

Overview of Cardiac Arrest During Coronary Angiography and PCI

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~~Unexpected~~ Hemodynamic Collapse

A definition

A previously stable patient who develops threatening blood pressure, rhythm, and/or respiratory compromise during the course of a cath lab procedure

- ***Complications should not be unexpected***
- ***Preparedness is the key***

Unexpected Hemodynamic Compromise during PCI

the challenge

- Unexpected
- **Many potential etiologies**
- **Minimal time**
- Poor environment for multitasking
- Physician and team
 - Reaction
 - Plan
 - Coordination
 - Effective therapy

The Myth of Multitasking

- “Research shows that we can’t multitask. We are biologically incapable of processing attention-rich inputs simultaneously.”
- What we actually do is *rapid-task switching*
 - Inefficient
 - Reduction in productivity
- Alternatives
 - Task opportunism (*do what you can when you can, process*)
 - Single tasking (*checklist*) with assigned roles

References

1. Decker, Ed. “Multitasking makes us inefficient”. *Rewire me*. May 21, 2018.
2. Telis, Gisela. “Multitasking Splits the Brain”. *Science*. April 15, 2010.
3. Weinschenk, Susan. “The True Cost of Multitasking”. *Psychology Today*. September 18, 2002.

AO 123/45 (69)

1
F

54 M
BPM



I 100
II 100
VI 100
Sp 100

EC
AO
AO
AO

Sweep Speed: 25 mm/s

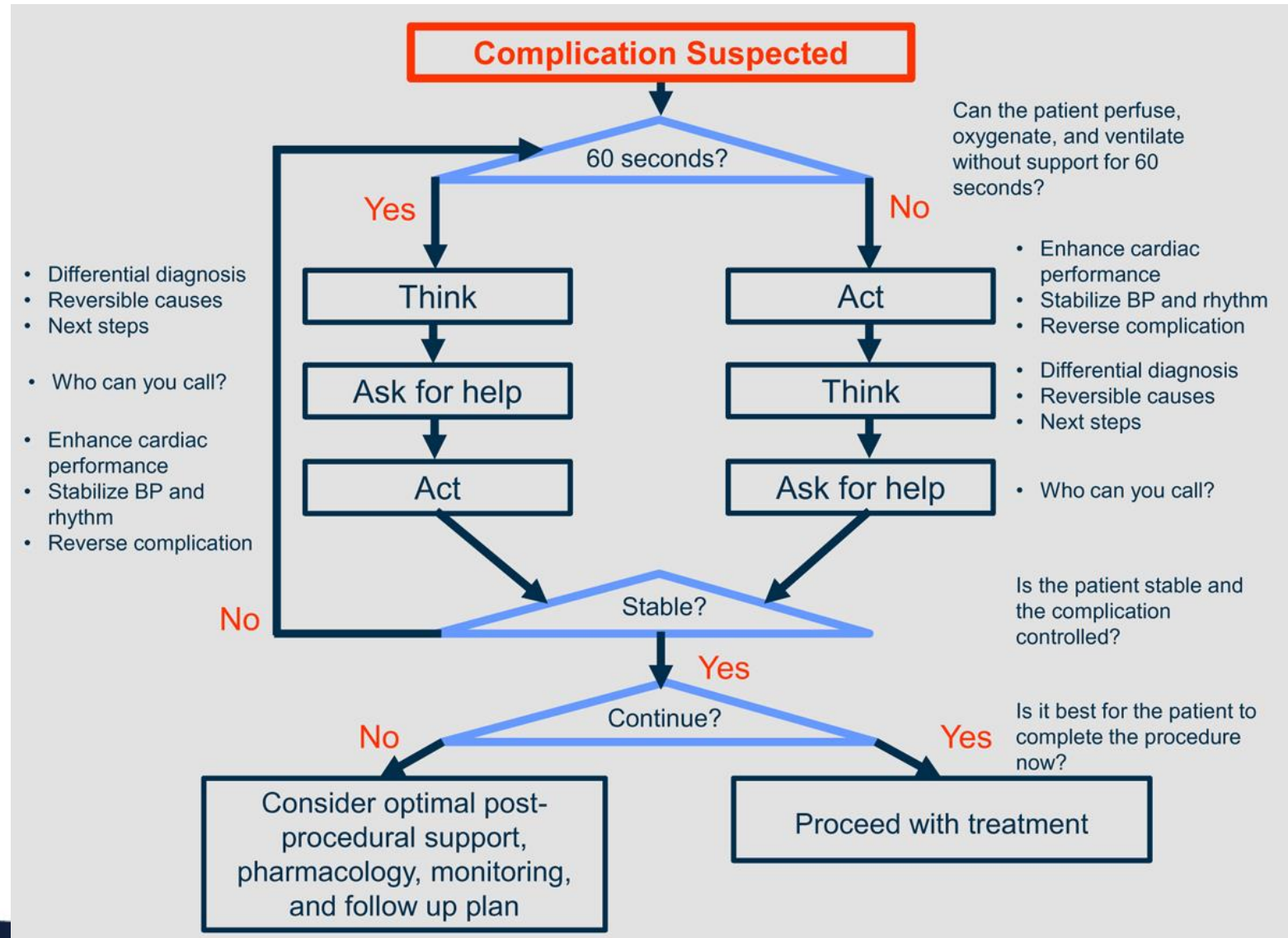
Paper Speed: off

Rhythm:

Condition: Baseline

Sample Length: 7 sec

Complication Management in the Cath Lab



Is this patient in danger during IVUS of LAD?



