

Traditional Thrombectomy Using Catheter Suction Thrombolysis Is Enough.

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Catheter-Based Thrombectomy (CBT)

Arterial

- Acute limb ischemia
- STEMI
- Ischemic stroke

Venous

- Deep vein thrombosis
- Pulmonary embolism
- AV fistula occlusion

ALI; Endovascular Thrombus Management

Thrombolysis

- Catheter-directed thrombolysis (CDT)

Mechanical Adjuncts

- Manual aspiration thrombectomy (MAT) – Sheath / Catheter
- Mechanical fragmentation – Rotarex, Jetstream
- Rheolytic thrombectomy – Angiojet
- Aspiration thrombectomy
 - Aspirex, ThromCat, Indigo, Megavac
- Ultrasonic / Laser

Manual vs. Mechanical Thrombectomy

Catheter Aspiration Thrombectomy:
Syringe suction used to aspirate the debris



Mechanical Thrombectomy: Saline jets or rotating catheter head to breakup thrombus before its aspiration

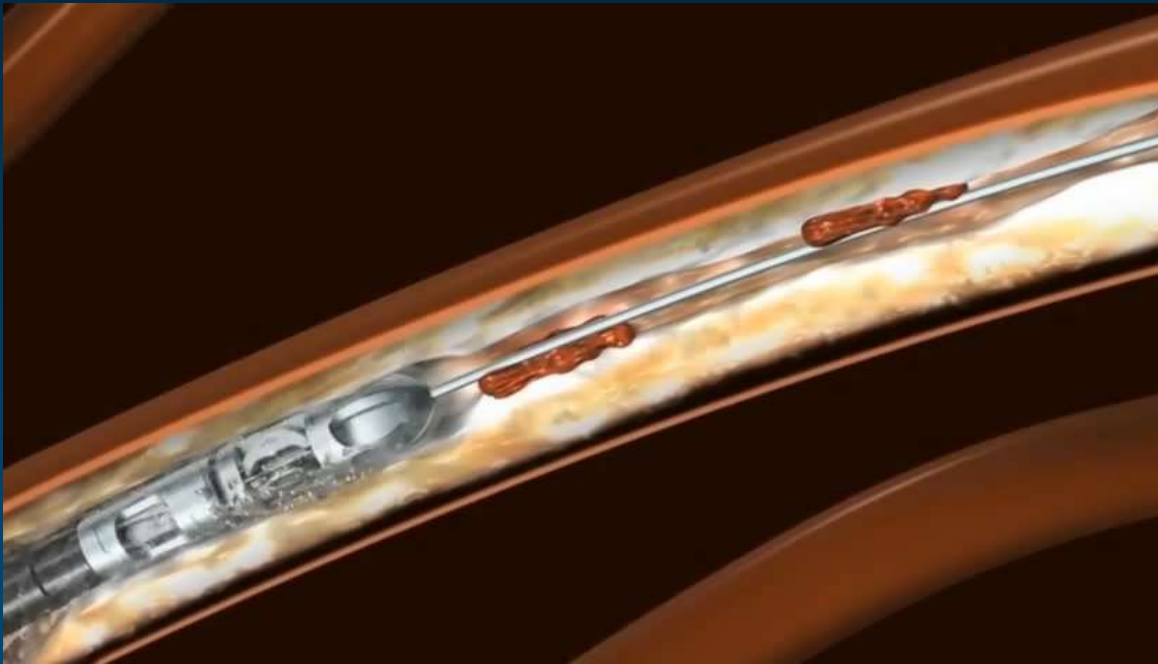


Manual Devices include: Diver™, Diver™ CE, Export®, Pronto™, QuickCat, Rescue™, Thrombuster®, and TransVascular Aspiration Catheter®.

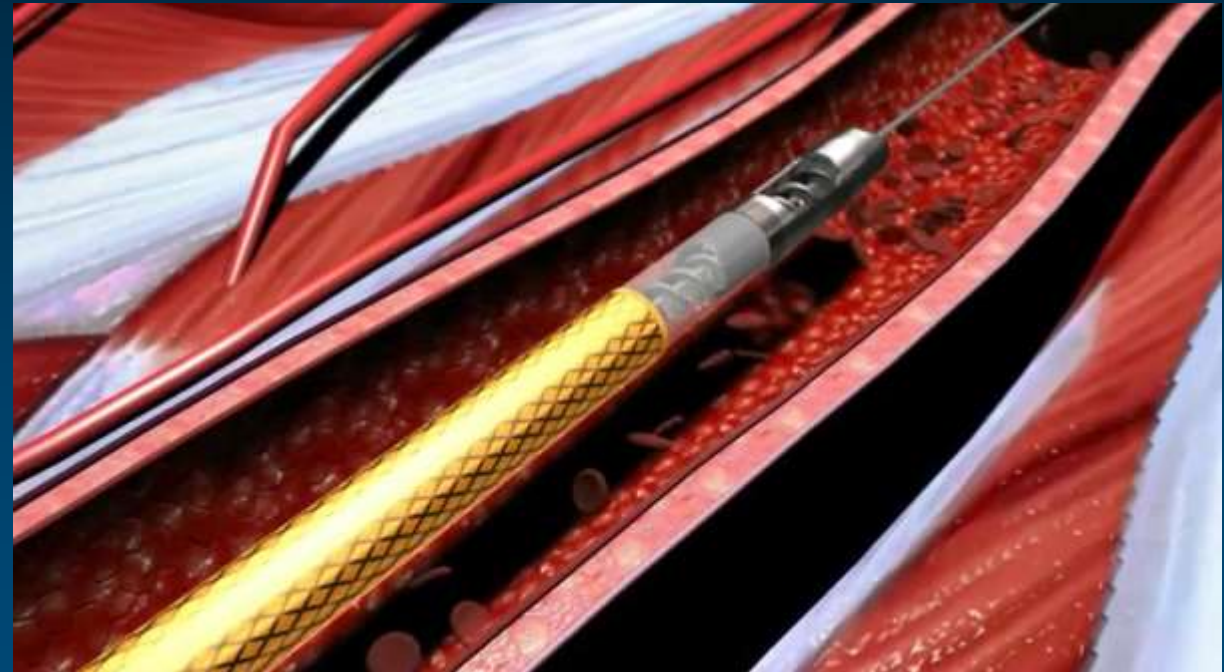
Mechanical devices include: AngioJet® (and X-Sizer®.)

