National Heart Centre SingHealth

When Aspiration Thrombectomy Does Not Work?

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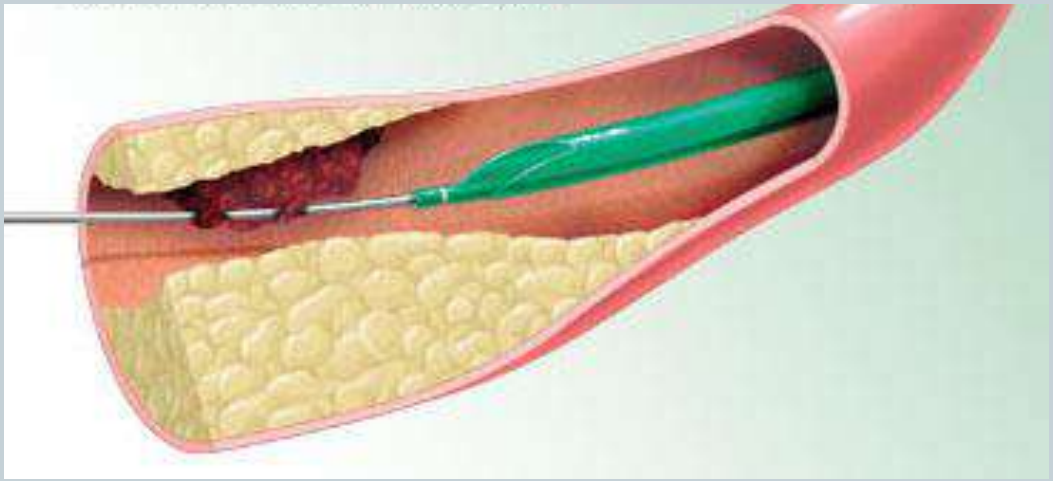
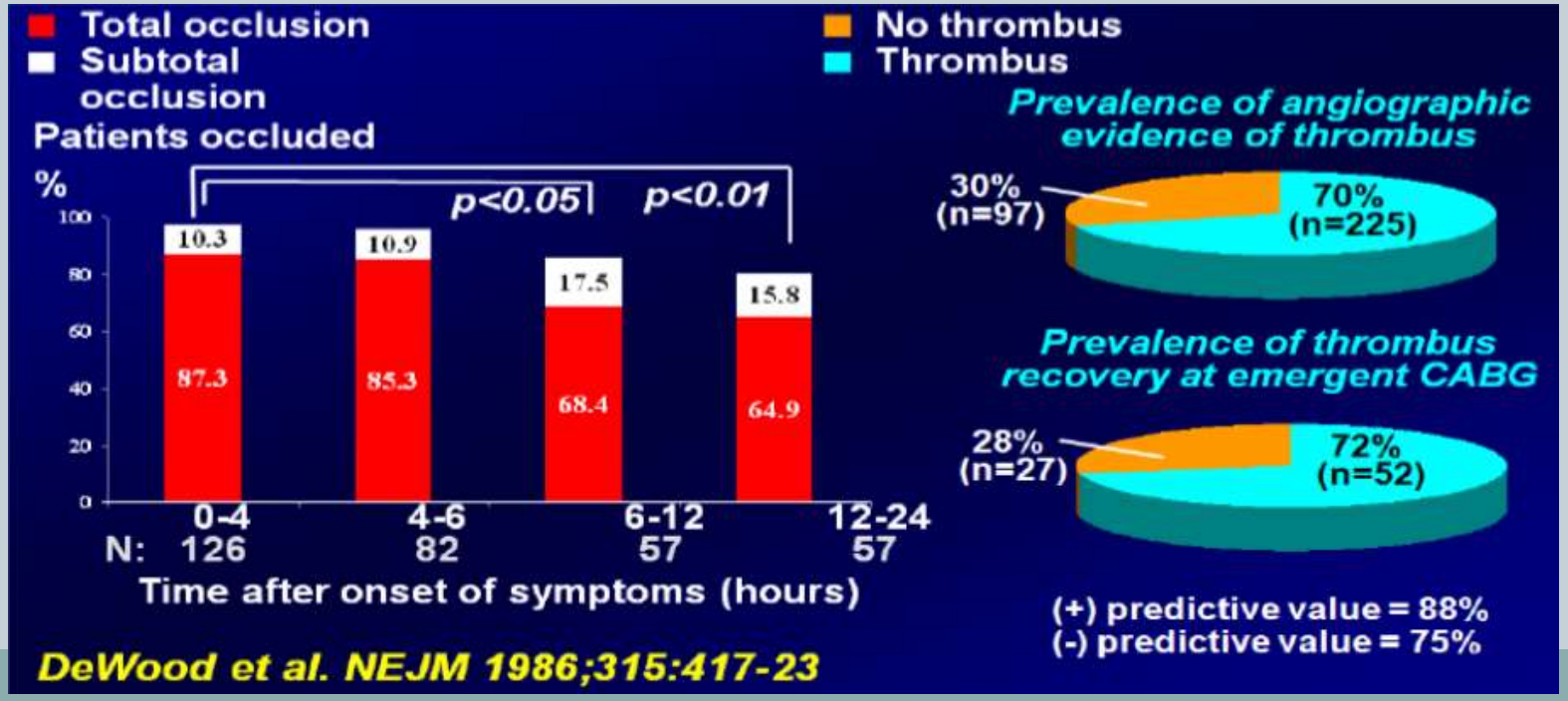


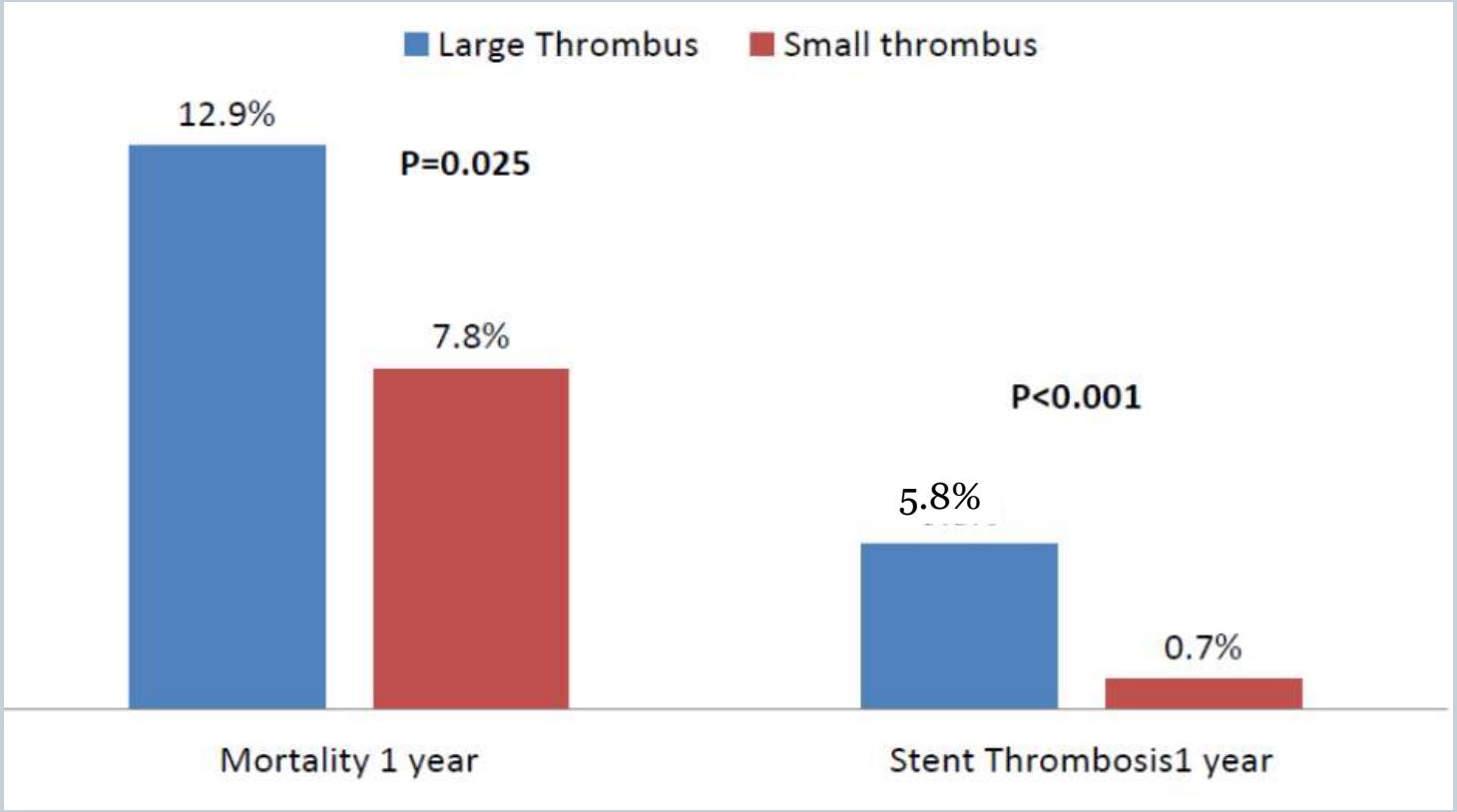
Thrombus in STEMI

- Over 70% of STEMI patients has angiographic evidence of thrombus
- Thrombus increases the risk of: ***No reflow/Distal embolization and Stent thrombosis***



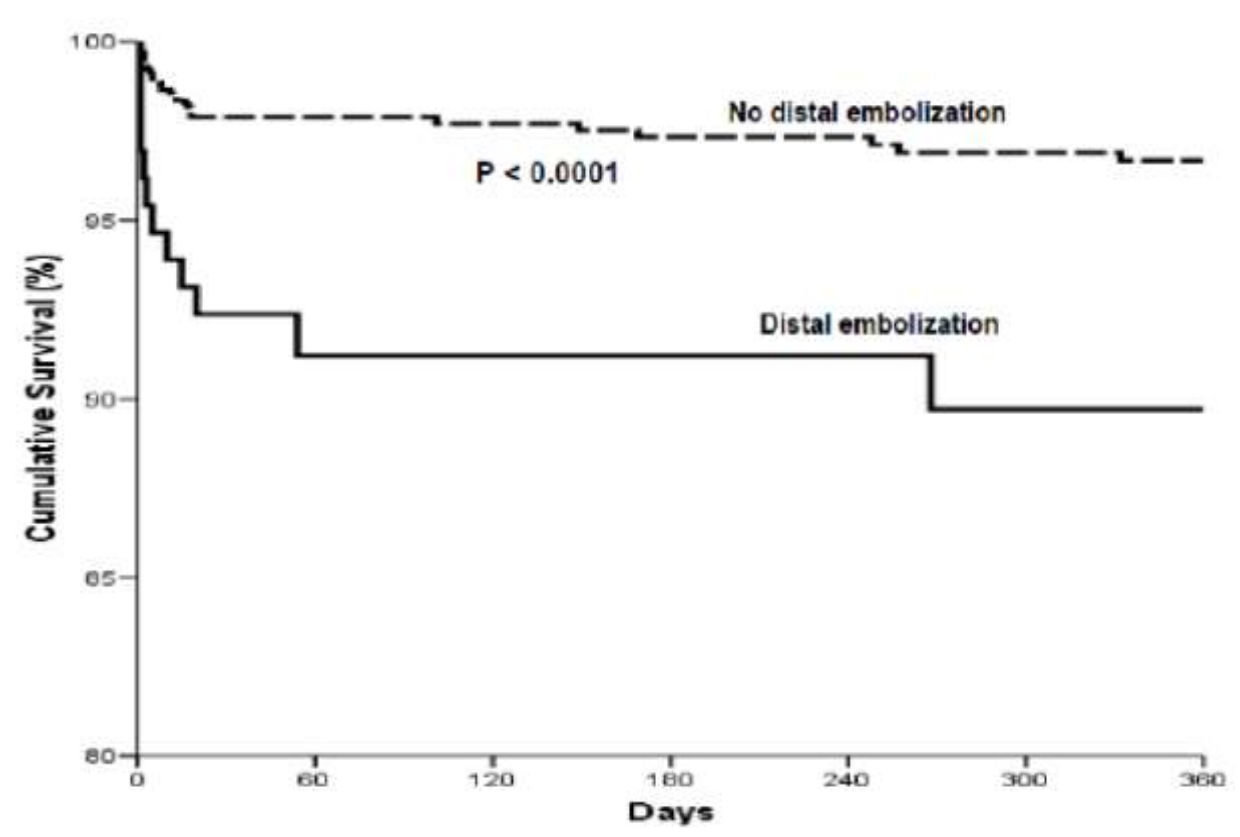
Thrombus in STEMI

- Worse outcome in patients with high thrombus load



Sianos G et al. JACC 2007;50:573-83

Distal Embolization and Mortality

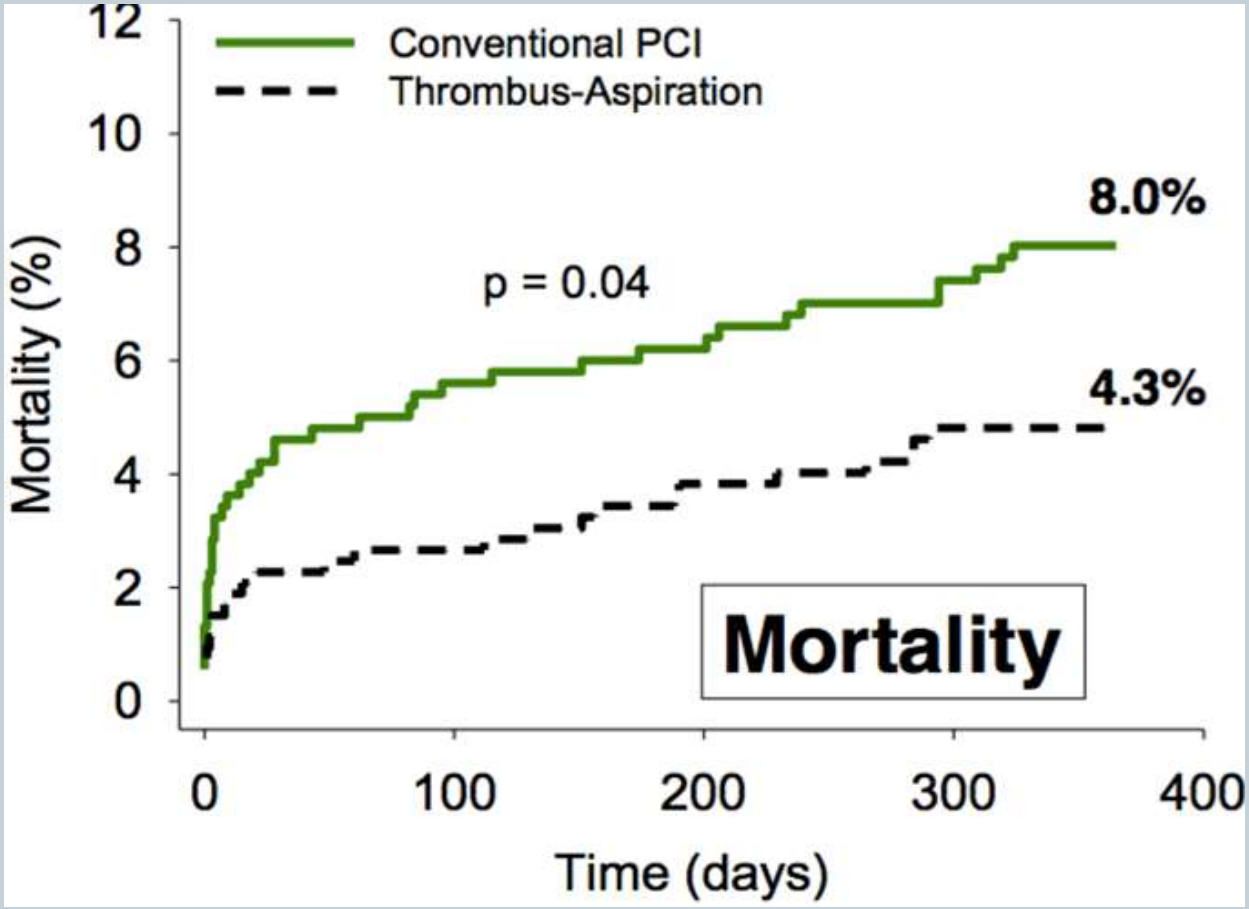


De Luca et al. Journal of Thromb Thrombolysis 2009

Aspiration Thrombectomy in Primary PCI

- Very appealing to interventionists:
  - Simple concept
  - Easy to use
  - Faster procedure

TAPAS Trial – Mortality at One year

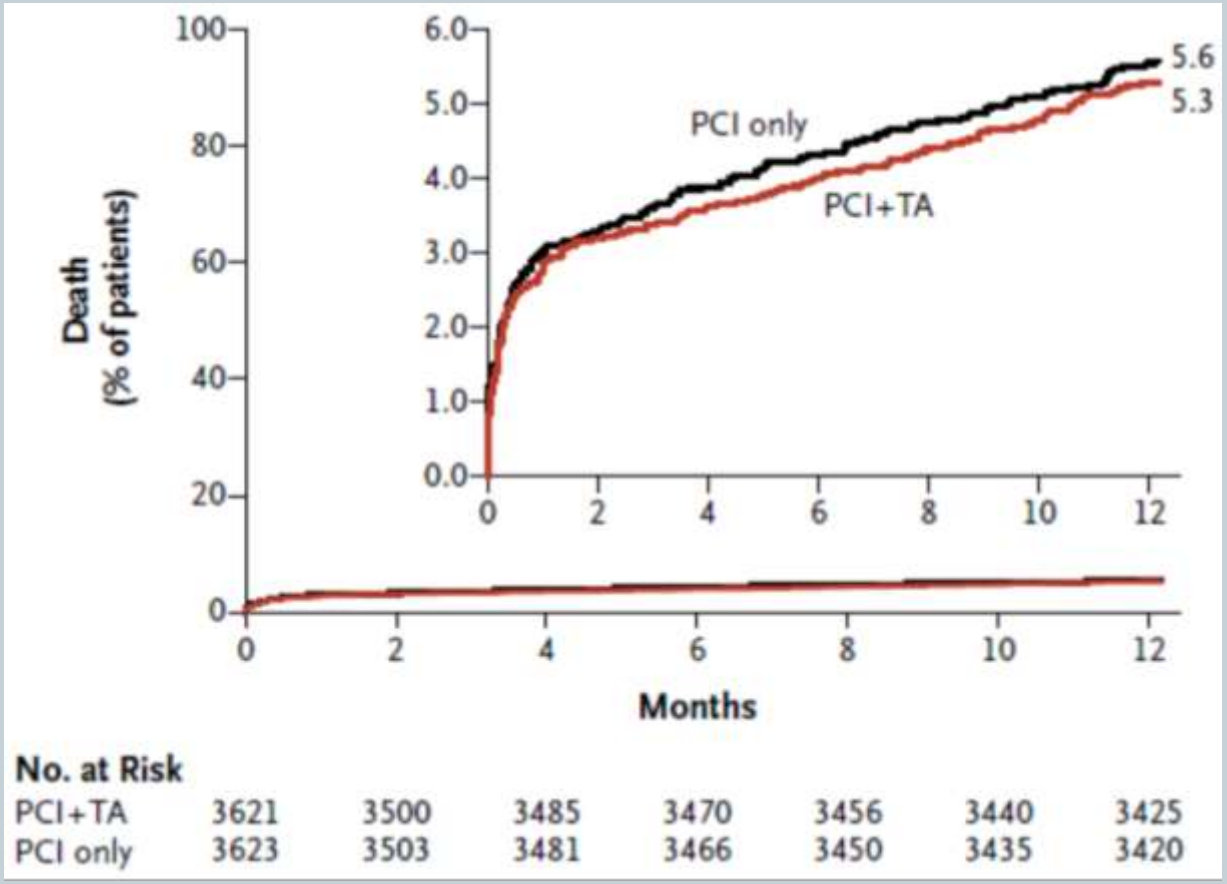


Higher rate of:

1) ST segment resolution
2) Better MBG

Vlaar et al. Lancet 2008;371:1965

TASTE Trial – Mortality at One year

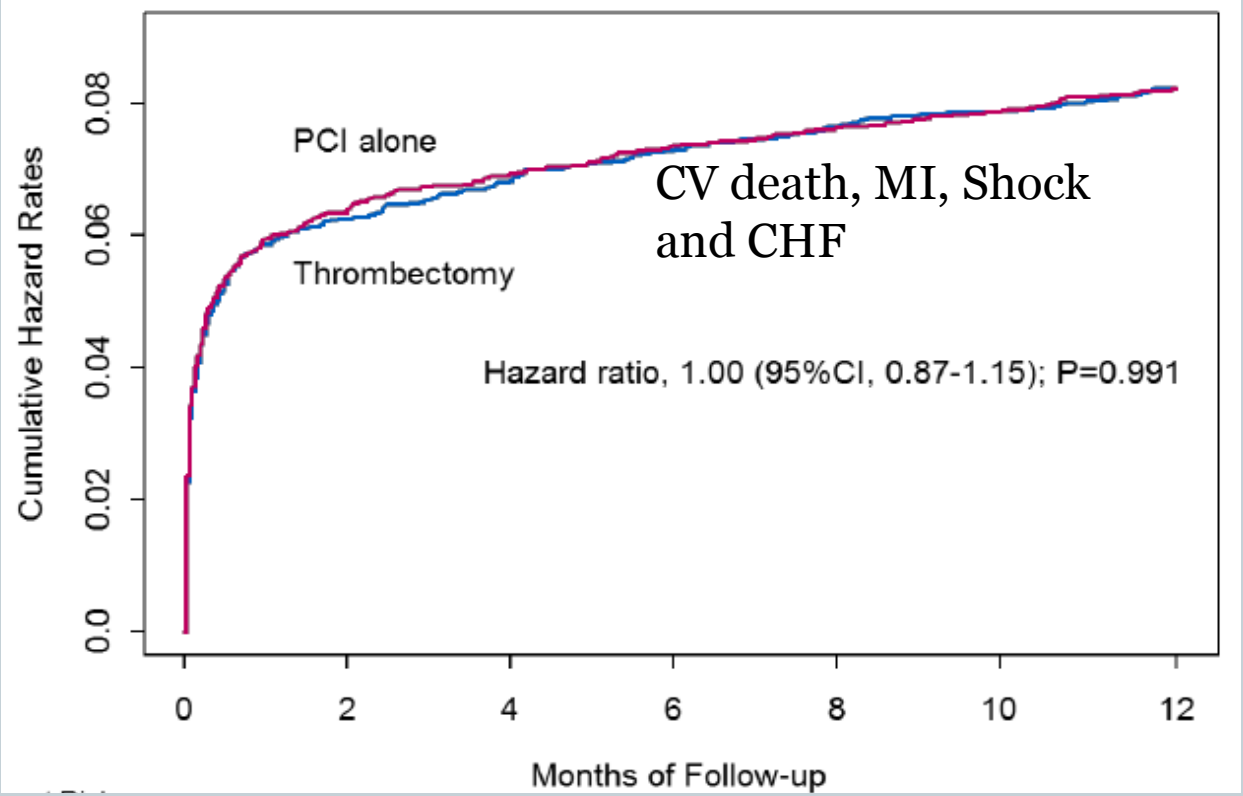


No difference in:

1) Rehospitalization for MI
2) Stent thrombosis

Lagerqvist et al. NEJM 2014;371:1111-20

TOTAL Trial – Primary Outcome at 1 year



- No difference in efficacy
- Worse outcome with increase risk of stroke

Recommendation of Aspiration Thrombectomy

"Manual catheter thrombus aspiration should be considered during PCI of the culprit lesion in STEMI."

"Aspiration thrombectomy is reasonable for patients undergoing primary PCI."

O'Gara Circulation 2013, Kushner JACC 2009
Steg EHJ 2012, Wijns EHJ 2010, Van de Werf EHJ 2009

Recommendation of Aspiration Thrombectomy

COR	LOE	Recommendations
IIb	C-LD	The usefulness of selective and bailout aspiration thrombectomy in patients undergoing primary PCI is not well established.[1]
III: No Benefit	A	*Routine* aspiration thrombectomy before primary PCI is not useful.[2]

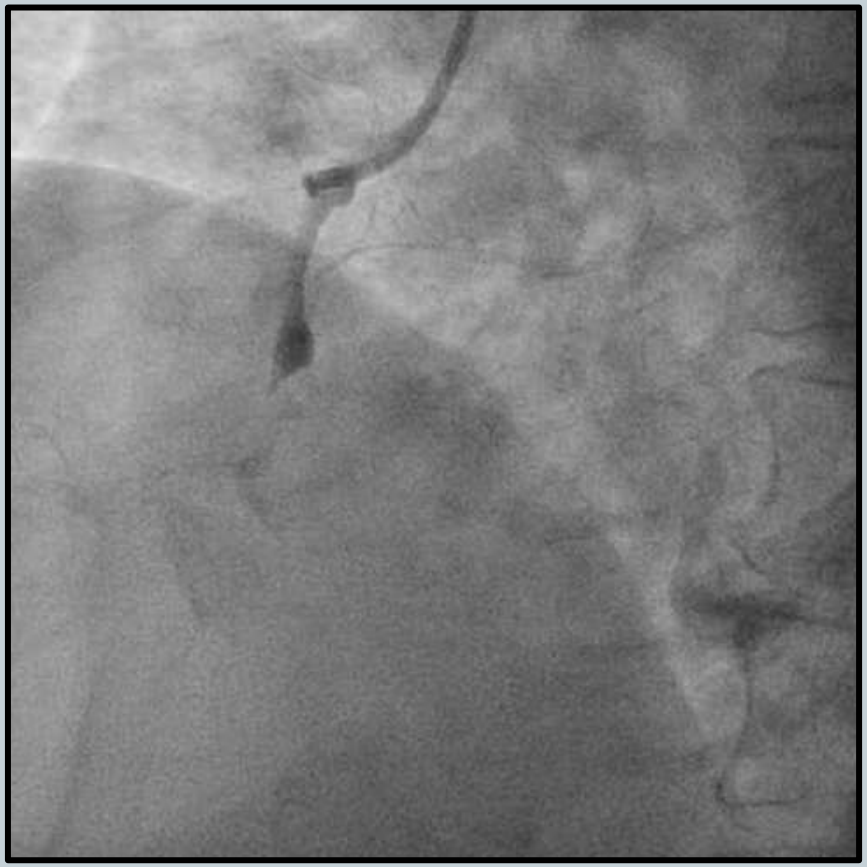
1. Modified recommendation from 2013 guideline (Class changed from IIa to IIb for selective and bailout aspiration thrombectomy before PCI)
2. New recommendation

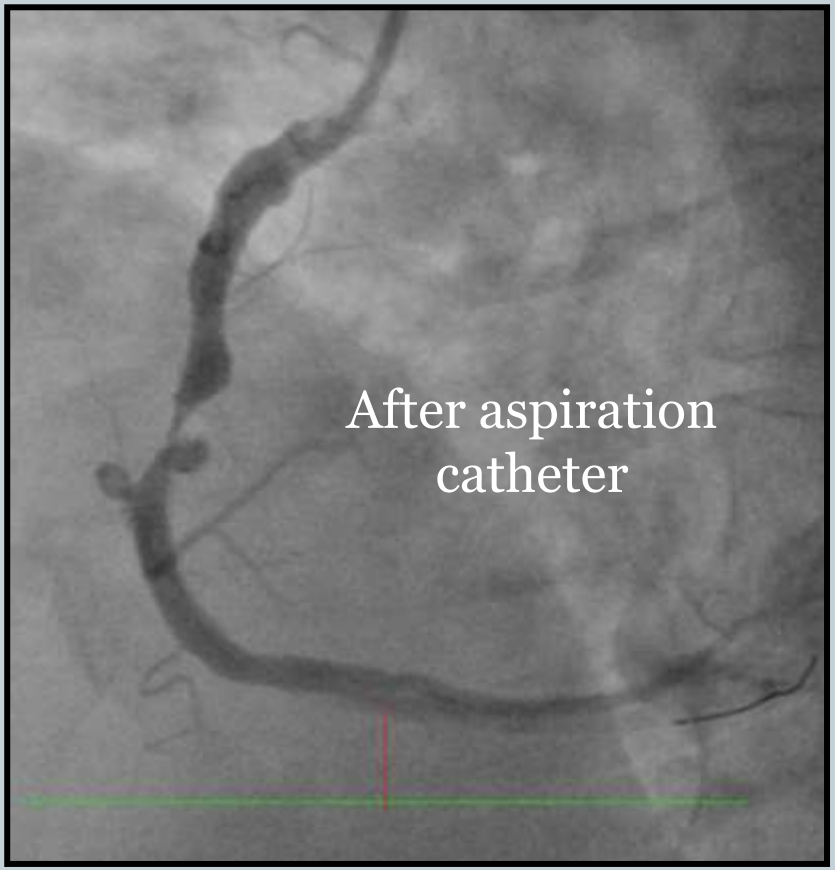
Levine et al. Circulation. 2016; 133: 1135-1147

When Aspiration Thrombectomy Doesn't work?

- *Routine* aspiration thrombectomy in primary PCI is a Class III recommendation
- Correct topic?
- Shouldn't the topic be:
  - **"When aspiration thrombectomy does work?"**
  - **"Why aspiration thrombectomy doesn't work?"**
  - **"When aspiration thrombectomy doesn't work"**
- We either:
  - Do not follow the updated guidelines! Or
  - Still believe that aspiration thrombectomy still works!
- I believe most interventionists still believe that aspiration thrombectomy still works for selected cases

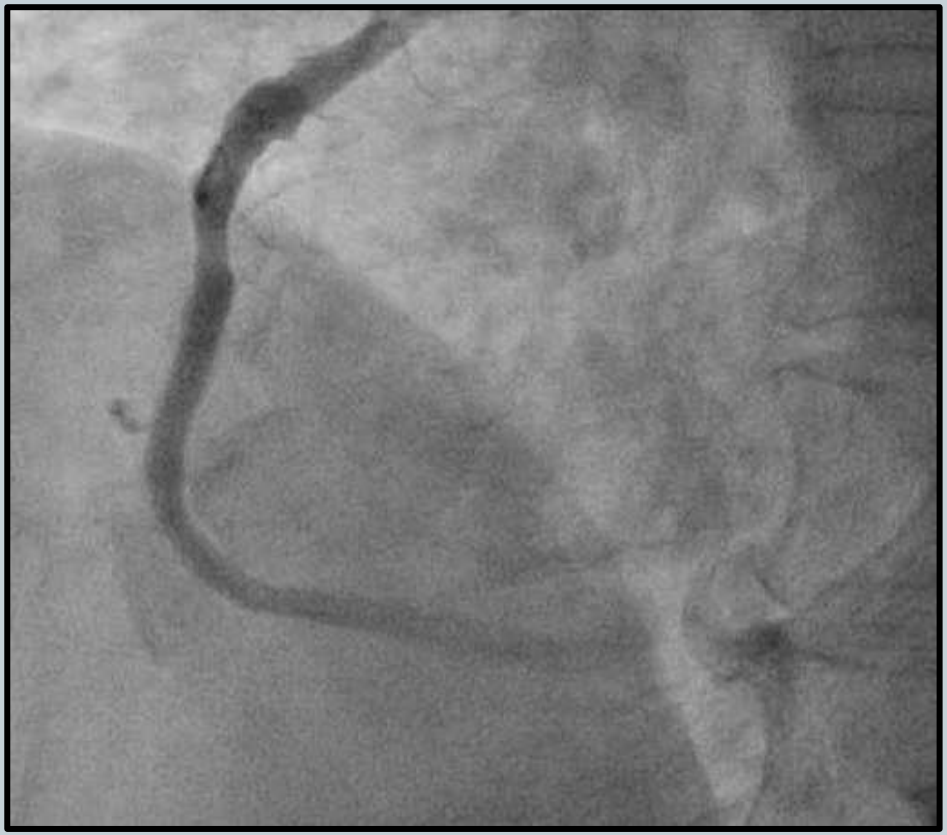
Case 1 – Just aspirate and stent!





