Advanced Hemodynamic Support in the Cath Lab

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Background

- While CABG is generally preferred in symptomatic patients with severe, complex multivessel or left main CAD, some patients present with clinical features that make CABG clinically unattractive
- During PCI, repetitive contrast dye injections, balloon inflations, atherectomy passes, and stent manipulations transiently interrupt blood flow to the target coronary artery resulting in a negative inotropic effect

J Am Coll Cardiol. 2006; 47; e1– e121
Am J Cardiol. 2006;98:608–612

Goals of Hemodynamic Support in the Cath Lab

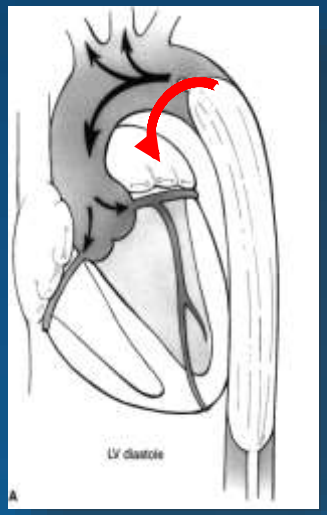
- Stabilizing systemic perfusion
- Balancing myocardial perfusion against demand and supply
- Augmenting perfusion
- Creating a window to perform complete revascularization (if appropriate)

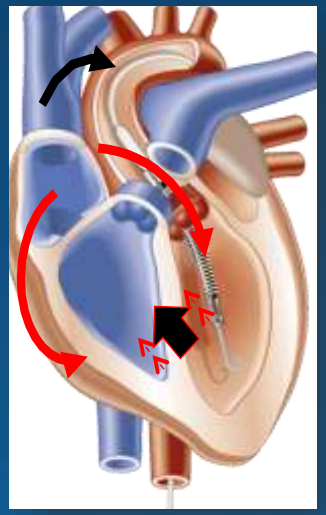
J Am Coll Cardiol. 2006; 47; e1– e121
Am J Cardiol. 2006;98:608–612

Types of Hemodynamic Support in the Cath Lab

Hemodynamic support in the cath lab

- Inotropes
- Intra-aortic balloon pump (IABP)
- Impella
- Tandem Heart



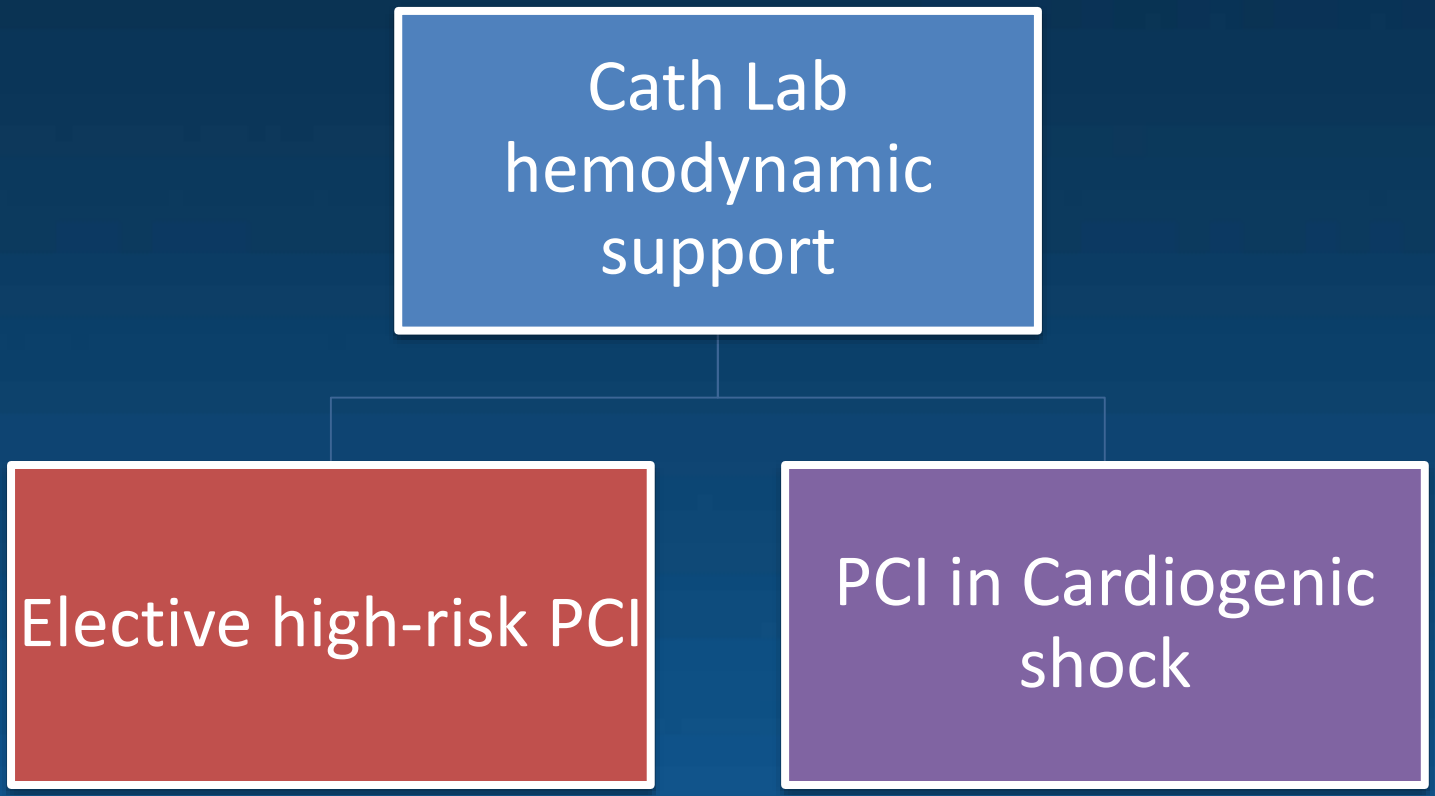


Hemodynamic Support Devices for the Cath Lab

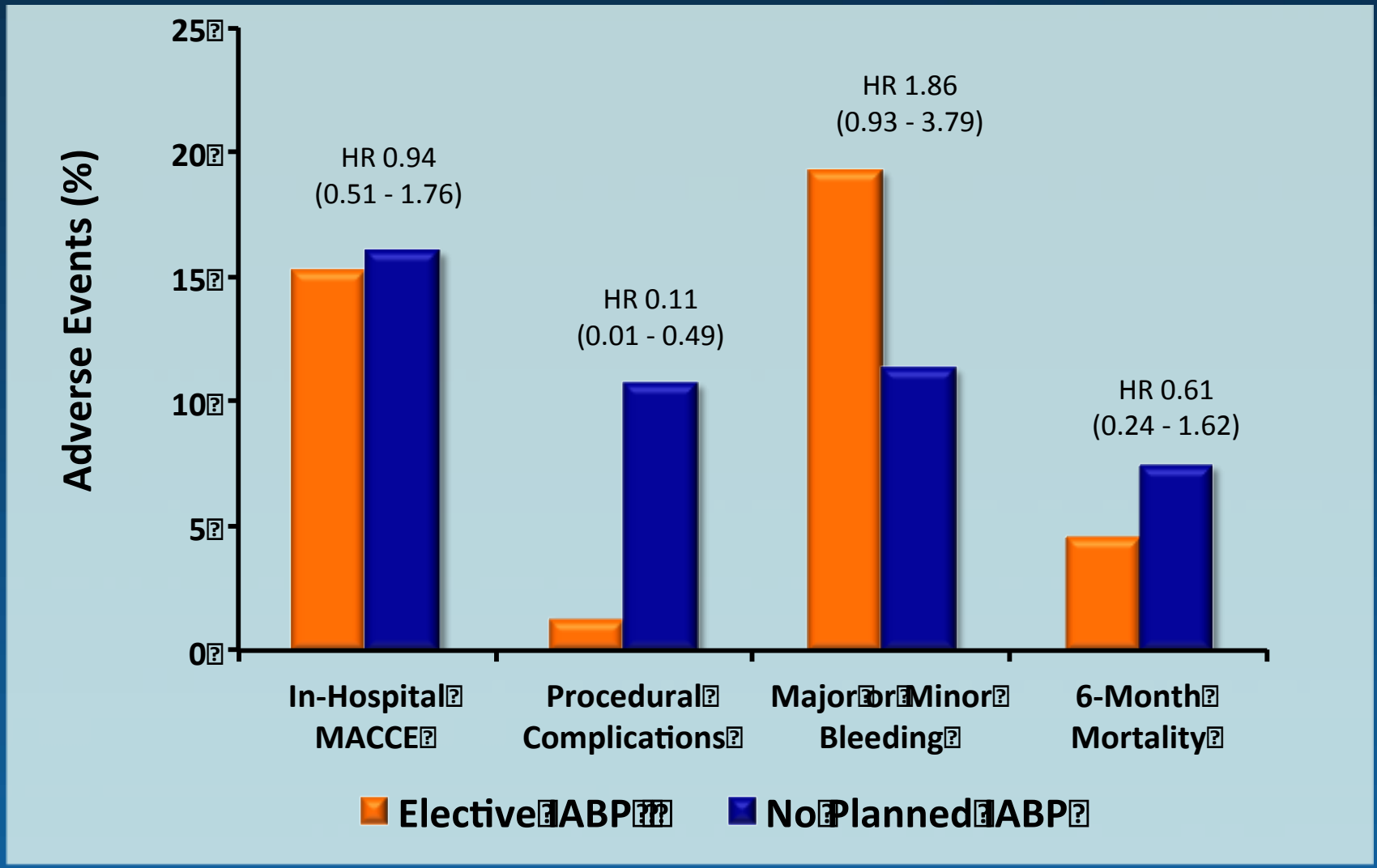
	IABP	Impella	Tandem Heart
High-risk PCI/shock	Yes	Yes	Yes
Location	Descending aorta	LV-AO	Inflow-LA Outflow-CFA
Trans-septal puncture	No	No	Yes
Support	0.5L/min	2.5-5L/min	4-5L/min
Hemodynamic support	↑Diastolic AO Pr.	↓LVEDV, ↓LVEDP, ↑Mean AO Pr.	↓MVO_2
Largest sheath	9F Fibro-optic-7F	2.5-12F, CP-14F	LA-21F; CFA-15F
Complications	5-10%	5-10%	20-50%