Mechanical Devices for Thrombus Removal

Now available in Korea



Jetstream, BSC



Rotarex, Straub Medical

Most Simple & Cheap Way;
Thrombosuction by a sheath



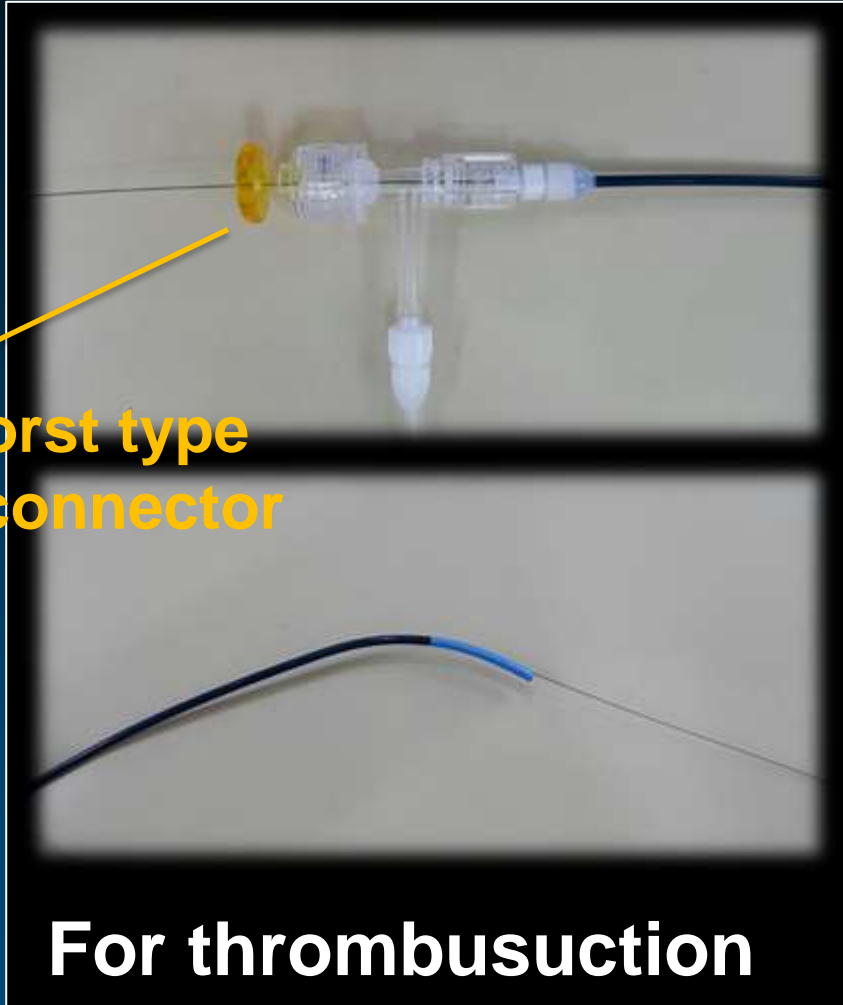
Most Simple & Cheap Way;
Thrombosuction by a sheath



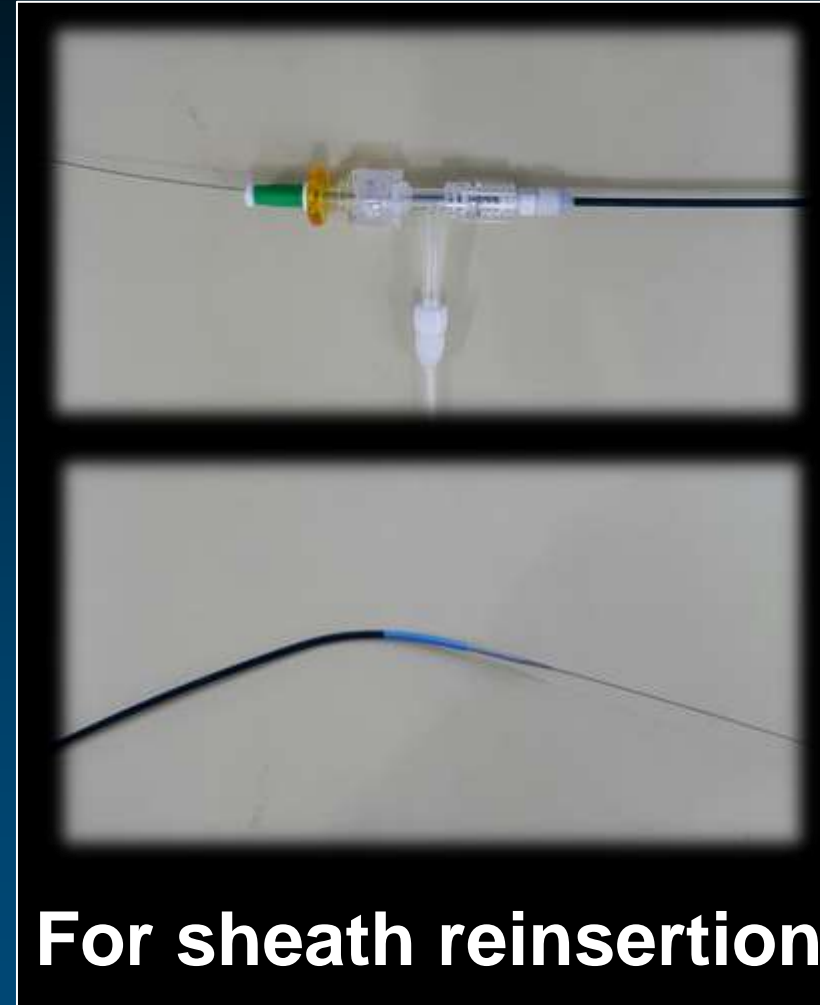
My Aspiration Devices

Ipsilateral approach;

Ansel sheath + Sheath dilator + 0.014" Command ES GW



For thrombusuction



For sheath reinsertion

Contralateral approach;

Shuttle sheath + 0.035" compatible Dilator + 0.035" Amplatzer extrastiff GW

My Personal Aspiration Devices

Iliac

- Ipsilateral or Contralateral
- 7 Fr Ansel sheath + Sheath dilator + 0.014" Command ES GW

