

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

Slides developed by:

Srihari S. Naidu, MD, FACC, FAHA, FSCAI, Chair

David A. Baran, MD, FACC, FSCAI, FHSFA, Co-Chair



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SCAI Clinical Expert Consensus Statement on the Classification of Cardiogenic Shock

David A. Baran MD, FSCAI (Co-Chair); Cindy L. Grines MD, FACC, FSCAI; Steven Bailey MD, MSCAI, FACC, FACP; Daniel Burkhoff MD, PhD; Shelley A. Hall MD, FACC, FHFA, FAST; Timothy D. Henry MD, MSCAI; Steven M. Hollenberg MD; Navin K. Kapur MD, FSCAI; William O'Neill MD, MSCAI; Joseph P. Ornato MD, FACP, FACC, FACEP; Kelly Stelling RN; Holger Thiele MD, FESC; Sean van Diepen MD, MSc, FAHA; Srihari S. Naidu MD, FACC, FAHA, FSCAI (Chair)

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CLINICAL DECISION MAKING

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SCAI clinical expert consensus statement on the classification of cardiogenic shock

This document was endorsed by the American College of Cardiology (ACC), the American Heart Association (AHA), the Society of Critical Care Medicine (SCCM), and the Society of Thoracic Surgeons (STS) in April 2019

David A. Baran MD, FSCAI (Co-Chair)¹ | Cindy L. Grines MD, FACC, FSCAI^{2*} | Steven Bailey MD, MSCAI, FACC, FACP³ | Daniel Burkhoff MD, PhD⁴ | Shelley A. Hall MD, FACC, FHFA, FAST⁵ | Timothy D. Henry MD, MSCAI⁶ | Steven M. Hollenberg MD^{7†} | Navin K. Kapur MD, FSCAI⁸ | William O'Neill MD, MSCAI⁹ | Joseph P. Ornato MD, FACP, FACC, FACEP¹⁰ | Kelly Stelling RN¹ | Holger Thiele MD, FESC¹¹ | Sean van Diepen MD, MSc, FAHA^{12†} | Srihari S. Naidu MD, FACC, FAHA, FSCAI (Chair)¹³

¹Sentara Heart Hospital, Division of Cardiology, Advanced Heart Failure Center and Eastern Virginia Medical School, Norfolk, Virginia
²Department of Cardiology, Zucker School of Medicine at Hofstra/Northwell, North Shore University Hospital, Manhasset, New York
³Department of Internal Medicine, LSU Health School of Medicine, Shreveport, Louisiana
⁴Cardiovascular Research Foundation, New York City, New York
⁵Taylor University Medical Center, Dallas, Texas
⁶Lindner Research Center at the Christ Hospital, Cincinnati, Ohio
⁷Cooper University Hospital, Camden, New Jersey
⁸The Cardiovascular Center, Tufts Medical Center, Boston, Massachusetts
⁹Honory Ford Health System, Detroit, Michigan
¹⁰Virginia Commonwealth University Health System, Richmond, Virginia
¹¹Heart Center Leipzig at University of Leipzig, Department of Internal Medicine/Cardiology, Leipzig, Germany

*ACC Representative.
†AHA Representative.
‡SCCM Representative.

Abstract
Background: The outcome of cardiogenic shock complicating myocardial infarction has not appreciably changed in the last 30 years despite the development of various percutaneous mechanical circulatory support options. It is clear that there are varying degrees of cardiogenic shock but there is no robust classification scheme to categorize this disease state.
Methods: A multidisciplinary group of experts convened by the Society for Cardiovascular Angiography and Interventions was assembled to derive a proposed classification schema for cardiogenic shock. Representatives from cardiology (interventional, advanced heart failure, noninvasive), emergency medicine, critical care, and cardiac nursing all collaborated to develop the proposed schema.
Results: A system describing stages of cardiogenic shock from A to E was developed. Stage A is "at risk" for cardiogenic shock, stage B is "beginning" shock, stage C is "classic" cardiogenic shock, stage D is "deteriorating", and E is "extremis". The difference between stages B and C is the presence of hypoperfusion which is present in stages C and higher. Stage D implies that the initial set of interventions chosen have not restored stability and adequate perfusion despite at least 30 minutes of

