Case - Advanced HF and Shock (INTERMACS 1)

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The CardioVascular Center

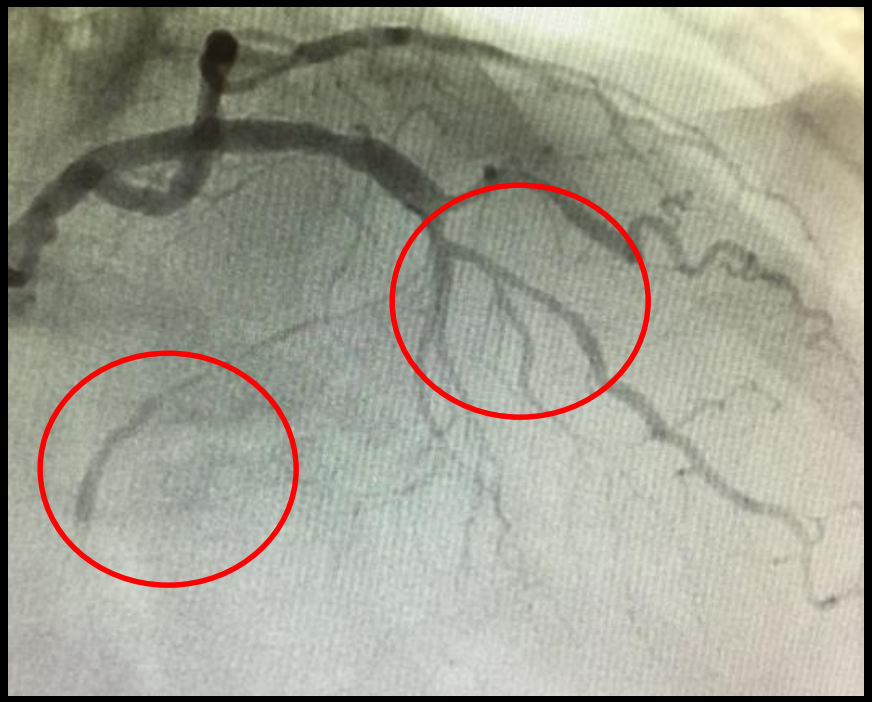
The Acute MCS Working Group

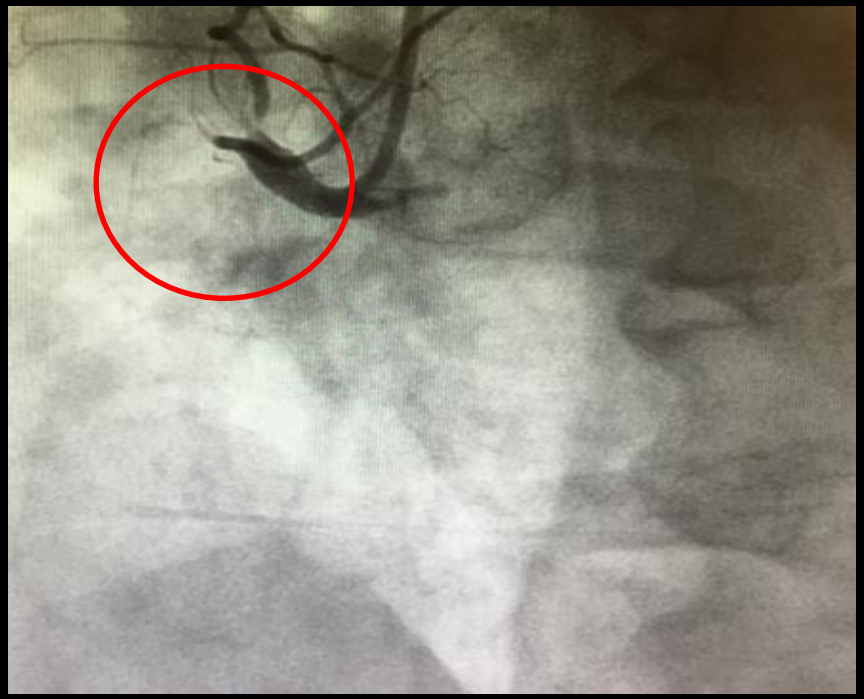
ACC/SCAI
Interventional Cardiology Overview and Board Preparatory Course

Impella Platform for Emergent INTERMACS 0

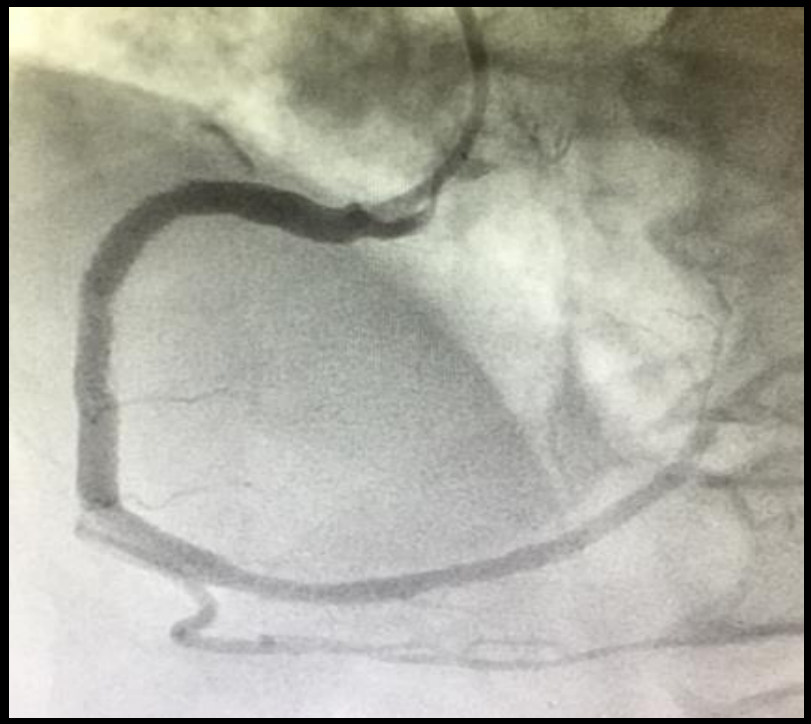
‘This would be like raising Lazarus’

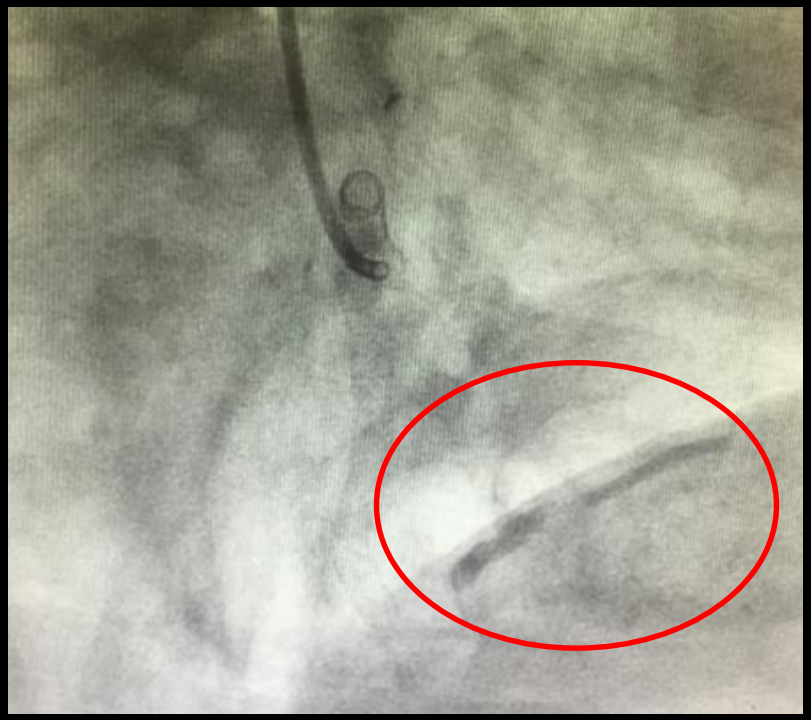
70 year old man with inferior STEMI.
18 hours after symptom onset.
BP 110/80 and HR 90 on Cath Lab arrival.





