When is Hemodynamic Support needed during Left Main PCI?

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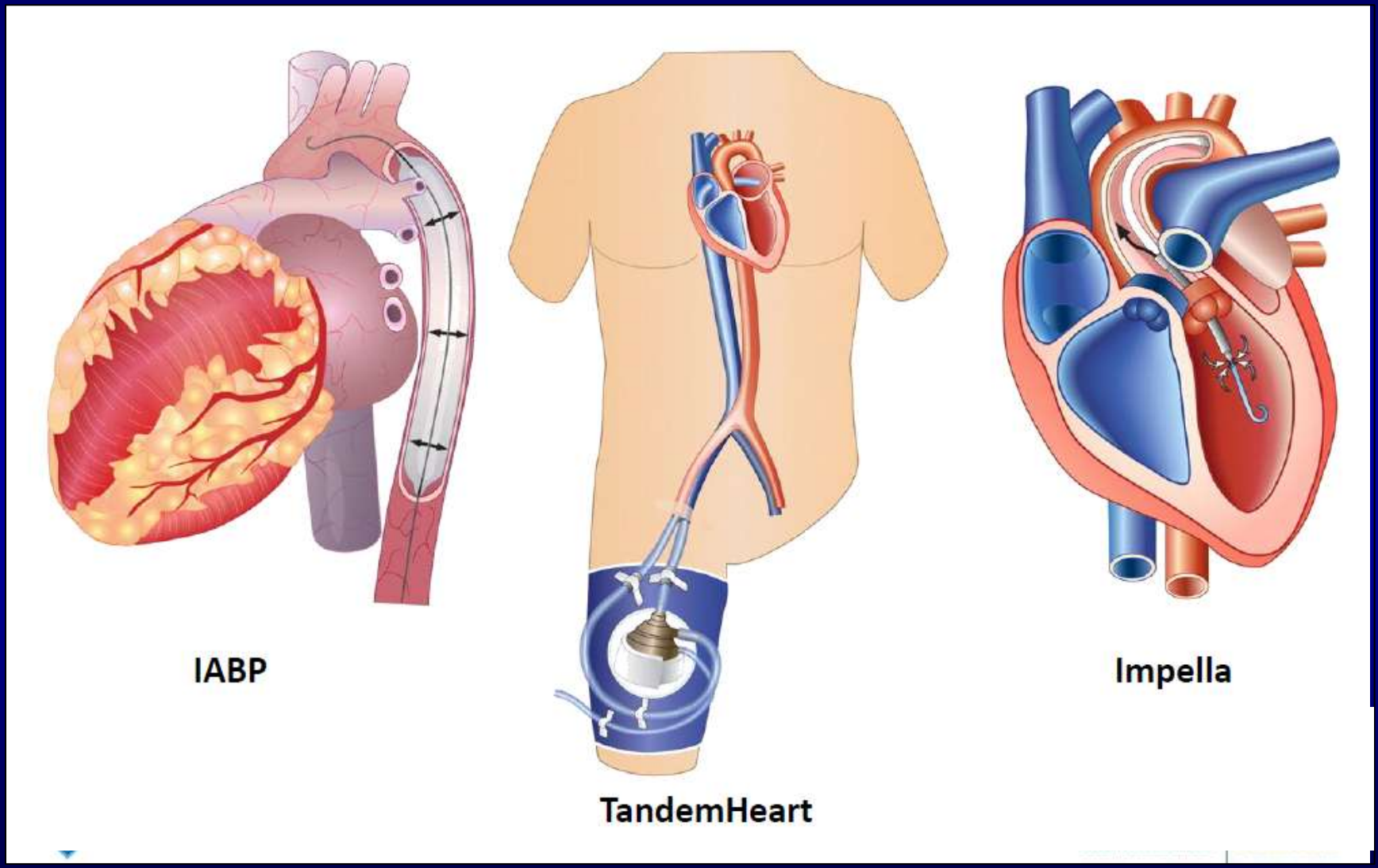
Most commonly used hemodynamic support devices in the cath lab



O'Neill W. et al. TCT 2012.

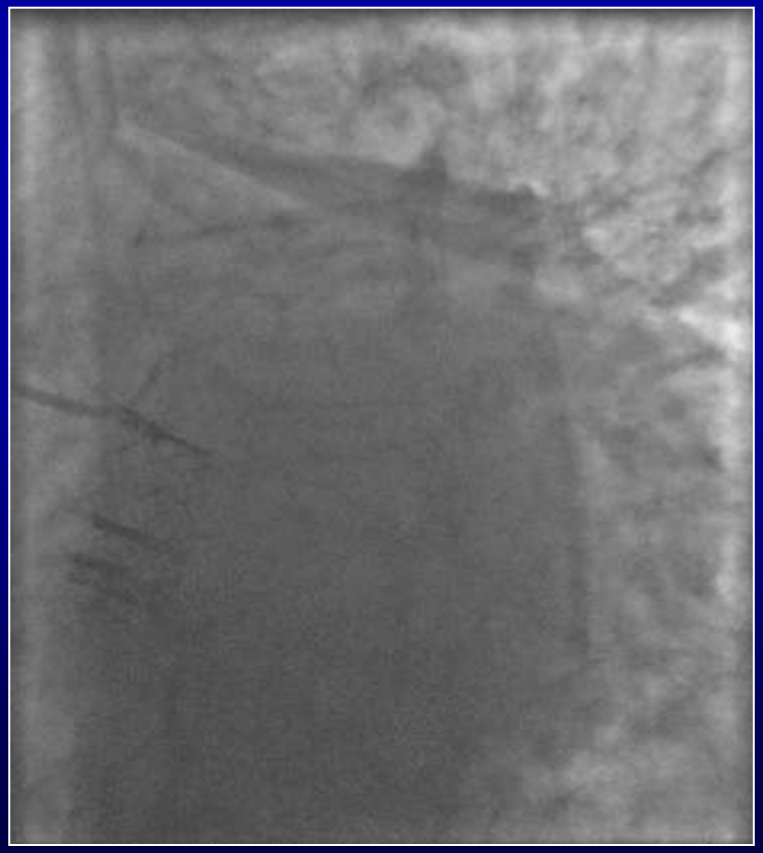
LM subsets requiring hemodynamic support

- Severely depressed LV systolic dysfunction
- Occluded/Non-dominant RCA
- Severe aortic stenosis
- Cardiogenic shock
- Ventricular arrhythmias
- Complex/calcified coronary anatomy, requiring atherectomy, multiple balloon dilatations and aggressive lesion prep

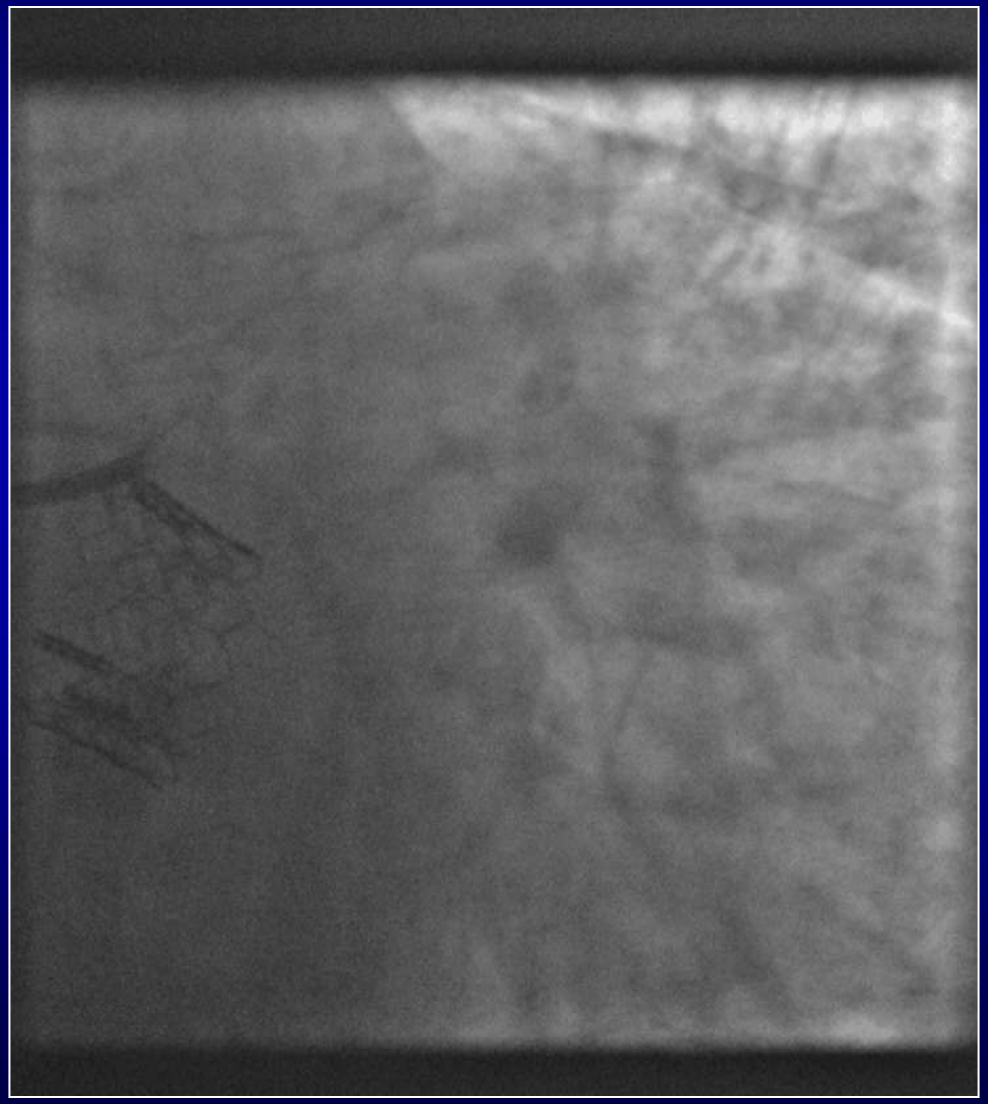
84 y/o female with h/o severe AS s/p TAVR with 23mm Edwards-SAPIEN 2 years ago p/w SOB on exertion. LVEF Normal