IABP & Impella most frequently used in the cath. lab

Indications for Cath Lab Hemodynamic Support

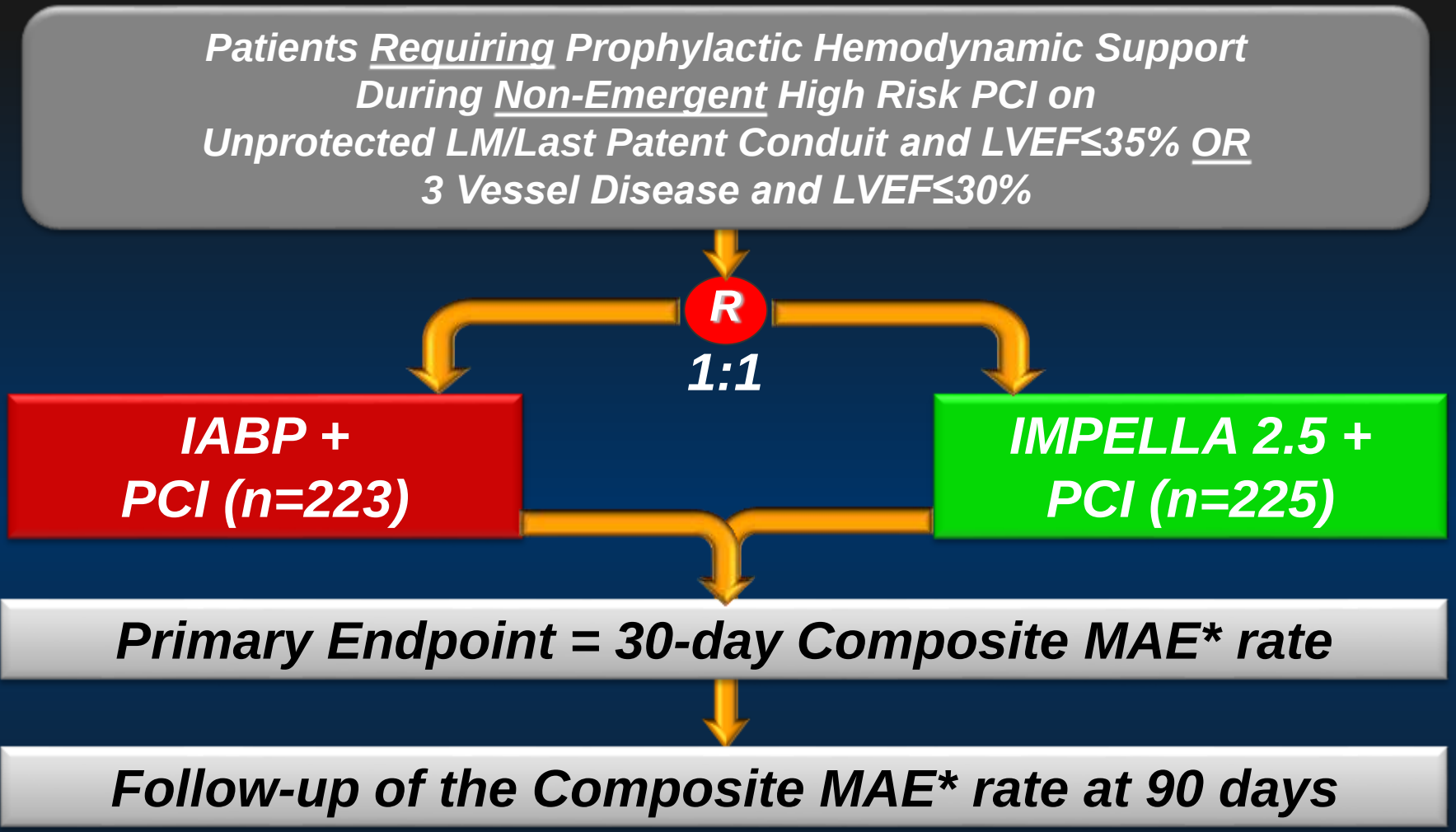


BCIS-1: Major Outcomes



JAMA 2010; 304(8):867-874

PROTECT II Trial Design



*Major Adverse Events (MAE) :
Death, MI (>3xULN CK-MB or Troponin) , Stroke/TIA, Repeat Revasc, Cardiac or Vascular Operation or Vasc. Operation for limb ischemia, Acute Renal Dysfunction, Increase in Aortic insufficiency, Severe Hypotension, CPR/VT, Angio Failure

O'Neill et al, Circulation. 2012;126(14):1717-27

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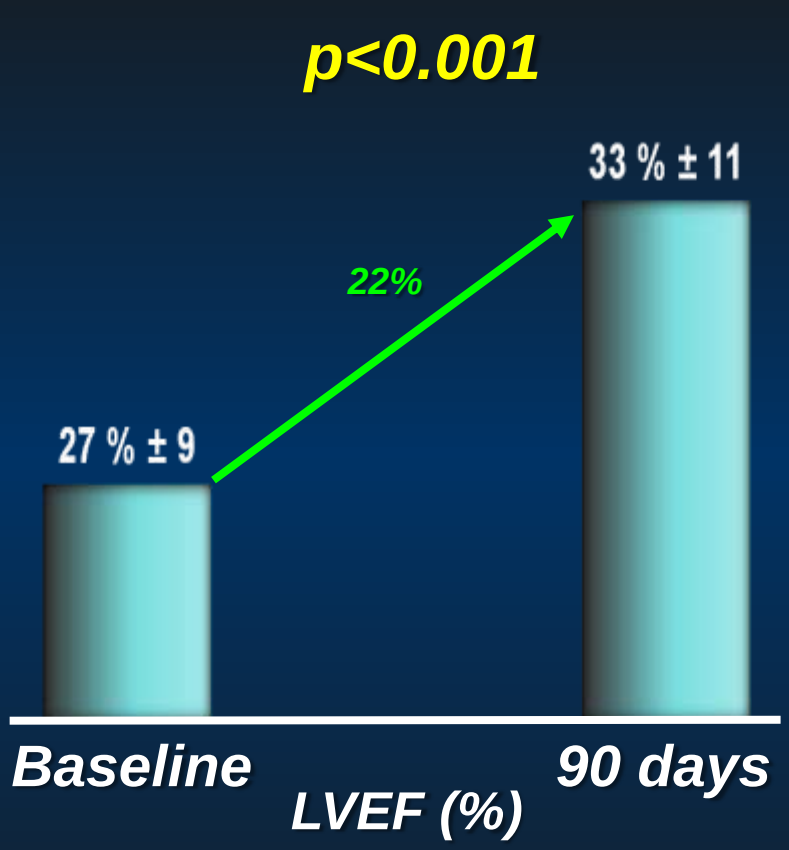
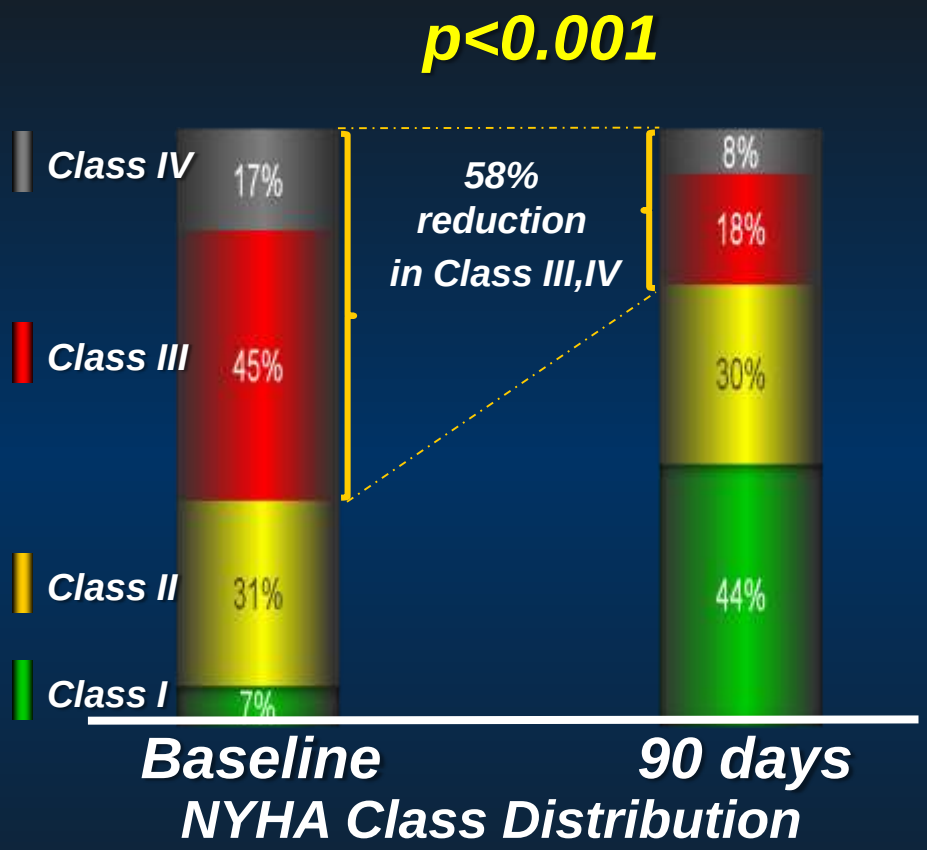
Procedural Characteristics

Procedural Characteristics	IABP (N=223)	Impella (N=225)	*p-value*
Use of Heparin	83.3%	93.3%	*<0.001*
IIb/IIIa Inhibitors	26.0%	13.8%	*0.001*
Total Contrast Media (cc)	241±114	267±142	*0.036*
Rotational Atherectomy (RA)	9.0%	14.2%	*0.083*
Median # of RA Passes/lesion (IQ range)	1 (1-2)	3 (2-5)	*0.001*
Median # of RA passes/pt (IQ range)	2.0 (2.0-4.0)	5.0 (3.5-9.5)	*0.003*
Median RA time/lesion (IQ range sec)	40 (20-47)	60 (40-118)	*0.004*
RA of Left Main Artery	3.1%	8.0%	*0.024*
Total Support Time (hours)	8.4±21.8	1.9±2.7	*<0.001*
Discharge from Cath Lab on device	36.7%	5.9%	*<0.001*