Femoral

- Ipsilateral; 7 Fr Ansel sheath + Sheath dilator + 0.014" Command ES GW
- Contralateral; 6-7 Fr Shuttle sheath + Sheath dilator
 - + 0.014" Command ES GW → for soft aortoiliac anatomy
 - + 0.035" Amplatzer extrastiff GW → for difficult aortoiliac anatomy

Proximal BTK; 5 Fr Heartrail through the Ansel / Shuttle sheath

Foot level; Thrombuster or Export catheter

Representative Cases

Case

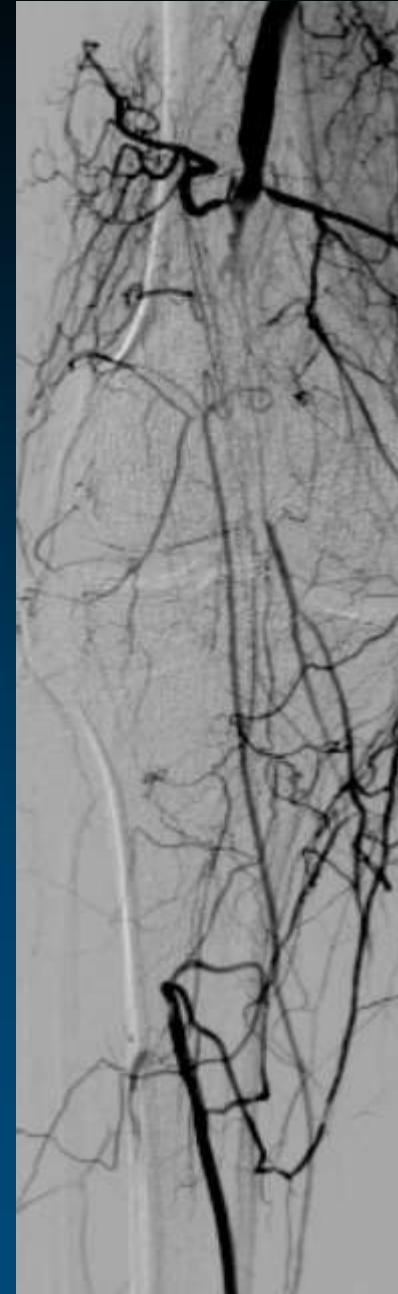
- 75 / M, ALI, Rutherford IIa
- H/O CHF with pulmonary edema, 2010
 - severe LV dysfunction, EF 28% with LAA thrombi
 - F/U Lost
 - Right lower leg pain for 5 days
- Atrial fibrillation



