Cardiogenic Shock in Acute MI

Mark Sheldon, MD
UNMH Interventional Cardiology
Objectives

• Overview
  • Definition
  • Shock profiles
  • Causes

• Treatment
  • Medical
  • Mechanical
    – Revascularization methods
    – Basics of various methods of support

• Illustrative case

• Questions?
Pathophysiology Basics

Cardiogenic Shock

- Poor myocardial contractility
- High venous pressure leads to fluid extravasation and oedema
- Despite normal or high BP, organs are poorly perfused due to a reduction in blood flow
- Sympathetic overactivity leads to vasoconstriction in order to maintain BP
CS Defined

• Low cardiac output/index
  • < 1.8 l/min/m² without support
  • < 2.0-2.2 l/min/m² with support

• Relative hypotension
  • < 80-90 mmHg systolic
  • Mean pressure < 60 mmHg

• Poor tissue oxygenation
  • End organ failure
## Hemodynamic Profiles

### Hemodynamics of Shock

<table>
<thead>
<tr>
<th>Red arrow indicates primary abnormality</th>
<th>PCWP (preload)</th>
<th>Cardiac Output</th>
<th>SVR (afterload)</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypovolemic shock</td>
<td>↓</td>
<td>↑</td>
<td>↑</td>
<td>IV fluids</td>
</tr>
<tr>
<td>Cardiogenic shock</td>
<td>↑</td>
<td>↓</td>
<td>↑</td>
<td>Inotropes Revascularization</td>
</tr>
<tr>
<td>Distributive shock (septic, neurogenic)</td>
<td>↓</td>
<td>↑</td>
<td>↓</td>
<td>Pressors IV fluids</td>
</tr>
</tbody>
</table>

PCWP = pulmonary capillary wedge pressure  
SVR = systemic vascular resistance
CS Epidemiology

• Incidence in MI decreasing since the 70’s:
  • ~7% to <6% since the late 90’s

• Mortality rates decreasing:
  • Historically- 80-90%
  • Currently- about 50% (40-70%)

• Why?
Causes

- LV pump failure (80%)
- RV pump failure (5-6%)
- Acute mitral valve insufficiency (7%)
- Ventricular rupture (<2%) or VSD (4%)
- Concomitant aortic/mitral stenosis
- Others
Clinical manifestations

• Hypotension
• Hypoperfusion:
  • Oliguria
  • Cool extremities
  • Altered mental status
• Pulmonary congestion
• Metabolic acidosis
  • Elevated Lactate
Treatment- Medical

• Usual medical therapy
  • Aspirin
  • Clopidogrel/Ticagrelor/Prasugrel
  • Heparin
  • Avoid beta blockers

• Inotropes/Pressors
  • Hypotensive: Dopamine/Norepinephrine
  • Not hypotensive: Dobutamine
Treatment- Mechanical

• **Revascularization**
  - SHOCK trial
  - PPCI greatly preferred over fibrinolytics
  - Culprit artery first
  - Multi-vessel revascularization?
    – PCI vs. Surgery
SHOCK Trial

![Bar chart showing percent with different p-values for 30-Day, 6-Month, and 12-Month periods.](source: CHF © 2003 Le Jacq Communications, Inc.)
Treatment- Mechanical

• Intra-aortic balloon pump

• Left ventricular assist devices
  • Impella (percutaneous)
  • Tandem Heart (percutaneous)
  • LVAD (surgical)
  • ECMO (surgical/percutaneous)
IABP Mechanics
IABP Arterial Waveform

- Unassisted Systole
- Unassisted Aortic End-Diastolic Pressure
- Balloon Inflation
- Assisted Systole
- Diastolic Augmentation
  - ↑ Coronary Perfusion

mm Hg

Ganfyd.org
Impella Catheter
Impella positioning

Aortic Valve
Axial Pump
ECMO Circuit

VA ECMO: Dual Cannula Circuit Model

ecmosimulation.com
Treatment of Cardiogenic Shock: Recommendations- ACC/AHA

• CLASS I
  – Emergency revascularization with either PCI or CABG is recommended in suitable patients with cardiogenic shock due to pump failure after STEMI irrespective of the time delay from MI onset (212, 379, 452). (Level of Evidence: B)
  – In the absence of contraindications, fibrinolytic therapy should be administered to patients with STEMI and cardiogenic shock who are unsuitable candidates for either PCI or CABG (81, 453, 454). (Level of Evidence: B)
Treatment of Cardiogenic Shock: Recommendations- ACC/AHA

• CLASS IIa
  – The use of intra-aortic balloon pump (IABP) counterpulsation can be useful for patients with cardiogenic shock after STEMI who do not quickly stabilize with pharmacological therapy (455, 456, 457, 458, 459). *(Level of Evidence: B)*

• CLASS IIb
  – Alternative LV assist devices for circulatory support may be considered in patients with refractory cardiogenic shock. *(Level of Evidence: C)*
Guideline Evolution

• More recent European Guidelines de-emphasized IABP’s and brought up the recommendations for percutaneous LVAD’s (Impella)
Case
CS 1

- 68 yo woman with a history of HTN, HLP, active smoking, known CAD, s/p BMS of the RCA for an ACS 8 years ago. Also has a history of poor medical compliance and has not seen a physician for 5+ years.
  - Chest discomfort then N/V >> collapsed at home
  - VF found and shocked x 4, CPR, + 3 mg epi and 70 mg lidocaine with ROSC
  - Intubated and brought to UNMH ED
Vitals: 70/40, 75, intubated

Pulse was lost (PEA) and CPR resumed with more Epi given and amiodarone/shock given for pulseless VT

ROSC with a blood pressure of 185/100, then down to the 90’s systolic >> dopamine begun

Taken to the cath lab
UNM Cath Lab

- Upon arrival to the cath lab bradycardic and hypotensive again
- TVP placed
- Norepinephrine begun
Angios
After RCA stents x 2- still hypotensive requiring IABP and dopamine/norepinephrine

What next?
– Impella?
– ECMO?
– Further Revasc?
Hospital Course

- Dopamine weaned off in the cath lab prior to transfer
- <24 hours- norepinephrine weaned off
- 36 hours- IABP removed and extubated
- Full neurologic recovery
- LVEF on TTE 45-50% with inferior hypokinesis
- Discharged on Hospital day 6
Any Further Questions

• Mark Sheldon
• Email: masheldon@salud.unm.edu
• Phone: 505-272-9223