

Non-AMI (ADHF-CS) Shock

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Allegheny General Hospital
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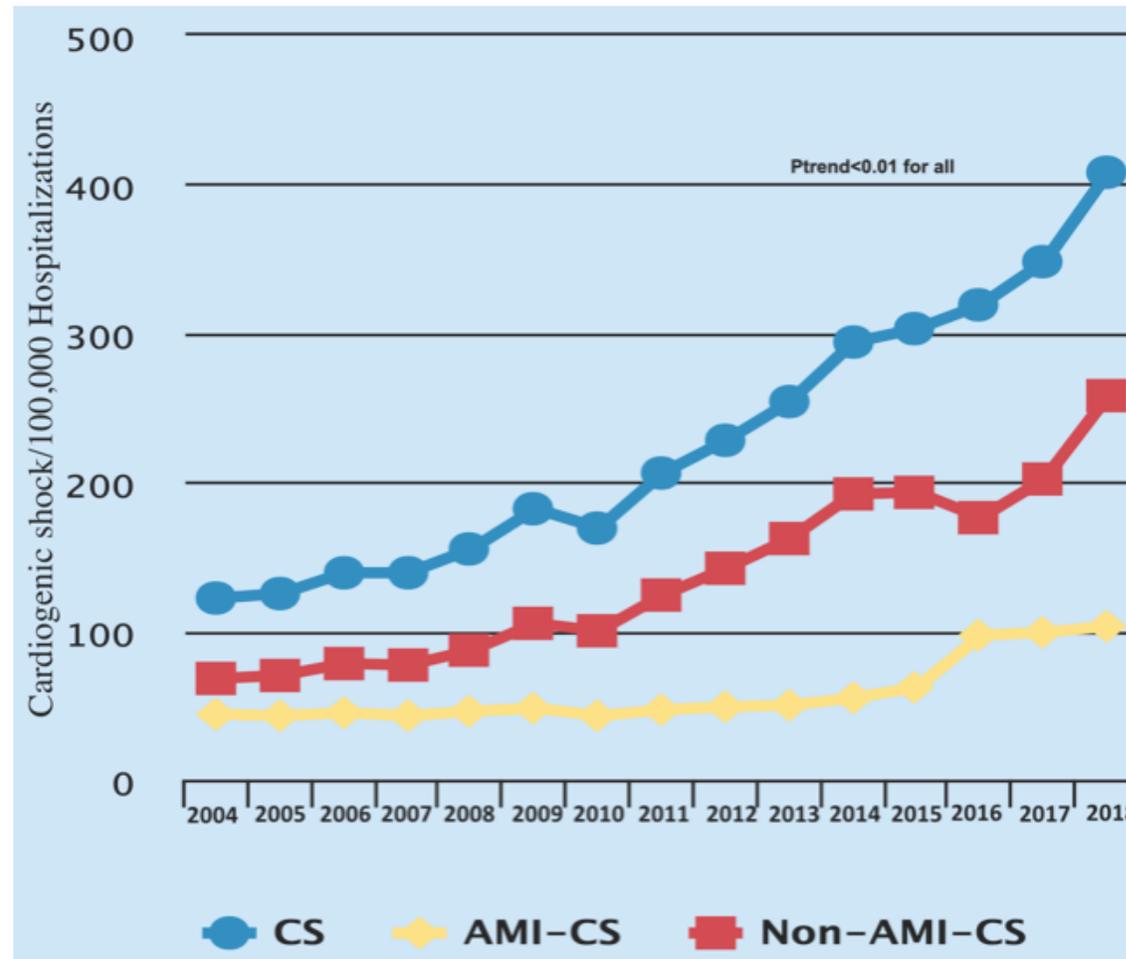
Objectives

1. Review the incidence and impact of non AMI cardiogenic shock (ADHF-CS)
2. Understand differences in new acute HF-shock and chronic HF-shock
3. Awareness of different treatment algorithms for non AMI shock

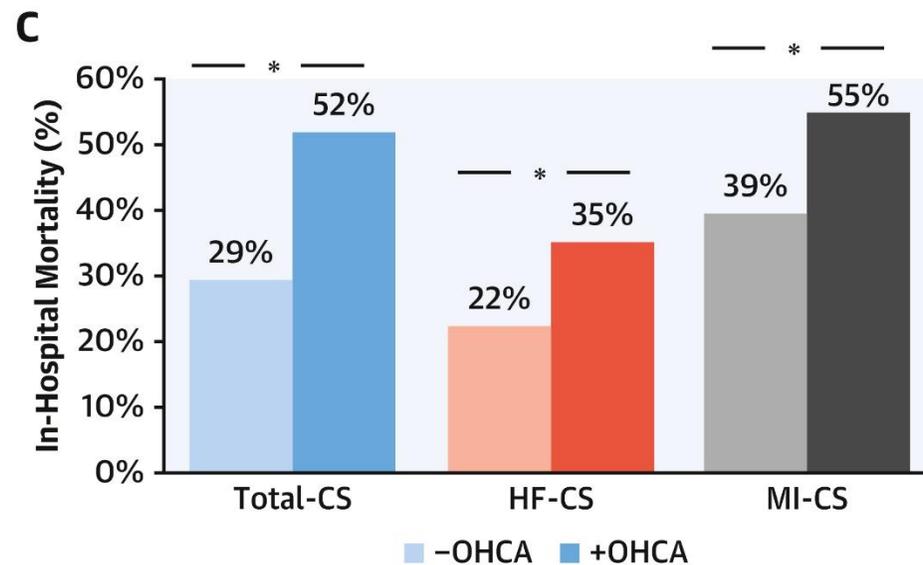
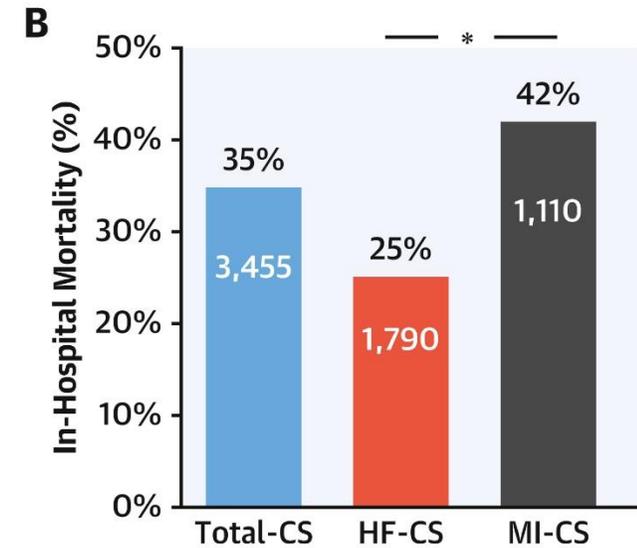
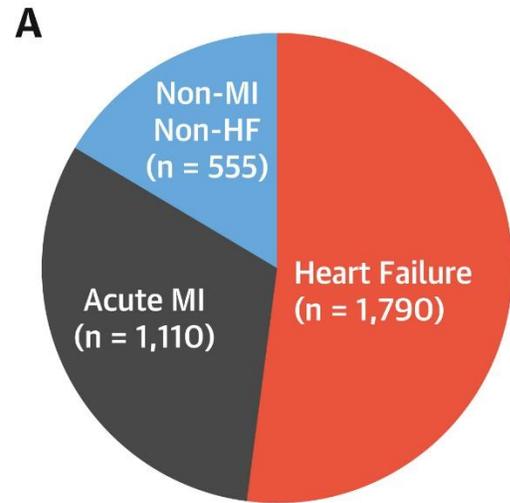
Disclosures

