Defining Cardiogenic Shock

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Cardiogenic Shock Working Group (CSWG)

The mission of the CSWG is to improve clinical outcomes for cardiogenic shock by promoting rigorous scientific investigation inclusive of a prospective multicenter registry to generate real-world evidence for this deadly problem

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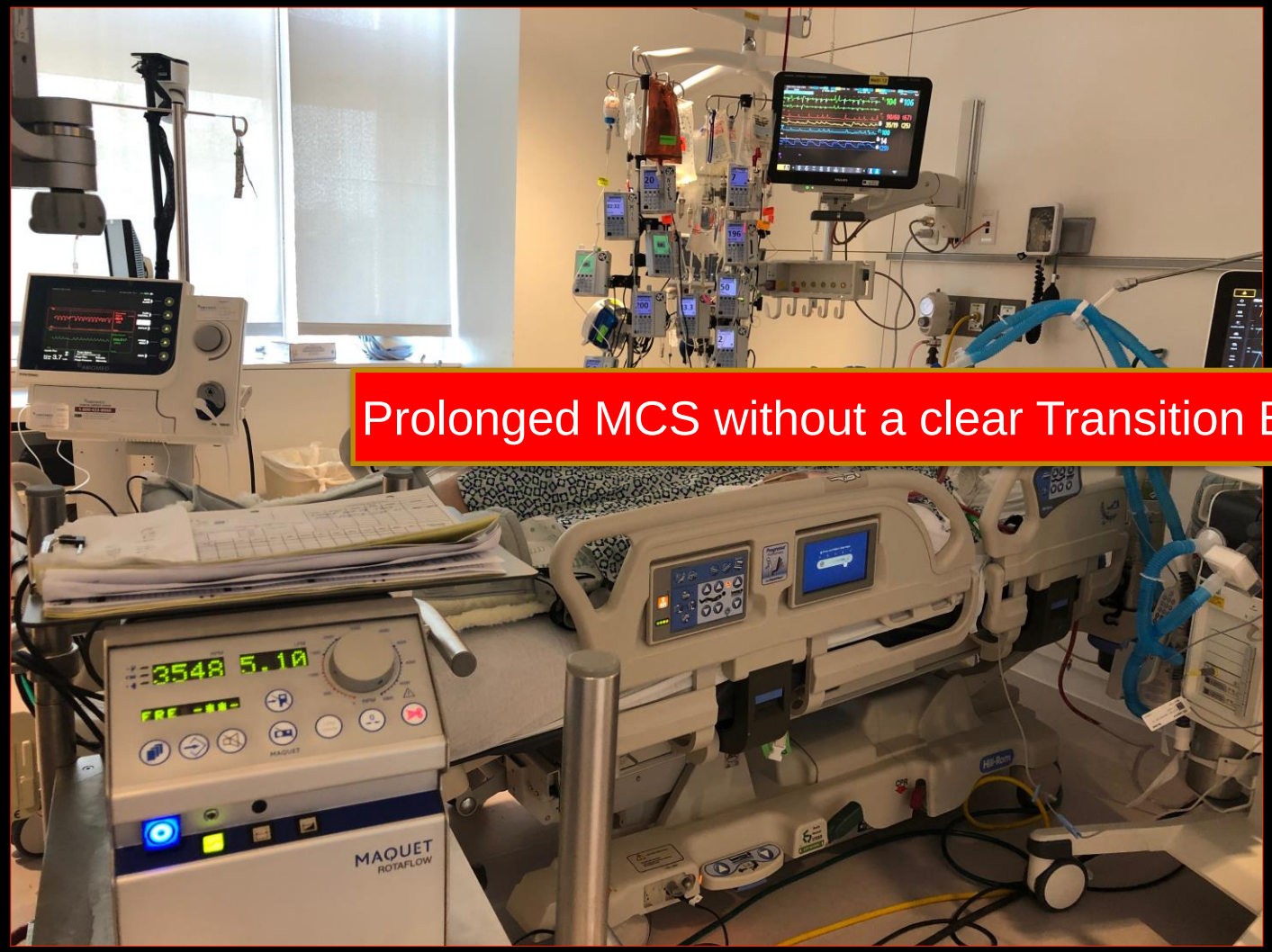
Cardiogenic Shock

>50% in-hospital **Mortality** rate


MAQUET
ROTAFLOW



Prolonged MCS without a clear Transition Bridge

Guided approach:

- Early Recognition
- Assess shock severity
- LV/ RV or both
- Timely management

Multi-disciplinary care

Exit strategy

- Recovery
- Replacement
- Palliation

Key Considerations in the Diagnosis & Management of Cardiogenic Shock

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Defining Cardiogenic Shock

- A Cardiac disorder presenting with:
  - SBP <90mm Hg
  - CI <1.8 L/min/m2 without hemodynamic support
  - CI <2.2 L/min/m2 with hemodynamic support
  - PCWP >15

Clinical Definition	SHOCK Trial[9]*	IABP-SHOCK II[1]†	ESC HF Guidelines[15]
Cardiac disorder that results in both clinical and biochemical evidence of tissue hypoperfusion	Clinical criteria: SBP <90 mm Hg for ≥30 min OR Support to maintain SBP ≥90 mm Hg AND End-organ hypoperfusion (urine output <30 mL/h or cool extremities) Hemodynamic criteria: CI of ≤2.2 L·min^{-1}·m^{-2} AND PCWP ≥15 mm Hg	Clinical criteria: SBP <90 mm Hg for ≥30 min OR Catecholamines to maintain SBP >90 mm Hg AND Clinical pulmonary congestion AND Impaired end-organ perfusion (altered mental status, cold/clammy skin and extremities, urine output <30 mL/h, or lactate >2.0 mmol/L)	SBP <90 mm Hg with adequate volume and clinical or laboratory signs of hypoperfusion Clinical hypoperfusion: Cold extremities, oliguria, mental confusion, dizziness, narrow pulse pressure Laboratory hypoperfusion: Metabolic acidosis, elevated serum lactate, elevated serum creatinine

Early identification

Step 1: Suspect shock

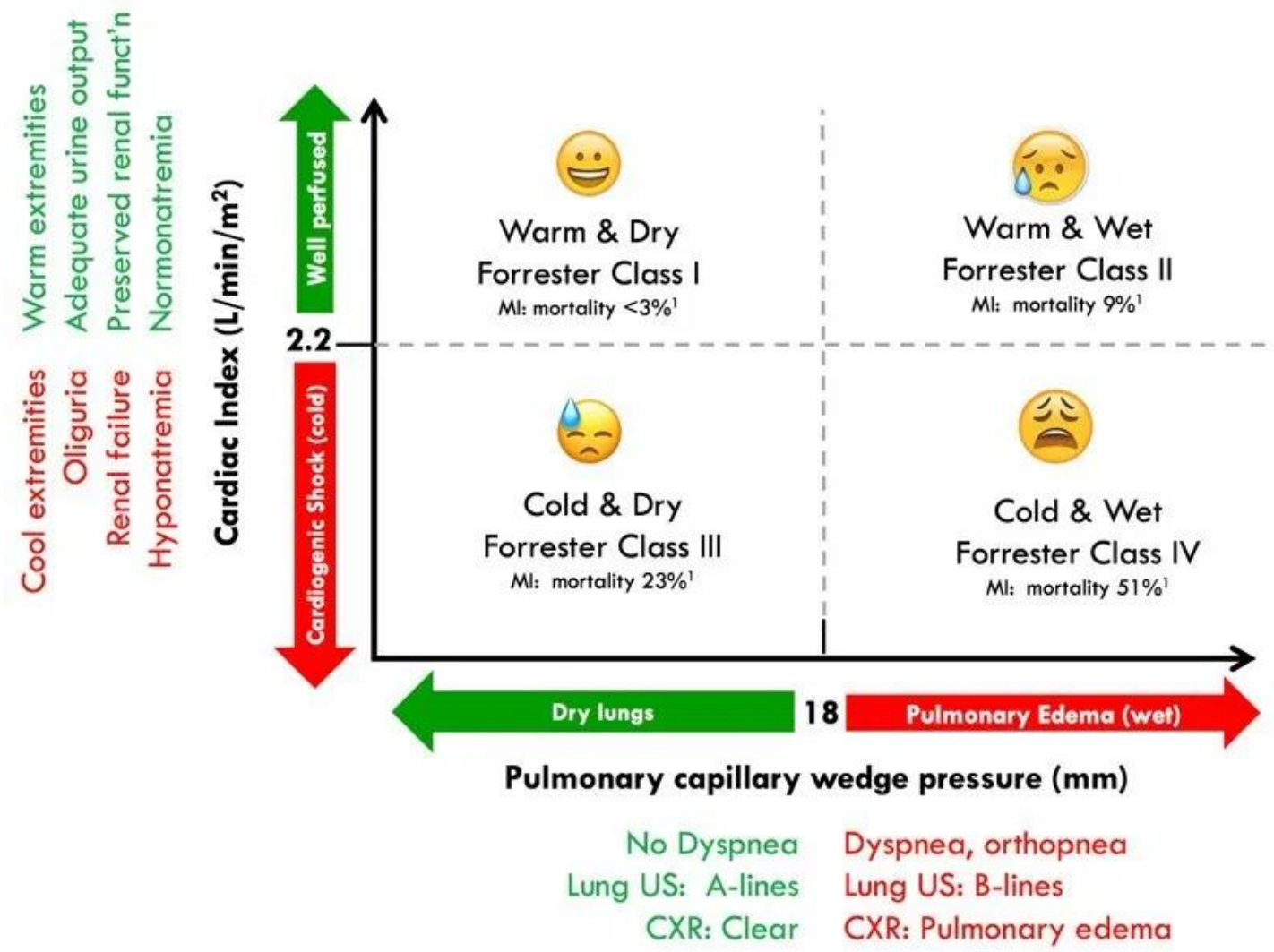
- SBP < 90 mm Hg for > 30 mins
- need for inotrope/ pressor/ IABP to maintain SBP > 90 mm Hg
- decrease in UO to < 0.5 cc/kg/h
- lactic acid > 2 mmol/L

