Implementing Acute MCS Putting it All Together

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The CardioVascular Center

The Acute MCS Working Group

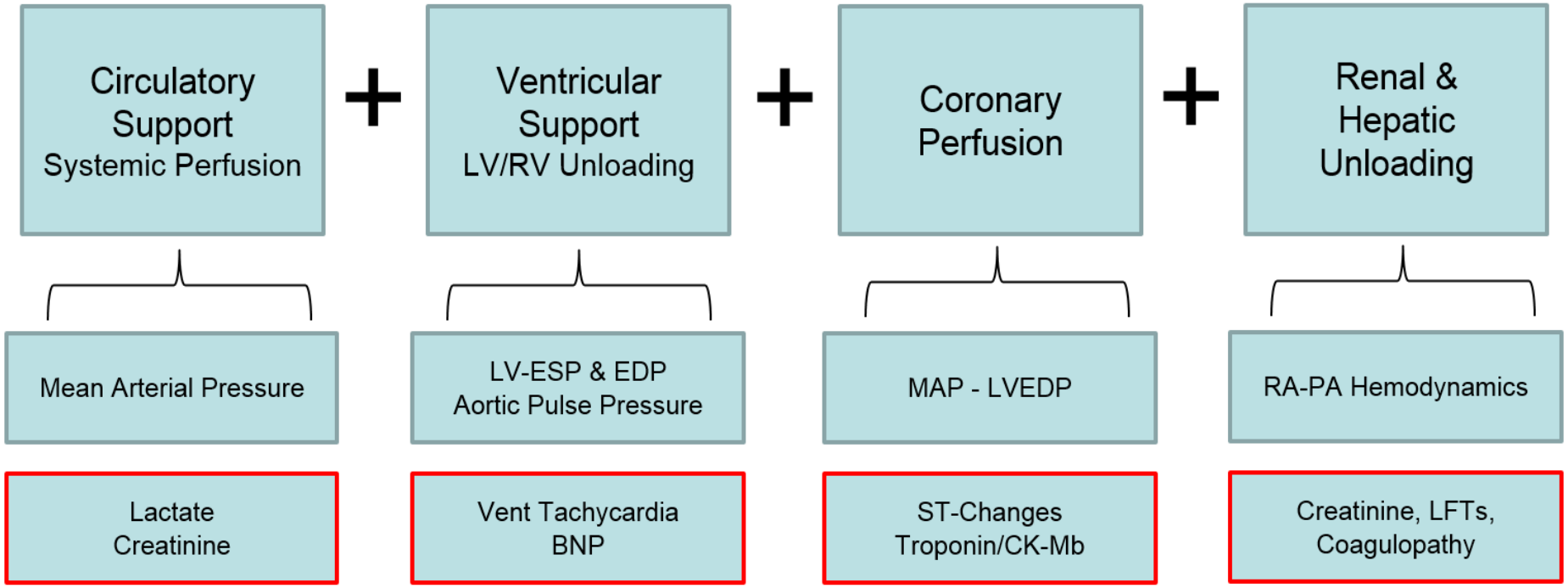
ACC/SCAI
Interventional Cardiology Overview and Board Preparatory Course

Relevant Disclosures

Research Funding: Abiomed, Maquet, Cardiac Assist, Abbott, Boston Scientific

Speaker/Consulting Honoraria: Abiomed, Maquet, Cardiac Assist, Abbott

We don't provide hemodynamic support *effectively or early enough* in the Shock Spectrum



Hemodynamic Problem

Hemo-Metabolic Problem

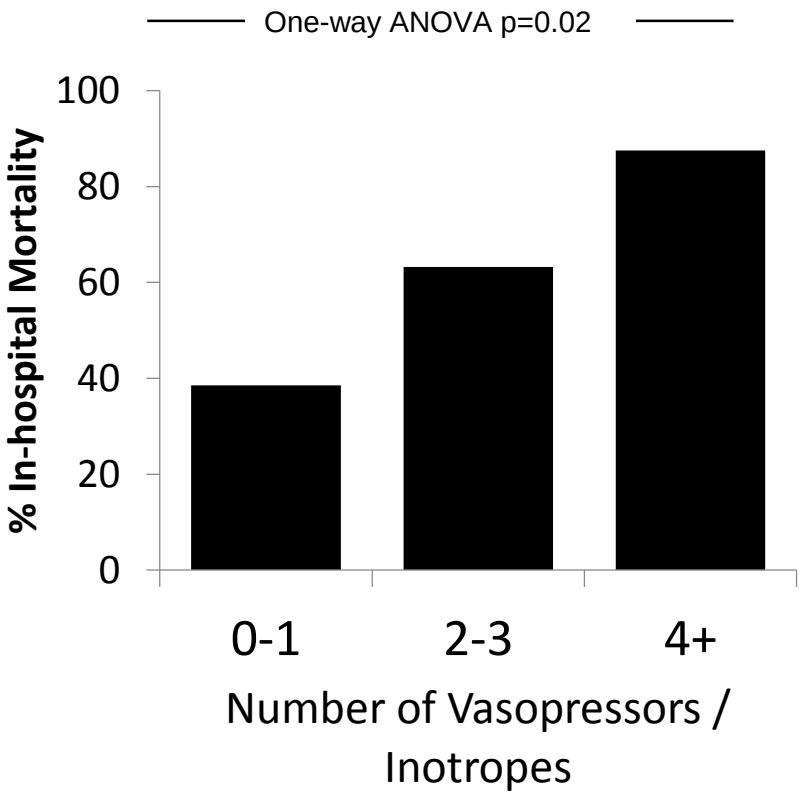
Recovery — Time in Cardiogenic Shock — Death

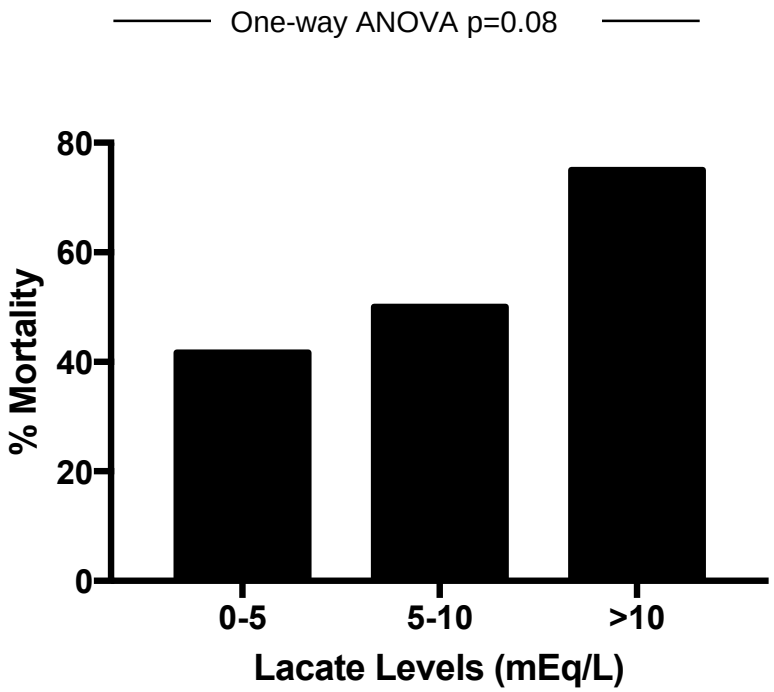
Bridge to Recovery
Detroit Cardiogenic Shock Initiative

It's Too Late for AMCS
Impress Trial

Kapur and Esposito Curr Cardio Risk 2016 & F1000 2017

Mortality vs Number of Vasopressors/inotropes Pre-Device Implant Among the Total Cohort