PCI of the RCA with 4 overlapping BMS.
Distal rPL and rPDA thrombus.
BP 80/60 and HR 110 post-PCI.
Now what?



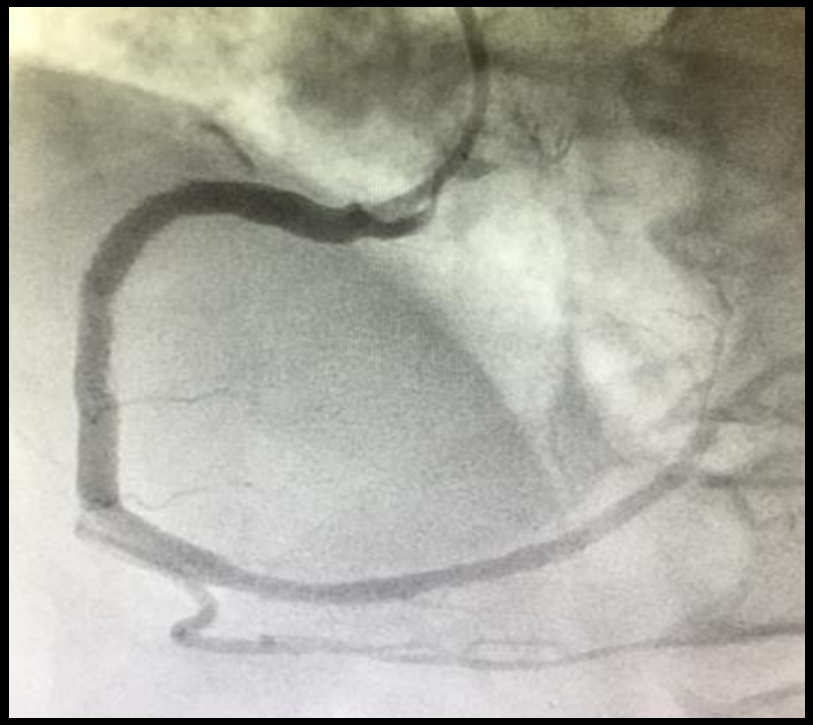


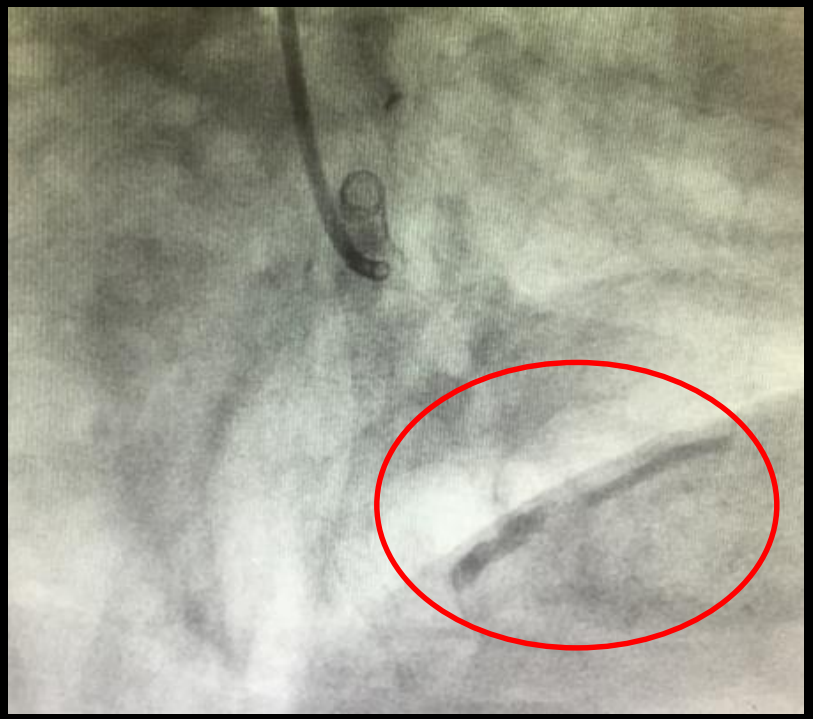
IABP and RHC Inserted

RHC: RA 18, PA 34/28, PCWP 18, MVO2: 38% on IABP support. CPO = 0.42 and PAPi = 0.3

Echocardiogram: Mod-severe RVF and LVEF 40%

Now what?





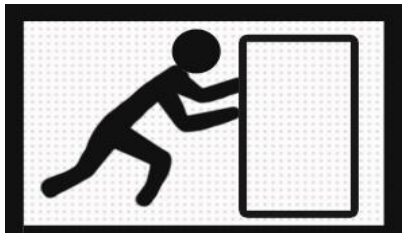
Hemodynamic Formulas to Assess RV Function

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]

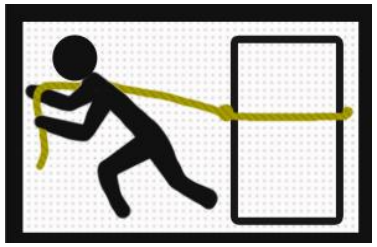
Right atrial (RA); Pulmonary artery (PA); PA systolic pressure (PASP); PA diastolic pressure (PADP); mean PA pressure (mPAP); Pulmonary capillary wedge pressure (PCWP); Right ventricular failure (RVF); Left ventricular assist device (LVAD); Myocardial infarction (MI); Stroke volume (SV)

Kapur, Esposito, and Burkhoff et al Circulation 2017

Not All RV AMCS Devices are Created Equal

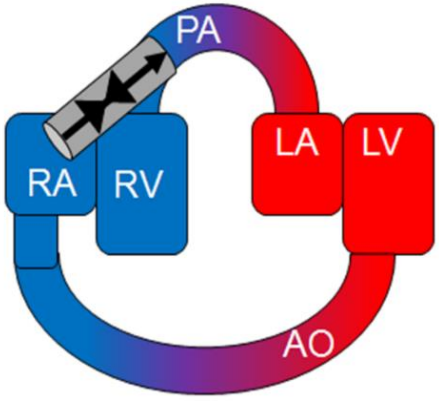


Direct RV Bypass (RA→PA)

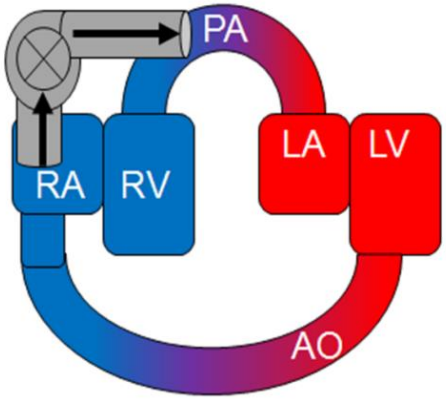


Indirect RV Bypass (RA→AO)