Baseline coronary angiogram via trans-radial approach

Although FFR LM → LAD 0.81, but IVUS MLA of LM 4.6 mm^2

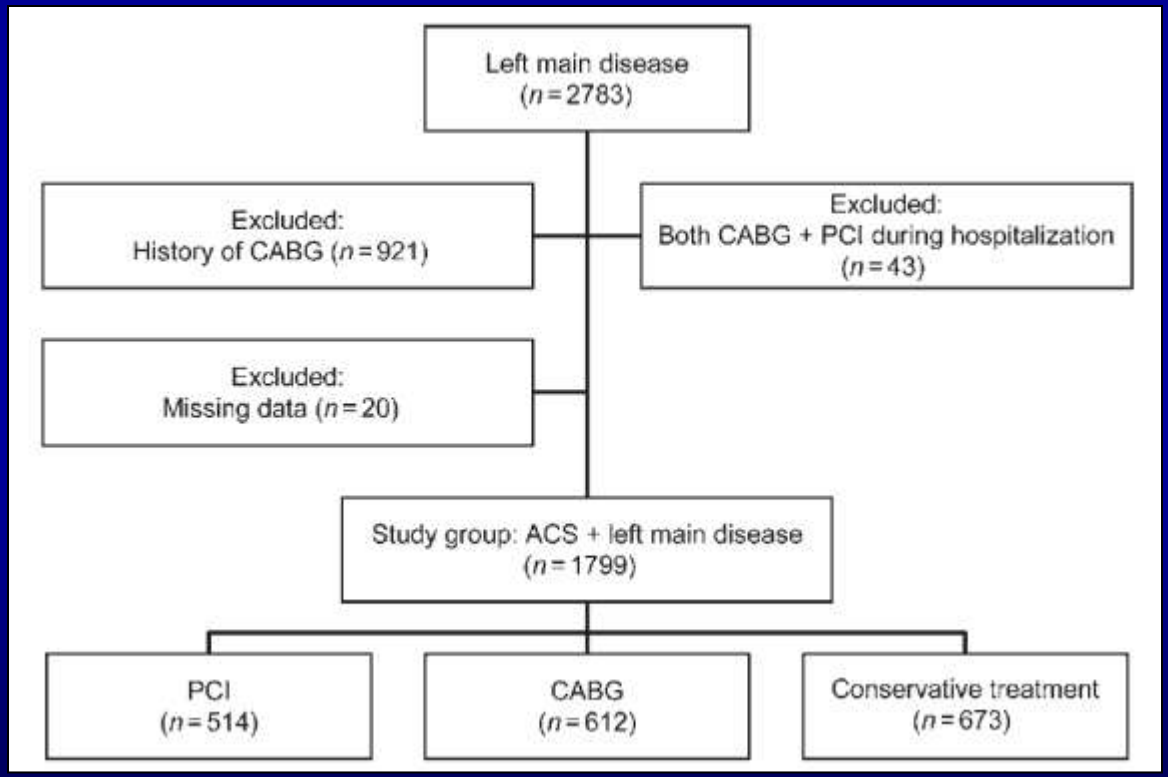


DES 3.5 x 18 mm to LM to LAD by Trans-radial approach, No hemodynamic support



Unprotected left main revascularization in patients with acute coronary syndromes

1799 patients with unprotected left main coronary artery stenosis presenting with ACS in the GRACE Registry



Balloon pump used in 20% of patients with undergoing PCI of ULMCA for ACS

Montalescot G. et al. European Heart Journal 2009.

Use and Effectiveness of IABP during high-risk PCI: NCDR Registry

Background—Intra-aortic balloon pumps (IABP) frequently are used to provide hemodynamic support during high risk percutaneous coronary intervention (PCI), but clinical evidence to support their use is mixed. We examined hospital variation in IABP use among high risk PCI patients, and determined the association of IABP use on mortality in this population.

Methods and Results—We analyzed data submitted to the CathPCI Registry between January 2005 and December 2007.

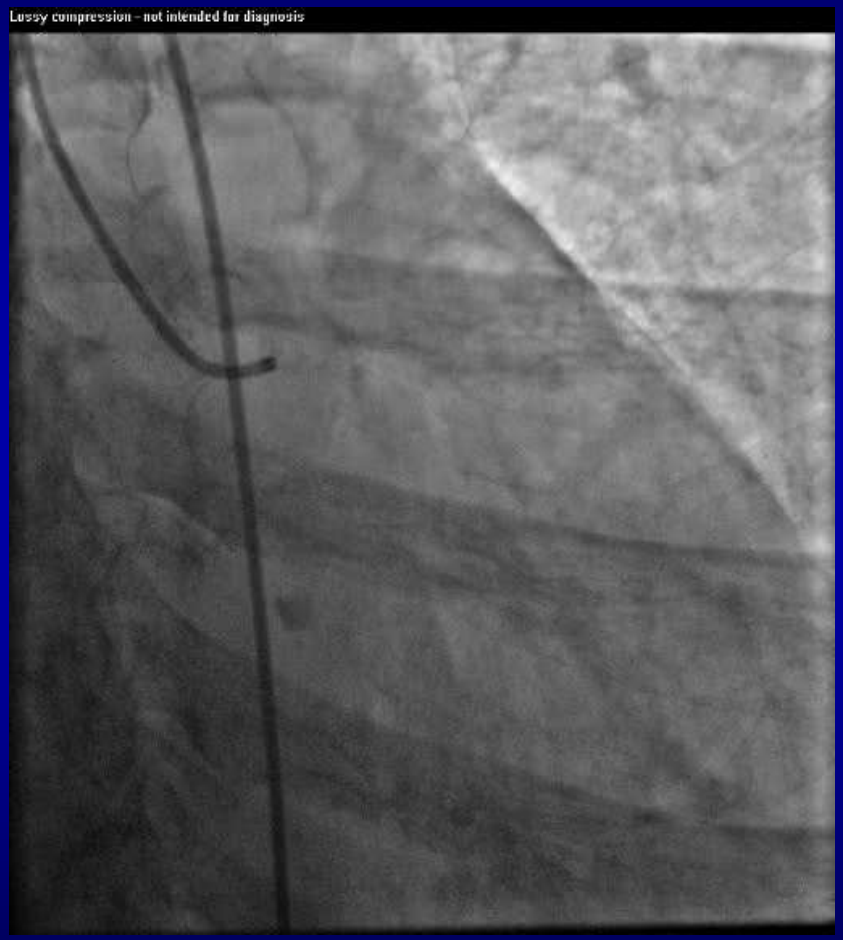
IABP used in 28.1% of ULMCA PCI in the United States

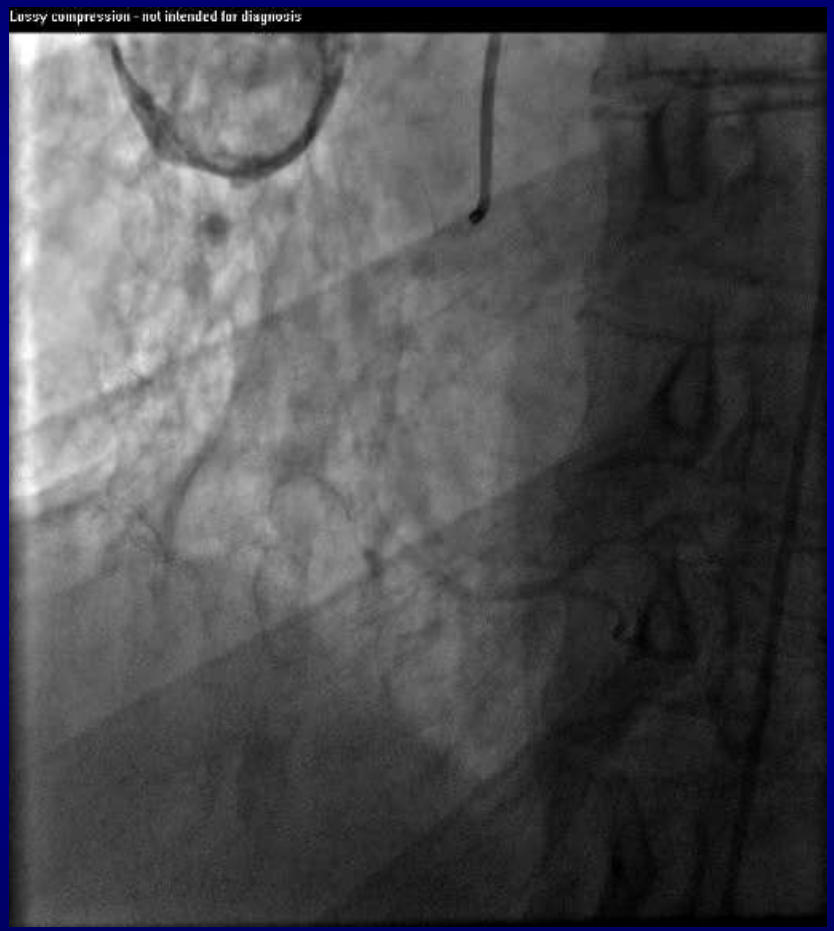
Hospitals were categorized into quartiles by their proportional use of IABP. We examined differences in in-hospital mortality across hospital quartiles using a hierarchical logistic regression model to adjust for differences in patient and hospital characteristics across hospital quartiles of IABP use. IABPs were used in 18 990 (10.5%) of 181 599 high risk PCIs. Proportional use of IABP varied significantly across hospital quartiles: Q1, 0.0 to 6.5%; Q2, 6.6 to 9.2%; Q3, 9.3 to 14.1%; Q4, 14.2 to 40.0%. In multivariable analysis, after adjustment for differences in patient and hospital characteristics, in-hospital mortality was comparable across quartiles of hospital IABP usage (Q1, Ref; Q2, odds ratio 1.11, 95% CI 0.99–1.24; Q3, OR 1.03, 95% CI 0.92–1.15; Q4, OR 1.06, 95% CI 0.94–1.18).

Conclusions—IABP use varied significantly across hospitals for high risk PCI. However, this variation in IABP use was not associated with differences in in-hospital mortality. (***Circ Cardiovasc Qual Outcomes*. 2012;5:21-30.**)

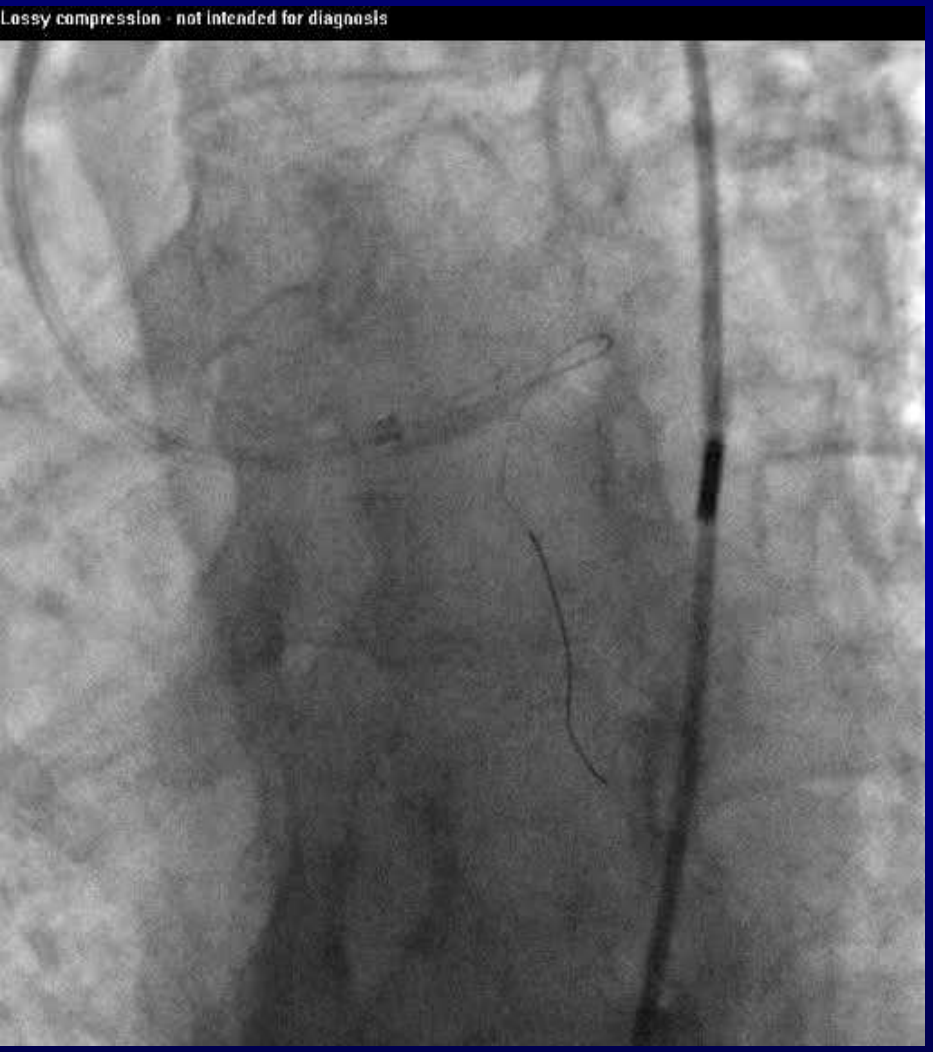
Curtis JP. et al. Circulation: Cardiovascular Quality and Outcomes 2012.