Step 2: Confirm Cardiogenic shock

- Check ECG, Troponin, TTE, rhythm
- Swan/ PAC
- CI < 2.2 and PCWP > 15 mm Hg
- Check SVR and CVP

	CAUSED BY	SKIN	PCWP (PRELOAD)	CO	SVR (AFTERLOAD)
Hypovolemic	Hemorrhage, dehydration, burns	Cold, clammy	↓↓	↓	↑
Cardiogenic	Acute MI, HF, valvular dysfunction, arrhythmia	Cold, clammy	↑ or ↓	↓↓	↑
Obstructive	Cardiac tamponade, pulmonary embolism, tension pneumothorax				
Distributive	Sepsis, anaphylaxis	Warm	↓	↑	↓↓
	CNS injury	Dry	↓	↓	↓↓

Step 3: Patient Assessment in Cardiogenic shock



(1) Mortality numbers from Forrester 1976 PMID 790191. Mortality is probably lower today.

The Internet Book of Critical Care, by @PulmCrit

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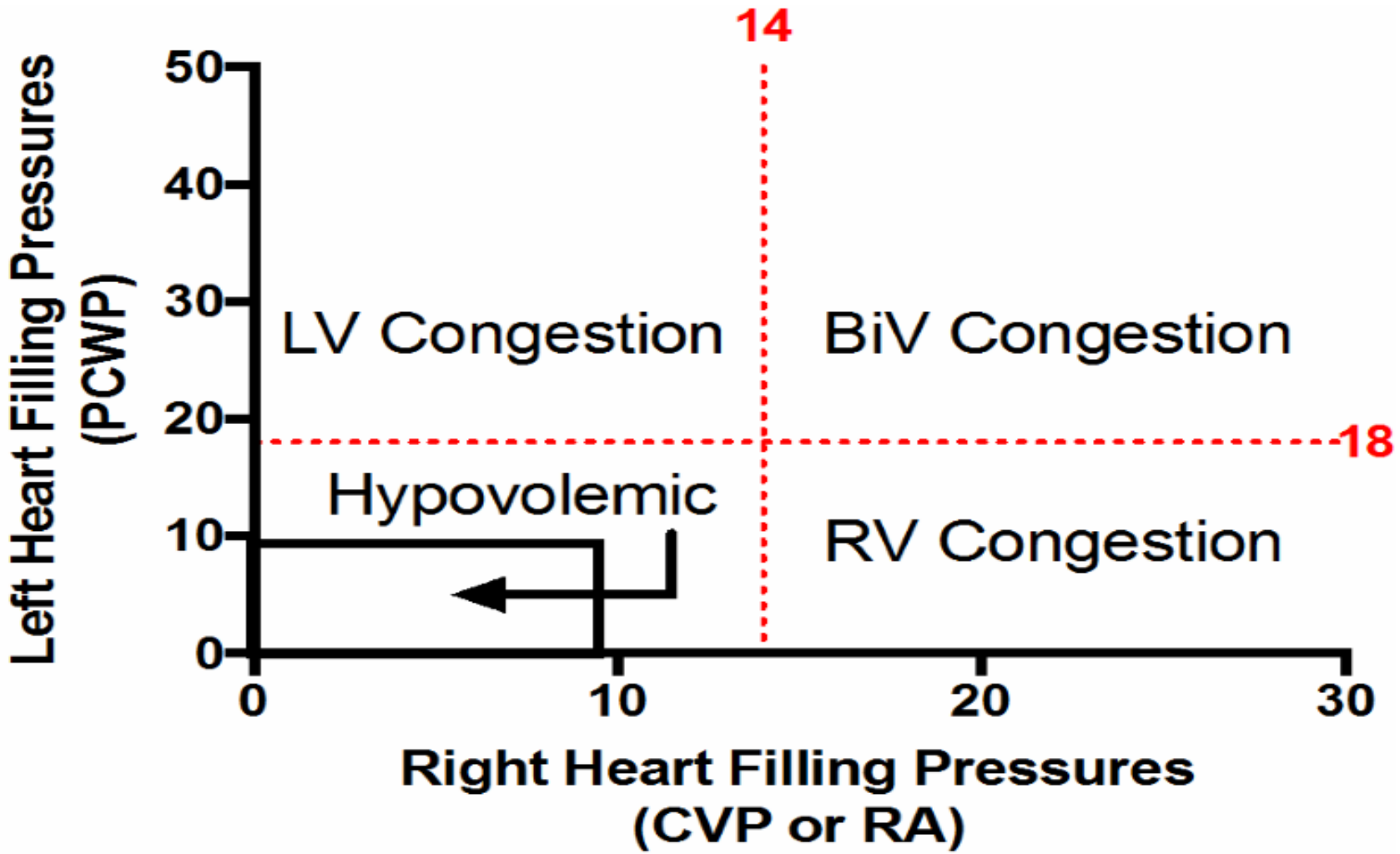
Hemodynamic Profiles in Cardiogenic shock



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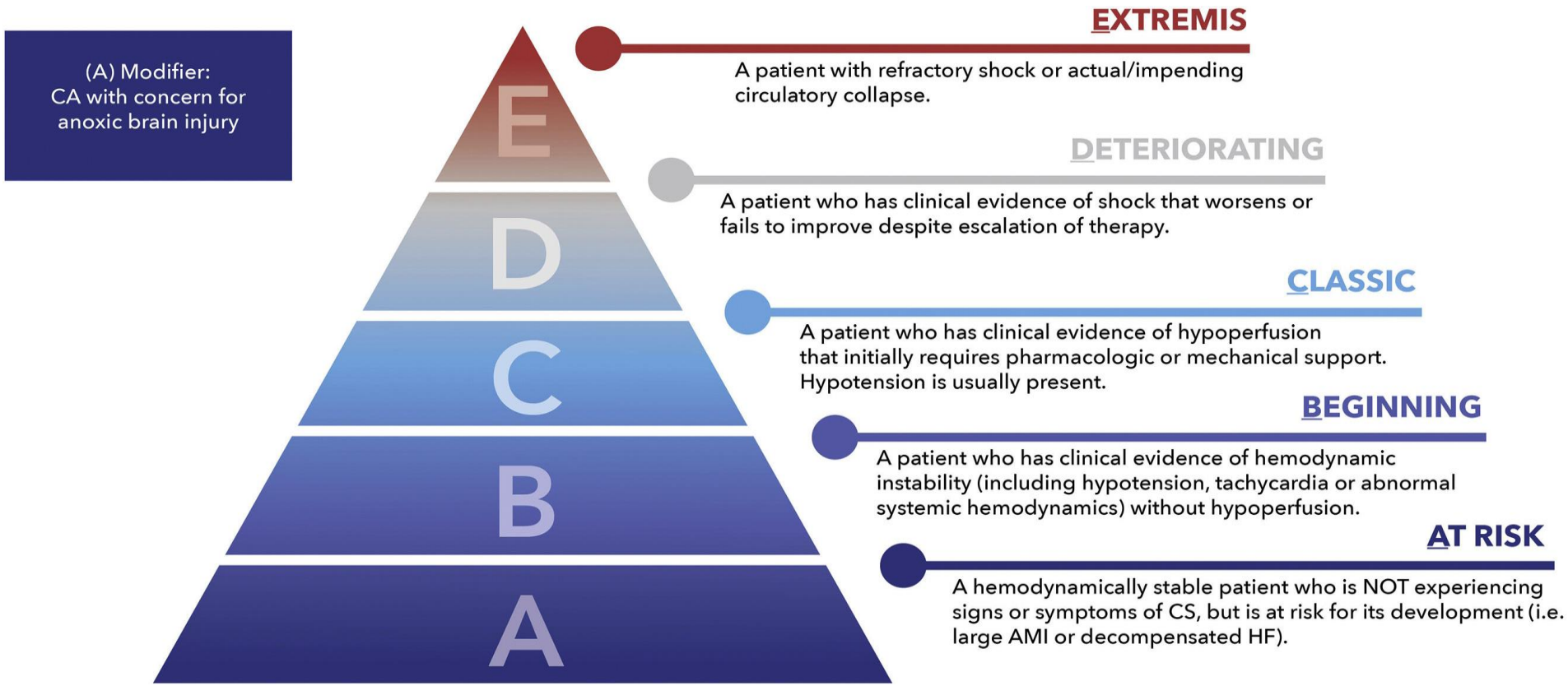