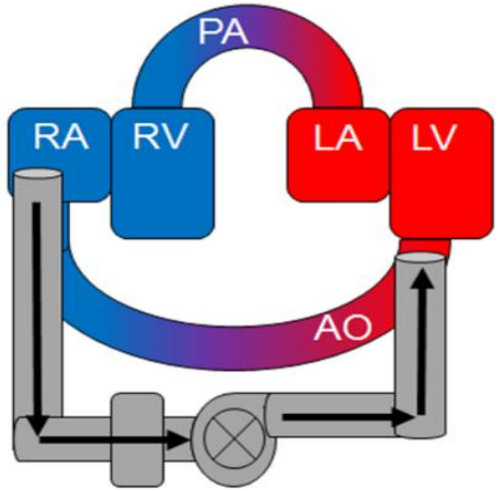
Impella RP



Tandem RVAD



VA-ECMO



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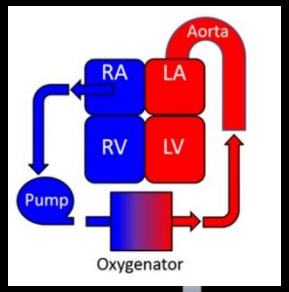
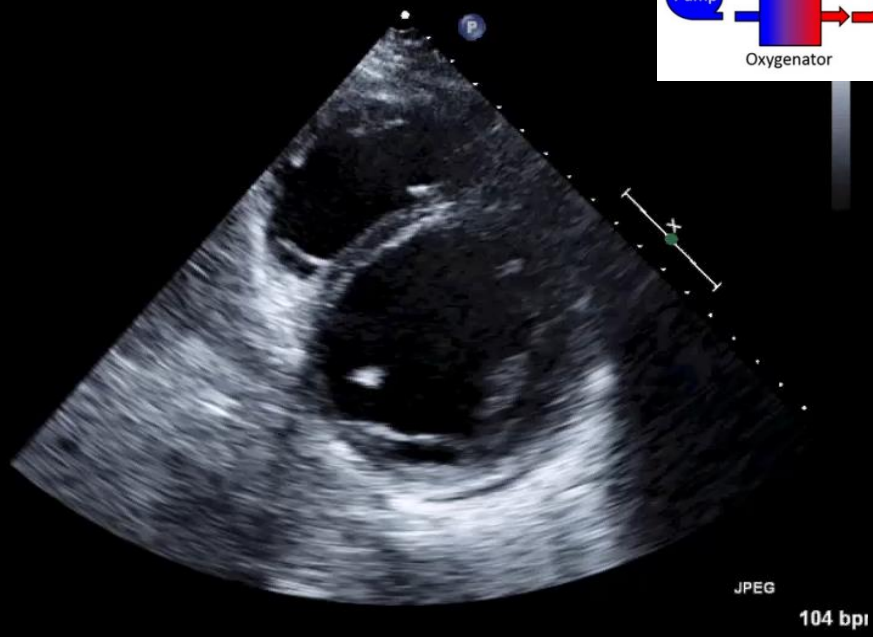


VA-ECMO Initiated
29Fr Venous Inflow
17Fr Arterial Outflow
IABP left 1:1

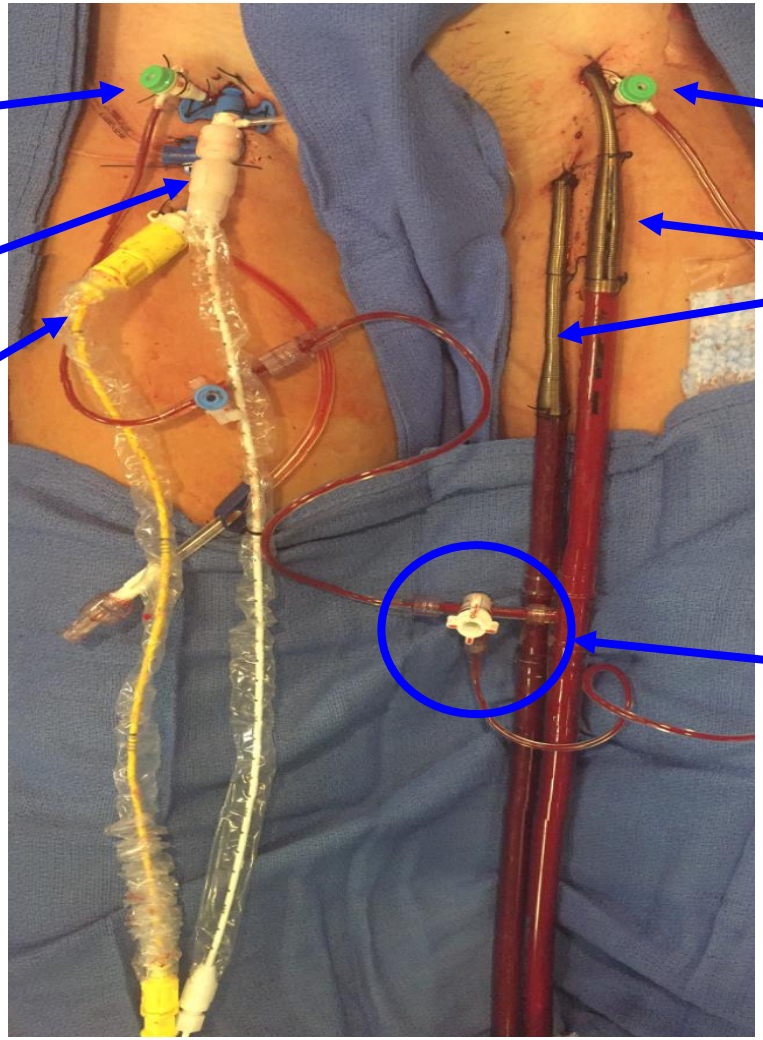
4500 RPM/4.7LPM Flow
MAP improves to 80-90
Patient extubated in 48 hours,
but unable to wean VA-ECMO
due to LV failure with turndowns

Now what?



Echocardiogram during
VA-ECMO turndown

All Acute MCS: Troubleshooting Tip Monitor and Prevent Limb Ischemia



Antegrade Perfusion
6Fr Braided Sheath

Impella CP 14Fr Sheath

PA Catheter 8Fr Cordis

Antegrade Perfusion
6Fr Braided Sheath

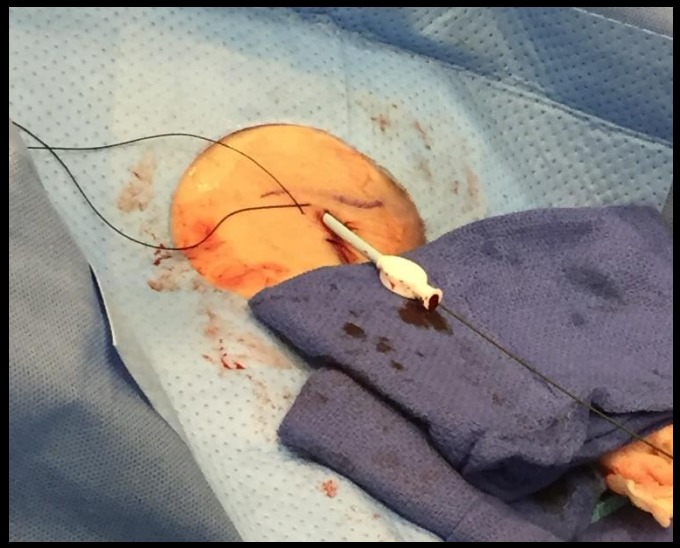
17Fr Arterial Cannula

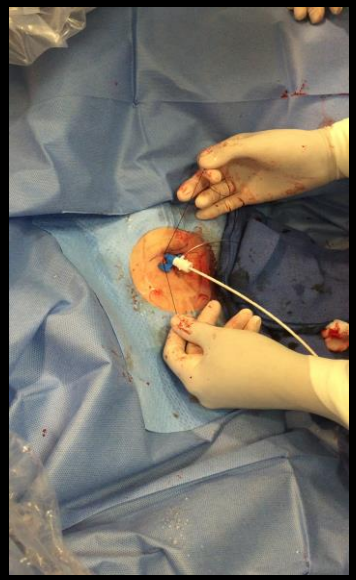
25Fr MS Venous Cannula

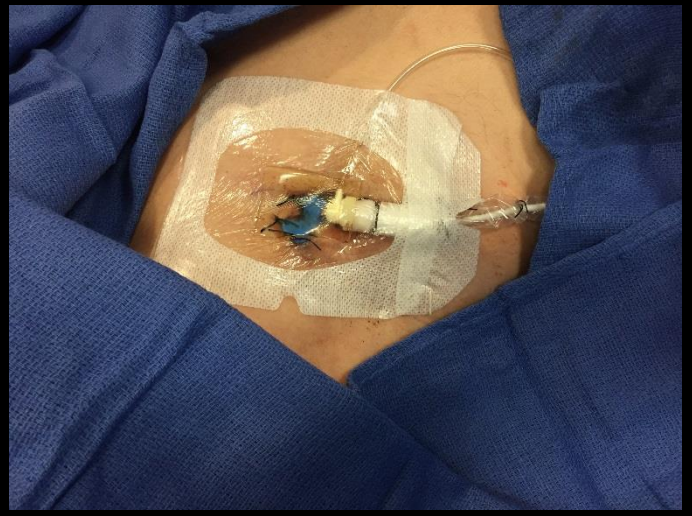
High Pressure 3-Way
+ 2 Male-to-Male
Connectors