47 y old executive with history of hodgkin’s disease and radiation to chest. Presents with exertional angina. Vital capacity 40% of normal, MRI possible constriction. CT Surgical consultation is obtained.





Post Procedure, Procedure time 1 hour, Discharged <24 hrs



BCIS-1 Study: Randomized trial of elective IABP versus no IABP in high-risk PCI

IABP (n=150, *27% LM*); no IABP (n=151, *29% LM*)

Primary end-point: MACCE at 28 days (Death/MI/Stroke/Revascularization)

No difference in primary end point at 28 days

Trend towards improved mortality at 6 months

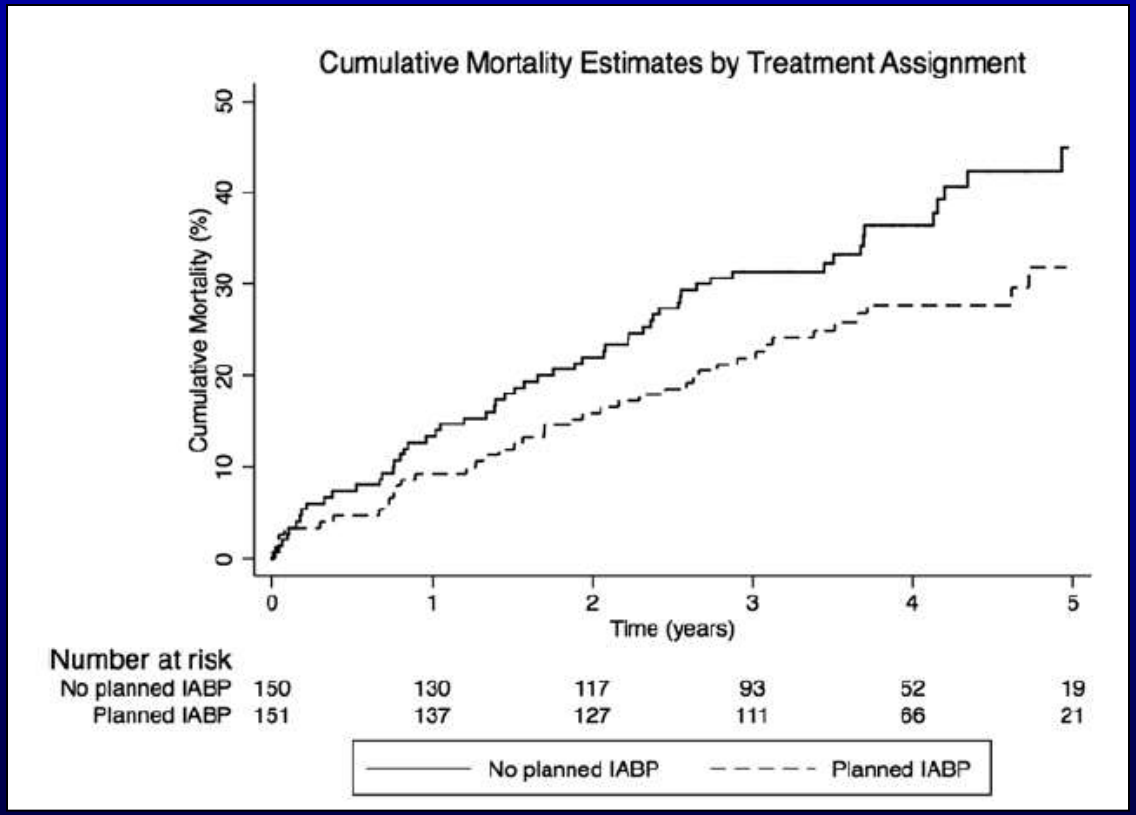
Variable	No. (%) Elective IABP (n = 151)	No. (%) No Planned IABP (n = 150)	OR (95% CI)[a]	*P* Value
Primary end point				
MACCE[b]	23 (15.2)	24 (16.0)	0.94 (0.51-1.76)	.85
MI	19 (12.6)	20 (13.3)	0.93 (0.48-1.83)	.85
Death	3 (2.0)	1 (0.7)	3.02 (0.31-29.37)	.34
CVA	2 (1.3)	0		
Further revascularization	1 (0.7)	4 (2.7)	0.24 (0.03-2.20)	.21
Secondary end points				
6-mo mortality	7 (4.6)	11 (7.4)[c]	0.61 (0.24-1.62)	.32

Perera D. et al. JAMA 2008.

BCIS-1 Study: Randomized trial of elective IABP versus no IABP in high-risk PCI

IABP (n=150, *27% LM*); no IABP (n=151, *29% LM*)

Significantly improved long-term mortality with IABP in high-risk PCI



31% relative reduction in long-term mortality with IABP

28% vs. 38.4%

Perera D. et al. Circulation 2013.

Elective versus provisional intraaortic balloon pumping in unprotected left main stenting

Milan Experience

Elective IABP (n=69); Conservative group (n=150)

Predictors of outcomes during LM PCI

Elective IABP is protective during LM PCI

	Odds ratio
Elective IABP	0.08 (0.01-0.69)
Euroscore > 6 plus distal LM	5.49 (1.47-20.51)
SBP < 100mmHg	3.52 (0.50-24.73)

Intraprocedural events are higher with conservative approach

1.4% vs. 9.5%

	Elective IABP group (N = 69)	Conservative group (N = 150)	P
Intraprocedural events			
Cumulative	1 (1.4%)	14 (9.5%)	.032
VF/VT	0	2 (1.4%)	1.00
CPA	0	3 (2.0%)	.48
Hypotension/shock	0	12 (8%)	.020
Death	0	0	1.00
AMI	0	2 (1.4%)	1.00
Urgent CABG*	1 (1.4%)	5 (3.3%)	.42

Briguori C. et al. American Heart Journal 2006.

Elective versus provisional intraaortic balloon pumping in unprotected left main stenting

Milan Experience

Elective IABP (n=69); Conservative group (n=150)

Elective IABP used in 31% of patients undergoing LM PCI

Milan criteria for elective IABP before ULMCA PCI

- LM bifurcation lesion
- EF < 40%
- Atherectomy
- Unstable angina
- RCA critical stenosis

15% (12/150) patients in the conservative group required insertion of IABP due to hemodynamic instability

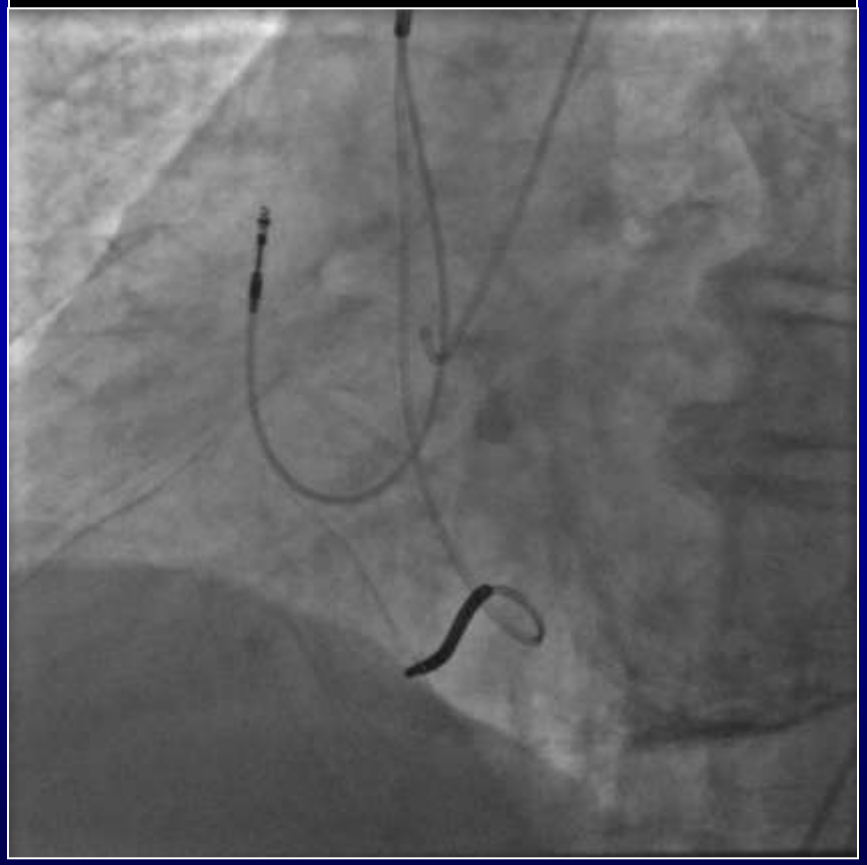
Briguori C. et al. American Heart Journal 2006.

87 y/o male presenting with NSTEMI

Severely depressed cardiac function (EF 15%)

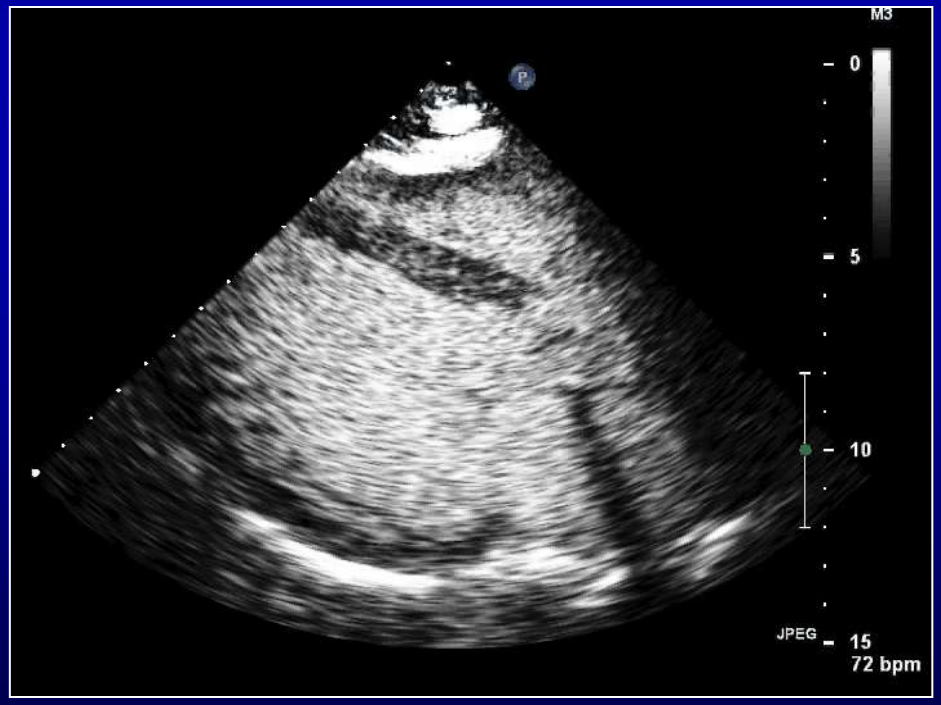
80% ostial LM, 90% distal LM, 90% ostial LAD, 80% mid-LAD