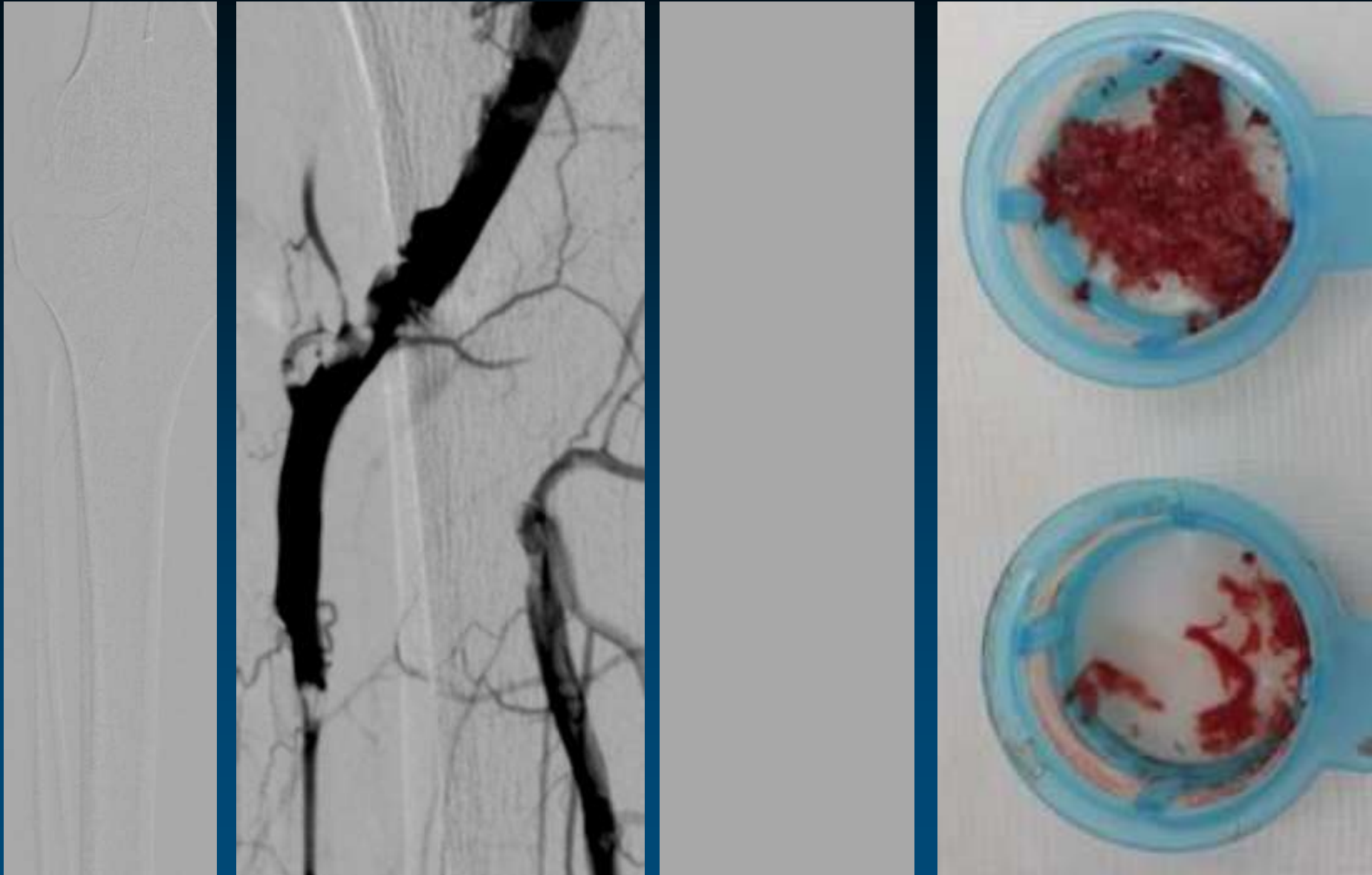
CT angiogram



Angiogram



Thrombus aspiration from Popliteal, ATA and PTA



Ipsilateral antegrade 7 Fr Ansel sheath

Overnight intralésional UK infusion

→ Followed by adjunctive balloon angioplasty

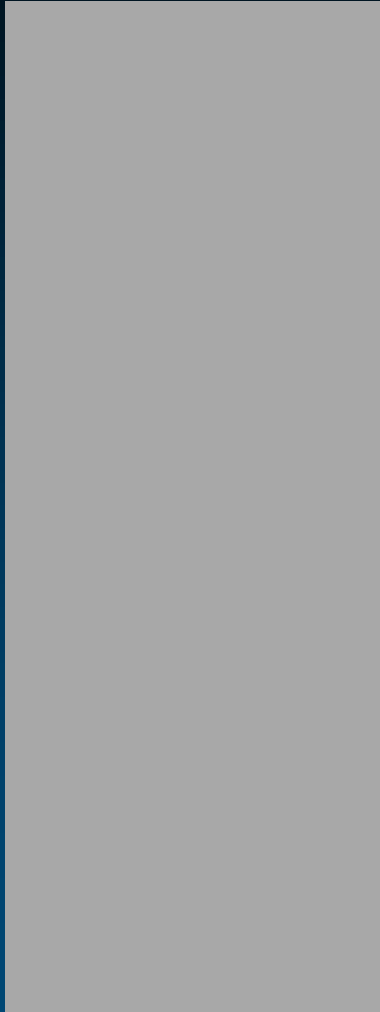


Case

- 61 / F, ALI Rutherford I
- Slowly progressing dyspnea, NYHA Fc 3
- Right leg pain, coldness and numbness for 2 weeks
- ECG; Afib
- TTE; Severe MS, MVA 0.9 cm², LAA thrombi



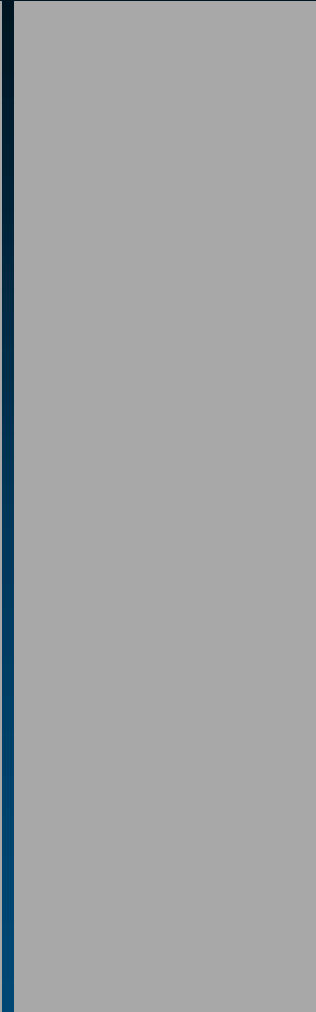
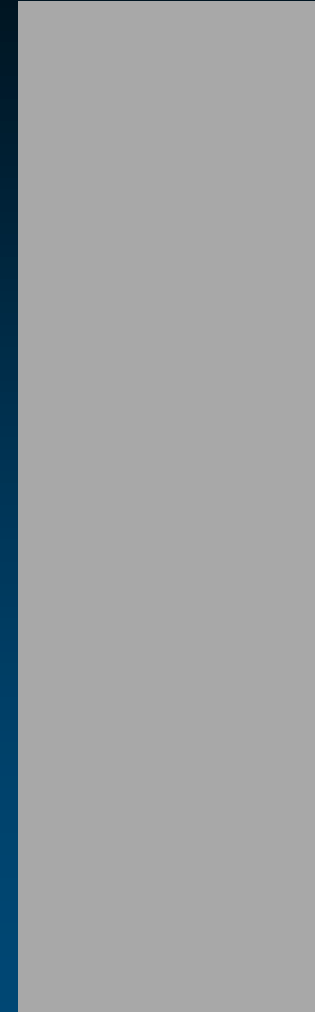
Right popliteal embolic occlusion