Percutaneous Axillary/Brachial Impella CP

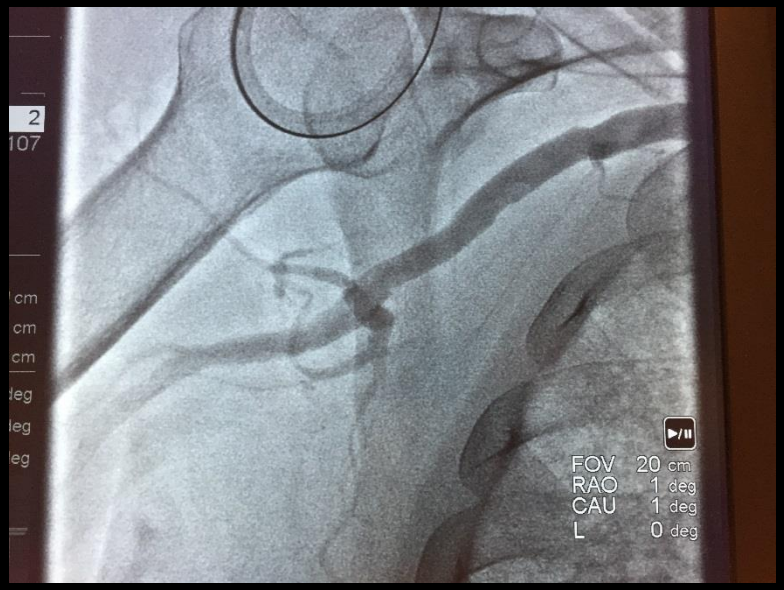
Percutaneous Axillary/Brachial Impella CP