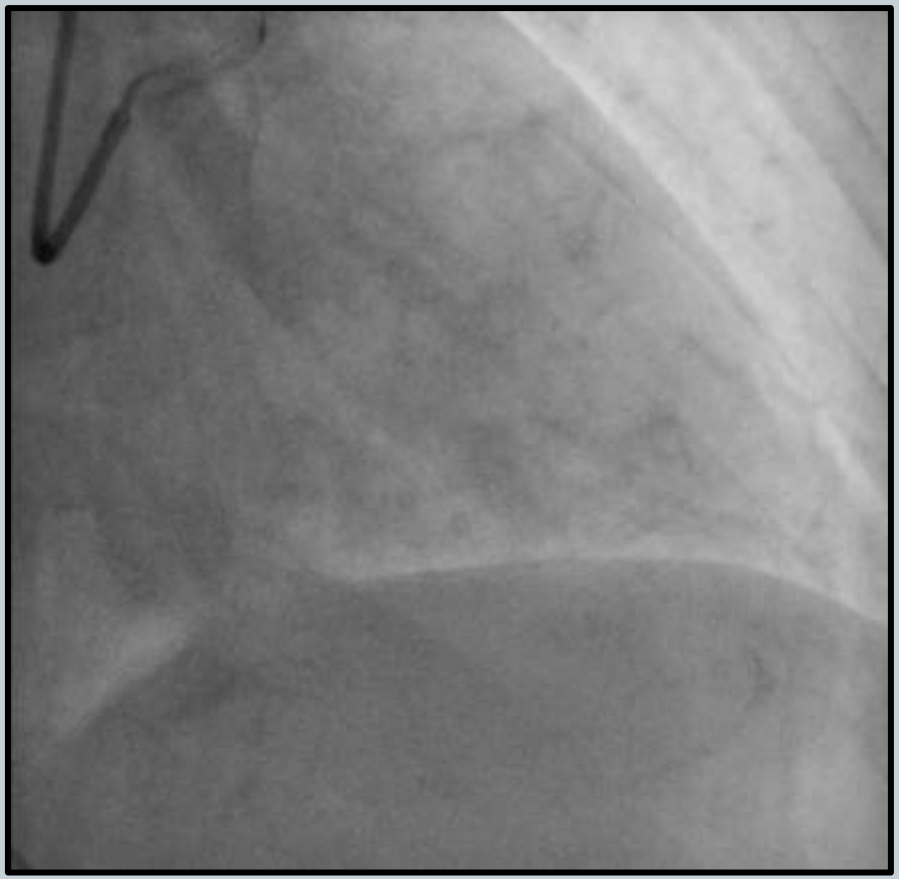
Advantages: Removal of thrombus, establish flow and visualization of the vessel for sizing of stent

Case 1 – Just aspirate and stent!

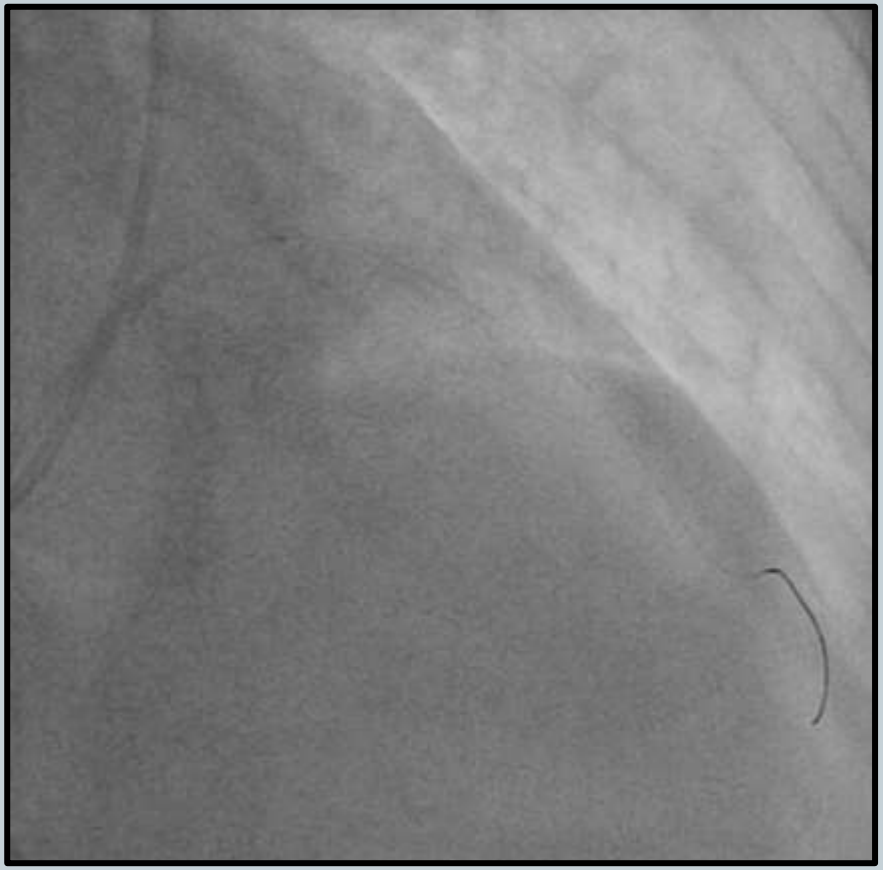


After stenting

Case 2 – Just aspirate and stent!

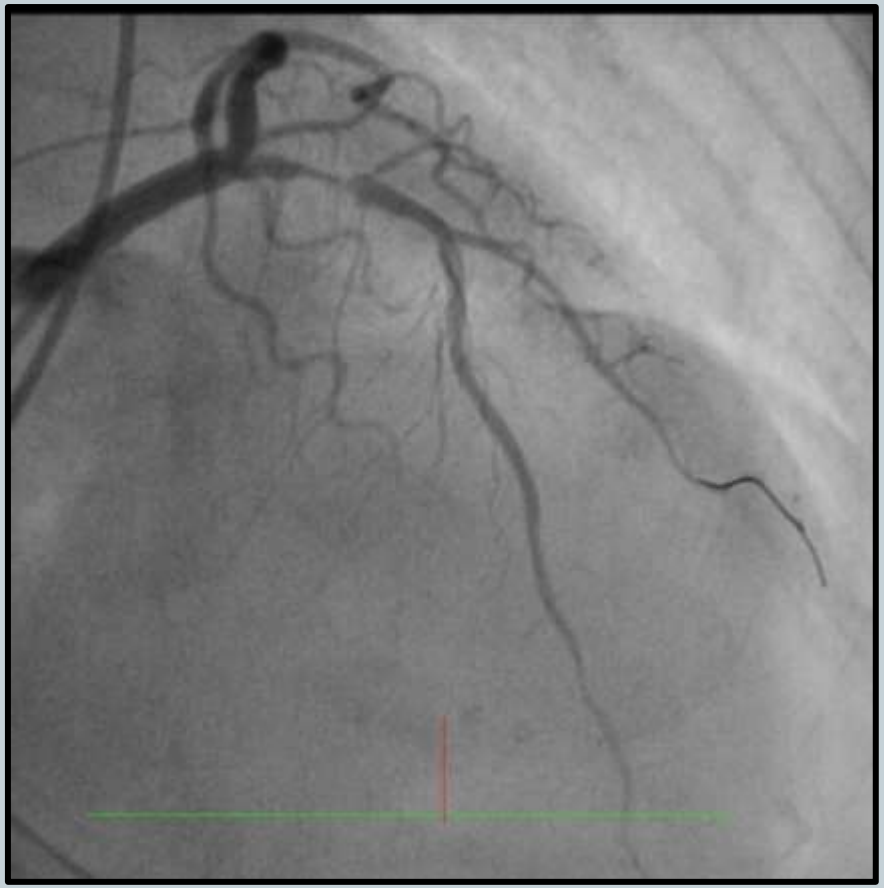


Anterior STEMI

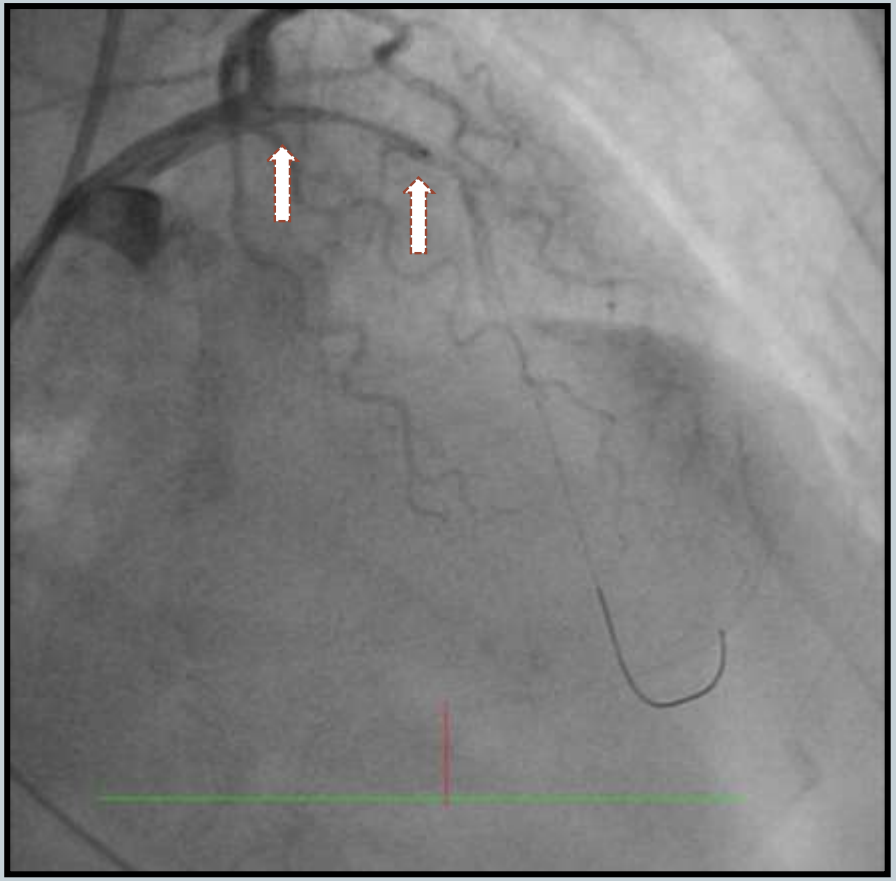


Aspiration thrombectomy

Case 2 – Just aspirate and stent!

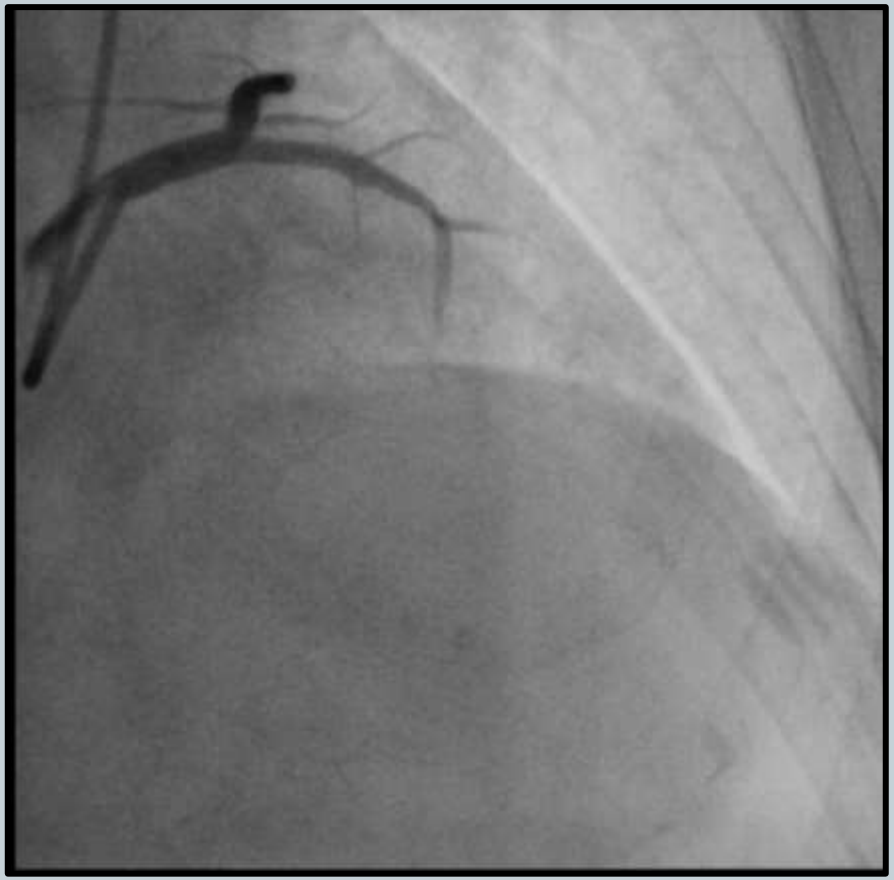


Post aspiration thrombectomy

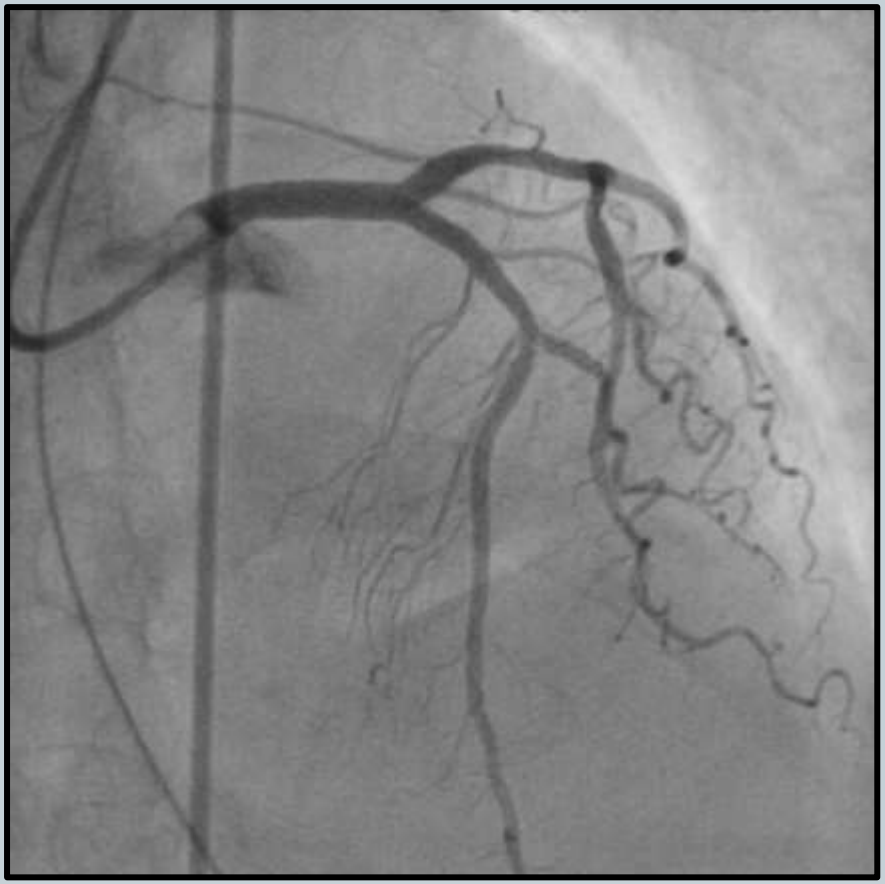


Stent placement

Case 2 – Just aspirate and stent!



Final angiography



TIMI 2 flow and good myocardial blush

When aspiration thrombectomy does not work?

- Define “works”
- What do we expect aspiration thrombectomy to do?
  - Reduce thrombus load
  - Reduce distal embolization

Improves microvascular perfusion

Reduc ity
Reduc events

  - Facilitate PCI – assess lesion size and length
  - Faster procedure

Reasons for failure of Aspiration Thrombectomy

- Too little experience with device use
- Too little thrombus presence

- Too much thrombus
- Too little thrombus can be removed

- Too late to have a discernable effect against the large background of myocardial necrosis

Limitation of TASTE and TOTAL Trial

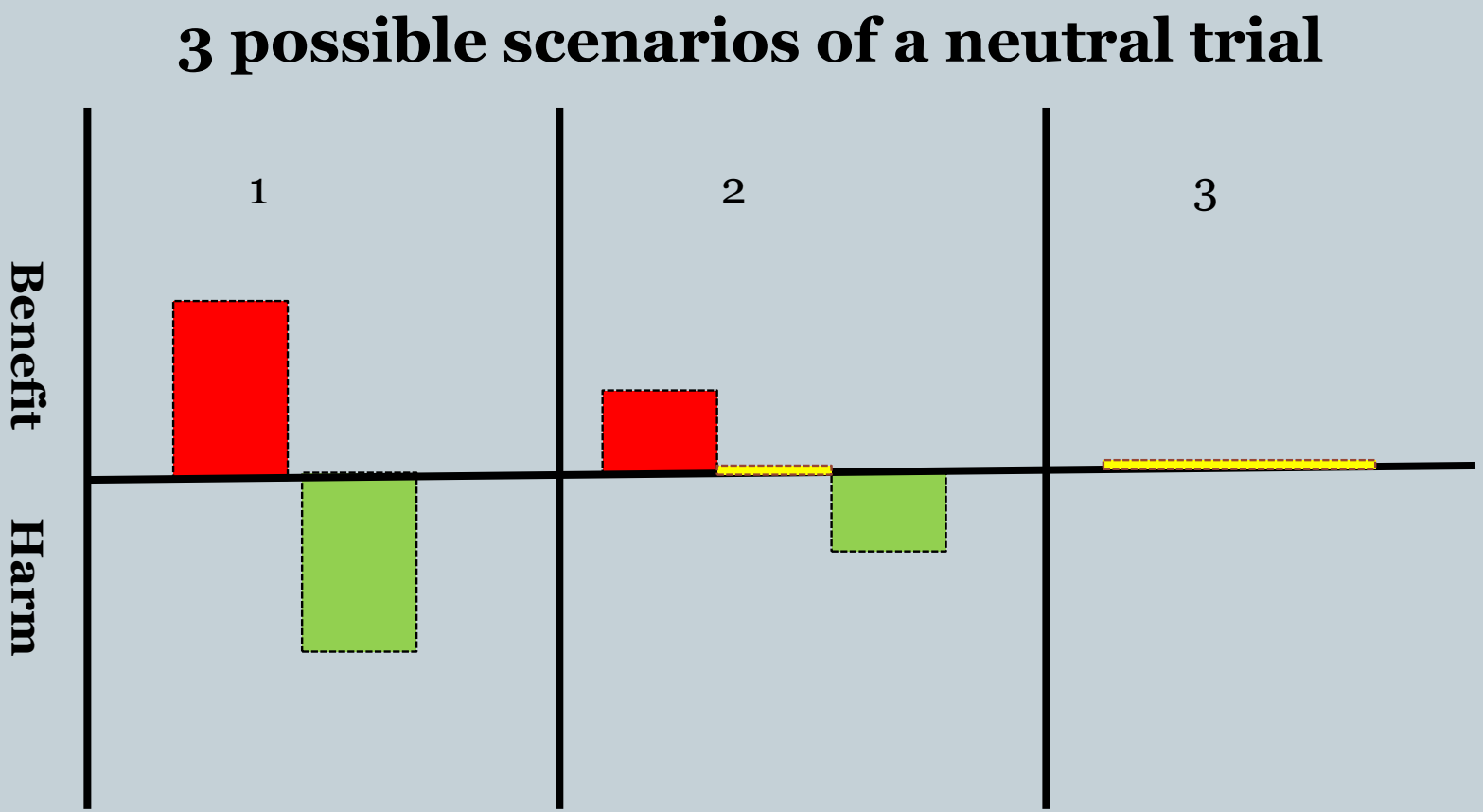
Highly selected patients

- 60% of patients who met criteria for this study were not randomized into the trial
- 30-day mortality of 2.9% in randomized versus 10.6% in non-randomized patients
- 5 thrombectomy catheter use per 2 years and 2.5 patients/month/hospital

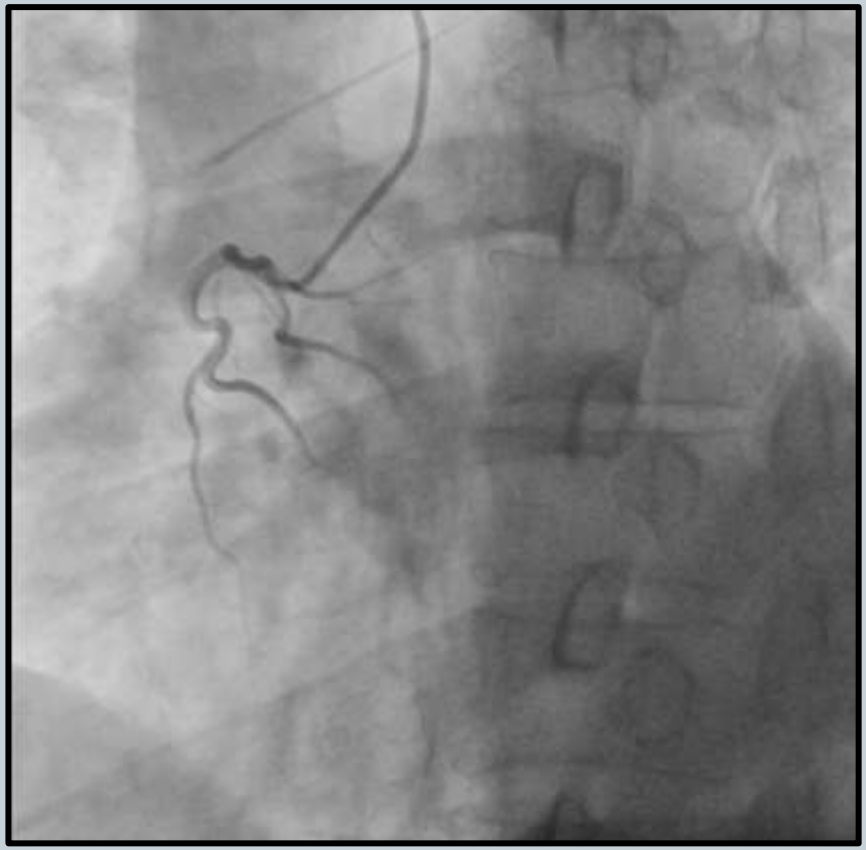
Not selective enough

- Inclusion of some patients with low thrombus burden

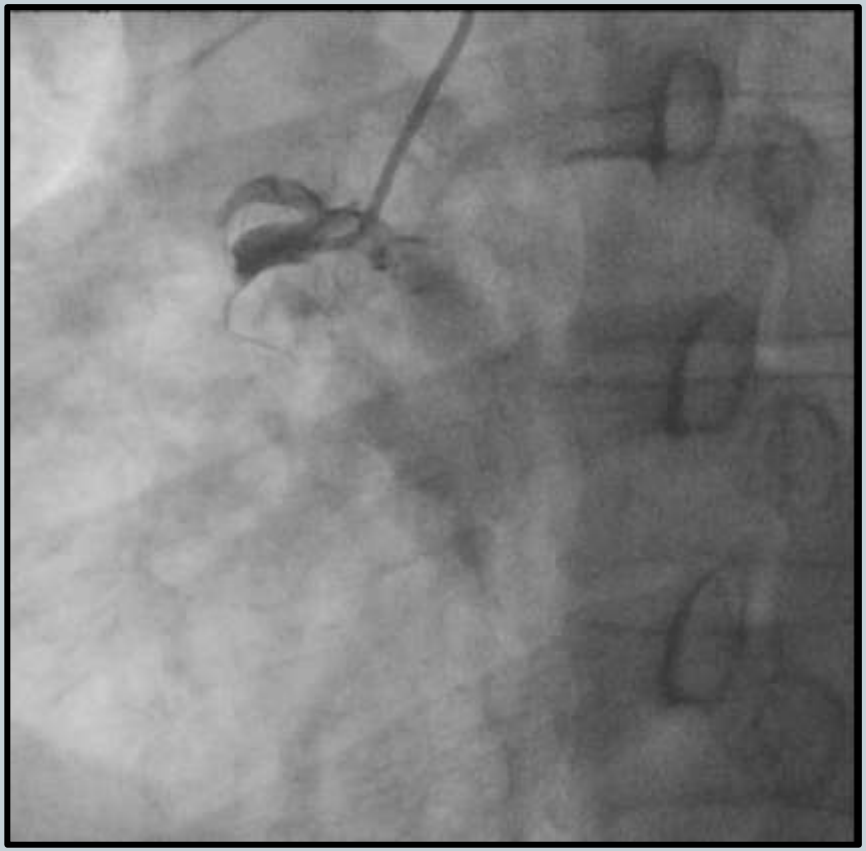
What does neutral trial means?



Stroke and Aspiration Thrombectomy

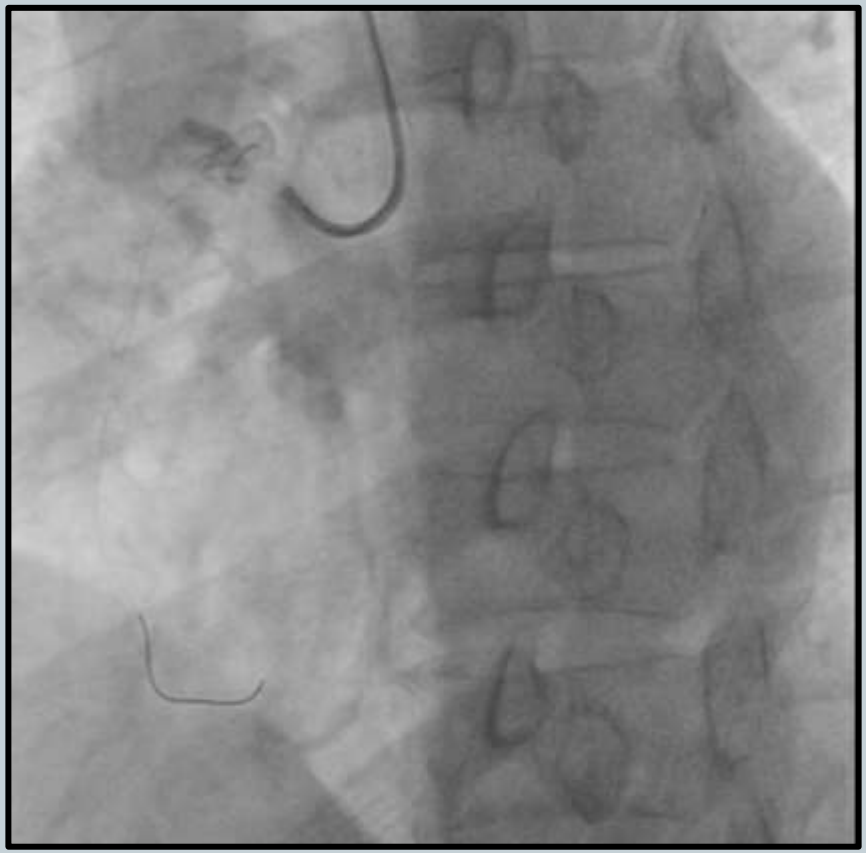


Inferior STEMI with large conus branch

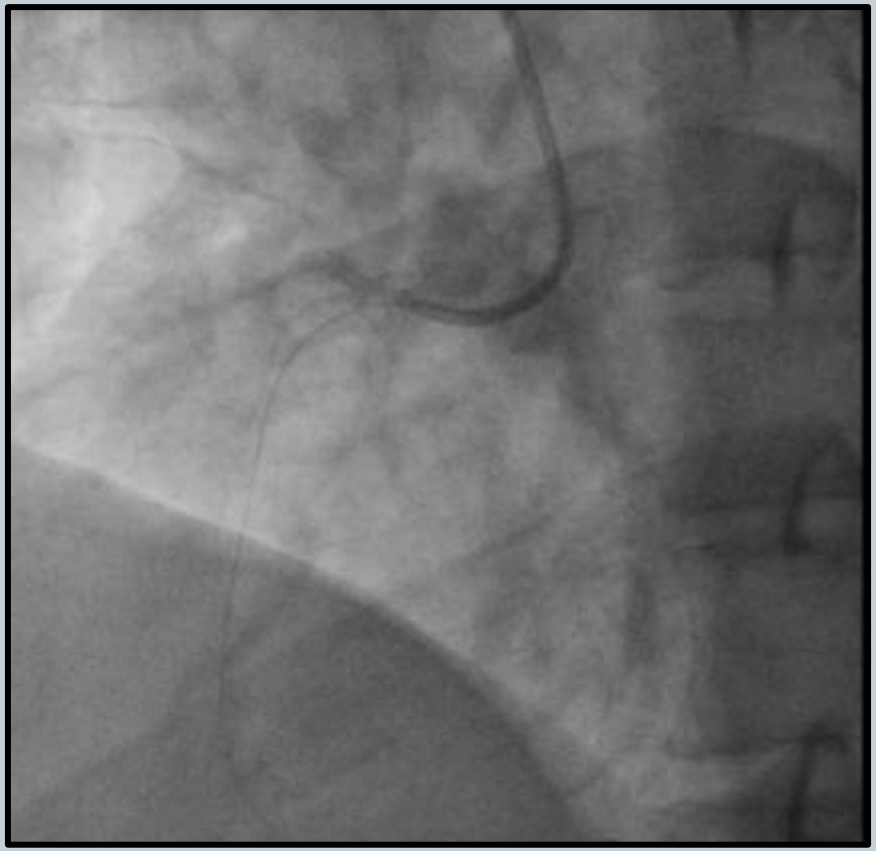


Proximal RCA occlusion

Stroke and Aspiration Thrombectomy



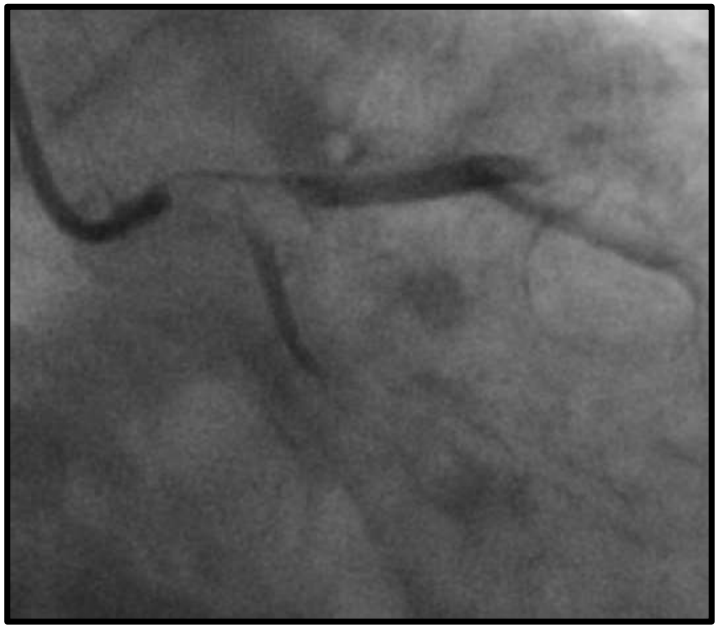
Transradial approach with difficult guiding



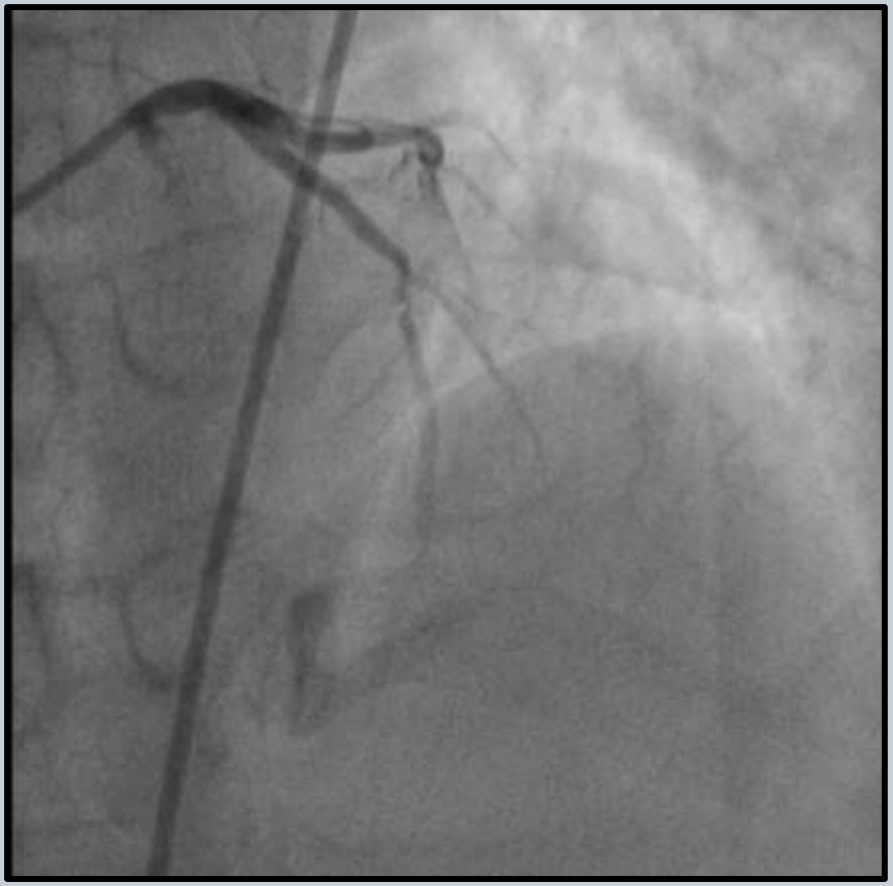
Proximal embolization to conus branch after aspiration thrombectomy

When Aspiration Thrombectomy Doesn't work?

