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

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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 mmHg
## Shock is Variable

<table>
<thead>
<tr>
<th>IMPRESS Trial</th>
<th>IABP SHOCK II Trial</th>
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<tbody>
<tr>
<td>• SBP &lt; 90 for 30 minutes</td>
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</tr>
<tr>
<td>• Pressors to SBP &gt; 90</td>
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<tr>
<td>• All pts intubated</td>
<td>• Pulmonary Congestion</td>
</tr>
<tr>
<td>• 90% cardiac arrest</td>
<td>• Signs of Hypoperfusion</td>
</tr>
<tr>
<td>• 20 minutes to ROSC</td>
<td>• Lactate &gt; 2, Alt mental status or Urine Output &lt; 30/hour</td>
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<tr>
<td>• 70-80% induced hypothermia</td>
<td><strong>(Lactate &gt; 7-8, pH 7.1-7.2)</strong></td>
</tr>
<tr>
<td>• Signs of Hypoperfusion</td>
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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
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
Encorosed by ACC, AHA, SCAI, 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/shockdefiniton
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.
Stage B: Beginning

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

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

<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 rales</td>
<td>Increased LFT’s</td>
<td>PCW &gt; 1.5</td>
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<tr>
<td>Killip 3 /4</td>
<td></td>
<td></td>
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<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><strong>DETERIORATING</strong></td>
<td>Requiring multiple pressors OR addition of MCS to maintain perfusion</td>
</tr>
<tr>
<td>Acute alteration of mental status</td>
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Stage E: Extremis

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

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<td>“Trying to die”</td>
<td>Lactate ≥ 5</td>
<td>No blood pressure without CPR</td>
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<tr>
<td>Cardiac collapse</td>
<td>Arterial pH ≤ 7.2</td>
<td>PEA or refractory VT/VF</td>
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<tr>
<td>Mechanical Vent</td>
<td>Increased LFT’s</td>
<td>Hypotension despite max support</td>
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<tr>
<td>BiPAP or mechanical vent</td>
<td>Increased BNP</td>
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<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>
<td>Normal renal function</td>
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<td></td>
<td>Lung sounds clear</td>
<td>Normal lactate acid</td>
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<td></td>
<td>Strong distal pulses</td>
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<td><strong>B</strong></td>
<td>Elevated JVP</td>
<td>Normal lactate</td>
</tr>
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<td></td>
<td>Railes in lung fields</td>
<td>Minimal renal function</td>
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<td>Strong distal pulses</td>
<td>impairment</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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<td><strong>E</strong></td>
<td>Near pulselessness</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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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
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• Cool everything
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**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