O'Neill et al, Circulation. 2012;126(14):1717-27

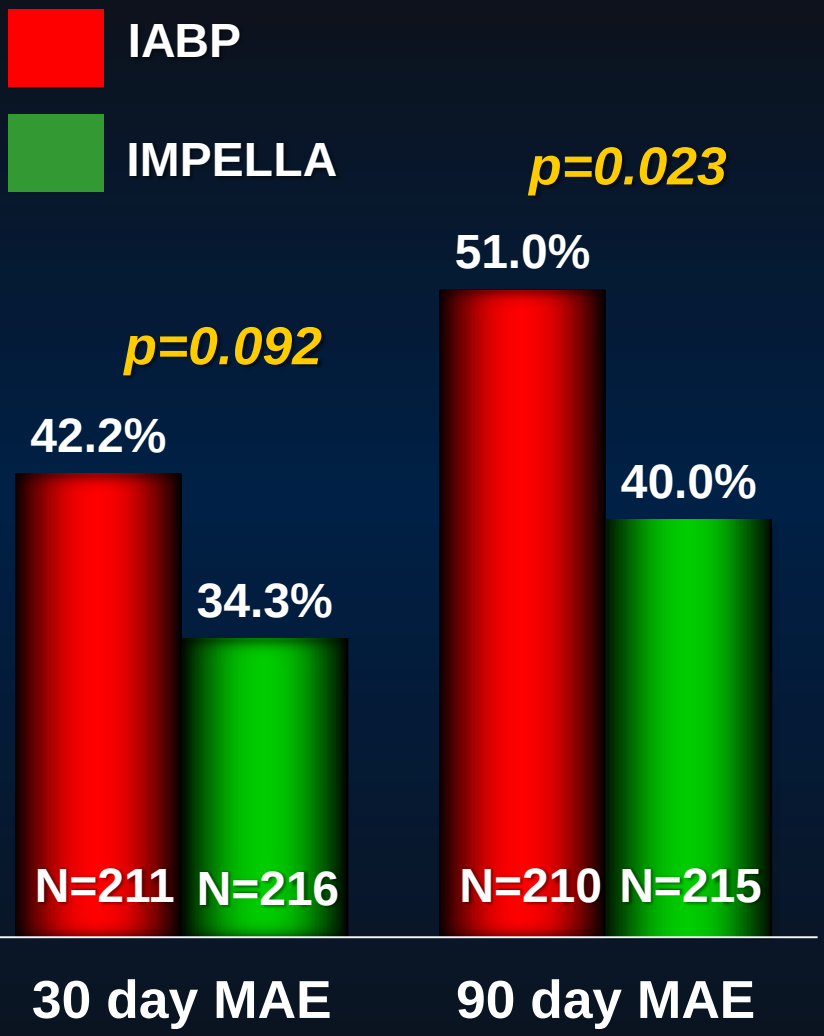
LVEF and NYHA Improvement Post PCI

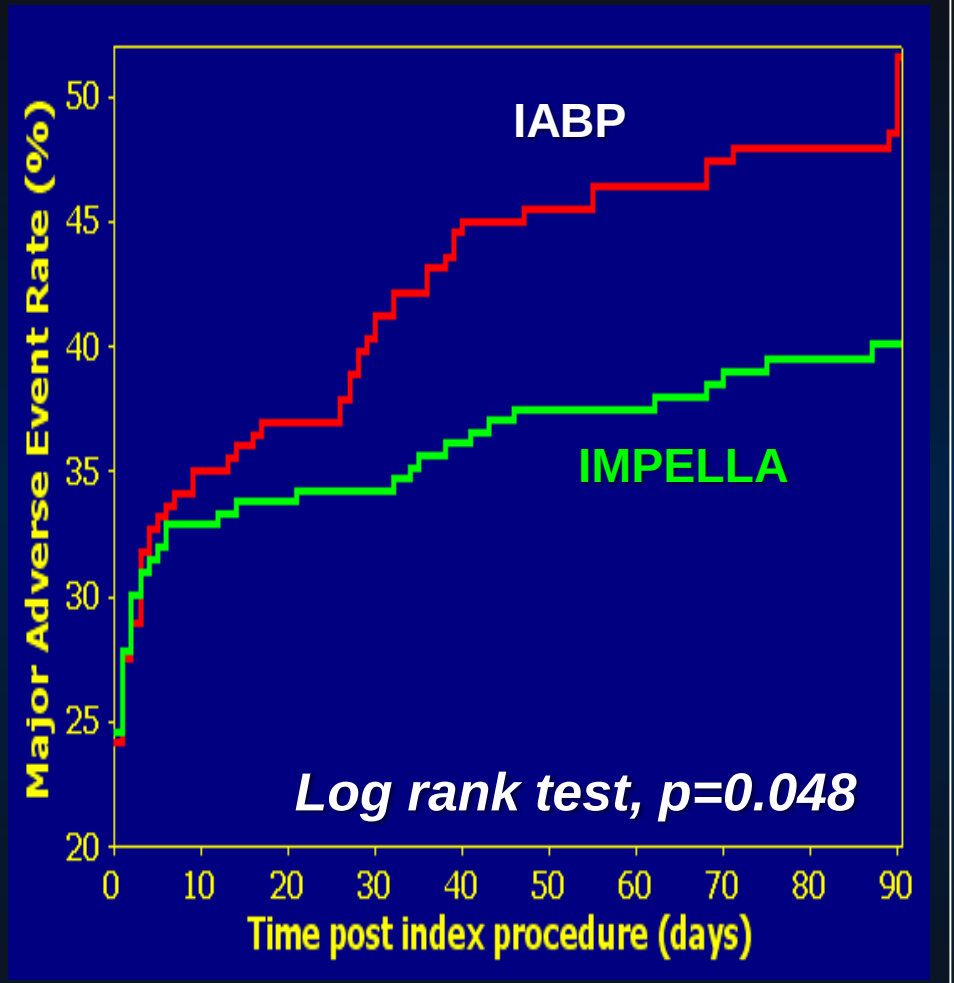




O'Neill et al, Circulation. 2012;126(14):1717-27

PROTECT II: Per Protocol MAE (N=427)



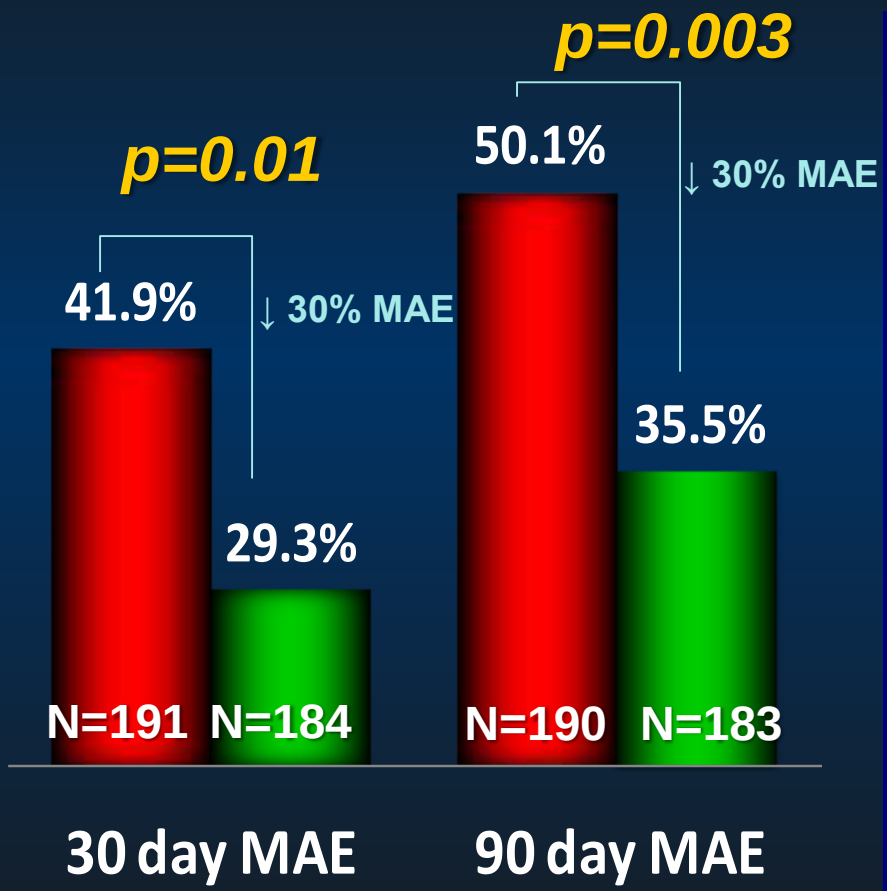


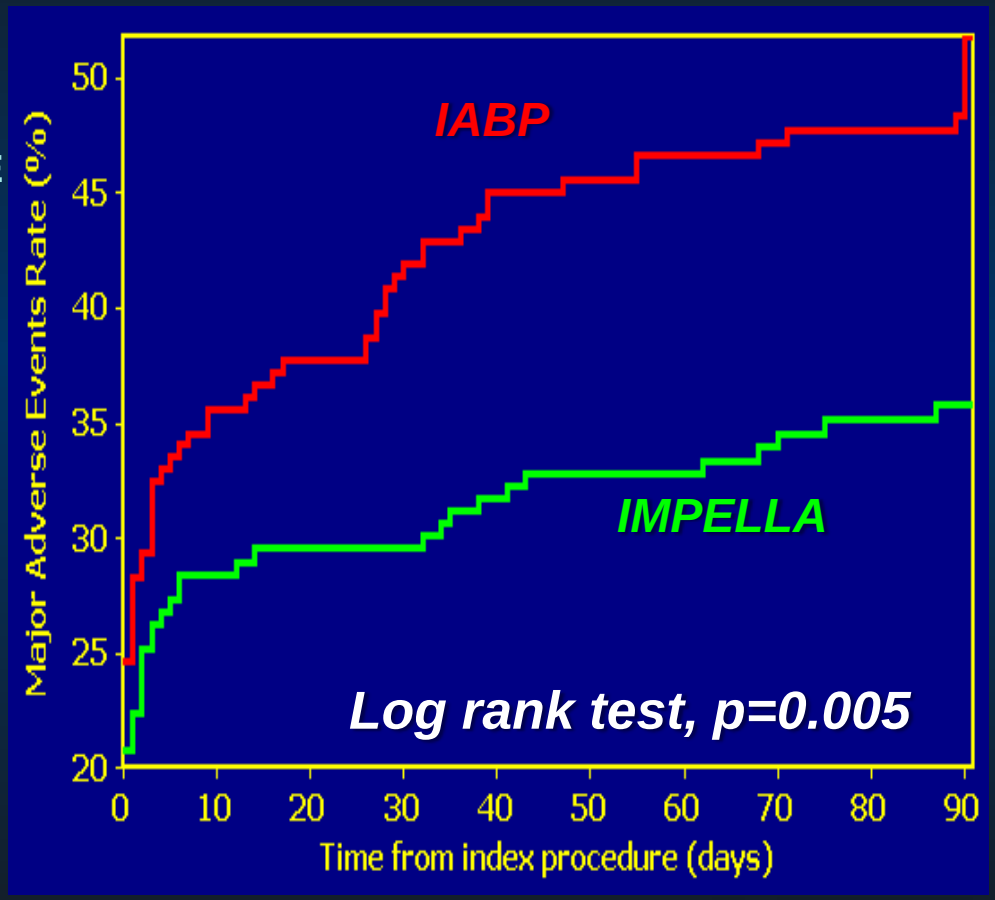
O'Neill et al, Circulation. 2012;126(14):1717-27

PROTECT II MAE Outcome

Pre-specified High Risk PCI Without Atherectomy Group

Per Protocol (N=374)





MAE= Major Adverse Event Rate

Cohen et al, Catheter Cardiovasc Interv. 2013 (In press)

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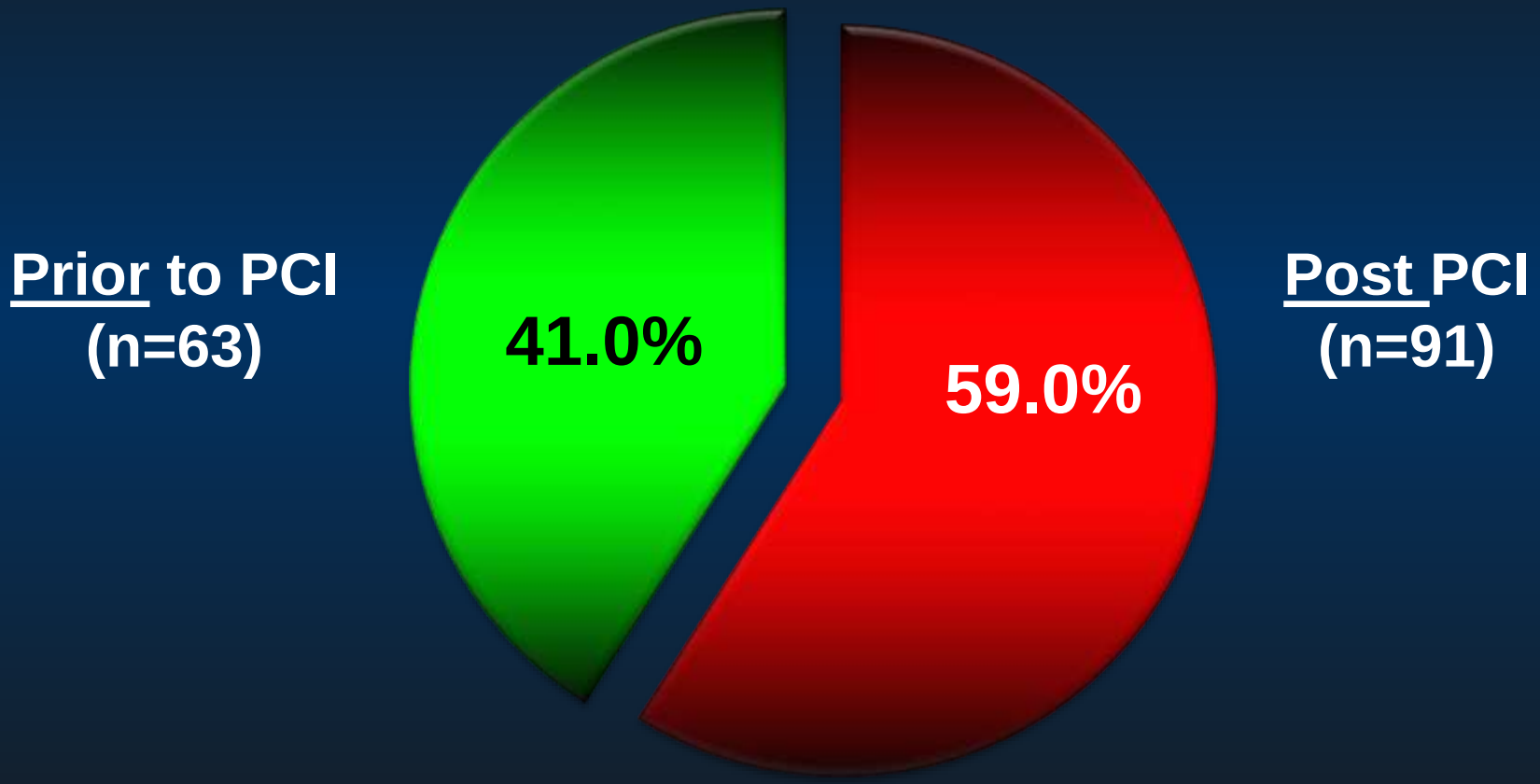
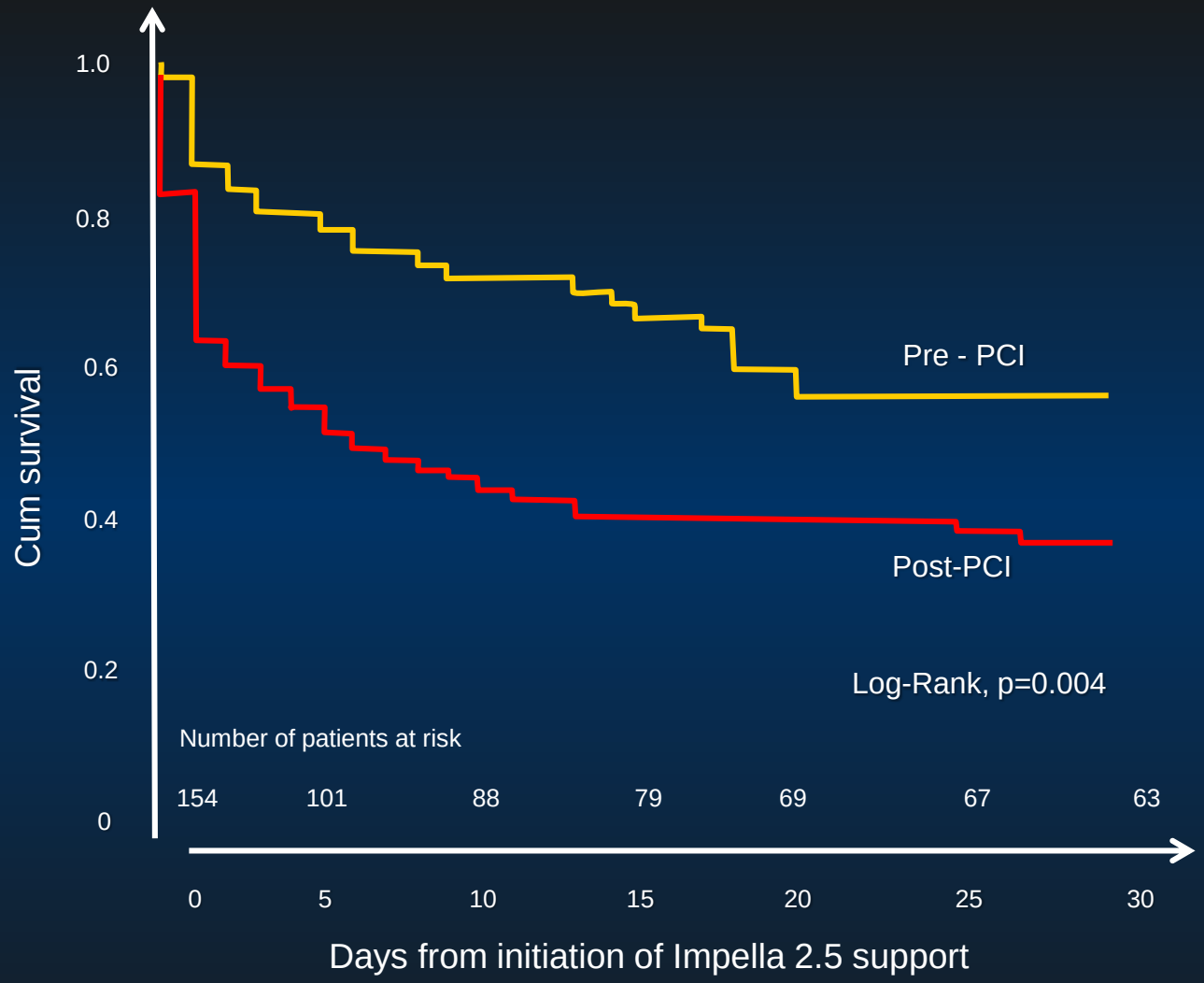
USPELLA Registry: Impella® Insertion Timing (N= 154)