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Key Considerations in the Diagnosis & Management of Cardiogenic Shock



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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 mmg Hg



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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



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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



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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)



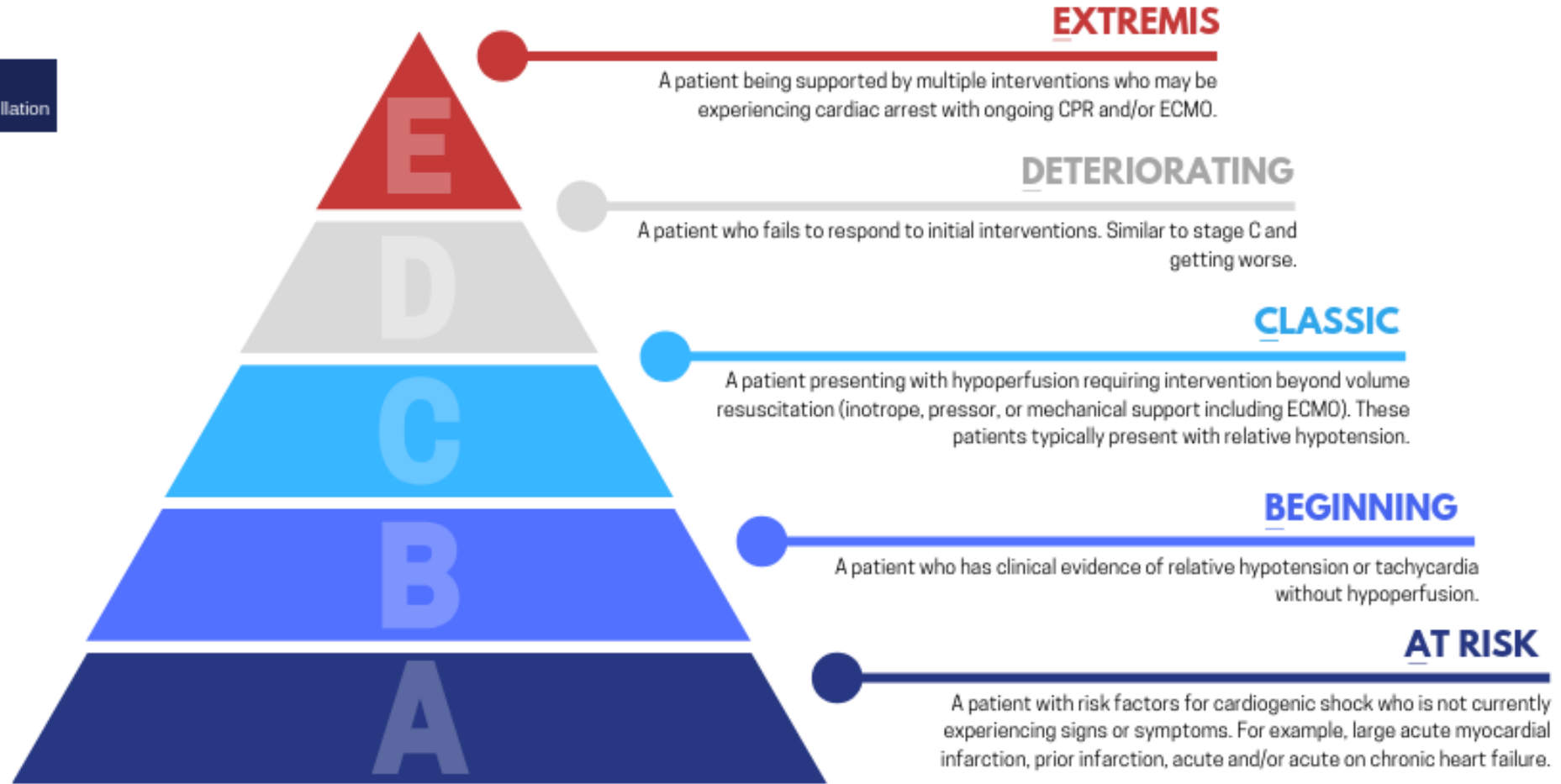
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SCAI Stages of Cardiogenic Shock

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

Arrest (A) Modifier:
CPR, including defibrillation



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For more information, please visit: www.scai.org/shockdefinition

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.