- Speaker, Abbott (cardiomems)
- Advisory Committee, Abiomed

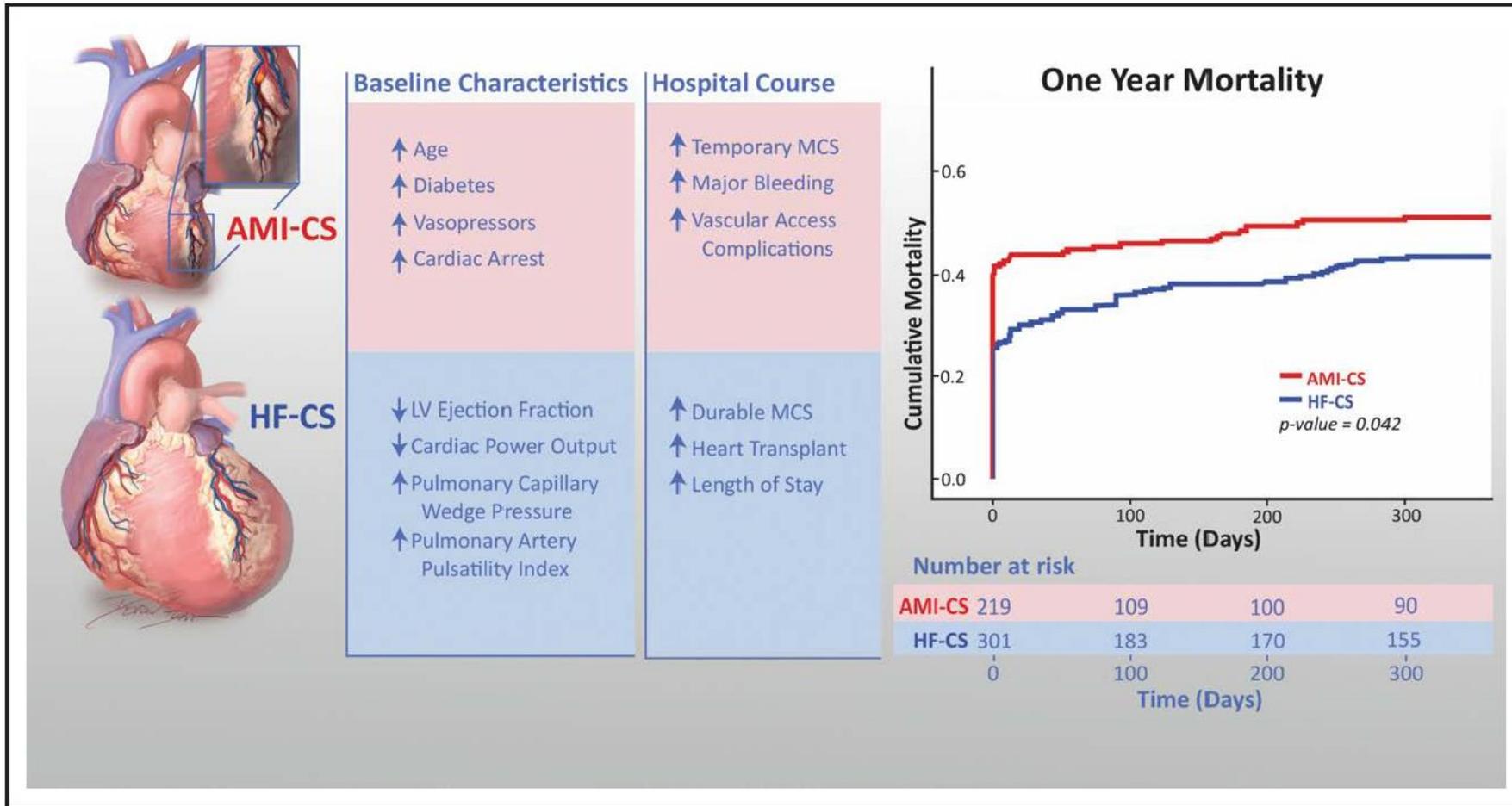
Non-AMI shock is now the dominant etiology of CS



CSWG Registry



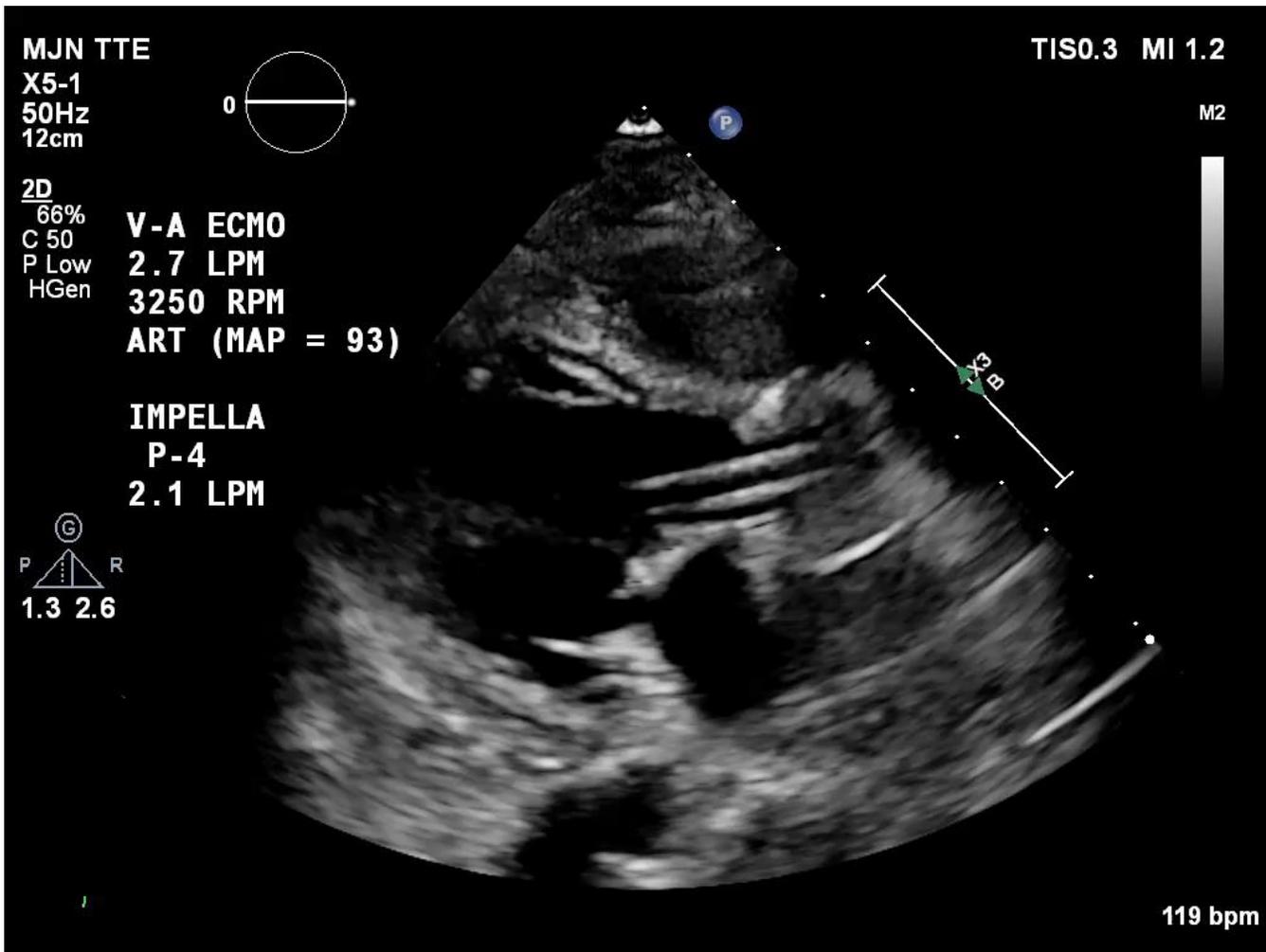
Single Center Study of CS





Case

- 39 year-old woman with no medical history presented to an outside emergency department with hypotension, sinus tachycardia and shortness of breath one week after returning from a hiking trip.
- IV administration of beta blocker precipitated cardiac arrest for which she was cannulated for VA ECMO.
- IABP placement for venting was complicated by RP hematoma and right iliac artery injury causing hemorrhagic shock requiring massive transfusion and high dose vasopressors.