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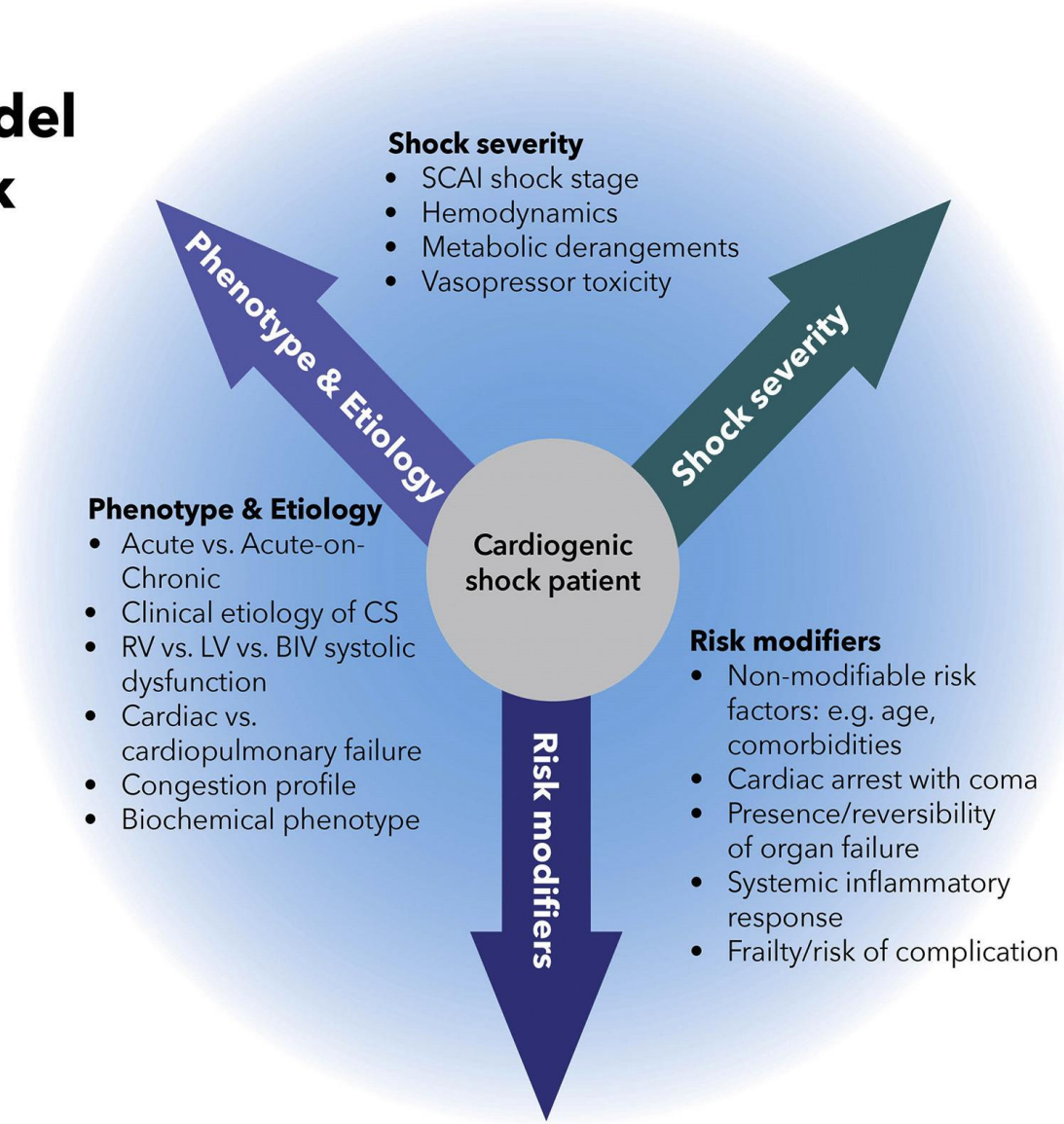
Journal of the Society for Cardiovascular Angiography & Interventions 2022 1DOI: (10.1016/j.jscai.2021.100008)

Proposed 3-axis model of cardiogenic shock evaluation and prognostication



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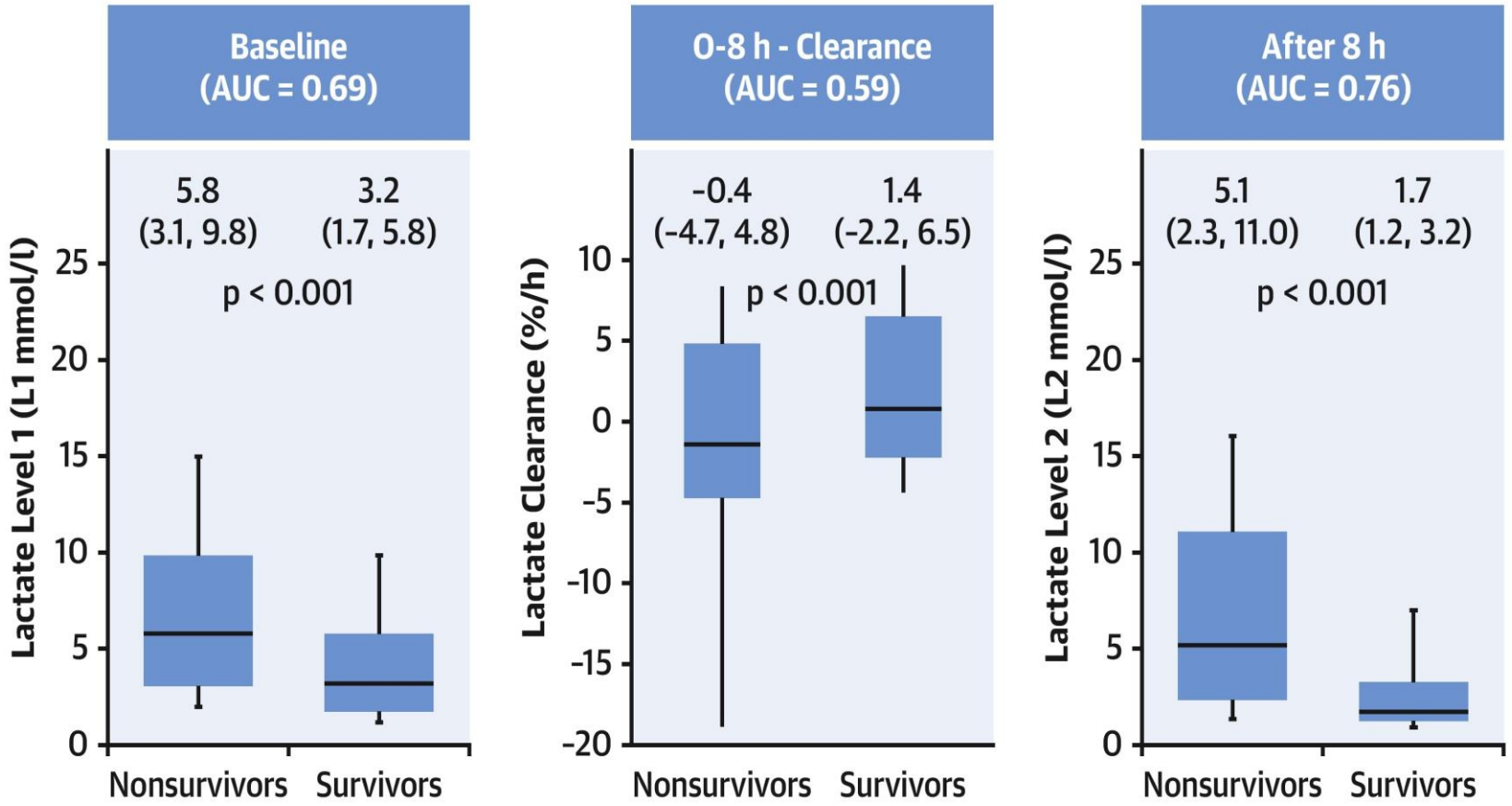
CENTRAL ILLUSTRATION: Arterial Lactate in Cardiogenic Shock



Fuernau, G. et al. J Am Coll Cardiol Intv. 2020;13(19):2208-16.