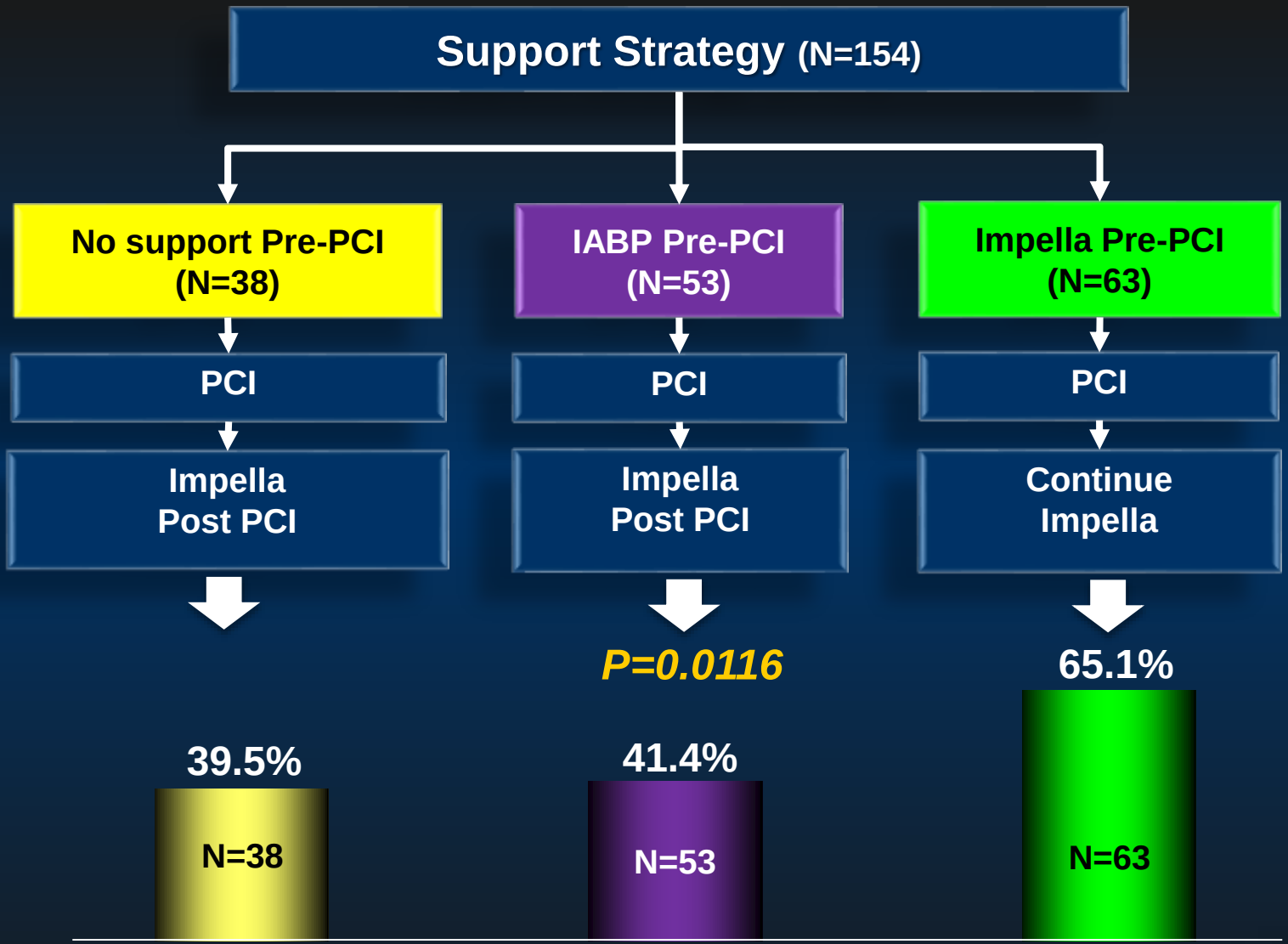
O'Neill et al, J Interven Cardiol 2013;9999:1-11

Outcome: Impella Pre or Post PCI



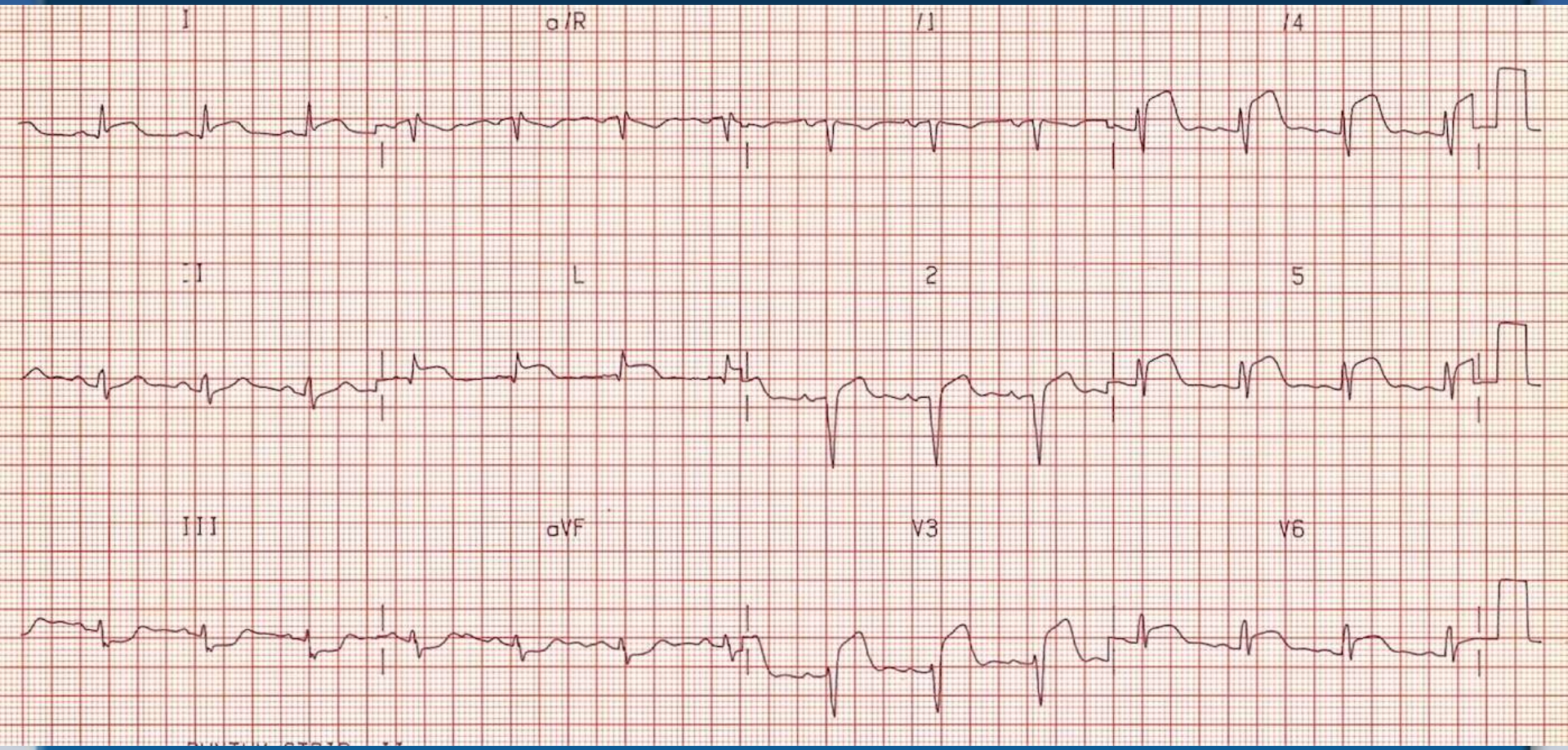
O'Neill et al, J Interven Cardiol 2013;9999:1-11