2022
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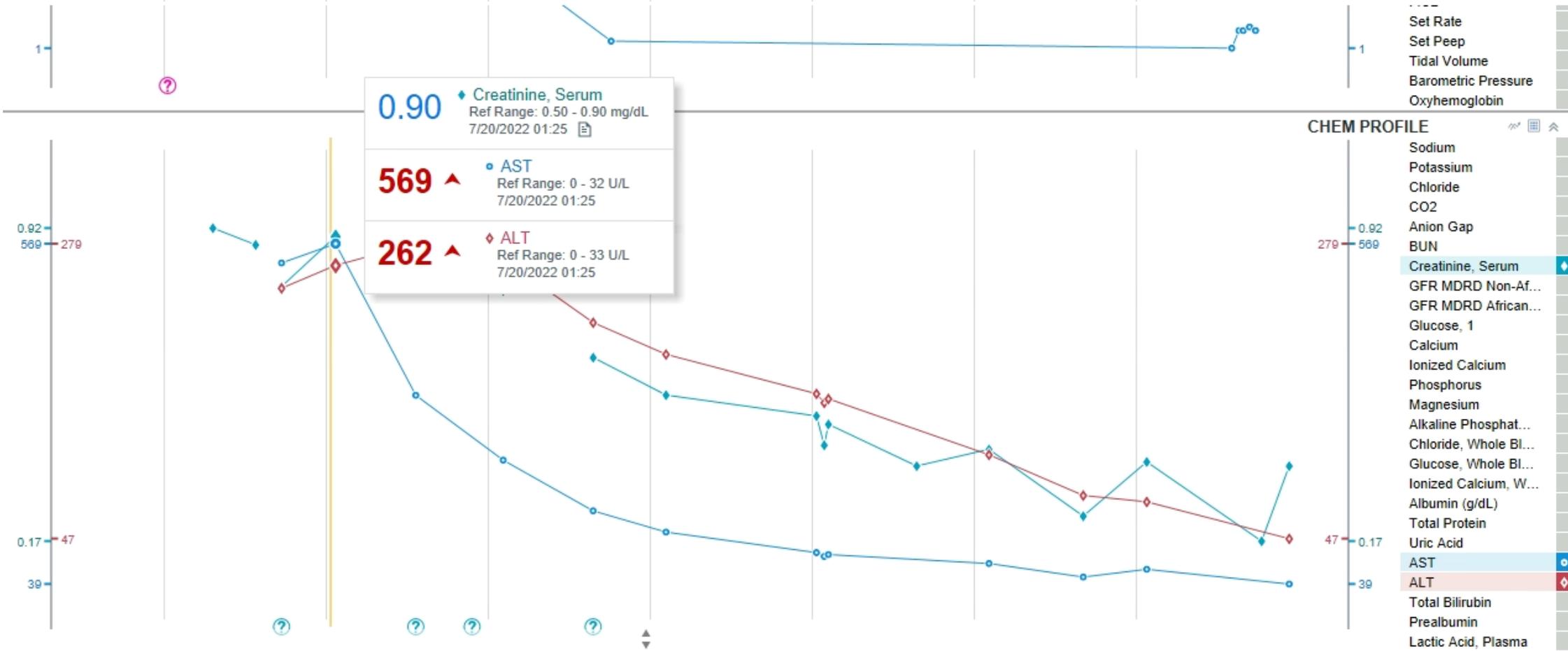
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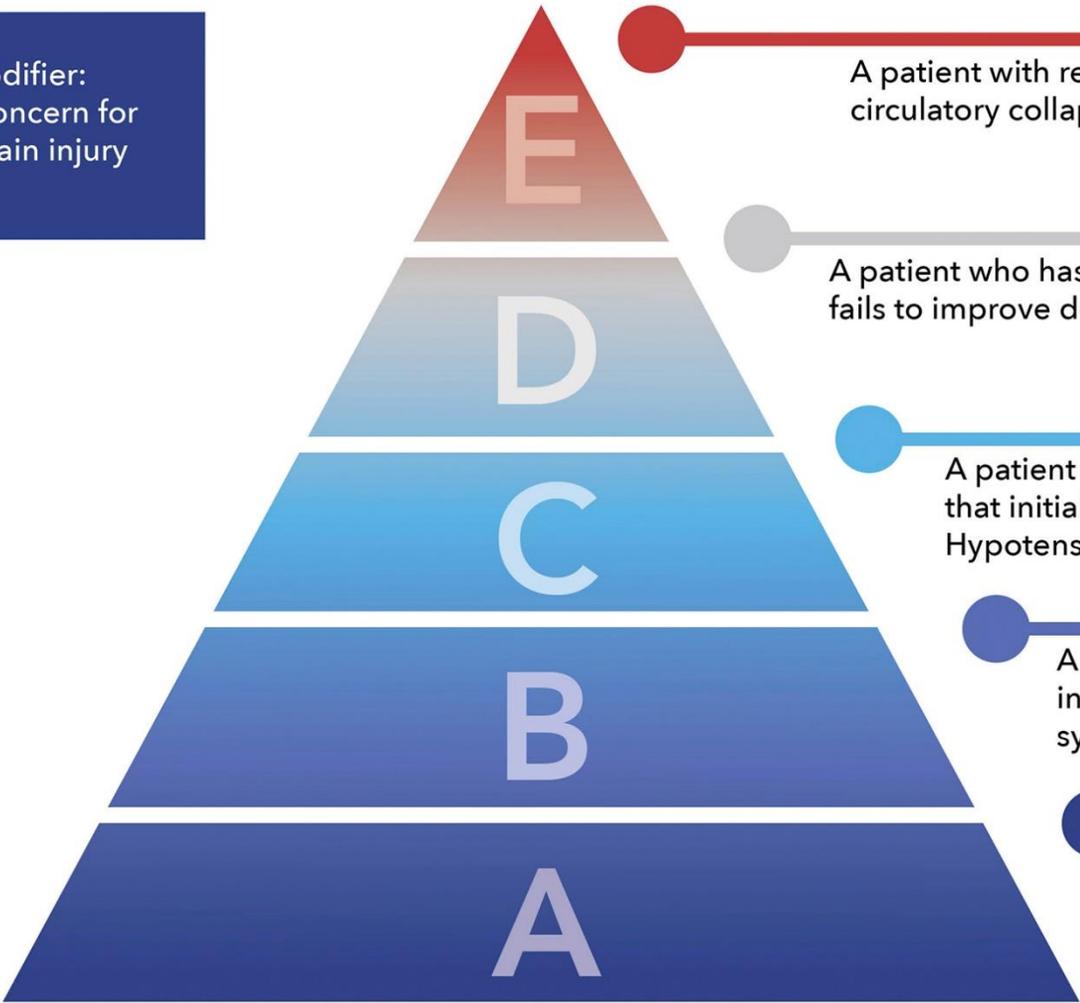
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Back to Table ?

- Set Rate
- Set Peep
- Tidal Volume
- Barometric Pressure
- Oxyhemoglobin



(A) Modifier:
CA with concern for
anoxic brain injury



EXTREMIS

A patient with refractory shock or actual/impending circulatory collapse.

DETERIORATING

A patient who has clinical evidence of shock that worsens or fails to improve despite escalation of therapy.

CLASSIC

A patient who has clinical evidence of hypoperfusion that initially requires pharmacologic or mechanical support. Hypotension is usually present.

