

# Rescue Strategy for Cardiogenic Shock During Complex CHIP PCI



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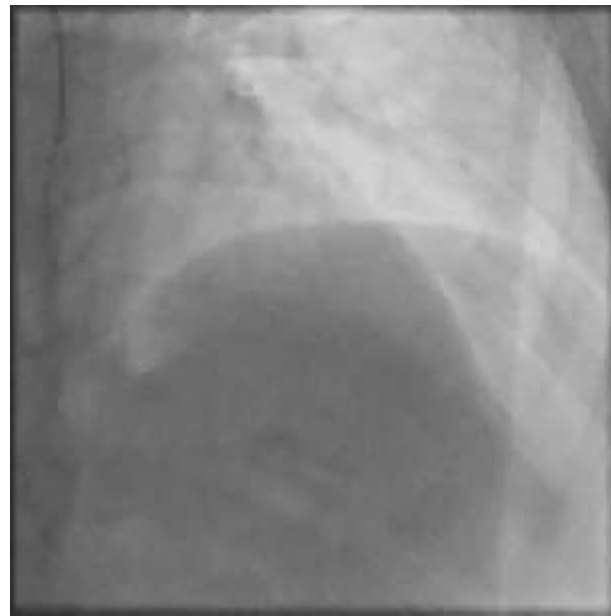
# Disclosures

None

# Case 1

- 43-y/o man
- Anterior ST-elevation

Flow restored



100%  
LAD



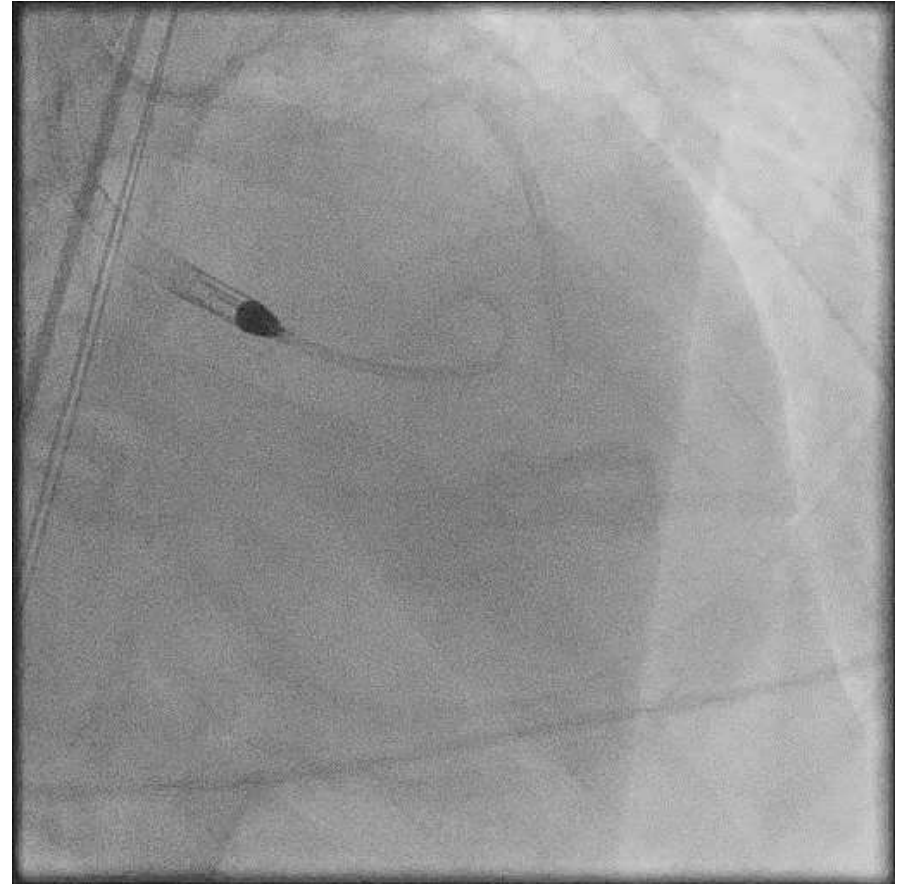
Post-stent  
no reflow,  
shock

# Case 1

- 43-y/o man
- Anterior ST-elevation
- No reflow
- Shock

What to do next?

- Intracoronary vasodilators?
- Vasopressors?
- LV support device?



# How Often do Patients Die *From* PCI?

## Cause of Death Within 30 Days of Percutaneous Coronary Intervention in an Era of Mandatory Outcome Reporting



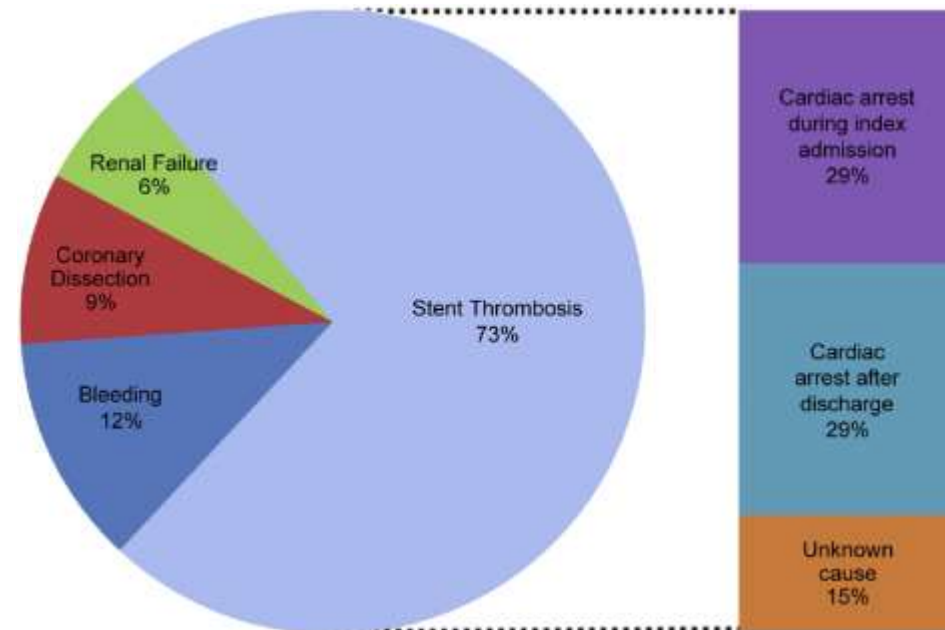
4078 PCI patients

(13.1% STEMI, 1.3% Shock, 1.2% Arrest)