54 year old woman with NSTEMI, shock requiring IABP initially with ischemic limb necessitating removal

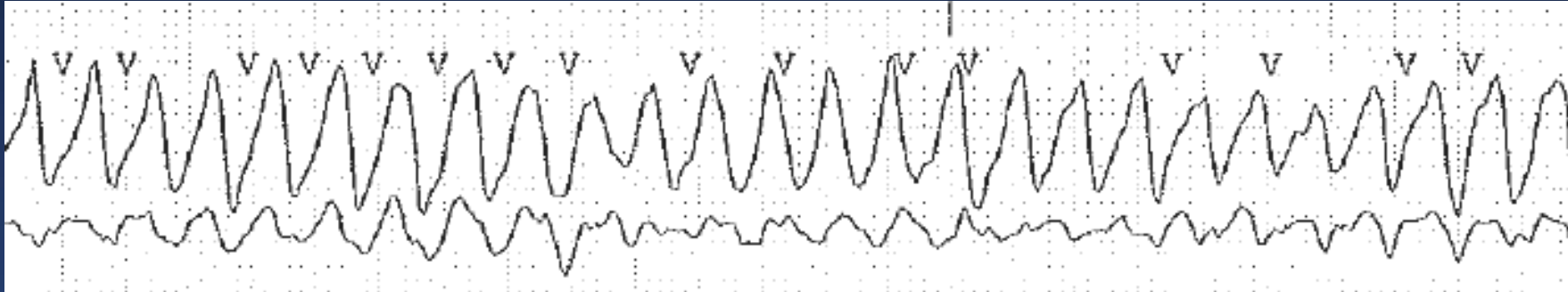
- BMS to proximal LAD
- Occluded RCA
- EF 20%
- Episode of VT
- Ischemic LAD territory

Returned for LAD IVUS/PCI

During IVUS, patient complained of cough/difficulty breathing...

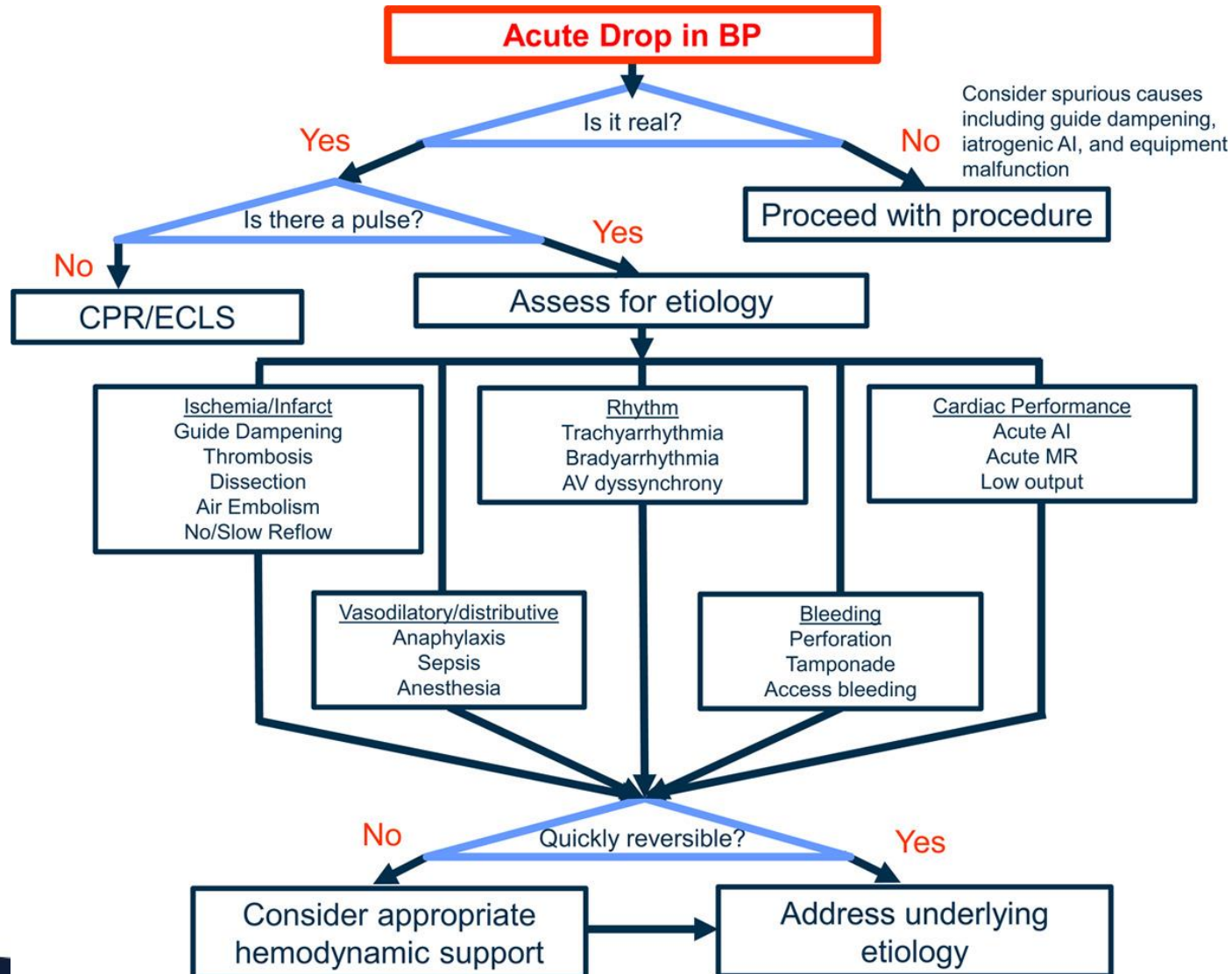
What Happened...