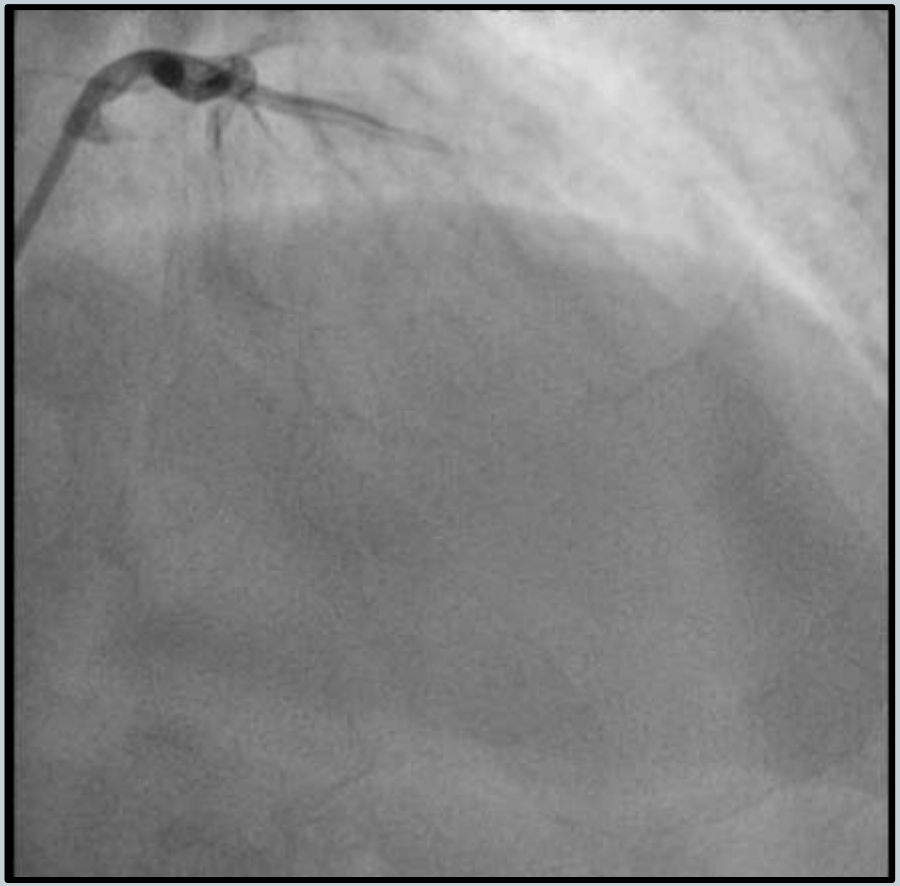
PRESENTATION OF CASES



Case 3

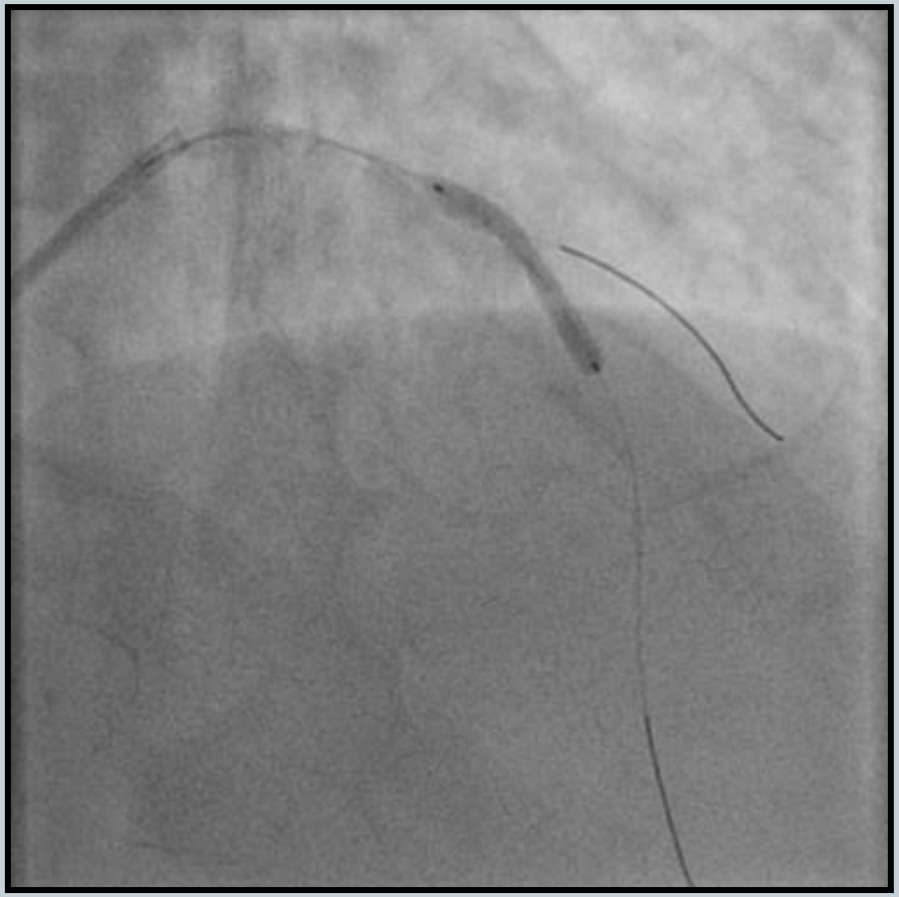


Anterior STEMI

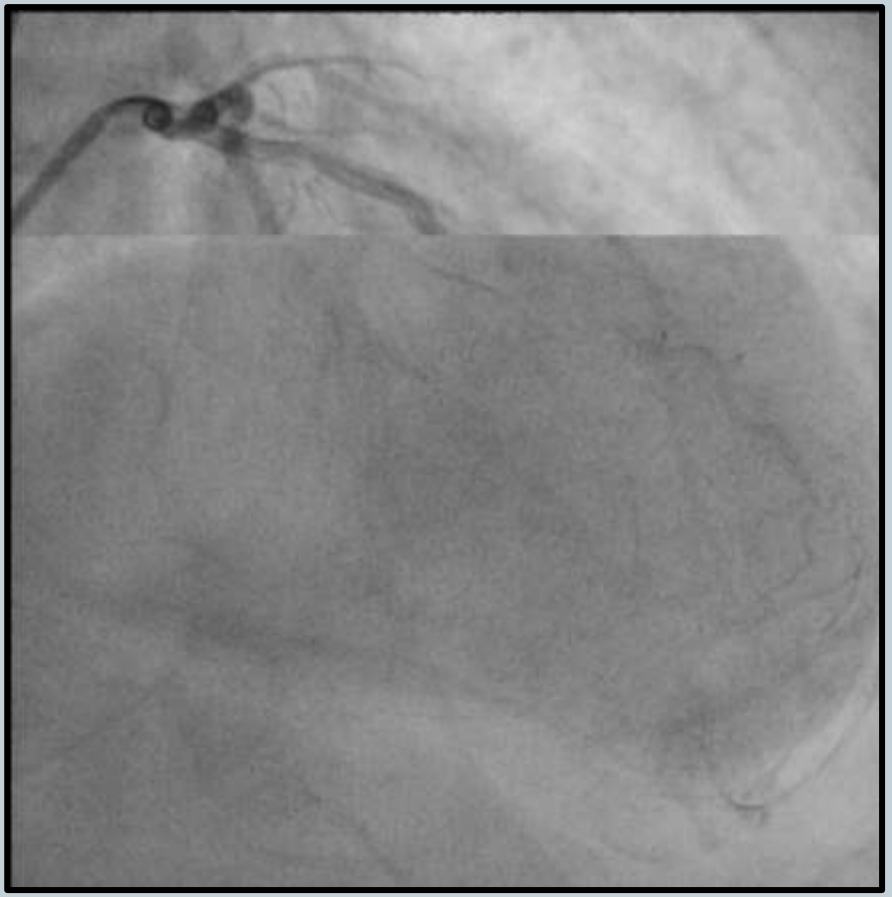


Spontaneous recannalization – TIMI 3

Case 3



Stenting of LAD with wire in diagonal



Final angiography

When Aspiration Thrombectomy doesn't work?

When there is nothing to aspirate

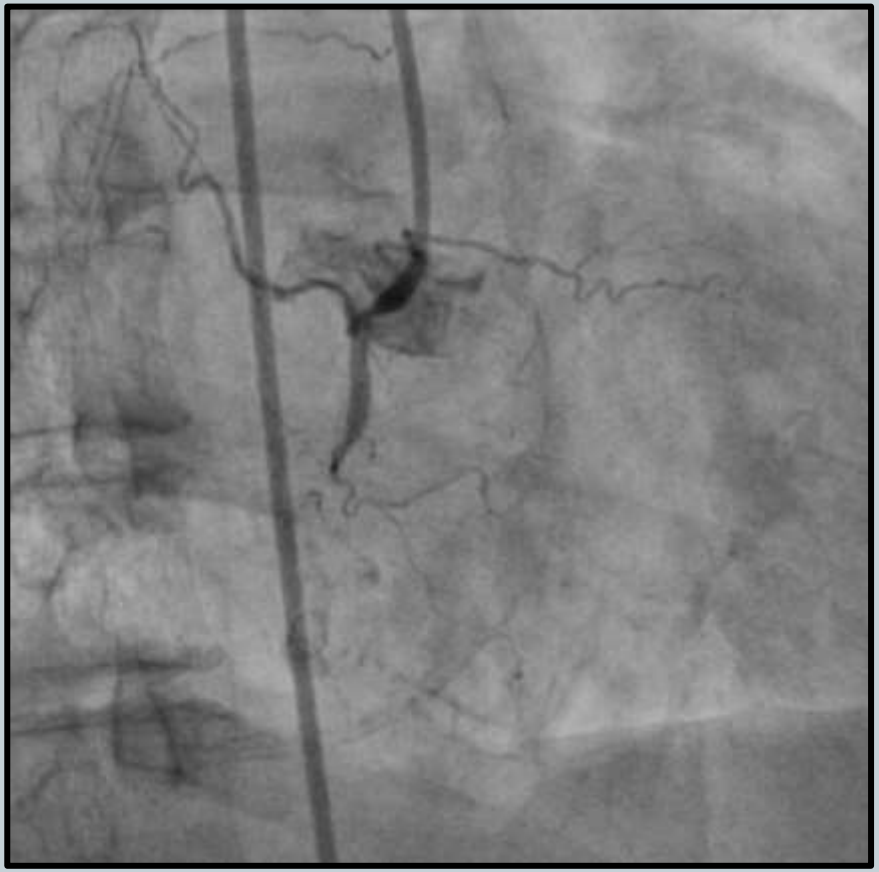
- Minimal thrombus with TIMI 3 flow
- The amount of thrombus make no difference to the outcome
- Risk of distal embolization is minimal

When to aspirate?

- TIMI 0 – definitely

Case 4

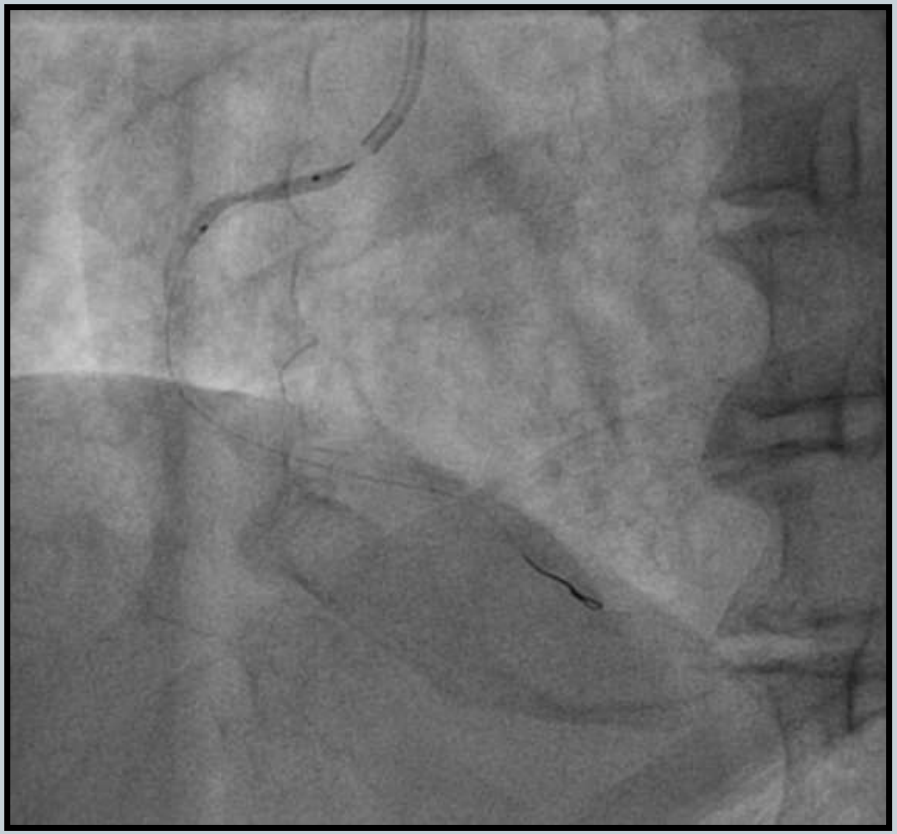
Inferior STEMI



Mid RCA occlusion

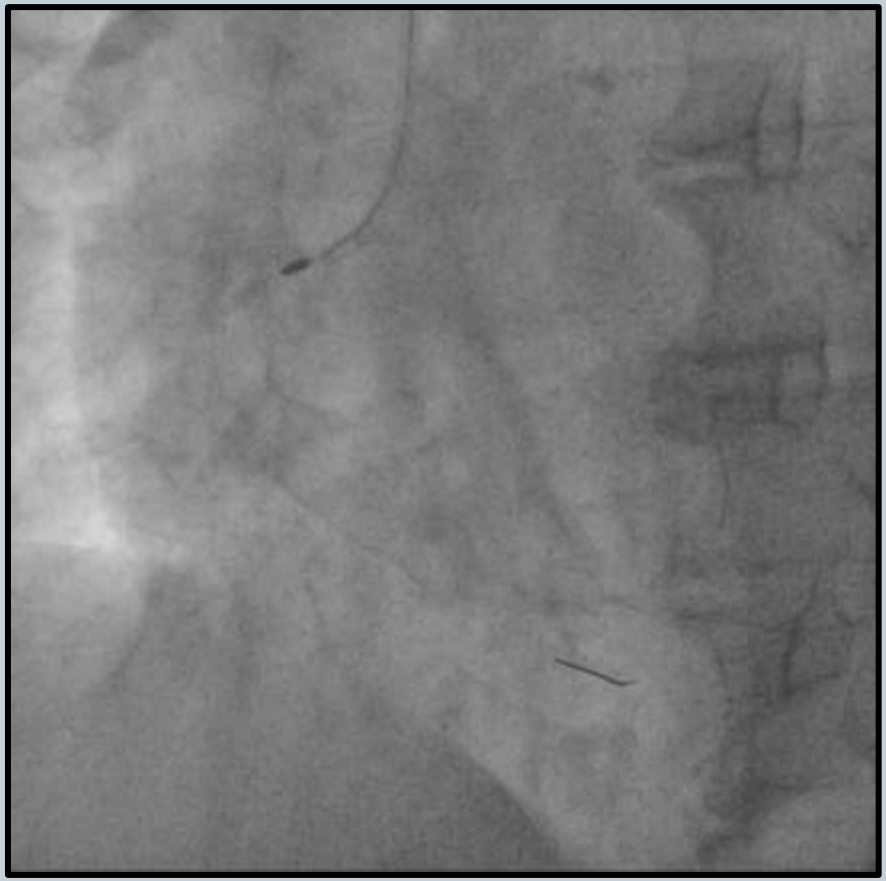
Case 4

After wire crossing but aspiration catheter not able to cross

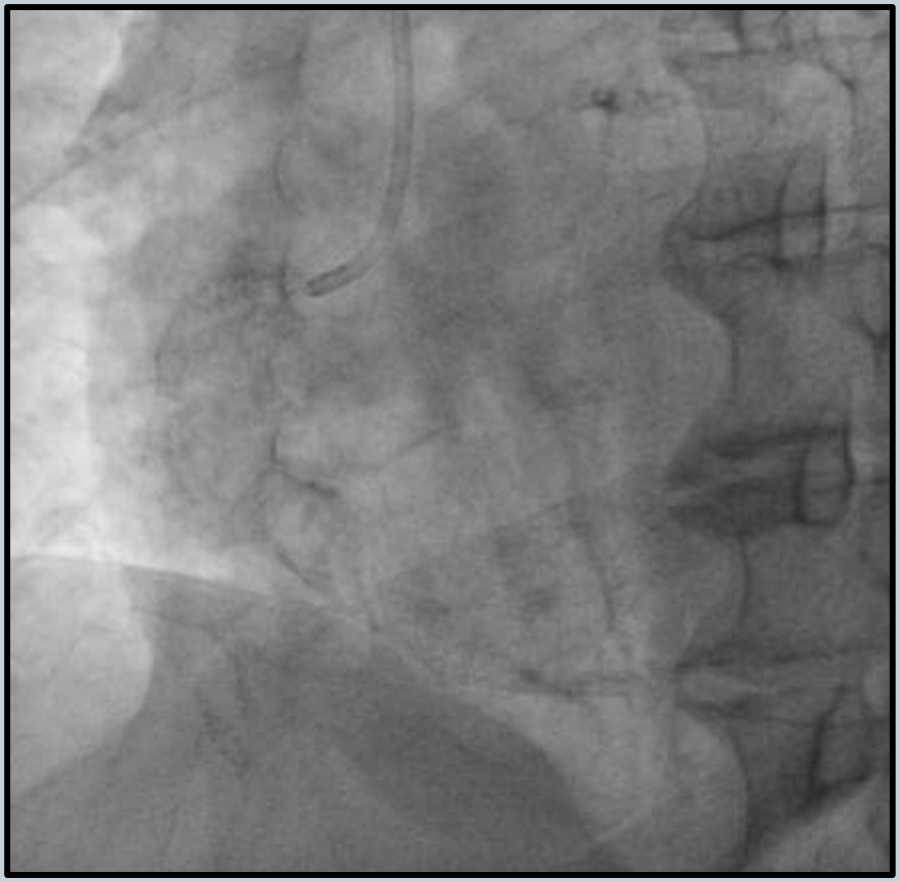


2 mm balloon failed to dilate lesion proximal to culprit lesion

Case 4

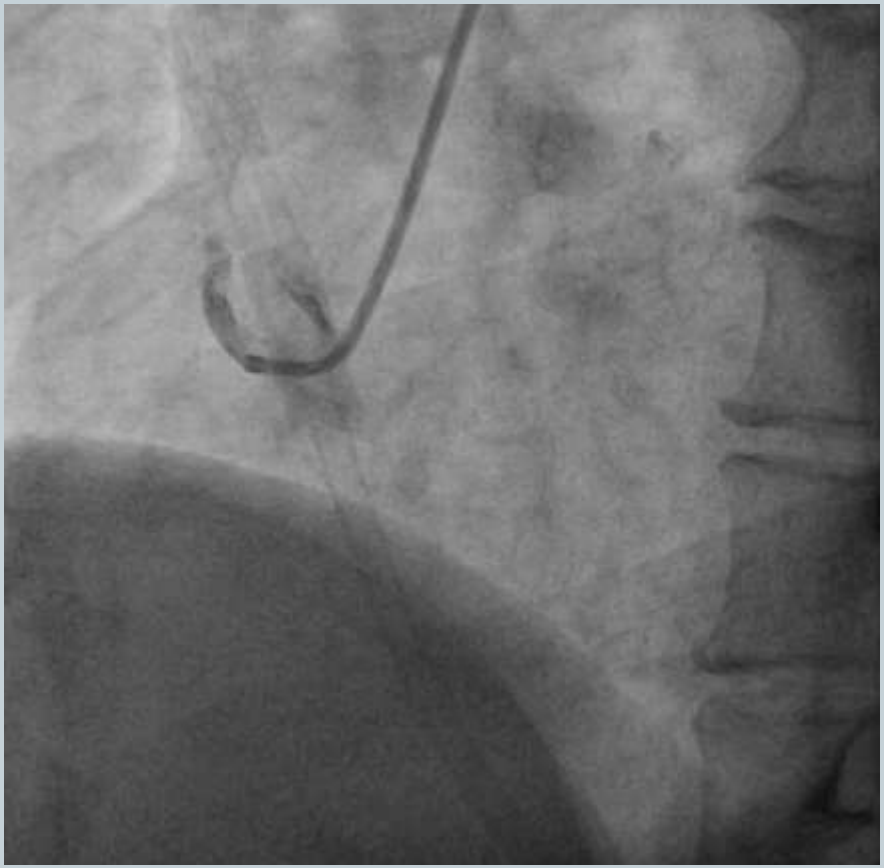


1.25 mm rotablation burr was used



Final angiography after high pressure balloon and 2 DES implanted

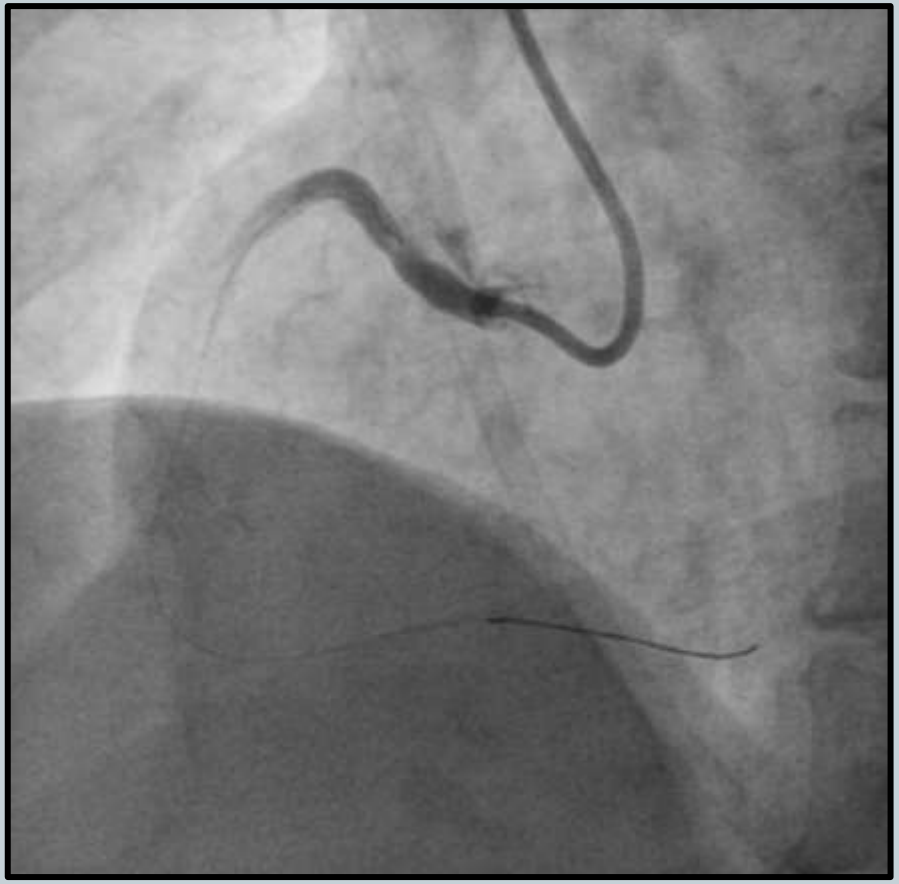
Case 5



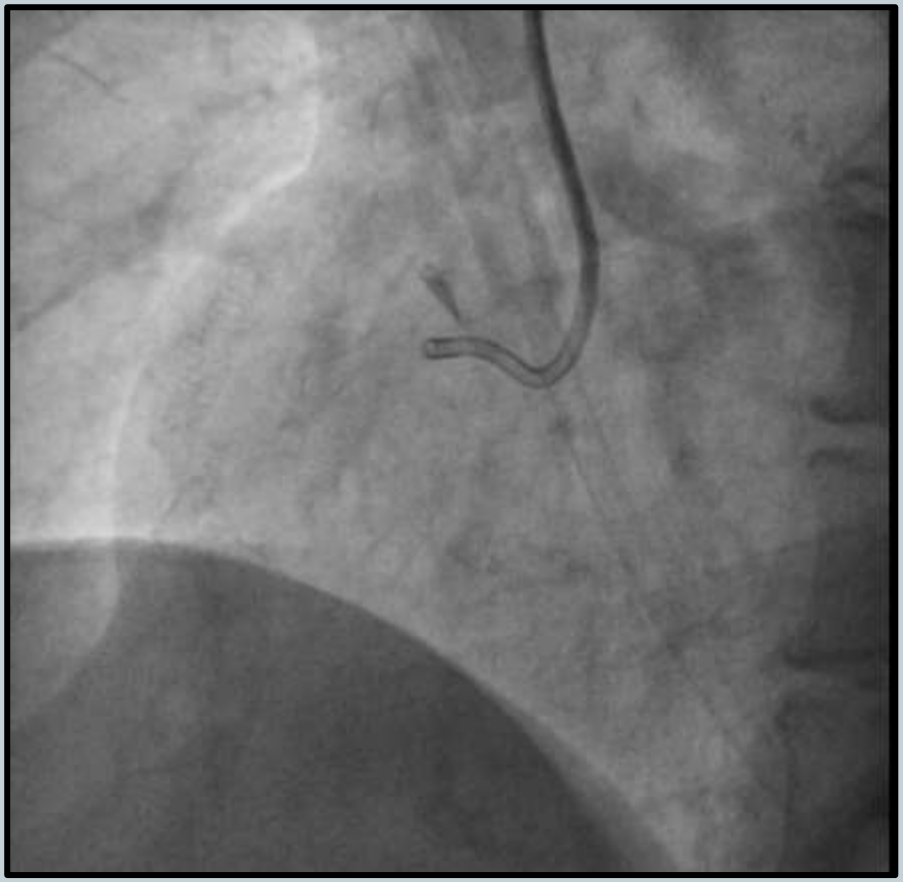
Inferior STEMI with mid RCA occlusion

Aspiration catheter not able to go beyond lesion

Case 5



Post aspiration thrombectomy



Final angiography

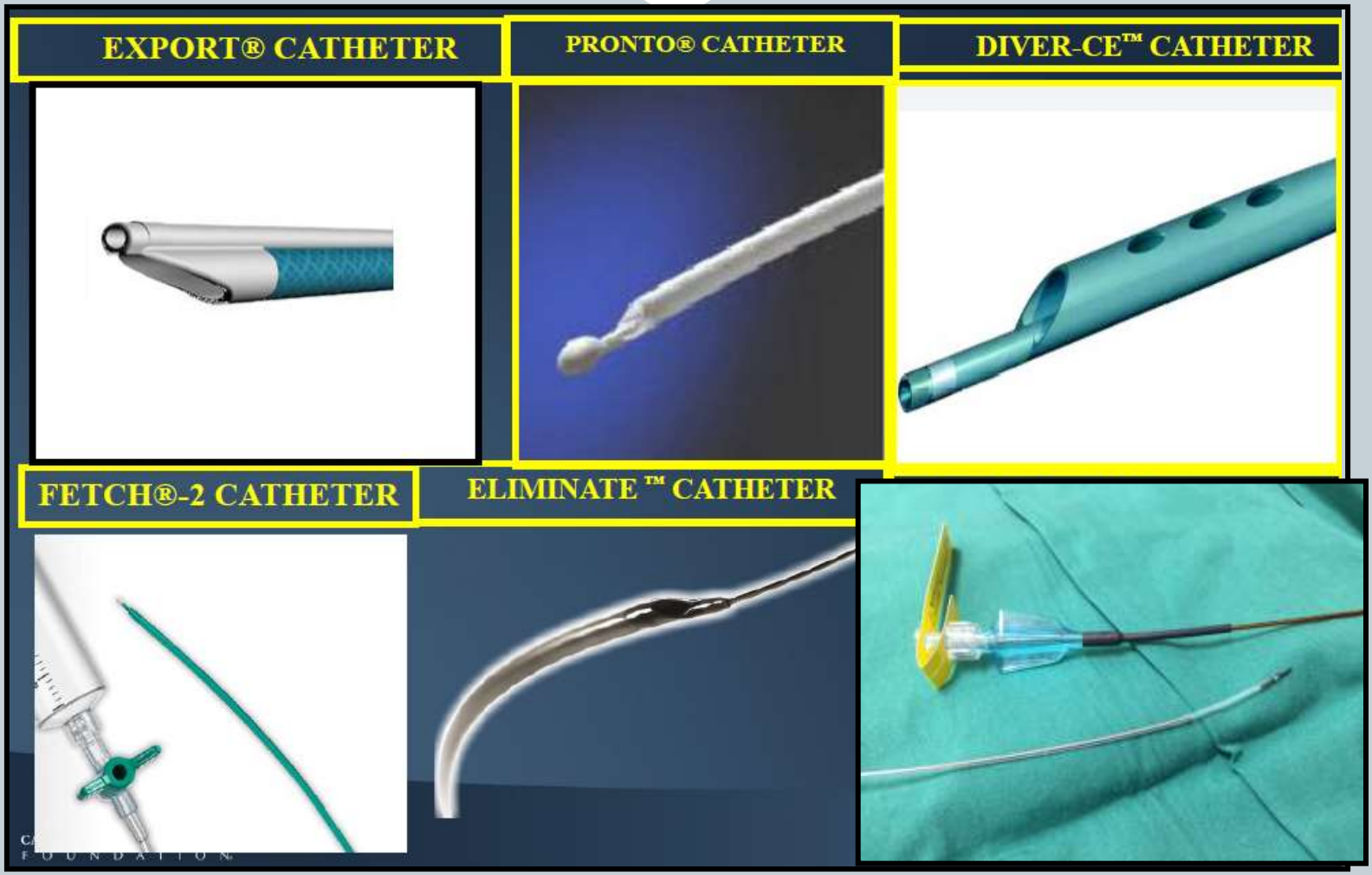
When Aspiration Thrombectomy doesn't work?

