MODES OF IN-HOSPITAL DEATH IN PATIENTS WITH CARDIODENISCHE SHOCK: AN ANALYSIS FROM THE CRITICAL CARE CARDIOLOGY TRIALS NETWORK

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DISCLOSURES

BACKGROUND

- Cardiogenic shock is a complex, life-threatening syndrome characterized by impaired cardiac output, systemic hypoperfusion, & multi-organ system dysfunction
- Estimated mortality from cardiogenic shock (CS): 30-50%¹
- Data regarding how patients with CS die are limited
- Potential implications for:
  - Clinical trial design
  - Identifying therapeutic strategies
  - Improving outcomes

CLASSIFYING CAUSE OF DEATH

Traditional Approach
- 78 yo M with late-presenting STEMI
- LVEF 20%
- Lactate = 5 mmol/L
- Escalating pressor requirement
- Emergent coronary revascularization of pLAD (TFG 0 → 3)
- Impella CP placed for HD support
- Intubated in cath lab

Proximate cause of death: Myocardial infarction

Mode of death: Downstream event directly leading to death

- Unable to wean tMCS
- Not a candidate for destination therapies
- Family withdraws care
- Shock resolves, Impella removed
- Aspiration pneumonia → unable to wean from mech ventilation
- Trach not within GOC
- Massive ICH with herniation while on full-dose anticoagulation

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OBJECTIVES

To describe the primary modes of in-hospital death among patients admitted with cardiogenic shock to cardiac intensive care units (CICUs)
METHODS

Study Population

• CCCTN is a multinational research network of advanced CICUs coordinated by TIMI Study Group (Boston, MA)

• In 2021, additional data fields for mode of death were added to registry eCRF

• From 2021-2022, 32 centers contributed data on consecutive CICU admissions

• Present analysis included patients with cardiogenic shock
  ➢ Patients with post-cardiotomy shock not included
  ➢ Patients with COVID-19 excluded
METHODS

Study Design

- Nested prospective study
- Site investigators asked to classify the primary mode of in-hospital death using standardized definitions
- Investigators educated to identify the direct reason for death (mode of death) rather than proximate cause of death
METHODS

Modes of Death

<table>
<thead>
<tr>
<th>Cardiovascular</th>
<th>Non-cardiovascular</th>
</tr>
</thead>
<tbody>
<tr>
<td>❑ HF/ Cardiogenic Shock</td>
<td>❑ Anoxic Brain Injury</td>
</tr>
<tr>
<td>❑ Arrhythmia</td>
<td>❑ Respiratory Failure</td>
</tr>
<tr>
<td>❑ Stroke</td>
<td>❑ Non-cardiogenic shock</td>
</tr>
<tr>
<td>❑ Other CV Death</td>
<td>❑ Other Non-CV Death</td>
</tr>
</tbody>
</table>
METHODS

Examples of Standardized Definitions

• Death due to **Heart Failure or Cardiogenic Shock**: Death occurring in the context of clinically worsening symptoms and/or signs of HF, regardless of HF etiology

• Death due to **Respiratory Failure**: Death occurring in the context of insupportable oxygenation or ventilation on maximum ventilator settings or inability to liberate from mechanical ventilation, *and not primarily due to heart failure*

• Death due to **Stroke**: Death after a cerebrovascular event that is either a direct consequence of or substantially contributed to by the stroke
METHODS

Subgroup Analyses

• Subtype of CS
  ➢ AMI-CS
  ➢ HF-CS
  ➢ Secondary (non-myocardial) CS (e.g., pericardial tamponade, etc.)

• Cardiac arrest prior to CICU admission

• Use of temporary MCS during CICU admission
RESULTS

Study Population

• 1,068 CS admissions → 337 (31.6%) died during index hospitalization

• Median time to death = 4.4 (Q1 – Q3, 1.2 – 10.9) days from CICU admission

Characteristics of Patients who Died from CS (N=337)

<table>
<thead>
<tr>
<th>Clinical Characteristics</th>
<th>N (%) or Median (Q1-Q3)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Demographics</strong></td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td>70 (62-78)</td>
</tr>
<tr>
<td>Female sex</td>
<td>34%</td>
</tr>
<tr>
<td><strong>Shock Etiology</strong></td>
<td></td>
</tr>
<tr>
<td>AMI-CS</td>
<td>36%</td>
</tr>
<tr>
<td>HF-CS</td>
<td>50%</td>
</tr>
<tr>
<td>Secondary CS</td>
<td>14%</td>
</tr>
<tr>
<td><strong>Preceding cardiac arrest</strong></td>
<td>33%</td>
</tr>
<tr>
<td><strong>Shock Management</strong></td>
<td></td>
</tr>
<tr>
<td>Temporary MCS</td>
<td>39%</td>
</tr>
</tbody>
</table>
RESULTS

Mode of In-Hospital Death in Patients with Cardiogenic Shock

- Cardiovascular (82.2%)
  - Cardiogenic Shock
  - Arrhythmia
  - Stroke
  - Other Cardiovascular
- Non-Cardiovascular (17.8%)
  - Anoxic Brain Injury
  - Respiratory Failure
  - Non-Cardiogenic Shock
  - Other Non-Cardiovascular
RESULTS
Mode of Death By CS Subtype

• No meaningful differences in modes of death between patients with AMI-CS and HF-CS
Results

Mode of Death By Preceding Cardiac Arrest

- Patients with cardiac arrest prior to CICU admission more likely to die from:
  - Arrhythmia (22% vs. 8%; p<0.001)
  - Anoxic brain injury (17% vs. <1%; p<0.001)
RESULTS
Mode of Death By Preceding Cardiac Arrest

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Mode of Death By Temporary MCS Use

- Patients managed with temporary MCS more likely to die from refractory shock ($p<0.01$):
  - Cardiogenic (74% vs. 62%)
  - Non-cardiogenic (6% vs. 3%)
RESULTS
Mode of Death By Temporary MCS Use

- Patients managed with temporary MCS more likely to die from refractory shock ($p<0.01$):
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  - Non-cardiogenic (6% vs. 3%)
LIMITATIONS

• Death classification made by investigator rather than by central clinical endpoint adjudication committee (CEC)

• Assigning single mode of death may not fully account for clinical nuances involved in patient’s death

• Analysis limited to modes of in-hospital death
CONCLUSIONS

• Most in-hospital deaths in patients with CS are related to direct cardiovascular causes, particularly *persistent cardiogenic shock*

• However, a substantial proportion (~1/3) of deaths in patients with CS are due to causes other than cardiogenic shock

• Substantial heterogeneity in how patients die with CS and cardiac arrest
  ➢ Greater prevalence of arrhythmic deaths and deaths due to anoxic brain injury
  ➢ Distinct insults and clinical sequelae associated with cardiac arrest
  ➢ Important implications for clinical trial design
THANK YOU