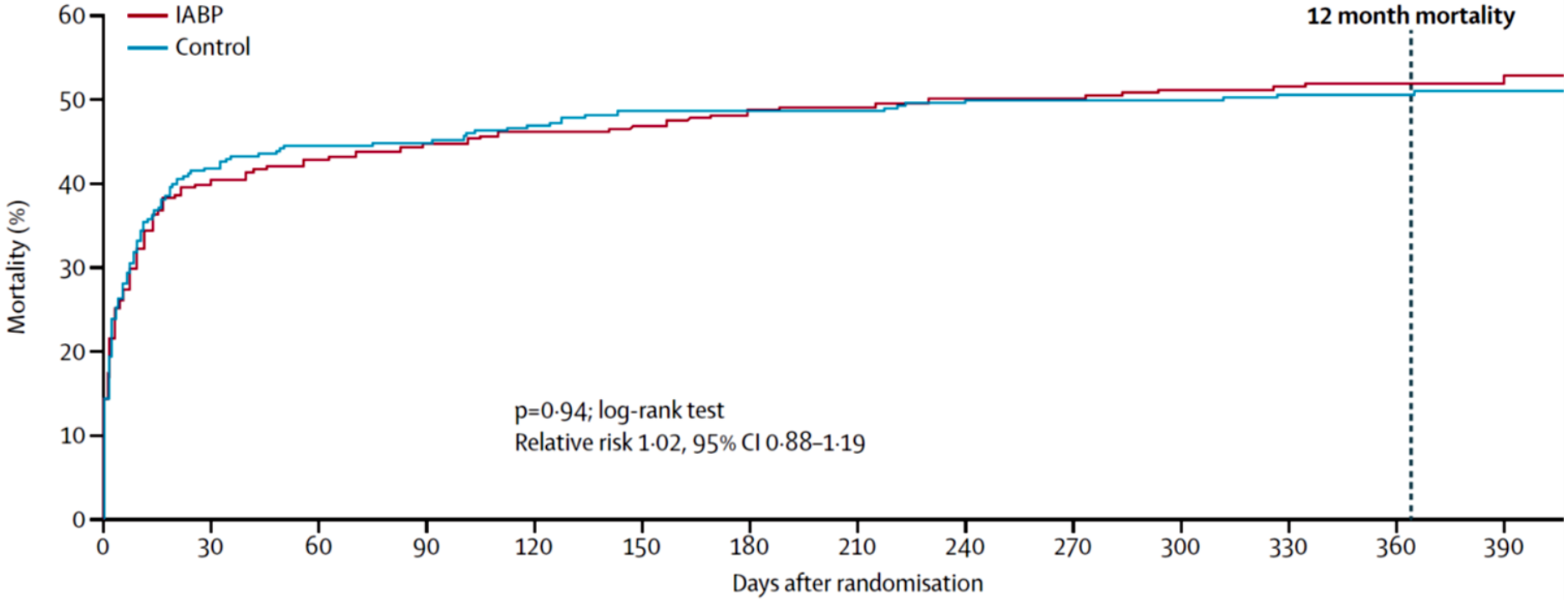




Early and Effective Device Support is Critical for Survival

Esposito and Kapur et al. TCT 2016

It's Hard to Ignore these Data
IABP Therapy in Acute-MI + Cardiogenic Shock



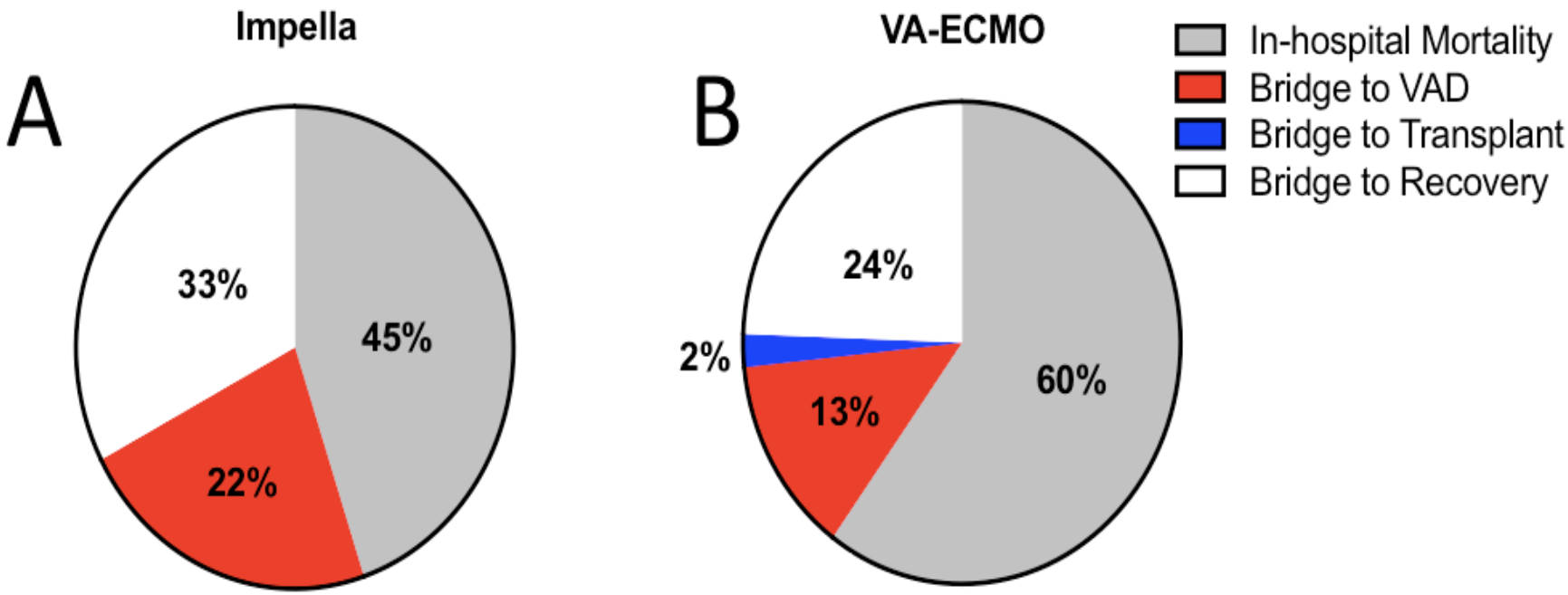
Examine your own practice and evaluate the clinical efficacy of IABP therapy for CGS

Thiele H et al. NEJM 2012
Thiele H et al Lancet 2013

It's Hard to Ignore those Data…But We Do Stepwise Escalation of Support Delays Treatment

60+% of Cardiogenic Shock Patients Fail an IABP First before Receiving an Impella or VA-ECMO