When unable to cross lesion

- Too tight, calcified or tortuous
- Tight lesion usually associated with less thrombus
- If unable to cross, aspirate at the site of occlusion may help to establish some flow distally
- Different aspiration catheter has different crossing profile and deliverability
- Thrombuster® comes with stylet to facilitate delivery

- May need pre-dilation but risk of distal embolization

Aspiration Thrombectomy Catheters

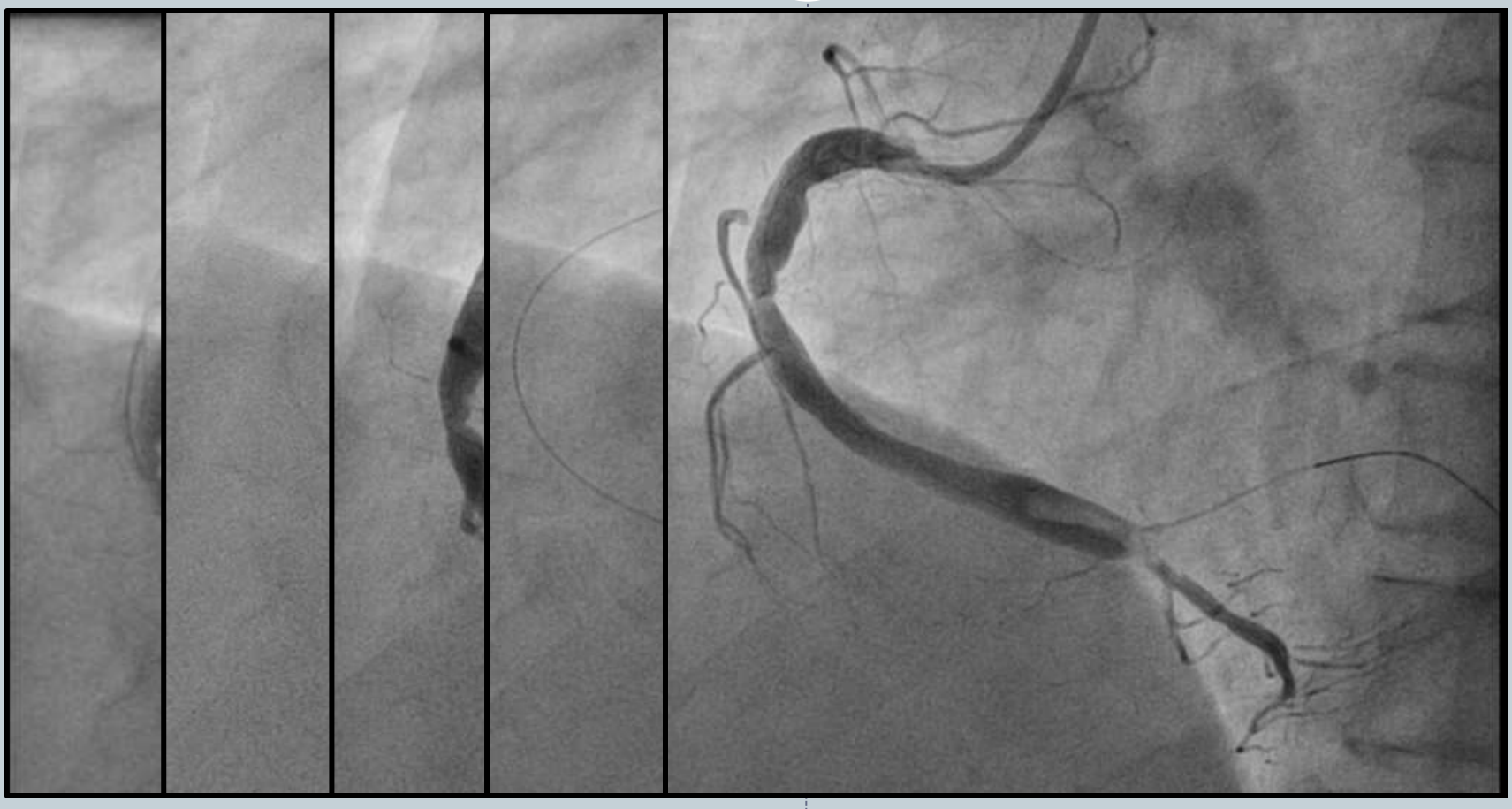


Case 6

Inferior STEMI with ectactic RCA

Large thrombus lodged in distal RCA bifurcation

Case 6



Aspirated with aspiration catheter but still have large thrombus present
Angiojet® used for mechanical aspiration but still have residual thrombus

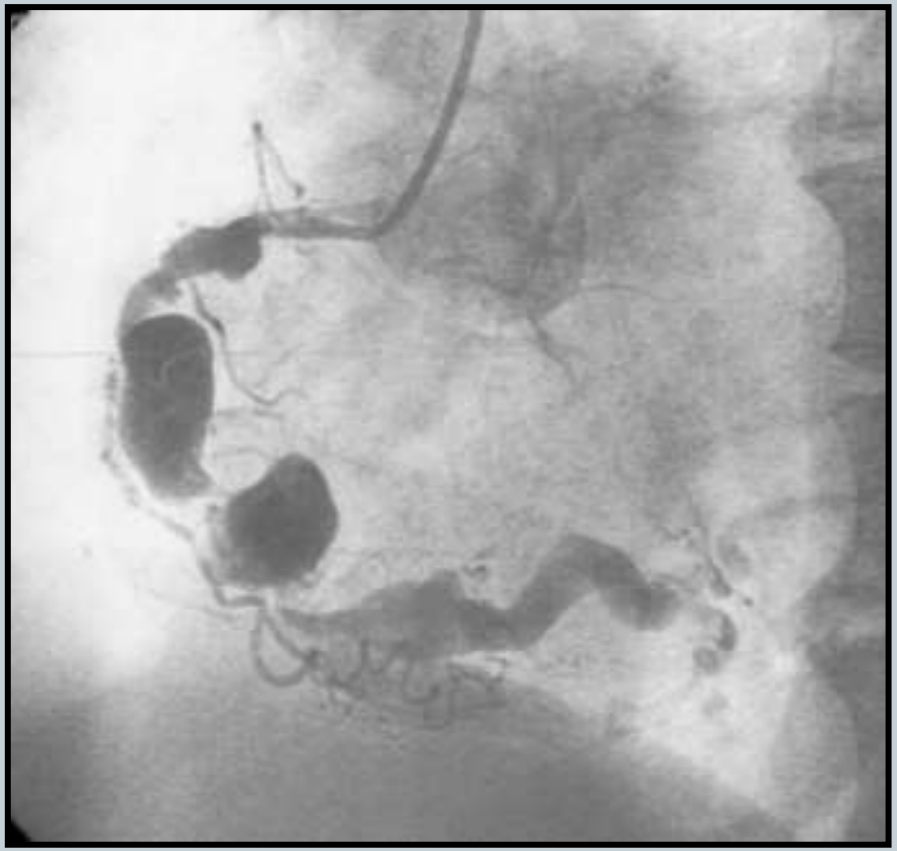
Case 6

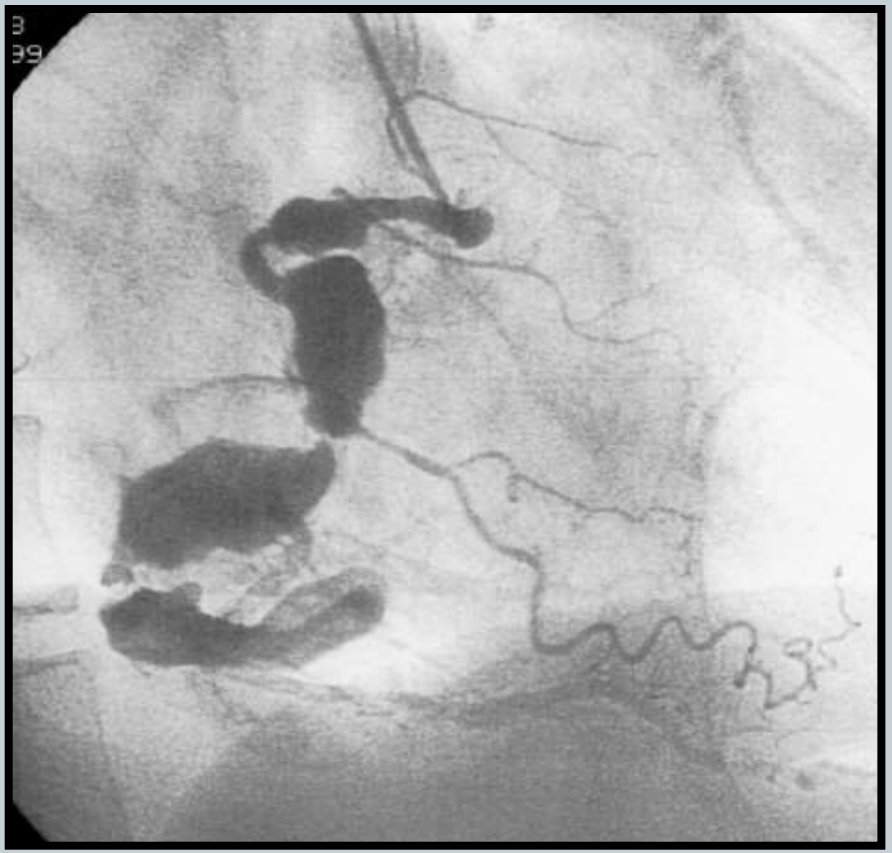
Final angiography after multiple aspiration thrombectomy, Angioget® and balloon. Glycoprotein 2b3a inhibitors was given as bailout.

Case 6 – 3 days later

TIMI 3 flow with resolution of thrombus in distal RCA

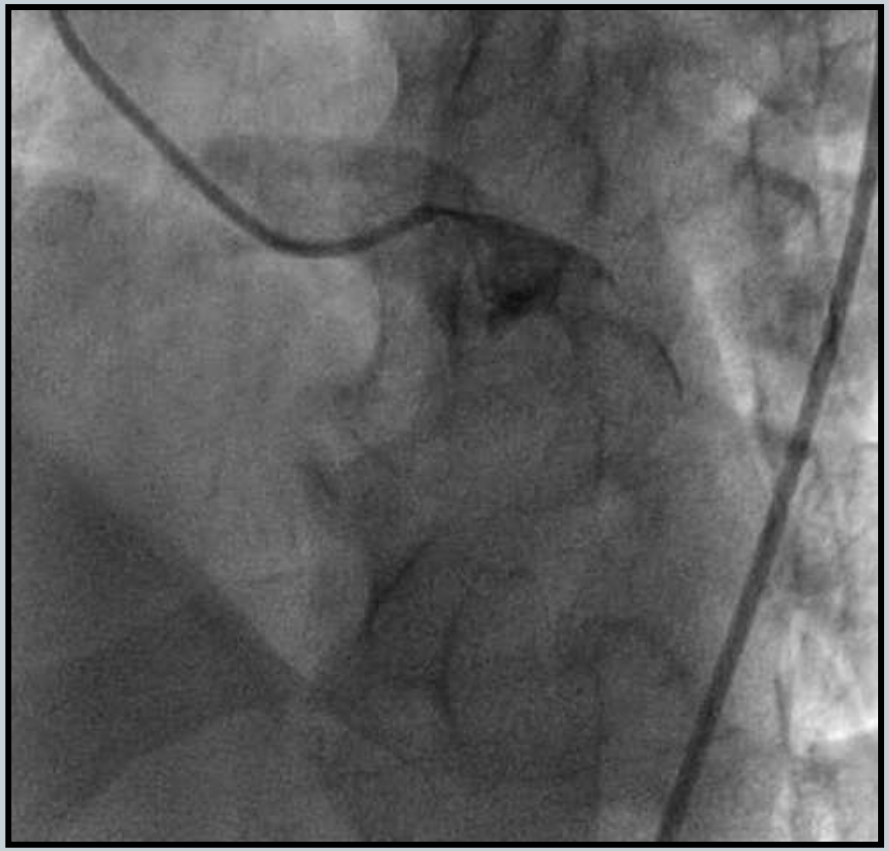
Case 7

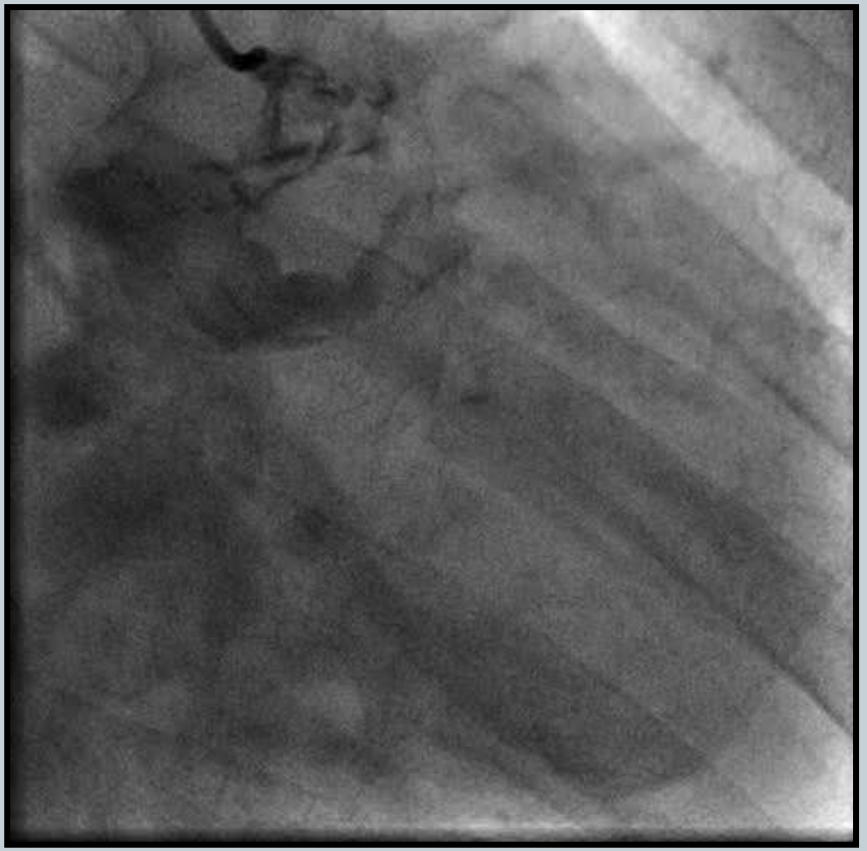




Inferior STEMI with thrombus laden aneurysmal RCA with multiple critical lesions

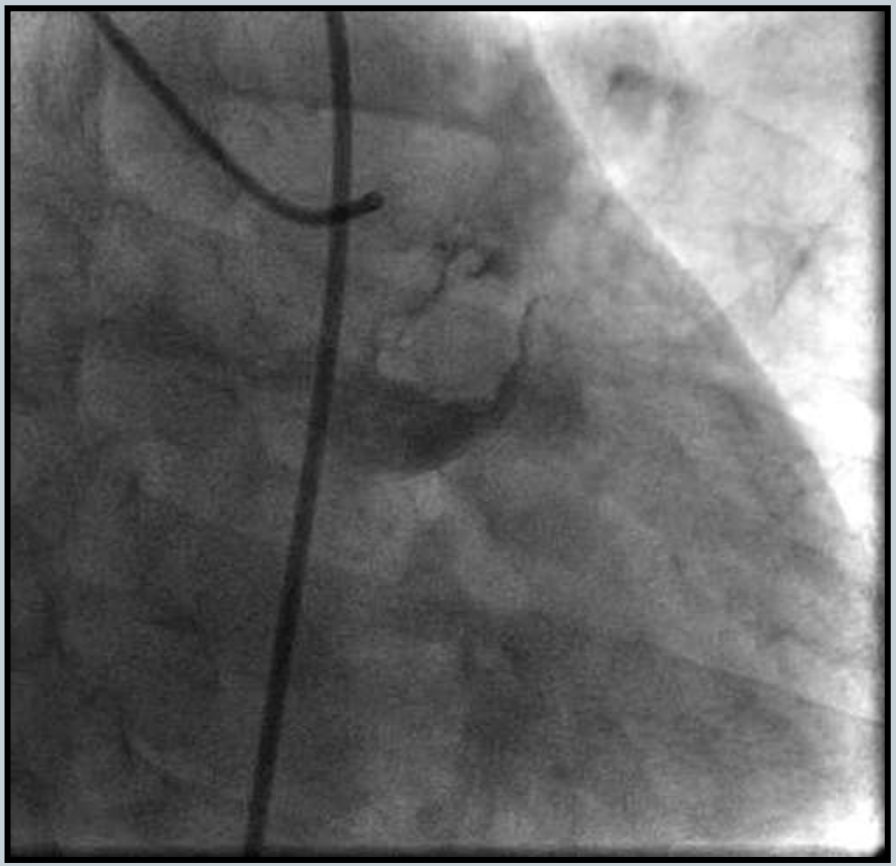
Case 8 – An unusual case

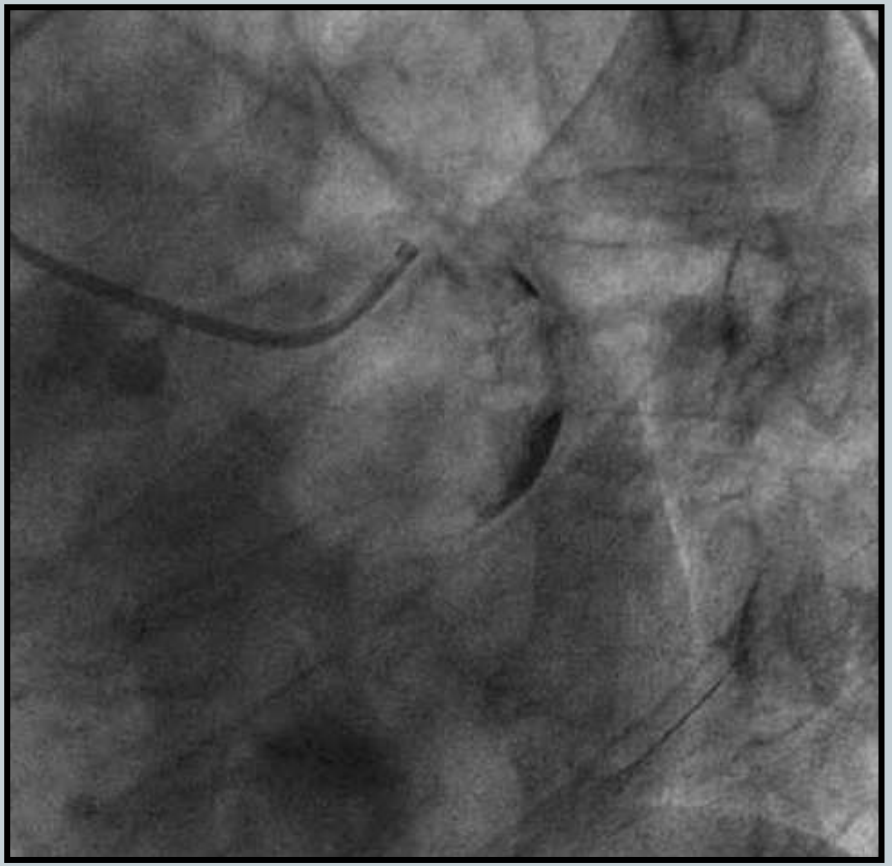




Inferior STEMI with a huge thrombus compressing proximal segment of a dominant LCX with spontaneous recannalization

Case 8 – An unusual case





Inferior STEMI with a huge thrombus compressing proximal segment of a dominant LCX with spontaneous recannalization

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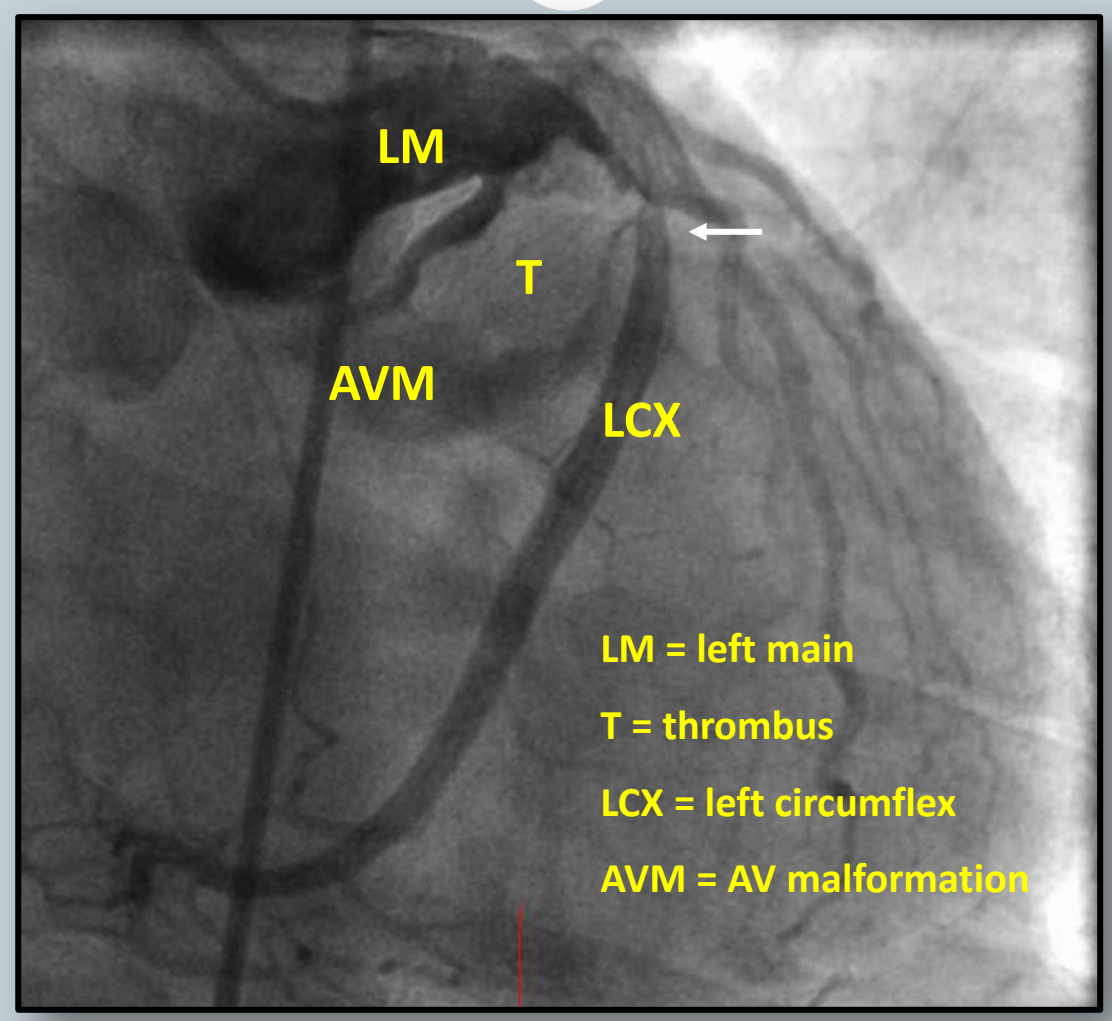


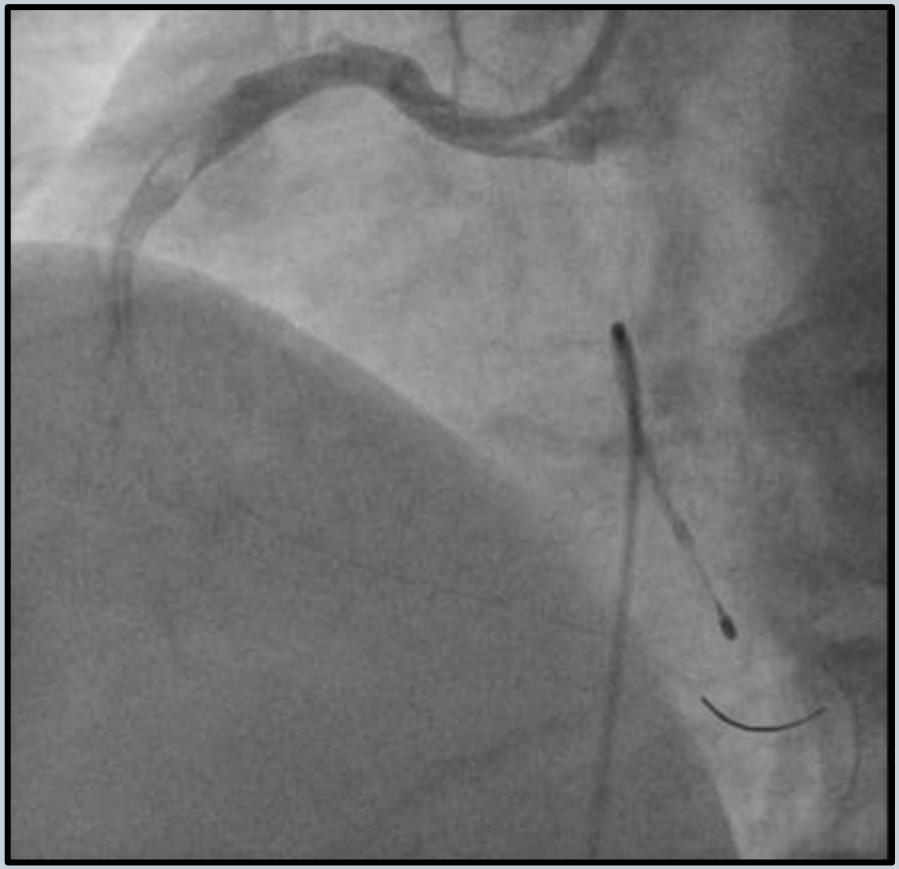
When Aspiration Thrombectomy doesn't work?

When there is too much thrombus

- Commonly in large, ectatic and/or aneurysmal artery
- AMI in these situations are sometimes due to embolization of thrombus formed in the dilated segment
- Usually these vessels have high thrombus load

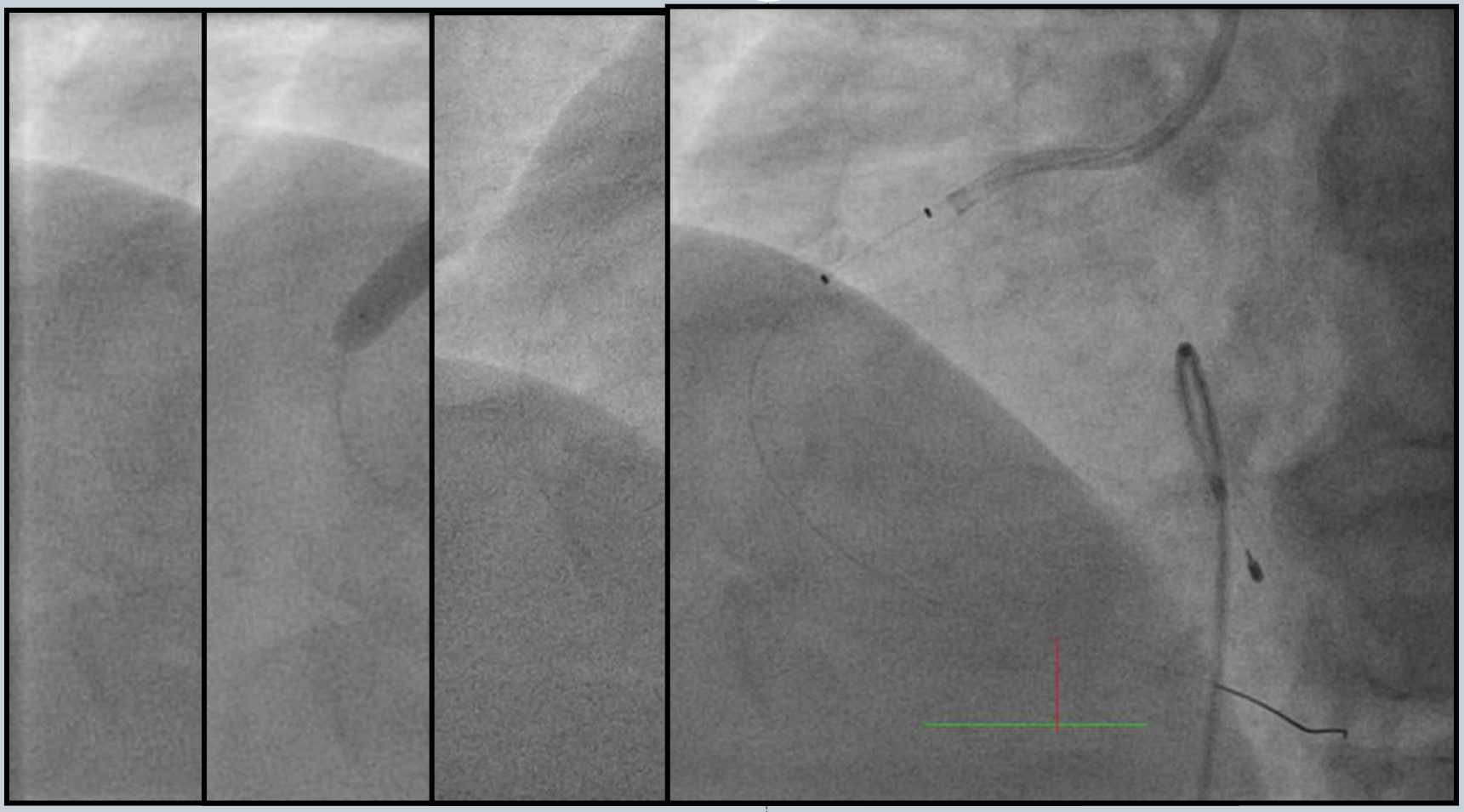
- 2 other scenarios usually high thrombus load and related to poor PCI outcomes despite aspiration or even mechanical thrombectomy – ***RCA and left main***

Case 9



Inferior STEMI with large thrombus load in RCA and despite aspiration thrombectomy, there was still slow flow in RCA

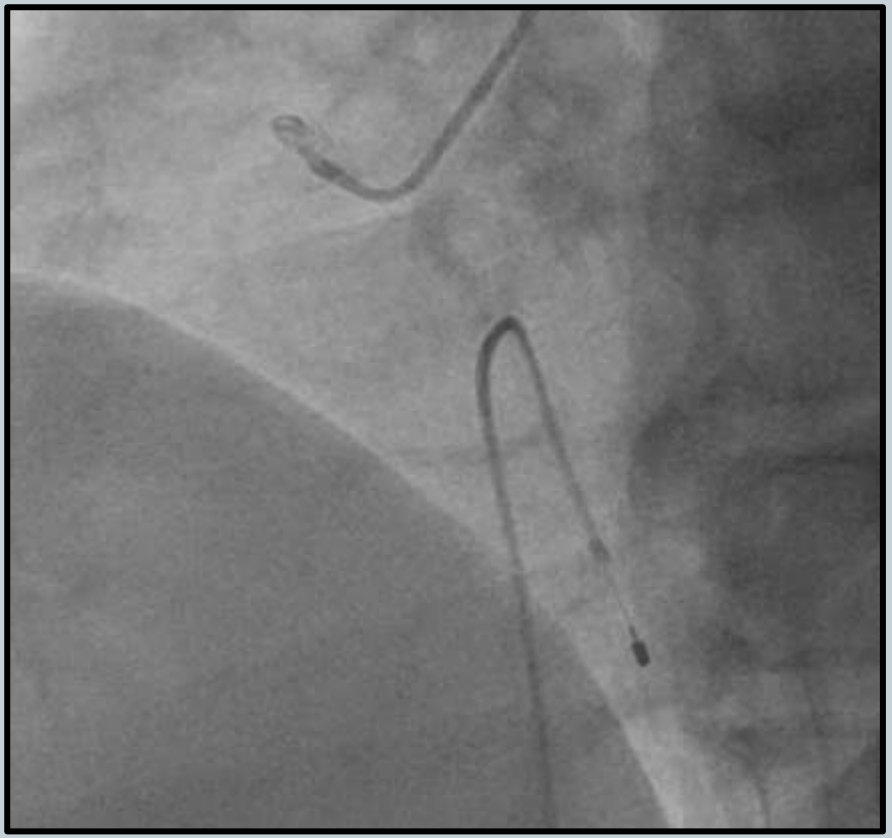
Case 9



Filter device was placed in the distal RCA and Angiojet® was used
Further balloon dilatation and Angiojet® were used