- Delay in arrival of BiPAP machine, and after desaturation (despite lasix, NTG, O₂)...



- Despite shocks, intubation, CPR, Impella CP, patient continued to have refractory VT/VF and required emergent ECMO but ultimately left the hospital 3 weeks later

Algorithm for Acute Hypotension



Think also of other common (non-cardiac) causes:

Vasodilator Cocktail for TRI

Respiratory issues

- Over-Sedation

Vasovagal

- Urinary issues

Hemodynamics are Key Inputs Beyond Lesion Complexity/EF Alone

| Anatomic Characteristics | mLAD 90% pRCA 80% | mLAD 90% pRCA 80% | mLAD 90% pRCA 80% |
|--|----------------------|----------------------|----------------------|
| Blood Pressure) | 130/72 | 106/74 | 96/78 |
| RA Pressure (mean) | 8 | 14 | 20 |
| PA Pressure | 26/12 (17) | 65/23 (37) | 48/35 (38) |
| PCWP (mean) | 14 | 27 | 33 |
| PA Sat / Cardiac Output (Cardiac Index) | 60.8% 4.9(2.5) | 58.8% 5.1(2.6) | 38% 3.1(1.4) |

Why are hemodynamics so essential?

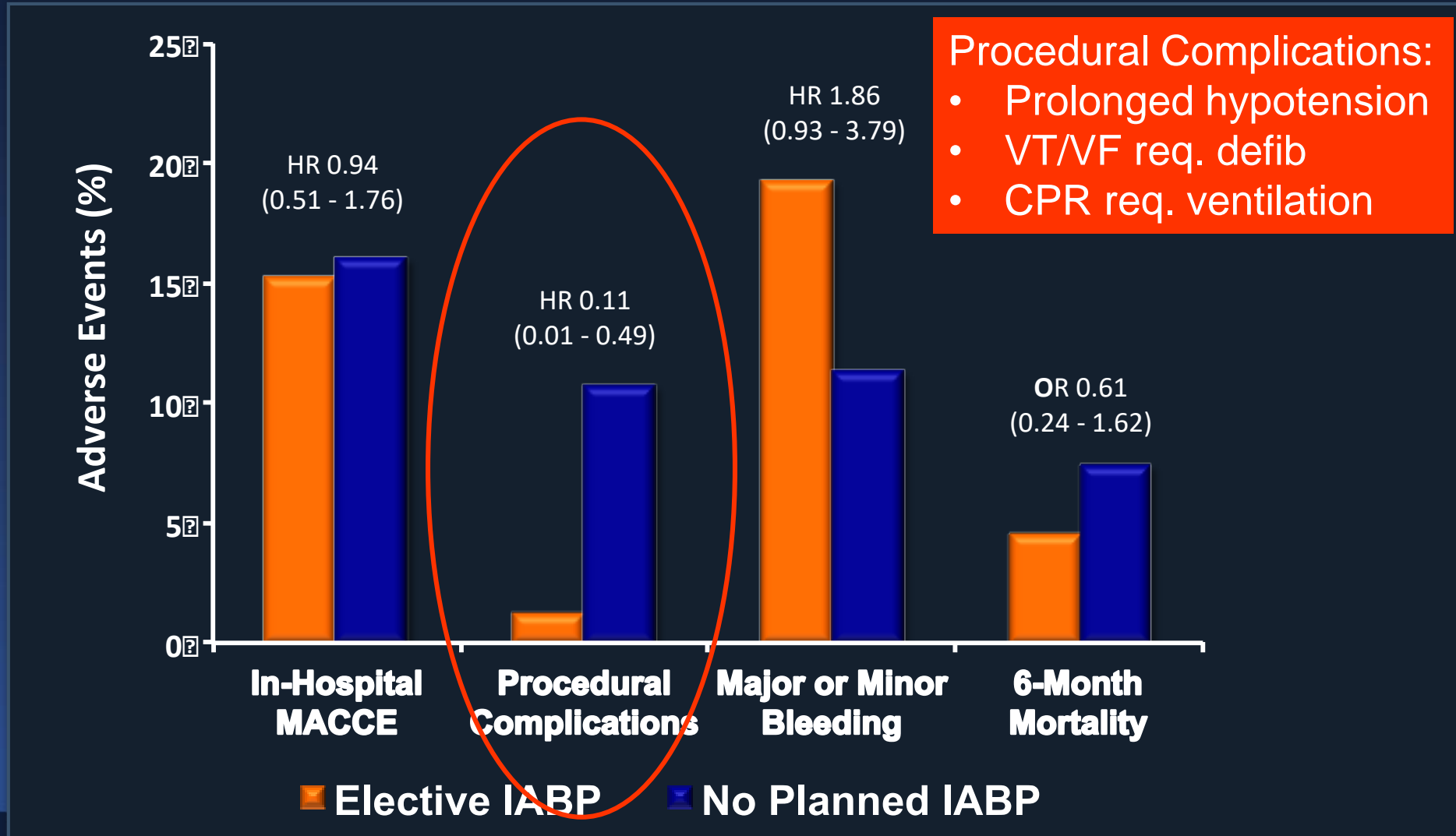
- Catheters can obstruct native aorto-ostial flow (especially larger catheters)
- Contrast does not contain hemoglobin and is a myocardial depressant
- Wires, balloons, stents, devices can obstruct flow and when inflated by definition are producing ischemia
- Adverse hemodynamics will make it difficult to do the case and can worsen short and long term outcomes – ignore them at your peril..