BEGINNING

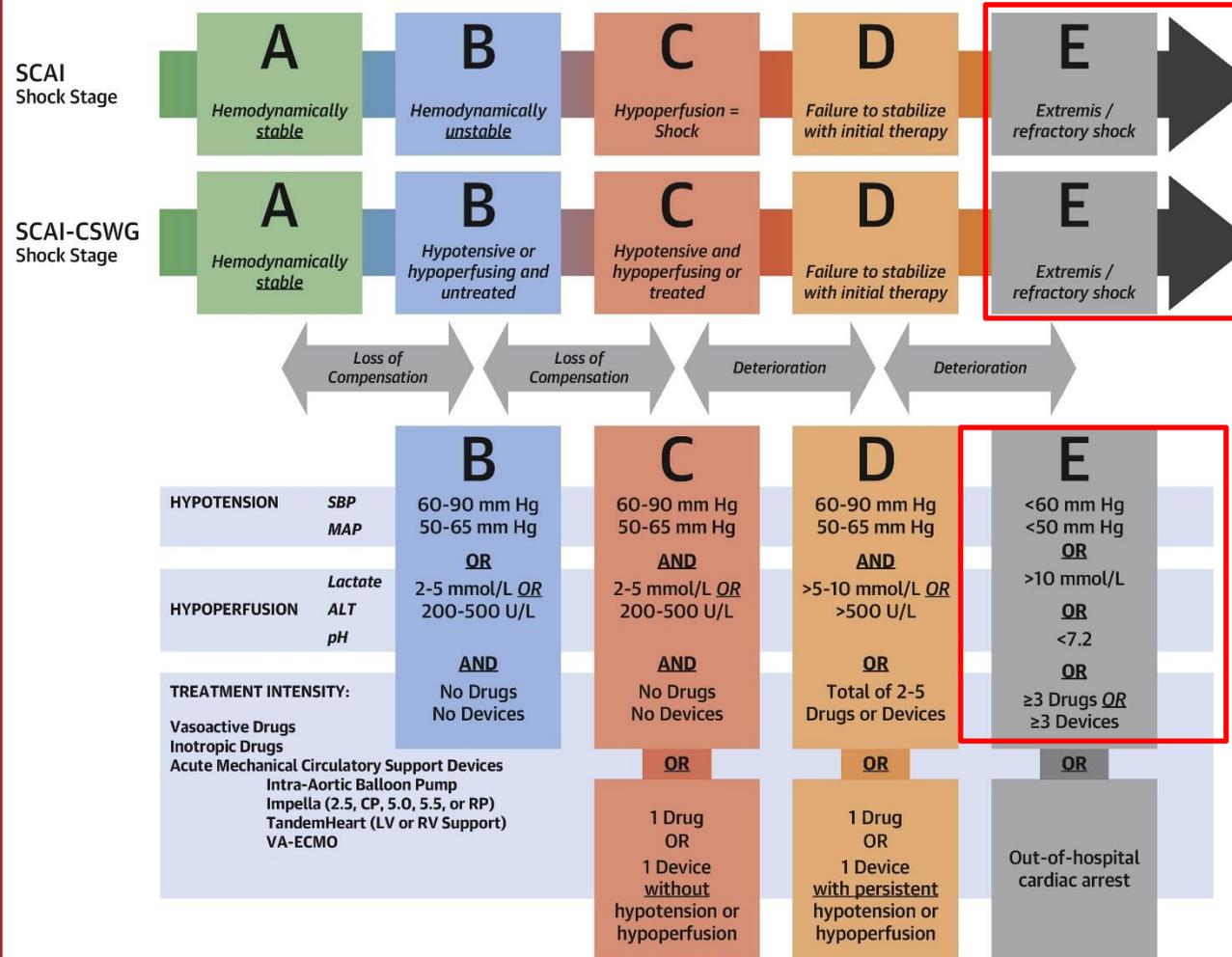
A patient who has clinical evidence of hemodynamic instability (including hypotension, tachycardia or abnormal systemic hemodynamics) without hypoperfusion.

AT RISK

A hemodynamically stable patient who is NOT experiencing signs or symptoms of CS, but is at risk for its development (i.e. large AMI or decompensated HF).

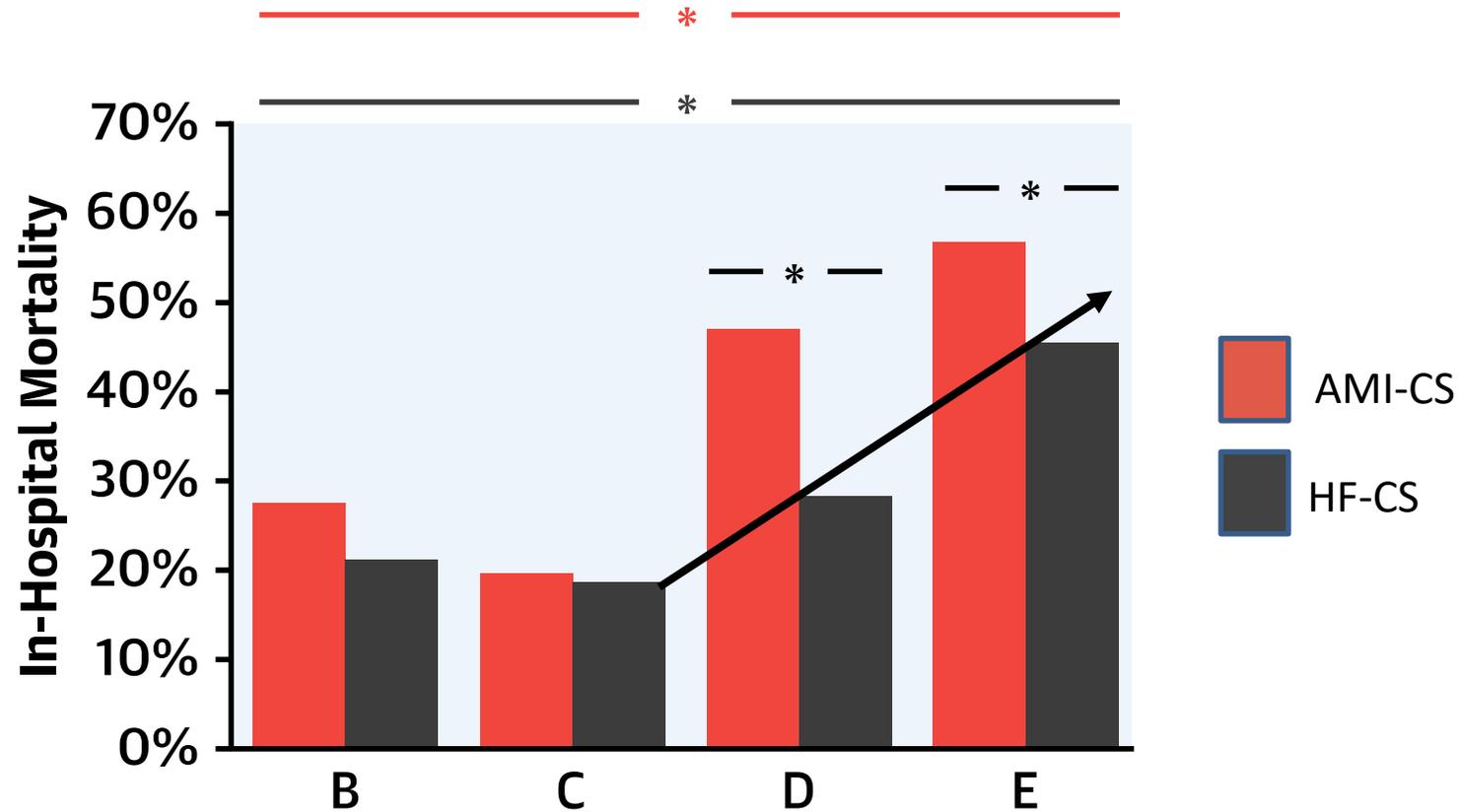
Srihari S. Naidu et al. *J Am Coll Cardiol* 2022; 79:933-946.

CENTRAL ILLUSTRATION: Clinical Variables and Parameters to Define Society for Cardiovascular Angiography and Interventions Stages



Kapur NK, et al. J Am Coll Cardiol. 2022;80(3):185-198.