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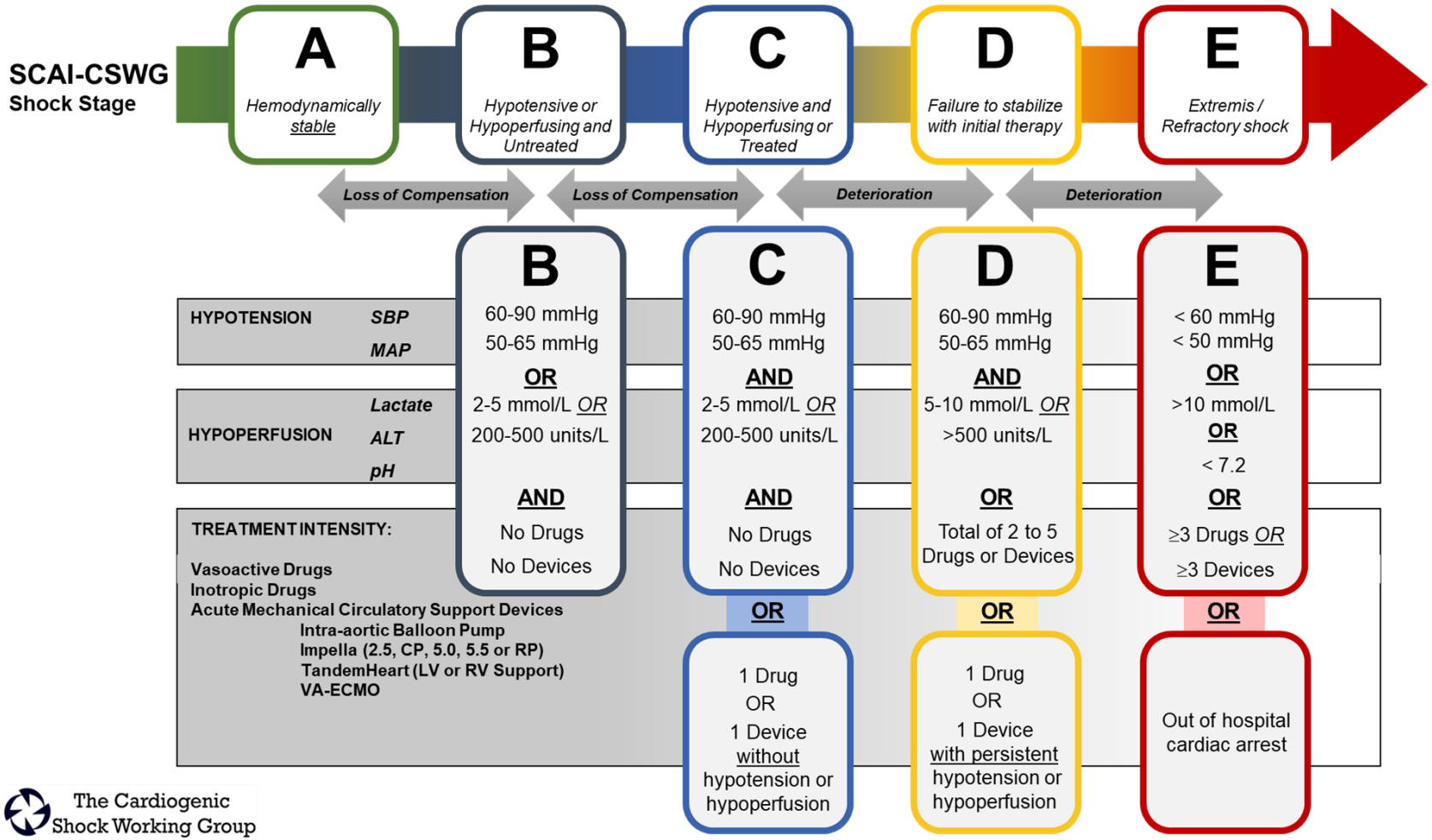
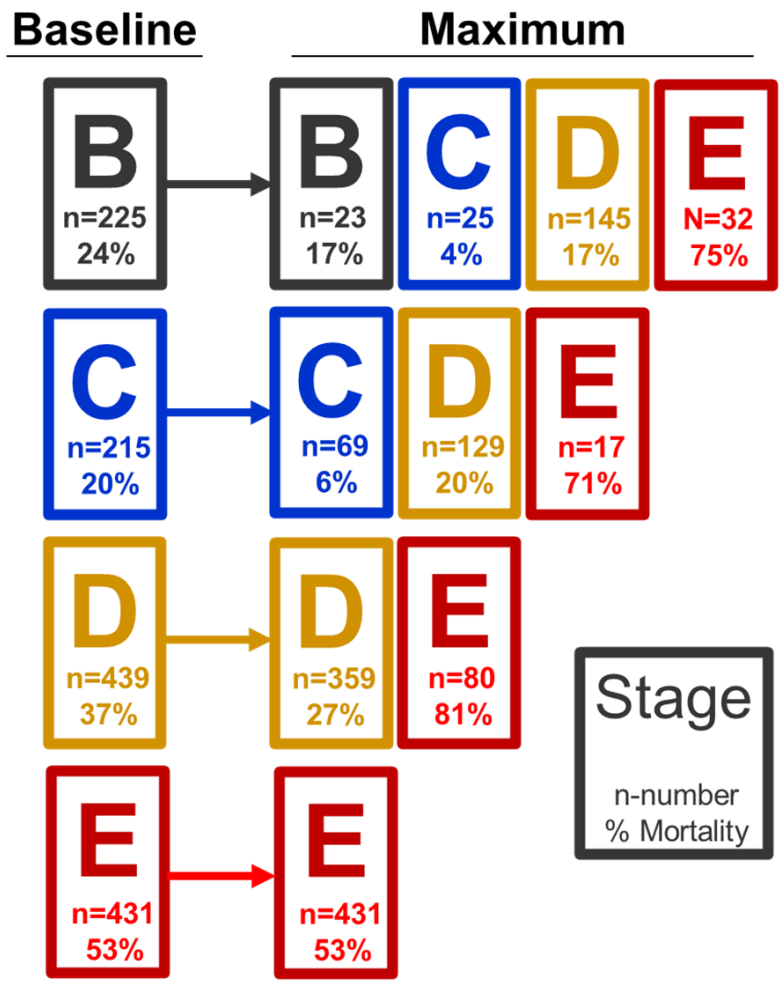
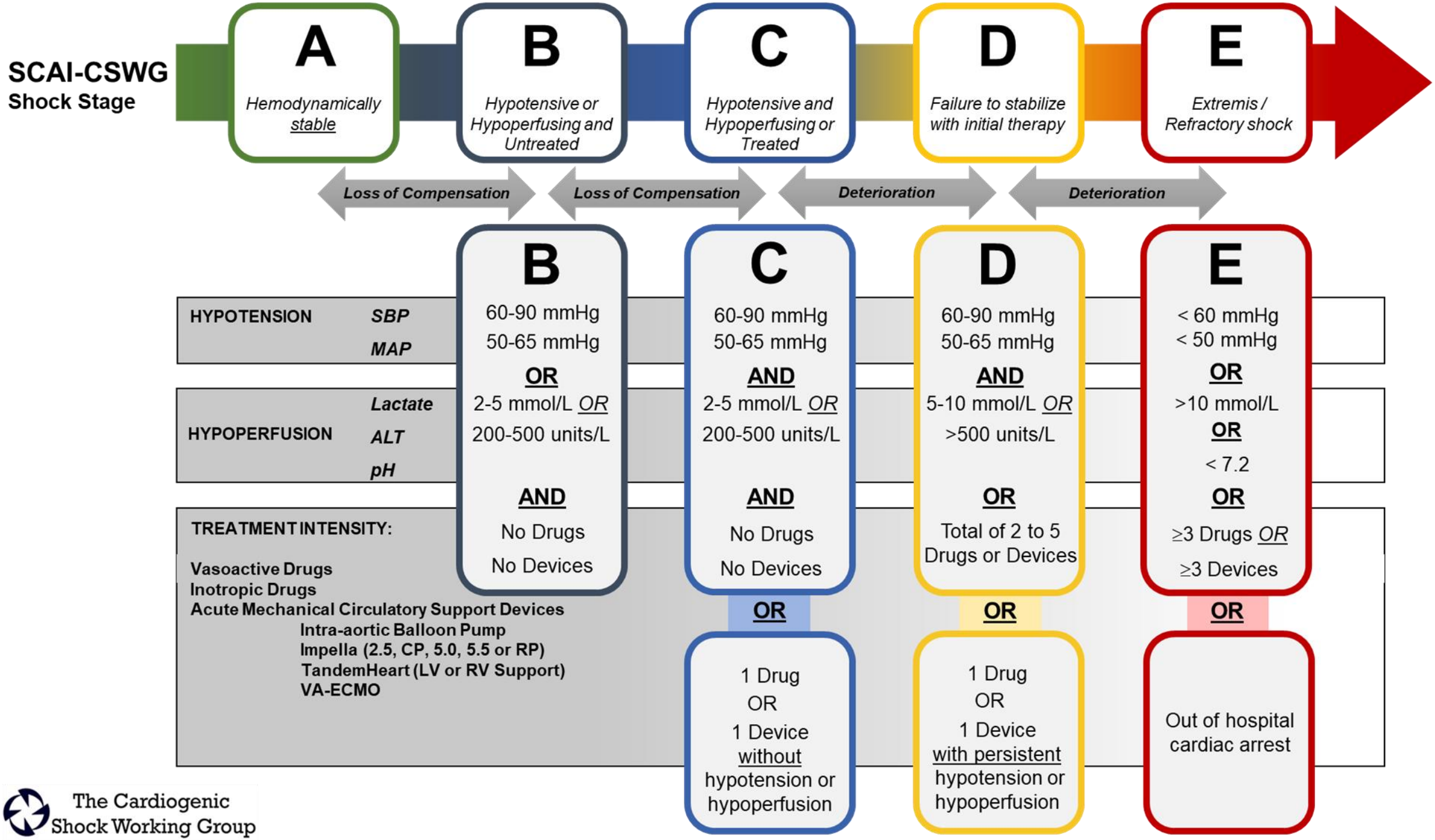




