A Unified Definition of Cardiogenic Shock: Introducing the SCAI SHOCK Classification System

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SCAI Clinical Expert Consensus Statement on the Classification of Cardiogenic Shock

Key Considerations in the Diagnosis & Management of Cardiogenic Shock

- Is this cardiogenic shock?
- What is the severity?
- Is it predominately LV, RV, or both?
- What are the support options?
Traditional Definition of Cardiogenic Shock

- Persistent SBP < 90 mm Hg not responsive to fluid administration alone
- Secondary to cardiac dysfunction
- Associated with signs of hypoperfusion of a CI < 2.2 L/min/m2 and a PCWP > 15 mm Hg
Shock is Variable

**IMPRESS Trial**
- SBP < 90 for 30 minutes
- Pressors to SBP > 90
- All pts intubated
- 90% cardiac arrest
- 20 minutes to ROSC
- 70-80% induced hypothermia
- Signs of Hypoperfusion
- (Lactate > 7-8, pH 7.1-7.2)

**IABP SHOCK II Trial**
- SBP < 90 for 30 minutes
- Pressors to SBP > 90
- Pulmonary Congestion
- Signs of Hypoperfusion
- Lactate > 2, Alt mental status or Urine Output < 30/hour

One size does not fit all: Lack of common language has impeded the advancement of research on optimal diagnosis & management of these patients
Multidisciplinary Lexicon

Experts with diverse backgrounds engaged in the creation of the SCAI SHOCK system

Endorsed by AHA, ACC, STS, and SCCM

Interventional Cardiology
Heart Failure
Critical Care / Cardiology
Emergency Medicine
Critical Care Nursing
Cardiac Surgery

SCAI
Society for Cardiovascular Angiography & Interventions
Goals of a New Shock Definition

• Simple and intuitive without the need for calculation
• Adds needed granularity in the severity of shock
• Suitable for rapid assessment at the bedside
• Allows for frequent reassessment and reclassification
• Can be applied to retrospective datasets or prior trials to re-examine outcomes, and future trials to better define the included population
• Provide new lexicon for communication between providers, including facilitating multidisciplinary communication within a hospital and between hospitals (hub and spoke model)
• Prognostic discriminatory potential for morbidity and mortality
• Easy to remember nomenclature (model INTERMACS)
SCAI Stages of Cardiogenic Shock

Adapted from the SCAI Clinical Expert Consensus Statement on the Classification of Cardiogenic Shock
Endorsed by ACC, AHA, SCCM, and STS

EXTREMIS
A patient being supported by multiple interventions who may be experiencing cardiac arrest with ongoing CPR and/or ECMO.

DETERIORATING
A patient who fails to respond to initial interventions. Similar to stage Card getting worse.

CLASSIC
A patient presenting with hypoperfusion requiring intervention beyond volume resuscitation (inotrope, pressor, or mechanical support including ECMO). These patients typically present with relative hypotension.

BEGINNING
A patient who has clinical evidence of relative hypotension or tachycardia without hypoperfusion.

AT RISK
A patient with risk factors for cardiogenic shock who is not currently experiencing signs or symptoms. For example, large acute myocardial infarction, prior infarction, acute and/or acute on chronic heart failure.

For more information, please visit: www scai org shock definition
Stage A: At Risk

- A patient who is not currently experiencing signs or symptoms of CS but is at risk for its development.
- These patients may include those with NSTEMI, STEMI, acute or acute on chronic CHF.

<table>
<thead>
<tr>
<th>Physical Exam</th>
<th>Biochem Markers</th>
<th>Hemodynamics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal JVP</td>
<td>Normal Labs</td>
<td>Normotensive</td>
</tr>
<tr>
<td>Clear Lungs</td>
<td>Normal renal function</td>
<td>SBP ≥ 100 or normal for pt</td>
</tr>
<tr>
<td>Warm/ Well Perfused</td>
<td>Normal lactic acid</td>
<td>If hemodynamics done</td>
</tr>
<tr>
<td>Strong distal pulses</td>
<td></td>
<td>CI ≥ 2.5</td>
</tr>
<tr>
<td>Normal mentation</td>
<td></td>
<td>CVP &lt; 10</td>
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<tr>
<td></td>
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<td>PA Sat ≥ 65%</td>
</tr>
</tbody>
</table>
Stage B: Beginning

- A patient who has clinical evidence of relative hypotension or tachycardia **without hypoperfusion**.

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<tr>
<th>Physical Exam</th>
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</thead>
<tbody>
<tr>
<td>Elevated JVP</td>
<td>Normal lactate</td>
<td>SBP &lt;90 OR MAP &lt; 60 or &gt; 30 mm drop from baseline</td>
</tr>
<tr>
<td>Rojas in Lung fields</td>
<td>Normal renal function</td>
<td>Pulse ≥ 100</td>
</tr>
<tr>
<td>Warm/ Well Perfused</td>
<td>Elevated BNP</td>
<td>If hemodynamics done</td>
</tr>
<tr>
<td>Strong distal pulses</td>
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<td>CI ≥ 2.2</td>
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<tr>
<td>Normal mentation</td>
<td></td>
<td>PA Sat ≥ 65</td>
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</table>
Stage C: Classic

• A patient with hypoperfusion that requires interventions such as inotrope, pressor, or perc. MCS to restore perfusion.

• These patients typically have relative hypotension.