63% 64%

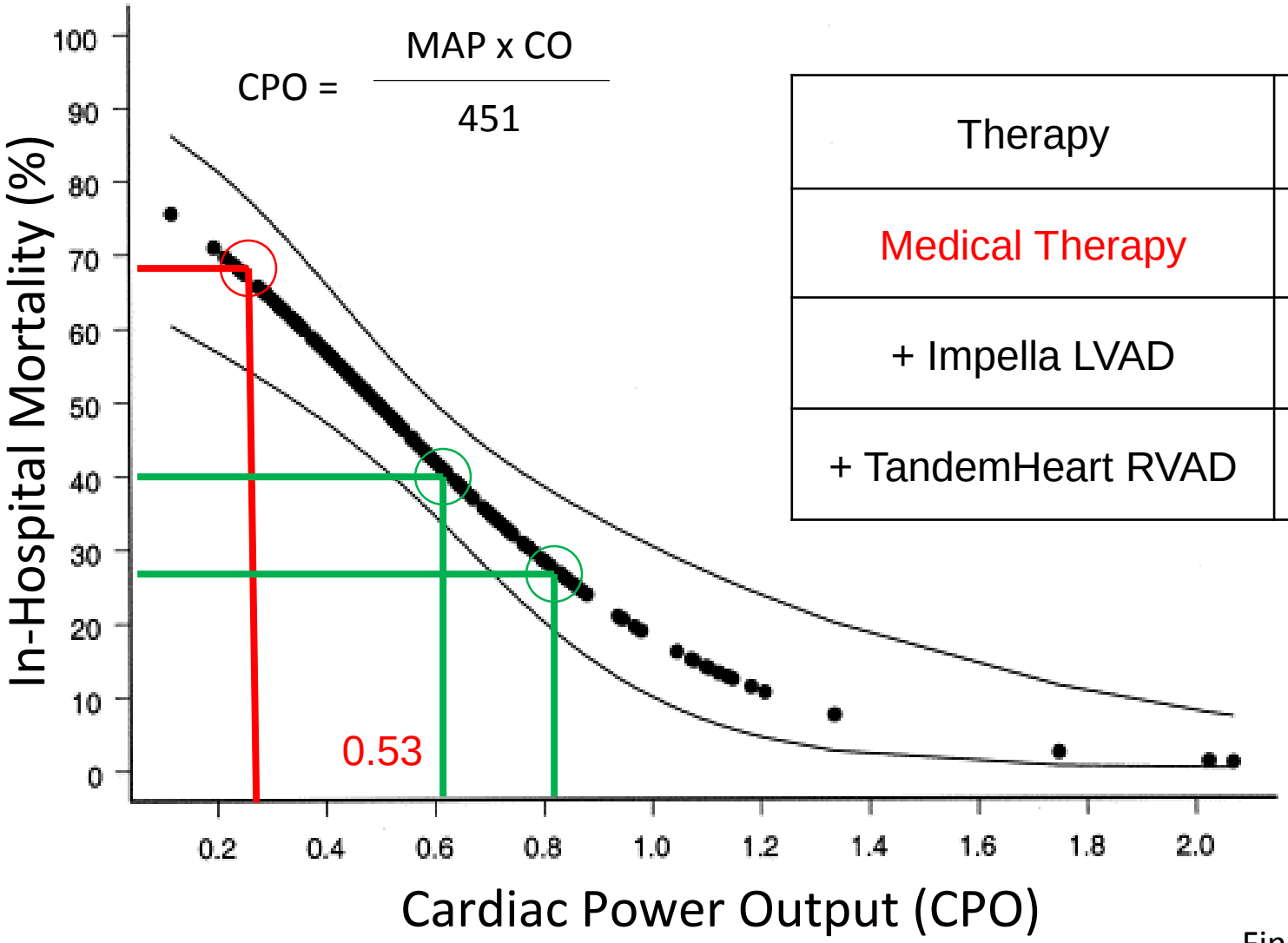


Esposito and Kapur et al. Under Review 2017

We don't use hemodynamic data to guide Acute MCS decision-making

$$CPO = \frac{MAP \times CO}{451}$$

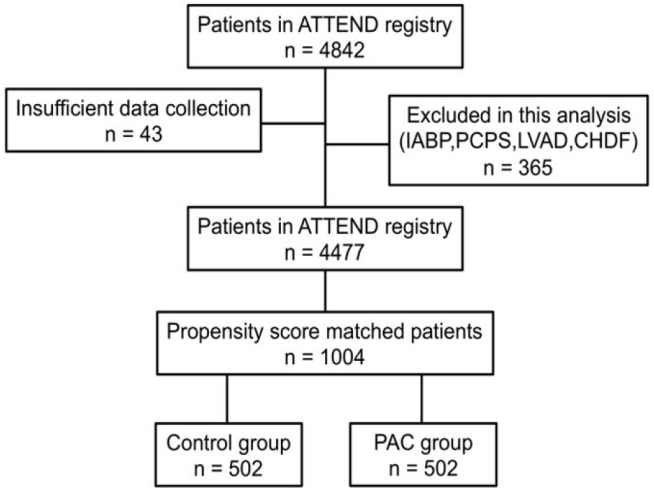
Therapy	CPO (W)
Medical Therapy	0.28
+ Impella LVAD	0.68
+ TandemHeart RVAD	0.80

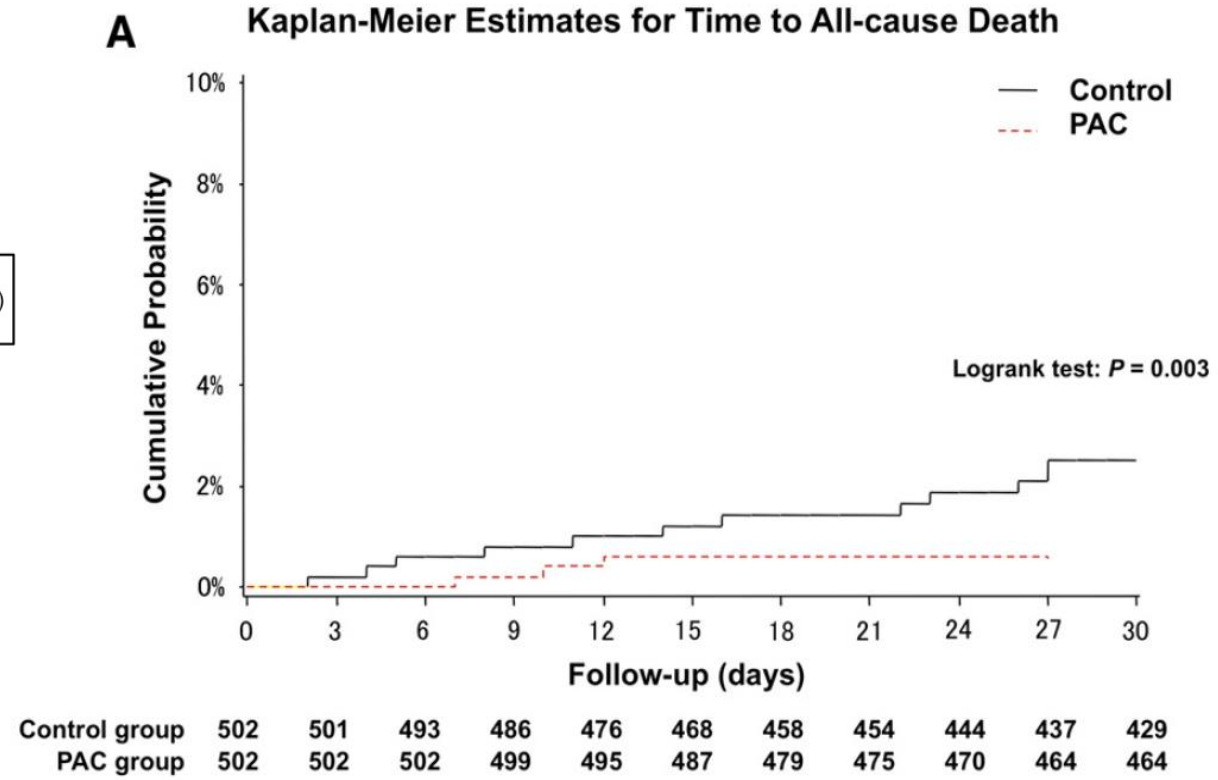


Fincke et al JACC 2004

Early Use of a PA Catheter Improves Outcomes in Acute HF and CG-Shock

Impact of pulmonary artery catheter on outcome in patients with acute heart failure syndromes with hypotension or receiving inotropes: From the ATTEND Registry☆,☆☆,★