Kapur, Kanwar, Burkhoff et al JACC 2022 July 80(3) 185-198


SCAI-CSWG
Shock Stage
A
Hemodynamically stable
B
Hypotensive or Hypoperfusing and Untreated
C
Hypotensive and Hypoperfusing or Treated
D
Failure to stabilize with initial therapy
E
Extremis / Refractory shock
Loss of Compensation
Loss of Compensation
Deterioration
Deterioration
HYPOTENSION
SBP
MAP
HYPOPERFUSION
Lactate
ALT
pH
TREATMENT INTENSITY:
Vasoactive Drugs
Inotropic Drugs
Acute Mechanical Circulatory Support Devices
Intra-aortic Balloon Pump
Impella (2.5, CP, 5.0, 5.5 or RP)
TandemHeart (LV or RV Support)
VA-ECMO
B
60-90 mmHg
50-65 mmHg
OR
2-5 mmol/L OR
200-500 units/L
AND
No Drugs
No Devices
C
60-90 mmHg
50-65 mmHg
AND
2-5 mmol/L OR
200-500 units/L
AND
No Drugs
No Devices
OR
1 Drug
OR
1 Device without hypotension or hypoperfusion
D
60-90 mmHg
50-65 mmHg
AND
5-10 mmol/L OR
>500 units/L
OR
Total of 2 to 5 Drugs or Devices
OR
1 Drug
OR
1 Device with persistent hypotension or hypoperfusion
E
< 60 mmHg
< 50 mmHg
OR
>10 mmol/L
OR
< 7.2
OR
≥3 Drugs OR
≥3 Devices
OR
Out of hospital cardiac arrest
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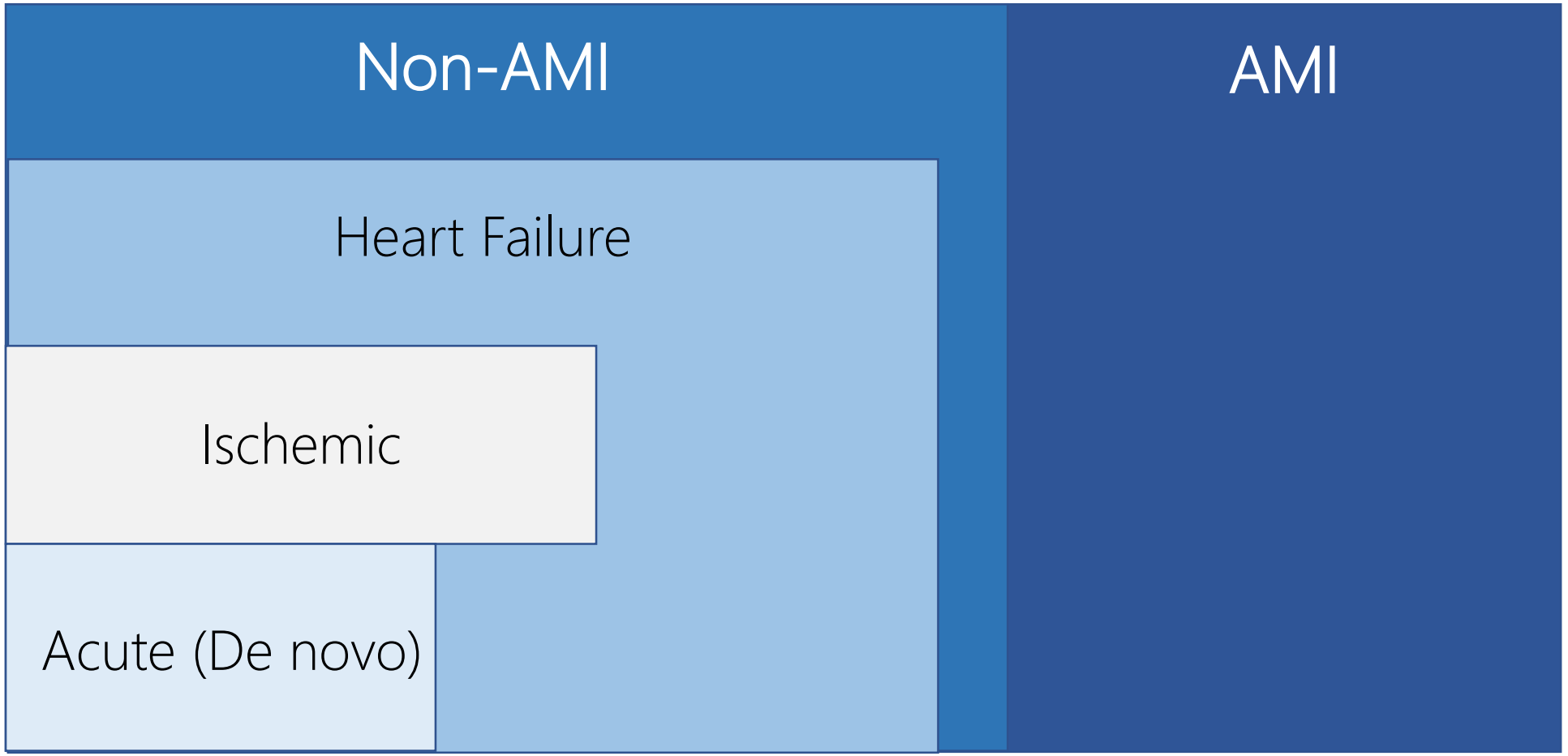
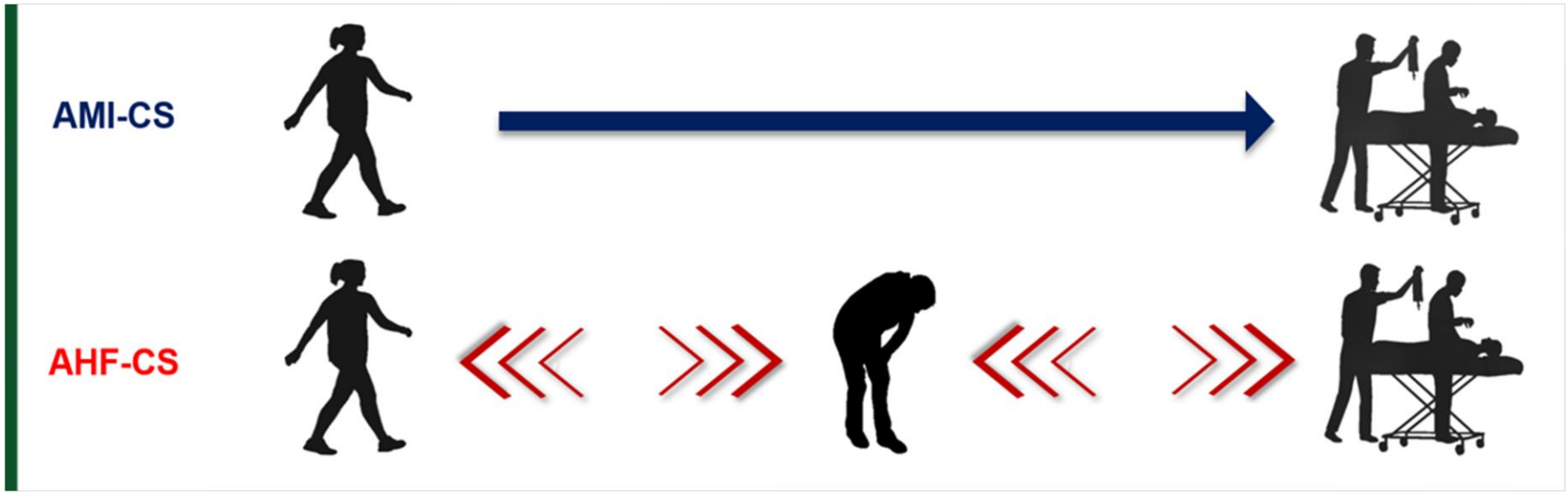
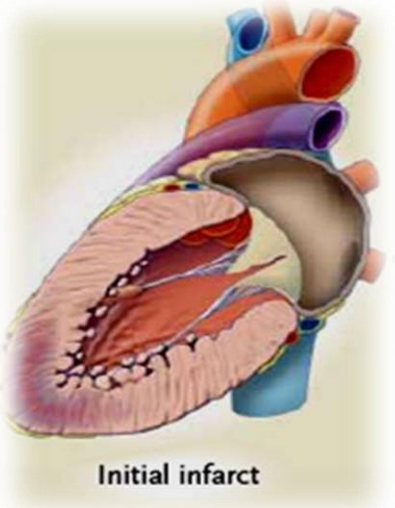
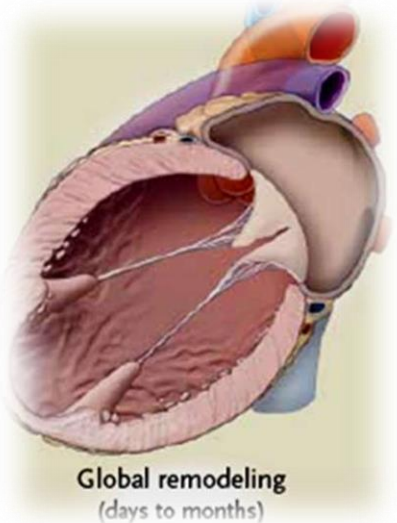
Phenotypes of Cardiogenic Shock



Not all shock is equal







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Abraham J, Blumer V et al. JCF 2021