2% mortality rate at 30 days

(7.0% STEMI, 32% Shock, 41% Arrest)

42% Deaths deemed PCI related



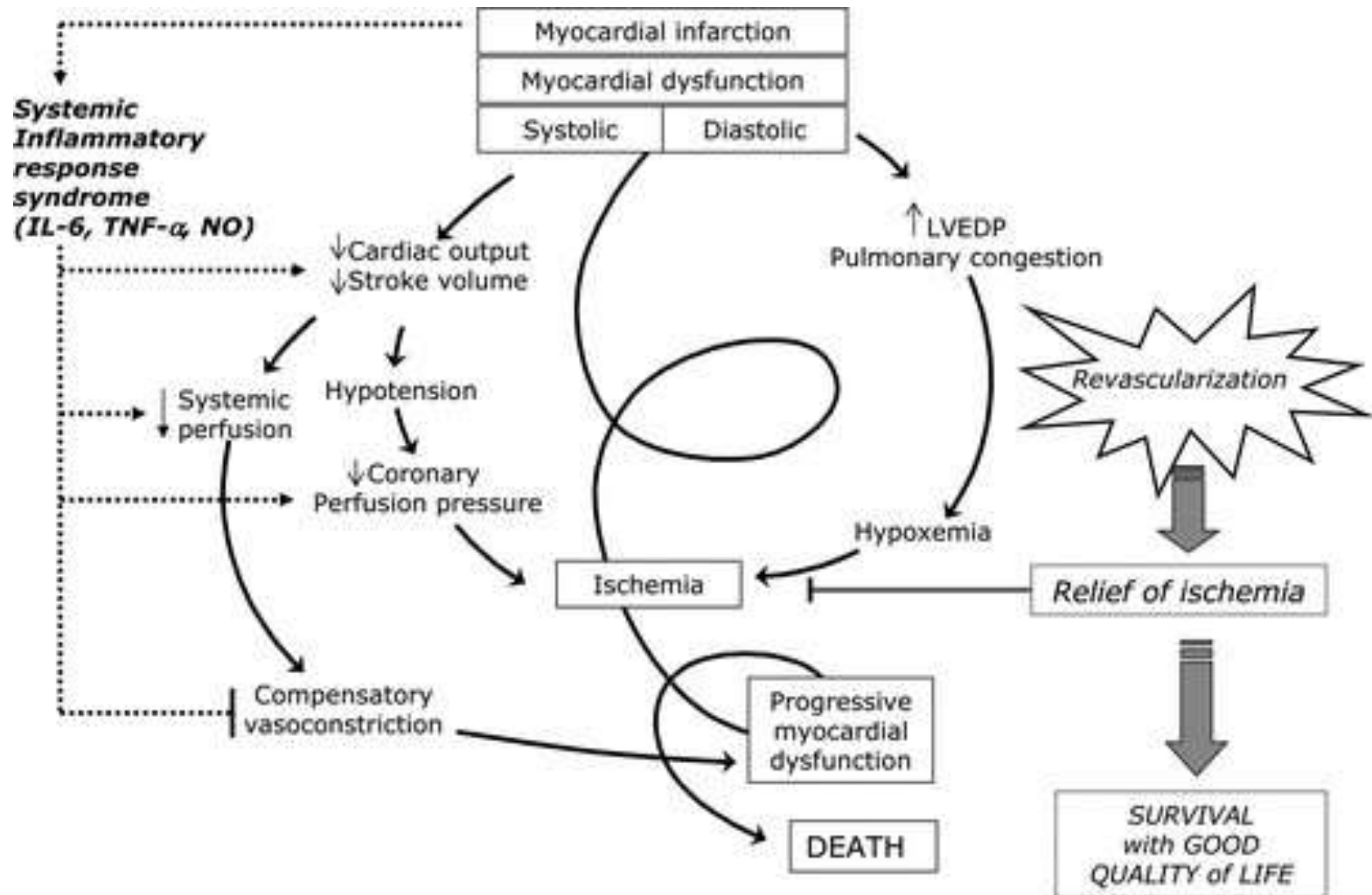
**Aggarwal *et al.* 2013;62:409-15**

# Causes of Hemodynamic Collapse During PCI

- Acute thrombosis
- Severe Ischemia
- No reflow
- Coronary Dissection
- Arrhythmia/Arrest
- Acute Hemorrhage
- Coronary Perforation/Tamponade
- Air Embolism