We must identify and treat CS in early stages



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

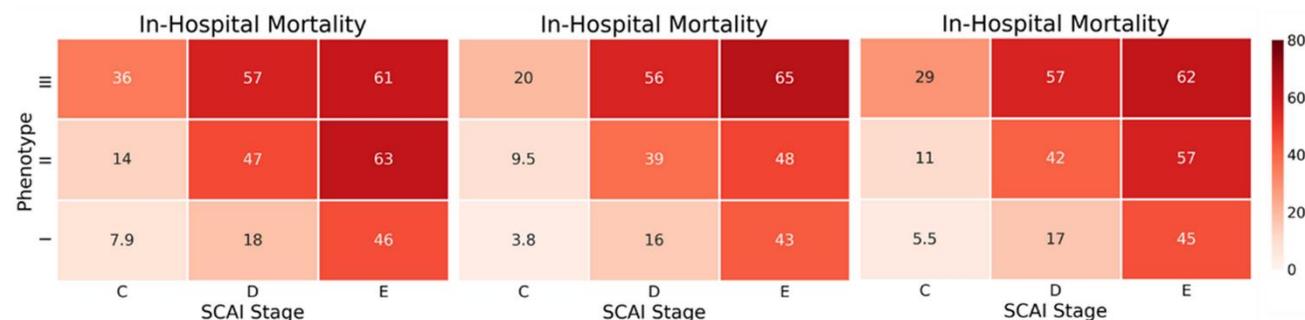
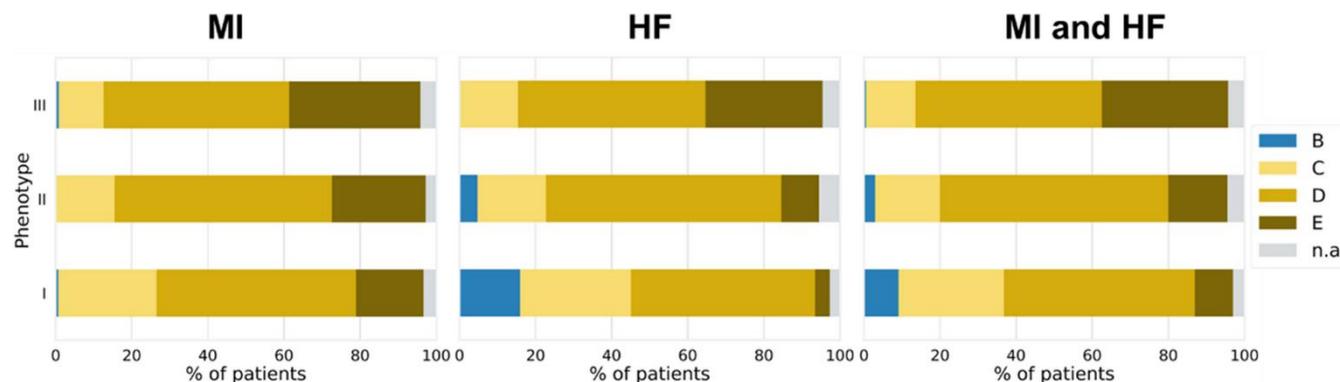
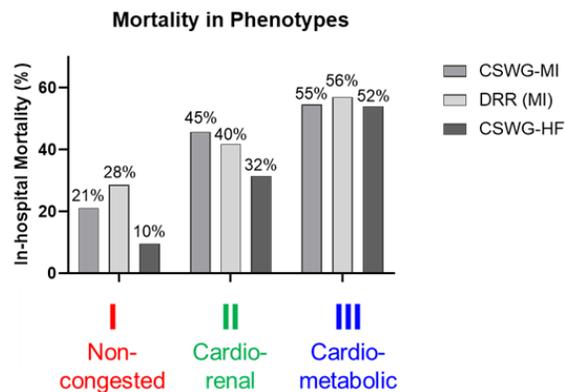
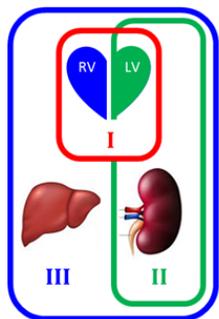
Case, Continued

- She was transferred to AGH
- Underwent hematoma evacuation and vein patch repair to the artery with covered stent placement needed for hemostasis.
- For the ongoing cardiogenic shock with VA ECMO, an Impella CP was placed via her right axillary artery (small patient size) for venting.
- Her echocardiogram showed an EF of 10-14% with slightly depressed RV function. Viral screen was positive for Coxsackie and corticosteroids were initiated for myocarditis treatment.

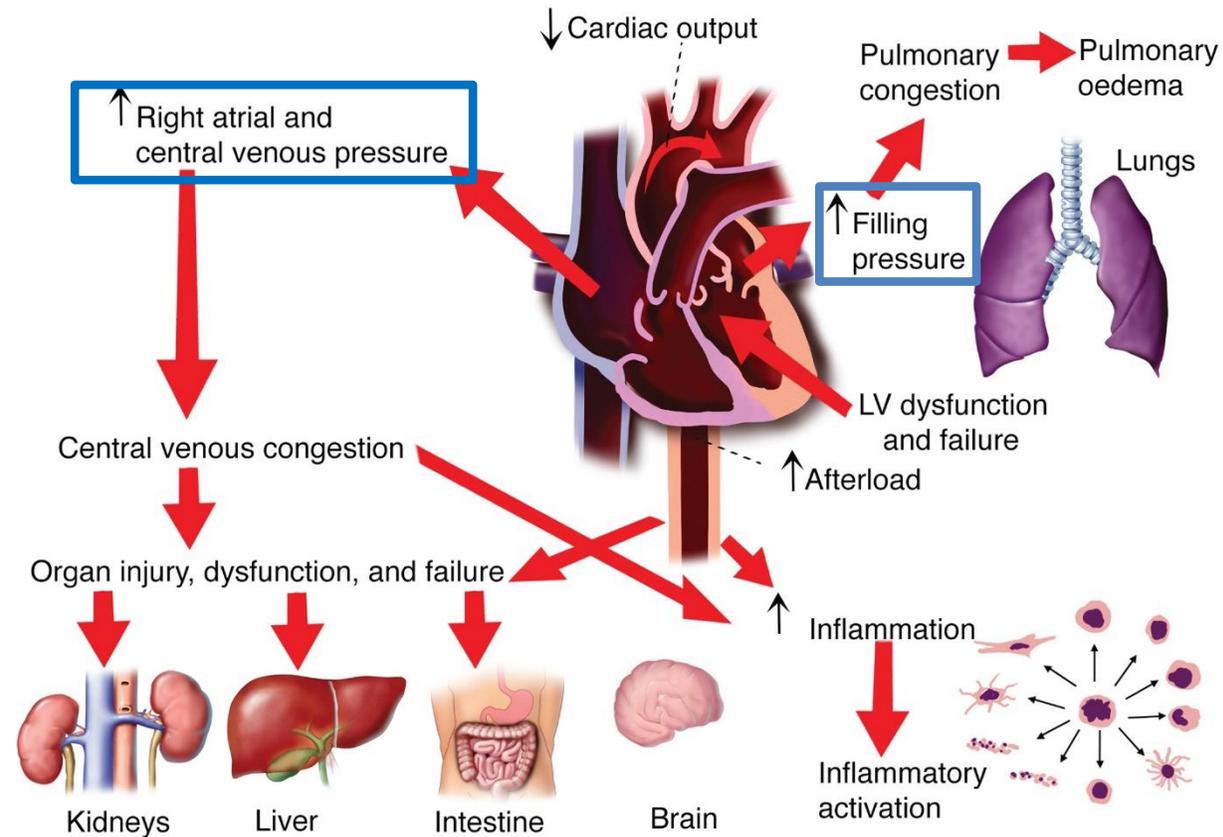
Case continued

- To allow more opportunity to assess for myocardial recovery, one week later she was decannulated from ECMO and Impella CP was replaced with Impella 5.5. Given her small size (BSA 1.38) and diminutive axillary artery on imaging, her 5.5 was implanted through a graft to the aortic root via mini-sternotomy.
- She was gradually weaned off pressor support and initiated on low dose guideline directed medical therapy. Her serial echocardiograms showed recovery of the RV function but her LV EF remained at 15-20%.
- Two weeks later, a HeartMate 3 was implanted