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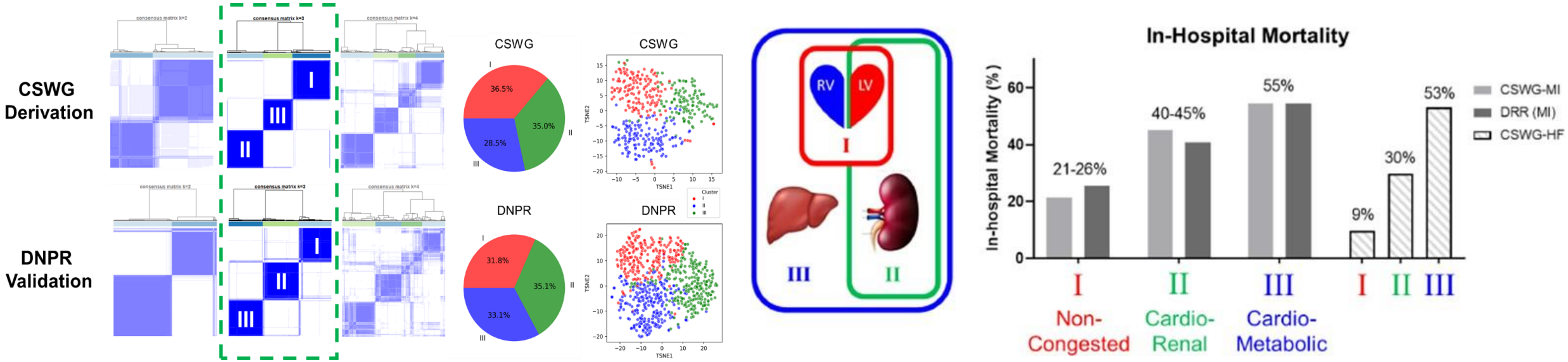
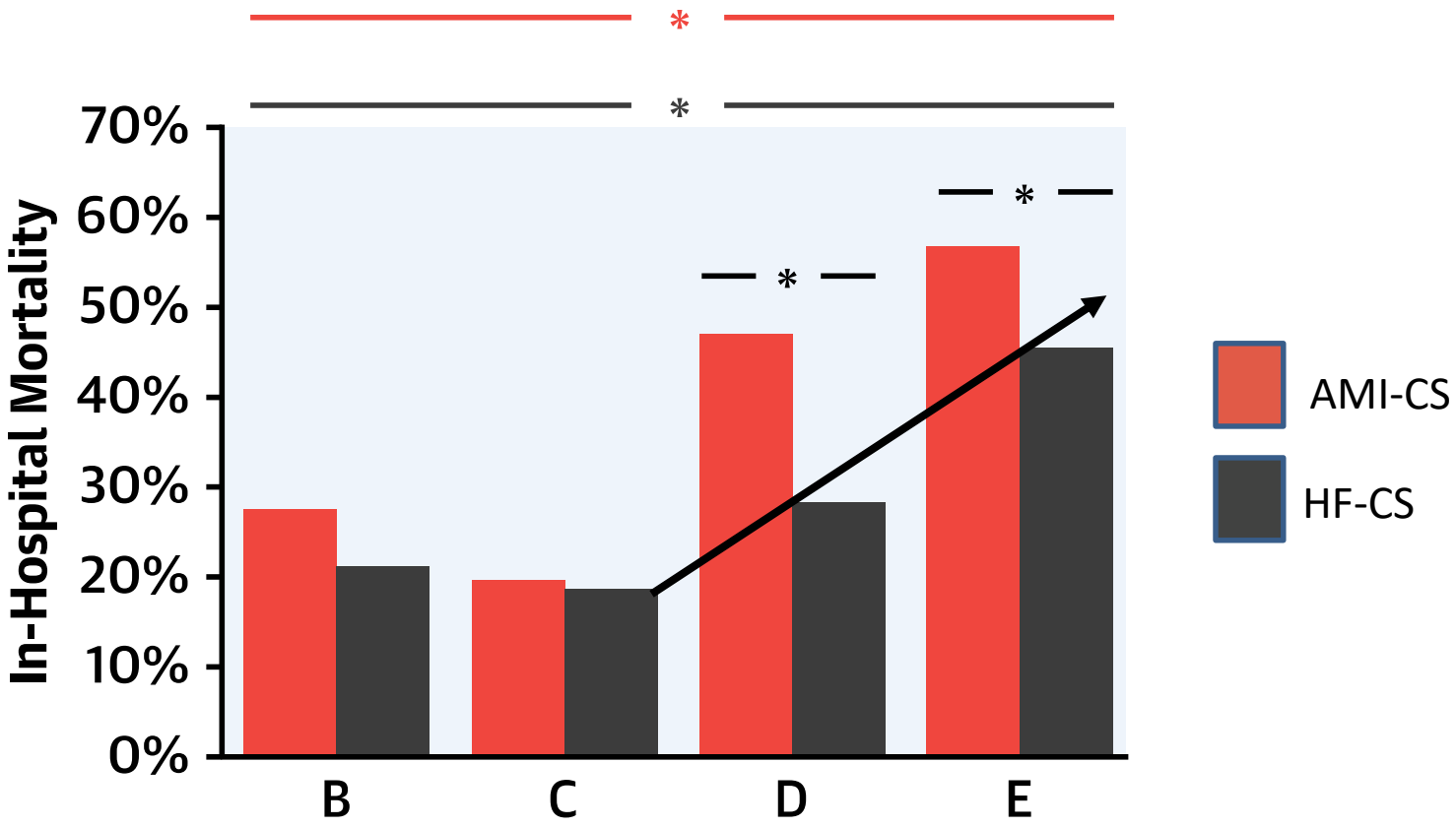
Machine learning algorithms identified 3 distinct phenotypes associated with increasing morality in the CSWG dataset, which were then validated in collaboration with a Danish Shock Registry



Zweck E, Kanwar M, Kapur N JAHA 2021

We must identify and treat CS in early stages



Kapur, Kanwar, et al for CSWG investigators, JACC 2022:185-198

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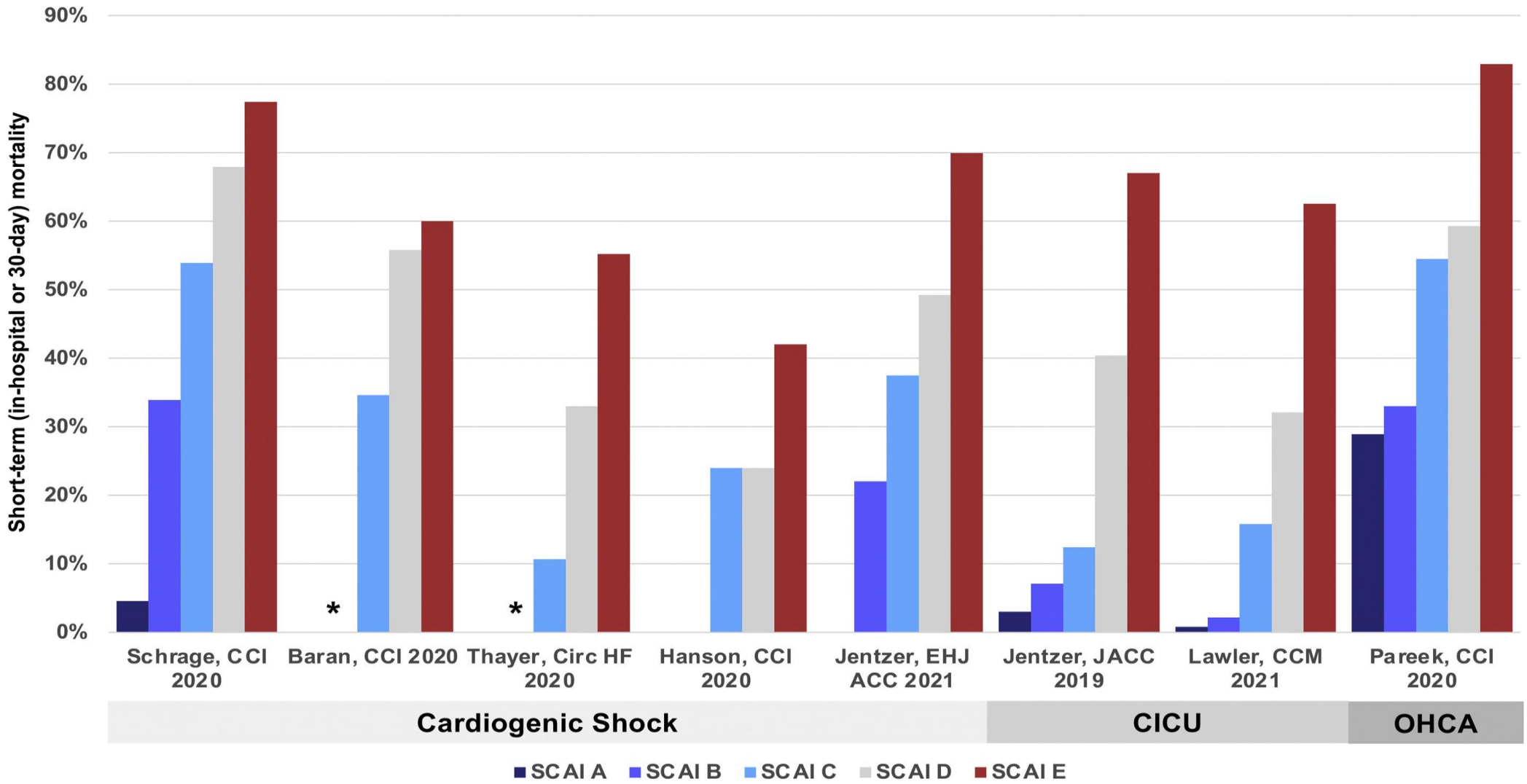