# Shock spiral

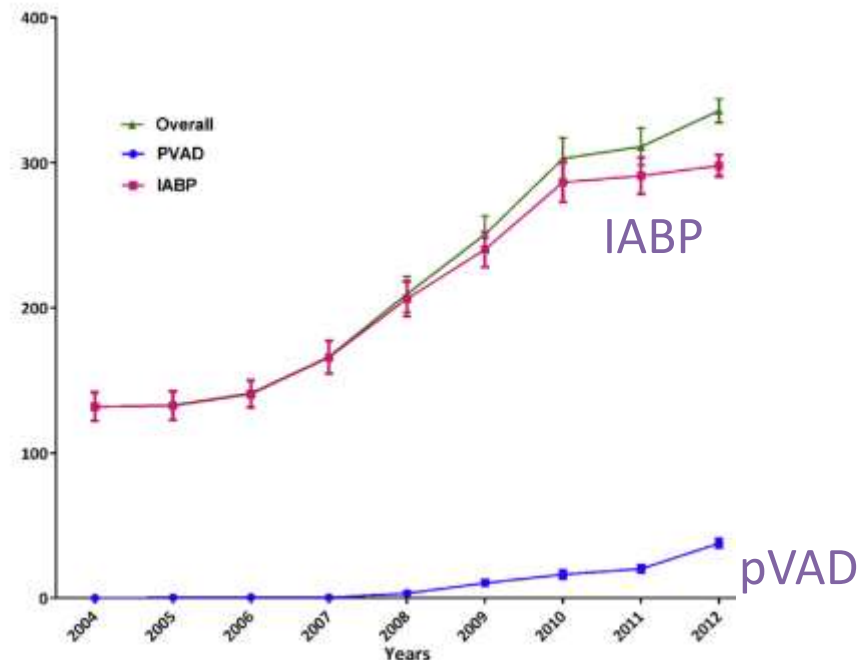
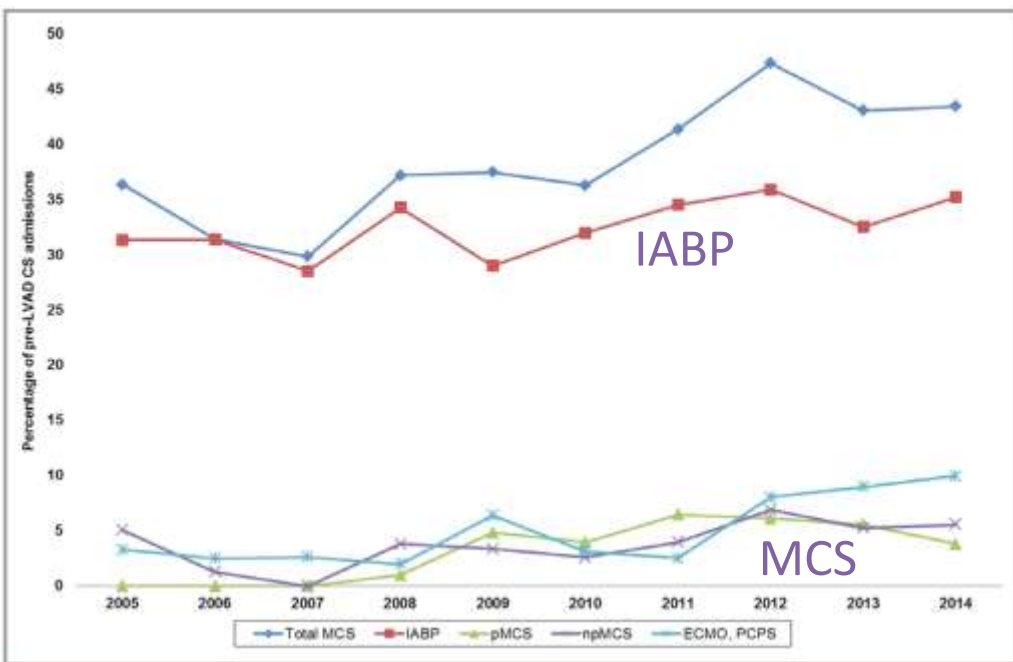


Harmony R. CIRCULATIONAHA.106.613596

# Use of MCS during PCI on the Rise in the US

## Advanced Heart Failure

## PCI



Vallabhajosyula *J Am Heart Assoc.* 2018;7: e010193

Khera *Am J Cardiol* 2016;117:10–16



*The* **NEW ENGLAND JOURNAL of MEDICINE**  
Intraaortic Balloon Support for Myocardial Infarction  
with Cardiogenic Shock  
for the IABP-SHOCK II Trial Investigators

600 patients with AMI and shock

IABP vs. none

30 day death: 39.7% vs. 41.3% (95% CI 0.79-1.17; P=0.69)

2012;367:1287-96.

# Percutaneous Mechanical Circulatory Support Versus Intra-Aortic Balloon Pump in Cardiogenic Shock After Acute Myocardial Infarction

JACC  
JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY

## IMPRESS in Severe Shock

48 patients with AMI and severe shock

Impella CP vs. IABP

Primary endpoint: 30-day mortality

46% vs. 50% (HR 0.96; 95% 0.42-2.18;p=0.92)