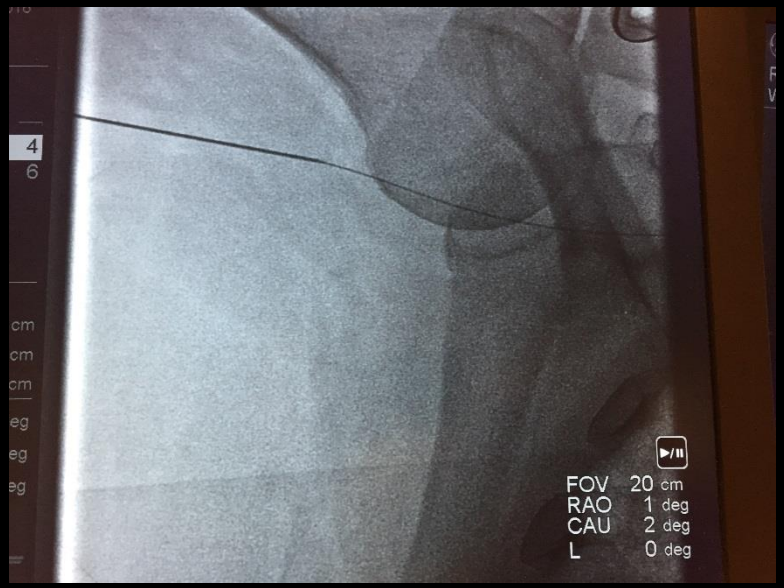


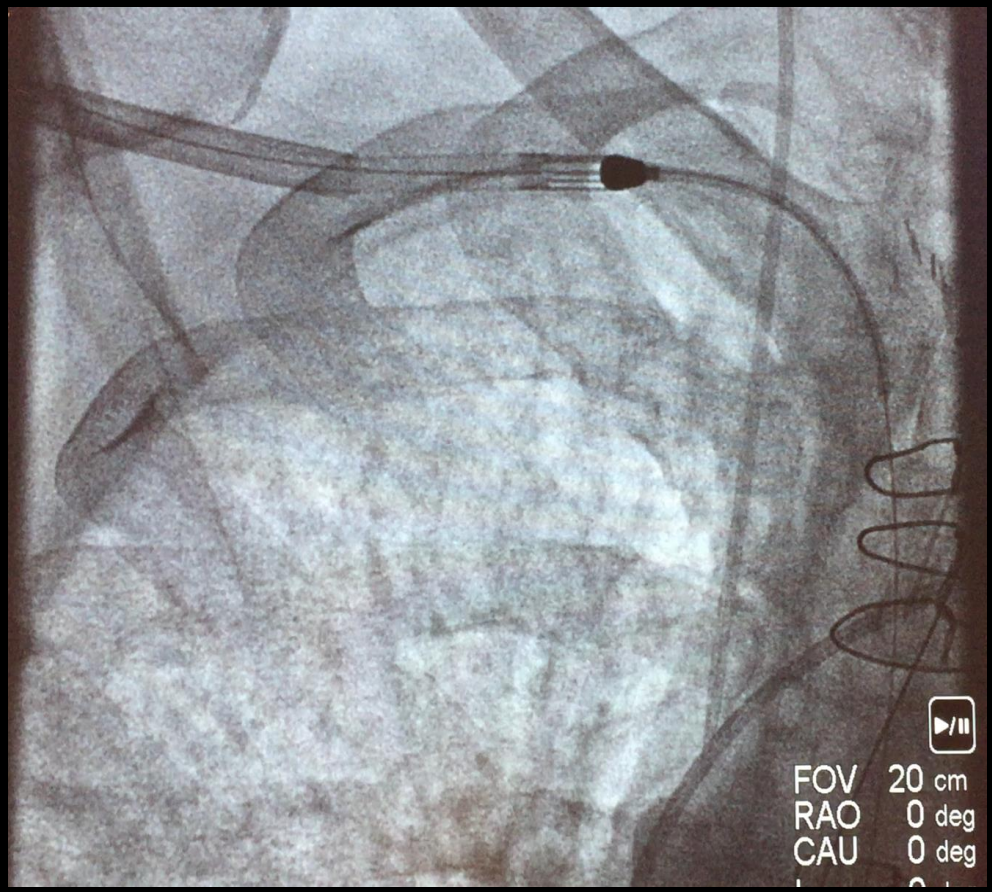




Percutaneous Axillary/Brachial Impella CP





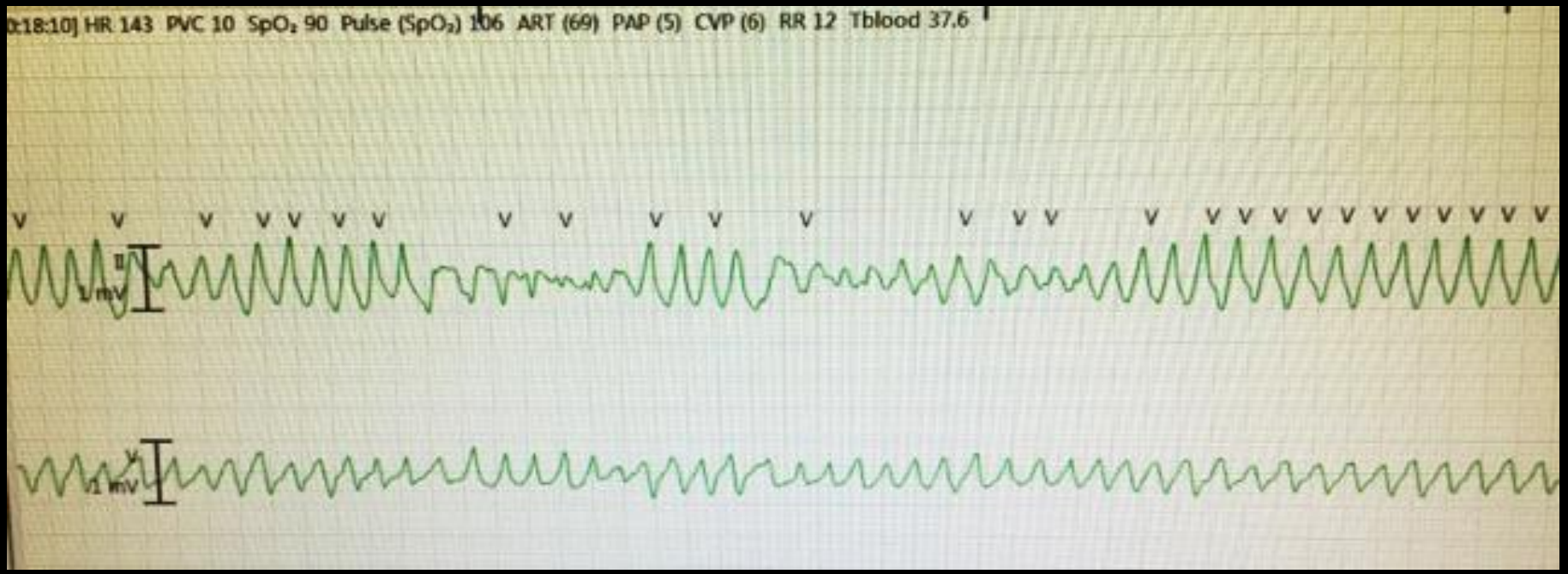


Transferred to Tufts for Advanced HF/BiVAD/OHTx Evaluation

On arrival, severe bleeding from IABP site. MAP 100. HR 90.

RA: 8; PA 20/14; MVO2 63%; FA O2 100%

IABP removed at the beside.



Recurrent VT and VF. Now what?

INTERMACS Profiles : Defining MCS Candidacy

ADULT PROFILES	Current CMS - DT Functional Indication	IV INO*	Official Shorthand	NYHA CLASS Assumed	Modifier option
INTERMACS LEVEL 1	Met	X	"Crash and burn"	IV	TCS A
INTERMACS LEVEL 2	Met	X	"Sliding fast" on inotropes	IV	TCS A
INTERMACS LEVEL 3	Met	X	"Stable" continuous inotrope dependent * Can be in hospital or at home	IV	TCA if hosp FF if home A
INTERMACS LEVEL 4	+ Peak $VO_2 \leq 12$		Resting symptoms on oral therapy at home	AMB IV	FF A
INTERMACS LEVEL 5	+ Peak $VO_2 \leq 12$		"Housebound", Comfortable at rest, symptoms with minimum activity ADL	AMB IV	FF A
INTERMACS LEVEL 6			"Walking wounded"-ADL possible but meaningful activity limited	IIIB	FF A
INTERMACS LEVEL 7			Advanced Class III	III	A only

** Intravenous inotropic therapy only approved for refractory Class IV symptoms*

Adapted from Stewart GC Circ 2011

Have an Exit Strategy Before Initiating Acute MCS

Bridge to Recovery/ Explantation	Device intended for short term support for a condition that is anticipated to reversible
Bridge to Bridge	Device intended for short term support (typically inserted in an emergent situation) until a more permanent device can be implanted
Bridge to Transplant	Device typically intended for short- to intermediate-term support in patients actively listed for transplantation
Bridge to Decision	Device inserted to support a patient in whom the ultimate therapy is not able to be determined at the time of implantation. Device may be used for short or long-term support.
Destination Therapy	Device inserted with the intention of long-term support in patients who are not candidates for transplantation

Have an Exit Strategy Before Initiating Acute MCS
Discuss BTT Status with your Heart Failure Team

Bridge to Transplant Implantation Criteria
(not regulatory)

- Listed for transplant
- Severity of illness that qualifies for Status 1A or 1B listing
- NYHA Class IV

Have an Exit Strategy Before Initiating Acute MCS Discuss DT Status with your Heart Failure Team

Who are Appropriate Candidates for DT Therapy: A Regulatory Definition

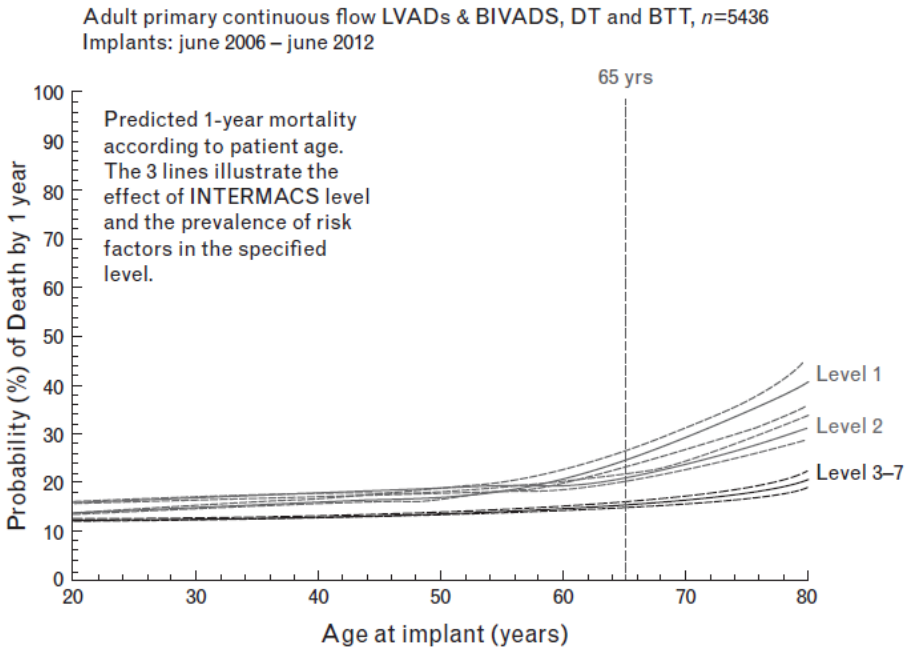
- LVEF ≤ 25%
- Peak VO2 < 14 ml/kg/min (or 50% age/sex predicted)
- And either
  - NYHA Class IIIb-IV symptoms despite optimal medical therapy for at least 45 of the prior 60 days, or
  - Dependence on IV inotropes for ≥14 days, or
  - Dependence on IABP for ≥ 7 days
- Not a transplant candidate