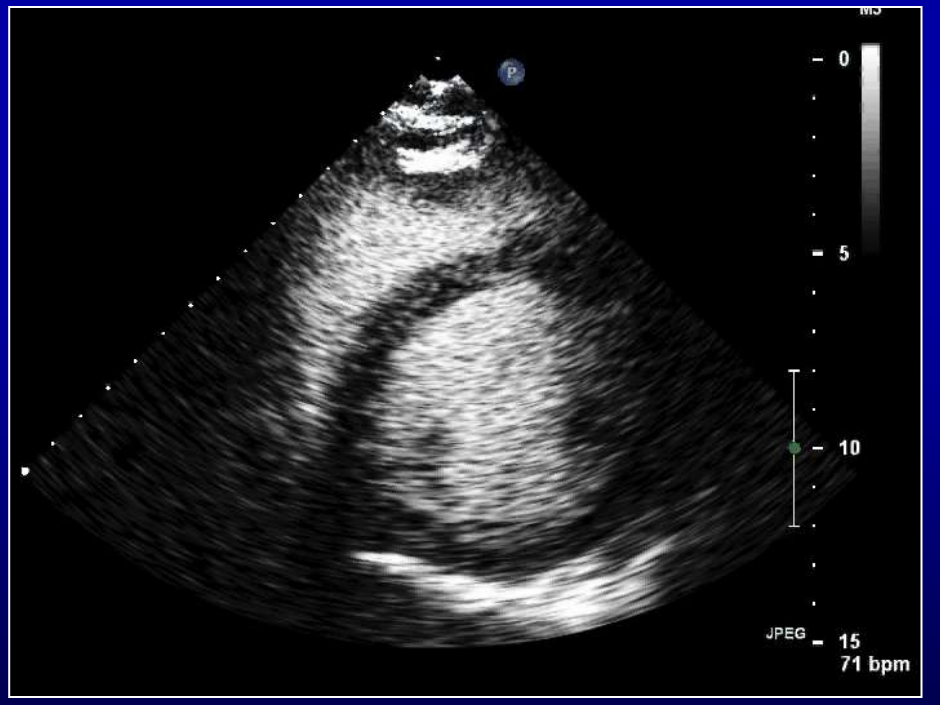
100% prox-RCA with bridging collaterals to mid-RCA



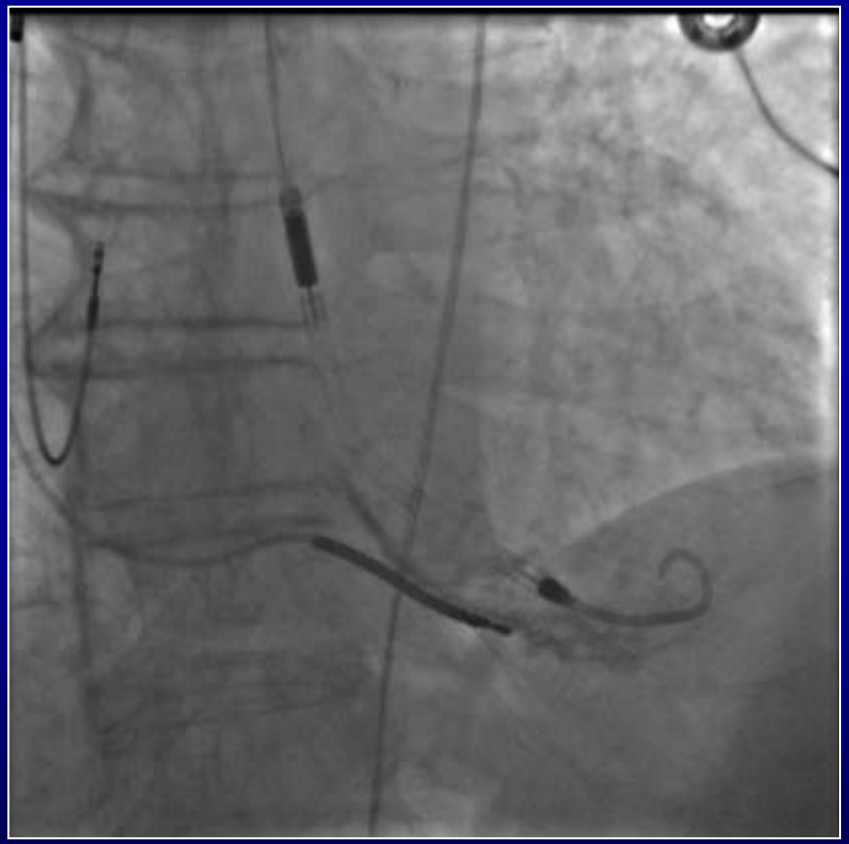
Severely depressed systolic function
Ejection Fraction 15%

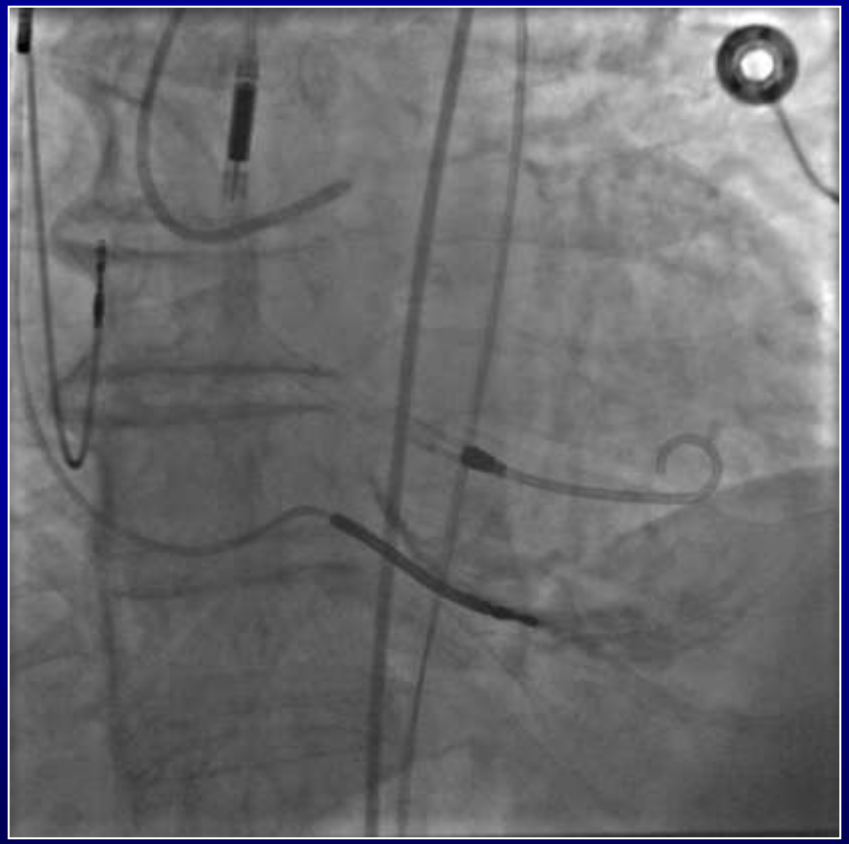
Patient not a surgical candidate





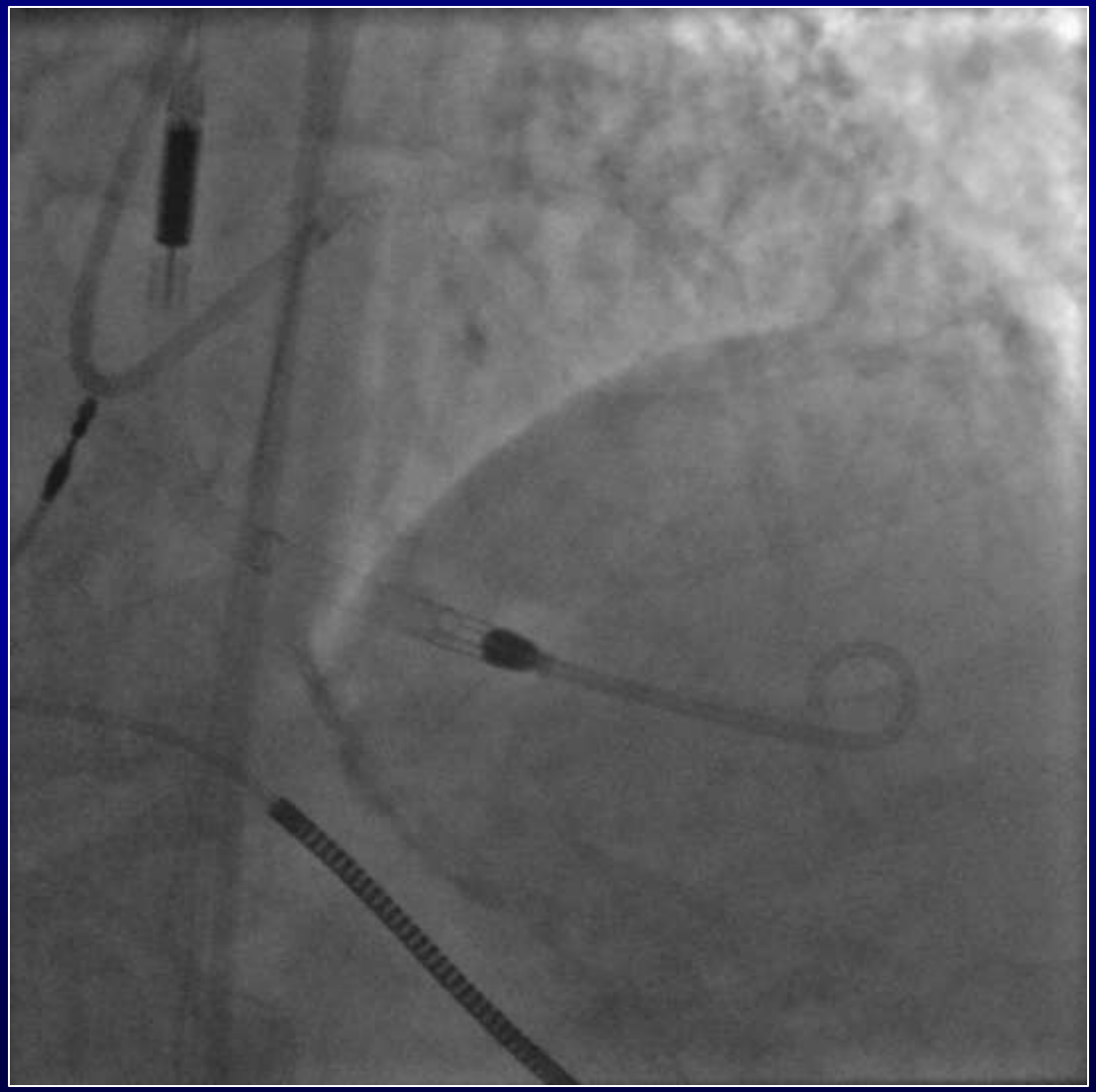
High-risk PCI of the LM performed with Impella 4.0 hemodynamic support