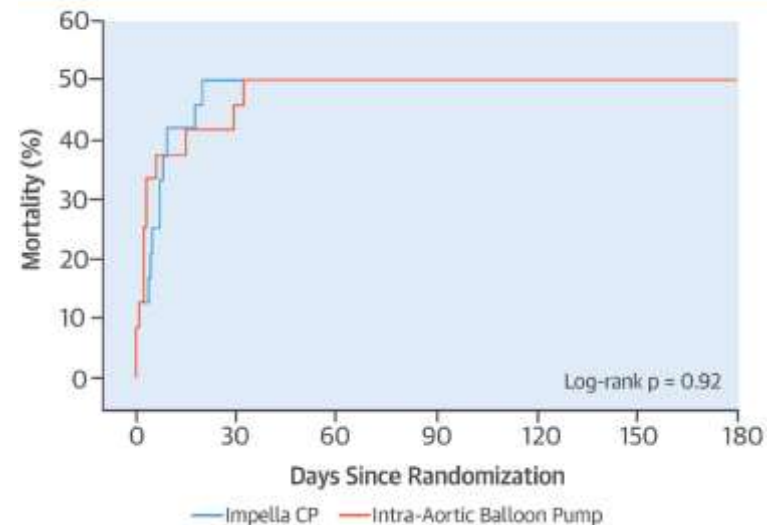
A. Impella CP



B. Intra-Aortic Balloon Pump



C. All-cause Mortality, ≤6 Months



Ouweneel et al 2017;69:278-87

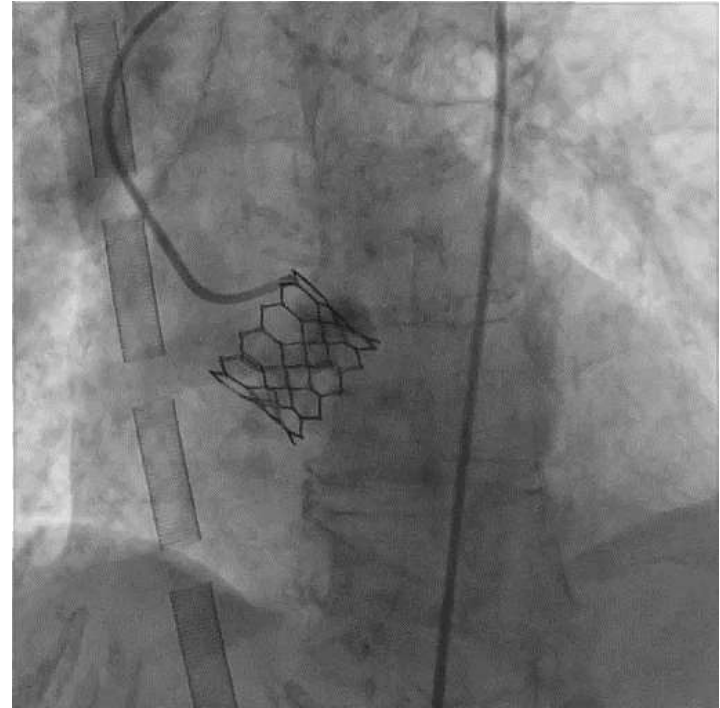


**Absence of evidence is  
not evidence of absence.**

Carl Sagan

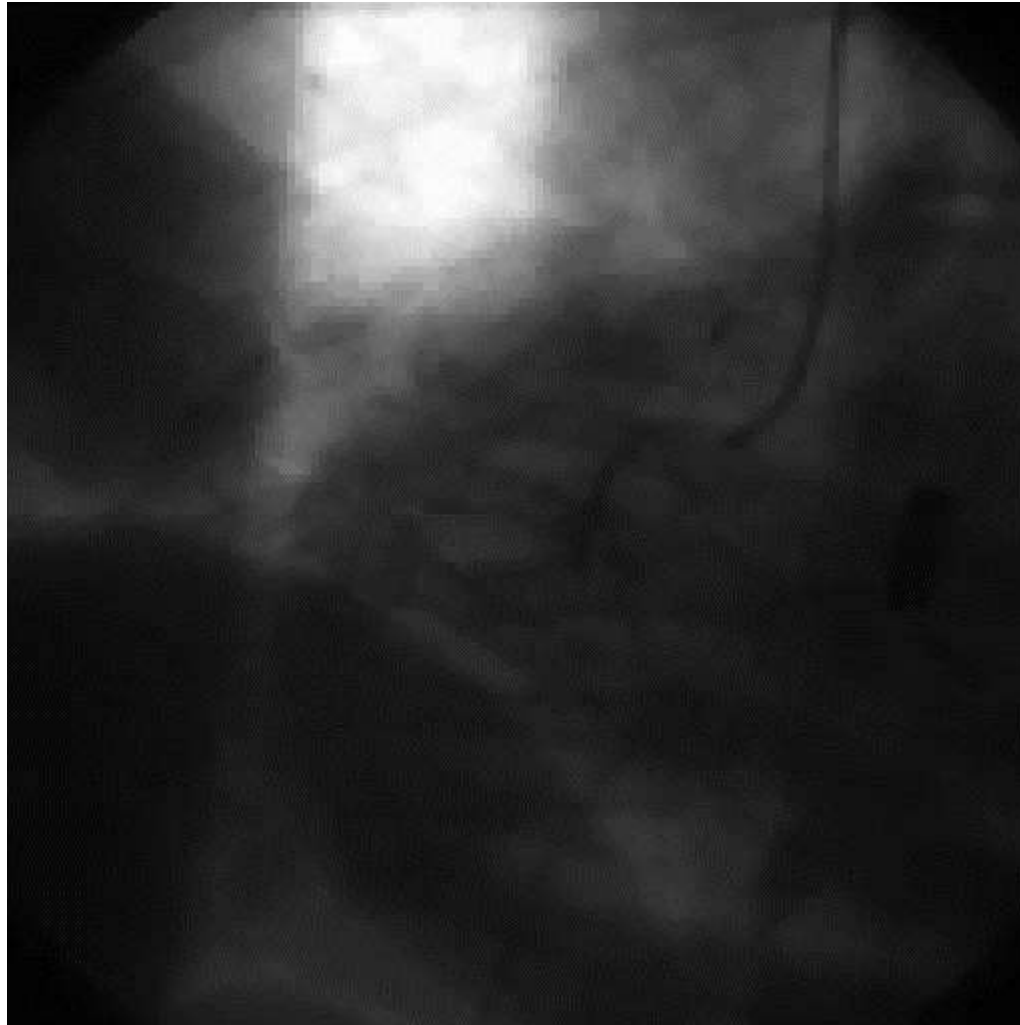
## Case 2

- 86 y/o woman
- Severe AS
- Incessant V-fib post-TAVR





We've All Been Here Before



# Automated CPR Machines



LUCUS



AutoPulse

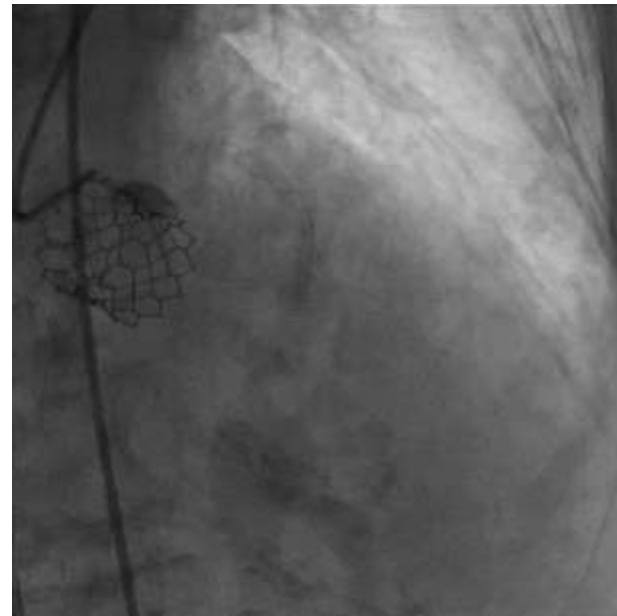
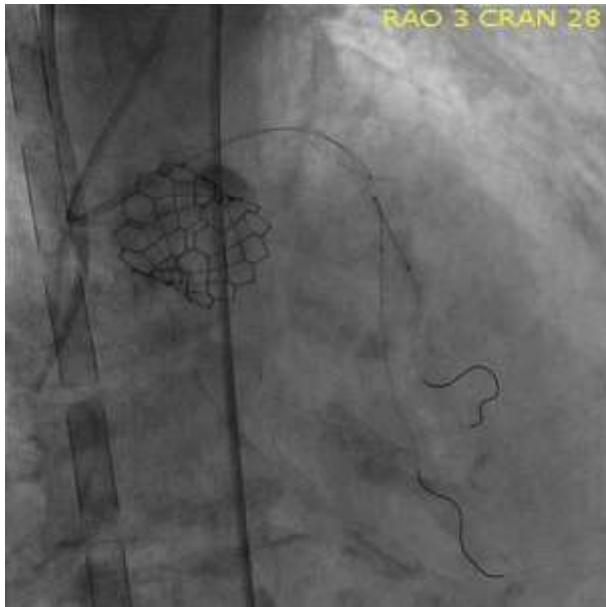