Physical Exam	Biochem Markers	Hemodynamics
Normal JVP	Normal Labs	Normotensive
Clear Lungs	Normal renal function	SBP \geq 100 or normal for pt
Warm/ Well Perfused	Normal lactic acid	If hemodynamics done
Strong distal pulses		CI \geq 2.5
Normal mentation		CVP < 10
		PA Sat \geq 65%



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Stage B: Beginning

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

Physical Exam	Biochem Markers	Hemodynamics
Elevated JVP	Normal lactate	SBP <90 OR MAP <60 or >30 mm drop from baseline
Rales in Lung fields	Normal renal function	Pulse \geq 100
Warm/ Well Perfused	Elevated BNP	If hemodynamics done
Strong distal pulses		CI \geq 2.2
Normal mentation		PA Sat \geq 65



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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.

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



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Stage D: Deteriorating

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

Physical Exam May Include any of:	Biochem Markers: May Include any of	Hemodynamics: May Include any of
Looks unwell, panicked	Lactate ≥ 2	SBP < 90 or MAP < 60 or > 30 mm drop from baseline AND drugs/ device used to maintain BP above these
Ashen, mottled, dusky	Creatinine doubling or > 50 % loss of GFR	Hemodynamics CI < 2.2
Volume overload Extensive rales Killip 3 /4	Increased LFT's	PCW > 15
BiPAP or mechanical vent	Increased BNP	RAP / CVP ≥ 0.8
Cold, clammy Urine output < 30 mL/h	DETERIORATING	PAPI < 1.85 CPO ≤ 0.6
Acute alteration of mental status		Requiring multiple pressors OR addition of MCS to maintain perfusion



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Stage E: Extremis

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

Physical Exam May Include any of:	Biochem Markers: May Include any of	Hemodynamics: May Include any of
“Trying to die”	Lactate ≥ 5	No blood pressure without CPR
Cardiac collapse	Arterial pH ≤ 7.2	PEA or refractory VT/VF
Mechanical Vent	Increased LFT's	Hypotension despite max support
BiPAP or mechanical vent	Increased BNP	
Defibrillated	No time to draw	



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SCAI SHOCK STAGE	PHYSICAL EXAM	BIOCHEMICAL MARKERS	HEMODYNAMICS
A	Normal JVP Lung sounds clear Strong distal pulses Normal mentation	Normal renal function Normal lactic acid	Normotensive (SBP \geq 100 or normal for pt.) If hemodynamics done: <ul style="list-style-type: none"> ▪ Cardiac index \geq2.5 ▪ CVP $<$10 ▪ PA Sat \geq65%
B	Elevated JVP Rales in lung fields Strong distal pulses Normal mentation	Normal lactate Minimal renal function impairment Elevated BNP	SBP $<$ 90 OR MAP $<$ 60 OR $>$ 30mmHg drop Pulse \geq 100 If hemodynamics done: <ul style="list-style-type: none"> ▪ Cardiac Index \geq2.2 ▪ PA Sat \geq65%
C	Ashen, mottled, dusky Volume overload Extensive Rales Killip class 3 or 4 BiPap or mechanical ventilation Acute alteration in mental status	Lactate \geq 2 Creatinine doubling OR $>$ 50% drop in GFR Increased LFTs Elevated BNP Urine Output $<$ 30mL/h	Drugs/device used to maintain BP above stage B values. <ul style="list-style-type: none"> ▪ Cardiac Index $<$2.2 ▪ PCWP $>$15 ▪ RAP/PCWP \geq0.8 ▪ PAPI $<$1.85 ▪ Cardiac Power Output \leq0.6
D	Any of stage C	Any of stage C AND deteriorating	Any of stage C AND Requiring multiple pressors OR addition of mechanical circulatory support devices to maintain perfusion
E	Near pulselessness Cardiac collapse Mechanical ventilation Defibrillator used	Lactate \geq 5 pH \leq 7.2	No SBP without resuscitation PEA or Refractory VT/VF Hypotension despite maximal support



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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)**



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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”



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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



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- 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”



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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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**ANSWER: Stage D(A) “Deteriorating”
with arrest modifier**



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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



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