Final result

s/p Resolute 2.5x22mm, 2.25x14mm, 2.75x12mm and 3.0x26mm stents to the LAD

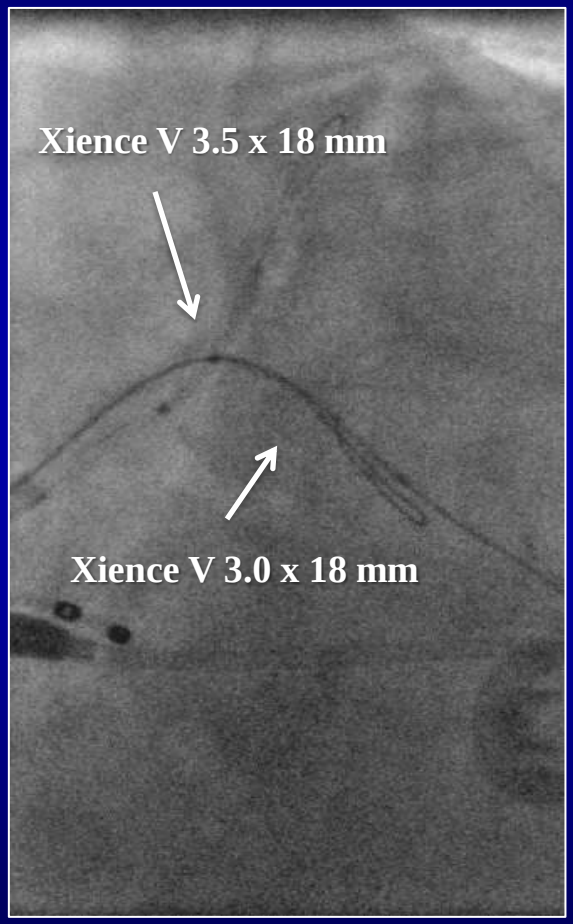


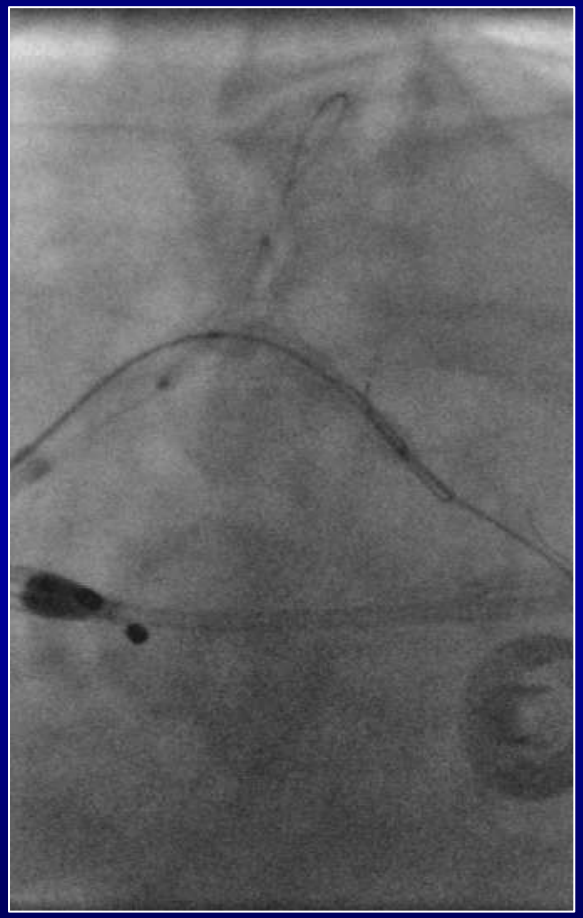
Patient discharged home 5 days later

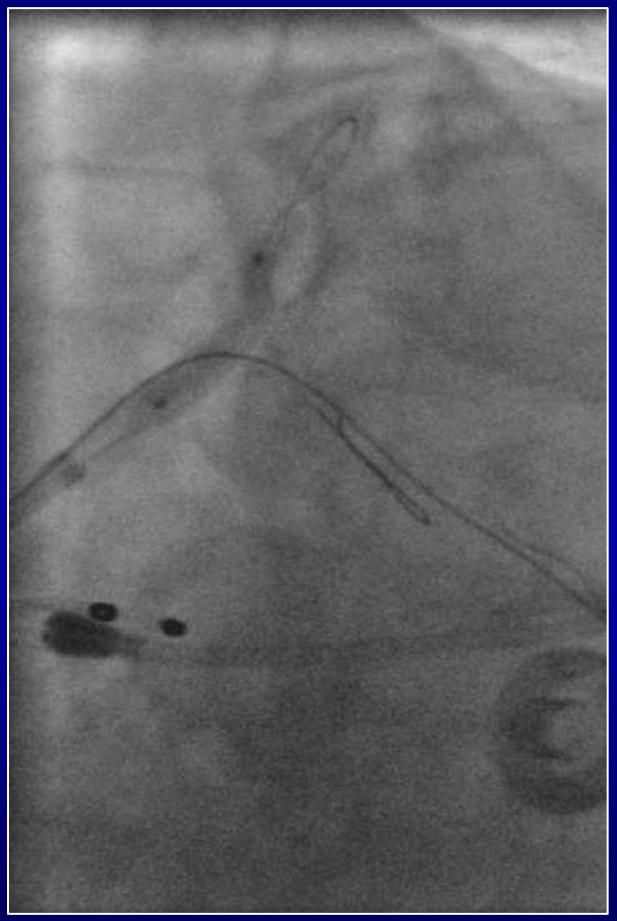
71 y/o male with AVA 1.3 cm^2, LVEF 60%

Baseline Coronary Angiogram

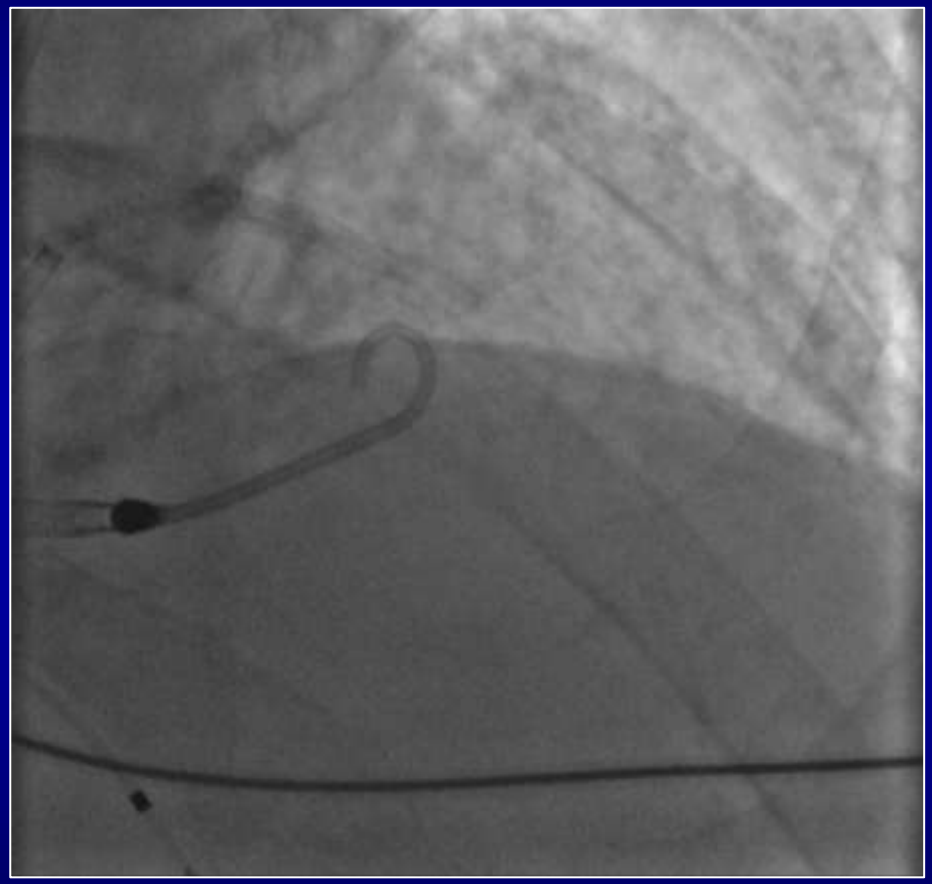
Stent Positioning and Deployment

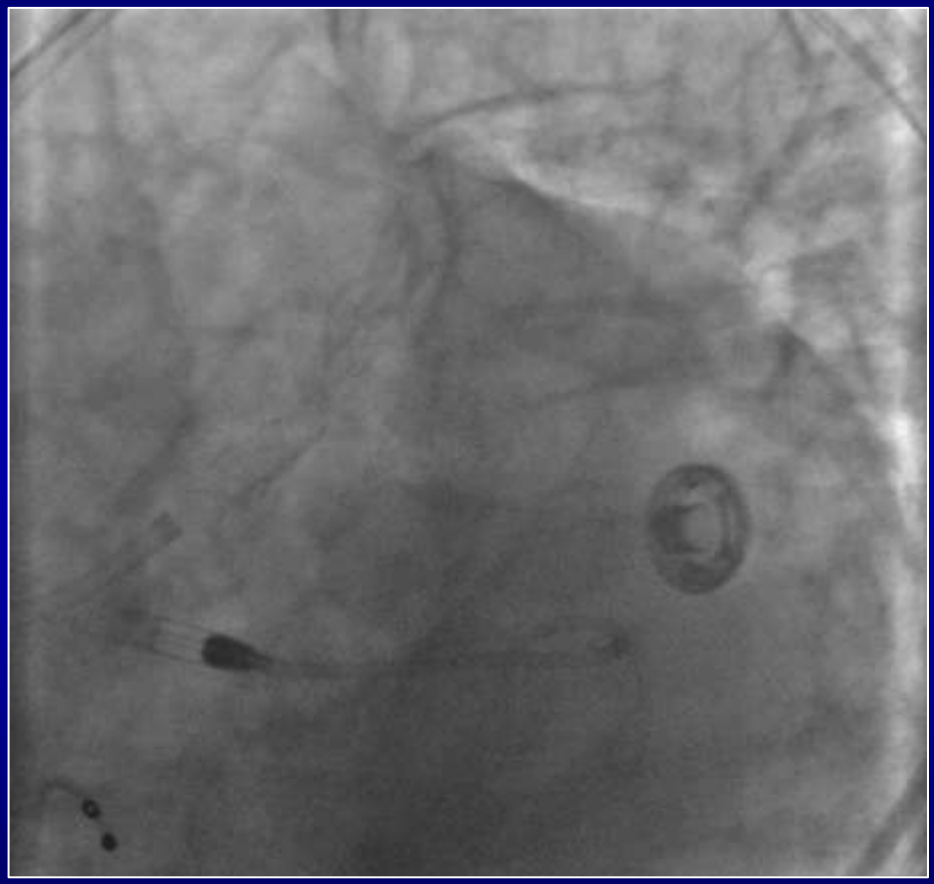






Final Angiogram

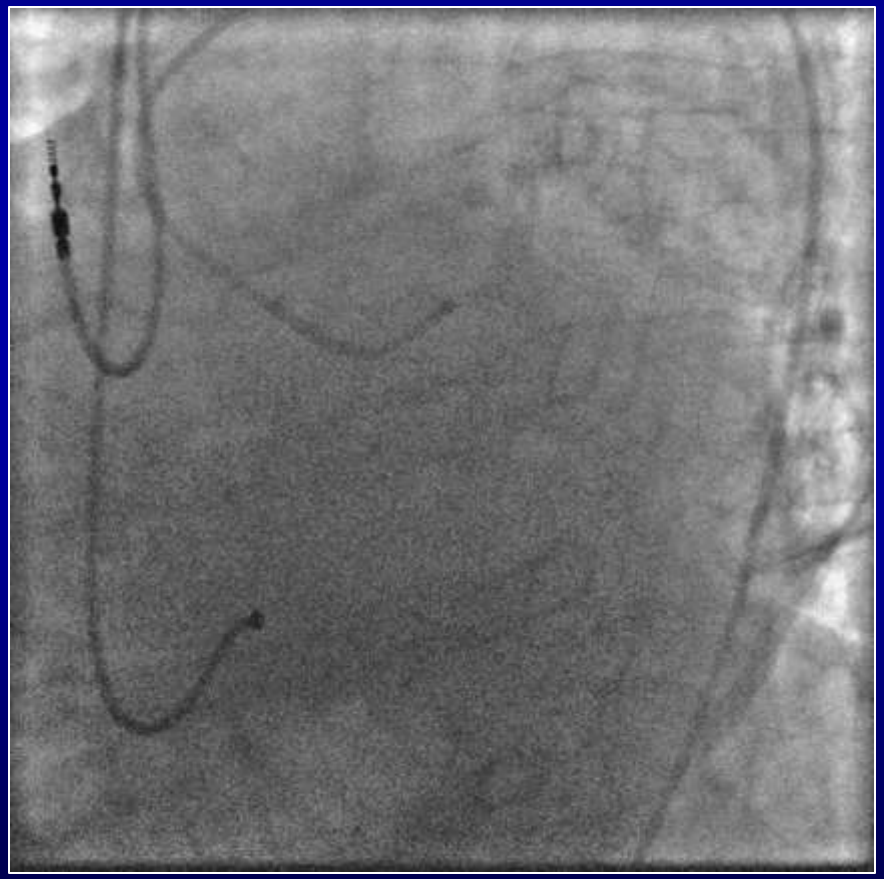


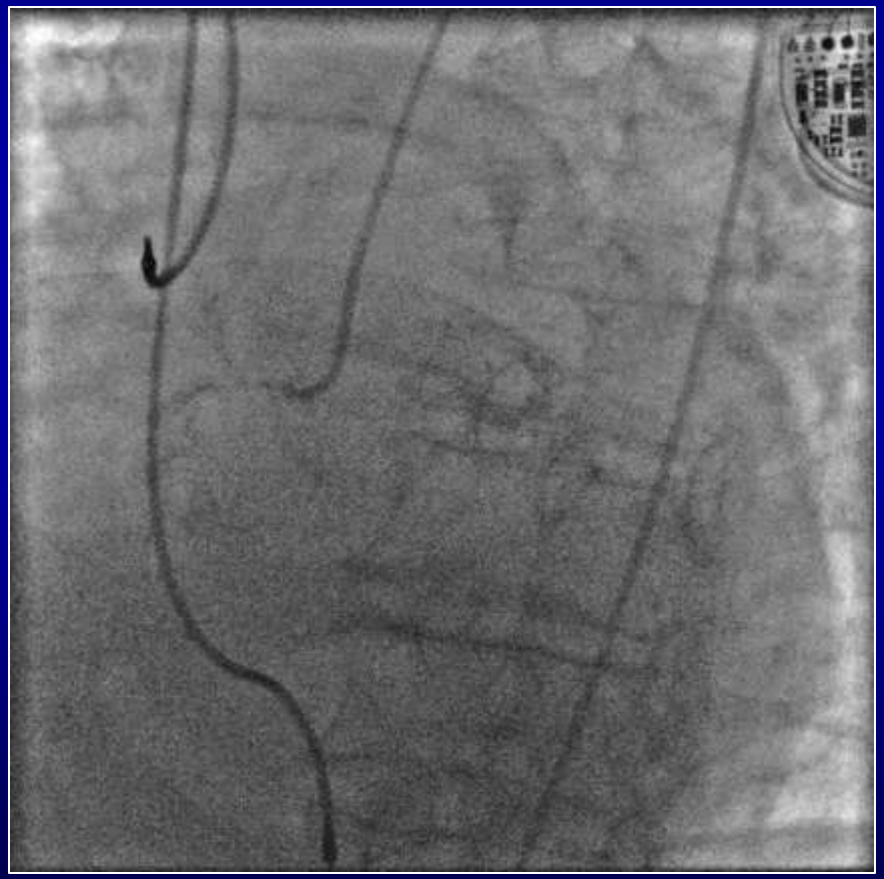


94 y/o male with LM trifurcation stenosis, severe AS and severely depressed EF (20%)

Patient turned down by 2 surgeons

