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*

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**Prevalence of angiographic evidence of thrombus**

- 30% (n=97) with no thrombus
- 70% (n=225) with thrombus

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**Prevalence of thrombus recovery at emergent CABG**

- 28% (n=27) with no thrombus
- 72% (n=52) with thrombus

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(+ predictive value = 88%  
(-) predictive value = 75%  

*DeWood et al. NEJM 1986;315:417-23*
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

CV death, MI, Shock and CHF
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
### Recommendation of Aspiration Thrombectomy

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<thead>
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<th>COR</th>
<th>LOE</th>
<th>Recommendations</th>
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<tr>
<td>IIb</td>
<td>C-LD</td>
<td>The usefulness of selective and bailout aspiration thrombectomy in patients undergoing primary PCI is not well established.(^1)</td>
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<tr>
<td>III: No Benefit</td>
<td>A</td>
<td><em>Routine</em> aspiration thrombectomy before primary PCI is not useful.(^2)</td>
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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
- Faster procedure
- Facilitate PCI – assess lesion size and length
- Reduce mortality
- Reduce MACE events
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 mean?

3 possible scenarios of a neutral trial

1

2

3

Benefit

Harm
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?
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
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
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 ectatic 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 recanalization
Inferior STEMI with a huge thrombus compressing proximal segment of a dominant LCX with spontaneous recannalization
Case 8 – An unusual case

LM = left main
T = thrombus
LCX = left circumflex
AVM = AV malformation
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*
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
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
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
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
65 year-old woman presented with chest pain, syncope and ECG showed inferior STEMI
Case 15

RCA showed proximal occlusion and wiring of occlusion was problematic despite using balloon support and multiple guidewires.

After attempted with multiple guidewires
Case 15

Wire eventually crossed.
Aspiration thrombectomy and balloon predilation was performed.
There was no flow to distal RCA.
In view of large thrombus load, Angiojet® was used to aspirate the thrombus mechanically.
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!