Baseline



Aspiration with 7Fr sheath

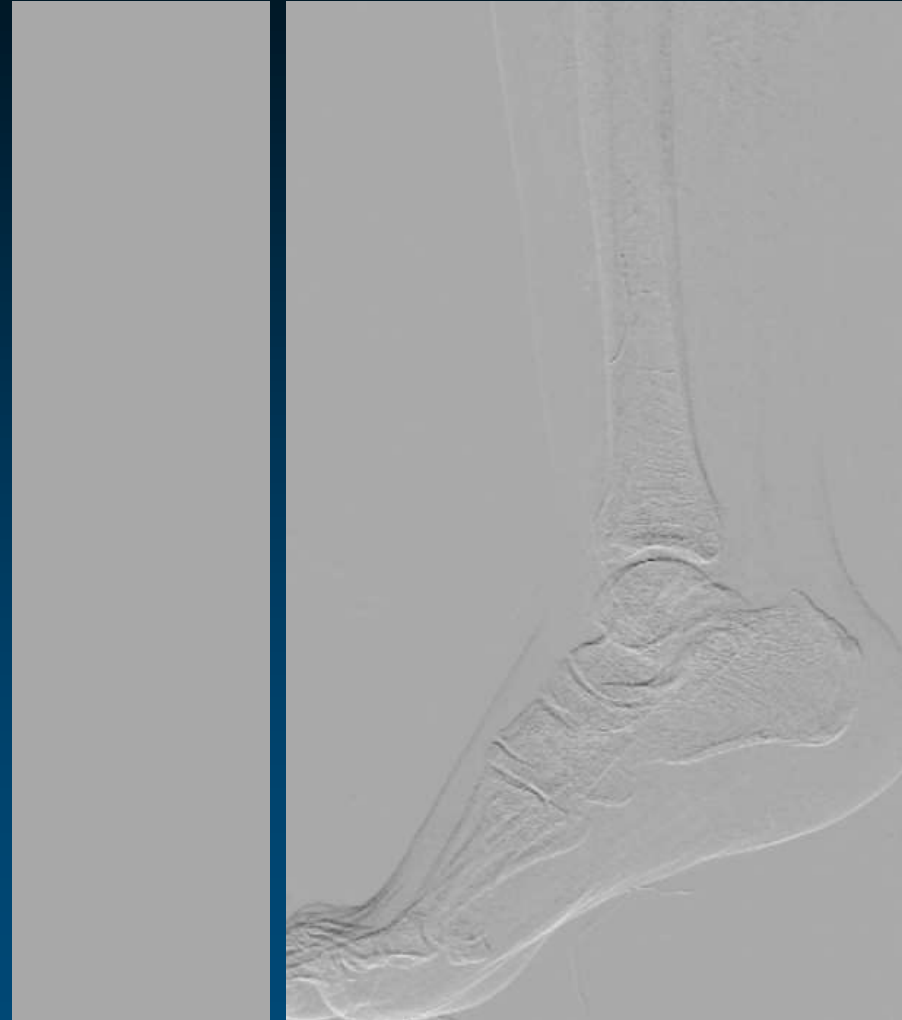


**Angiogram using
suction catheter**

Thrombectomy using both sheath and suction catheter



Sheath aspiration for P3

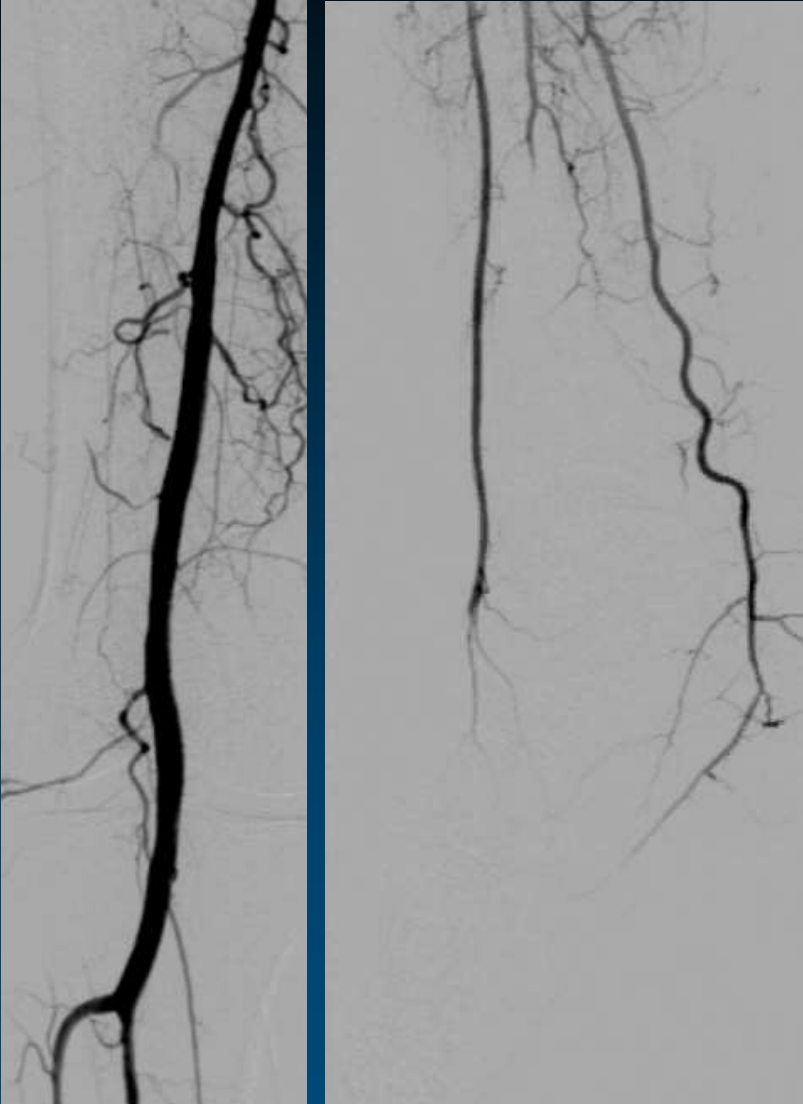


Final angiogram of the 1st procedure

Thrombus on the table



After overnight UK infusion, 100,000U/hr

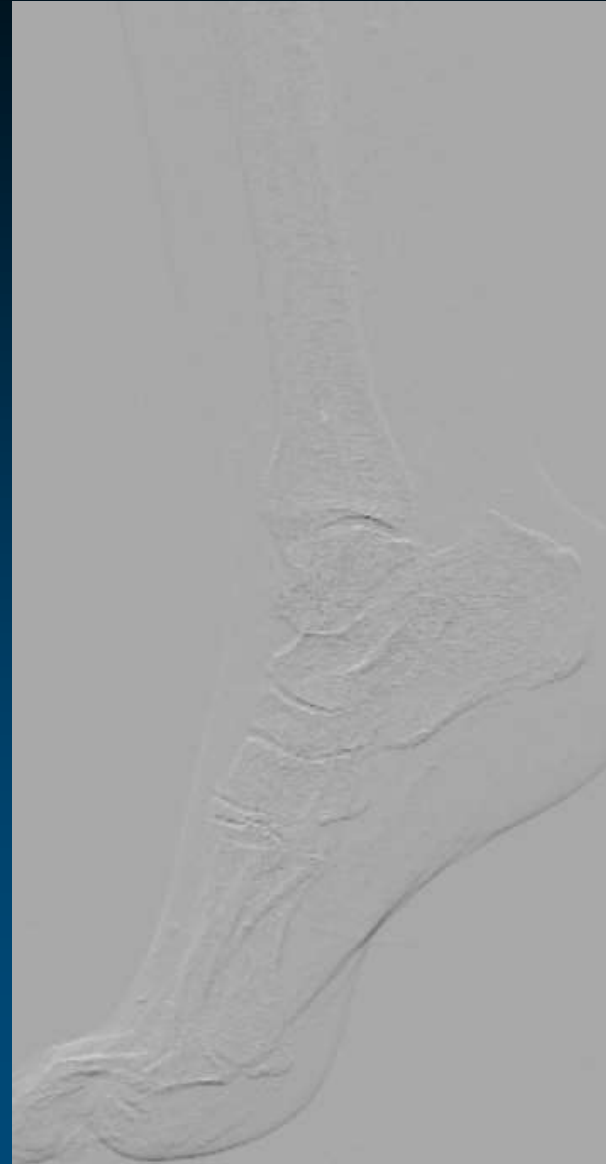


Next day angiogram



Suction and balloon angioplasty