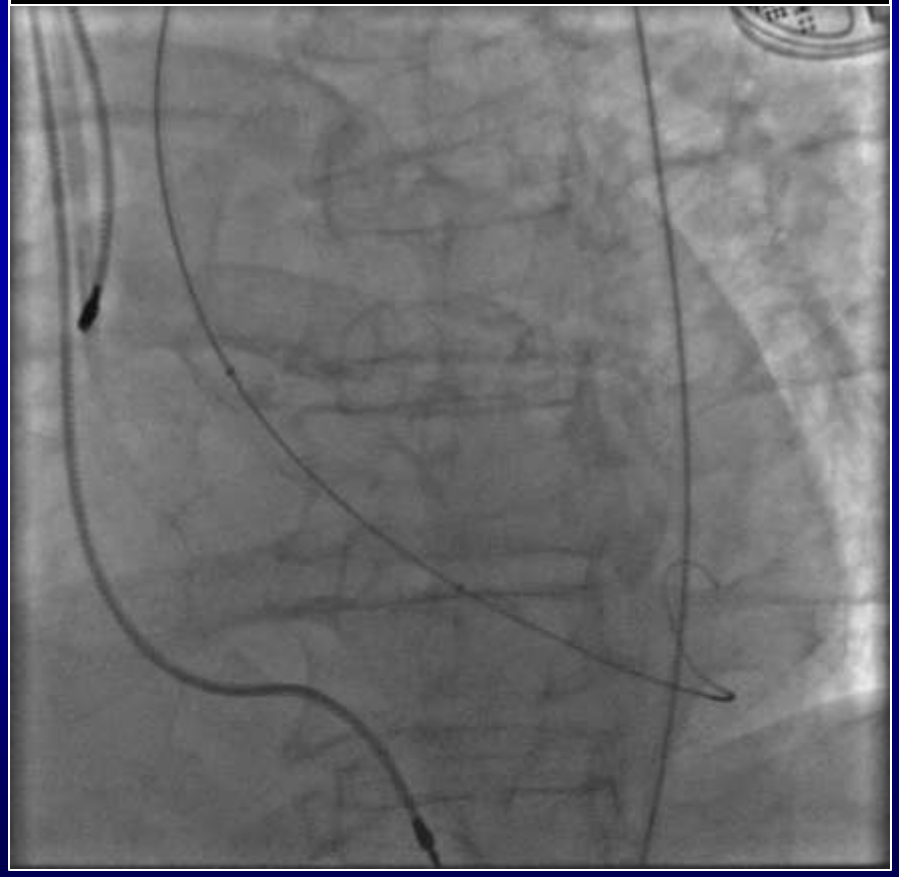
Baseline Coronary Angiogram





Balloon aortic valvuloplasty performed, followed by insertion of Impella 4.0

22 x 5 mm Z-med BAV balloon



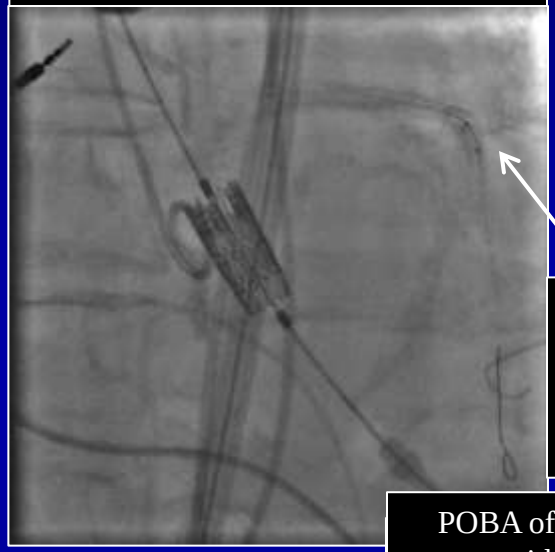
Angiogram after Impella insertion

Final Result

Impella removed at the end of the procedure

Transfemoral TAVR performed 1 month later

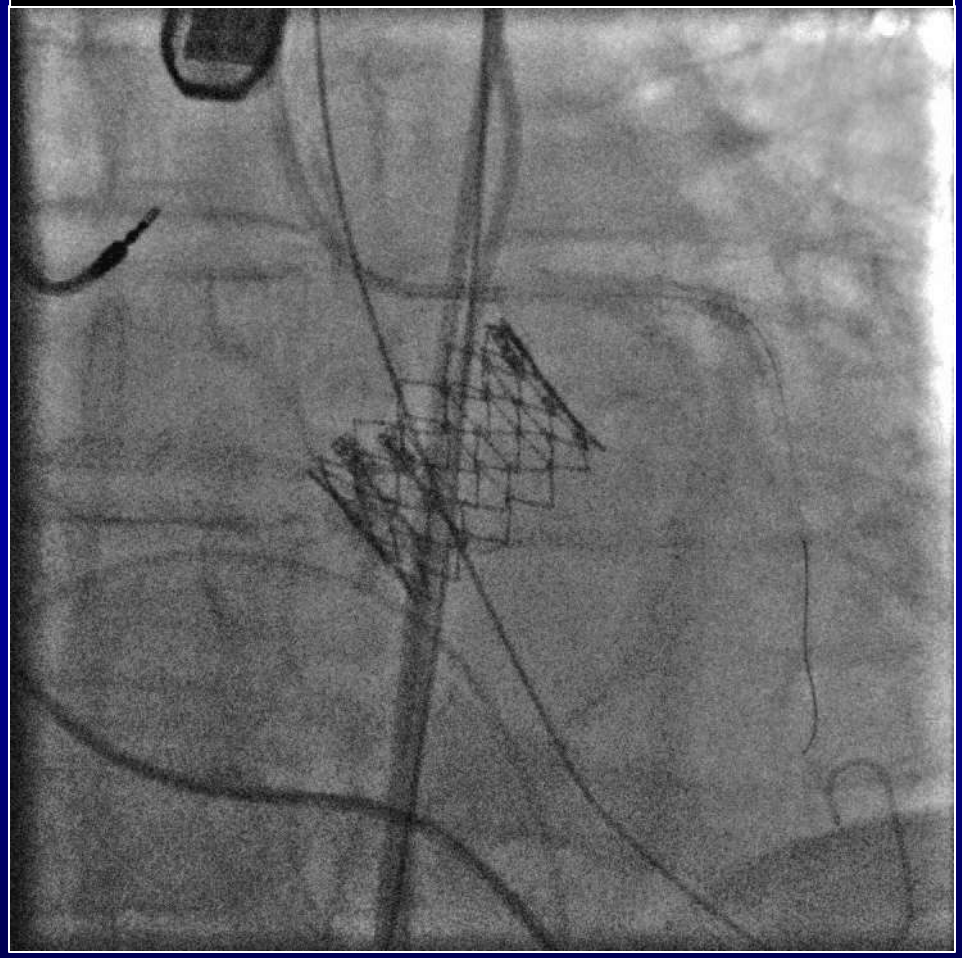
29mm Sapien-XT deployed



4.0 x 12 mm angioplasty balloon positioned in the LAD

POBA of the LM Stent performed with the 4.0x12 balloon

Final Result



Safety and feasibility of Impella 2.5 in patients undergoing high-risk PCI: Europella Registry