Outcome By Support Strategy

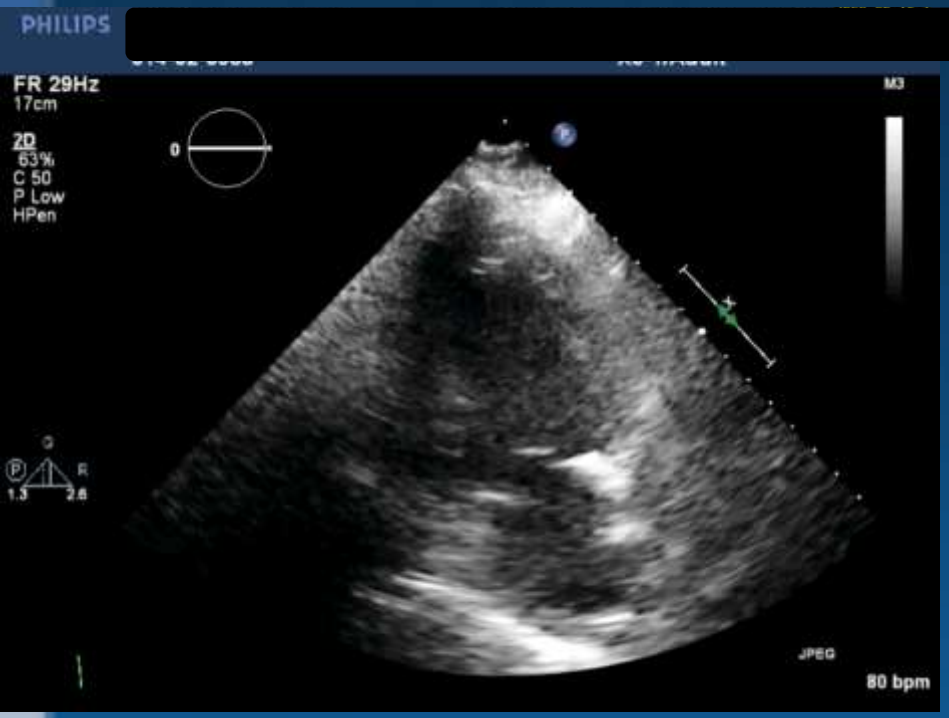


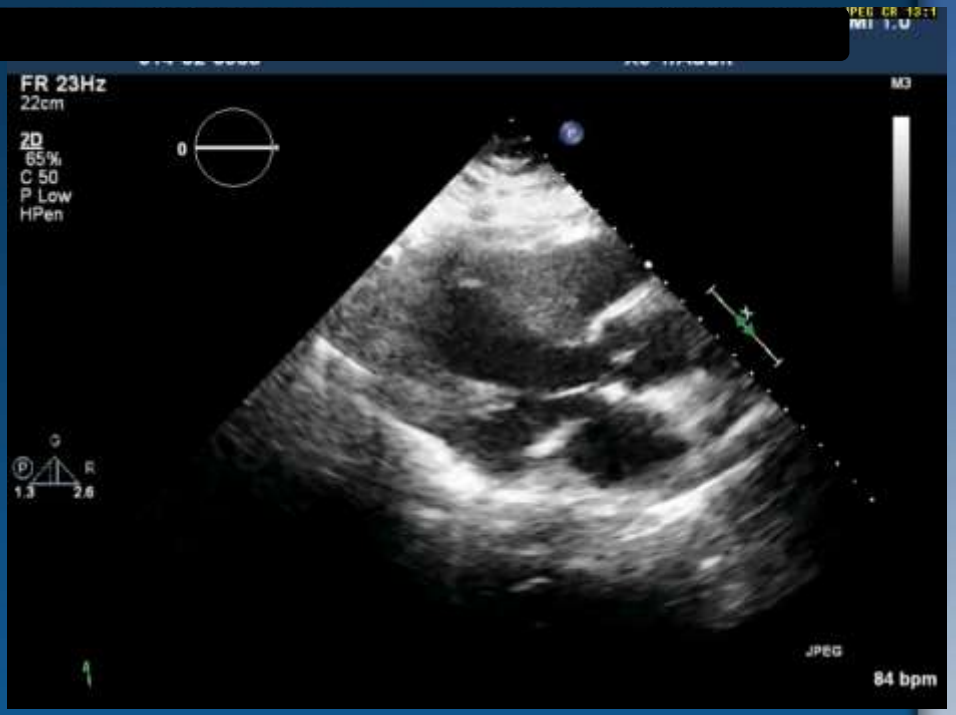
O'Neill et al, J Interven Cardiol 2013;9999:1-11

67y female, DM, PAD, Anterior STEMI at OSH, Trop I=16 hypotension, LVEF=35%



Transthoracic echocardiogram





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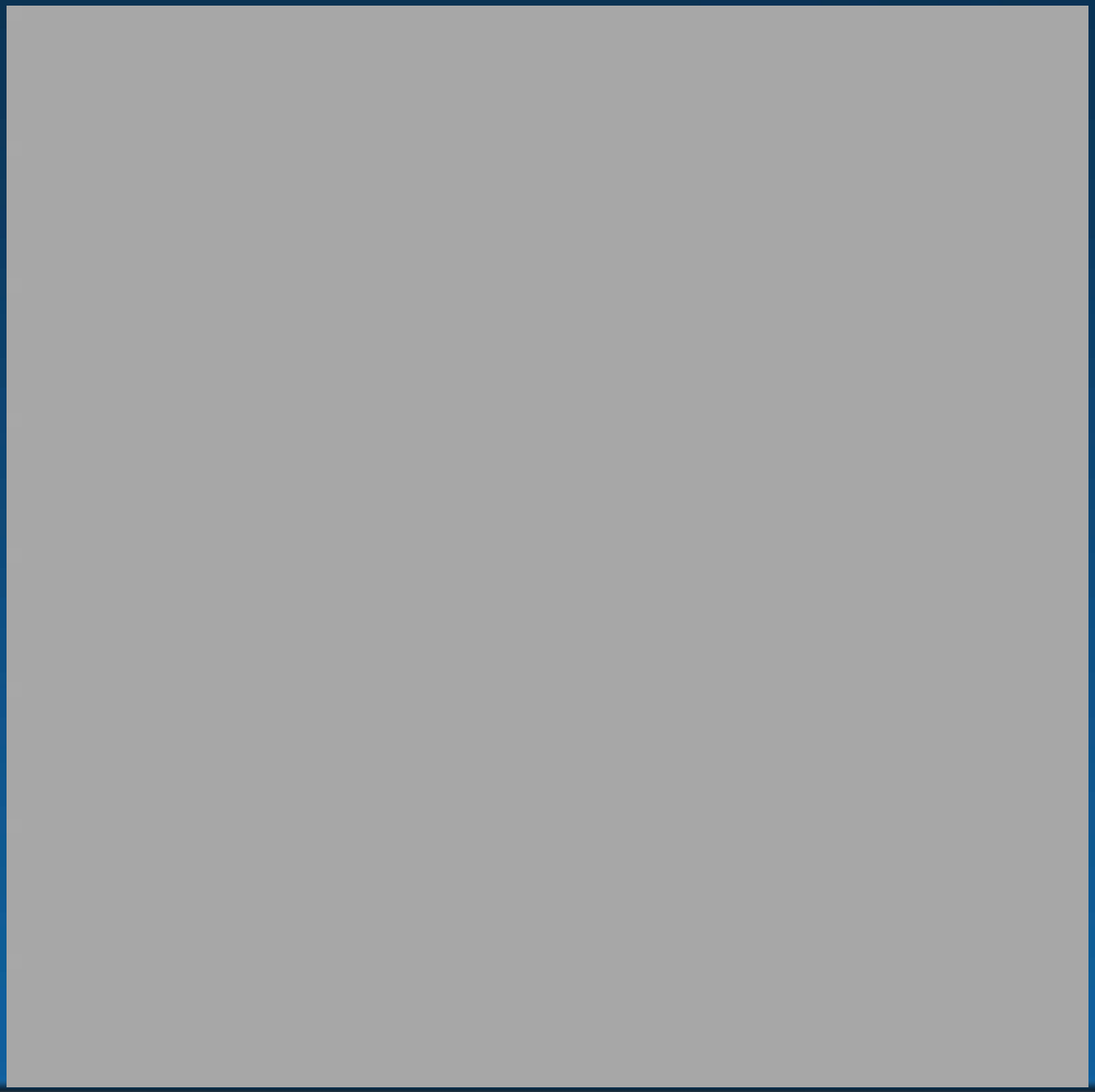
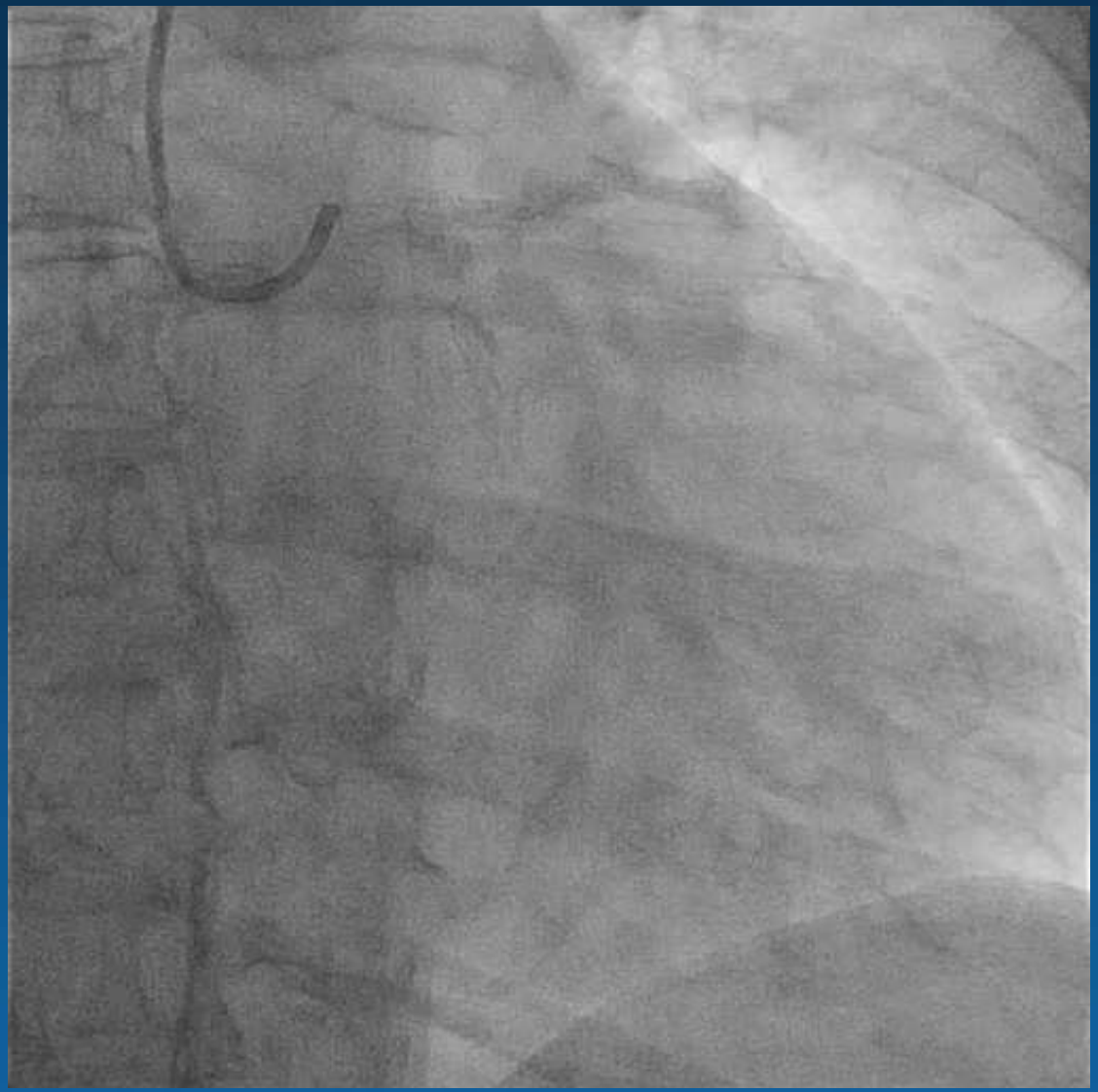
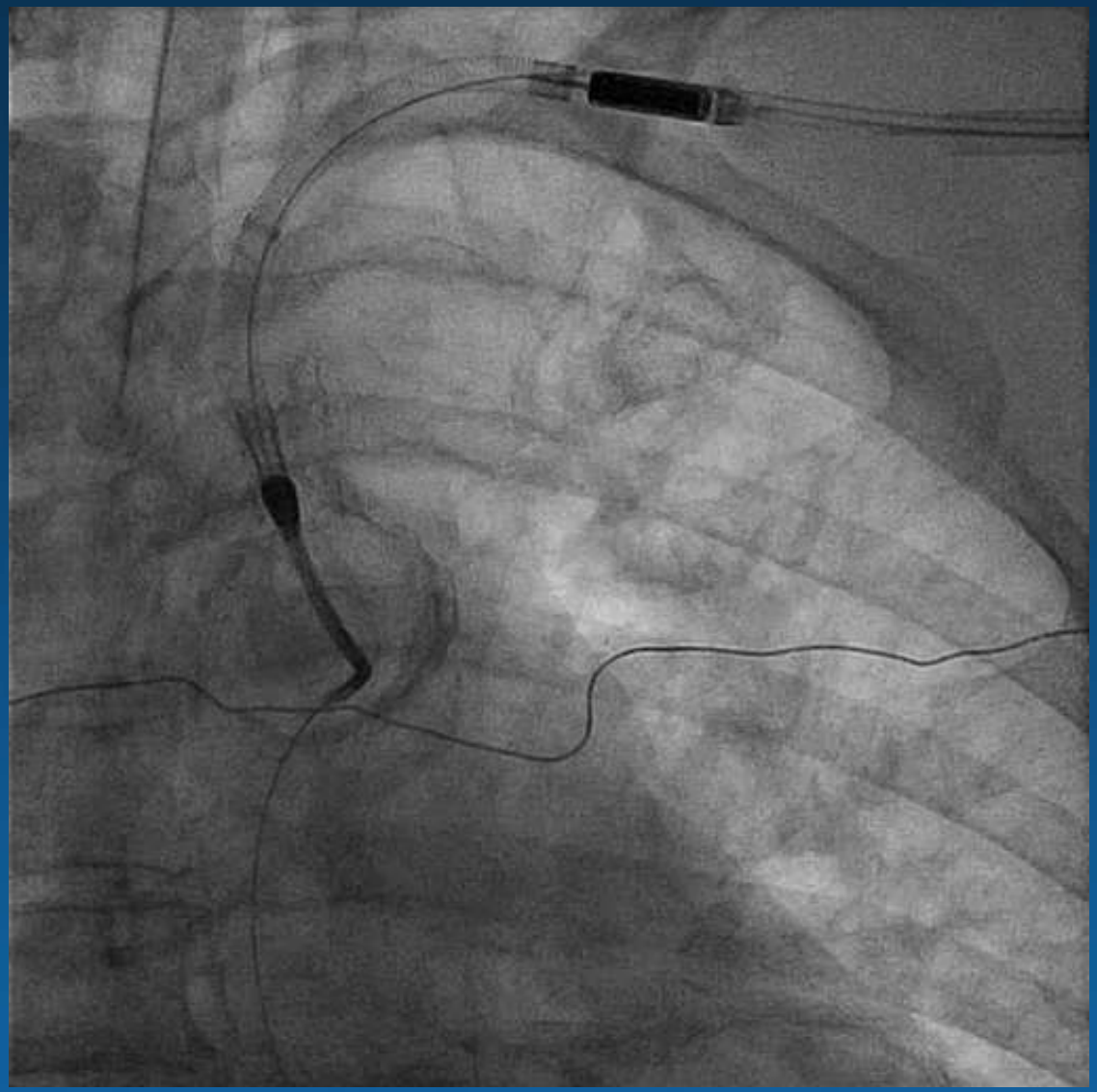
Distal Aortogram



