Cardiogenic Shock in Acute MI: Recognition and Treatment

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Case Presentation

- 76 yr old male with non STEMI
- ST depression $V_2 - V_5$
- SBP 70 mmHg, HR 118 bpm
- 3-vessel coronary artery disease
  - Prox LAD 90% - TIMI 2
  - OM1 90% - TIMI2
  - RCA 100% with good collaterals
- How to manage?
Question

Of the following, which would you recommend at this point?

A. Left ventriculography
B. PCI of LCx only
C. IABP and PCI of LCx
D. IABP and attempt multivessel PCI
E. Attempt to stabilize hemodynamics in CCU and consider CABG if patient improves
What is Cardiogenic Shock?

- SBP <90 mmHg (or ≥90 mmHg on support)
- CI <1.8 L/min/m² (or <2.2 L/min/m² on support)
- Adequate or elevated filling pressures (wedge ≥18 mmHg and RVEDP >10 mmHg)
- Evidence of tissue hypoperfusion
Cardiogenic Shock Frequency in NRMI Registry

Babaev A: JAMA 2005
In-Hospital Mortality Rates
NRMI Registry

Babaev A: JAMA 2005
Cardiogenic Shock Factoids

- Leading cause of death among hospitalized patients with AMI
  - Treatable
  - Long term survival possible

- In majority, develops after hospital admission
  - Look out for it! Know the early warning signs
  - Avoid β-blockers in high risk patients
Diagnosis and Management: Crucial Initial Steps

- Rule out volume depletion
  - Adequate volume expansion
- Rule out RV infarction if inferior MI
- Rule out mechanical causes (rupture)
  - Echocardiography or left ventriculography
- Swan Ganz catheter
  - Filling pressures
AMI and Shock

Non cardiogenic

- Hypovolemia, sepsis, blood loss, drugs
Effects of Early Beta-Blockers in AMI
Another Look

Odds ratio and 95% CI

- Combined efficacy & safety
  - Death
  - Reinfarction
  - Ventricular fib
  - Cardiogenic shock

- Composite stratified by shock risk
  - Low
  - Medium
  - High

Increased shock risk

- Age >70 yrs
- SBP <120 mmHg
- HR >110 bpm
- HR <60 bpm
- Longer time since onset

Sabatine M: Lancet (editorial) 2005
Key Points re β-Blockers

- No rush to initiate in ED
- IV beta blockers strongly discouraged
  – May use if severe hypertension
- Avoid if risk of developing shock
  – Including tachycardia!
- Use for secondary prevention
AMI and Shock

Non cardiogenic
- Hypovolemia, sepsis, blood loss, drugs

Cardiogenic – MI complications
- RV failure (infarct, PE)
- Rupture (non anterior or 1st MI)
- Tamponade (non rupture)
Mechanical Complications of MI

IABP and Emergency Surgery

Do not delay!
AMI and Shock

Non cardiogenic
- Hypovolemia, sepsis, blood loss, drugs

Cardiogenic – MI complications
- RV failure (infarct, PE)
- Rupture (non anterior or 1st MI)
- Tamponade (non rupture)

Cardiogenic - LV pump failure
- infarction, ischemia
Treatment of Shock
Main goals

- Restore and optimize coronary blood flow
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Influence of PCI Success on Shock Mortality

In-hospital Mortality

<table>
<thead>
<tr>
<th></th>
<th>SHOCK Registry</th>
<th>ALKK Registry</th>
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<tbody>
<tr>
<td>TIMI 0-1</td>
<td>86%</td>
<td>78%</td>
</tr>
<tr>
<td>TIMI 2</td>
<td>50%</td>
<td>66%</td>
</tr>
<tr>
<td>TIMI 3</td>
<td>33%</td>
<td>36%</td>
</tr>
</tbody>
</table>

Webb J: AHJ 2001; Zeymer: EHJ 2004
Mortality in the SHOCK Trial

- 30-Day: Revasc 47%, Medical 56% (P=0.11)
- 6-Month: Revasc 52%, Medical 64% (P=0.04)
- 1-Year: Revasc 53%, Medical 66% (P<0.03)

Hochman J: NEJM 1999
Shock Guidelines
Critical Initial Interventions

- CA with early CABG or PCI
  - ACC/AHA class I (LOE = A)

- Intra-aortic balloon support
  - ACC/AHA class I (LOE = B)

- Swan-Ganz catheter (and/or Echo)
  - ACC/AHA class IIa (LOE = C)
Inotropes and Vasopressors for Cardiogenic Shock

Temporizing measures only:

- Toxic – limit duration of use
- Dopamine commonly recommended
- Norepinephrine – less arrhythmia
  - add dobutamine if MAP allows
  - preferred over HD dopamine
- Lowest dose and/or in combination
  - aim for MAP >60-65 mmHg
  - avoid industrial strength!
SOAP II Trial

- 1679 shock patients
- Randomized and blinded
- Dopamine vs. norepinephrine
SOAP II Results

28 day mortality

Dopamine: 52.5%
NE: 48.5%
P = 0.10

Arrhythmias

Dopamine: 24.1%
NE: 12.1%
P < 0.001

De Backer D: NEJM 2010
SOAP II Trial
Predefined Subgroups

Hazard ratio (95% CI)

Type of shock

- Hypovolemic
- Cardiogenic
- Septic
- All patients

Norepinephrine better
Dopamine better

De Backer D: NEJM 2010
General Care of Shock Patient

- Transfer to cardiac intensive care
  - Skilled and experienced team
  - Availability of multi specialists

- Ensure adequate oxygenation
  - Prompt treatment of pulmonary edema
  - Intubation and mechanical ventilation

- Monitor for multi organ failure

- Prevent infection and prompt Rx of sepsis
What is new?
Impella 2.5

- Inflow (LV)
- Outflow (Aorta)
- Motor
ISAR-SHOCK Trial
Impella vs. IABP (randomized)

Primary endpoint =
\[ \Delta CI = 0.49 \text{ vs } 0.11 \text{ l/min/m}^2 \]

No difference in clinical events

Impella:
Leg ischemia (1)
More transfusions

Seyfarth M: JACC 2008
Tandem Heart

Trans septal cannula
# Circulatory Support Devices

<table>
<thead>
<tr>
<th></th>
<th>IABP</th>
<th>Impella 2.5</th>
<th>TandemHeart</th>
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<td>Max flow or aug</td>
<td>&lt;1 L/min</td>
<td>2.5 L/min</td>
<td>5 L/min</td>
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<tr>
<td>Ease of use</td>
<td>✔ ✔ ✔ ✔ ✔</td>
<td>✔ ✔ ✔ ✔ ✔</td>
<td>✔ ✔ ✔ ✔ ✔</td>
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<tr>
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<tr>
<td>Duration of use</td>
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<td>Cost - console</td>
<td>$59,000</td>
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<tr>
<td></td>
<td>- pump</td>
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Summary of New Devices for Cardiogenic Shock

- Superior hemodynamics to IABP
  - Not surrogate for survival
- Technically more difficult than IABP
- Bleeding and vascular complications
- Expensive
- Currently not first-line
Aggressive Approach to Treatment of LV Pump Failure in 2011

- IABP and angiography without delay
- PCI culprit vessel
  - multivessel PCI in selected cases??
  - or CABG in selected cases
- LVAD or ECMO – very selected cases as bridge to transplant

Mortality remains high