Machine Learning Phenotyping in CS

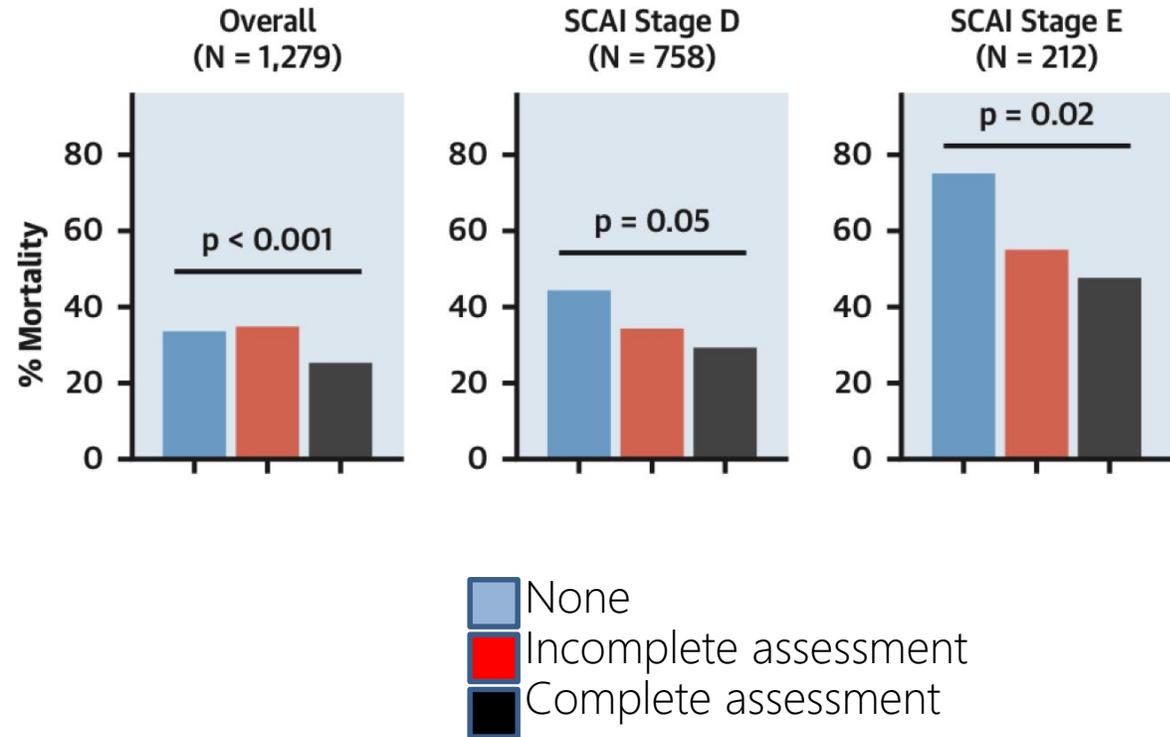
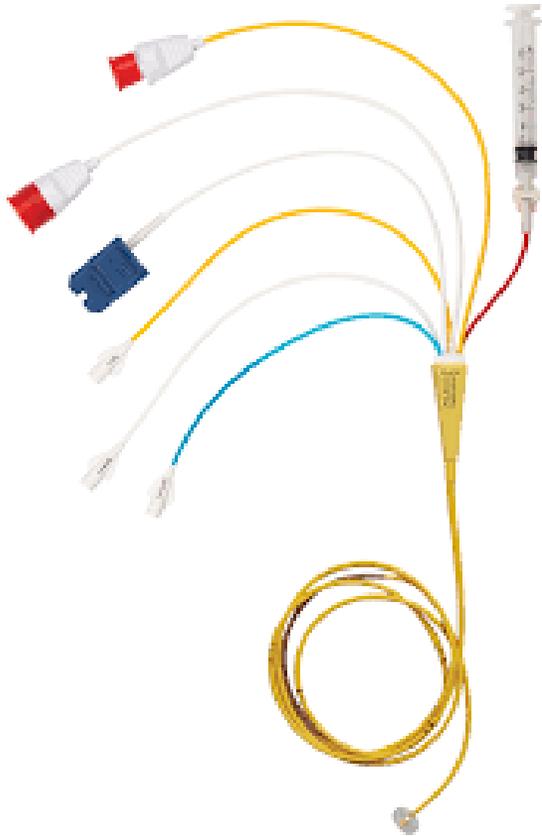


The congestive tipping point



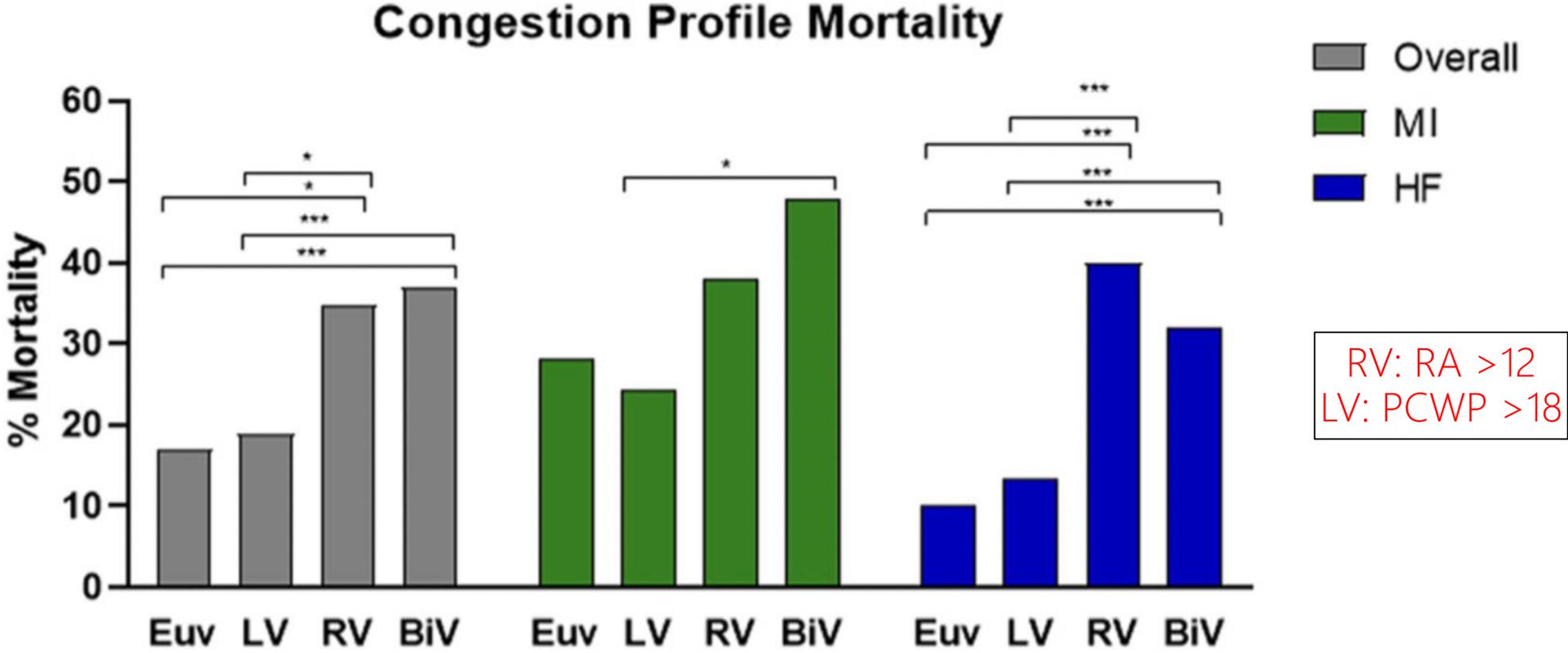
Congestion > Hypoperfusion > Hypotension

Should we use the PAC more?