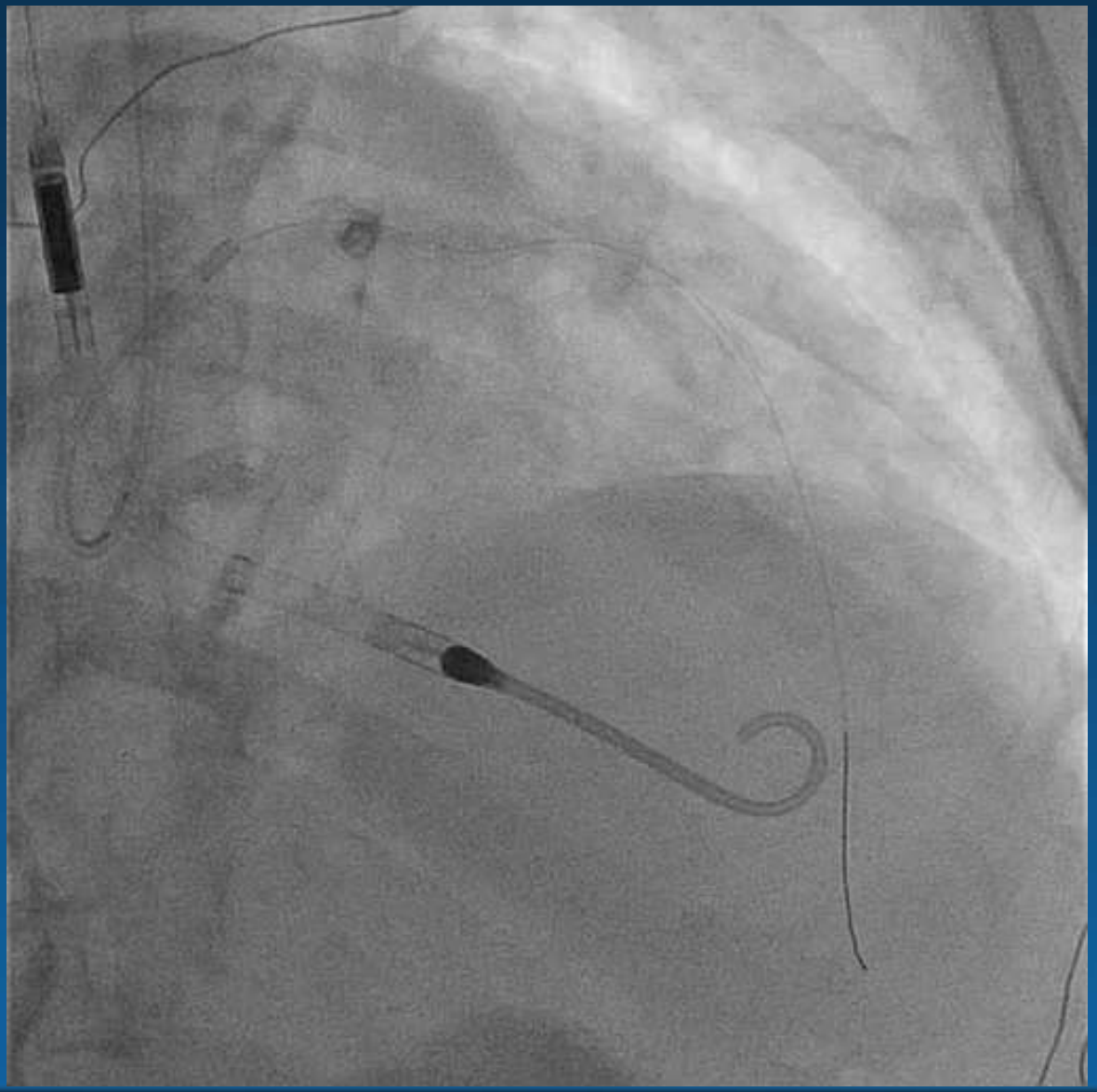
Diagnostic coronary angiogram



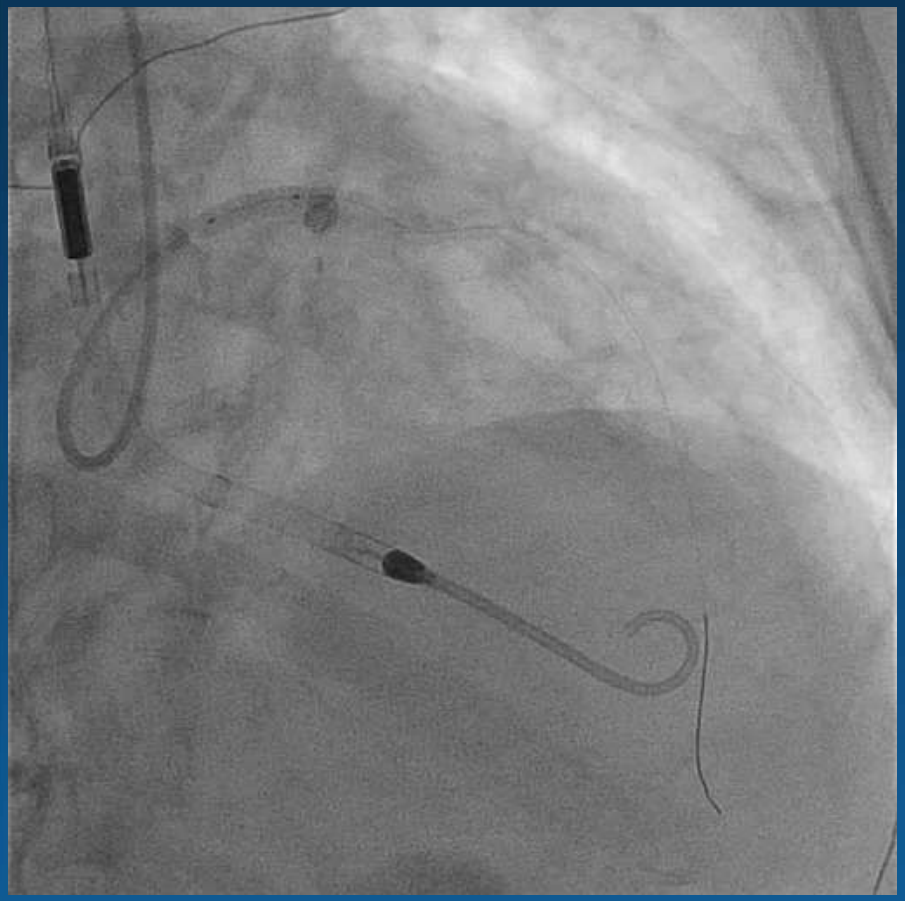
Impella 2.5 Insertion Via Left Axillary Artery Access

