetite
At least daily	Fluid intake and output	
More than daily	Vital signs	Orthostatic blood pressure, if indicated Oxygen saturation daily until stable
At least daily	Signs	Edema, ascites, pulmonary rales, hepatomegaly, increased jugular venous pressure, hepatojugular reflux, liver tenderness
At least daily	Symptoms	Orthopnea, paroxysmal nocturnal dyspnea or cough, nocturnal cough, dyspnea, fatigue, lightheadedness
At least daily	Electrolytes	Potassium, sodium
At least daily	Renal function	BUN, serum creatinine

Diuretics

- Patients with ADHF and evidence of fluid overload should be treated initially with loop diuretics IV
  - At a dose necessary to produce diuresis sufficient to relieve S&S of congestion (oedema,elevated JVP, dyspnoea)
  - Without inducing an excessively rapid reduction in
    - IV volume – symptomatic hypotension and/or worsening renal function
    - Serum electrolytes – arrhythmias or muscle cramps

- Monitor daily weight, intake and output to assess clinical efficacy of diuretic therapy
  - Foley catheter use when close monitoring of urine output is needed or if bladder outlet obstruction is suspected
- Side effect monitoring (esp. in high doses)
  - Renal dysfunction. electrolyte abnormalities, symptomatic hypotension and gout

- Alternatives
  - Re-evaluate presence/absence of congestion
  - Restricting sodium and fluid
  - Increasing doses of loop diuretic
  - Continuous infusion of a loop diuretic
  - Or addition of a second type of diuretic (e.g. spironolactone)

Sodium restriction

- Low sodium diet (2g daily) is recommended
- In patients with recurrent or refractory volume overload, stricter sodium restriction may be considered

Fluid restriction

- Fluid restriction (<2 liters/day)
  - Recommended in patients with moderate hyponatraemia (<130mEq/L)
- In patients with severe (<125mEq/L) or worsening hyponatraemia, stricter fluid restriction may be considered

Oxygen

- Supplemental oxygen
  - In the presence of hypoxia
- Non-invasive positive pressure ventilation
  - In severely dyspnoeic patients with clinical evidence of pulmonary oedema

VT Prophylaxis

- With low dose unfractionated heparin or low molecular weight heparin to prevent deep venous thrombosis and pulmonary embolism is recommended for patients who are admitted to the hospital with ADHF and who are not anti-coagulated and have no contraindication to anti-coagulation
- With a mechanical device (intermittent pneumatic compression device or graded compression stockings) to prevent proximal DVT and PE should be considered for patients who are admitted to the hospital with ADHF, who are not already anti-coagulated, and who have a contraindication to anti-coagulation

IV VASODILATORS

- In the absence of symptomatic hypotension, IV nitroglycerin may be considered as an addition to diuretic therapy for rapid improvement of congestive symptoms in patients admitted with ADHF
  - Frequent BP monitoring is recommended
  - Should be decreased in dosage or discontinued if symptomatic hypotension or worsening renal function develops
  - Reintroduction in increasing doses may be considered once symptomatic hypotension is resolved
- Recommended for rapid symptom relief in patients with acute pulmonary oedema or severe hypertension
- May be considered in patients with ADHF who have persistent severe HF despite aggressive treatment with diuretics and standard oral therapies

IV INOTROPES

- Dobutamine may be considered to relieve symptoms and improve end-organ function in patients with advanced HF characterised by
  - LV dilation
  - Reduced left ventricular ejection fraction
  - And diminished peripheral perfusion or end-organ dysfunction (low output syndrome)
- Particularly if these patients
  - Have marginal systolic BP (<90mmHg)
  - Have symptomatic hypotension despite adequate filling pressure
  - Or are unresponsive to, or intolerant of, IV vasodilators

- May be considered in similar patients with evidence of fluid overload if they respond poorly to IV diuretics or manifest diminished or worsening renal function
- When adjunctive therapy is needed in other patients with ADHF, administration of vasodilators should be considered instead of IV inotropes (dobutamine)
- IV inotropes (dobutamine) are not recommended unless left heart filling pressures are known to be elevated or cardiac index is severely impaired.