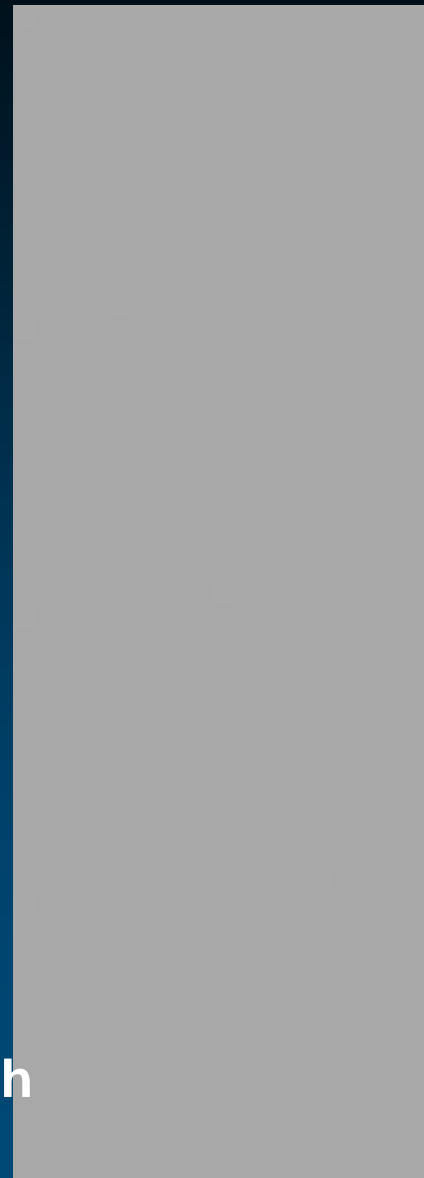
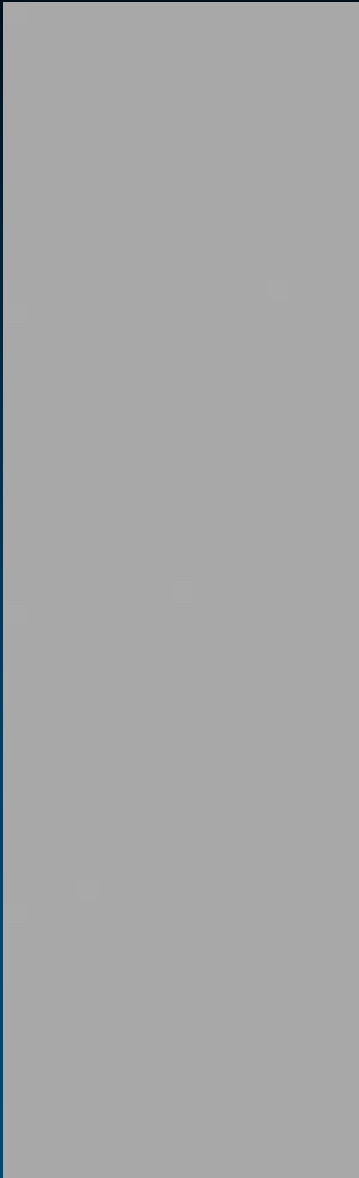
Final angiogram



Case

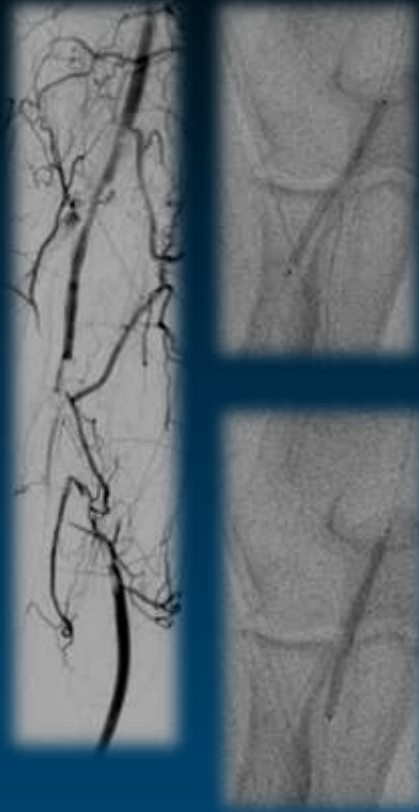
- ◎ 41 / F, Antiphospholipid syndrome with arm embolism
- ◎ Smoker
- ◎ Right hand color change, coldness and pain for 3 weeks
- ◎ Poor right ulnar and radial pulsation
- ◎ Normal left U/E and both L/E angiogram
 - Ruled out Buerger's disease
- ◎ Lupus anticoagulant Ab (+)