144 patients undergoing high-risk PCI

LM PCI performed in 52.8% (76/144) patients

30-day mortality 5.5%; 30-day MI 0%

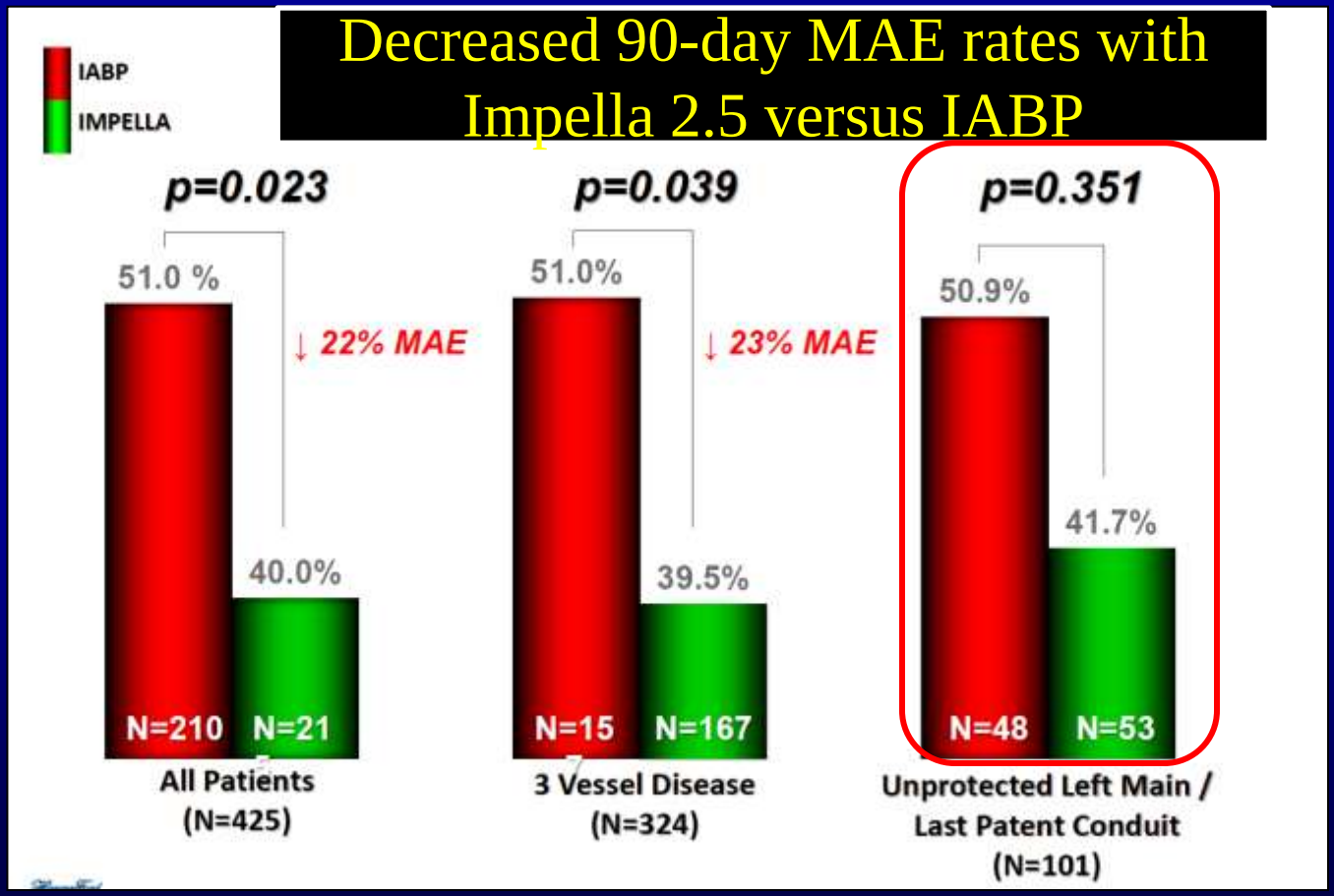
Qualification for high-risk PCI	
Left main coronary artery PCI	76 (52.8)
Last patent vessel PCI	25 (17.4)
Multivessel disease	118 (81.9)
Low LVEF	51 (35.4)
Other	12 (8.3)
Refused for CABG	62 (43.1)

Sjauw KD. et al. JACC 2009.

PROTECT II Study: Randomized trial of Impella 2.5 versus IABP during high-risk PCI

Unprotected left main/Last Patent Conduit group

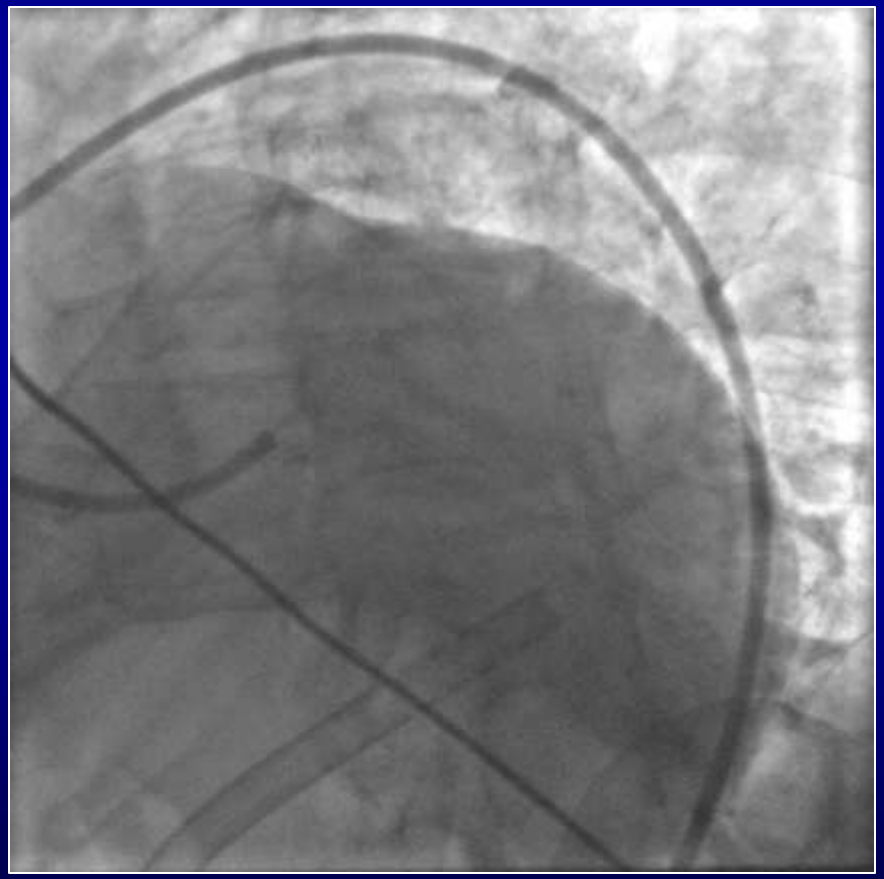
90 day Major Adverse Event (Per-Protocol)