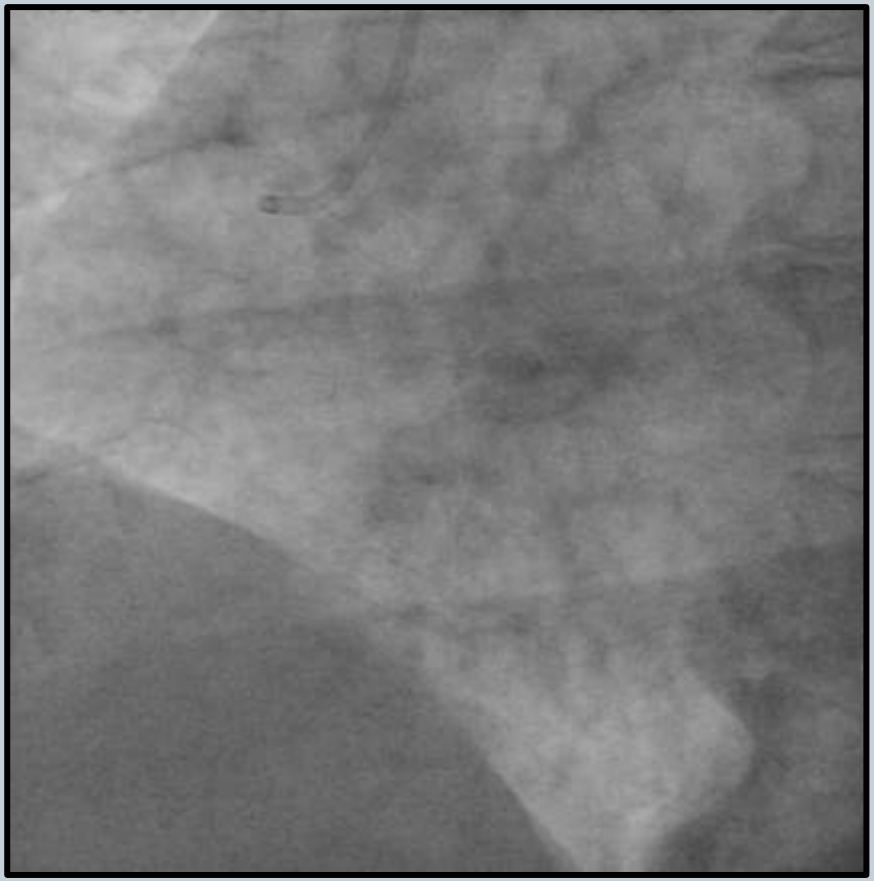
Case 9

Final angiography with slow flow

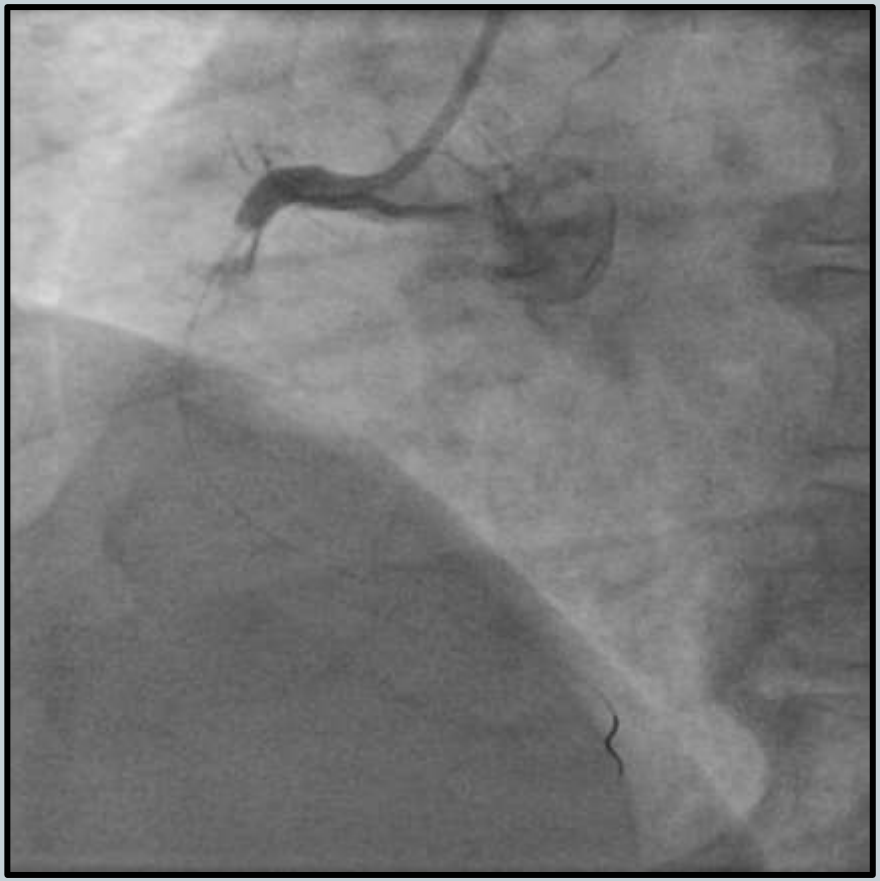


Repeat angiography 4 days later

Case 10

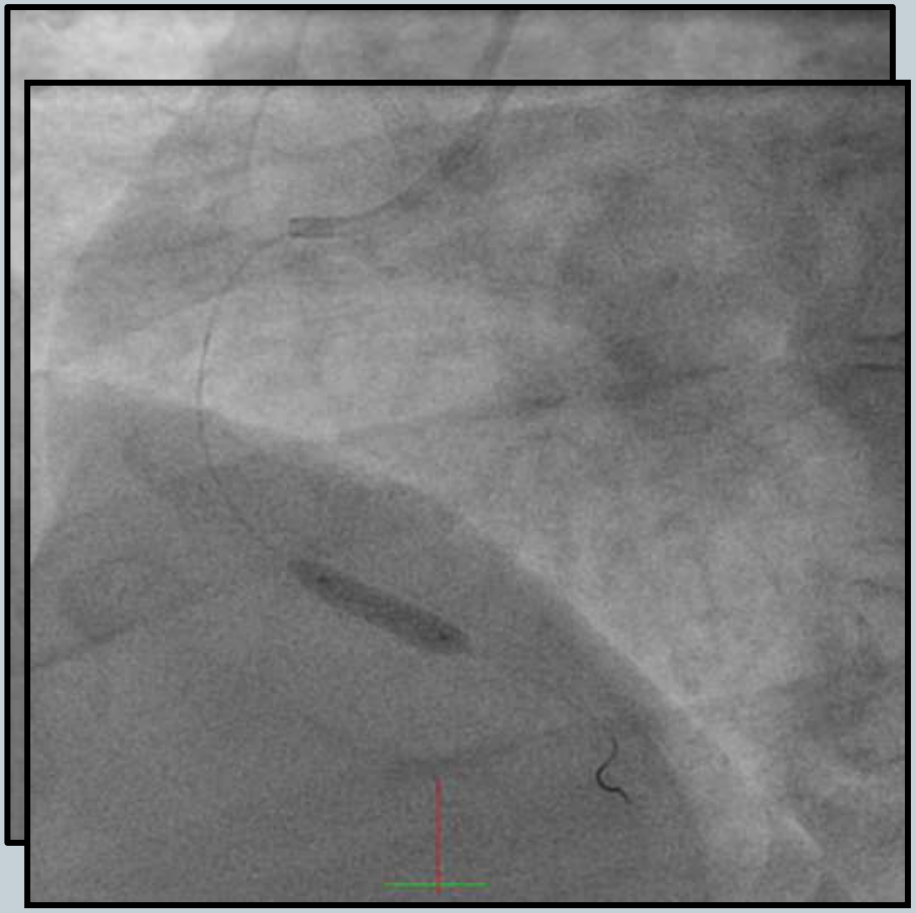


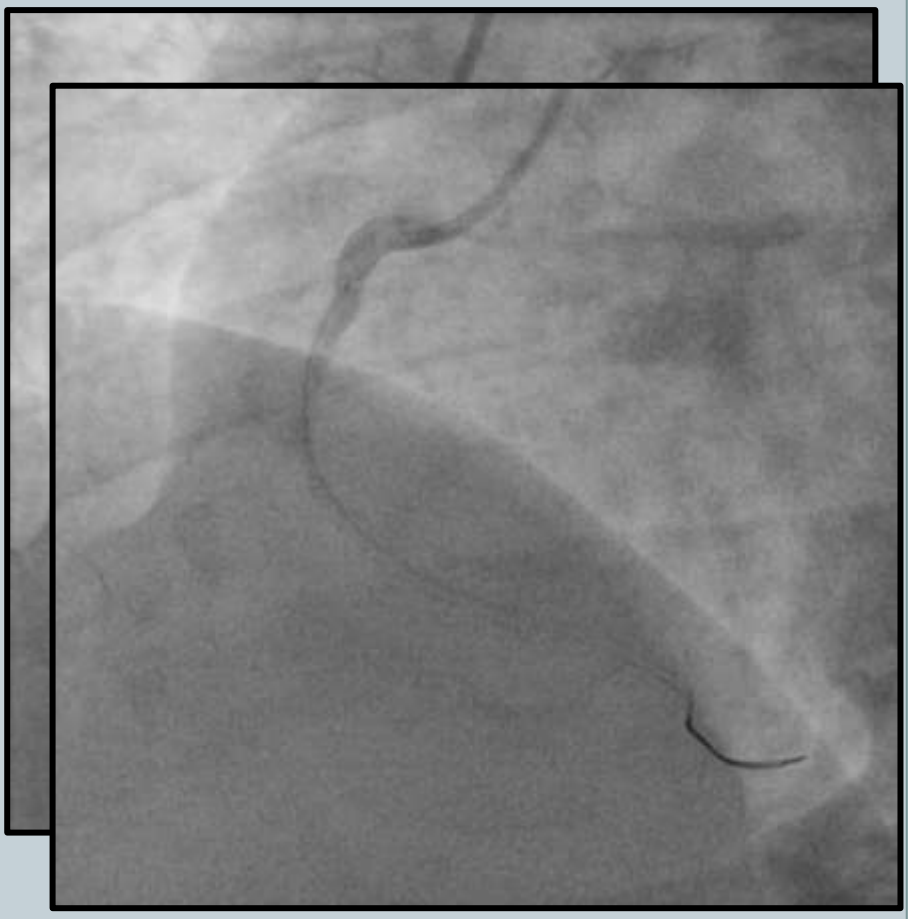
Inferior STEMI with occluded proximal RCA



After multiple aspiration thrombectomy

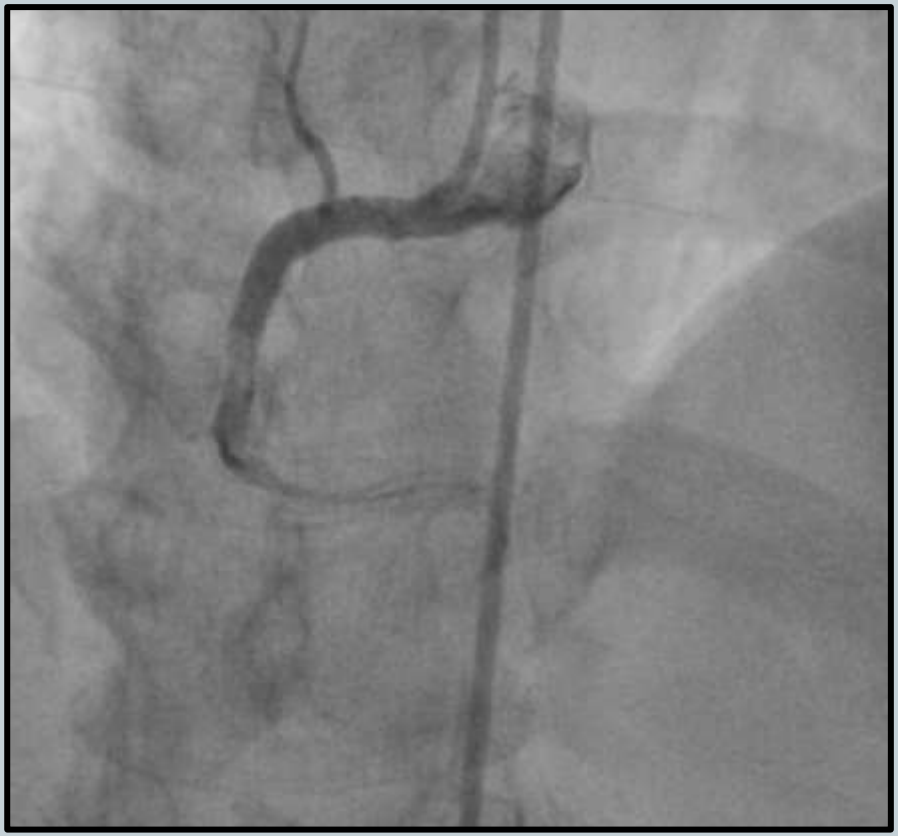
Case 10





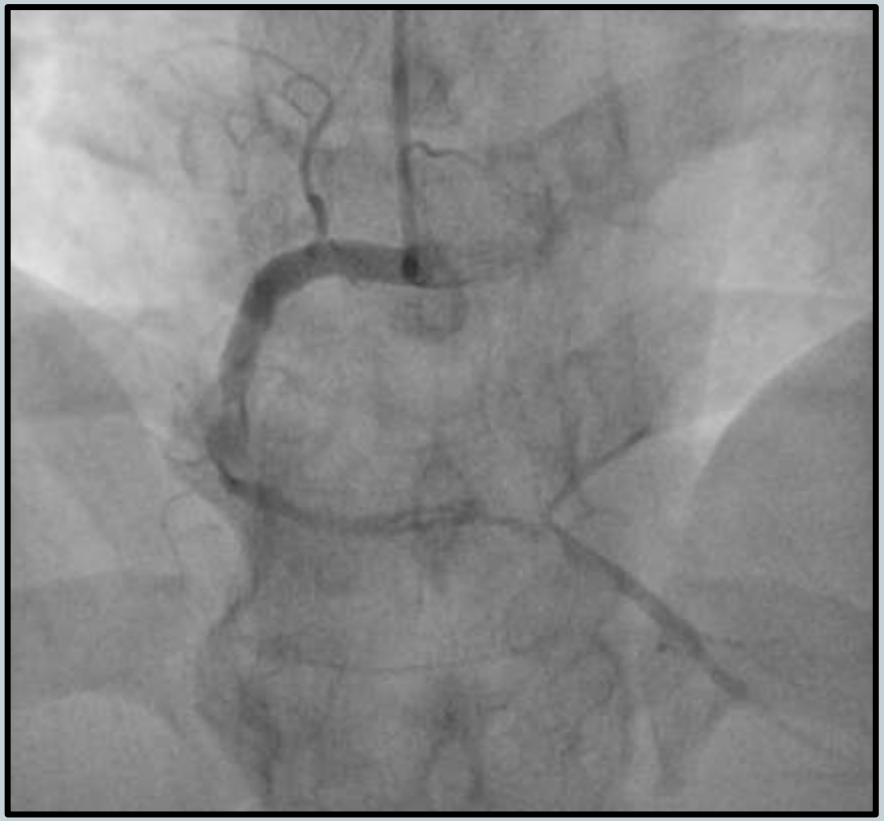
Despite multiple dilatation with larger balloon, there were still large amount of thrombus in RCA

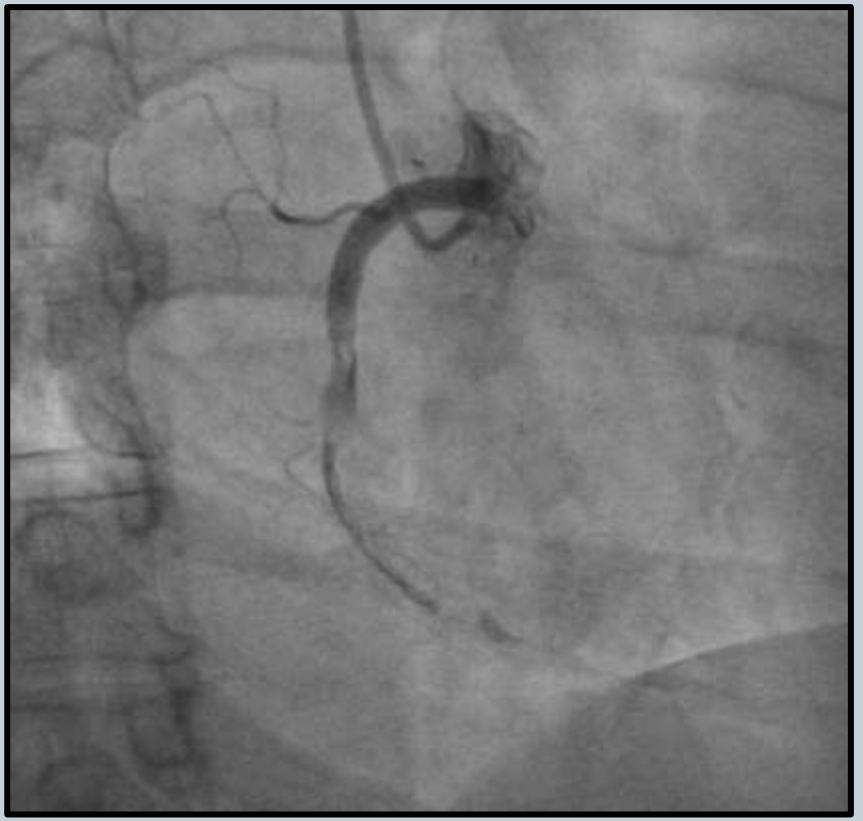
Case 10



Final angiography with residual thrombus and occluded right PL branches

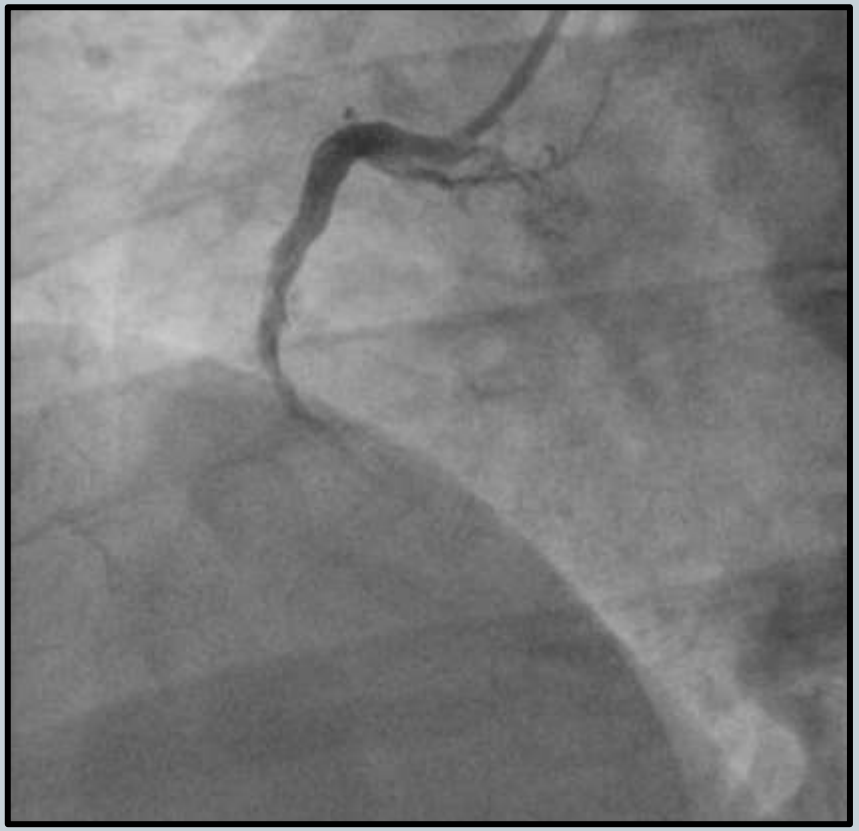
Case – 4 days later





Relook of RCA showed similar findings of thrombus laden RCA

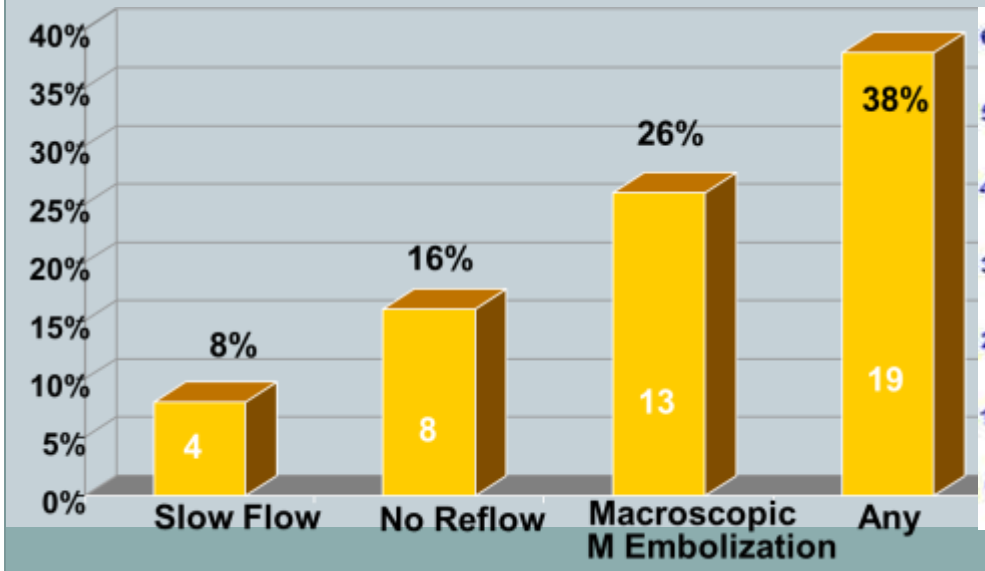
Case 10 – 4 days later

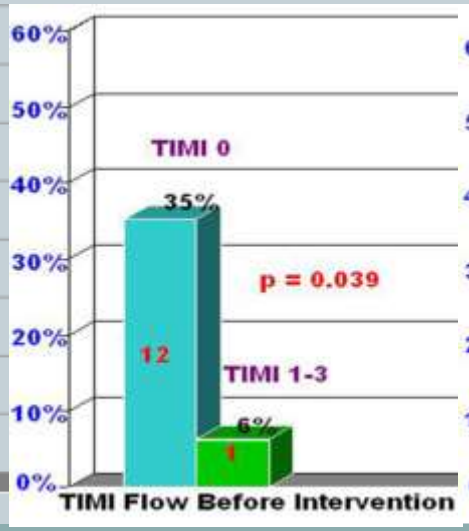


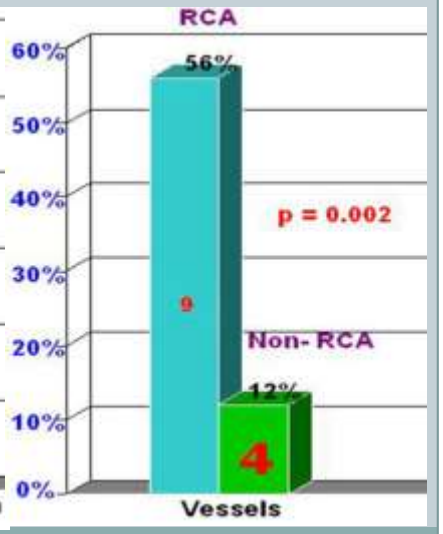
DES was deployed across right AV groove branch with minimal effect on distal RCA flow

Rate of Distal Embolization

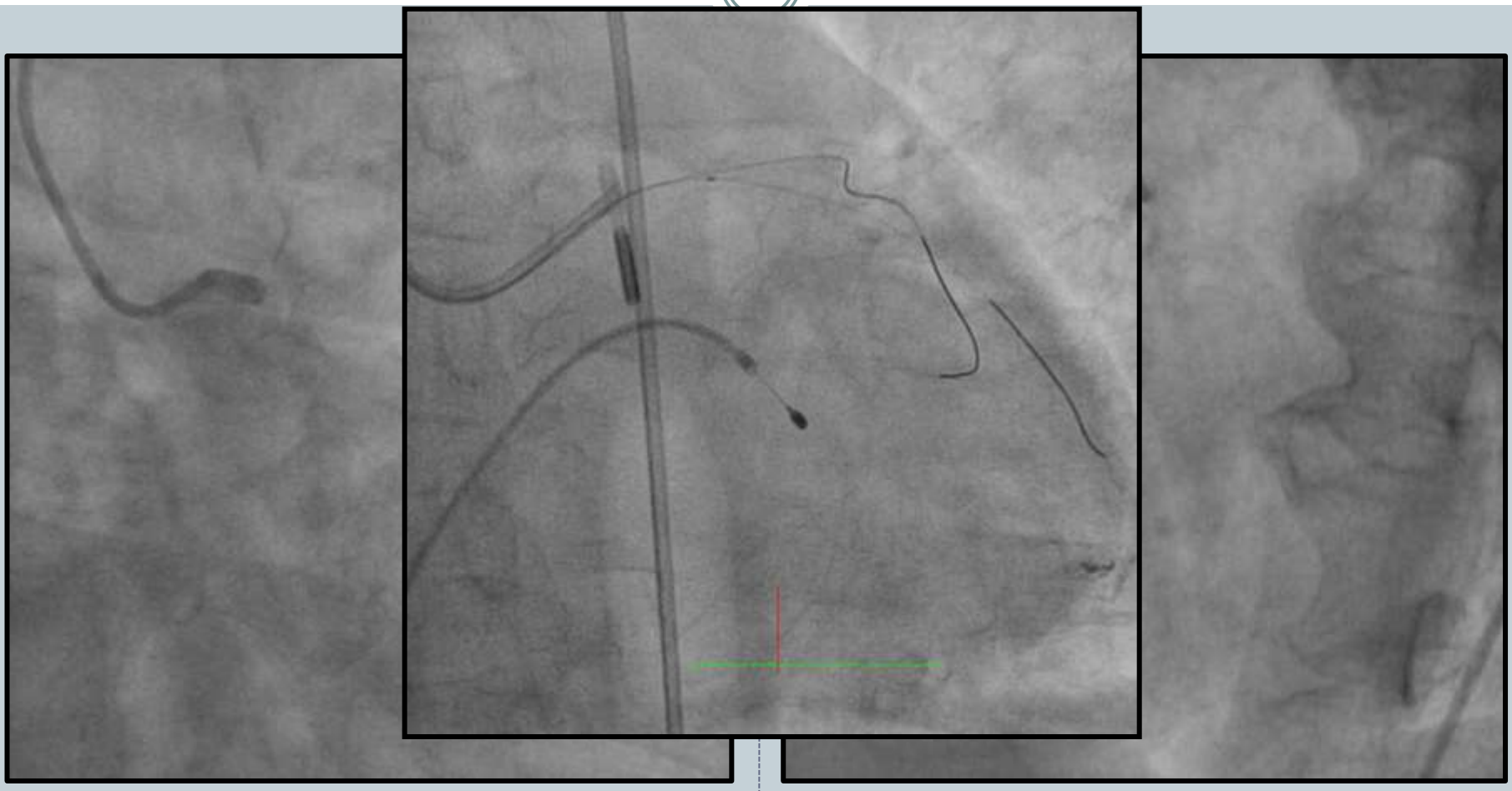
- NHCS in 1998, fifty consecutive primary PCI patient before the use of embolic protection devices
- Angiographic appearance of distal embolization:
  1. Slow flow
  2. No-reflow
  3. Macroscopic embolization





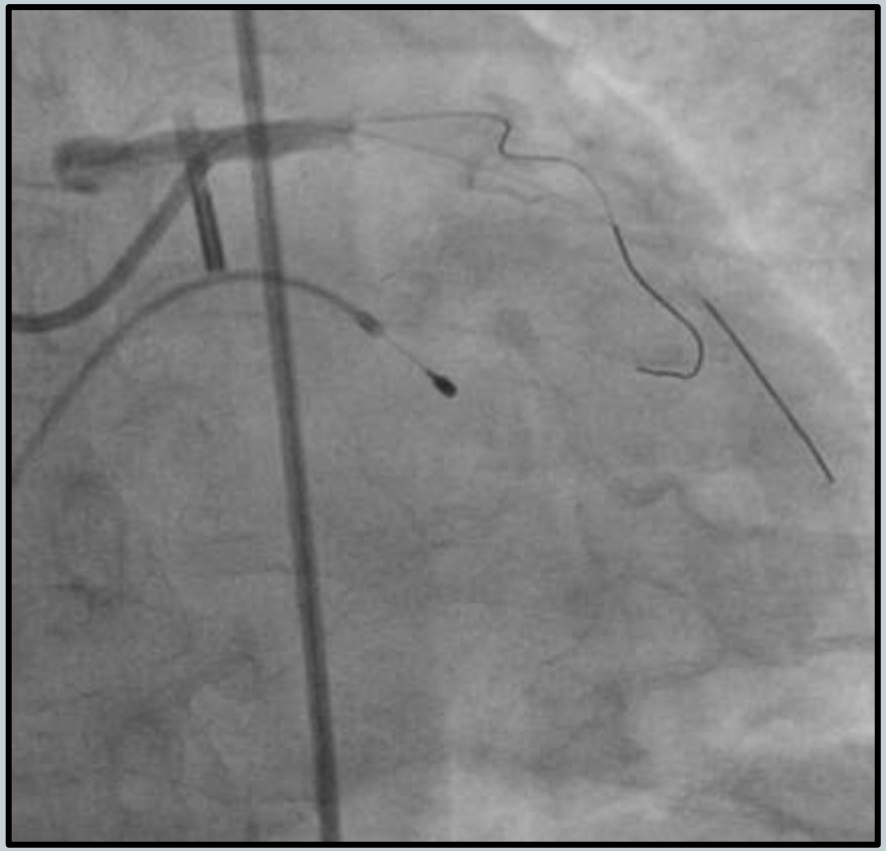


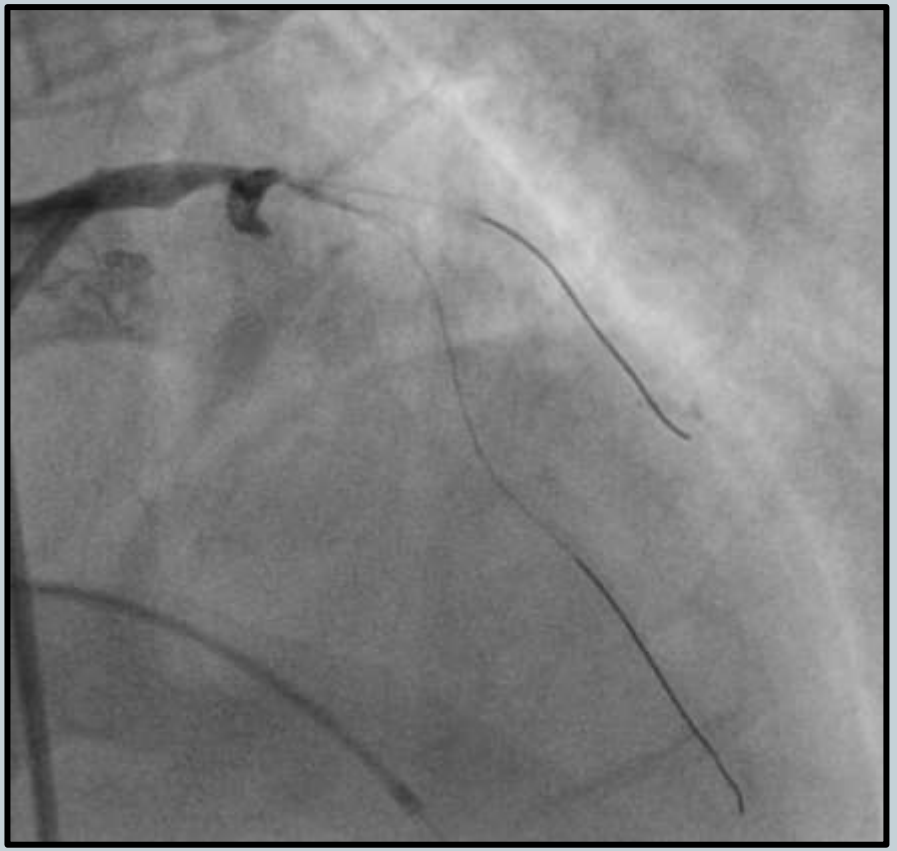
Case 11



"STEMI" with cardiogenic shock with LM occlusion
Both LAD and LCX were wired and aspiration thrombectomy was performed

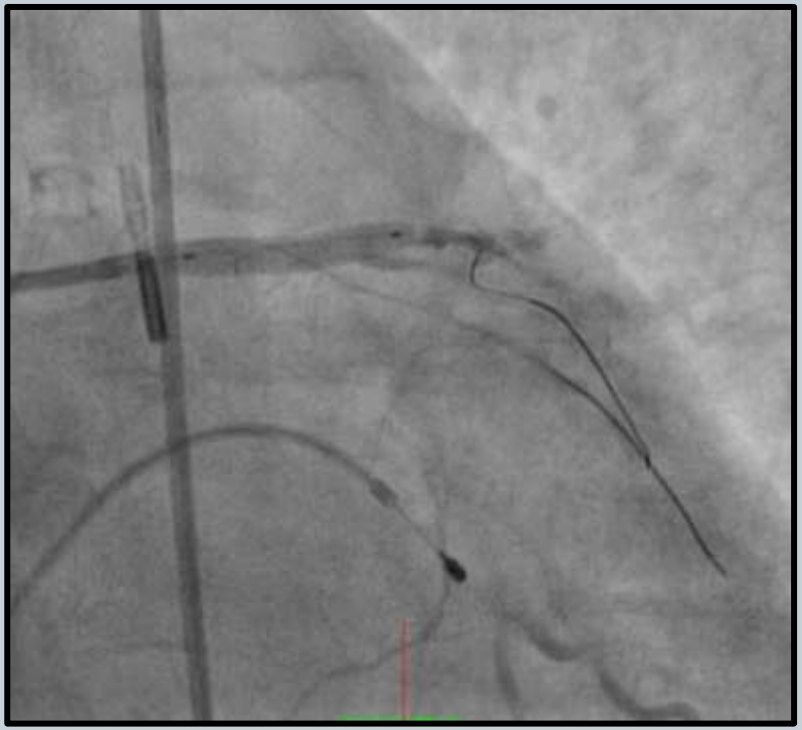
Case 11



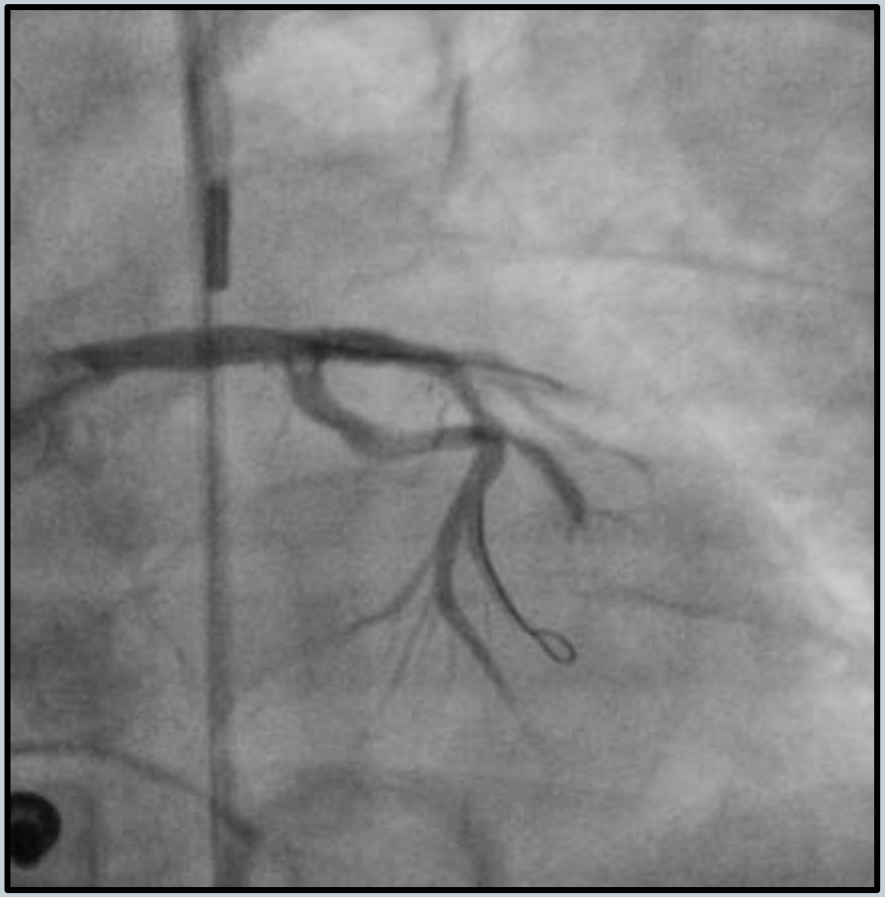


Flow was established in LAD and LCX but slow flow, with a large mobile thrombus sitting at the distal LM bifurcation