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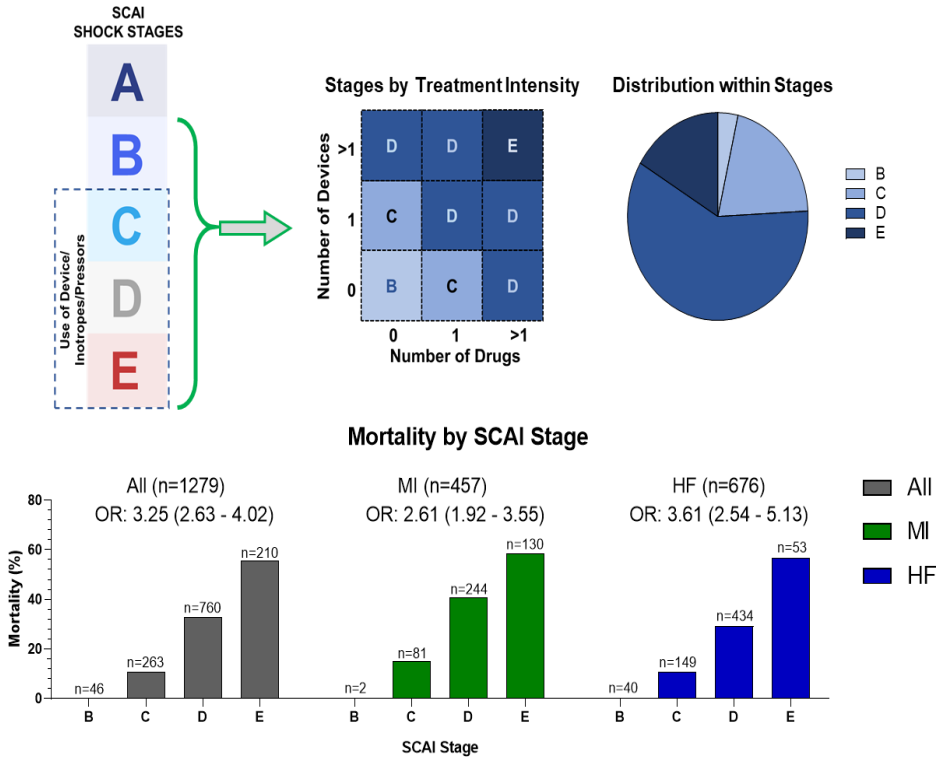
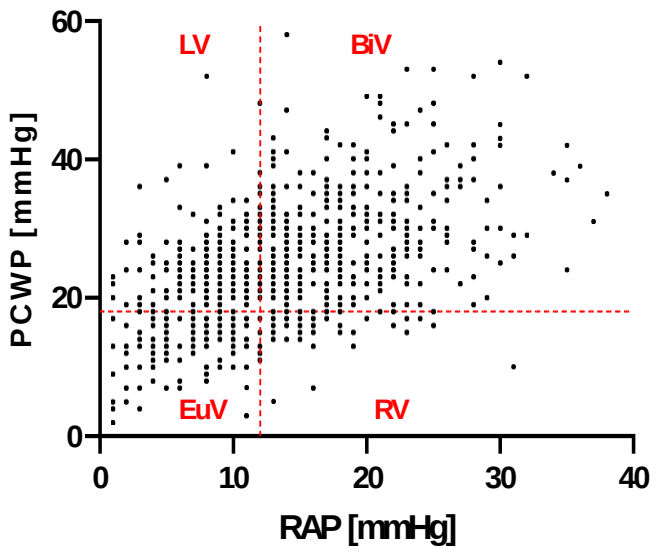
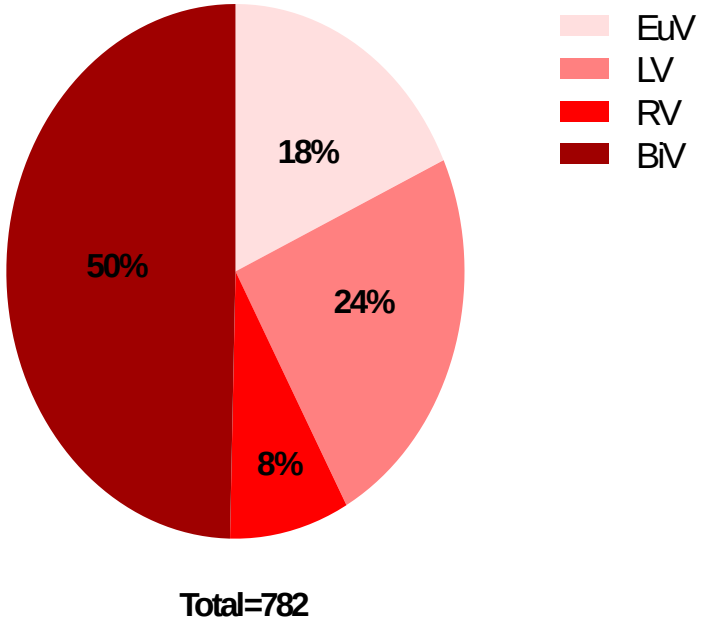
Biventricular congestion is commonly observed and associated with increased shock severity and higher in-hospital mortality. Congestion is an important target of therapy.







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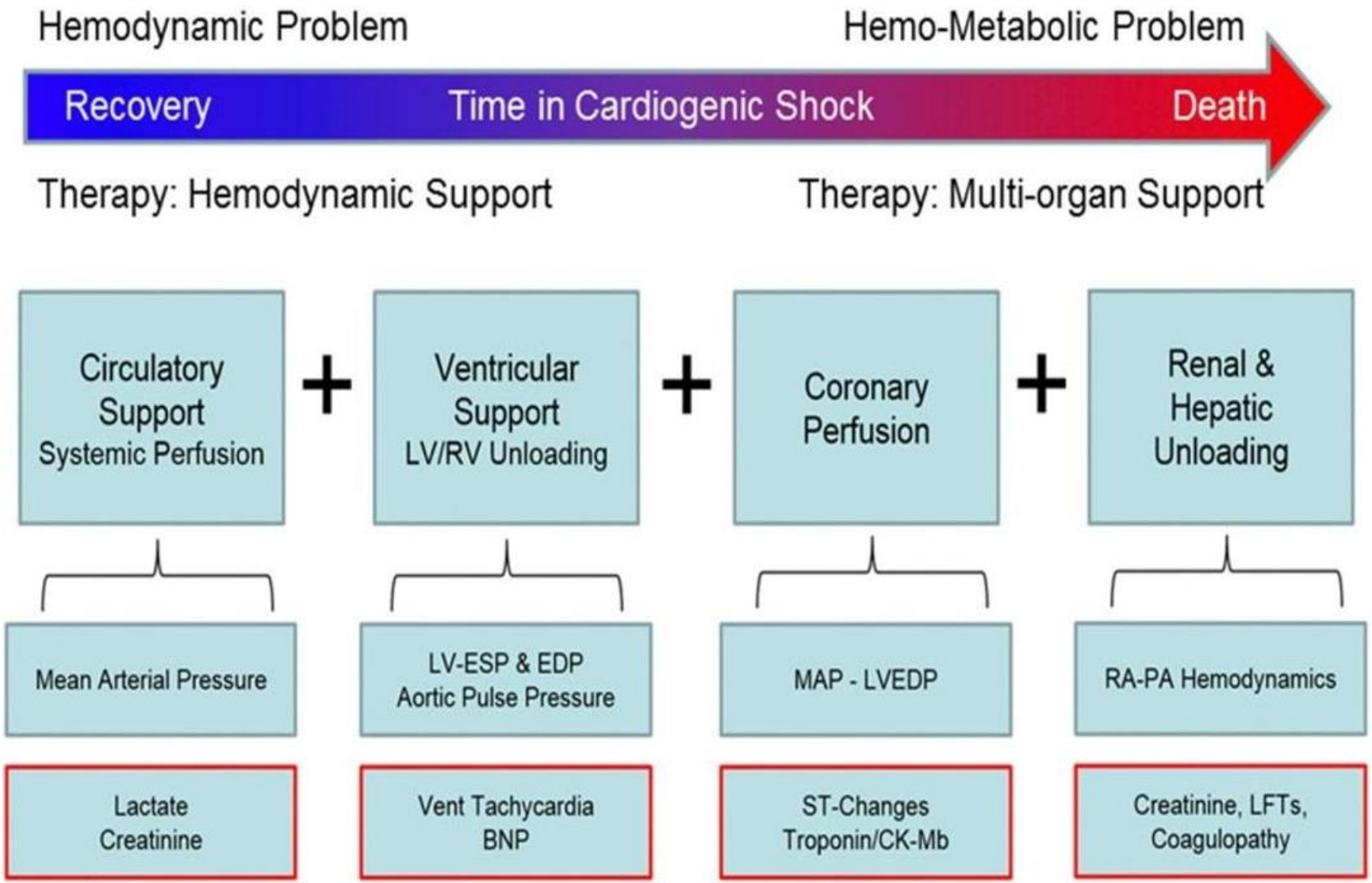
Thayer K, Kanwar M, Kapur N et al Circ HF 2020