Brachial artery embolic occlusion



**Femoral approach
5 Fr 110 cm long Shuttle sheath
0.014" Command GW
Thrombuster catheter**

After overnight UK infusion



Repeated aspiration thrombectomy +
Kissing balloon angioplasty

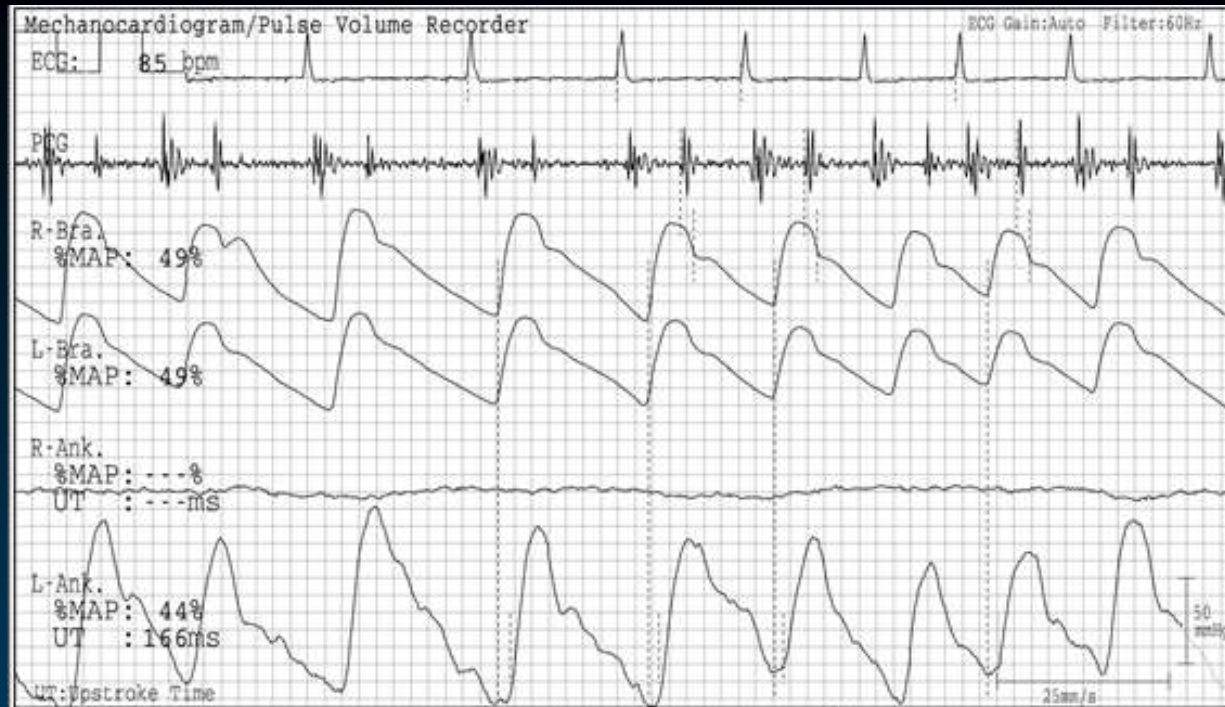
Case

- ◉ 70 / F
- ◉ C.C : Right leg resting pain for 10 days
Right 1st toe gangrenous change from 5 days ago
- ◉ Risk Factors : DM and Hypertension
- ◉ 2011.6 s/p PCI at LAD, LCx, RCA (6 stents), Other Hospital
- ◉ Cr 0.9 mg/dL
- ◉ ECG : Atrial fibrillation
- ◉ TTE : ischemic insult of RCA, LVEF=59%
- ◉ ABI : Uncheckable / 1.39

Foot photo



ABI



Measurement

(1st Measured Date)

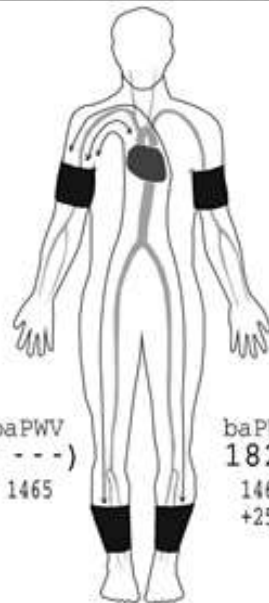
R-Bra.

SYS 114
MAP 94
DIA 64
PP 50

R-Ank.

Check Cuff/Patient[3]

baPWV
(---)
1465



baPWV
1829
1465
+25%

L-Bra.

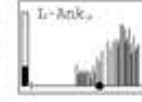
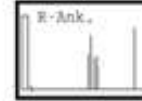
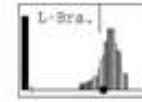
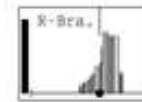
SYS 112
MAP 91
DIA 69
PP 43

L-Ank.

SYS 158
MAP 96
DIA 70
PP 88
ABI 1.39

Heart-Brachial(B) 32.4
Heart-Ankle(A) 139.9
Brachial-Ankle(A-B) 107.5 (cm)

BP:mmHg PWV:cm/s



Observation (based on AHA statement)

[Upper extremity]

[Right foot]

Arterial stenosis is suspected.
Pulse amplitude is too small to take normal pulse.

[Left foot]

Arterial calcification is suspected.
ABI is over 1.3, baPWV is over 1800.

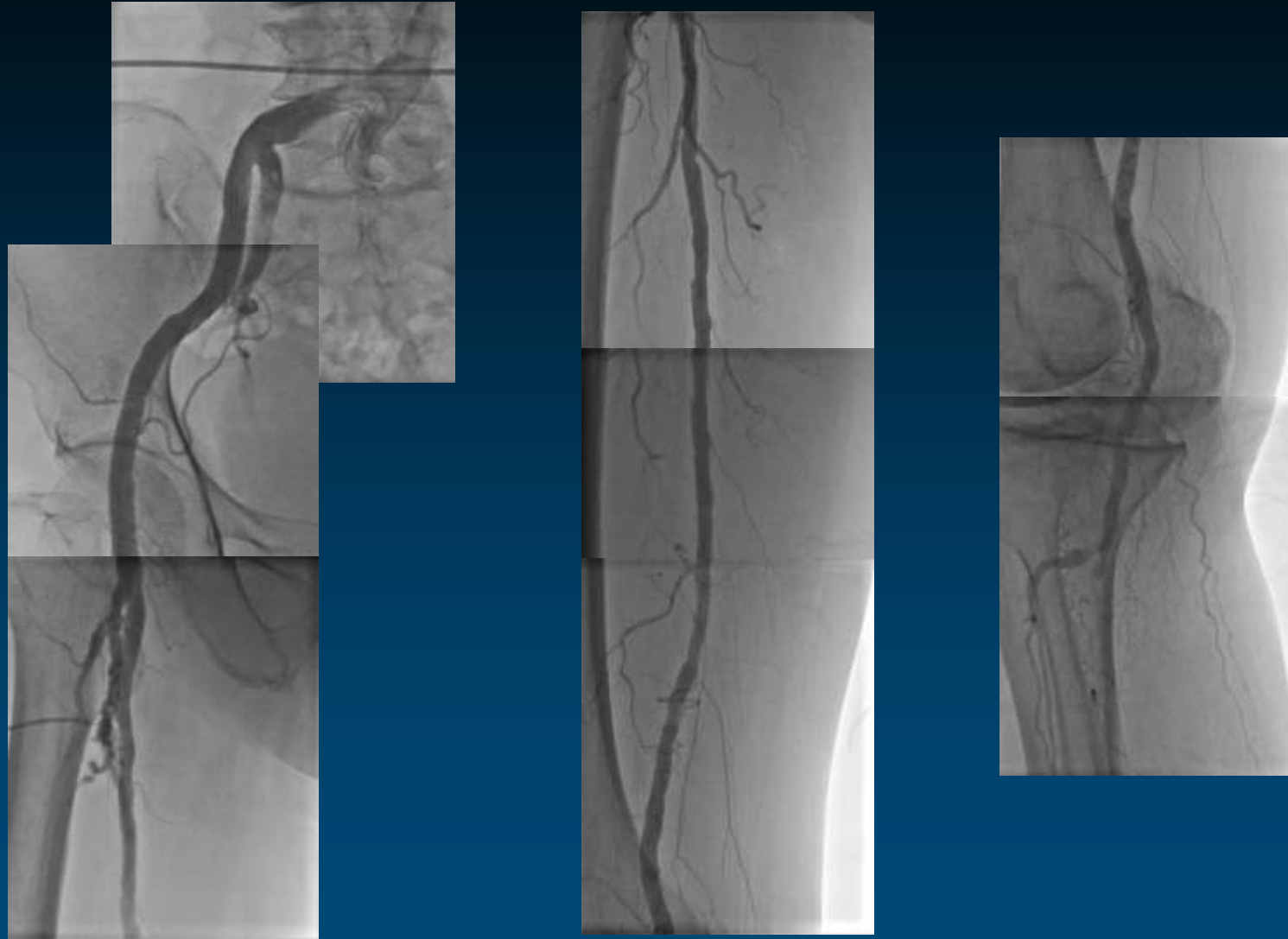
[Comment]