Case 11

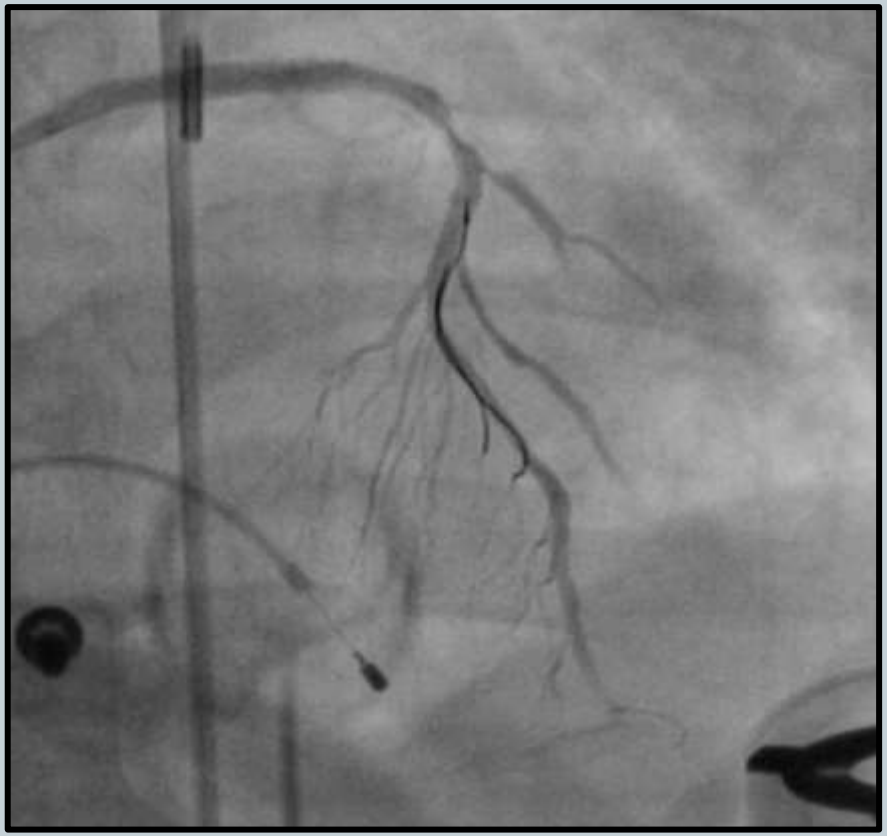


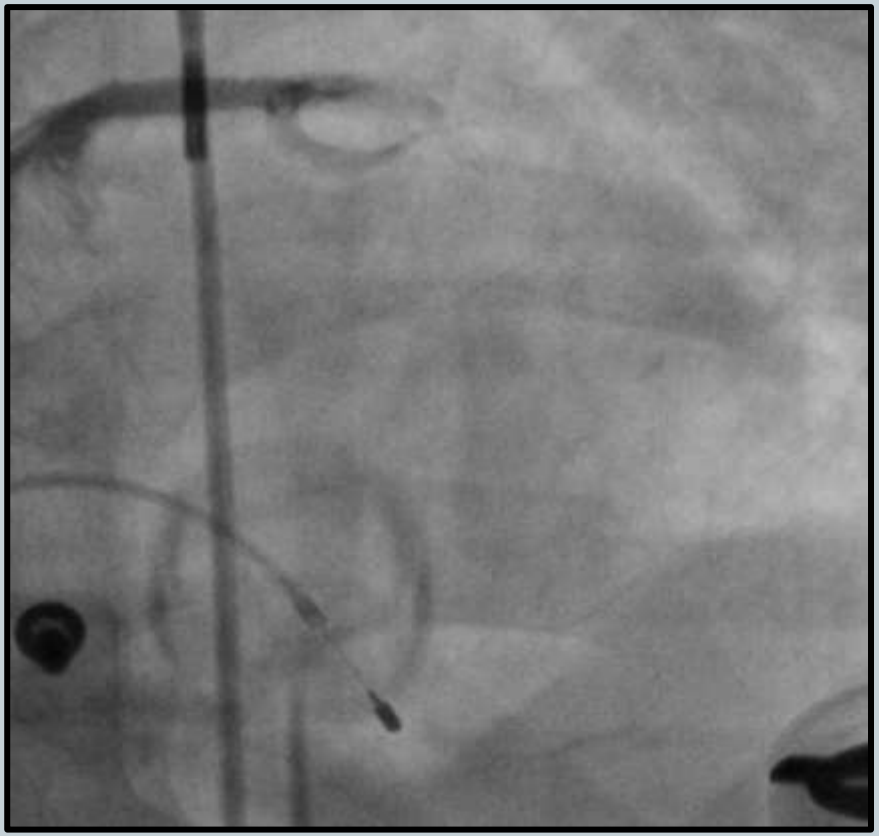
LM stenting into LAD with crossover LCX artery



No reflow and patient collapsed with Lucas® device used for CPR

Case 11



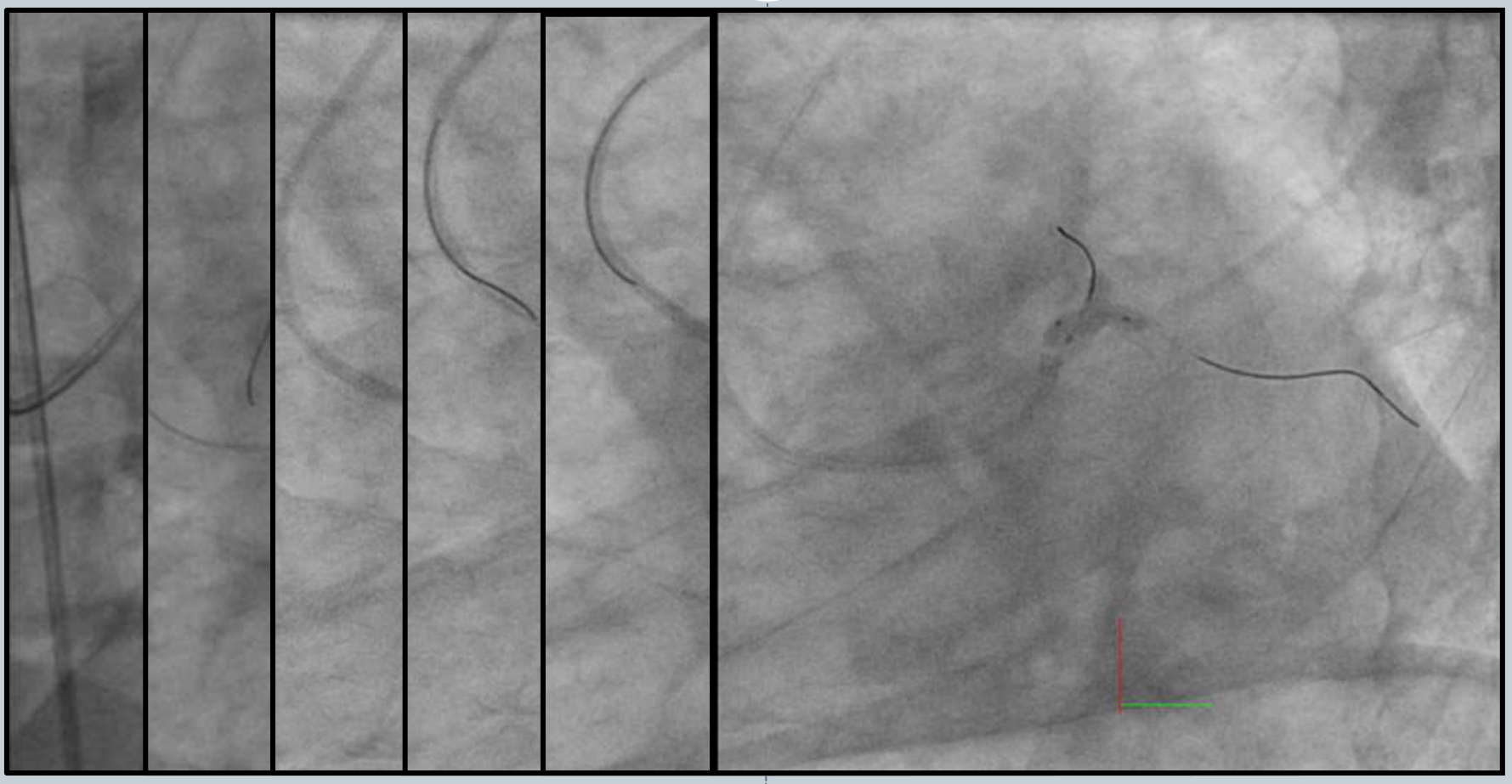


No adequate flow established after LM stenting and patient did not survived

Case 12

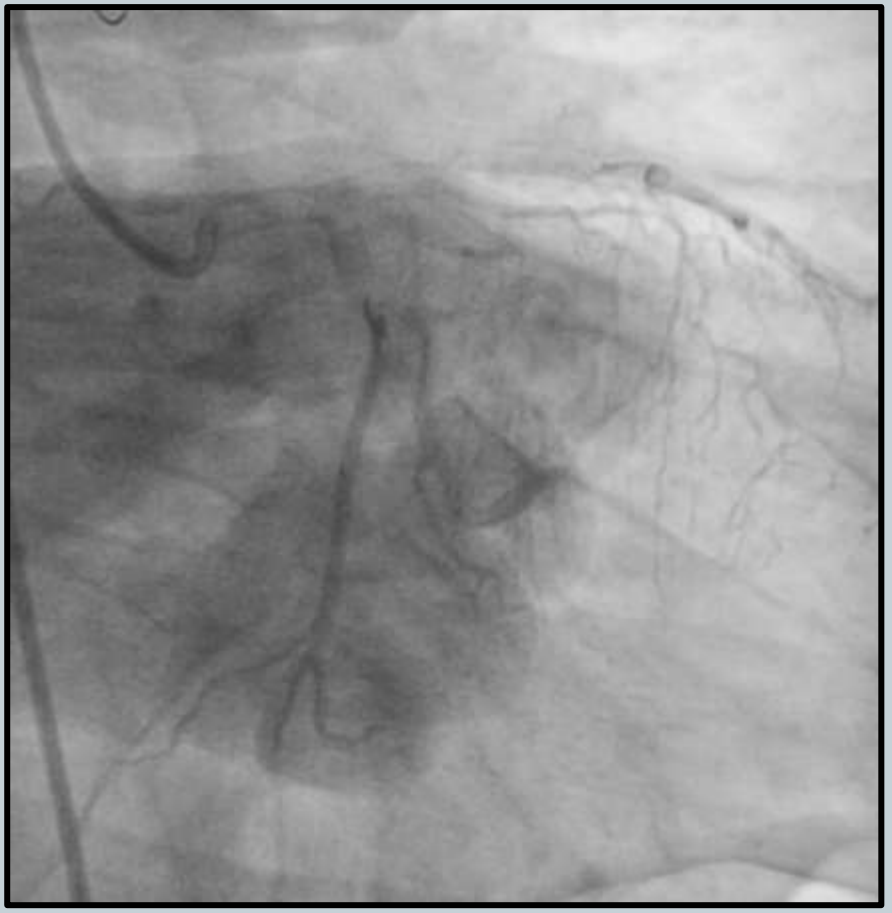
“STEMI” with distal LM occlusion with poor flow to LAD and LCX

Case 12



Aspiration thrombectomy was performed in both LAD and LCX
Crush technique was used for LM bifurcation stenting with FKBT

Case 12



Final angiography showing poor distal flow in both LAD and LCX despite GP2b3a inhibitors, vasodilators and IABP

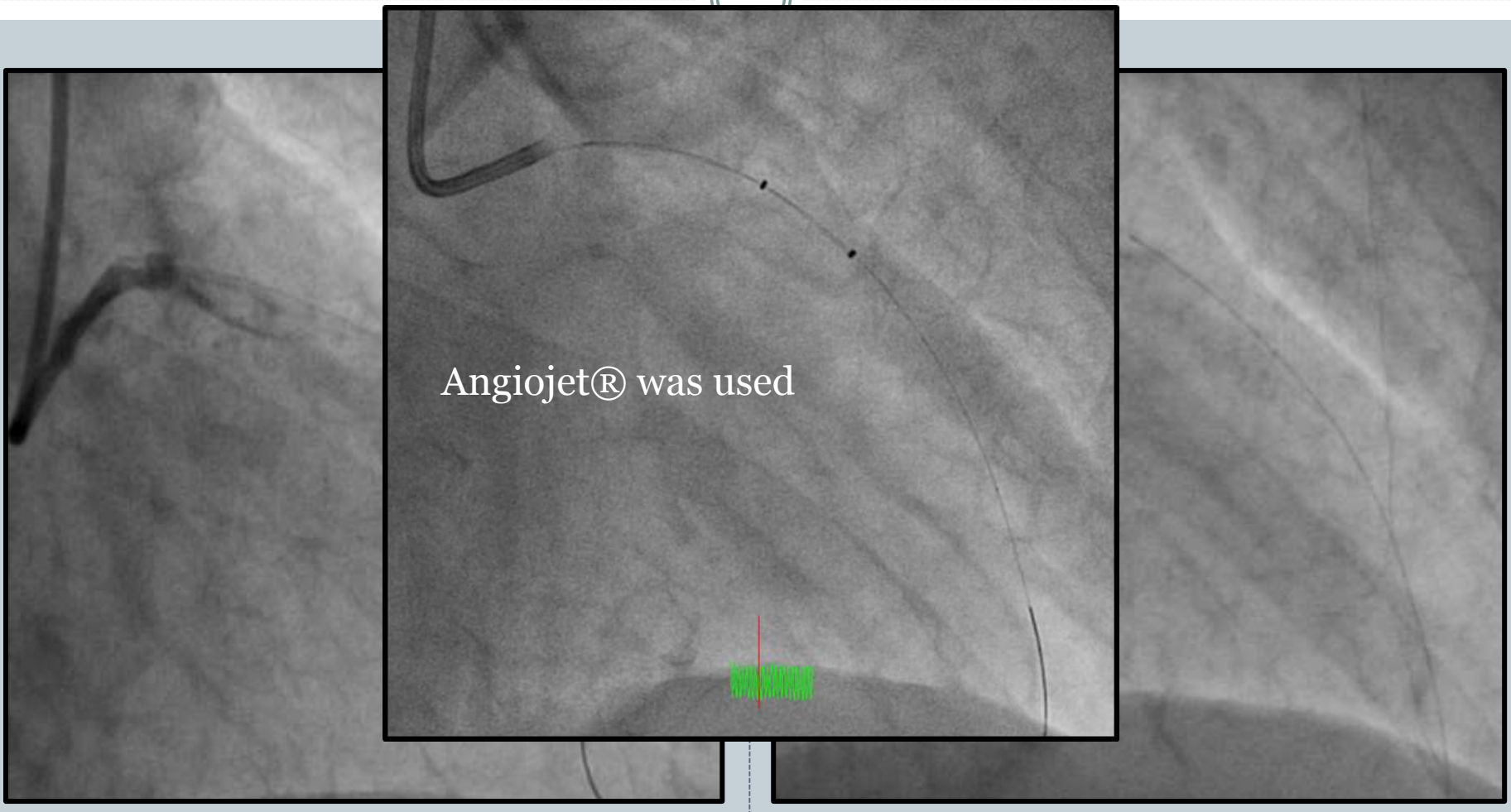
When Aspiration Thrombectomy does not work?

- Primary PCI in LM occlusion almost always do poorly
- Usually in cardiogenic shock and on multiple inotropic support– poor myocardial perfusion and vasoconstriction
- Left main is a large vessel – higher thrombus load
- Larger territory at risk of distal embolization commonly post stenting or post dilatation of stent
- Usually slow flow or no reflow – edematous myocardium may impede/reduce microvascular perfusion

Case 13

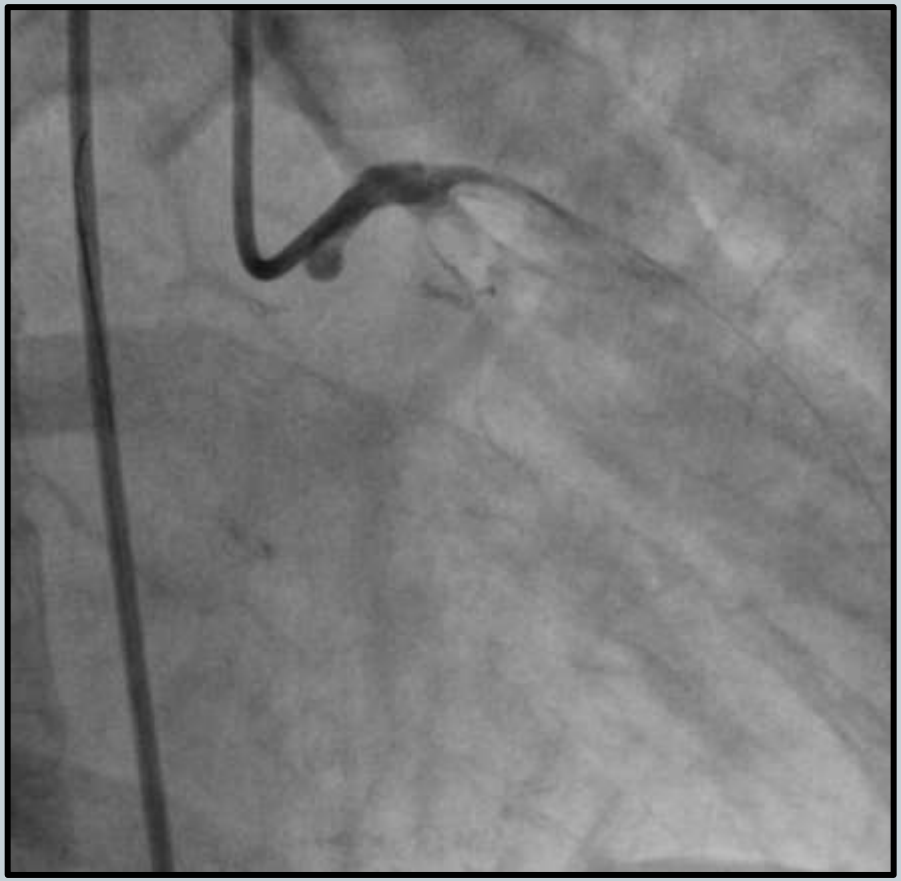
"STEMI" with LM occlusion and cardiogenic shock
RCA was relatively free of disease

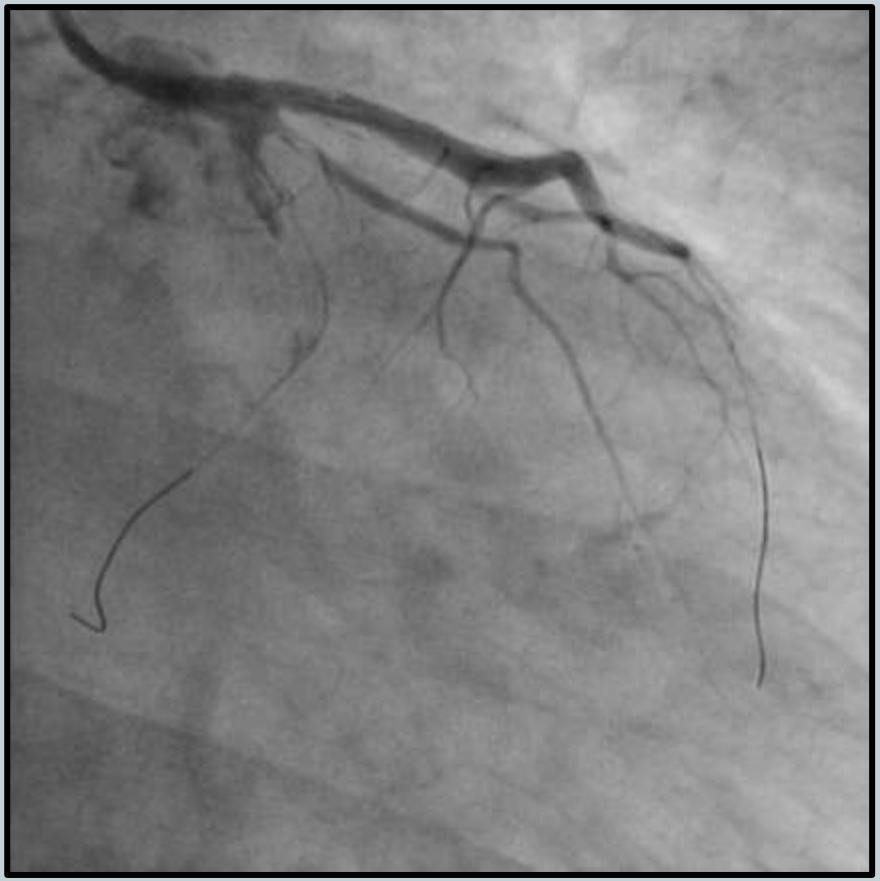
Case 13



LAD was wired and after aspiration thrombectomy there is huge filling defects in LAD and slow flow distally despite IC vasodilators.

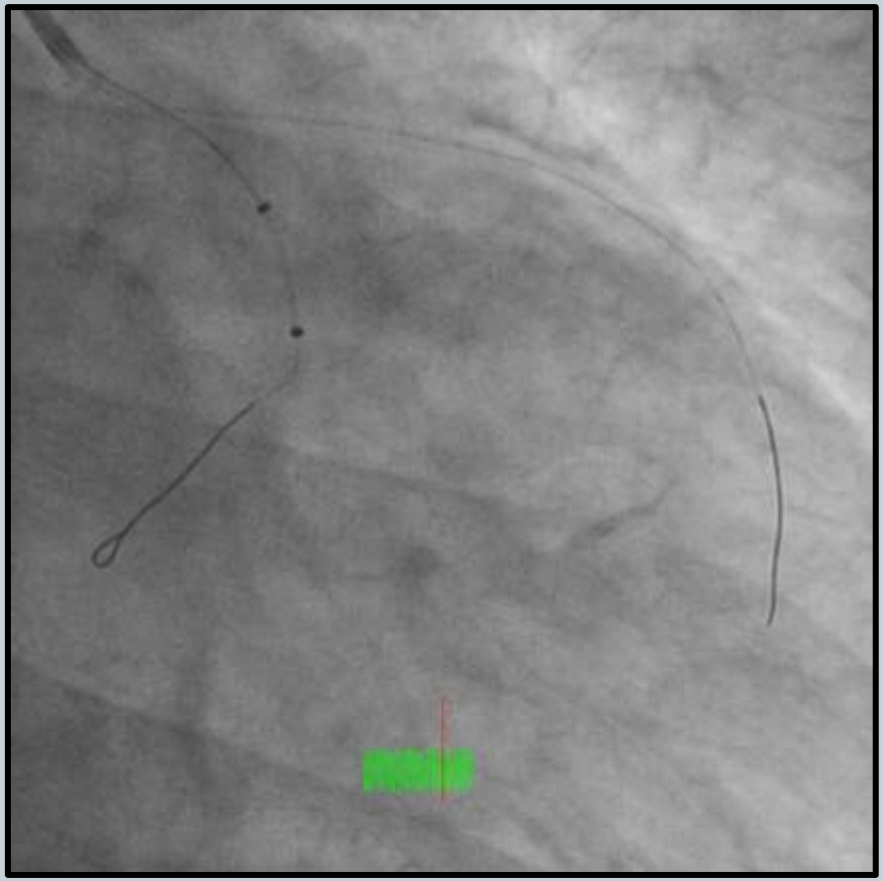
Case 13

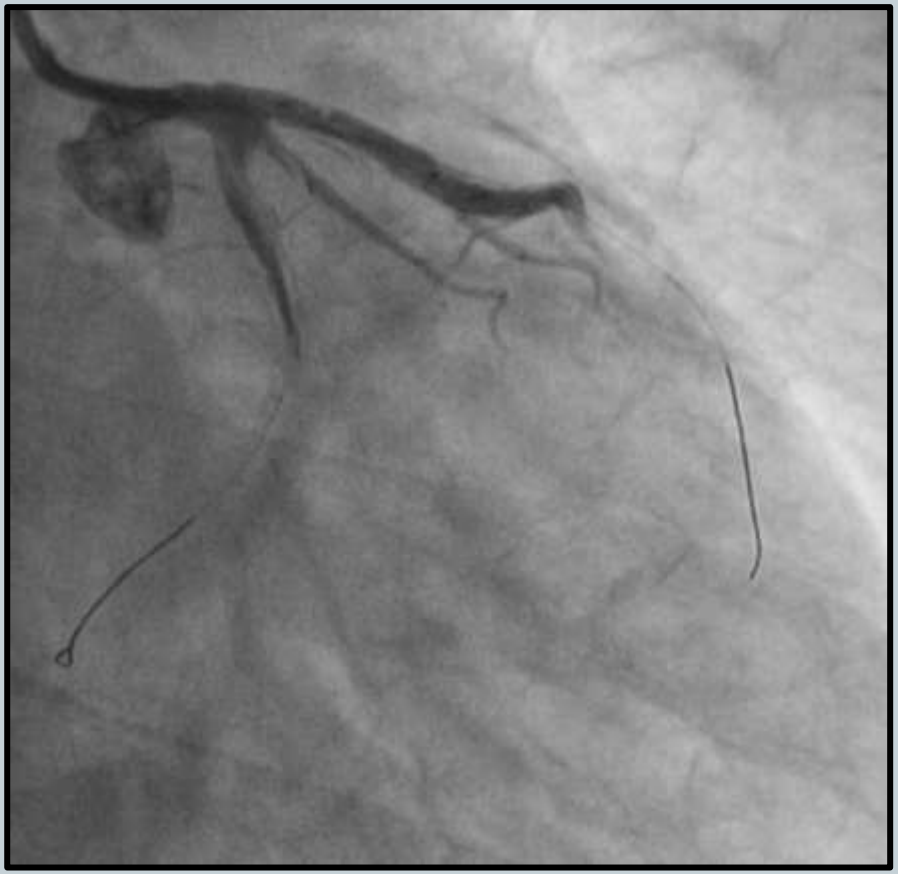




Slight improvement of LAD filling defects
LCX was wired and thrombus seen after aspiration with thrombectomy catheter

Case 13



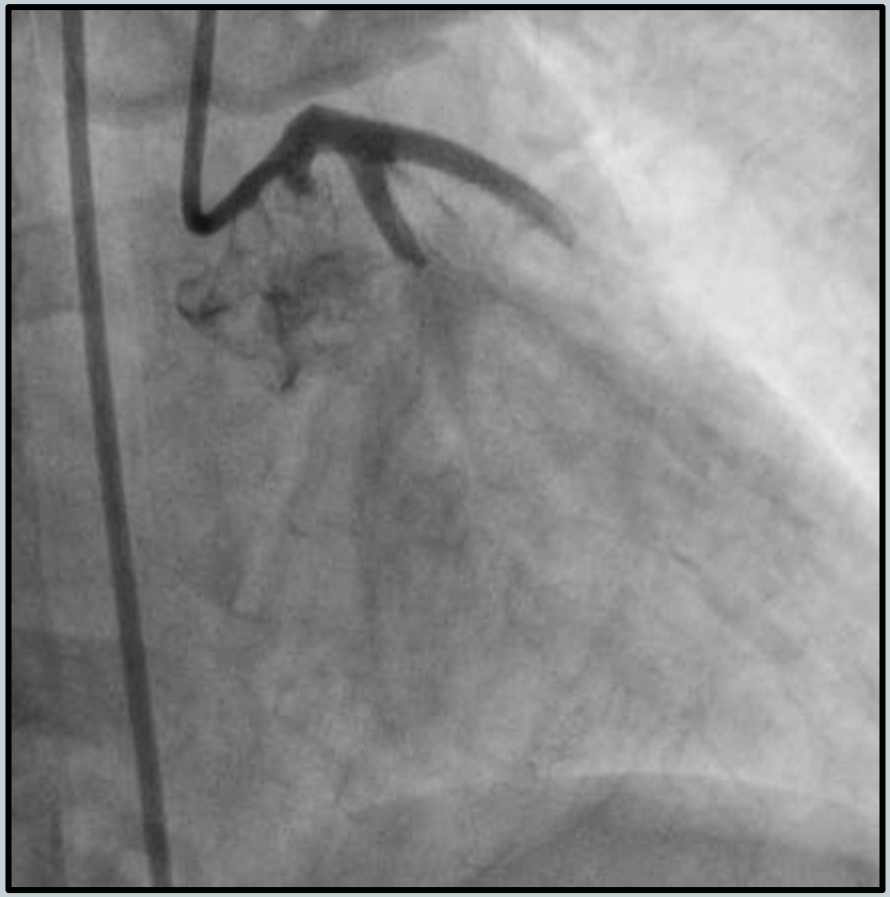


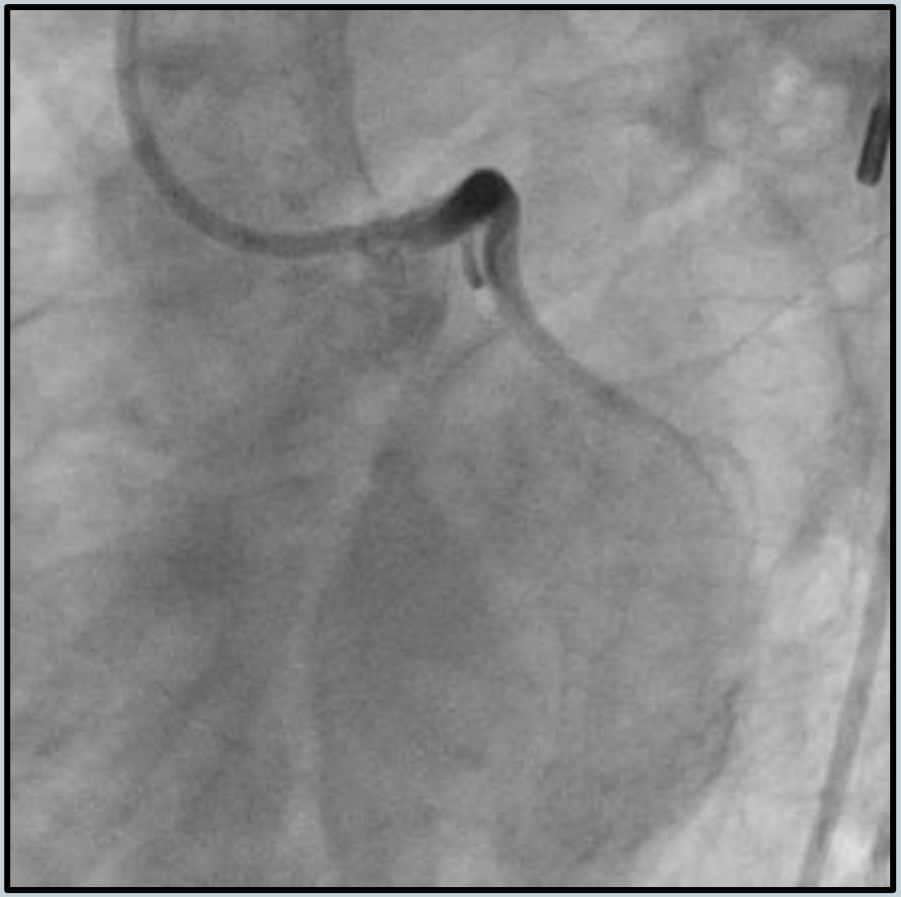
Angiojet® device was used with flow to distal LCA improved but still poor

Case 13

Both LAD and LCX was predilated with large balloon
LM was stented using Crush technique with FKBT

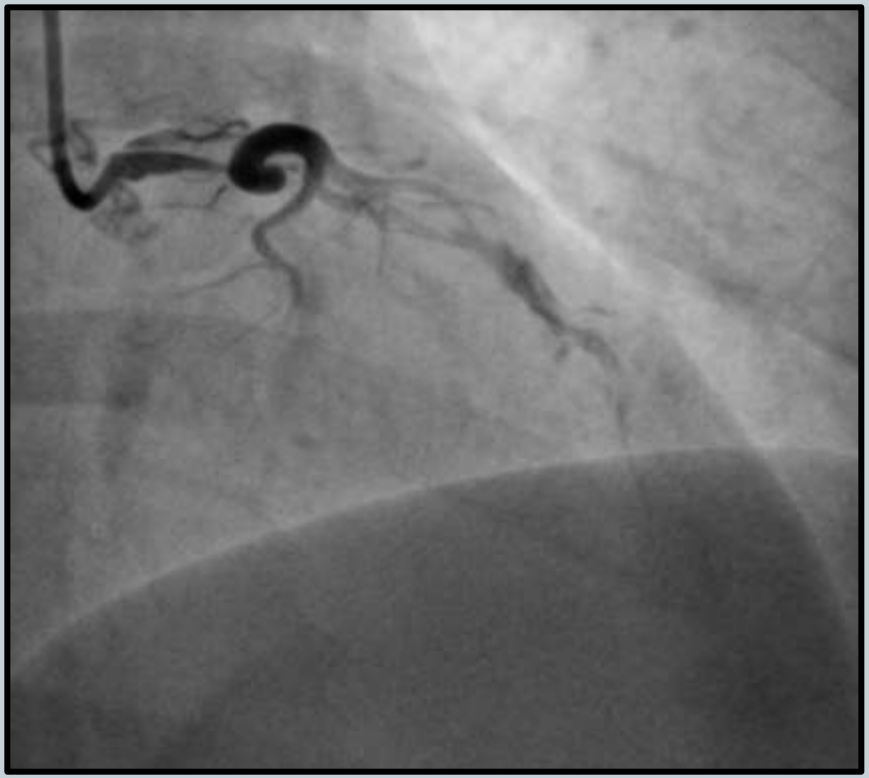
Case 13 – LM dissection 1/52 post partum

