Critical Care Medicine and Trauma

Medical Management of Acute Heart Failure

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Acute Decompensated Heart Failure

- Volume Overload
- Tachyarrhythmias
- Cardiogenic Shock
Volume Overload

- Diuretics
- Vasodilators
Volume Overload

- Left ventricular diastolic dysfunction

- **Risk factors:** LVH, female, age > 70, hypertension, coronary disease, diabetes

- **Acute HF precipitants:** Pain, anemia, tachycardia, cardiac ischemia or infarction
Diuretics:

loop > thiazide > spironolactone

Doses sufficient to induce diuresis that will optimize volume status and relieve the signs and symptoms of congestion without excessively rapid reductions in intravascular volume that may result in hypotension, renal dysfunction, or both.

Circulation 2009;119:e391-e479
Diuretics:

- Heart Failure Clinical Research Network: National Heart, Lung, Blood Institute

- Diuretic Optimization Strategies Evaluation (DOSE) Study — Braunwald et al.

*Circ Heart Fail* 2009;2:56-62
Diuretics: DOSE Study

- Hypothesis 1

“Low intensification” furosemide (1x chronic oral dose) is more efficacious (with regard to relief of symptoms) and safer (with regard to changes in renal function) compared to “high intensification” furosemide therapy (2.5x the chronic oral dose) in patients with ADHF.
Diuretics: DOSE Study

- Hypothesis 2

Continuous infusion diuretic therapy is more efficacious (with regard to relief of symptoms) and safer (with regard to renal function) when compared to 2x daily bolus therapy in ADHF.
Vasodilators:

In the absence of more definitive data, goals of therapy include (a) more rapid resolution of congestive symptoms, (b) relief of angina while awaiting coronary intervention, (c) control of hypertension, and (d) improvement of hemodynamic abnormalities prior to oral HF therapy.

*Circulation* 2009; 119: e391-e479
Vasodilators:

- Initial mean arterial pressure > 80 mmHg
- **Nitroprusside**: venodilator = arteriodilator
- **Nitroglycerin**: venodilator > arteriodilator
- **Nesiritide**: human B-type natriuretic peptide
Nitroprusside:

- Effective bridge therapy in ADHF patients
- Coronary steal syndrome may be possible
- Thiocyanate and cyanide toxicity rare with usual protocol: < 3 μg/kg/min for < 72 hrs
Nitroglycerin:

- Rapid reduction in pulmonary congestion
- Hypertension, ischemia, mitral regurgitation
- Resistance and tolerance in heart failure
Nesiritide:

- Rapid relief of congestive symptoms
- Possible adverse renal consequences
- Effects on mortality under investigation
Acute Decompensated Heart Failure

Cardiorenal Syndrome

Crit Care Med 2008; 36: S75-S88 (Supplement)
Features of the Cardiorenal Syndrome

- Cardiorenal failure

  **Mild:** eGFR 30 - 59 mL/min/1.73 m²

  **Moderate:** eGFR 15 - 29 mL/min/1.73 m²

  **Severe:** eGFR < 15 mL/min/1.73 m² or requirement for acute dialysis
Features of the Cardiorenal Syndrome

- Worsening renal function during treatment
  
  Increase in creatinine > 0.3 mg/dL or > 25% of baseline value

*Note:* Worsening renal function is as common in diastolic heart failure as in systolic heart failure.
Features of the Cardiorenal Syndrome

- Diuretic resistance

Persistent congestion despite:

- > 240 mg furosemide per day
- Continuous furosemide infusion
- Combination diuretic therapy
Management of Cardiorenal Syndrome

- Assess suitability of patient for dialysis and advanced heart failure options
- Consider PA catheter-guided therapy
- Consider renal structure and function

Crit Care Med 2008; 36: S75-S88 (Supplement)
Management of Cardiorenal Syndrome

• Optimize diuretic dosing schedule

• Consider renal-specific therapies

  Ultrafiltration versus hemodialysis

• Investigational therapies

  Vasopressin, adenosine antagonists
Tachyarrhythmias

Atrial Fibrillation and Acute Decompensated Heart Failure

Circ Heart Fail 2009;2:71-73
Atrial Fibrillation and Acute Decompensated Heart Failure

• Priority One: Rate Control

• Priority Two: Rhythm Control
Atrial Fibrillation and ADHF

- Does patient have a pacemaker or an implantable cardioverter-defibrillator?

- Does the patient have preserved or reduced left ventricular systolic function?

*Circ Heart Fail 2009;2:72-73*
Atrial Fibrillation and ADHF

- What is duration of atrial fibrillation?
- Is patient receiving agents for rate control, rhythm control, anticoagulation?
- What other disorders are present?

*Circ Heart Fail* 2009;2:72-73
Cardiogenic Shock

- State of end-organ hypoperfusion caused primarily by cardiac failure

- Acute myocardial infarction with left ventricular failure remains the most common etiology of cardiogenic shock.

*Circulation* 2008;117:686-697
• Persistent hypotension
  Systolic blood pressure < 80 to 90 mmHg
  Mean arterial pressure 30 mmHg < baseline

• Severe reduction in cardiac index
  < 1.8 L/min/m² without support
  < 2.0 - 2.2 L/min/m² with support

• Adequate or elevated filling pressure
  Left ventricular EDP > 18 mmHg
  Right ventricular EDP > 10 - 15 mmHg
Cardiogenic Shock

- Assess suitability for continued treatment
- Consider hemorrhage, infection, bowel ischemia, pulmonary embolism, Ao dissection
- Consider mechanical complications of MI
  - Ventricular septal rupture
  - Contained free wall rupture
  - Papillary muscle rupture
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*Circulation* 2008;118:1047-1056
Inotropes:

Dopamine, dobutamine, and milrinone are most useful in patients with relative hypotension and either intolerance or no response to diuretics and vasodilators.

Data from several studies suggest an increase in adverse clinical outcomes with inotrope use in acute heart failure.

*Circulation* 2009;119:e391-e479
Invasive Hemodynamic Monitoring:

Presumed cardiogenic shock requiring escalating pressor therapy and formal consideration of mechanical support.

Severe clinical decompensation with therapy limited by uncertainty regarding contributions of elevated filling pressure, tissue hypoperfusion, and vascular tone.

*Circulation* 2009;119:e391-e479
Cardiogenic Shock

- Percutaneous coronary intervention
- Intra-aortic balloon pump placement
- Ventricular assist device implantation

Circulation 2008;117:686-697