Sotomi et al. Intl J Card 2016

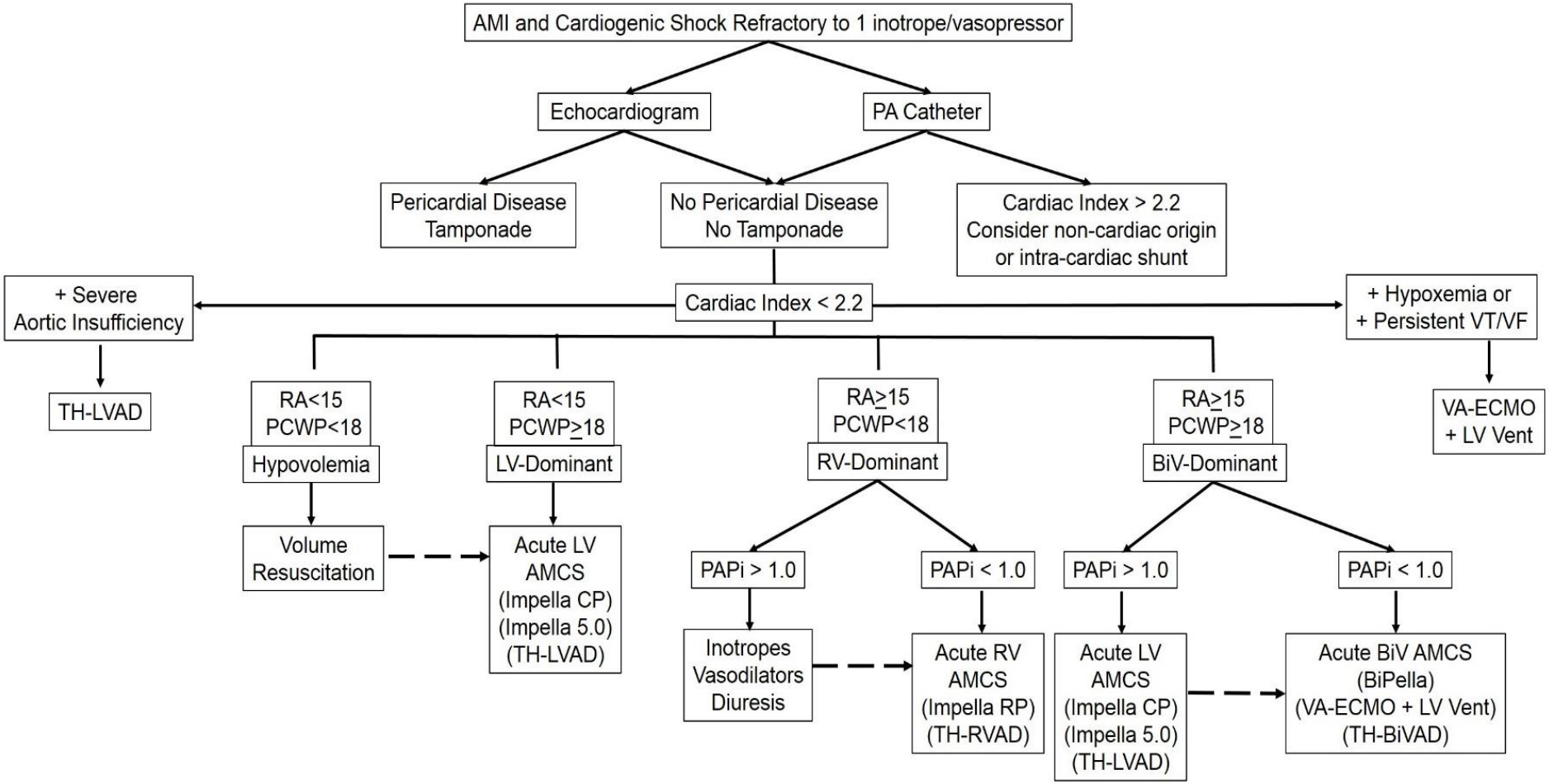
Hemodynamic Formulas to Assess RV Function

Cardiac Filling Pressures	RA / PCWP	>0.63 (RVF after LVAD) [14] >0.86 (RVF in Acute MI)[31]
PA Pulsatility Index	(PASP-PADP) / RA	<1.85 (RVF after LVAD) [42] <1.0 (RVF in Acute MI) [41]
Pulmonary Vascular Resistance	mPA-PCWP / CO	>3.6 (RVF after LVAD) [16]
Trans-pulmonary Gradient	mPA-PCWP	Undetermined [36]
Diastolic Pulmonary Gradient	PAD - PCWP	Undetermined [36, 37]
RV Stroke Work	(mPAP-RA) x SV x 0.0136	<15 (RVF after LVAD) [16] <10 (RVF after Acute MI) [40]
RV Stroke Work Index	(mPA-RA)/ SV Index	<0.3-0.6 (RVF after LVAD) [14,42]
Pulmonary Artery Compliance	SV / (PASP-PADP)	<2.5 (RVF in Chronic Heart Failure) [39]
Pulmonary Artery Elastance	PASP/ SV	Undetermined [38]

Right atrial (RA); Pulmonary artery (PA); PA systolic pressure (PASP); PA diastolic pressure (PADP); mean PA pressure (mPAP); Pulmonary capillary wedge pressure (PCWP); Right ventricular failure (RVF); Left ventricular assist device (LVAD); Myocardial infarction (MI); Stroke volume (SV)

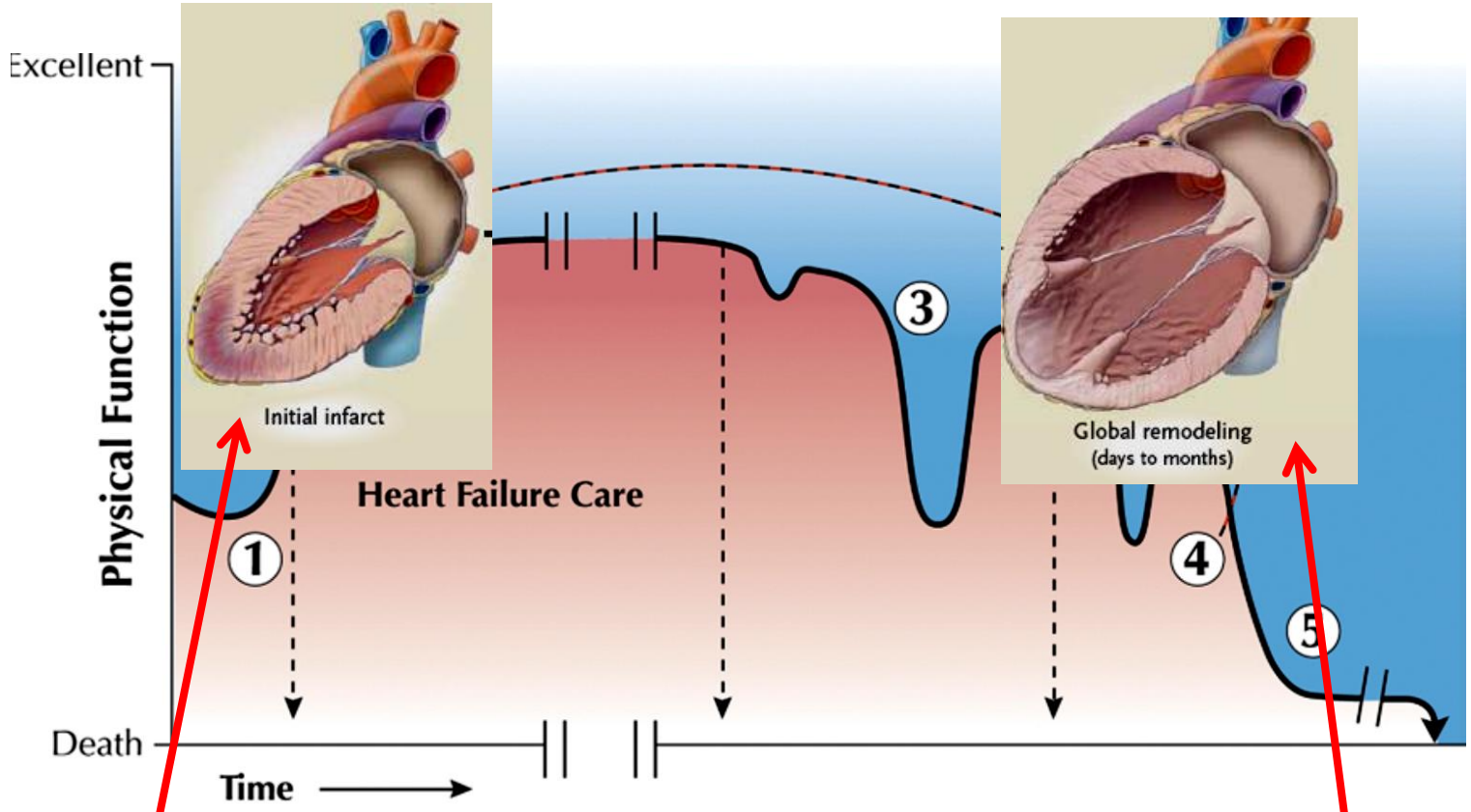
Kapur, Esposito, and Burkhoff et al Circulation 2017