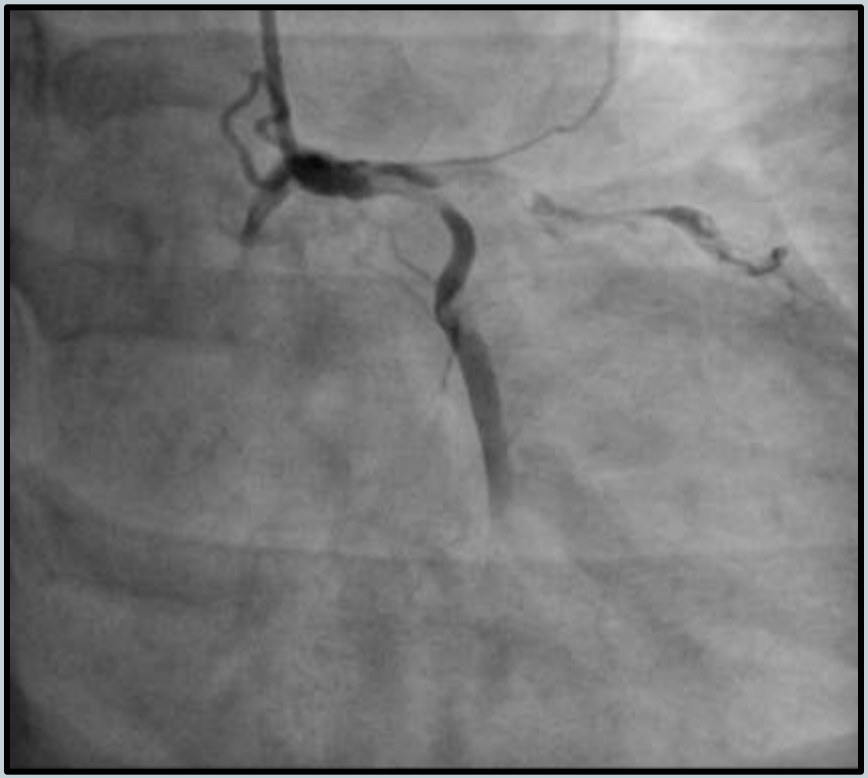




Poor distal flow in both LAD and LCX at final angiography
Patient required ECMO and eventual LVAD

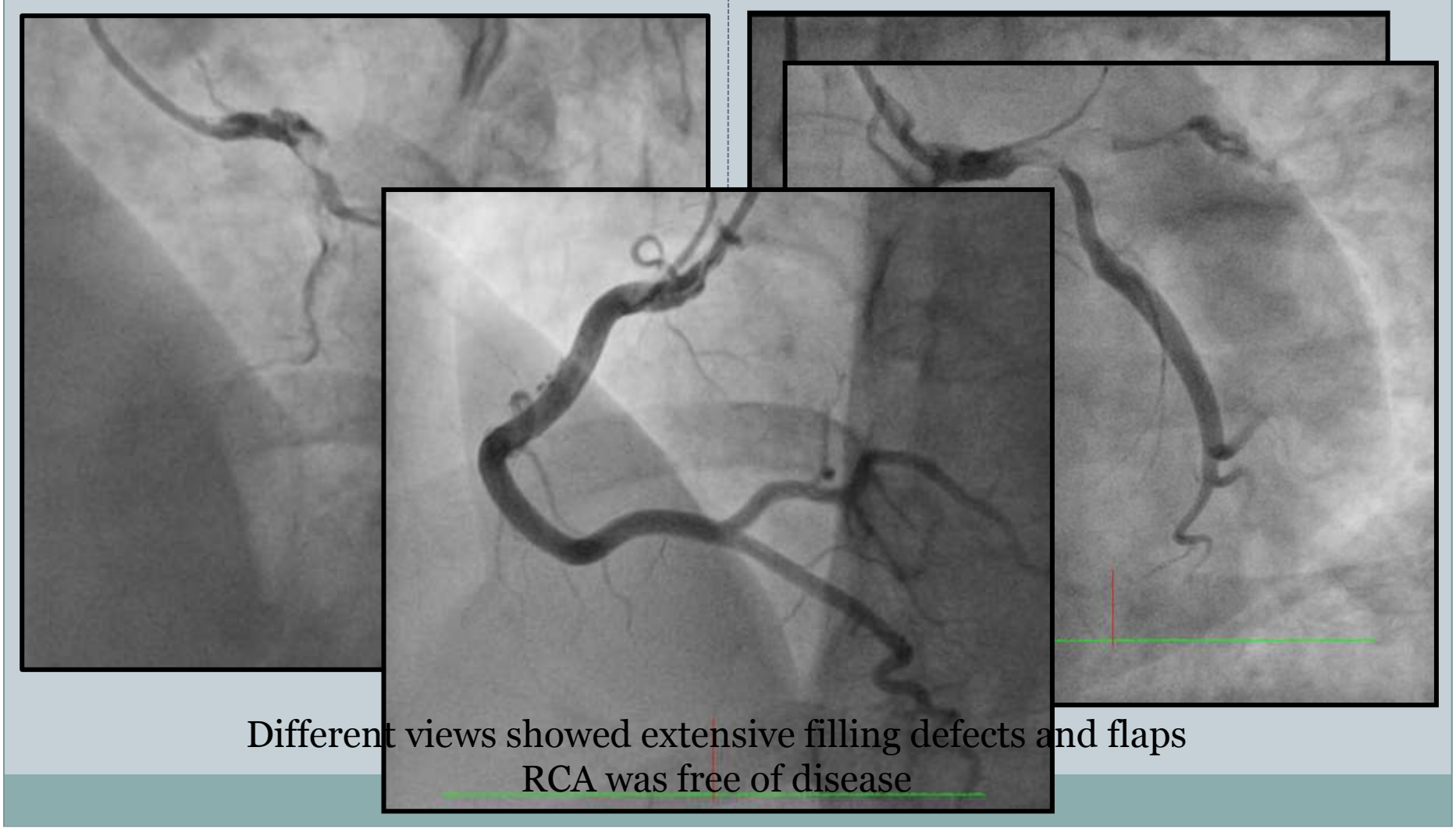
Case 14





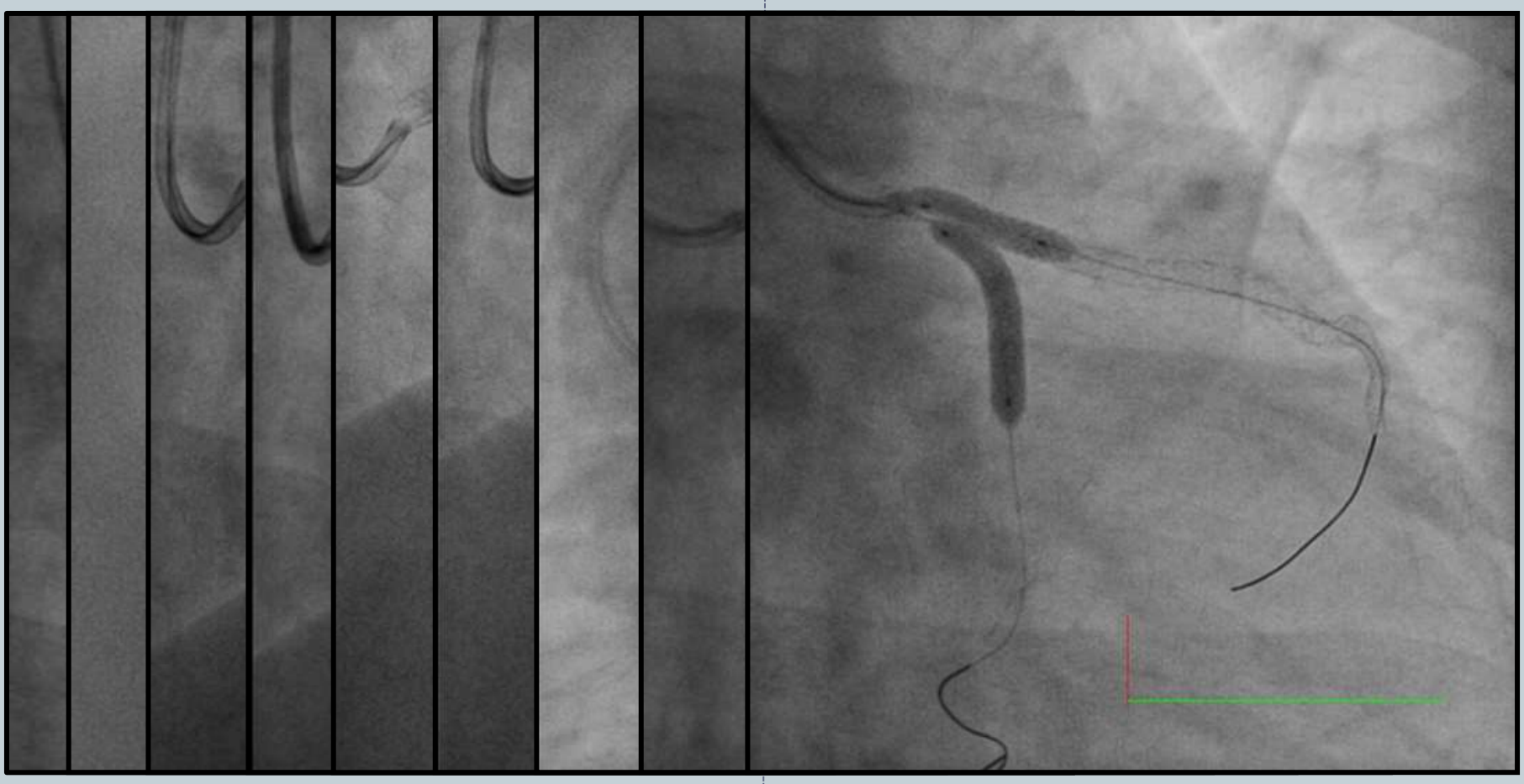
Young woman presented few days post partum with chest pain and “STEMI” and coronary angiography showed LM was occluded with filling defects

Case 14



Different views showed extensive filling defects and flaps
RCA was free of disease

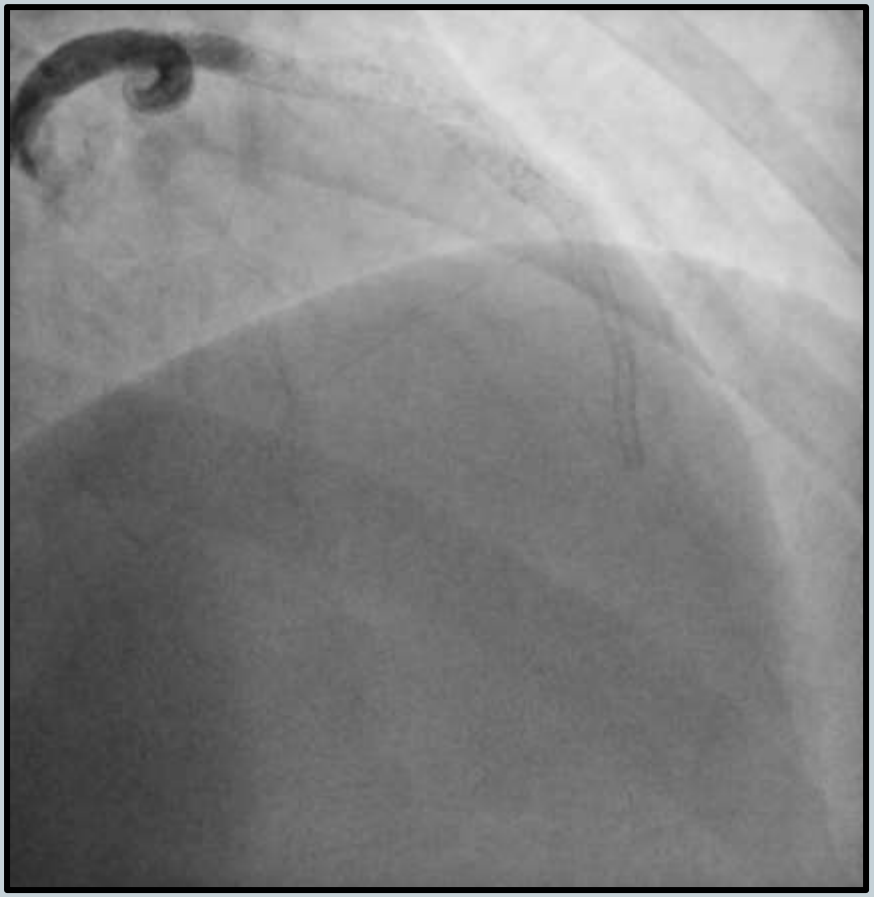
Case 14



LAD and LCX were wired with IVUS guidance

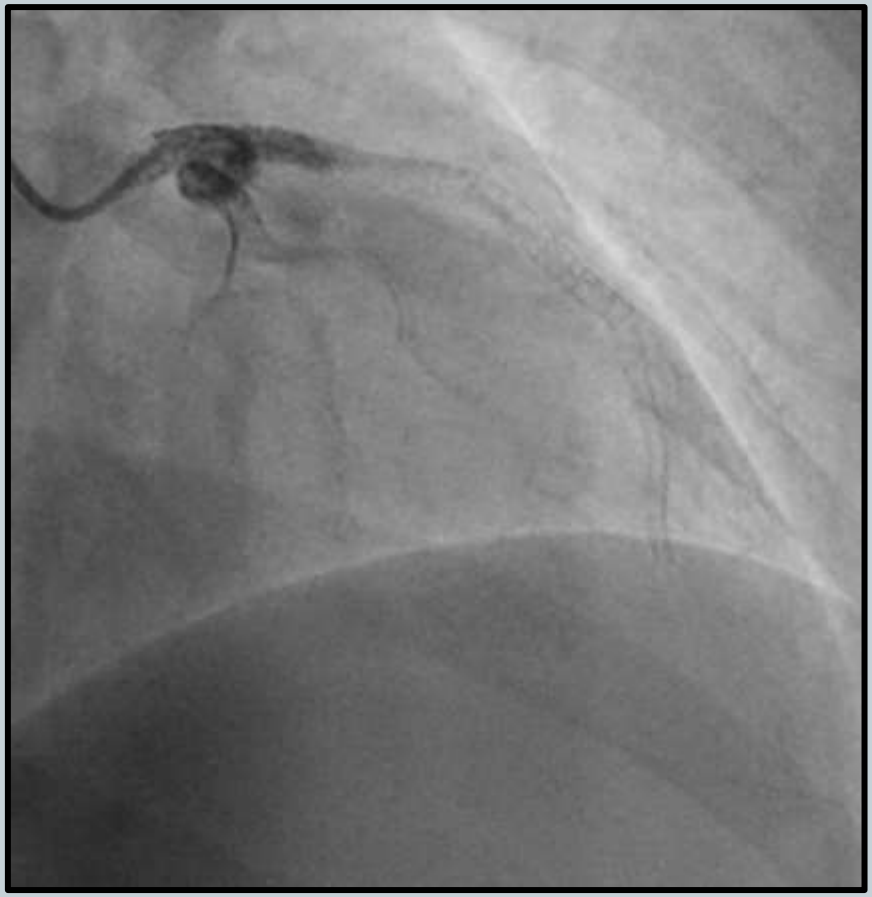
After confirming in true lumen stenting to LAD and LM/LCX/LAD using TAP

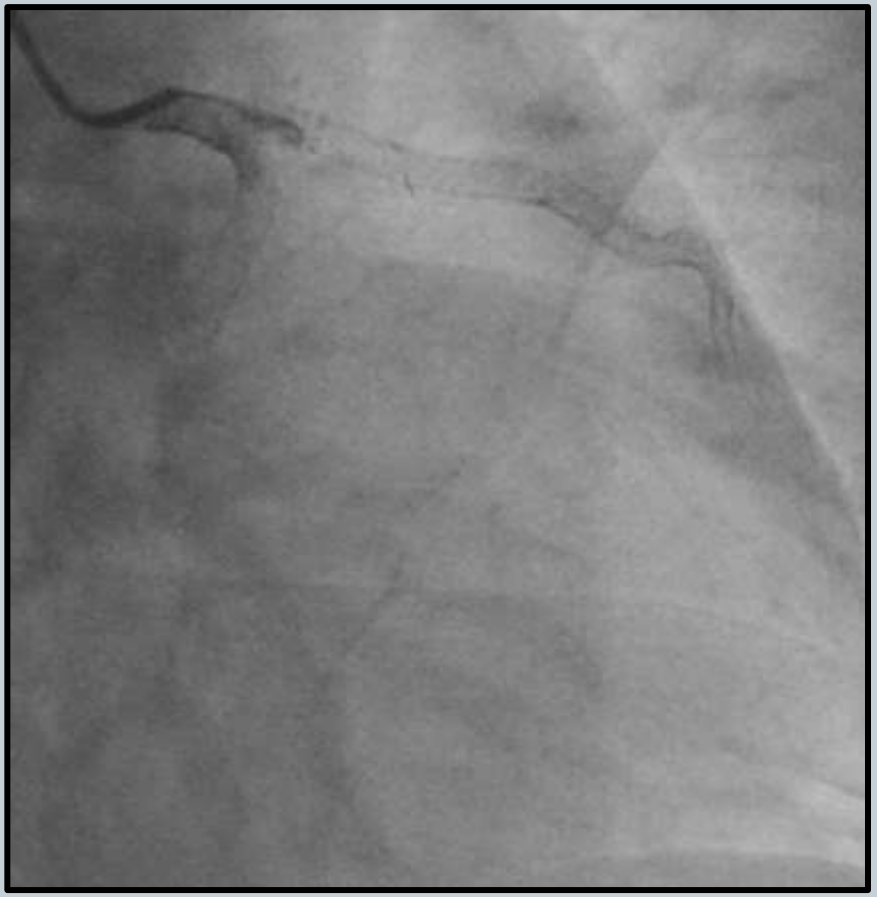
Case 14



Final angiography after GP2b3a inhibitors and IC vasodilator

Case 14 – 3 days later





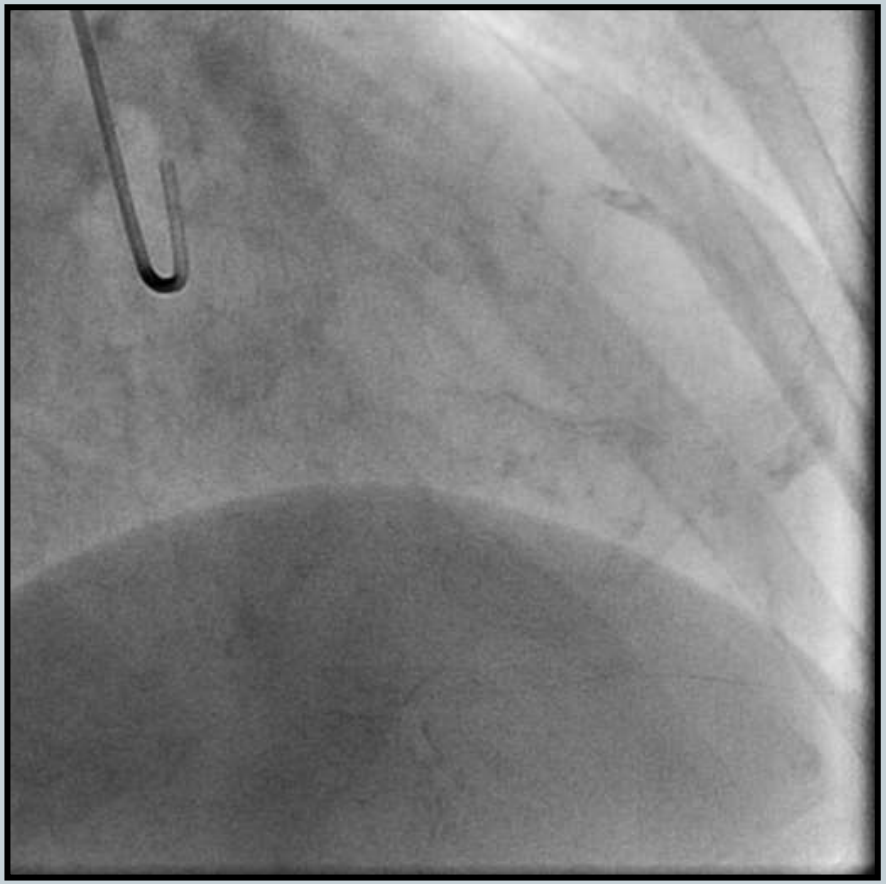
Repeat angiogram showed improved flow in both LAD and LCX 3 days later

When Aspiration Thrombectomy doesn't work?

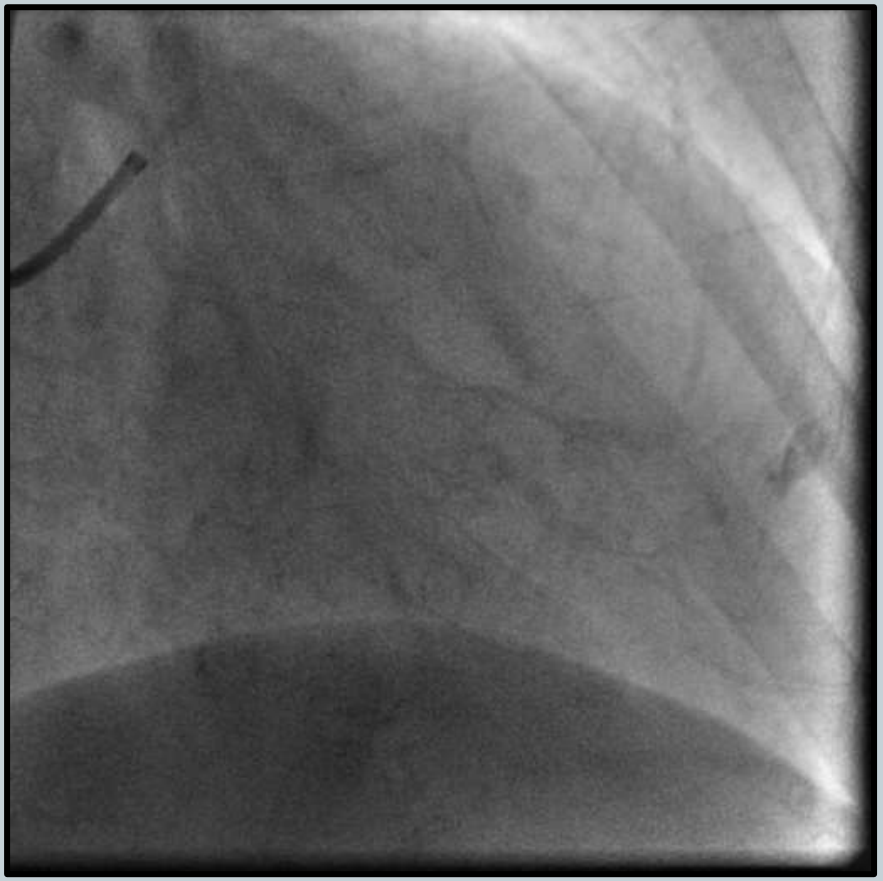
When the primary cause is not thrombus

- Coronary artery dissection (post partum, connective tissue disease, SCAD)
- Coronary artery spasm

Unusual case of STEMI

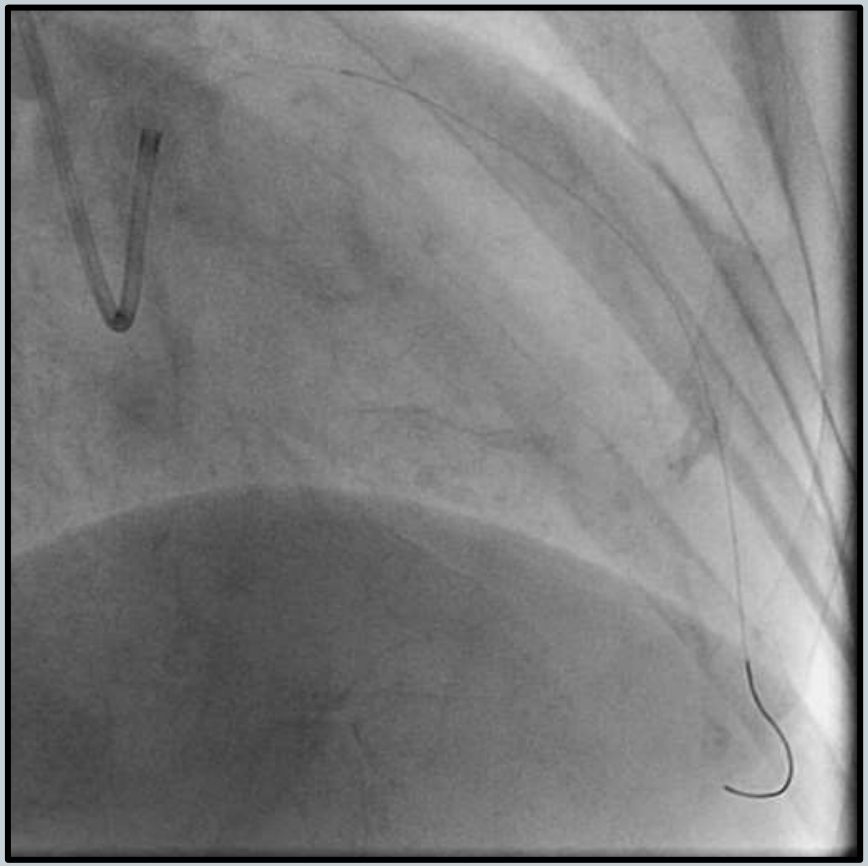


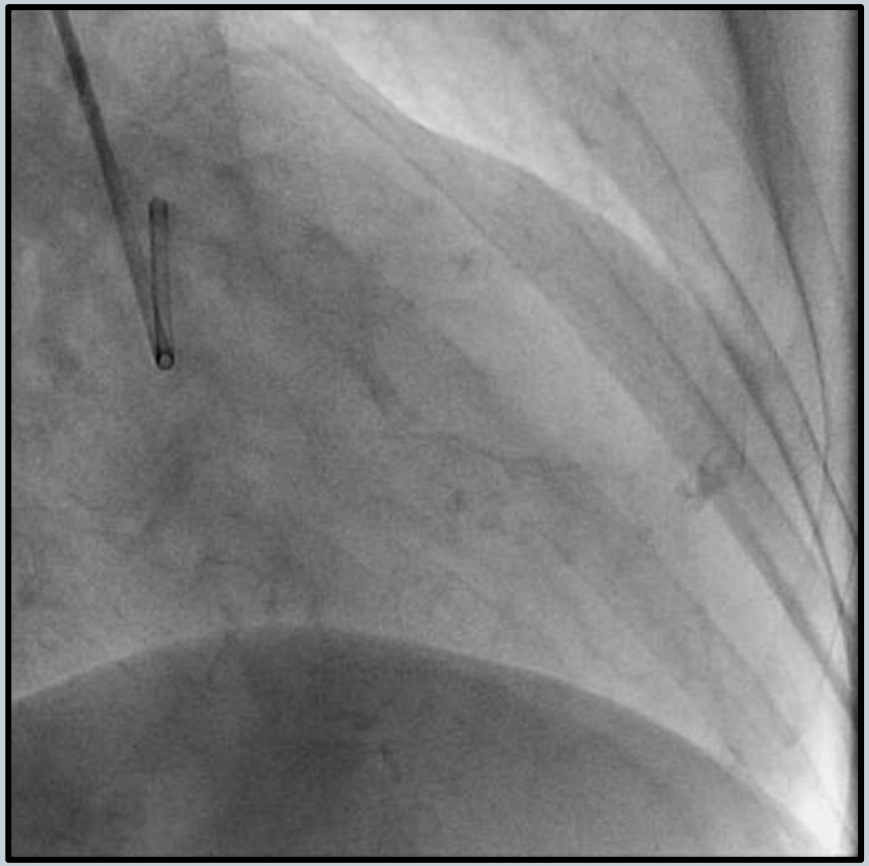
Chest pain and anterior STEMI



Patient had a cath done 4 hours ago with normal coronary artery

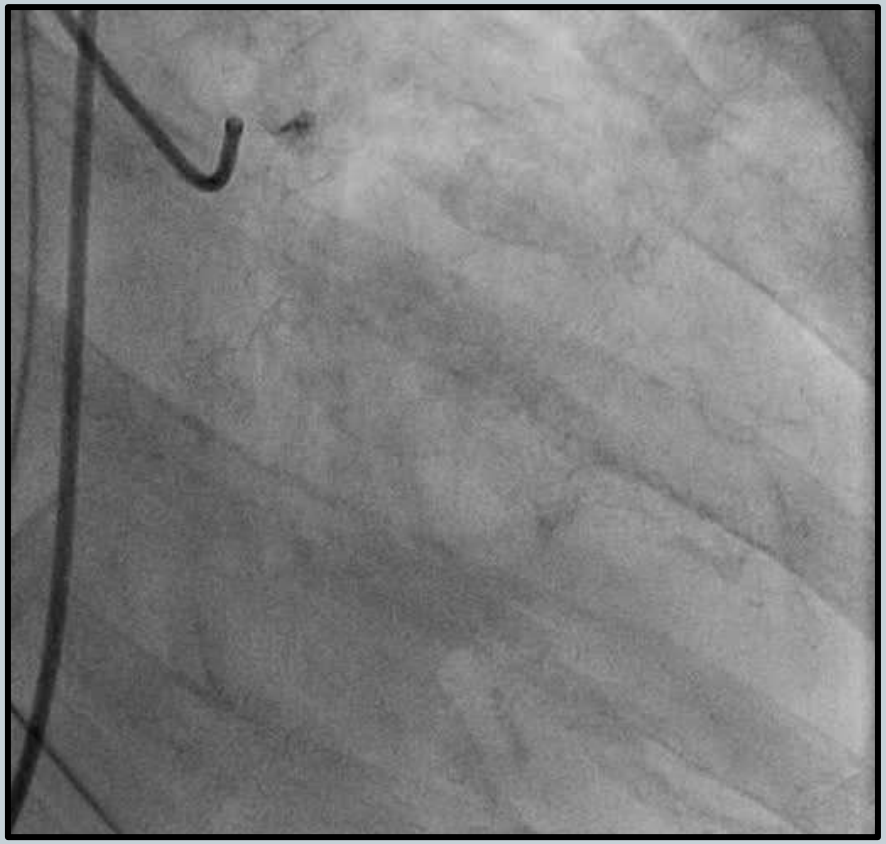
Coronary artery spasm

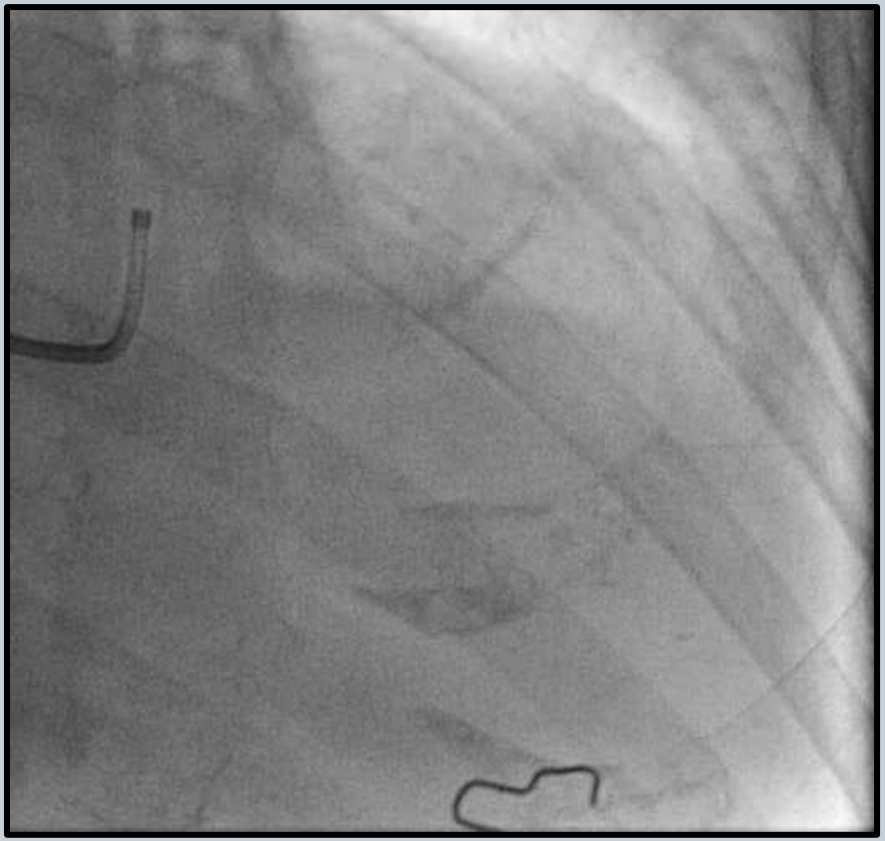




After aspiration and lots of IC GTN

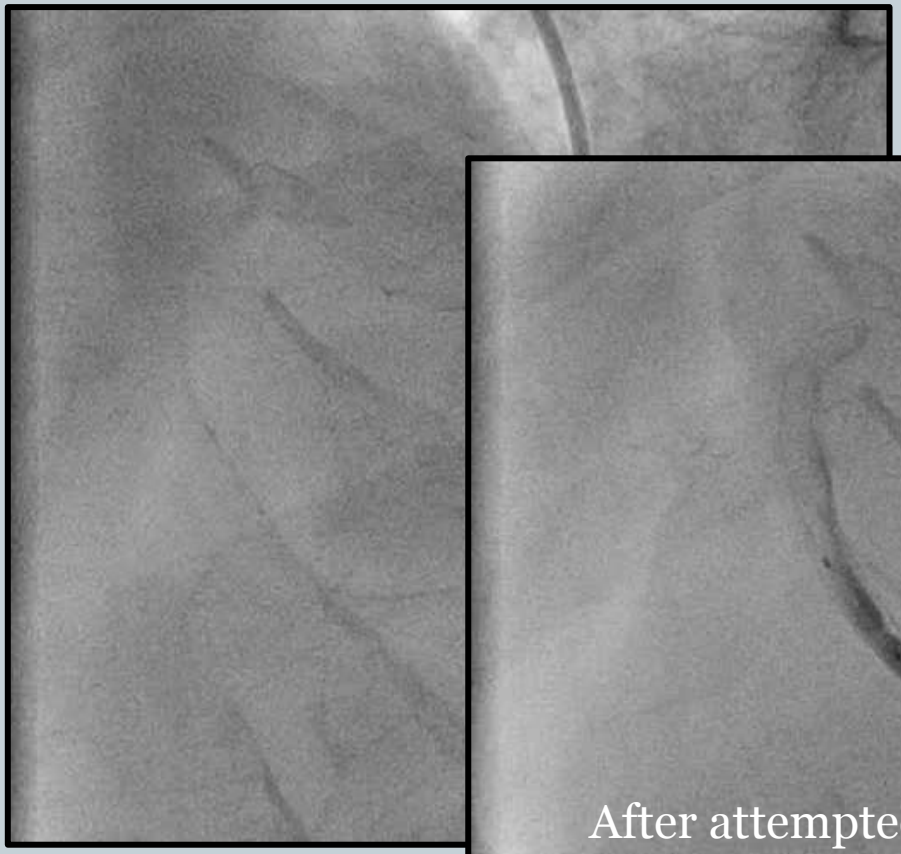
Case 15 – Finale

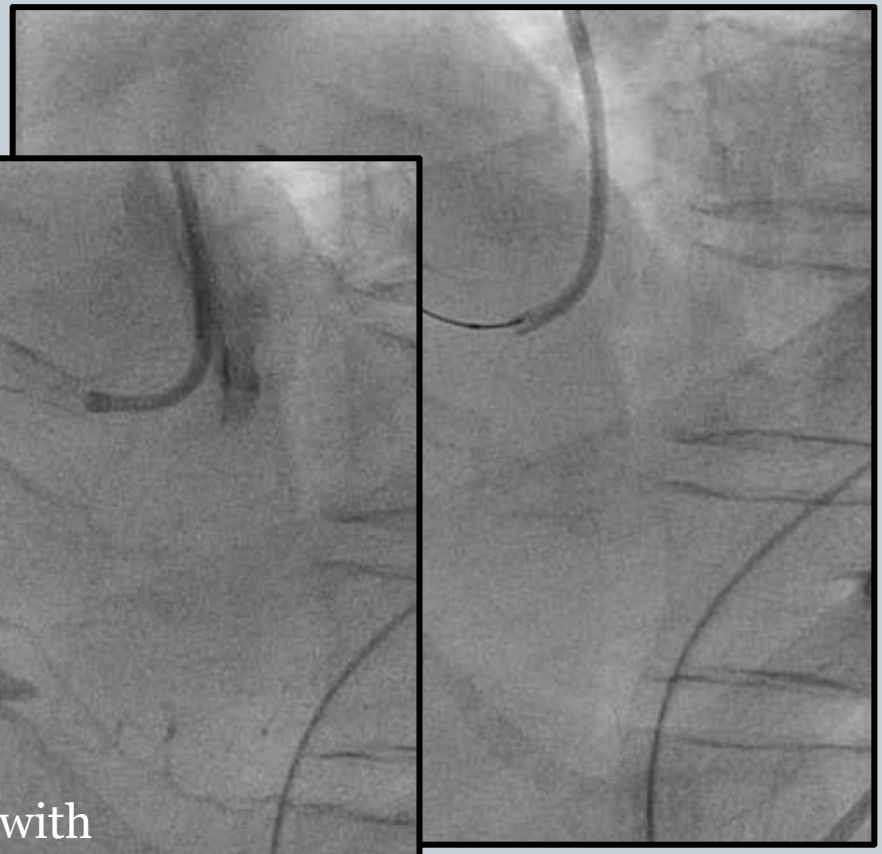




65 year-old woman presented with chest pain, syncope and ECG showed inferior STEMI