Lifeline ARM



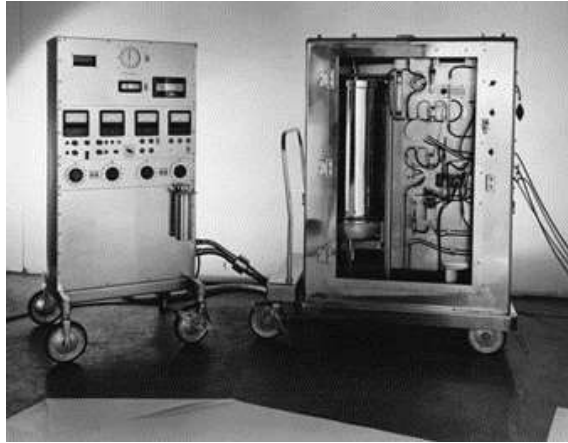
## Back to Case 2

- Immediate ECMO
- Thrombectomy, PCI
- ECMO off 1 hour later
- LVEF 52% at 1 week



# Extracorporeal Membrane Oxygenation (ECMO)

Heart Lung Machine 1953



ECMO 1971



In-hospital ECMO Circuit

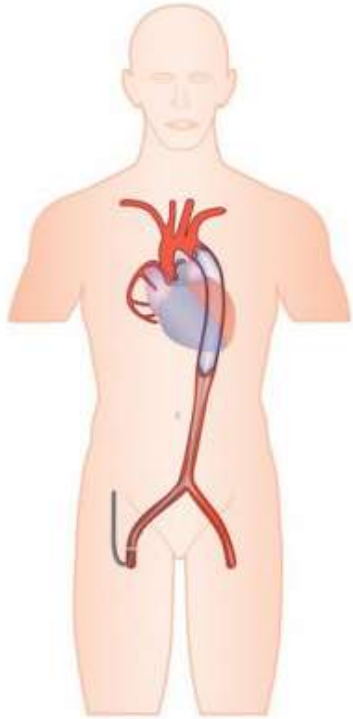


Portable ECMO Unit

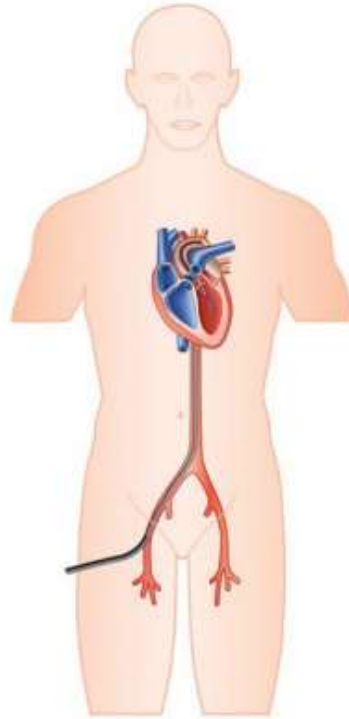


# Comparing LV Support Devices

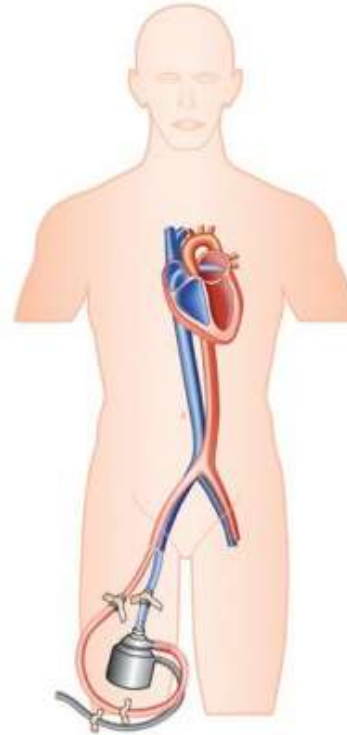
IABP



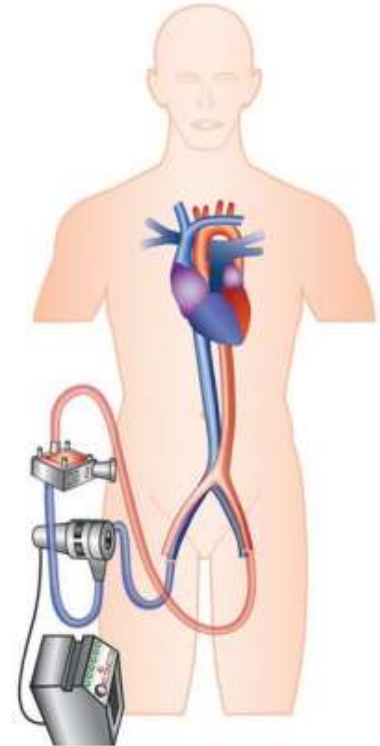
Impella



TandemHeart



ECMO



# Comparing LV Support Devices

	IABP	Impella	ECMO	Tandem Heart
Level of Support	+	+++	+++	+++
Cannula size	+	++	+++	+++
Cost	+	+++	++	+++
Anti-coagulation	+	++	+++	+++
Direct RV Support*	-	-	+	-
Oxygenation**	-	-	+	-