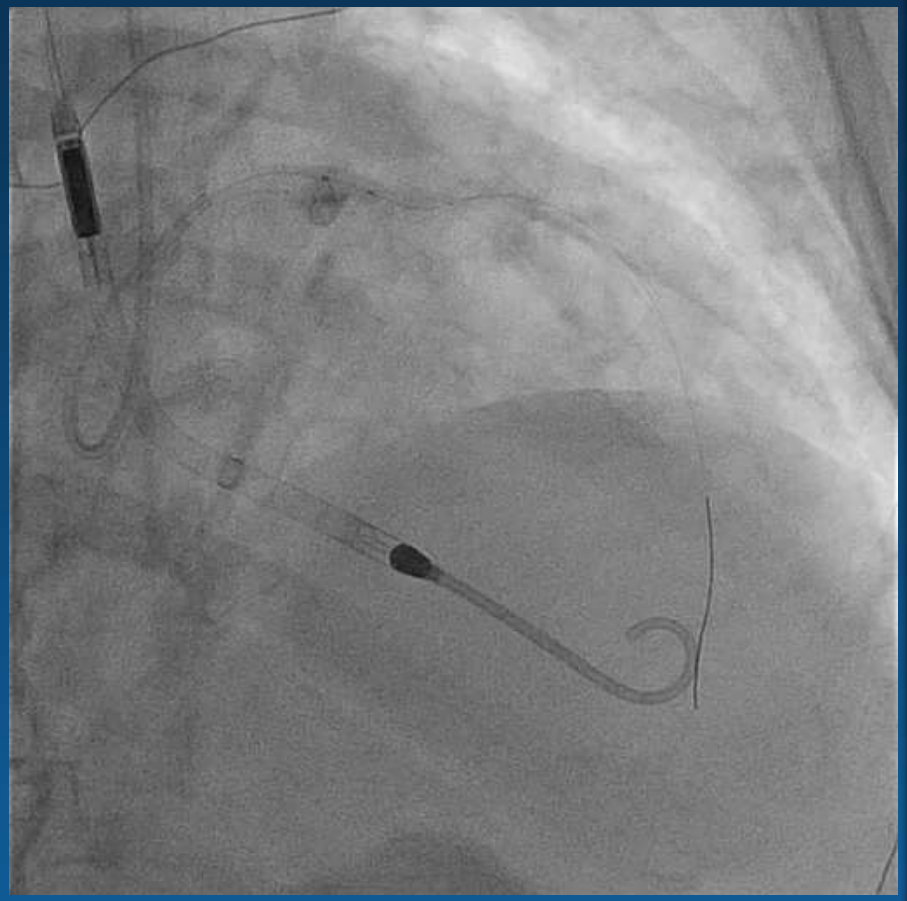


Coronary Angiogram Post-Balloon Angioplasty

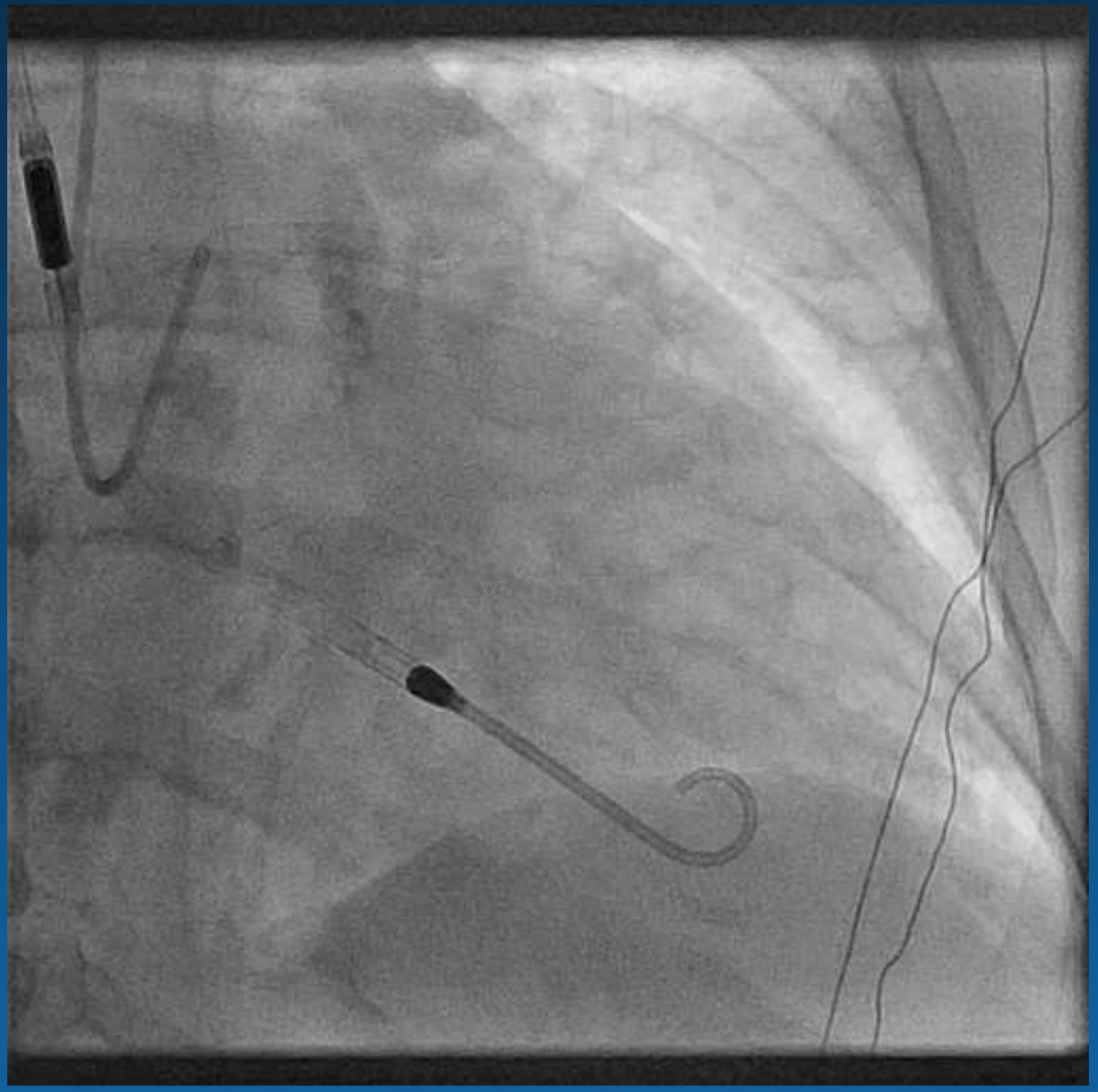


LM DES Implantation & Post-dilation

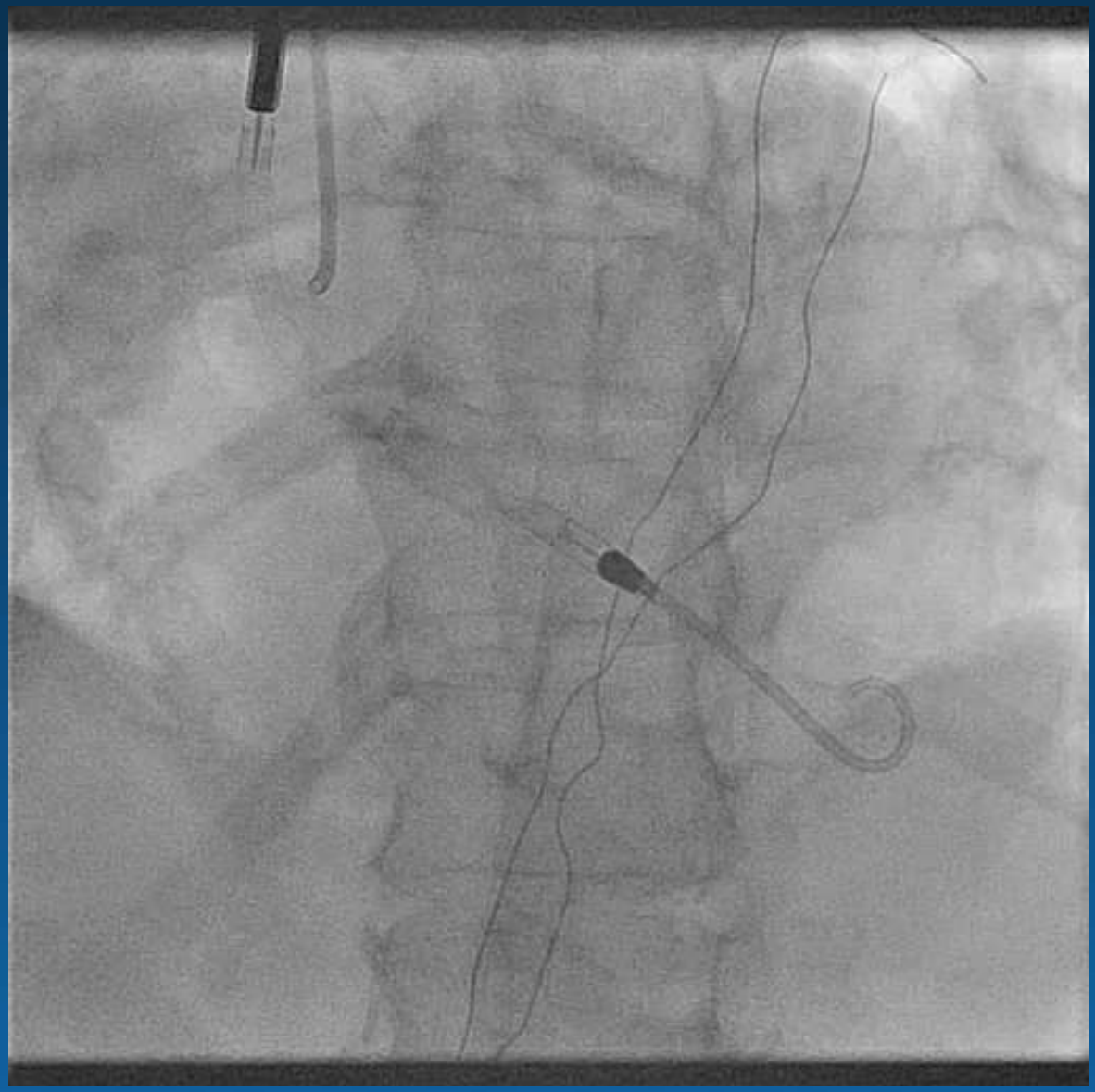




Final Left Coronary Angiogram

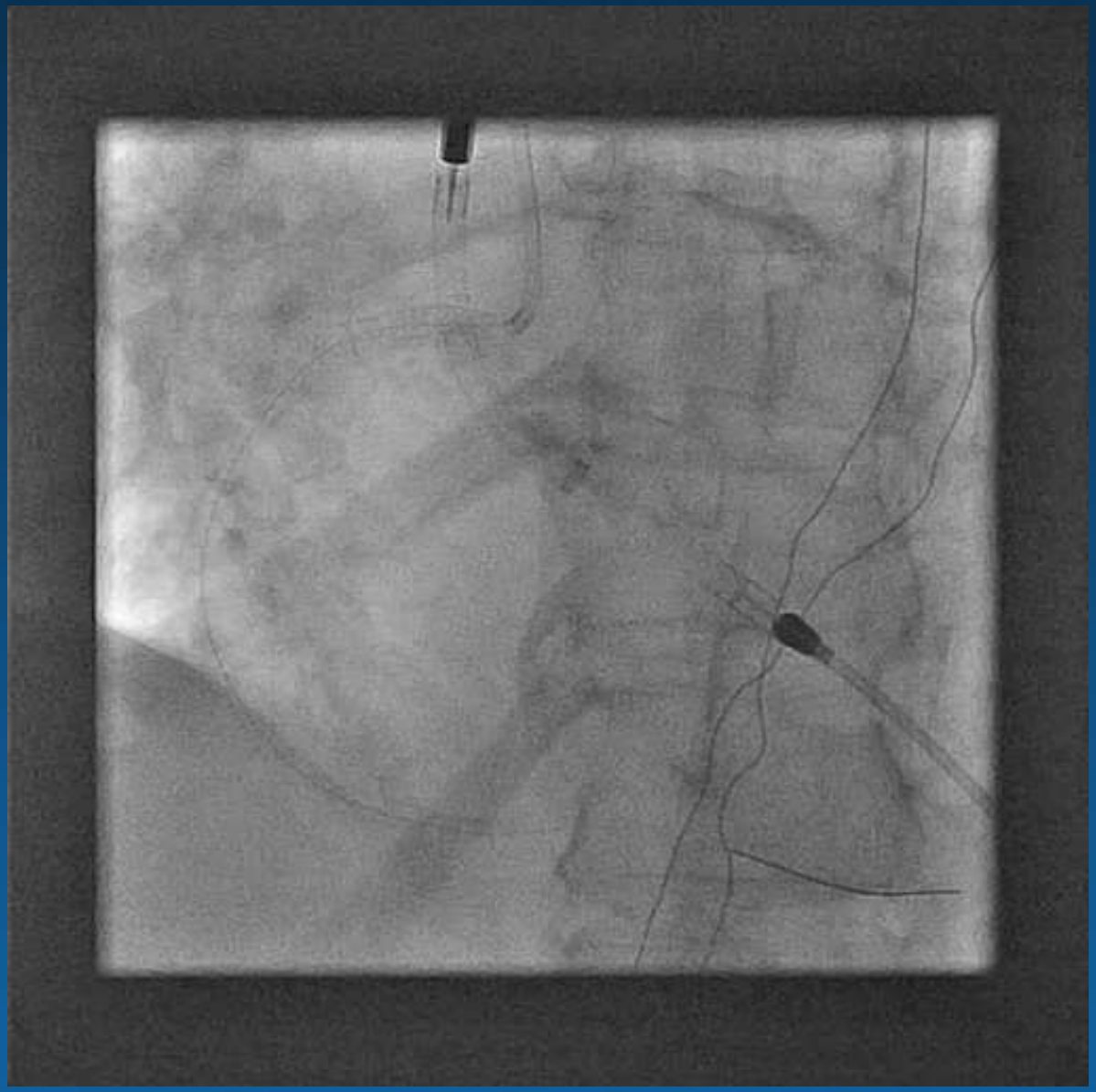


Right Coronary Angiogram

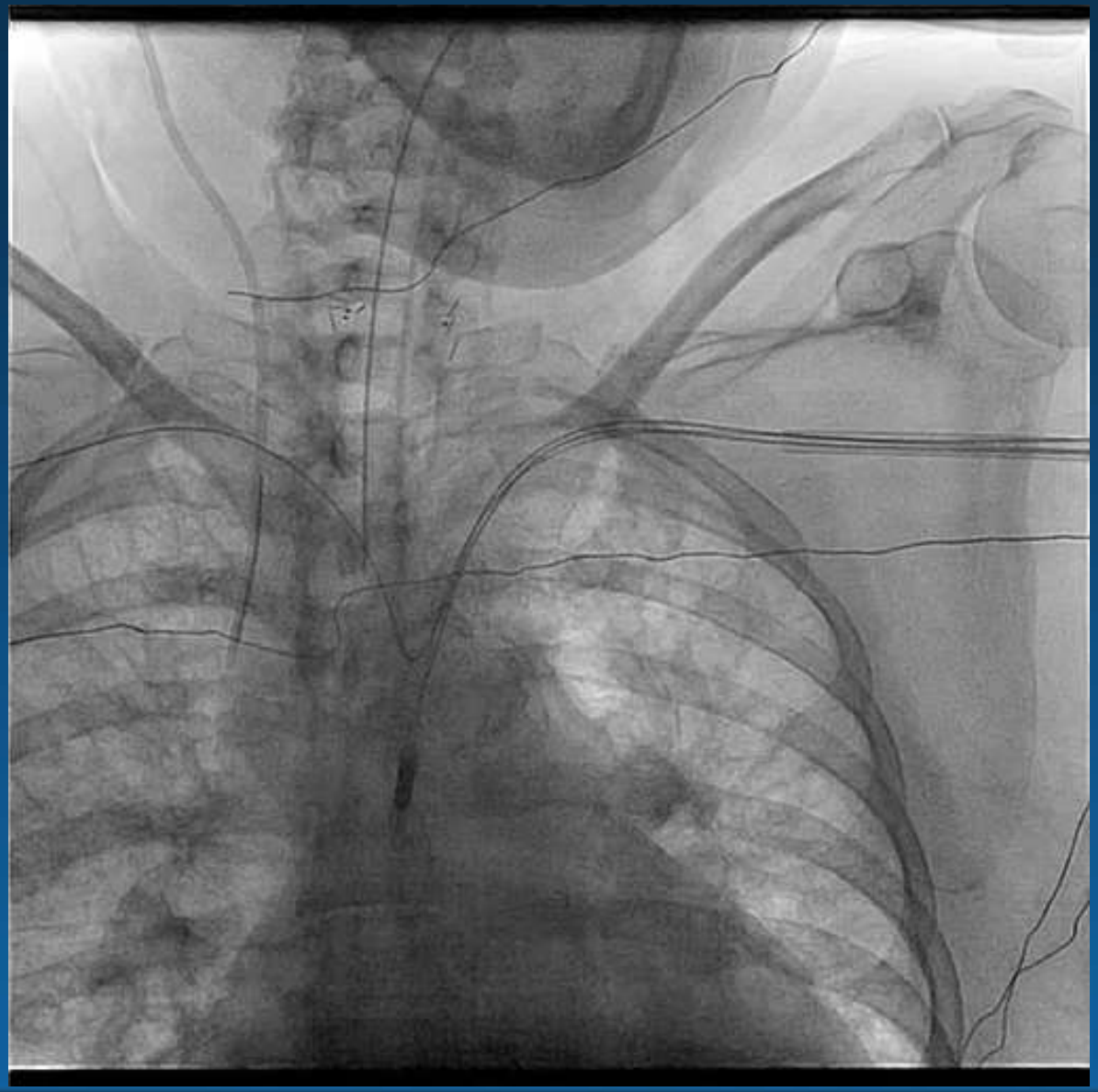


RCA Balloon Angioplasty & DES

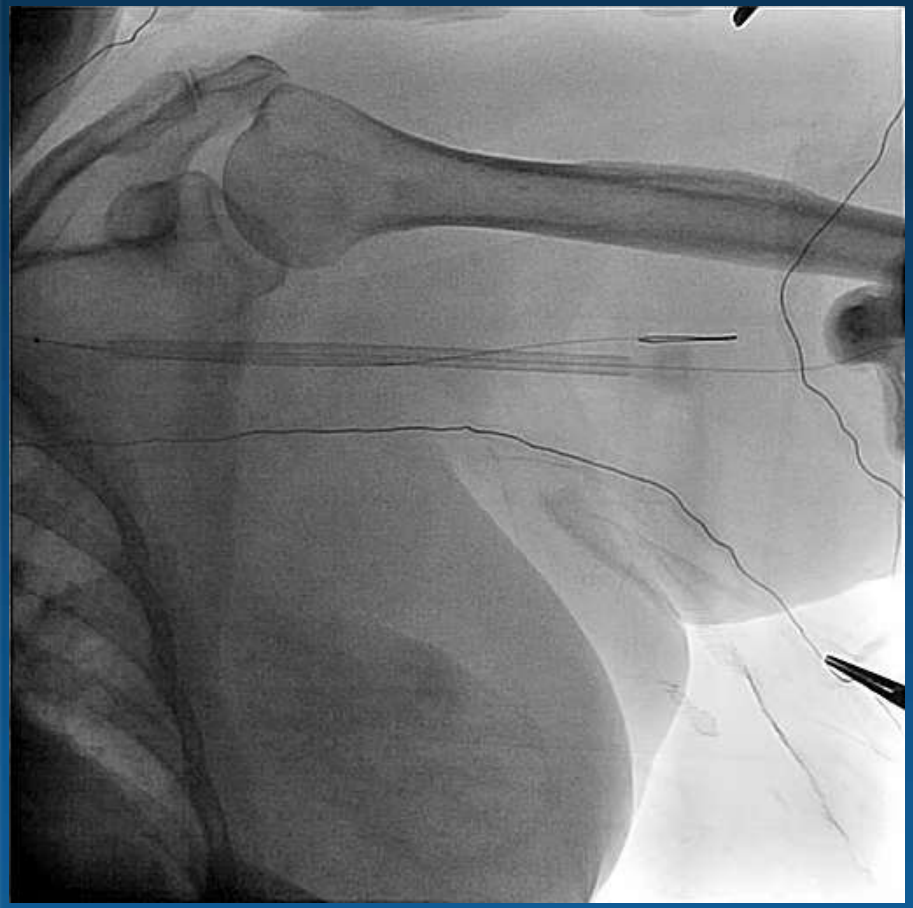
Final Right Coronary Angiogram

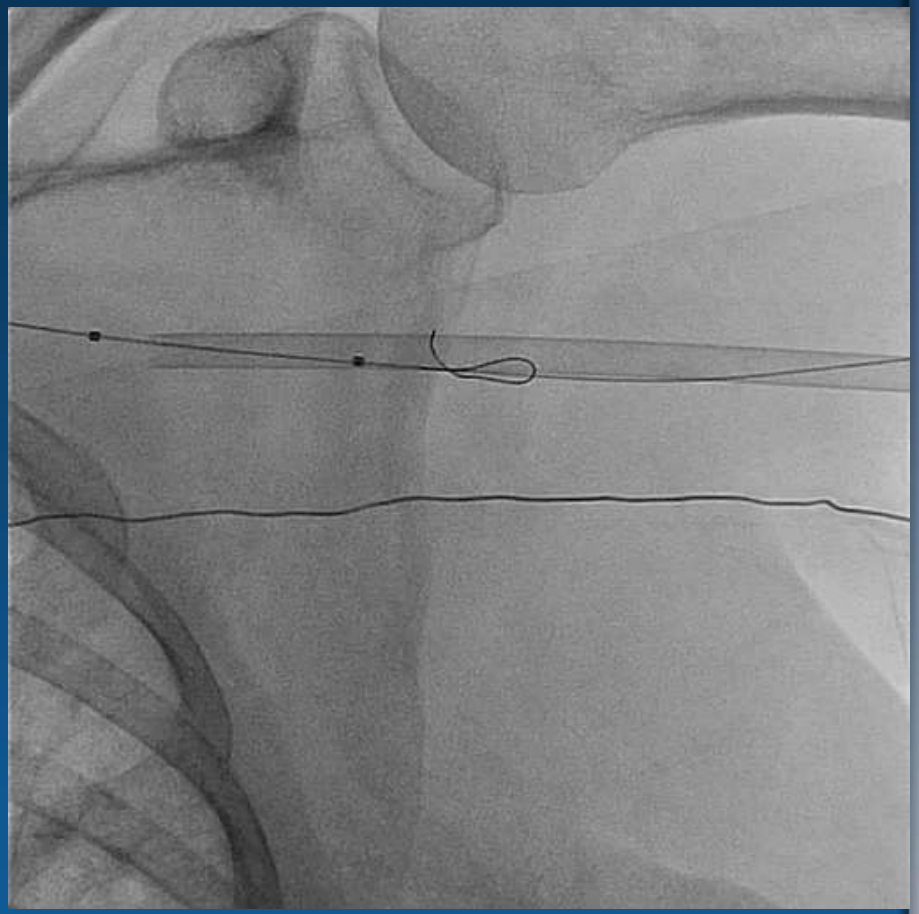


Impella Removal