High Risk PCI: When Should We Consider Support?

- PCI with either severe LV dysfunction or irreversible adverse hemodynamics (**DO RHC**)
 - Particularly MV-PCI: support for ischemic stress and contrast load
- Severe LV dysfunction w/prospect of uncontrolled interruption of flow in a major branch
 - High risk of no reflow (i.e., SVD, Laser, Roto)
 - Retrograde CTO thru a major vessel
 - Difficult wiring (w/increased probability of closure)
 - Difficult stent delivery
- +/- Last remaining vessel with preserved EF

BCIS-1: Major Outcomes

301 Randomized pts; Bail-out IABP in 18 cases (12%)



Clinical Scenarios for *Elective* Support

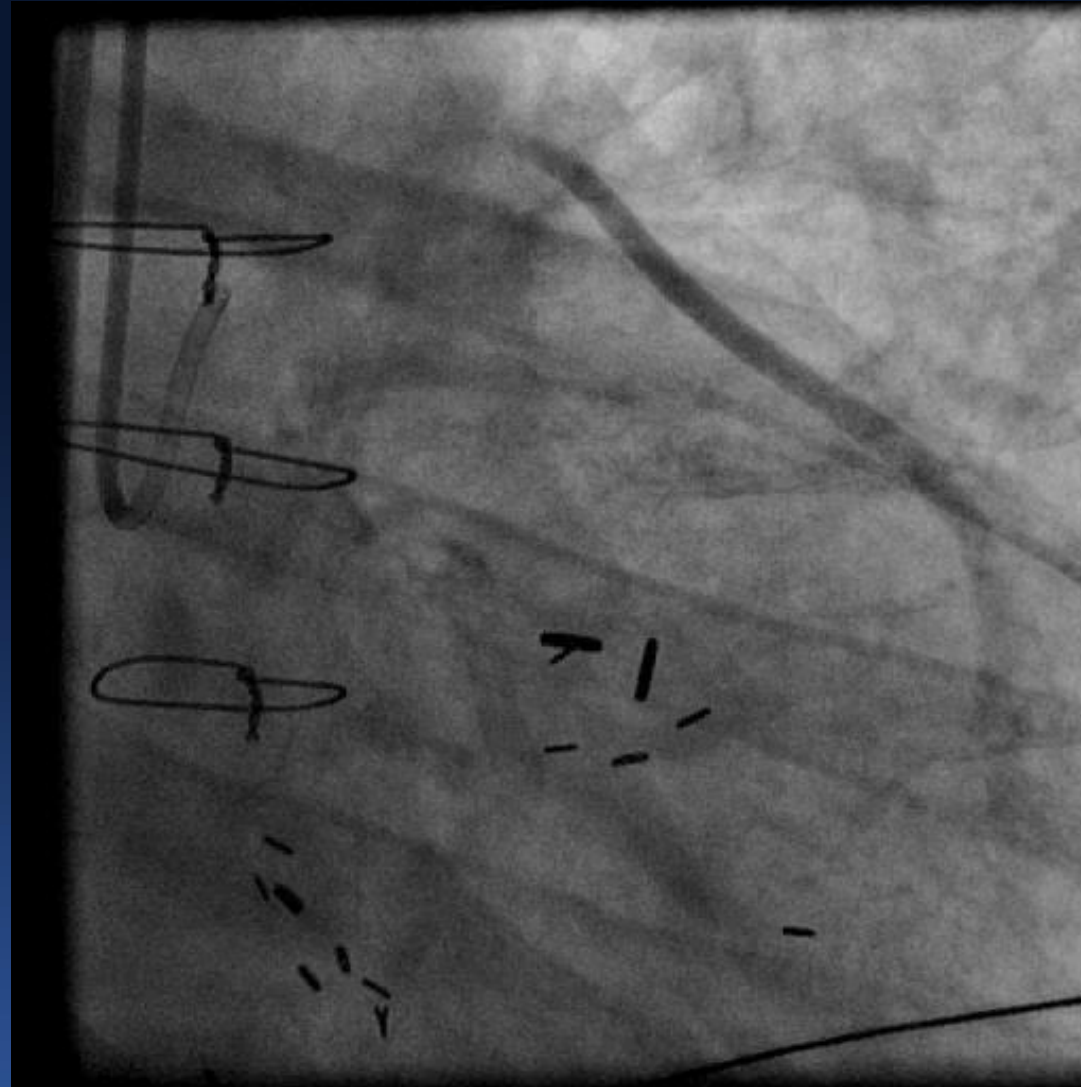
| Scenario | Frequency of Support | When to Consider Support |
|------------------|----------------------|---|
| Unprotected LMCA | <10% | Low EF w/extensive atherectomy or high risk of closure |
| Atherectomy | <5% | Extensive rota runs w/low EF or poor hemodynamics |
| CTO | <10% | Low EF with retrograde threat |
| Multivessel PCI | <10% | Low EF with long anticipated case time (e.g. multiple bifurcations) |
| AS PCI | <10% | Low EF PCI ± BAV (but not to facilitate BAV) |
| EF>40 | <1% | Very high anticipated risk of no reflow, dissection/closure |