\*Impella and Tandem Heart have dedicated RV devices

\*\*Tandem Heart can be used as an ECMO circuit

# How to Support? The Case for:

## IABP

### PRO

Quick  
Easy  
Cheap  
Smaller

### CON

Modest Support

## ECMO

### PRO

Quick (Bedside)  
Best for Arrest  
Bi-V Support  
Oxygenation

### CON

Large  
Need Local Expertise  
May Need LV Vent

## Impella

### PRO

Quick  
Easy  
Powerful\*

### CON

Large  
Expensive

## Tandem Heart

### PRO

Powerful  
Versatile

### CON

Transseptal  
Large  
Expensive  
Need Local Expertise

\*3 sizes/flow capacities

# Factors in Choosing an LV Support Device

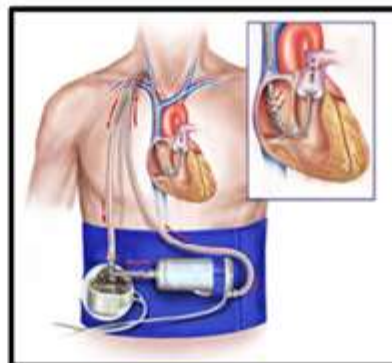
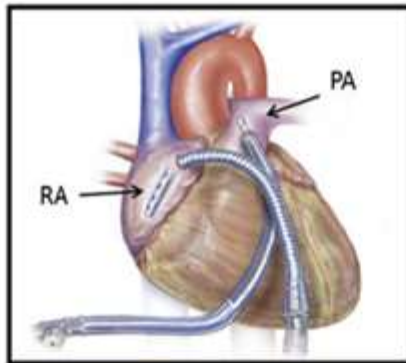
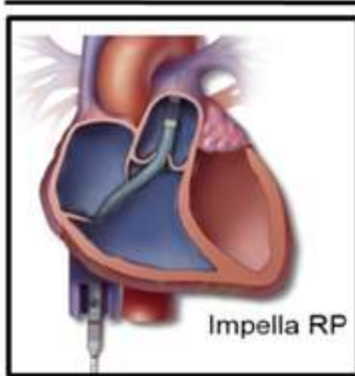
- Rhythm and blood pressure
  - If patient is “dead” go straight to ECMO
- Vascular access
- Oxygenation status
- RV function
- Severe valve lesions (AS, AI)
- Local equipment and expertise
- Cost considerations



# RV Support Devices

## Direct RV Bypass

## Indirect RV Bypass



Impella RP

Tandem RVAD

Protek Duo

VA-ECMO

Axial Flow

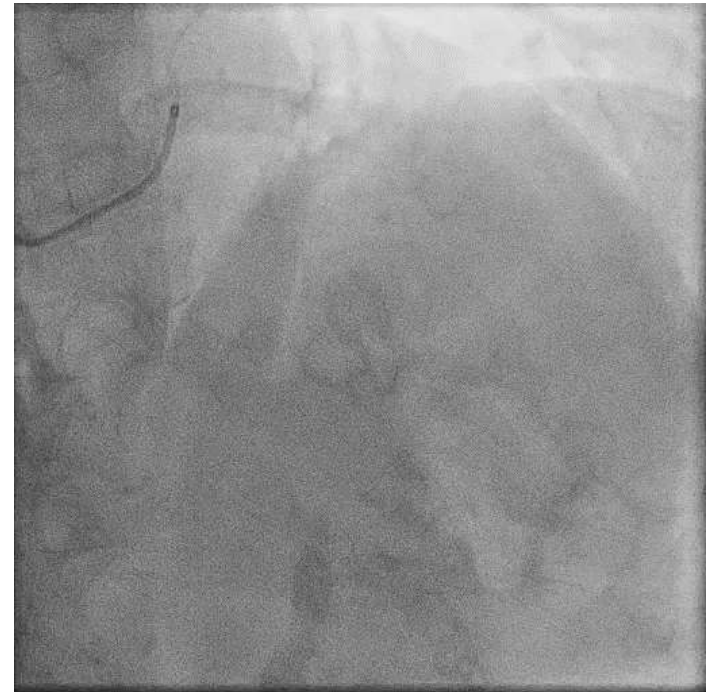
Extracorporeal Centrifugal Flow

# Case 3

- 89 y/o woman
- NSTEMI

90% Proximal LAD lesion

Lets do PCI!



## Case 3

- 89 y/o woman
- NSTEMI

Guide  
shot

Chest pain  
ST-elevation  
Hypotension

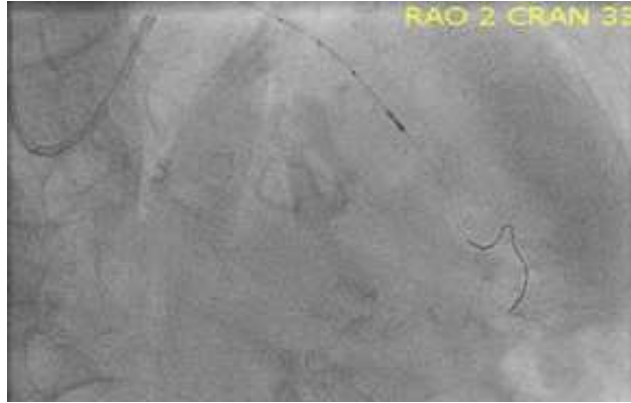


What to do next?

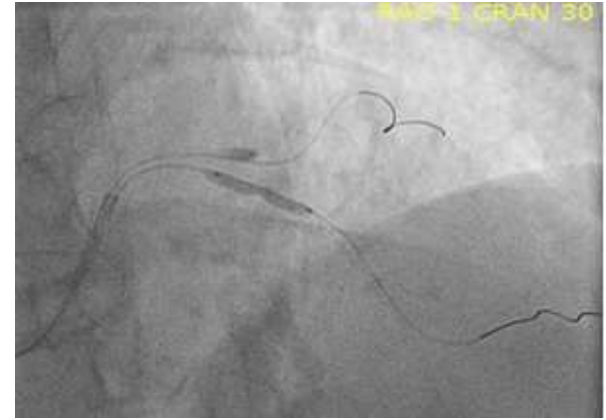
- Call for more help
- Immediate femoral arterial and venous access
- Low dose dopamine

# Case 3

## IVUS confirms true lumen



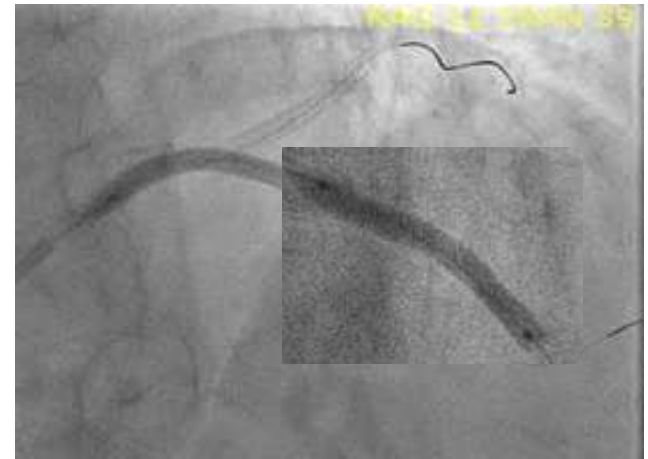
## Pre-dilation LAD



## Stent Ostial LCX into OM



## T-Stent LMCA into LAD





# Case 3



It's better to be lucky than good.