Re-Defining Cardiogenic Shock in the Era of AMCS
The Tufts Cardiogenic Shock Algorithm



Kapur & Esposito. Curr Cardiol. 2017

We must centralize and tailor expertise for cardiogenic shock management



Acute MI Cardiogenic Shock

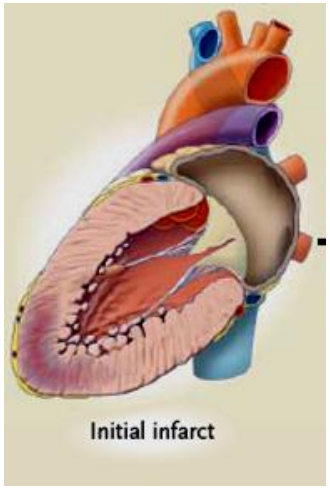
50-60%

Advanced HF Cardiogenic Shock

20-30%

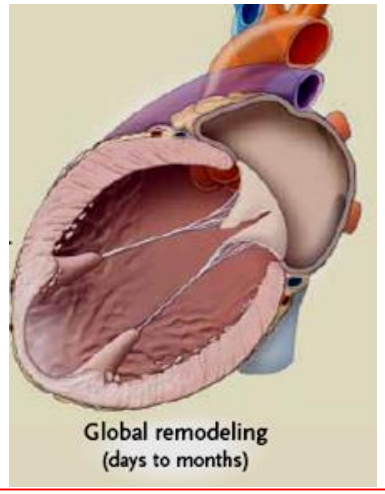
Modified from Goodlin. JACC 2009;54:386

Who do you want on *your* Shock Team?



Acute MI Cardiogenic Shock

1. Interventional Cardiologist
2. Cardiac Surgeon
3. Critical Care / Intensivist (MD)
4. Advanced HF Specialist
5. Critical Care Nursing Team
6. Perfusion Team
7. Respiratory Specialists
8. Physical and Occupational Therapy
9. Palliative Care



Advanced HF Cardiogenic Shock

1. Advanced HF Specialist
2. Interventional Cardiologist
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4. Critical Care / Intensivist (MD)
5. Critical Care Nursing Team
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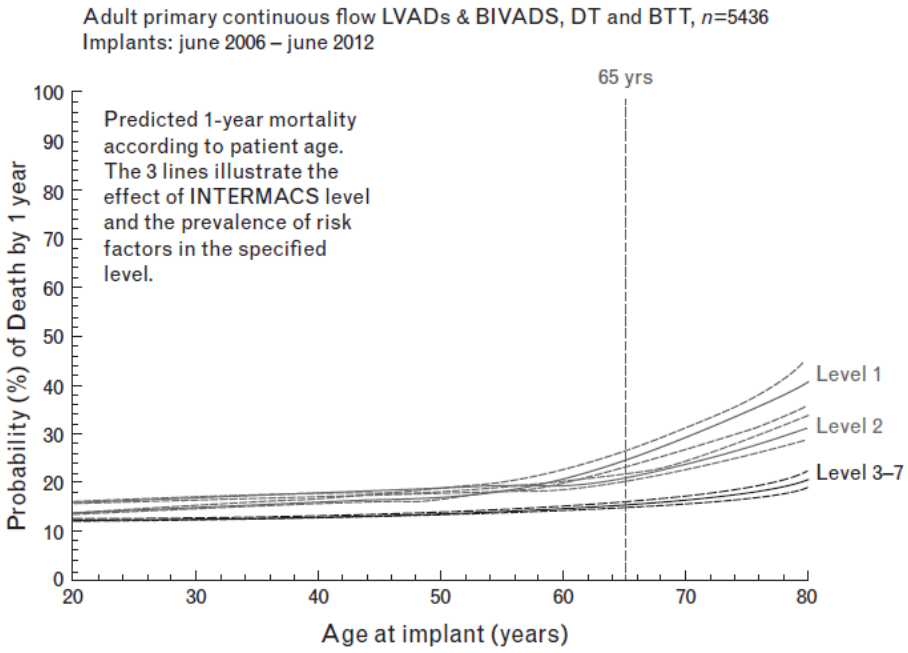
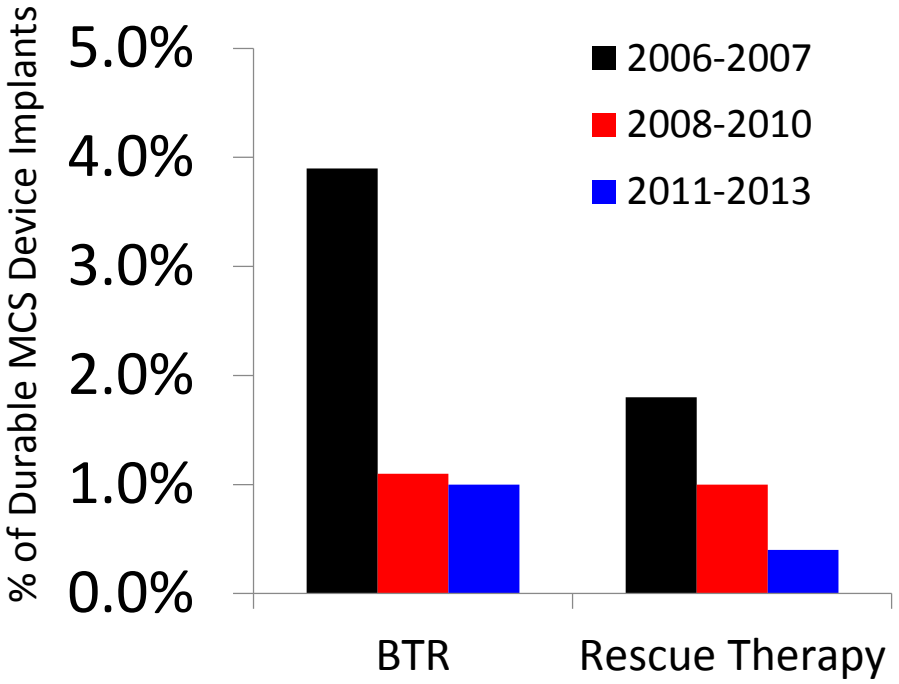
8. Respiratory Specialists
9. Physical and Occupational Therapy