All modified by Pre-PCI Hemodynamics (RHC numbers and BP)

Case Presentation

- **80 year old man with prior history of CABG (twice), TIA, PVD**
 - **Prior grafts:**
 - **SVG-LAD**
 - **SVG-OM1, SVG-OM2 (both down)**
 - **Radial-OM from descending aorta**
- **NSTEMI with Troponin of 3.6**
- **Anterolateral ST Depression**

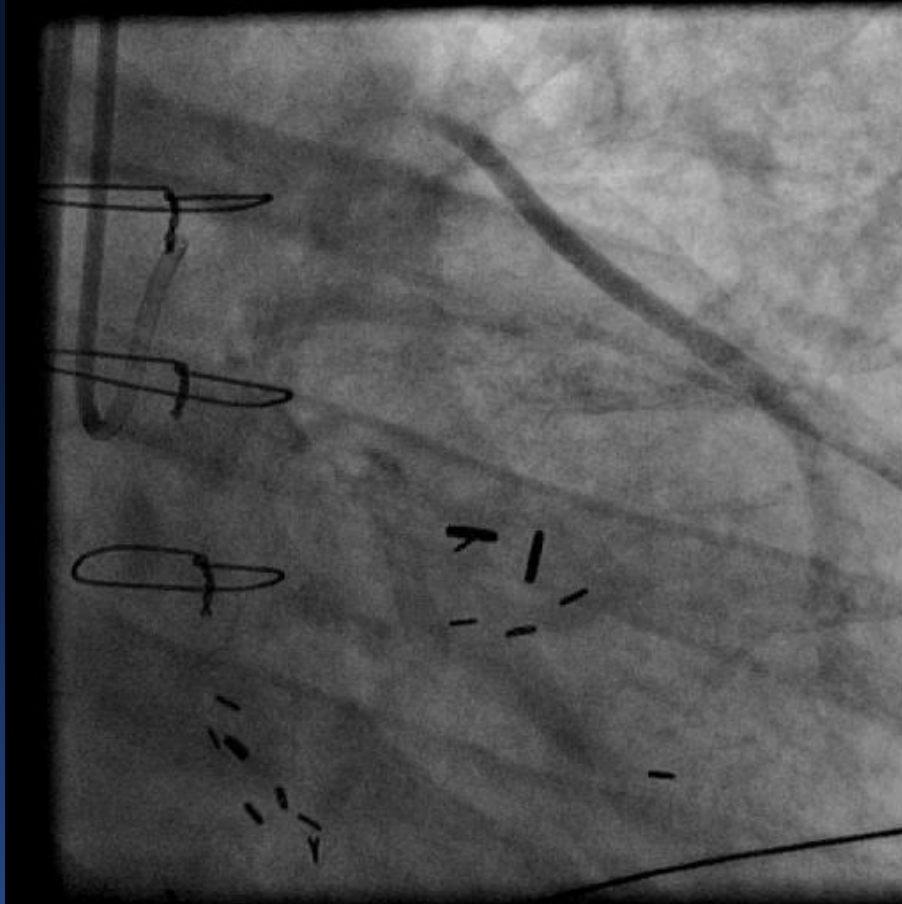
SVG-LAD supplying whole heart