— Lefty Gomez —



# What do the Guidelines Say?

## 2018 ESC/EACTS Guidelines on myocardial revascularization

### Recommendations for the management of patients with cardiogenic shock

In selected patients with ACS and cardiogenic shock, short-term mechanical circulatory support may be considered, depending on patient age, comorbidities, neurological function, and the prospects for long-term survival and predicted quality of life.

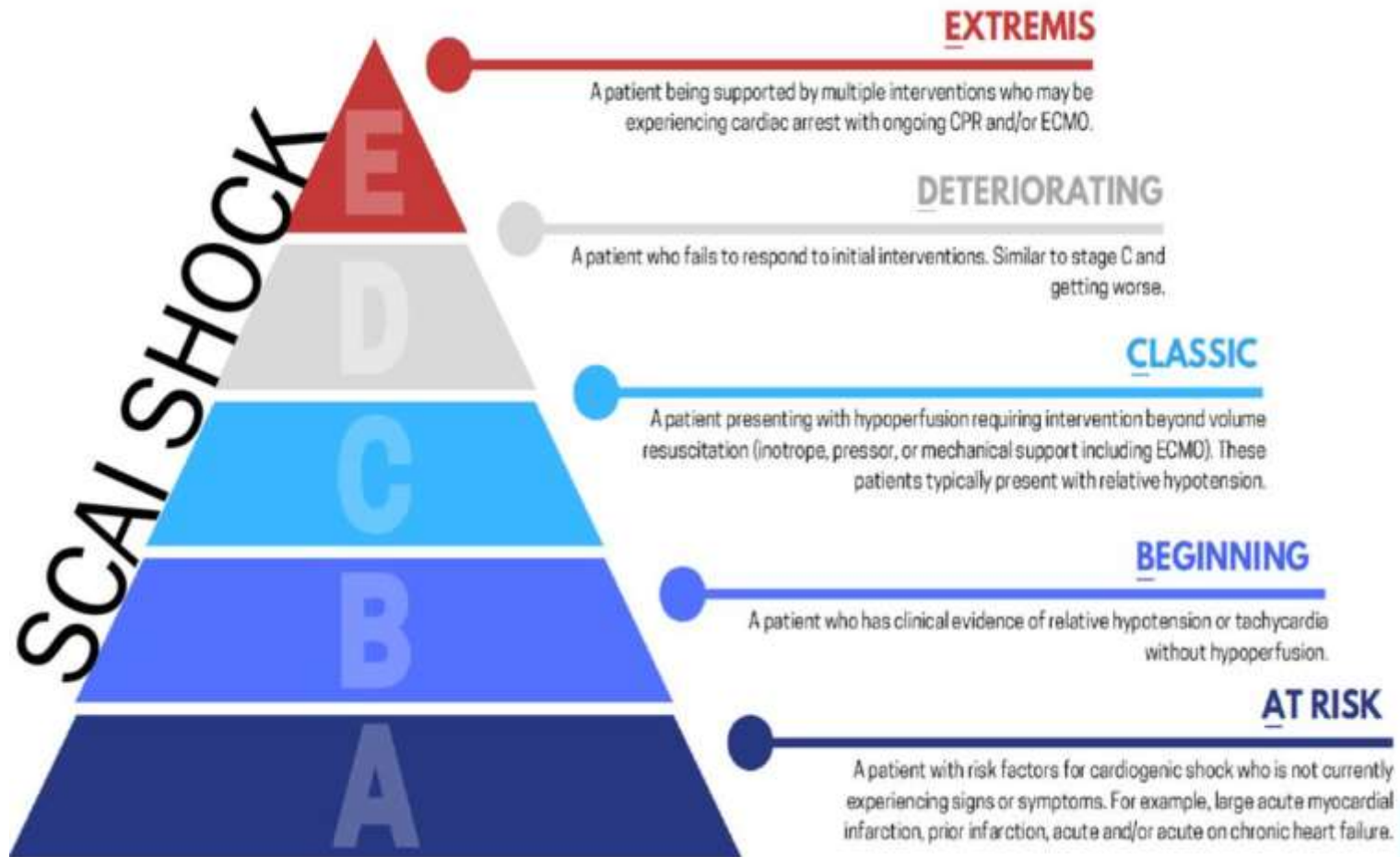
Routine use of IABPs in patients with cardiogenic shock due to ACS is not recommended.

IIb	C
III	B

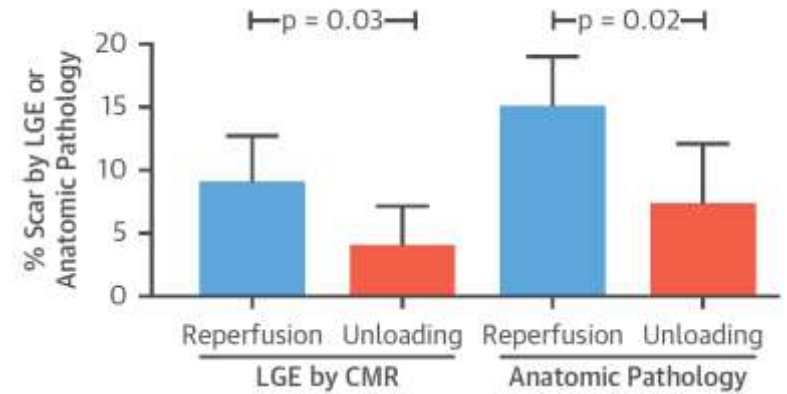
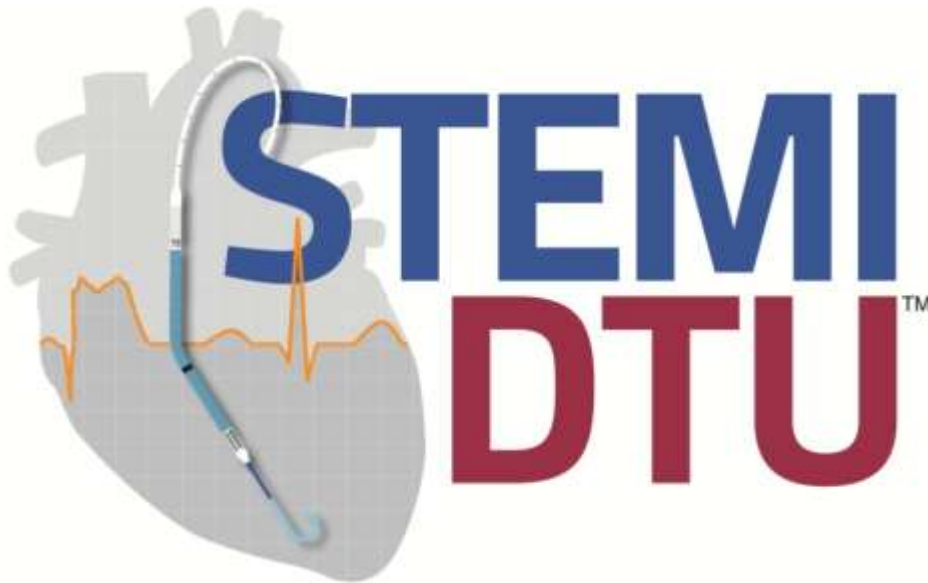
US Guidelines – no recent recommendations  
(IIb, LOE C in 2011 PCI guidelines)