Case 15





After attempted with multiple guidewires

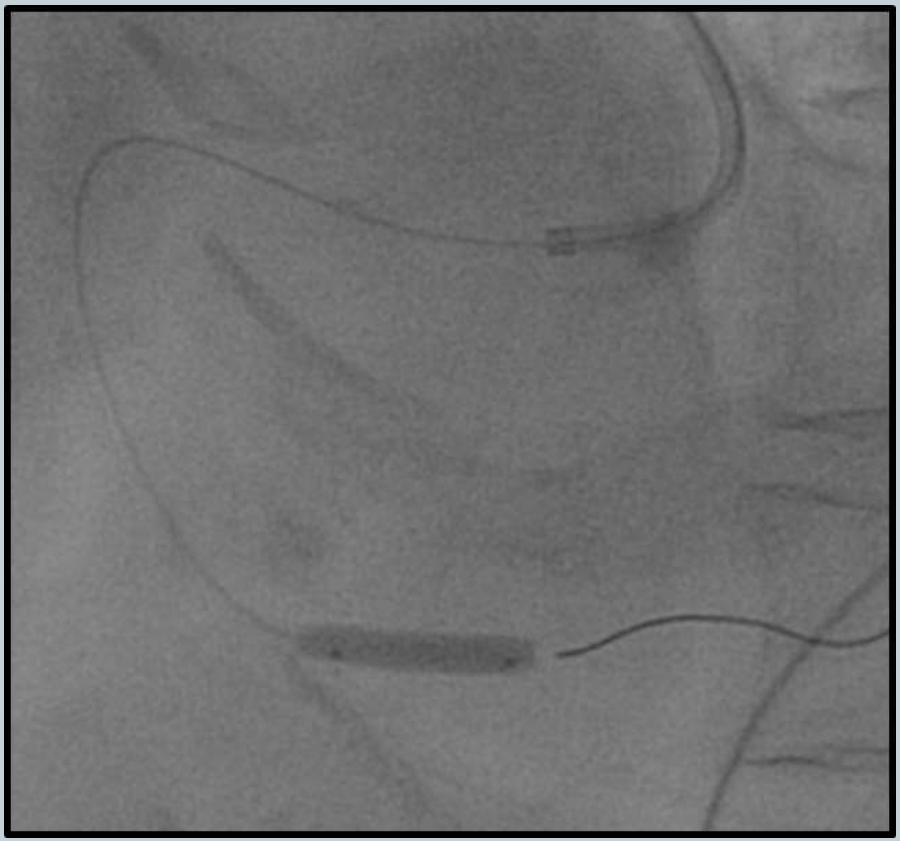
RCA showed proxi

us

roblematic despite

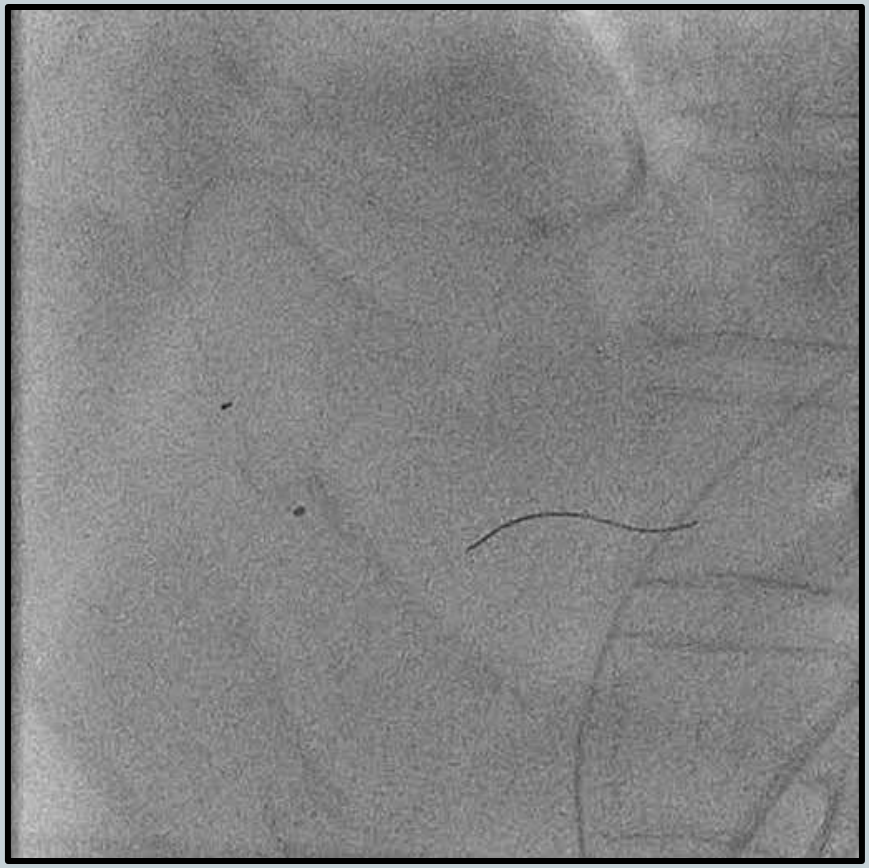
es

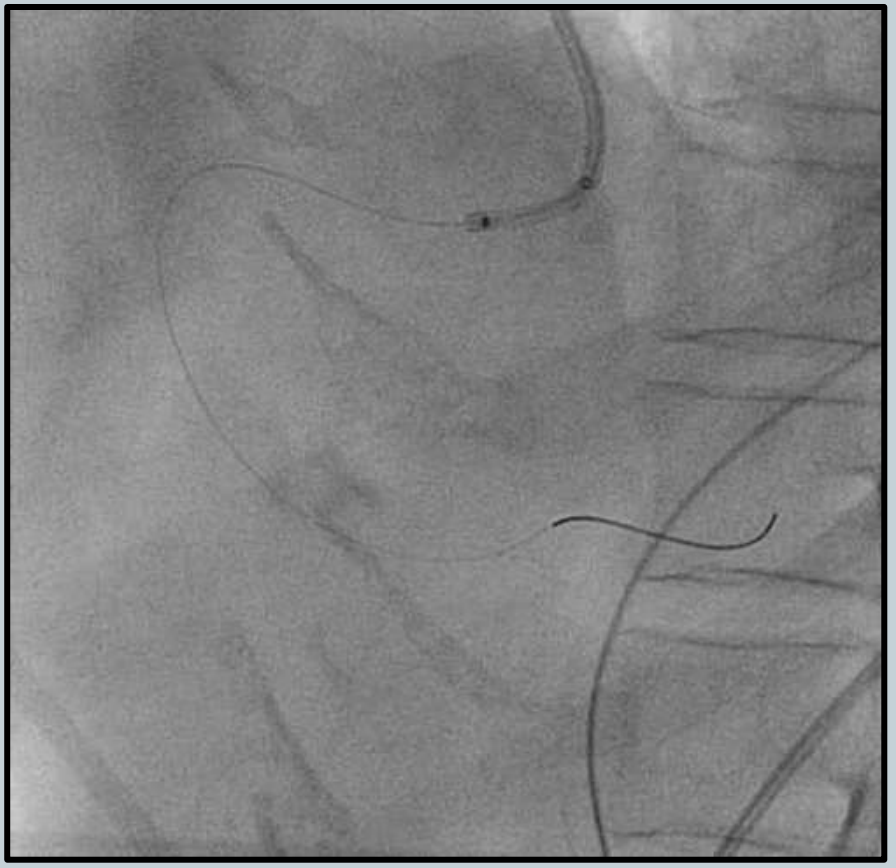
Case 15



Wire eventually crosssed
Aspiration thrombectomy and balloon predilation was performed
There was no flow to distal RCA

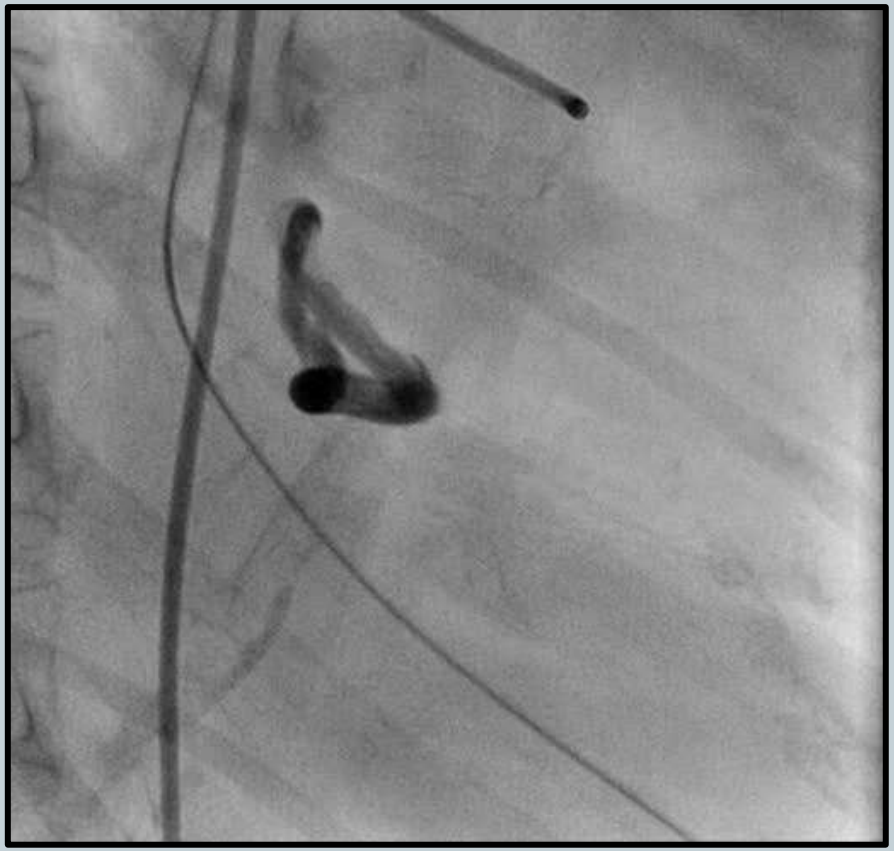
Case 15

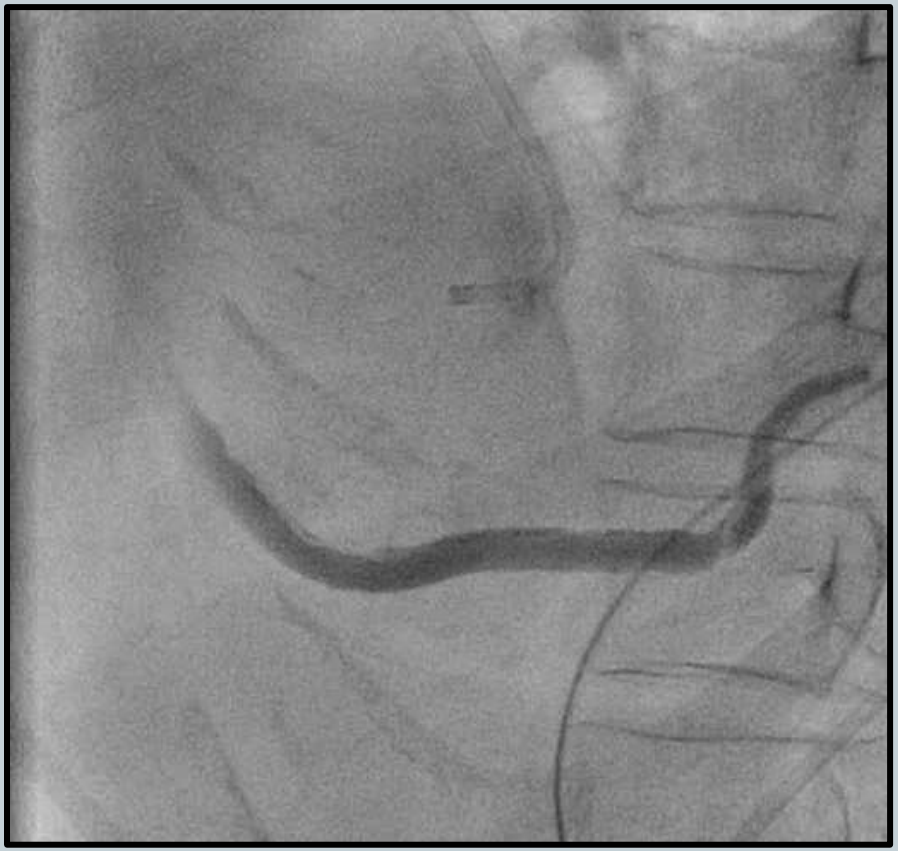




In view of large thrombus load, Angiojet® was used to aspirate the thrombus mechanically

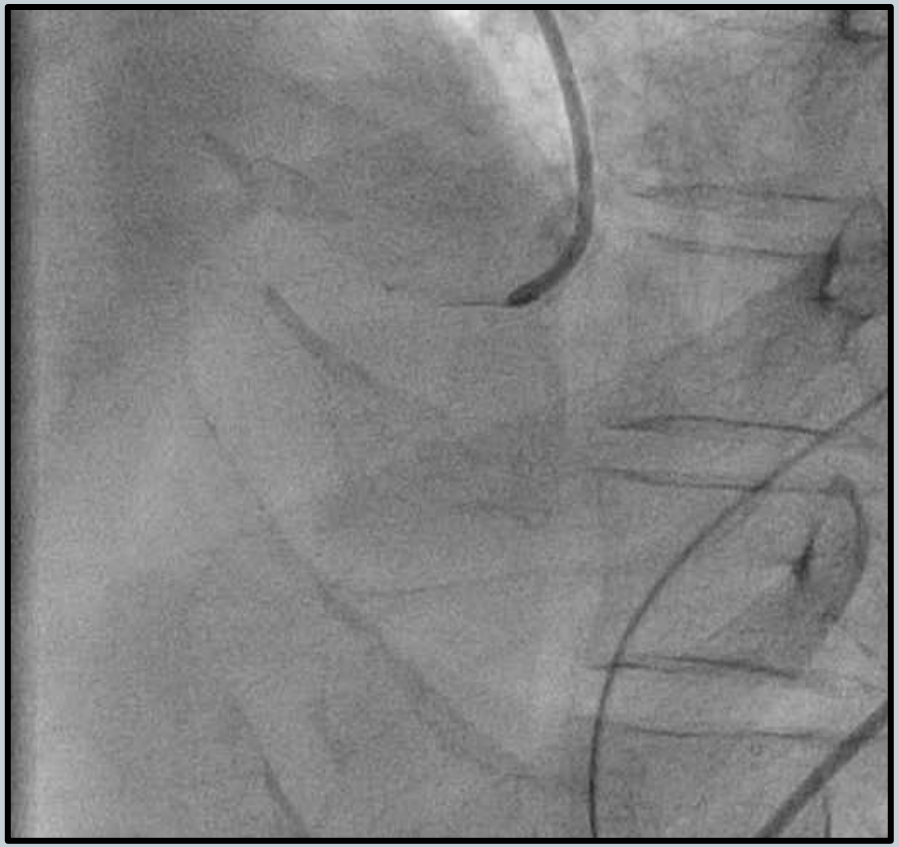
Case 15 – Final Angiography



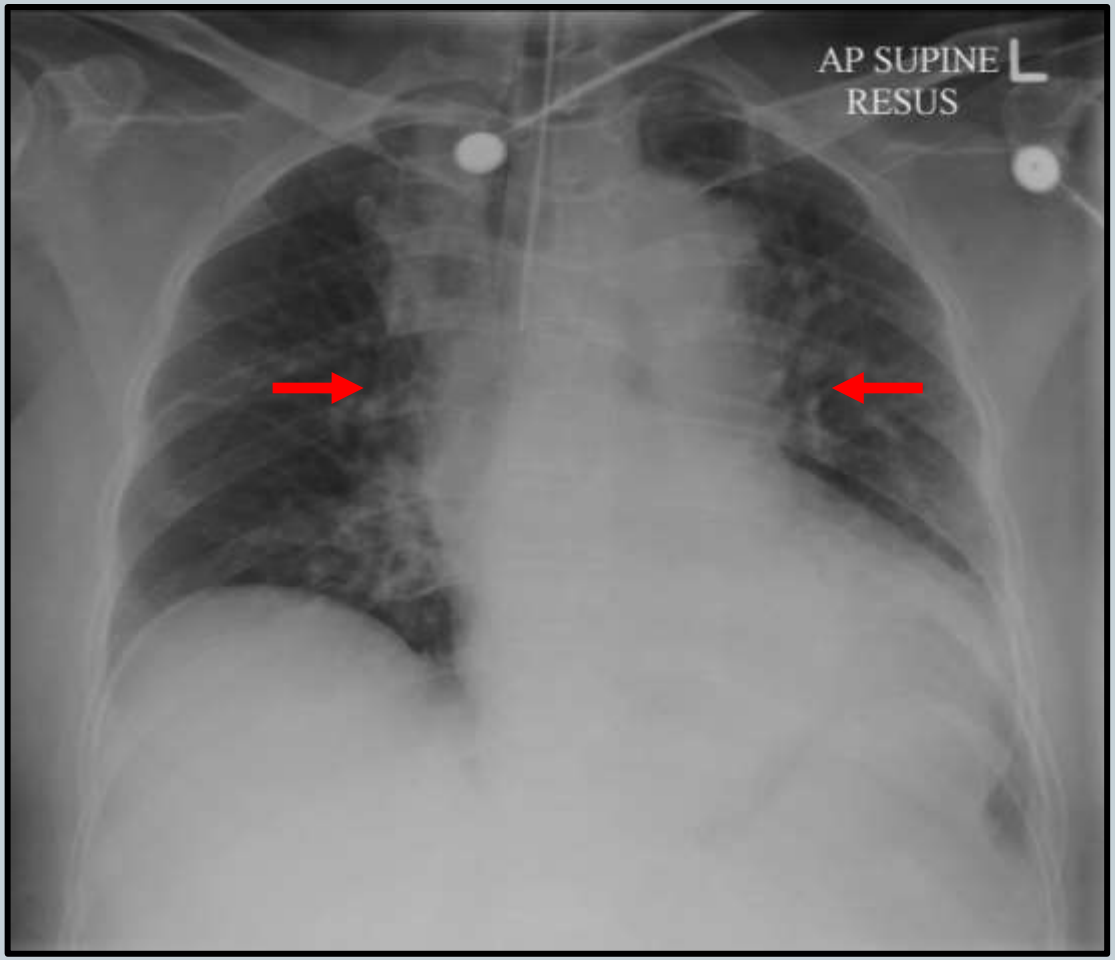


After Angiojet® failed, multiple balloon dilations and aspirations were performed
Eventually abandoned the attempt to recannalize RCA

Case 15 – In retrospect …

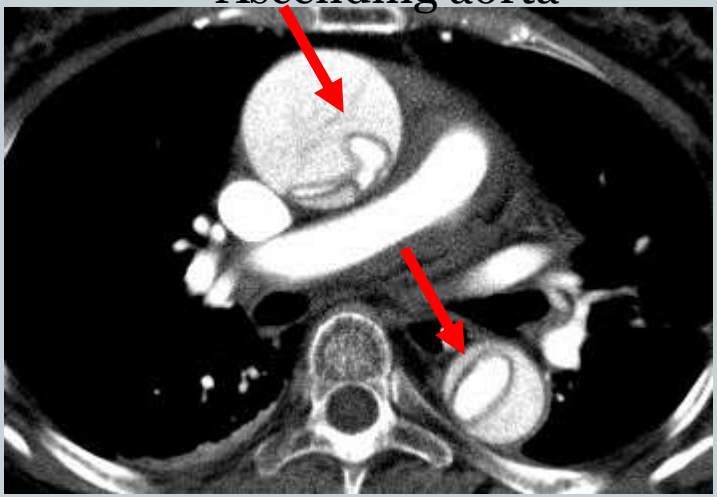


Case 15 – In retrospect …

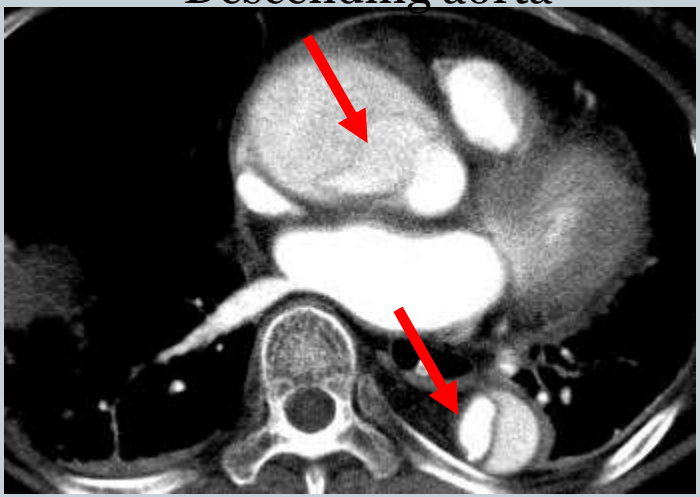


Case 15 – CT Aortogram

Ascending aorta

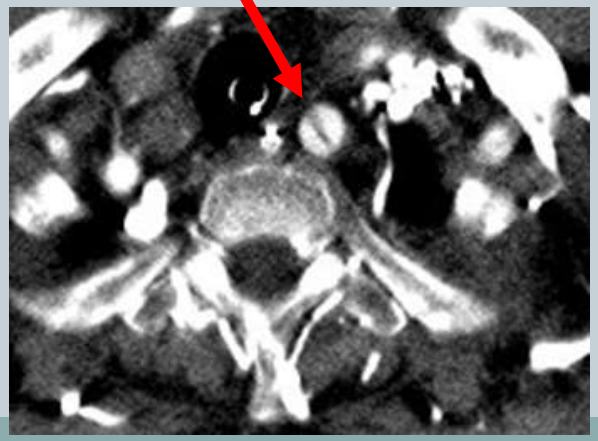


Descending aorta



Abdominal aorta

Common iliac



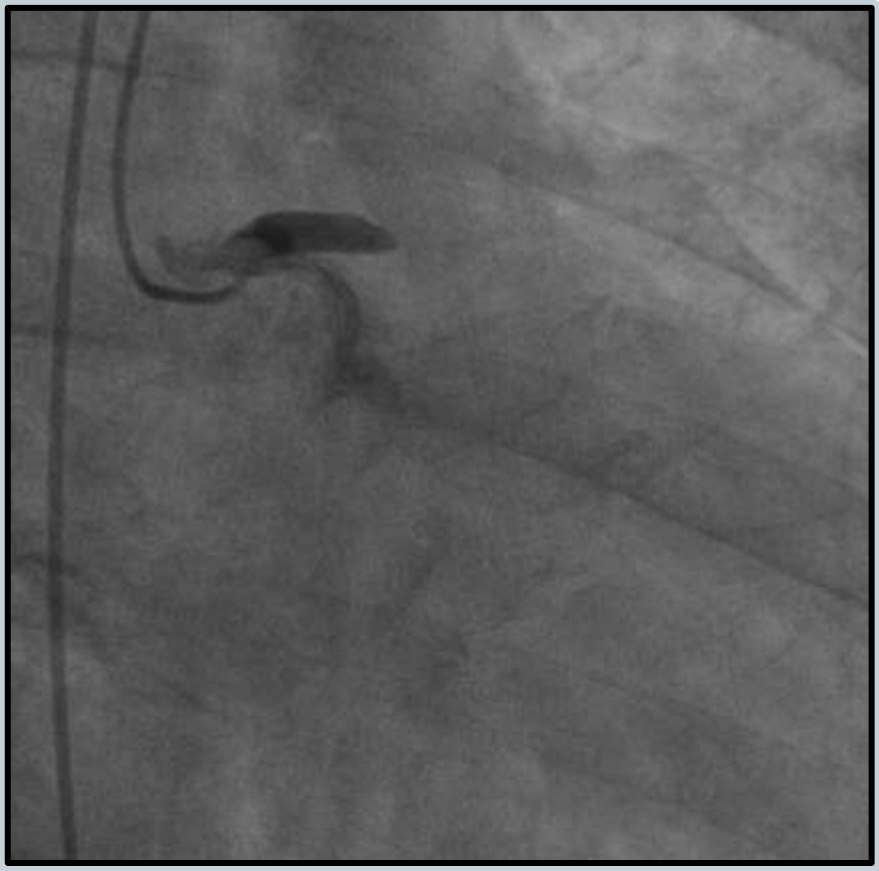
When Aspiration Thrombectomy doesn't work?

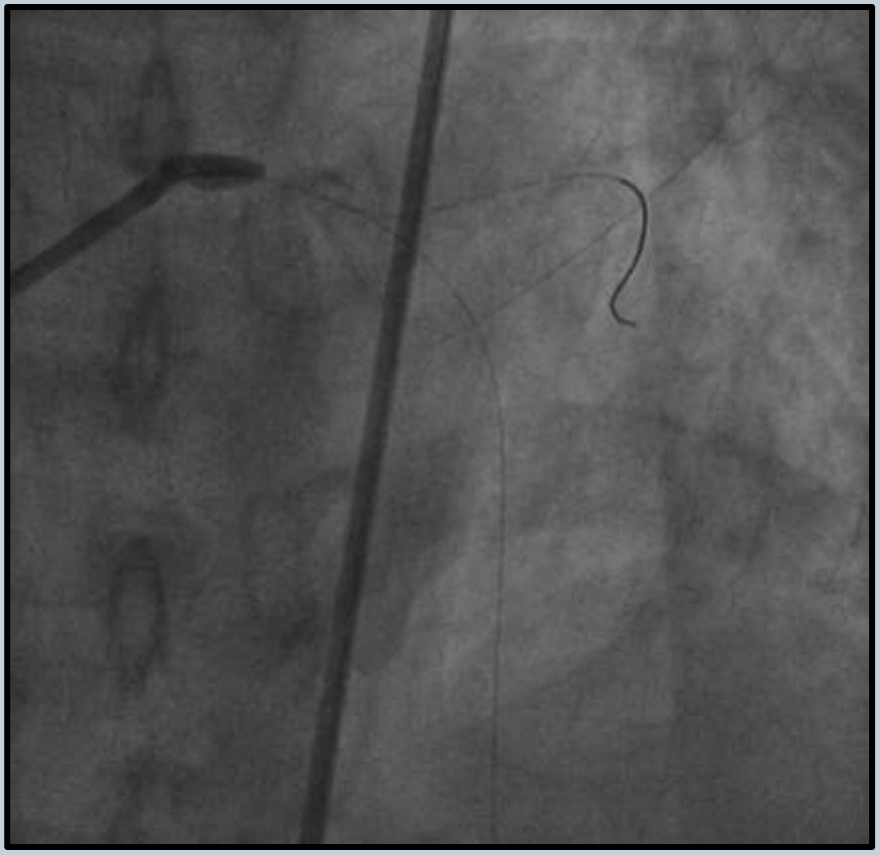
- When there is nothing to aspirate - Minimal thrombus with TIMI 3 flow
- When lesion cannot be crossed – too tight, calcified or tortuous
- When there is too much thrombus– large ectatic and aneurysmal vessel with huge thrombus load or in large vessels like RCA and LM
- When the primary problem is not thrombus - aortic dissection, spontaneous coronary artery dissection or spasm

When Aspiration Thrombectomy doesn't work ..

- **Angioget®** – in our experience not much more effective
- **Distal protection device** (filter devices)
- **IABP** – may improve coronary flow
- **M-Guard stent**
- **Glycoprotein 2b3a inhibitors**
- **Intracoronary vasodilators** – verapamil, adenosine, GTN, nitroprusside
- **Defer PCI** - provided patient pain free and adequate antegrade or collaterals flow
- **CABG**

CABG as option for STEMI





- Presented with chest pain and “STEMI” – LM occlusion
- After aspiration thrombectomy, TIMI 3 flow was established
- Operator decided for CABG as high likelihood of no reflow and demise

Conclusion

- *Routine* aspiration thrombectomy is not recommendation in primary PCI
- However, it may be beneficial in selected patient or bailout situation
- Operators need to pay careful attention to the technique of aspiration to prevent complications
- Although it does not work well in some situations discussed, it works well in selected STEMI patients
- Aspiration thrombectomy is here to stay as it is cheap, simple to use, facilitates equipment selection and probably shorten the time of procedure


Thank you for your attention!
National
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