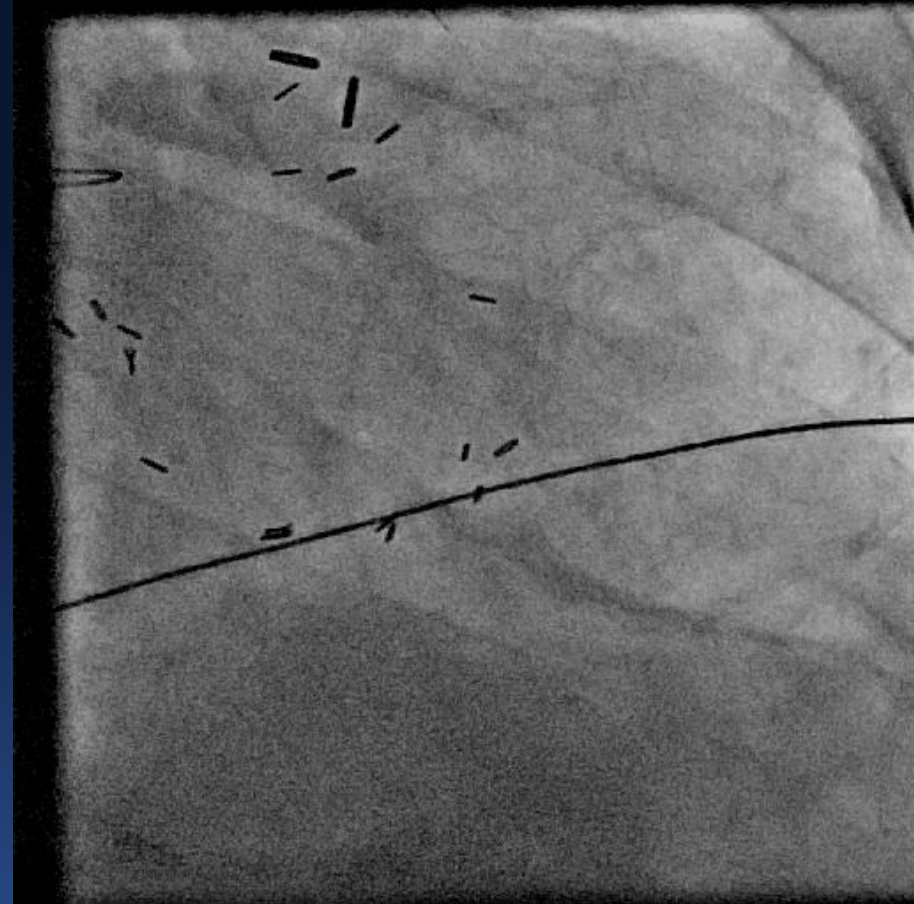
CODE!!!

- Hypotensive and unresponsive
- Ventricular fibrillation/Arrest
- CPR, Cooling
- Aggressive resuscitation
 - Fluid resuscitation, Pressors
 - Defibrillation, Amiodarone
 - Intubation and mechanical ventilation
 - What else???

After ECMO/Intubation: SVG Salvage

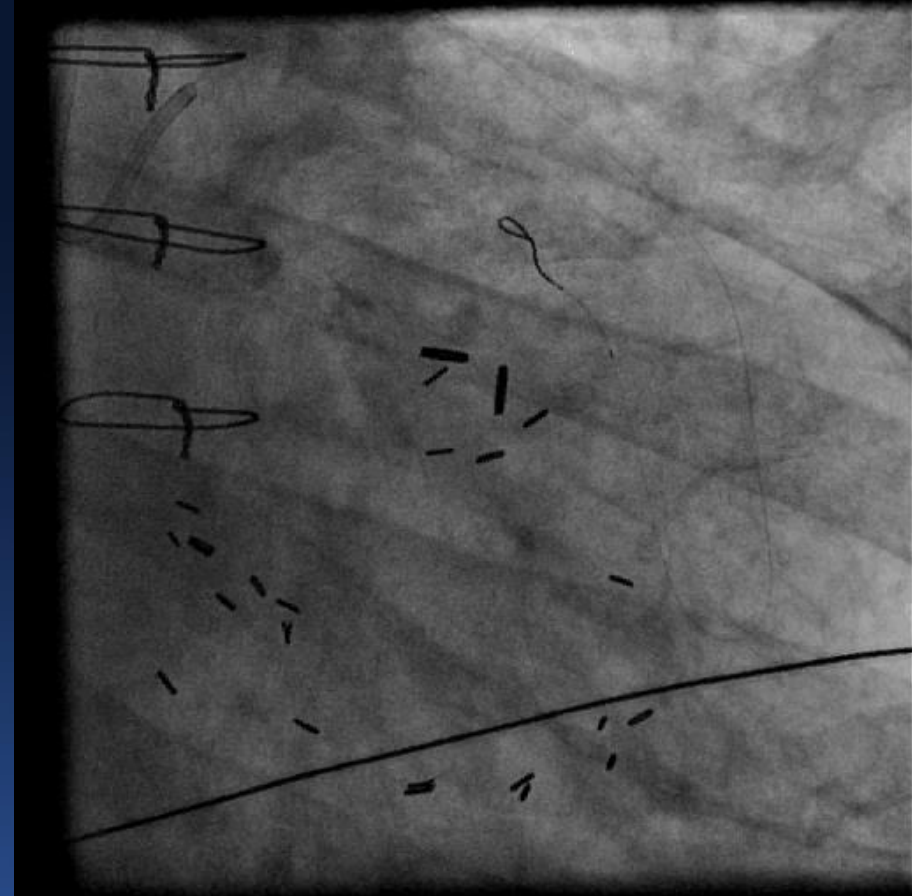
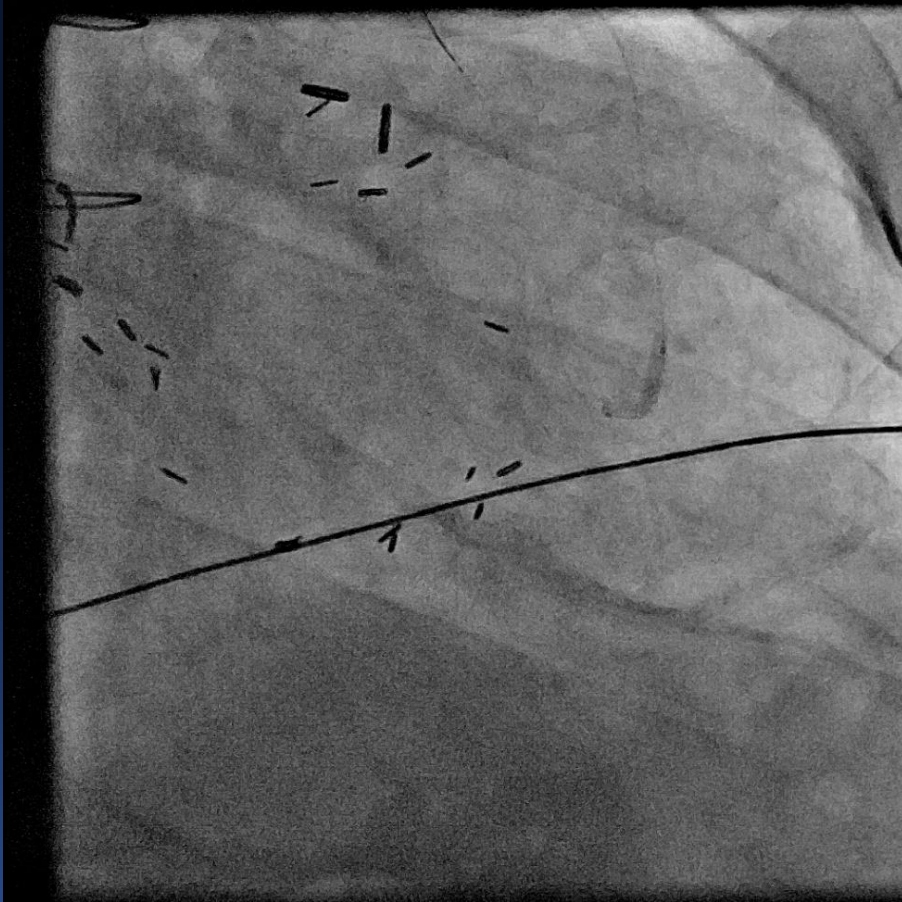