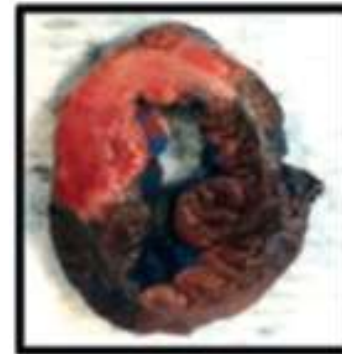
# SCAI Stages of Shock



# Door-to-Unloading



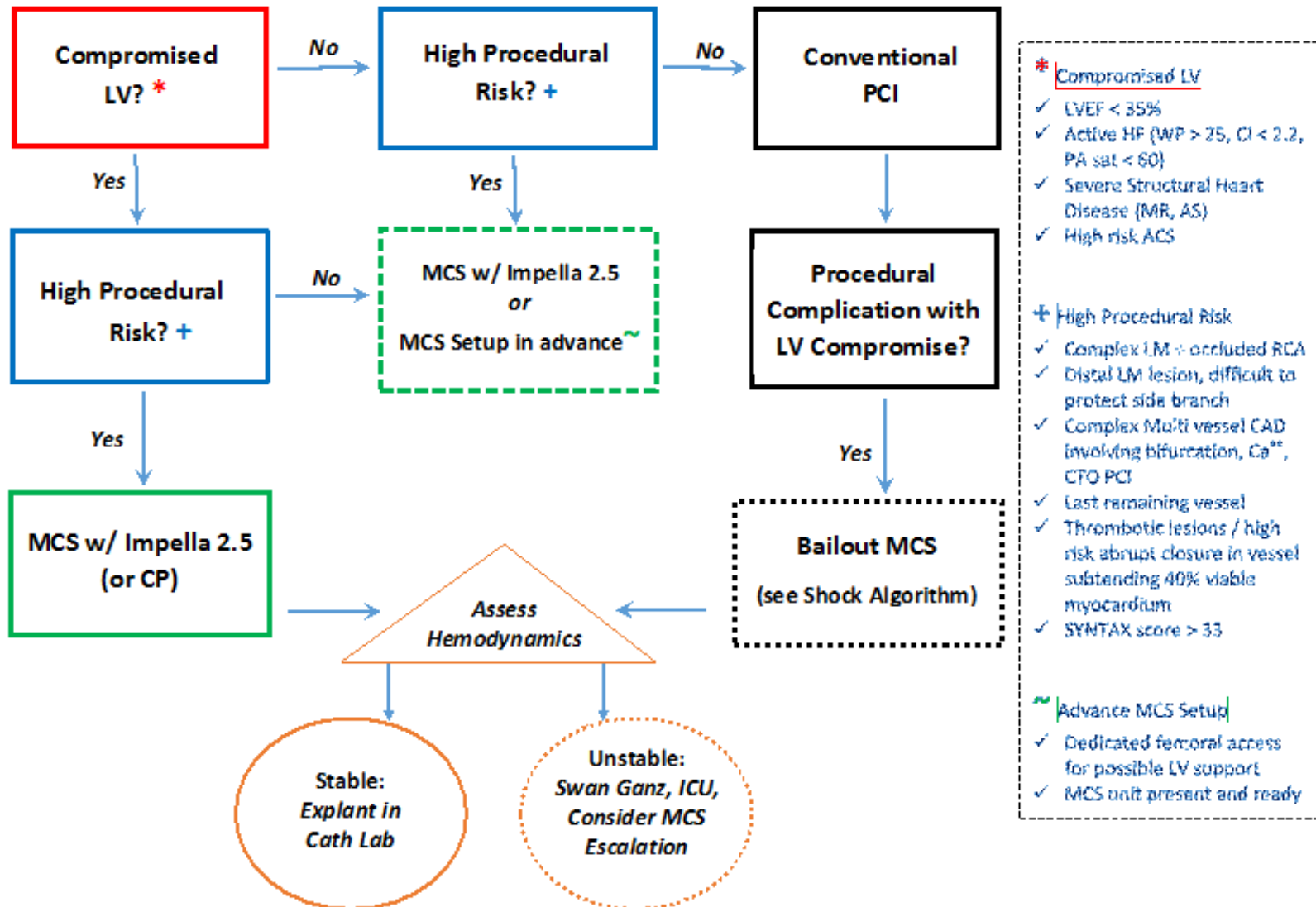
Primary  
Unloading



Primary  
Reperfusion



## Northwestern Memorial Hospital Planned High Risk Supported PCI Algorithm



# How to Emerge from a Cath Disaster

- Be prepared!
  - Radial artery access preserves femorals
  - Consider “place holder” in high-risk cases
  - Have well-defined emergency protocols
- Don't Panic
- Ask for Help
- Know your equipment and personnel
- Debrief the Team Afterwards