<table>
<thead>
<tr>
<th>Physical Exam May Include any of:</th>
<th>Biochem Markers: May Include any of</th>
<th>Hemodynamics: May Include any of</th>
</tr>
</thead>
<tbody>
<tr>
<td>Looks unwell, panicked</td>
<td>Lactate ≥ 2</td>
<td>SBP&lt;90 or MAP &lt; 60 or &gt; 30 mm drop from baseline AND drugs/device used to maintain BP above these</td>
</tr>
<tr>
<td>Ashen, mottled, dusky</td>
<td>Creatinine doubling or &gt; 50 % loss of GFR</td>
<td>Hemodynamics CI &lt; 2.2</td>
</tr>
<tr>
<td>Volume overload Extensive roles Killip 3 /4</td>
<td>Increased LFT’s</td>
<td>PCW &gt; 15</td>
</tr>
<tr>
<td>BiPAP or mechanical vent</td>
<td>Increased BNP</td>
<td>RAP / CVP ≥ 0.8</td>
</tr>
<tr>
<td>Cold, clammy Urine output &lt; 30 mL/h</td>
<td>PAPI &lt; 1.85</td>
<td>CPO ≤ 0.6</td>
</tr>
</tbody>
</table>

SCP SCAI Society for Cardiovascular Angiography & Interventions
Stage D: Deteriorating

- Patients similar to C but are getting worse.
- These patients have **failure to respond** to initial interventions.
Stage E: Extremis

- Patient in cardiac arrest with ongoing CPR or ECLS placement.
- Alternately, being supported by multiple interventions.

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<tr>
<td>“Trying to die”</td>
<td>Lactate ≥ 5</td>
<td>No blood pressure without CPR</td>
</tr>
<tr>
<td>Cardiac collapse</td>
<td>Arterial pH ≤ 7.2</td>
<td>PEA or refractory VT/VF</td>
</tr>
<tr>
<td>Mechanical Vent</td>
<td>Increased LFT’s</td>
<td>Hypotension despite max support</td>
</tr>
<tr>
<td>BiPAP or mechanical vent</td>
<td>Increased BNP</td>
<td></td>
</tr>
<tr>
<td>Defibrillated</td>
<td>No time to draw</td>
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<td>SCAI SHOCK STAGE</td>
<td>PHYSICAL EXAM</td>
<td>BIOCHEMICAL MARKERS</td>
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<td><strong>A</strong></td>
<td>Normal JVP</td>
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<td>Lung sounds clear</td>
<td>Normal lactate</td>
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<td></td>
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<td><strong>B</strong></td>
<td>Elevated JVP</td>
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<td>Minimal renal function impairment</td>
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<td></td>
<td>BPap or mechanical ventilation</td>
<td>Urine Output &lt;30mL/h</td>
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<td></td>
<td>Acute alteration in mental status</td>
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<td></td>
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<tr>
<td><strong>D</strong></td>
<td>Any of stage C</td>
<td>Any of stage C AND deteriorating</td>
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<tr>
<td><strong>E</strong></td>
<td>Near pulselessness</td>
<td>Lactate &gt;/5</td>
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<tr>
<td></td>
<td>Cardiac collapse</td>
<td>pH &lt; 7.2</td>
</tr>
<tr>
<td></td>
<td>Mechanical ventilation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Defibrillator used</td>
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Risk Modifier for Cardiac Arrest

• Any cardiac arrest however brief (Defib or CPR)
  • SCAI SHOCK B(A) = A patient with relative hypotension or tachycardia *without* hypoperfusion who suffers a witnessed VF successfully defibrillated and remains without signs of hypoperfusion
  • If signs of hypoperfusion develop after the arrest, this patient would be SCAI SHOCK C(A), and in need of *initial* efforts to improve perfusion; if those efforts do not work, the patient is now SCAI SHOCK D(A)
Case #1

- 57-year-old woman who had acute onset of arm pain while carrying laundry
- Pain not relieved after 2 hours of doing cleaning and chores and comes to the ER
- Blood pressure 90 / 65, pulse 101
- Looks anxious but appropriate to questions
- Clear lungs and heart exam normal
- Extremities somewhat cool but 2+ pulses
- ECG with ST elevation in lateral leads
- Going to lab for urgent cath
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- ECG with ST elevation in lateral leads
- Going to lab for urgent cath

ANSWER: Stage B “Beginning”
Case #2

- 62-year-old man who is seen in the emergency room with chest pain and anterior STEMI
- Blood pressure 85/50, pulse 115
- Cool, clammy, profusely diaphoretic
- No murmur, basilar crackles
- Extremities intact
- Going to Lab for cath / PCI
Case #2

- 62-year-old man who is seen in the emergency room with chest pain and anterior STEMI
- Blood pressure 85/50, pulse 115
- Cool, clammy, profusely diaphoretic
- No murmur, basilar crackles
- Extremities intact
- Going to Lab for cath / PCI

ANSWER: Stage C “Classic”
Case #3

- 78-year-old man brought in by EMS after collapsing at Costco
- Wife says last thing he told her is he was having “the big one” and clutched chest
- Initial rhythm VF – converted with 200 J shock
- Intubated at site
- “Stable” on wide open fluids during transport and dopamine 20 mic/kg/min
- Blood pressure 80/ palp, HR 130
- Crackles everywhere, ? Murmur
- Cool everything
- EKG LBBB
Case #3

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- “Stable” on wide open fluids during transport and dopamine 20 mic/kg/min
- Blood pressure 80/ palp, HR 130
- Crackles everywhere, ? Murmur
- Cool everything
- EKG LBBB

ANSWER: Stage D(A) “Deteriorating” with arrest modifier
Where do we go from here?

• Present, publish, and spread the word to the wider cardiovascular and critical care communities

• Validate the classification by evaluating its prognostic power and ease-of-use in databases

• Drive earlier recognition of shock and the more precise stage, to guide appropriate and timely escalation of care including transfer to centers more fully equipped

• Utilize the stages to better define prospectively the value of MCS/ECMO and other therapies

• Perhaps future trials looking at similar patients will finally reduce the mortality of cardiogenic shock