Durable MCS Devices are Not Commonly Used for Acute Circulatory Support





Higher Mortality with INTERMACS 1 and 2 Patients > 65 years of Age

Rare use of Durable MCS as a Bridge to Recovery or Rescue Therapy Option

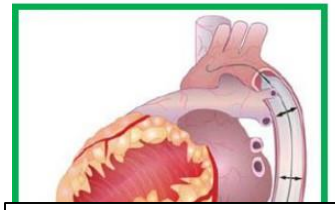
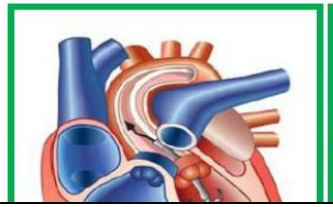
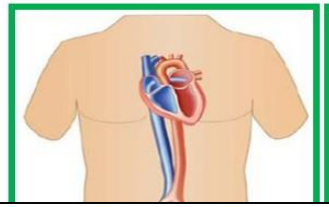
Adapted from Kirklin et al JHLT 2014

AMCS Device Options for Advanced HF & Shock

Left Ventricle

Continuous Flow Pumps

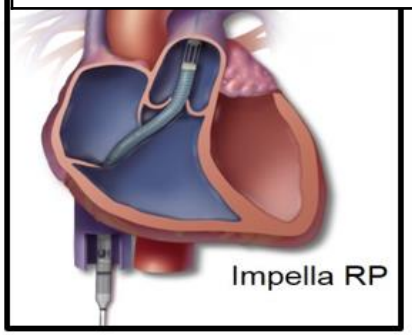
Pulsatile | **Axial-Flow** | **Centrifugal Flow**

Acute MCS Devices are Not VADs

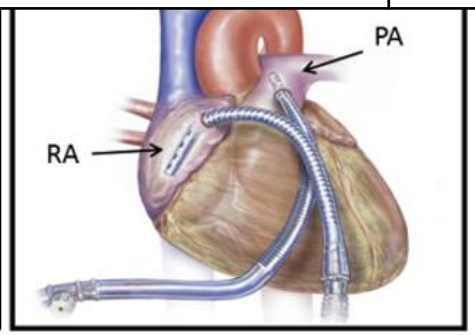
	Durable MCS	Acute MCS
Primary Objectives	Outpatient Discharge	Inpatient Stabilization
Clinical Scenarios	Stable, but sick	Sick and unstable
Technical Implant Features	Cardiotomy	Vascular Puncture
Post-procedural Management	Surgical	Medical
Outcomes/Metrics of Success	OHTx or DT-VAD	Recovery, Durable MCS, OHTx
Withdrawal of Care	Failure	Success in select cases

Ri

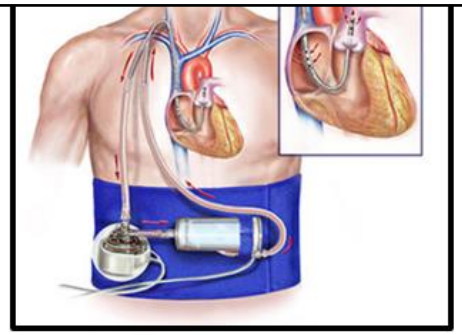


Impella RP

VA-ECMO

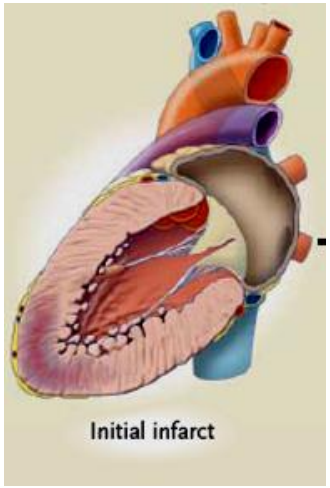


Tandem pRVAD

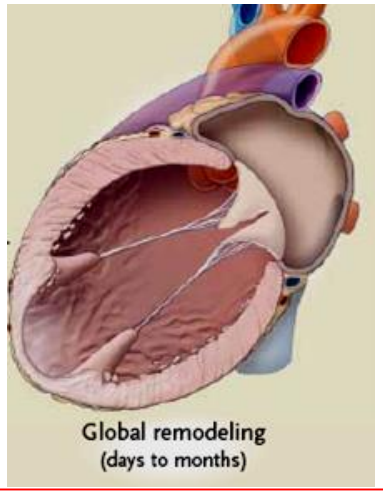


Protek Oxy-RVAD

The Role of the Cardiac Intensivist



Acute MI
Cardiogenic Shock



Advanced HF
Cardiogenic Shock

1. Optimize hemodynamic status
2. Pulmonary stabilization
3. Renal stabilization
4. Sepsis/infectious issues (prevention and management)
5. Nutrition, mobilization, prophylaxis against DVT/ulcers
6. Optimize metabolic parameters (ie lactate)
7. Assist with Acute MCS, VA-ECMO, and VV-ECMO management

Cardiac Intensivists Improve Clinical Outcomes for Patients with Cardiogenic Shock

Association Between Presence of a Cardiac Intensivist and Mortality in an Adult Cardiac Care Unit

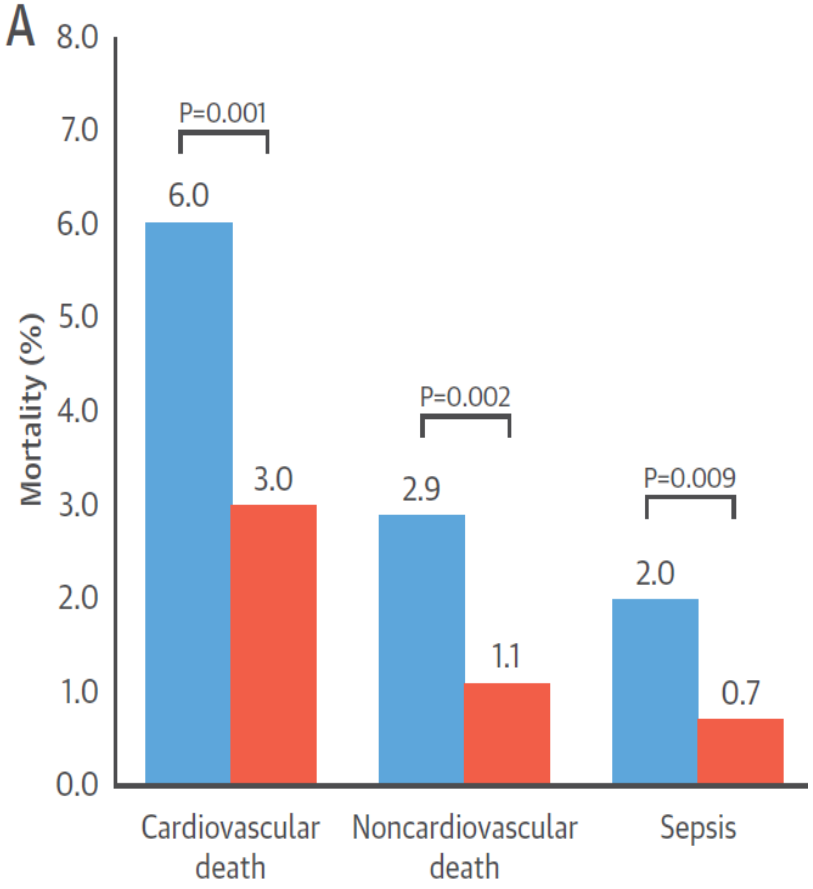


TABLE 2 Treatment Characteristics

	Total Patients			
	Low-Intensity (n = 616)	High-Intensity (n = 1,815)	p Value	Standardized Difference (%)
Inotropes or vasopressors	203 (33.0)	506 (27.9)	0.02	−9.5
Dopamine	117 (19.0)	170 (9.3)	<0.001	−21.5
Norepinephrine	125 (20.3)	321 (17.7)	0.15	−5.7
Dobutamine	99 (16.1)	248 (13.7)	0.14	−2.2
Vasopressin	25 (4.1)	51 (2.8)	0.12	−3.3
Epinephrine	12 (2.0)	104 (5.7)	<0.001	8.2
Milrinone	4 (0.7)	29 (1.6)	0.08	2.4
Intra-aortic balloon pump	52 (8.4)	53 (2.9)	<0.001	−21.6
Extracorporeal membrane oxygenation	33 (5.4)	102 (5.6)	0.81	0.6
Mechanical ventilation	115 (18.7)	289 (15.9)	0.11	−5.3
Continuous renal replacement therapy	69 (11.2)	136 (7.5)	0.004	−9.5