7F AL1 Guide
Finecross, BMW



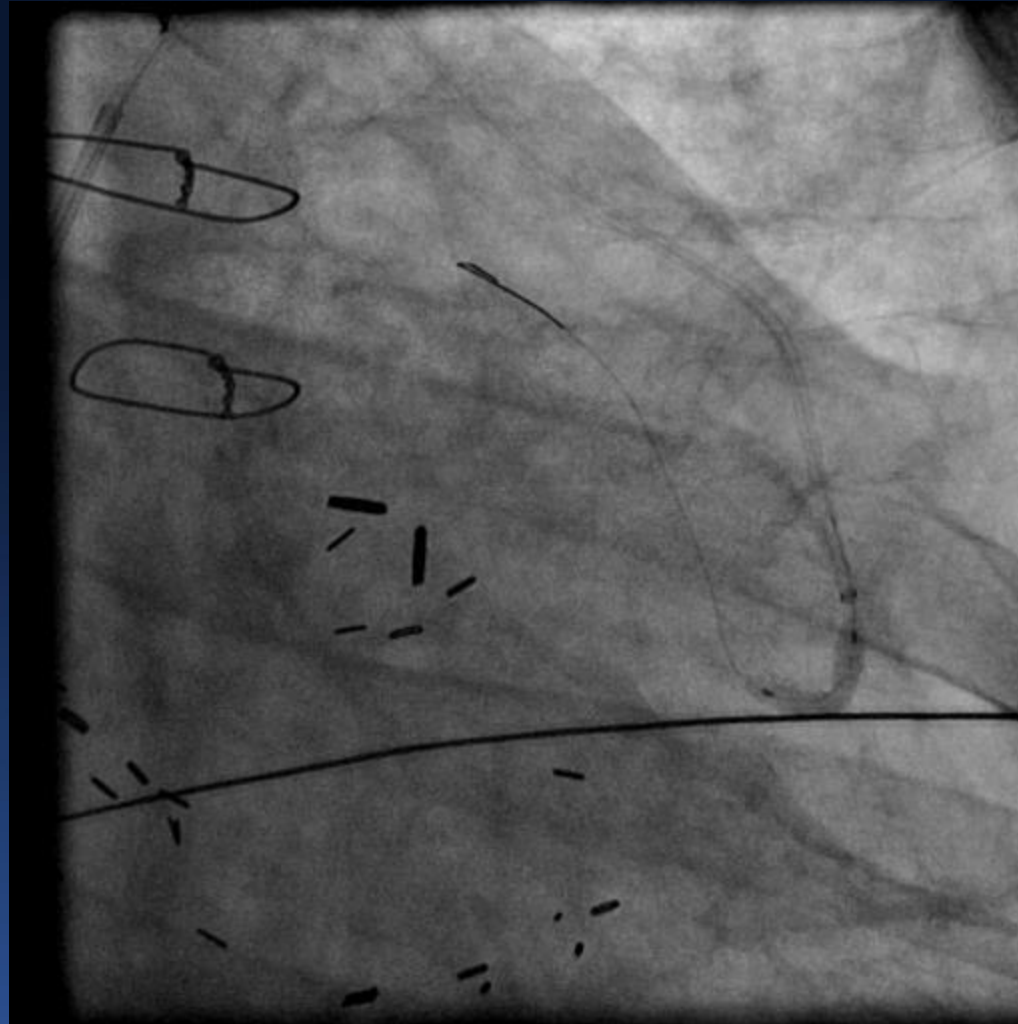
Exchange for Wiggle Wire,
After thrombectomy