- It is recommended that administration of IV inotropes in the setting of ADHF be accompanied by continuous or frequent BP monitoring and continuous monitoring of cardiac rhythm
- If symptomatic hypotension or worsening tachyarrhythmias develop during administration of these agents, discontinuation or dose reduction should be considered

Invasive haemodynamic monitoring

- Should be considered in a patient
  - Who is refractory to initial therapy
  - Whose volume status and cardiac filling pressures are unclear
  - Who has clinically significant hypotension (typically SBP <80mmHg) or worsening renal function during therapy
  - Or who is being considered for cardiac transplant and needs assessment of degree and reversibility of pulmonary hypertension
  - Or in whom documentation of an adequate haemodynamic response to theinotropic agent is necessary when chronic outpatient infusion is being considered

Evaluation for Precipitating Factors

- Recommended that patients admitted with ADHF undergo evaluation for the following precipitating factors
  - AF or other arrhythmias (e.g. atrial flutter, other SVT or VT)
  - Exacerbation of hypertension
  - Myocardial ischaemia/infarction
  - Exacerbation of pulmonary congestion
  - Anaemia, thyroid disease
  - Significant drug interactions
  - Other less common factors

Aetiology

- Coronary heart disease: 60-70% (esp. elderly)
- Dilated cardiomyopathy, arrhythmia, congenital or valvular heart disease, myocarditis: younger patients

Table 1 Causes and precipitating factors in AHF

(1) Decompensation of pre-existing chronic heart failure (e.g. cardiomyopathy)
(2) Acute coronary syndromes
  (a) myocardial infarction/unstable angina with large extent of ischaemia and ischaemic dysfunction
  (b) mechanical complication of acute myocardial infarction
  (c) right ventricular infarction
(3) Hypertensive crisis
(4) Acute arrhythmia (ventricular tachycardia, ventricular fibrillation, atrial fibrillation or flutter, other supraventricular tachycardia)
(5) Valvular regurgitation/endocarditis/rupture of chordae tendinae, worsening of pre-existing valvular regurgitation
(6) Severe aortic valve stenosis
(7) Acute severe myocarditis
(8) Cardiac tamponade
(9) Aortic dissection
(10) Post-partum cardiomyopathy
(11) Non-cardiovascular precipitating factors
  (a) lack of compliance with medical treatment
  (b) volume overload
  (c) infections, particularly pneumonia or septicaemia
  (d) severe brain insult
  (e) after major surgery
  (f) reduction in renal function
  (g) asthma
  (h) drug abuse
  (i) alcohol abuse
  (j) phaeochromocytoma
(12) High output syndromes
  (a) septicaemia
  (b) thyrotoxicosis crisis
  (c) anaemia
  (d) shunt syndromes

- Acute valvular (mitral or aortic) regurgitation
- Myocardial infarction
- Myocarditis
- Arrhythmia
- Drugs (e.g. cocaine, calcium channel blockers or beta-blocker overdose)
- Sepsis

Assessing Aetiology

- Blood tests
  - FBC, U&E and creatinine, LFTs, glucose, fasting lipids, TFTs
  - Consider cardiac enzymes if an undiagnosed MI is possible in the preceding few days
- CXR
  - Provides supportive evidence for heart failure and helps to exclude other potential causes of breathlessness
    - Cardiomegaly (cardiothoracic ratio >50%)
    - Ventricular hypretrophy
    - Prominent upper lobe veins (upper lobe diversion)
    - Peribronchial cuffing
    - Diffuse interstitial or alveolar shadowing – classical perihilar 'bat's wings' or nodular (esp. with pre-existing COPD)
    - Fluid in the fissures
    - Pleural effusions
    - Kerley B lines

- Apart from pulmonary congestion, CXR findings are only predictive of heart failure where there are co-existing typical signs and symptoms
  - Urinalysis
  - Lung function tests (peak flow or spirometry)
  - Cardiac MRI – the gold standard for assessing ventricular volumes, mass and wall motion. It can be used with contrast to identify inflammation, infiltration and scarring of the myocardium. Its use is limited by availablity and cost
  - Exercise testing, CT angiography or coronary angiography are not part of routine diagnosis of heart failure but may be considered where IHD is suspected
  - Radionuclide imaging may be helpful to assess global ventricular function when ECHO is not possible
  - Endomyocardial biopsy is rarely needed

Discharge Criteria

Recommended for all HF patients	Exacerbating factors addressed Near optimal volume status observed Transition from intravenous to oral diuretic successfully completed Patient and family education completed, including clear discharge instructions Near optimal pharmacologic therapy achieved, including ACEI and BB (for patients with reduced LVEF) or intolerance documented Follow-up clinic visit scheduled, usually for 7-10 days
Should be considered for patients with advanced HF or recurrent admissions for HF	Oral medication regimen stable for 24 hours No intravenous vasodilator or inotropic agent for 24 hours Ambulation prior to discharge to assess functional capacity after therapy Plans for post-discharge management (scale present in home, visiting nurse or telephone follow up generally no longer than 3 days after discharge) Referral for disease management, if available

Discharge Planning

- Discharge planning should address
  - Details regarding medication, dietary sodium restriction and recommended activity level
  - Follow-up by phone or clinic visit early after discharge to reassess volume status
  - Medication and dietary compliance
  - Alcohol moderation and smoking cessation
  - Monitoring of body weight, electrolytes and renal function
  - Consideration of referral for formal disease management