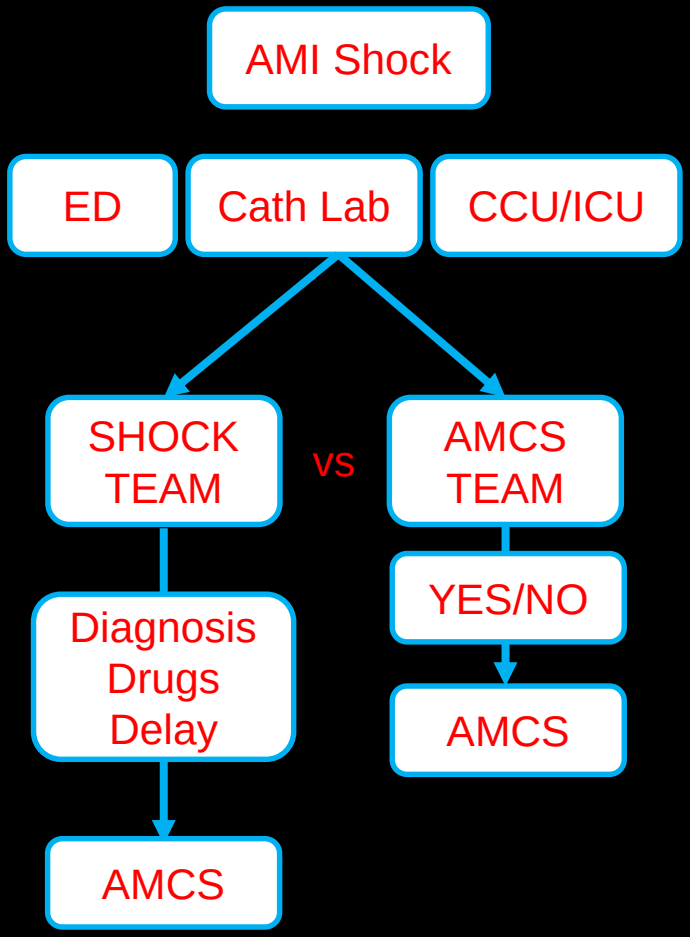
Na and Yang et al. JACC 2016

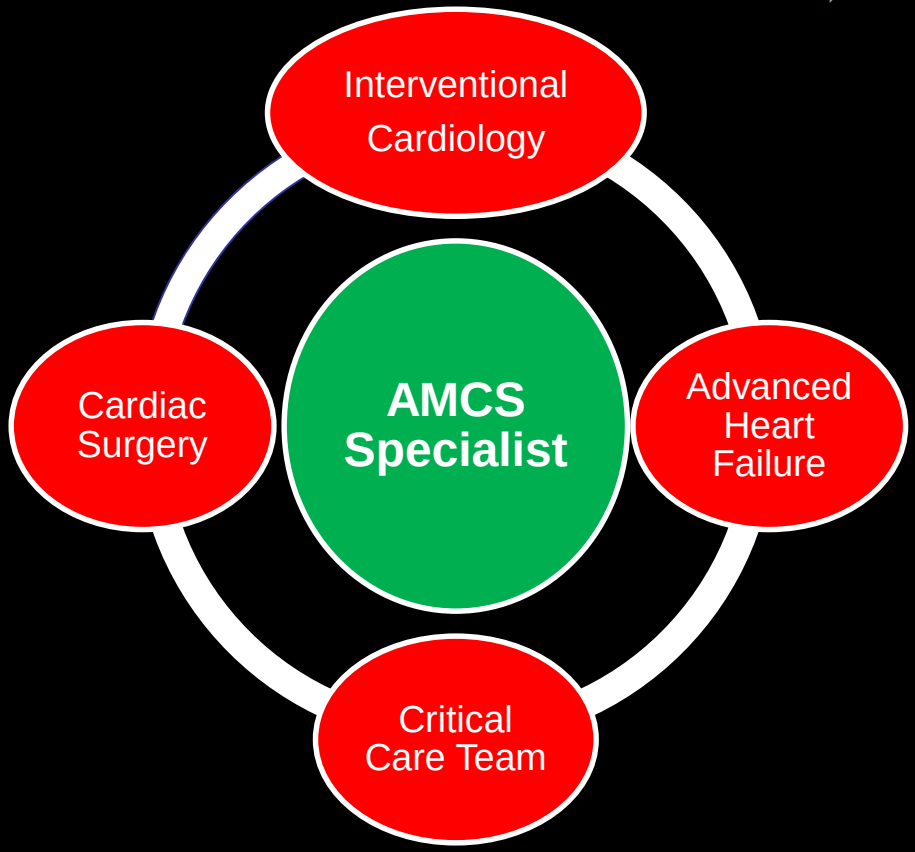
If you manage CG-Shock in 2017 you should be an Acute MCS Specialist