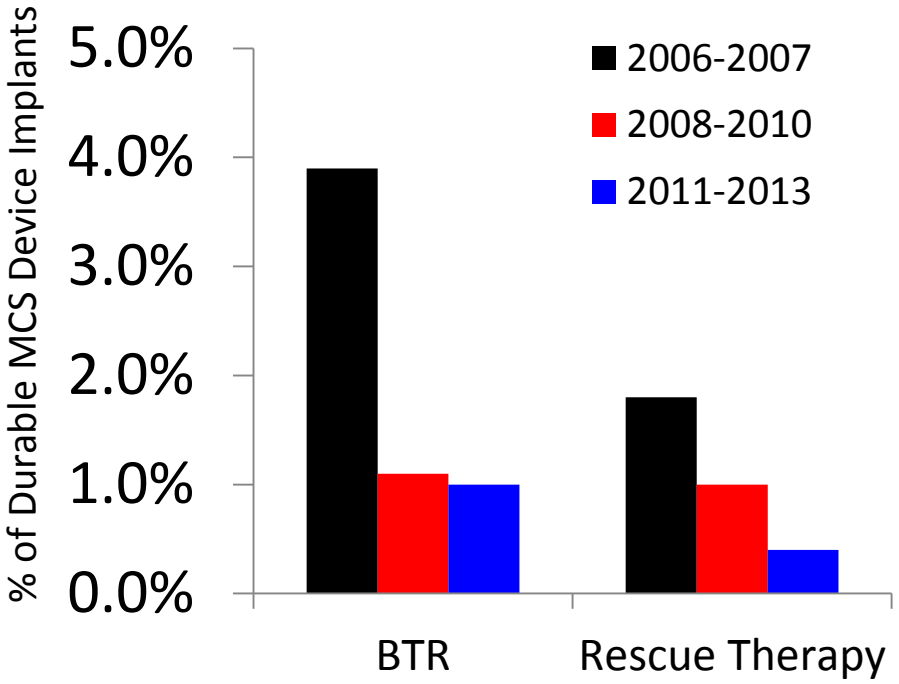
Rogers J. HFSA Board Review 2016

Have an Exit Strategy Before Initiating Acute MCS Discuss VAD Contra-indications

- Mechanical aortic valve without plan to replace or close
- Thrombocytopenia, coagulopathy
- Uncontrolled, systemic infection
- Recent stroke or cerebrovascular disease that increases risk for intra-operative CVA
- Contraindication to systemic anticoagulation or antiplatelet therapy
- Significant right heart failure
- Psychosocial instability (ongoing substance abuse, lack of care giving plan, non-compliance)
- Other condition that limits survival to < 24 months

Durable MCS Devices are Not Commonly Used for Acute Circulatory Support



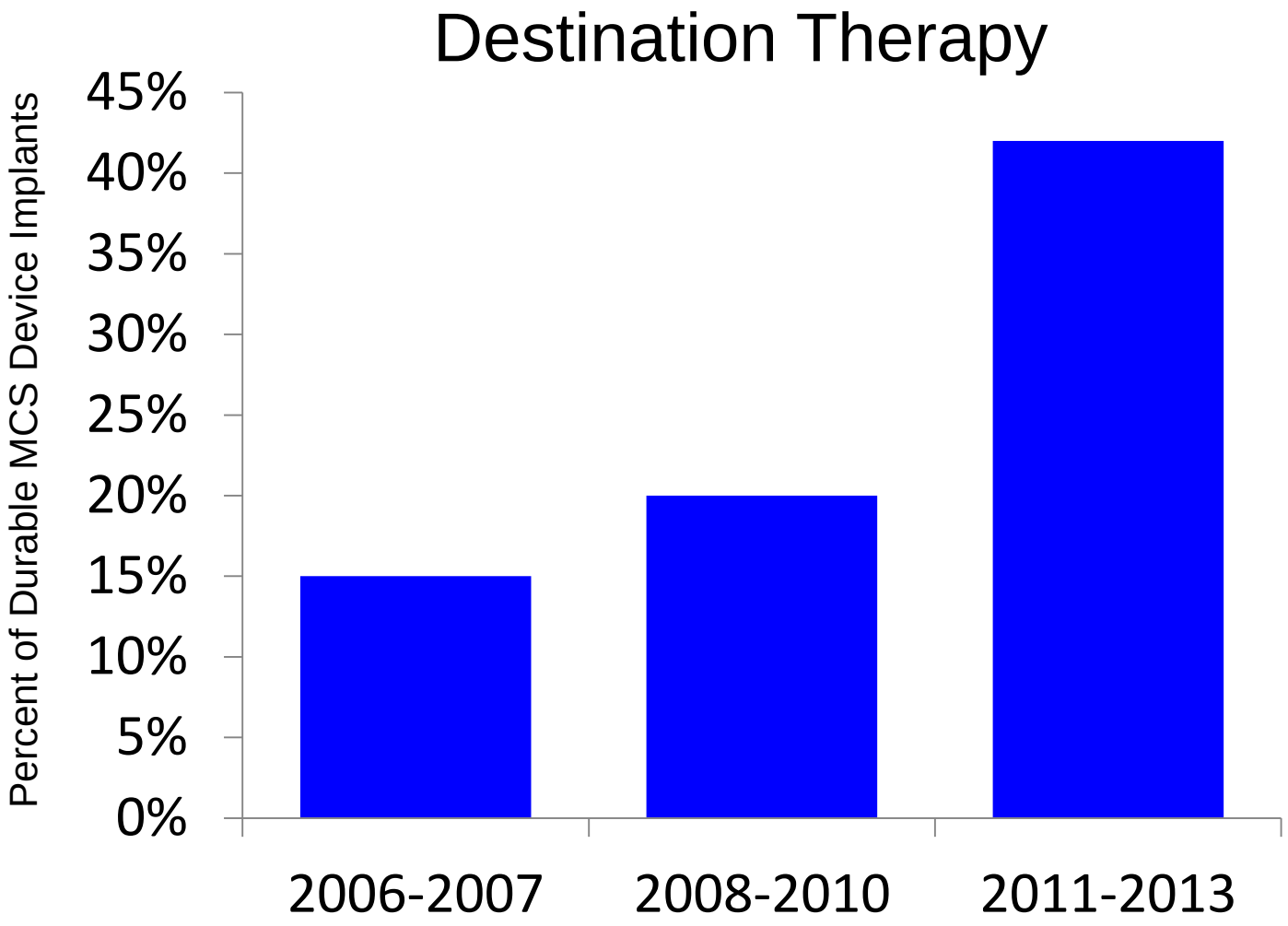


Higher Mortality with INTERMACS 1 and 2 Patients > 65 years of Age

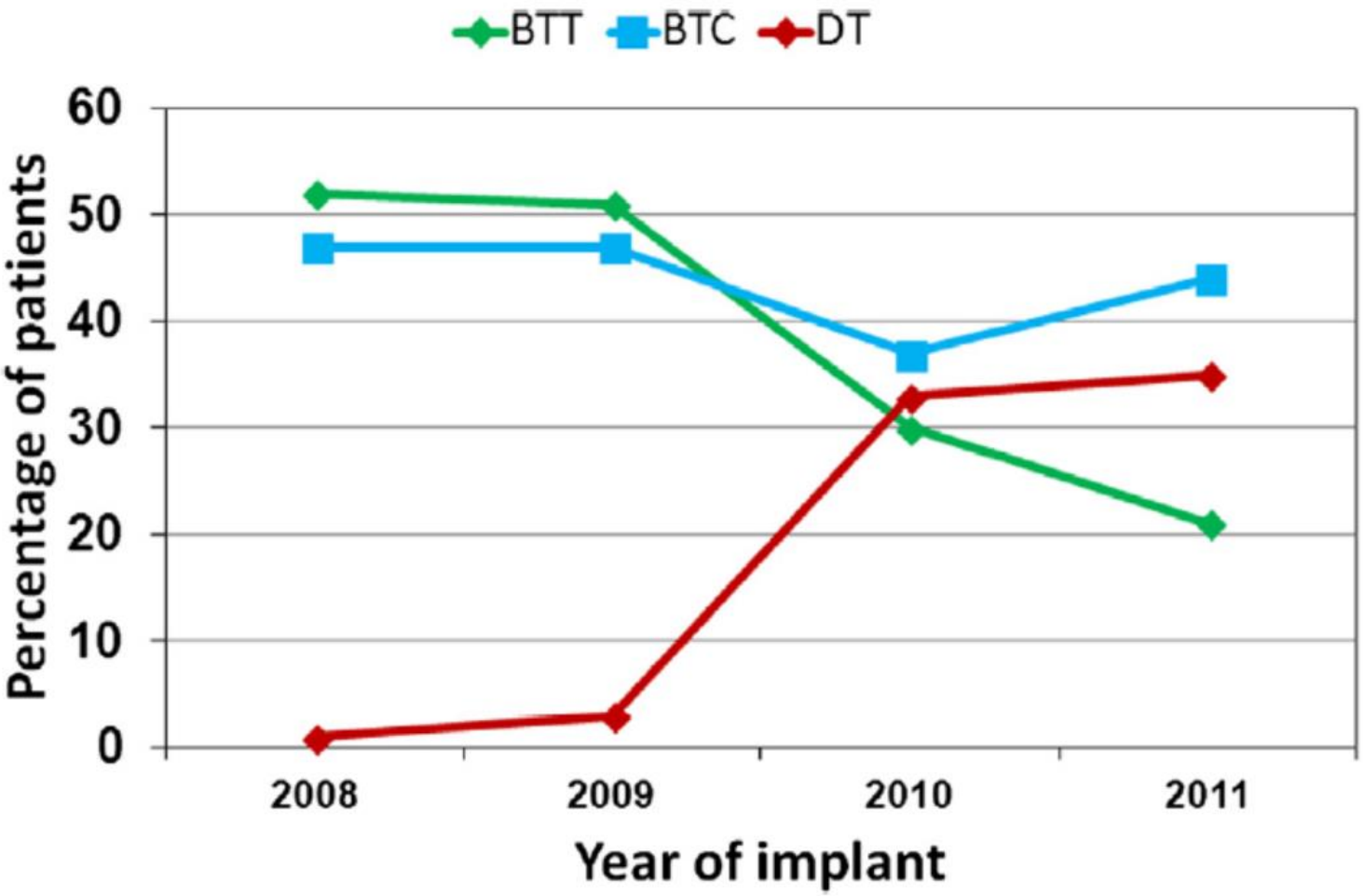
Rare use of Durable MCS as a Bridge to Recovery or Rescue Therapy Option