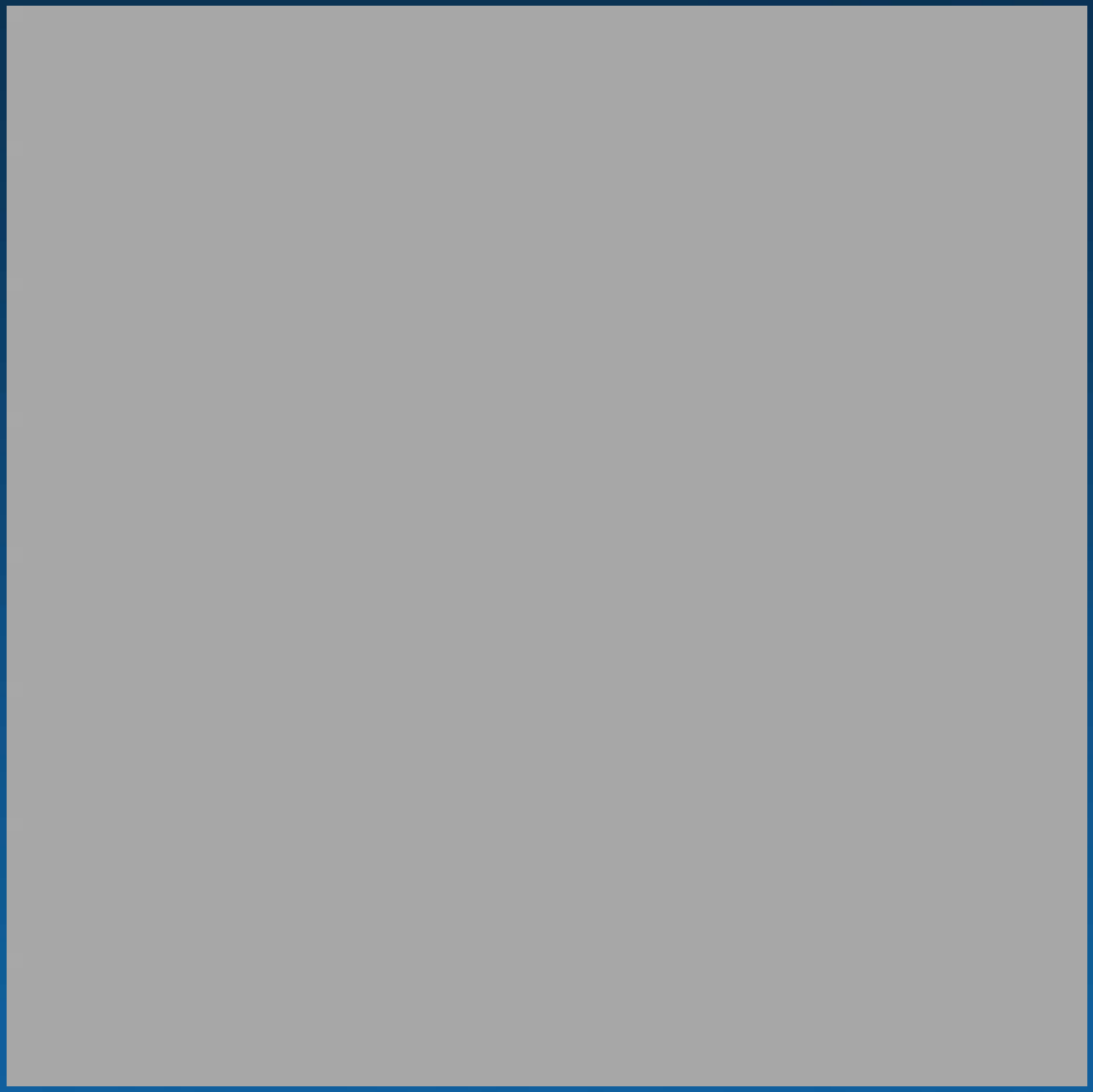


Balloon Placement in LSCA





Final LSCA Angiogram After Sheath Removal



Conclusions

- Impella & IABP are most frequently used hemodynamic support devices in the cath lab that facilitate performance of high-risk elective PCI & during cardiogenic shock
- Impella provides better balance of efficacy, safety & feasibility during high risk PCI, and provides superior hemodynamic support compared to IABP, especially if placed pre-PCI

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