SVG-LAD Intervention



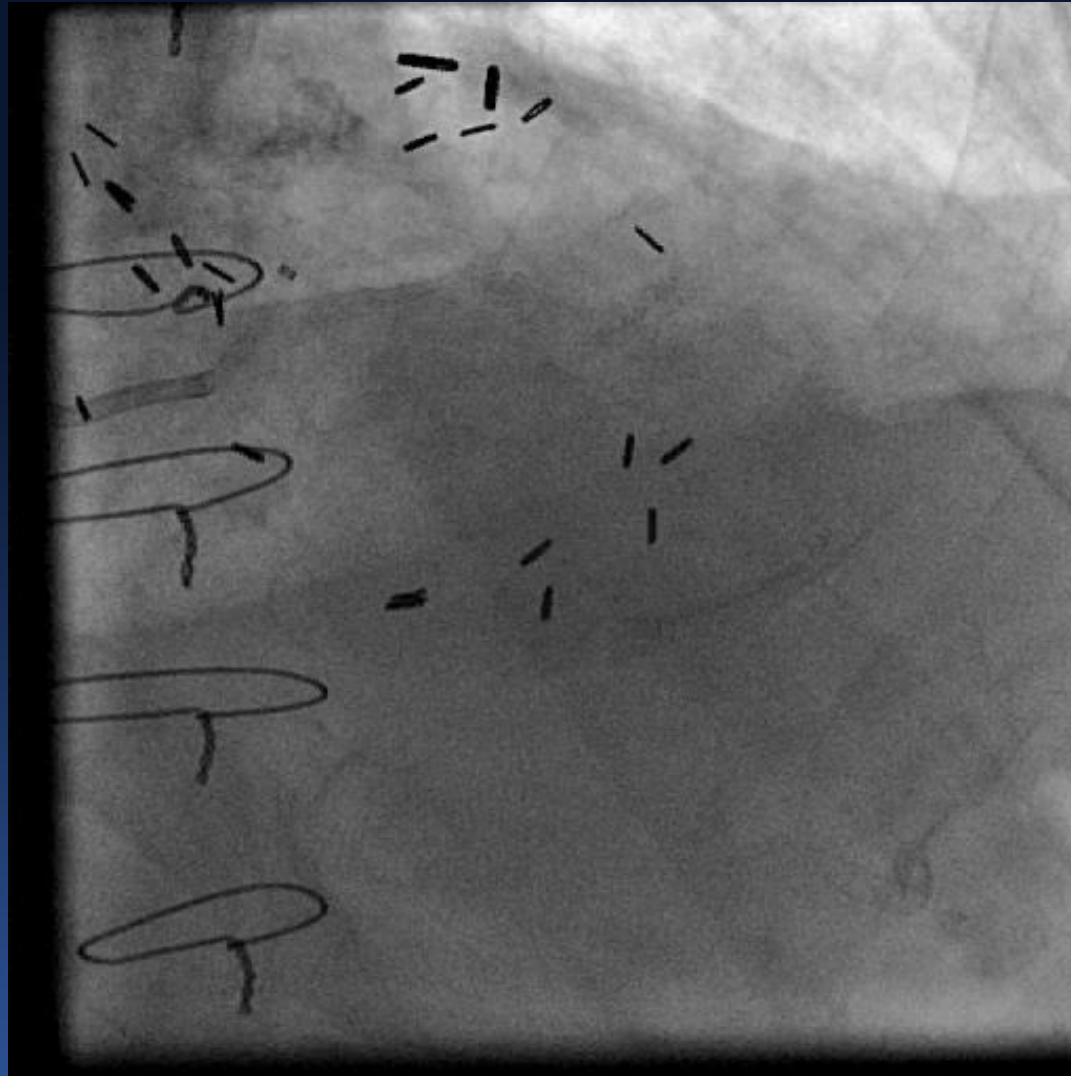
1.5 x 15 to 14 ATM
2.5 x 15 to 14 ATM

After Difficult Delivery...



3.0 x 18mm stent, postdilated

Final Result



Hemodynamic Support: Summary

- Appropriate management takes a team-based & patient-oriented approach, carefully weighing immediate & longer-term goals w/benefits-risks of pMCS/durable MCS
- IABP can stabilize, but a step-by-step (escalation) approach is needed in severe LV failure to facilitate intervention and bridging to recovery/decision or further supportive Rx
- ECMO is best for total “crash and burns” or combined oxygenation issues; may require venting
- The availability of percutaneous RV support has further expanded our options and armamentarium

Conclusions

- In the setting of cardiac arrest / unexpected hemodynamic collapse during PCI, the team should:
 - Rapidly, systematically evaluate potential causes
 - Reverse causal factors
 - Support blood pressure, rate, rhythm, oxygenation/ventilation as needed
 - Communicate effectively and use “closed communication” loops to reduce confusion
- **Triage pathways** and use of **rapid, sequenced checklists** are methods intended to balance the simultaneous needs to quickly assess and appropriately treat these patients