CSWG Investigators, JACC Heart Fail. 2020

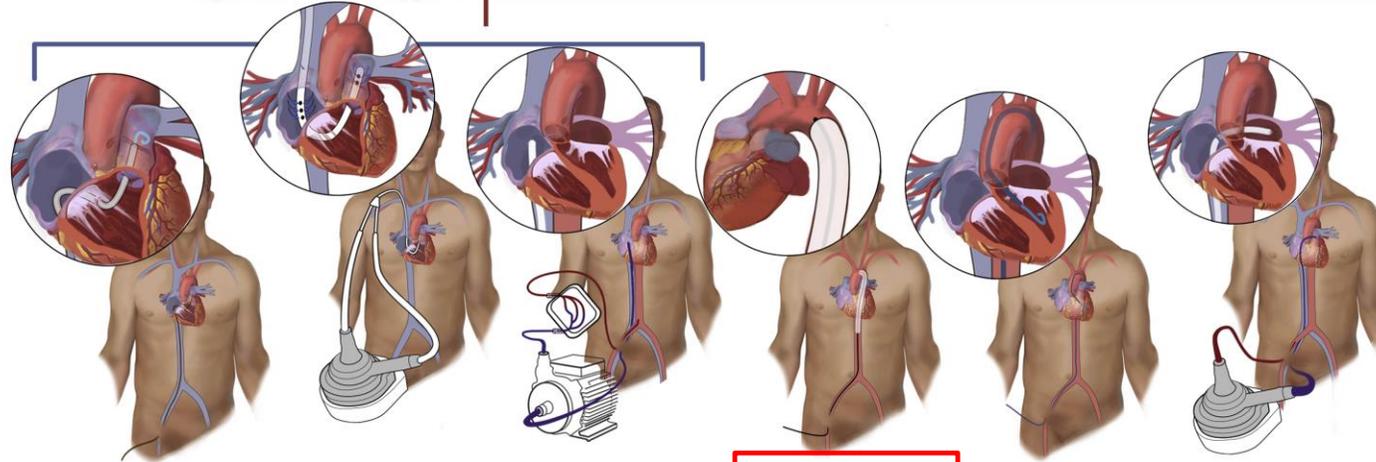
Congestion, but not perfusion, linked to mortality



TREATMENT

Right ventricular support

Left ventricular support



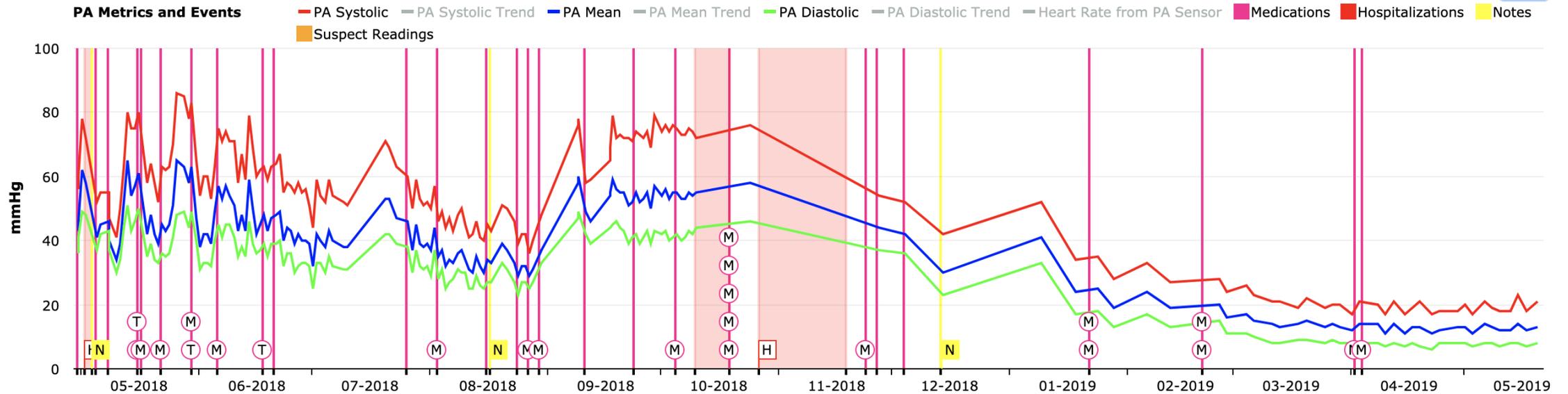
	Impella RP	TandemHeart RA-PA	VA-ECMO	IABP	Impella (2.5, CP, 5.0, 5.5)	TandemHeart LA-FA
Flow	max 4.0 l/min	max 4.0 l/min	max 7.0 l/min	0.5 l/min	2.5 - 5.5 l/min	max 4.0 l/min
Pump Speed	33000 rpm	max 7500 rpm	max 5000 rpm	NA	max 51,000 rpm	max 7500 rpm
Mechanism	Axial flow continuous pump (RA-to-PA)	Centrifugal flow continuous pump (RA-to-PA)	Centrifugal flow continuous pump (RA-to-AO)	Balloon inflation-deflation (AO)	Axial flow continuous pump (LV-to-AO)	Centrifugal flow continuous pump (LA-to-AO)
Cannula Size	22 F venous	29 F venous	14-19 F arterial 17-21 F venous	7-8 F arterial	13-21 F arterial	12-19 F arterial 21 F venous
Insertion/Placement	Femoral vein	Internal jugular vein	Femoral vein Femoral artery	Femoral artery Axillary artery	Femoral artery Axillary artery	Femoral artery Femoral vein
LV Unloading	-	-	-	+	+to+++	++
RV Unloading	+	+	++	-	-	-
Cardiac Power	-	-	↑↑	↑	↑↑	↑↑
Afterload	-	-	↑↑	↓	↓↓	↑
Coronary Perfusion	-	-	-	↑	↑	-
Considerations	<ul style="list-style-type: none"> RECOVER RIGHT: 73% survival-to-30 days in RVF post LVAD, AMI or cardiomy May 2019 - FDA post-approval study: 33% survival-to-30 days 	<ul style="list-style-type: none"> IJ access may facilitate early ambulation 	<ul style="list-style-type: none"> Bi-V + oxygenation support for CS following: <ul style="list-style-type: none"> AMI, ADHF or cardiac arrest Cardiotomy Myocarditis Allograft rejection 	<ul style="list-style-type: none"> Requires stable cardiac rhythm and native heart function May consider in select cases of post-AMI mechanical complications 	<ul style="list-style-type: none"> June 2008 – FDA 510(k) approval for HR-PCI April 2016: Expanded Indication for CS Contraindicated with mechanical aortic valve, LV thrombus 	<ul style="list-style-type: none"> Requires transeptal access Oxygenator may be added to the circuit