Adapted from Kirklin et al JHLT 2014

MCS: Go vs No-Go Decision Making



Implant Strategies for Surgical LVADs



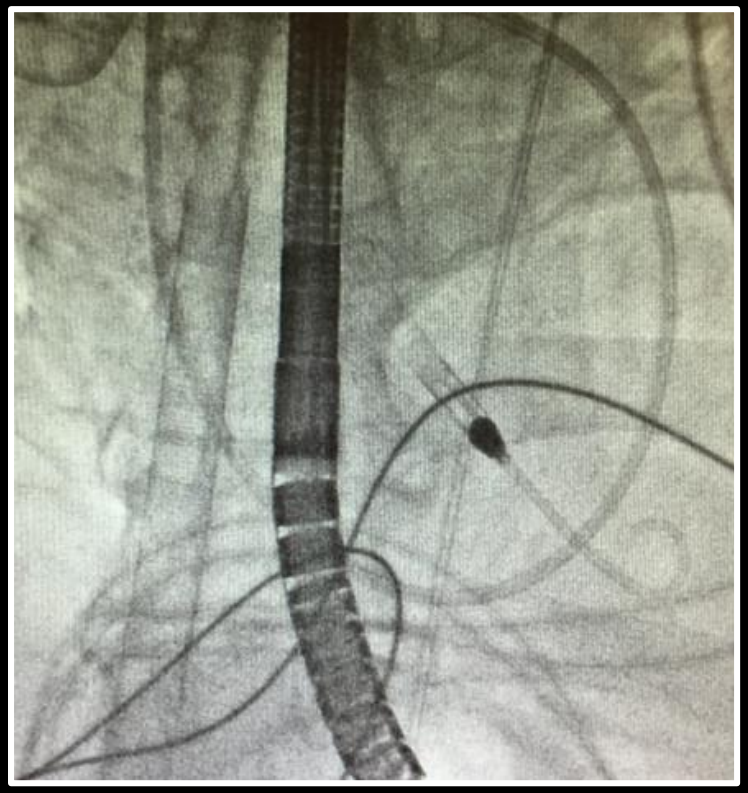
JACC: Heart Failure Vol. 1, No. 5, 2013

DDx for Polymorphic VT during VA-ECMO Support
LV Distention or LAD ischemia?
Get some Hemodynamic Data.

Cath Lab PA Numbers:
RA: 10
PA: 27/15
PCWP: 12
MVO2: 45%

Not due to LV Distention. Plan for LAD PCI.

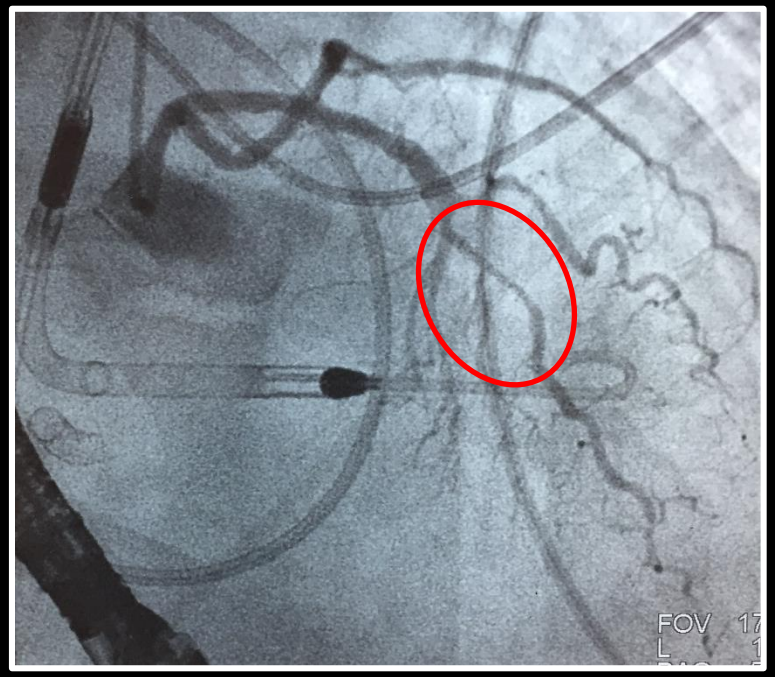
Impella CP inserted for BiV support and LAD PCI