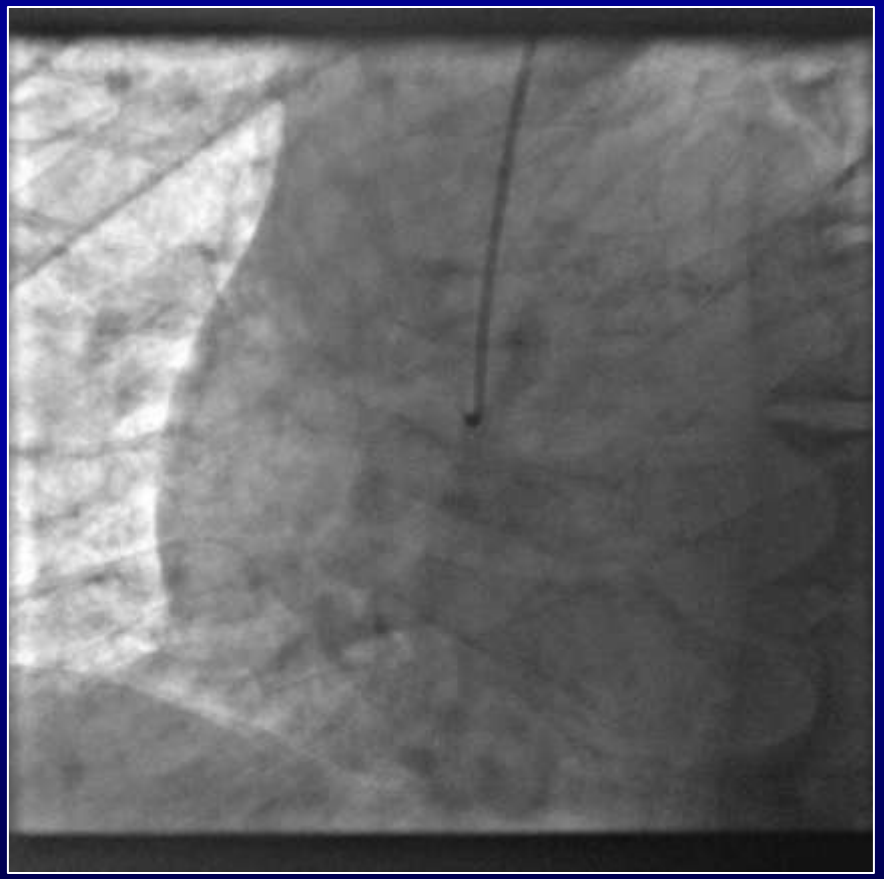


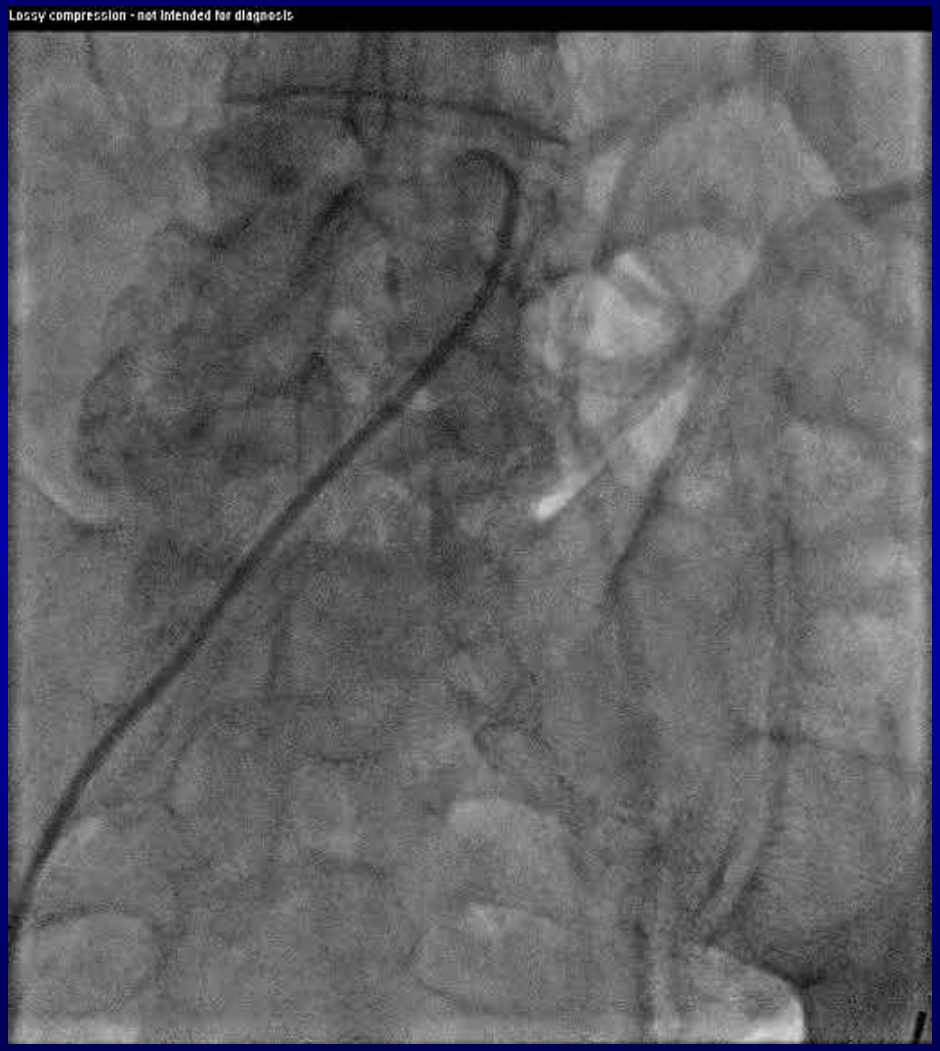
O'Neill W. et al. TCT 2012.

84 y/o male with unstable angina, LVEF 15%

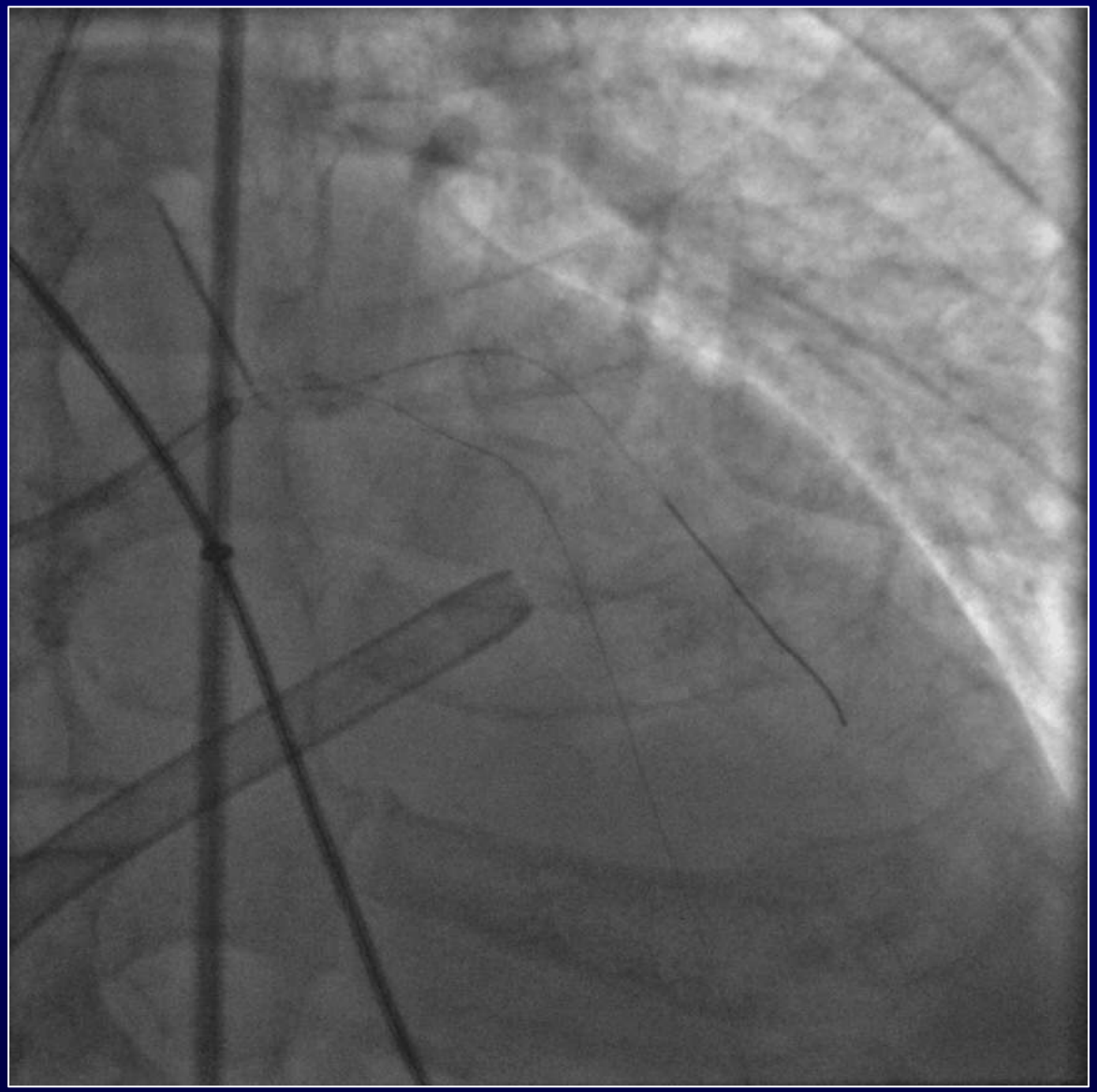
Baseline Coronary Angiogram



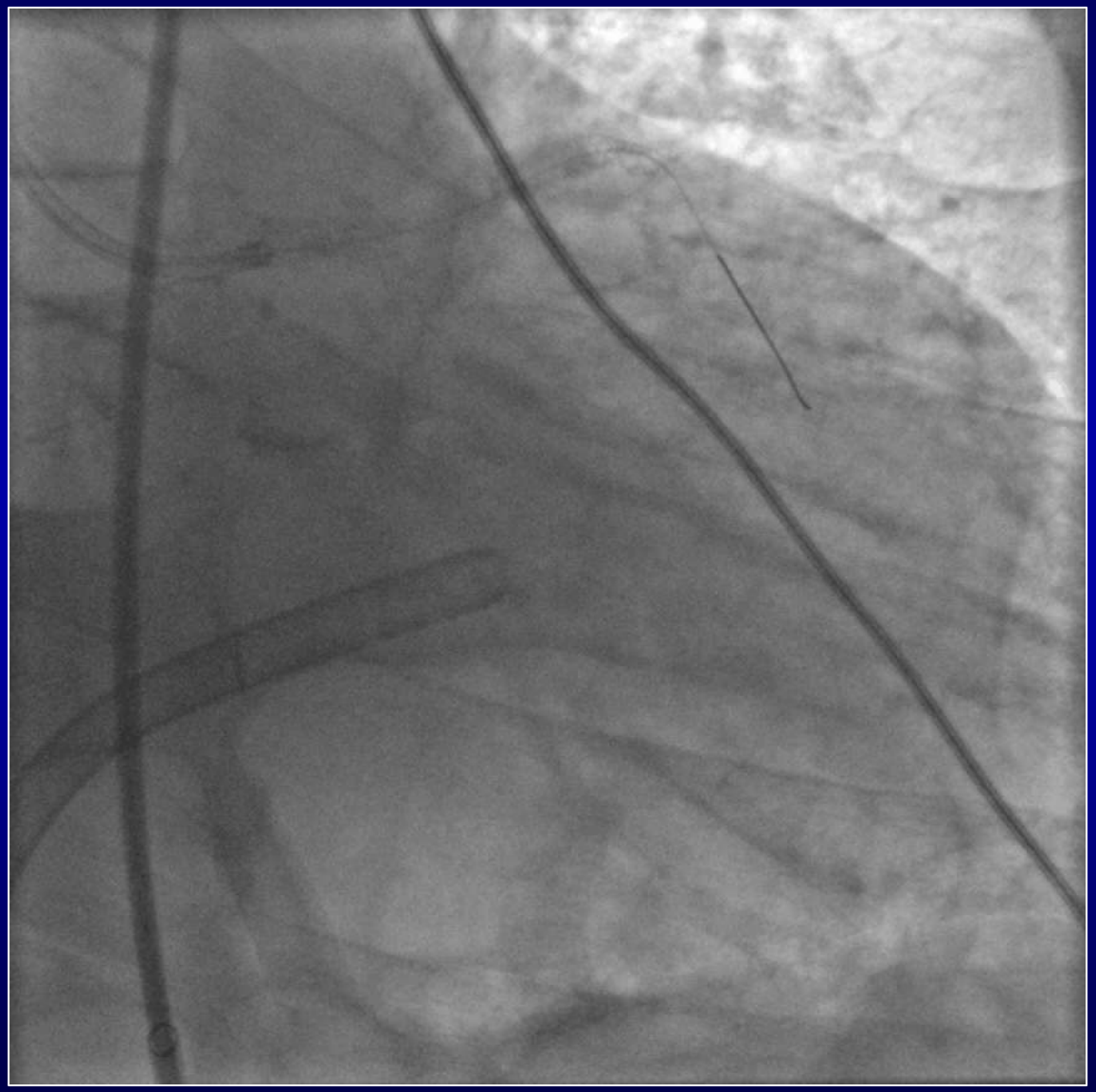



Lossy compression - not intended for diagnosis

Tandem heart placed for hemodynamic support



5 stents later…



Percutaneous Left Ventricular Assist Device With TandemHeart for High-Risk Percutaneous Coronary Intervention: The Mayo Clinic Experience

High-risk PCI = Left main/Multivessel PCI with low EF

33/54 patients (62%) underwent LM PCI

High-risk LM PCI is feasible with Tandem Heart support

Favorable hemodynamics with Tandem Heart

	Pre-tandem heart	Post-tandem heart	P-value
RA pressure	16 mmHg	10 mmHg	<0.001
PA pressure	45 mmHg	36 mmHg	0.04
PCWP	25 mmHg	17 mmHg	0.02
CO	4.7 L/min	5.7 L/min	0.03

97% procedural success

10% 30-day mortality

Alli et al. Catheterization and Cardiovascular Interventions 2012.

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Mayo Clinic Algorithm for hemodynamic support during high-risk PCI

	Simple PCI	Complex PCI
LVEF > 30%	None	IABP
LVEF < 30%	IABP	Impella or Tandem Heart

Alli et al. Catheterization and Cardiovascular Interventions 2012.

My approach to hemodynamic support in LM PCI

	Simple anatomy (Ostial, mid-shaft, single stent strategy)	**Complex anatomy** (Bifurcation lesion)	**Very complex anatomy**
LVEF < 20%	IABP/ Impella	Impella/ Tandem Heart	Impella/ Tandem Heart
LVEF 20-35%	IABP	IABP/ Impella	Impella
LVEF > 35%	4 French sheath	IABP	Impella