44-yo M with non-ischemic cardiomyopathy

Fixed Auto

From: 04-29-2018 To: 05-22-2019

Date Range: 30 days 90 days 180 days All

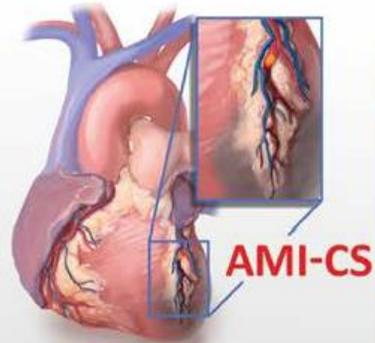


↑
Increase in sacubitril/valsartan

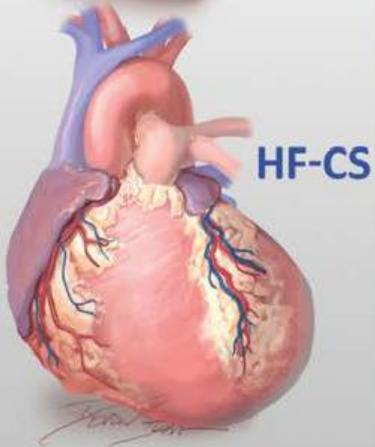
↑
Milrinone

↑
Axillary Impella 5.0 bridge to HM3 LVAD

↑
Worsening renal function



AMI-CS



HF-CS

Baseline Characteristics

- ↑ Age
- ↑ Diabetes
- ↑ Vasopressors
- ↑ Cardiac Arrest

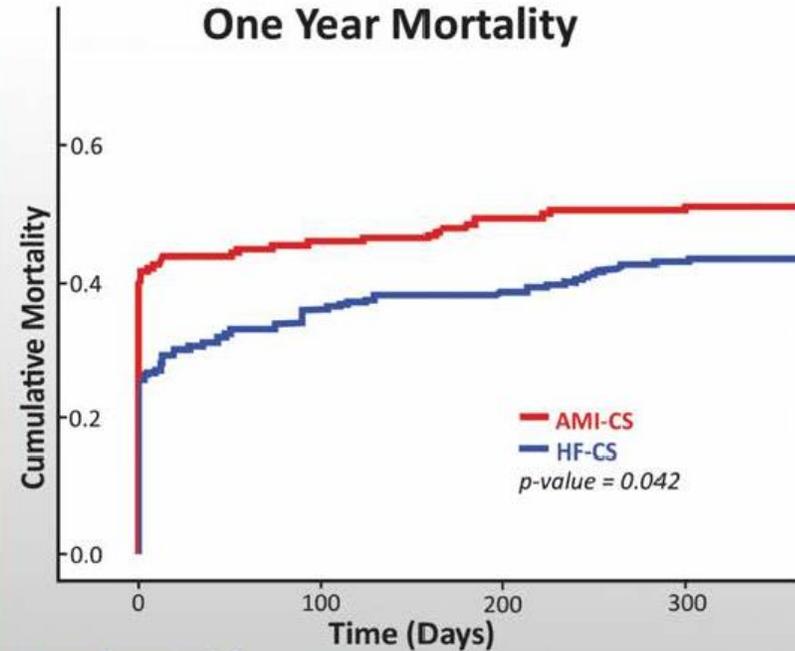
Hospital Course

- ↑ Temporary MCS
- ↑ Major Bleeding
- ↑ Vascular Access Complications

- ↓ LV Ejection Fraction
- ↓ Cardiac Power Output
- ↑ Pulmonary Capillary Wedge Pressure
- ↑ Pulmonary Artery Pulsatility Index

- ↑ Durable MCS
- ↑ Heart Transplant
- ↑ Length of Stay

One Year Mortality



Number at risk

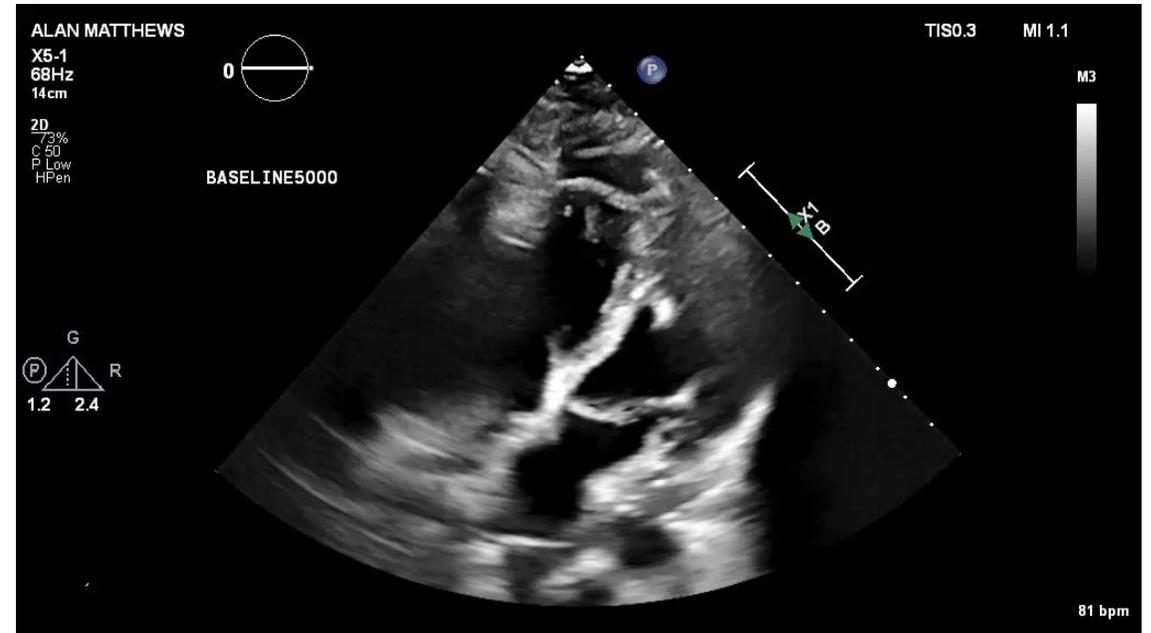
	0	100	200	300
AMI-CS	219	109	100	90
HF-CS	301	183	170	155

Time (Days)

Sinha, Shashank S. et al.. “Cardiogenic Shock from Heart Failure Versus Acute Myocardial Infarction: Clinical Characteristics, Hospital Course, and 1-year Outcomes”. *Circulation: Heart Failure* 15, no. 6 (2022).doi:10.1161/circheartfailure.121.009279.

Follow up

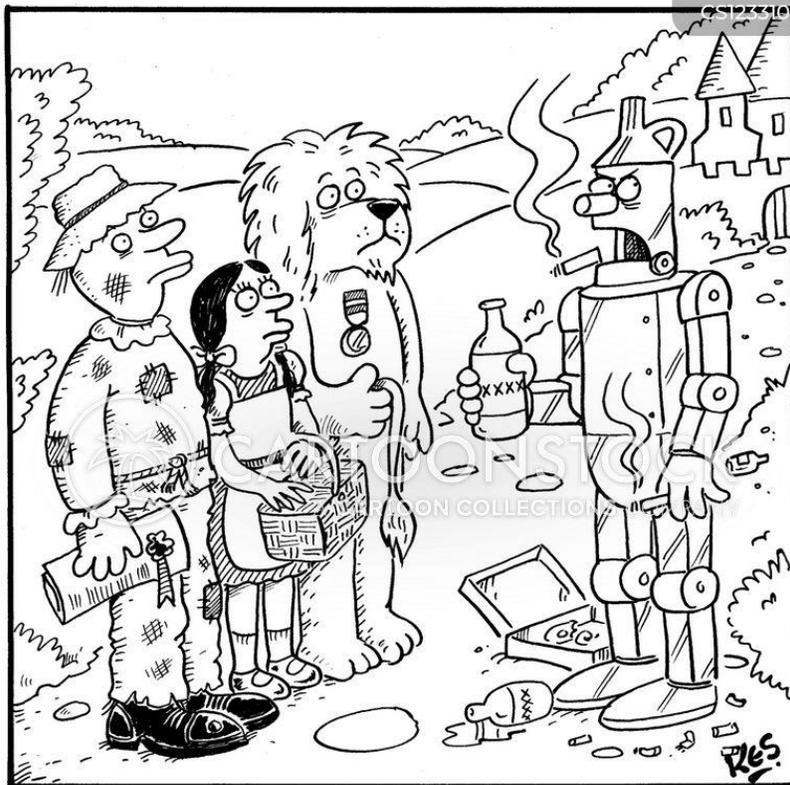
- ECHO one month post-discharge shows recovery of her EF to 54%.
- Her apical core showed evidence of lymphocytic myocarditis.
- Continued GDMT titration and hopes of recovery allowing explant



Conclusion

- Newly diagnosed NonAMI cardiogenic shock ≠ Chronic ADHF shock ≠ AMI shock
 - Including sub categories such as cardio-renal/cardio-metabolic
- New algorithms are needed to guide appropriate management
- Identify rapidly, reverse congestion quickly, and escalate support with any metabolic injury
- Future studies will hopefully validate complete hemodynamic assessment and phenotype-specific treatment paradigms

Thank You!



"He said he won't give me a new heart unless I change my lifestyle."