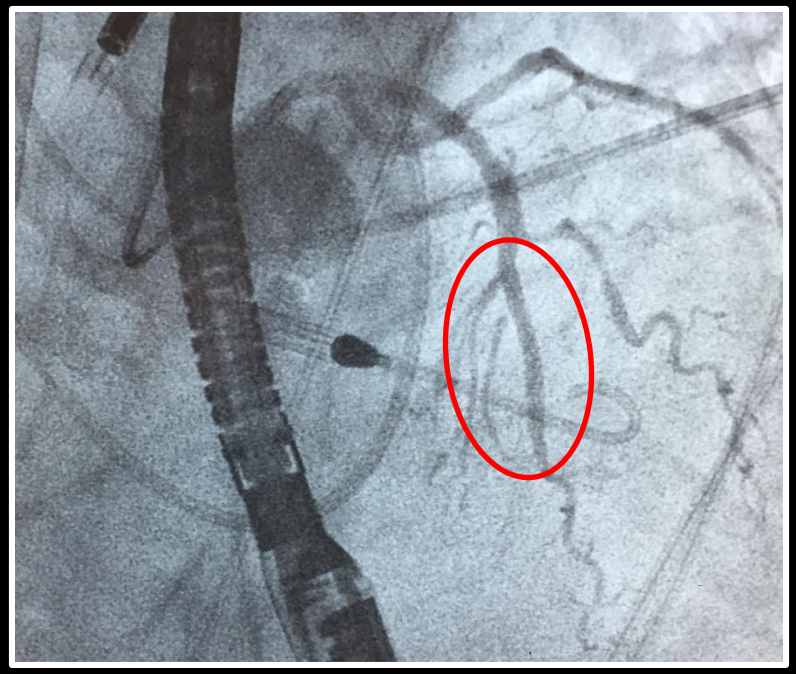


Impella for LV vent should be at P3-P4

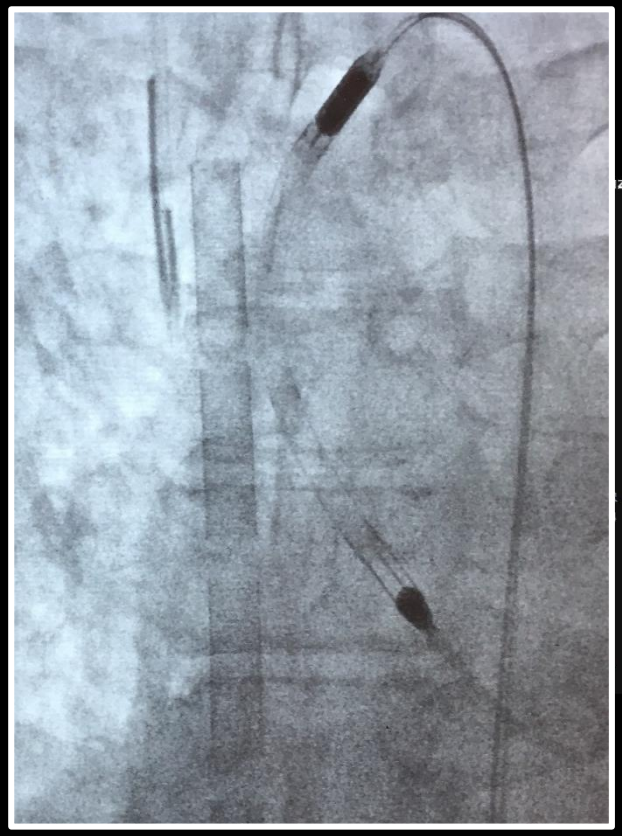
All cf-MCS devices are preload dependent

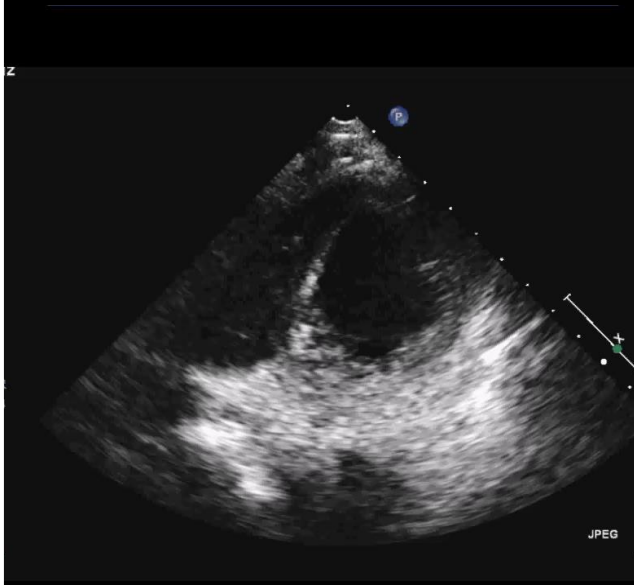
Not so complex LAD PCI Completed on Ec-Pella Support

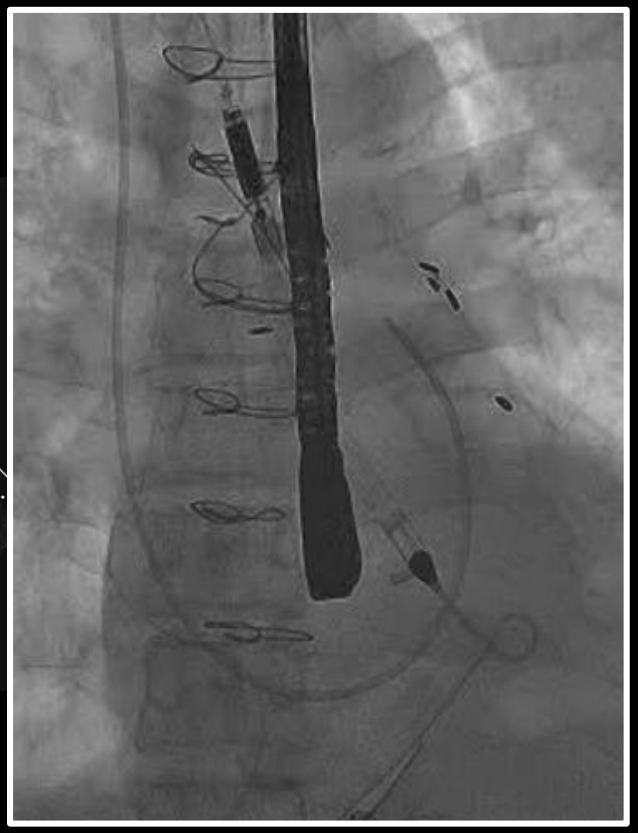




Post-revascularization: VA-ECMO successfully decannulated 3 days later. CP converted to Axillary 5.0

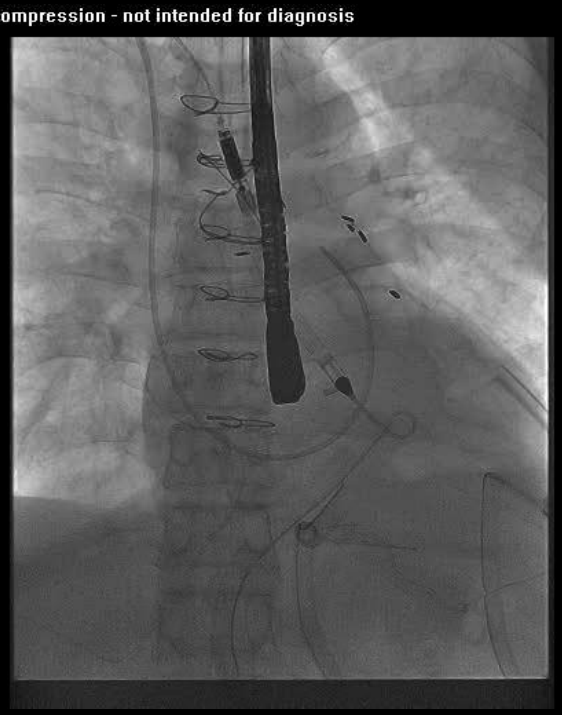


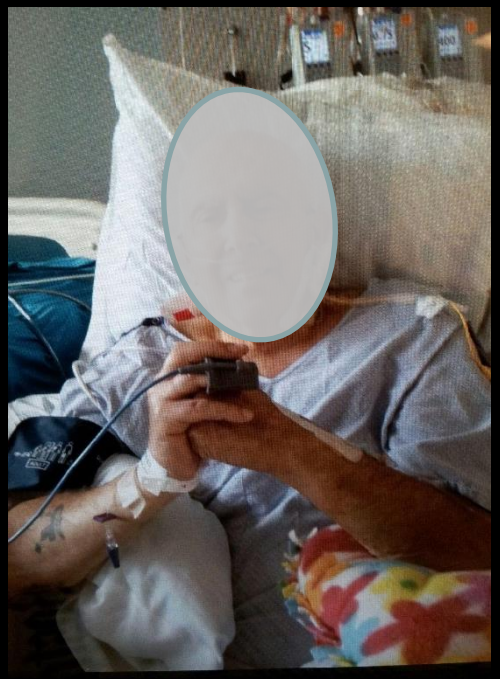




Weaning off from VA-ECMO is easier with a left sided support system

Axillary Impella 5.0 LP
Ambulation, RV Assessment, Recovery





On EcPella Configuration for 1 week.
Tolerating ECMO turndown on Day 5 post EcPella.
ECMO decannulated on Day 11 post-implant
CP removed and Impella 5.0 implanted via left axilla

Impella 5.0 for 5 days. LVEF 40%. RV improved.

RA 8; PA 25/10; PCWP 10; MVO2 68% on P3

Impella 5.0 Removed
Bridged to Recovery
Doing well at 7 months

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