Hemodynamic Problem

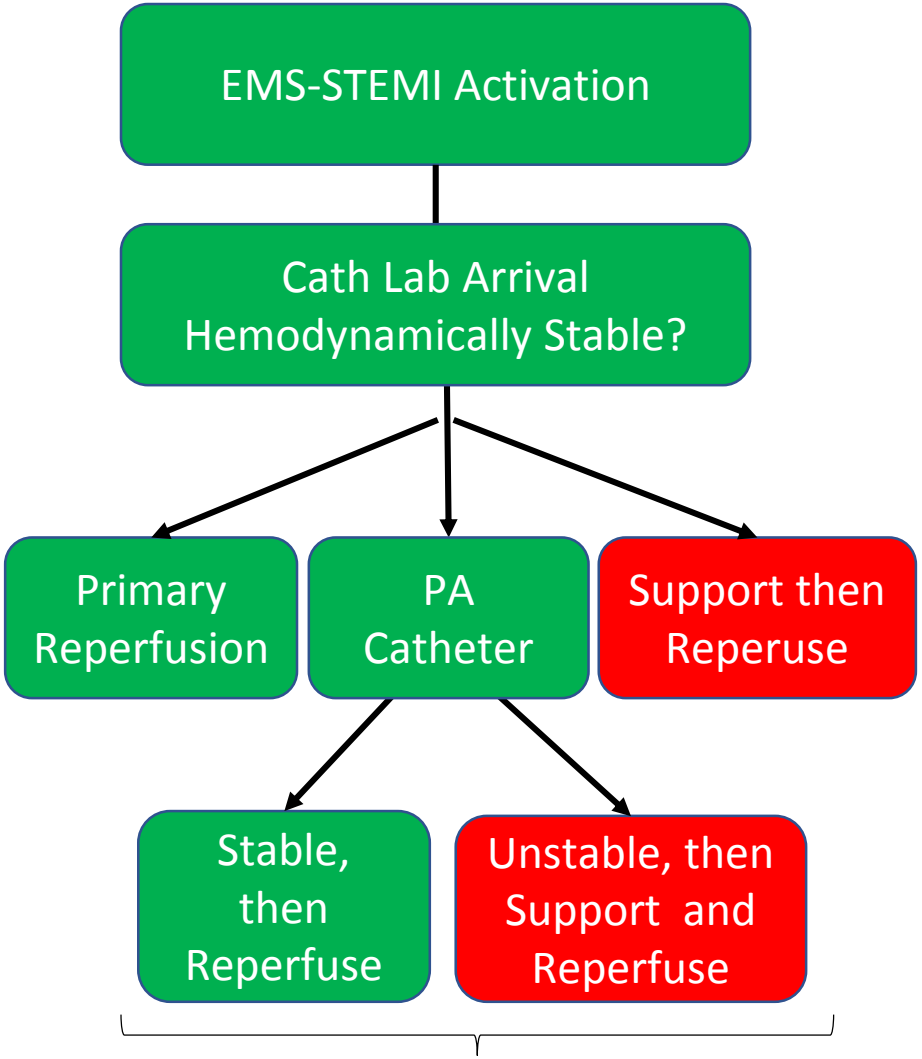
Hemo-Metabolic Problem

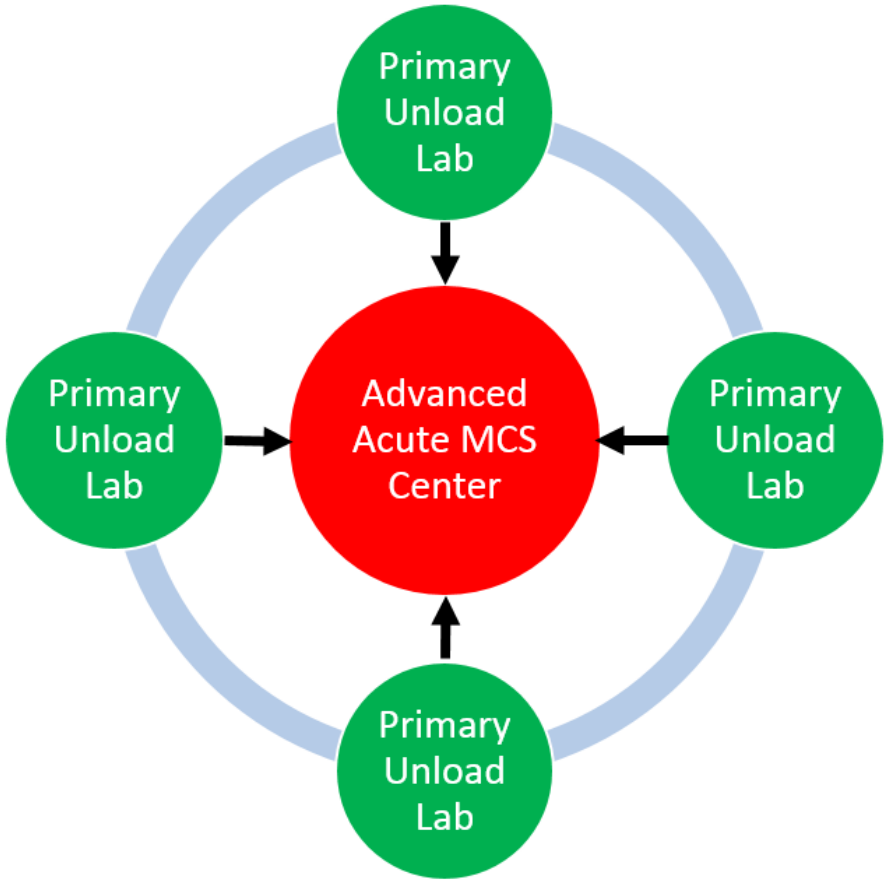
Recovery — Time in Cardiogenic Shock — Death





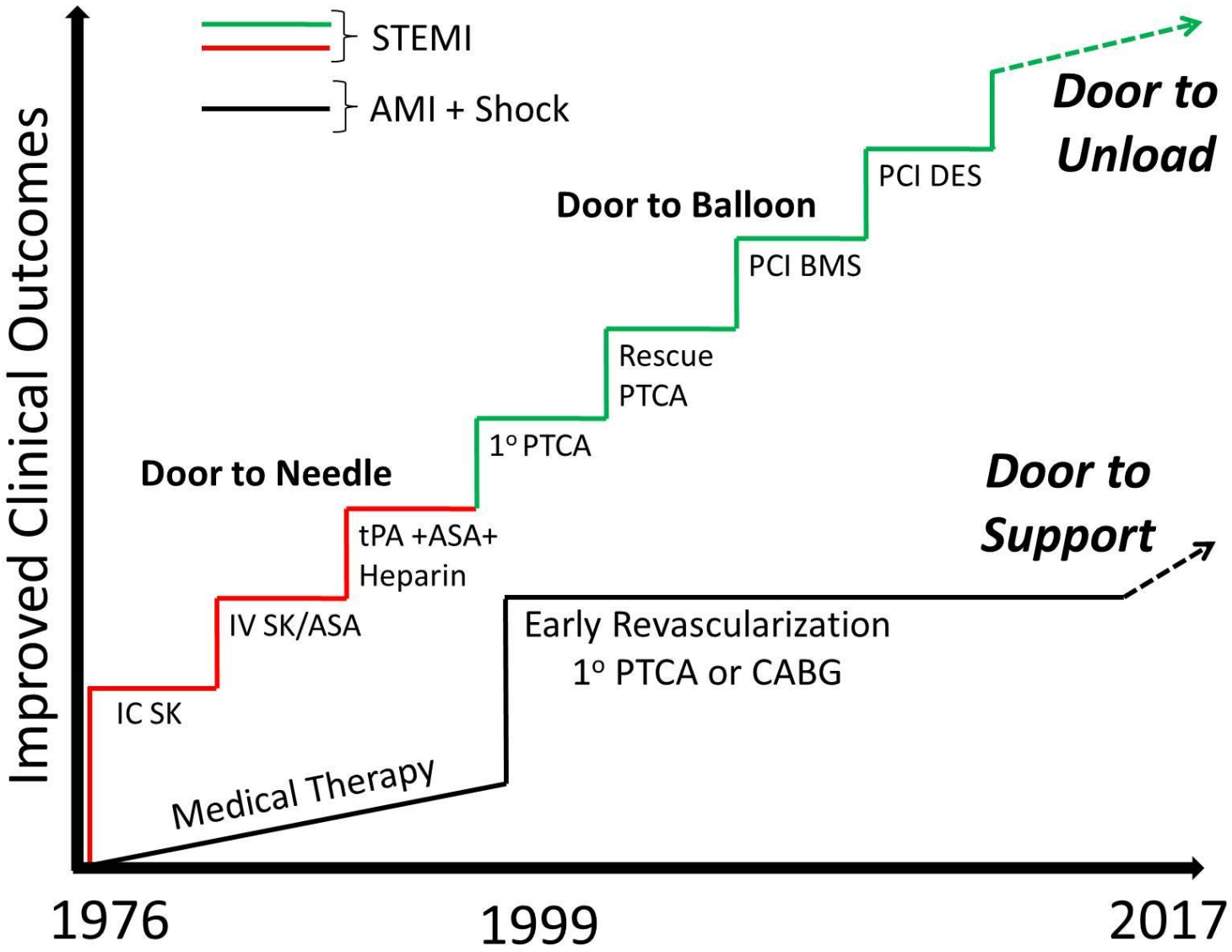
A Hub and Spoke Vision for Primary Unloading In AMI & Cardiogenic Shock





If Unstable after Revasc → Transfer to Adv AMCS Center

Clinical Success with Acute MCS:
Less about the tools, More about *how and when* you use them



Kapur and Davila Eur H J 2017

Thank you

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To Learn More about Acute MCS & Hemodynamics

The Acute MCS Working Group

TEACH TRAINING & EDUCATION IN ADVANCED CARDIOVASCULAR HEMODYNAMICS

CHIP: Hemodynamic Support and Complex PCI

Tufts Medical Center
The CardioVascular Center

Interventional Heart Failure

ACURE

August 24-25, 2017: Barcelona, Spain

Device Therapies for Heart Failure
December 15-16 2017
Berlin, Germany

D-HF