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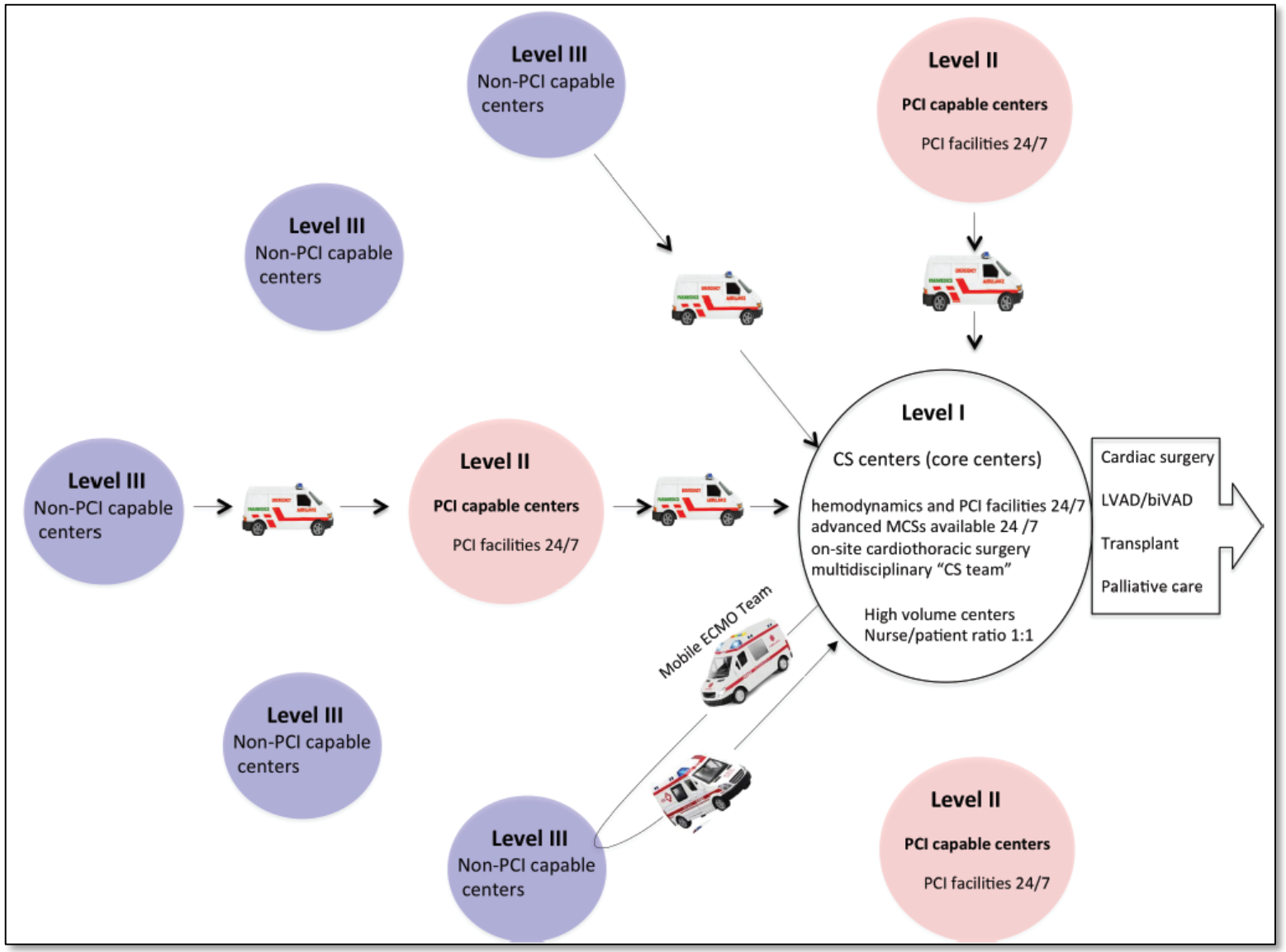

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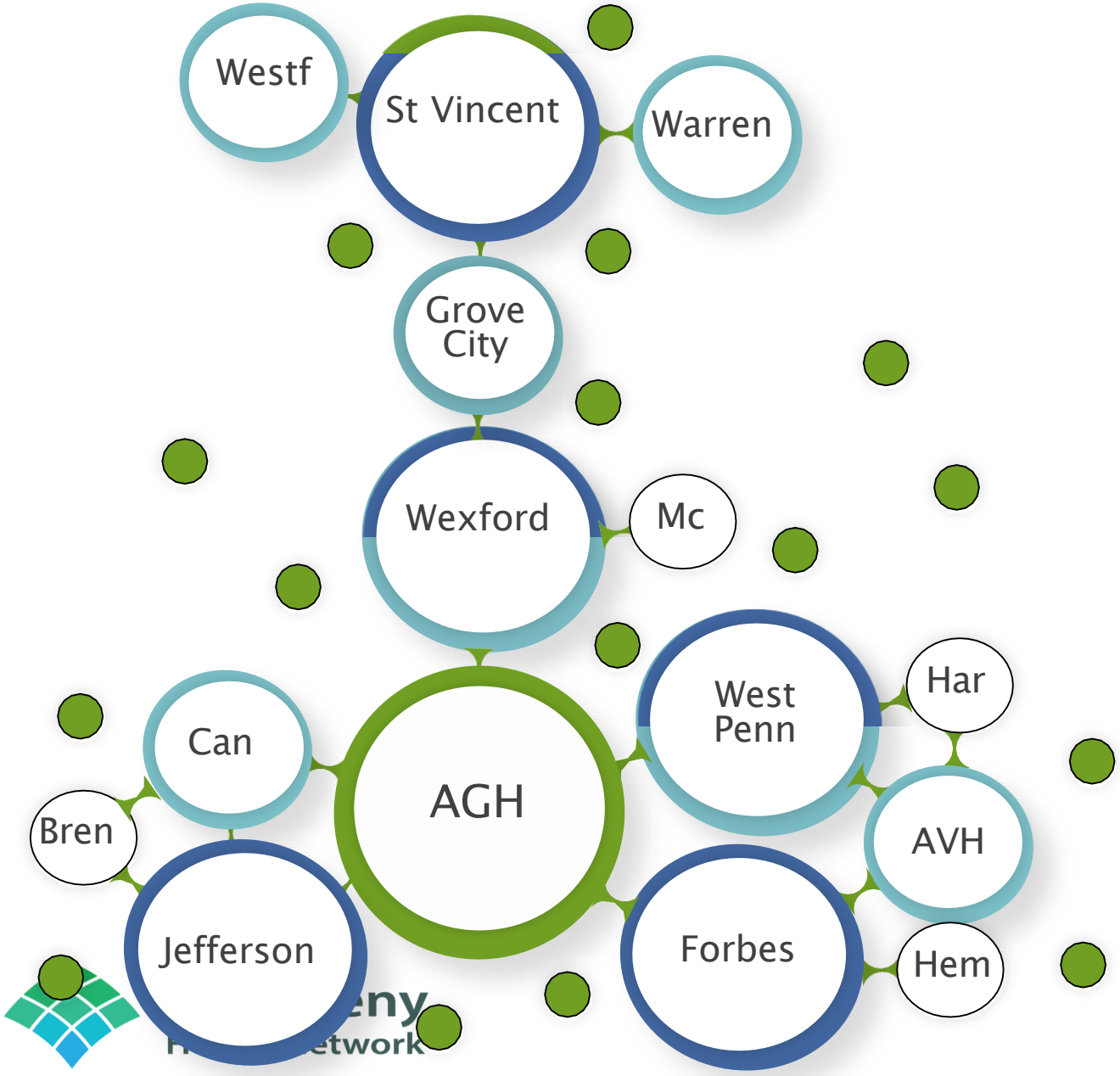
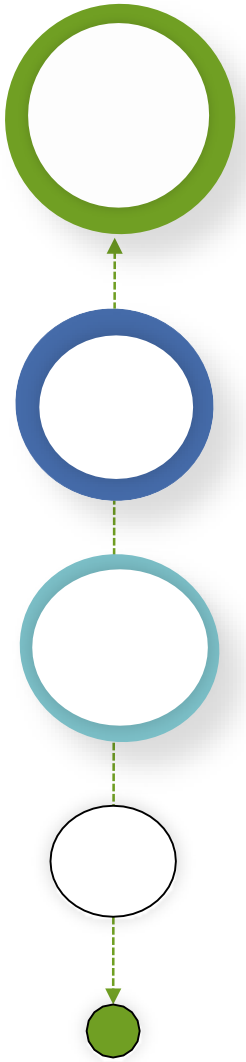
When to transfer a patient to a ‘hub’ hospital

- Escalating dose of 1st pressor / inotrope
- Adding a second pressor or inotrope
- Not improving / worsening on temporary MCS
- Lactate > 2 or rising

@AGH

- About 200 patients/ year in CS
- 60% are transferred in from OSH
- 55% are non AMI shock
- 60% supported on temporary MCS
- Top 3 t-MCS devices used: Impella, IABP and ECMO
- Survival to hospital discharge = 63% (increased from 53% in 2020)





Quaternary CV Hospital

- LVAD, Transplant

Intermediate CV Hospital

- Cath Lab, EP Lab, Advanced CV Imaging
- Disease Mgmt (AMI)
- Vascular, Thoracic Surgery
- Cardiac surgery (OH, TAVR)

Community Hospital

Neighborhood Hospital

Outpatient & Clinics

Thank you

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