More detailed examination by other means may be necessary.

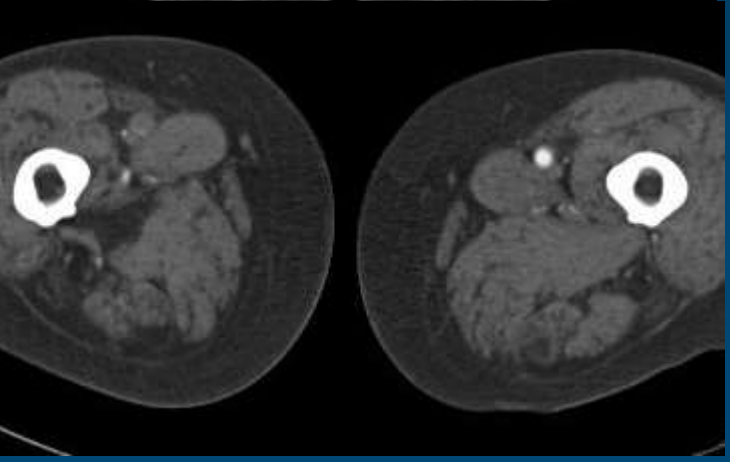
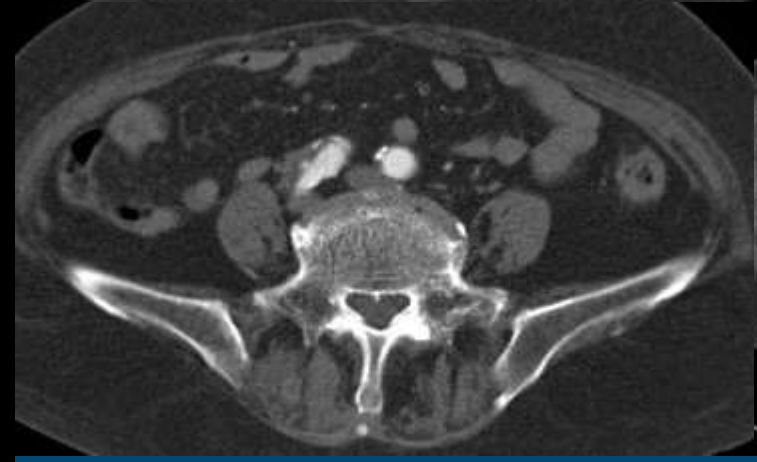
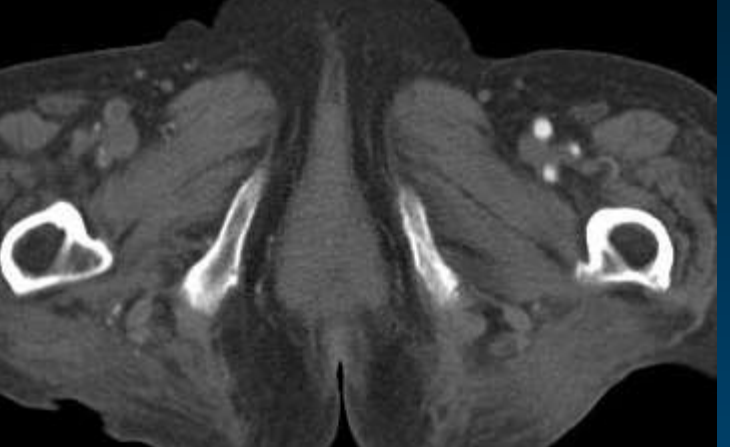
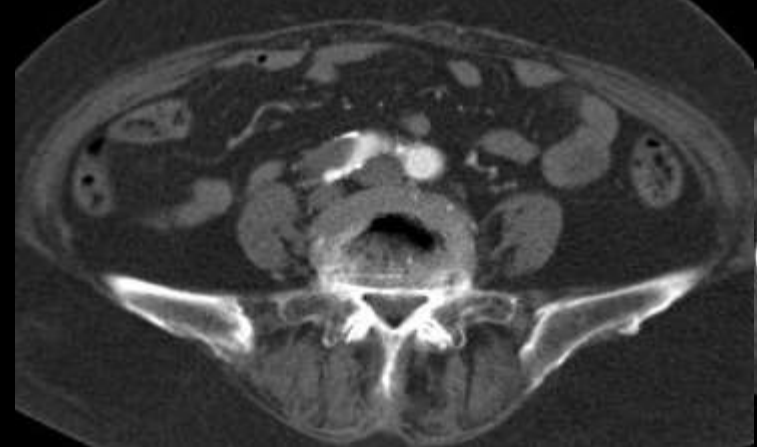
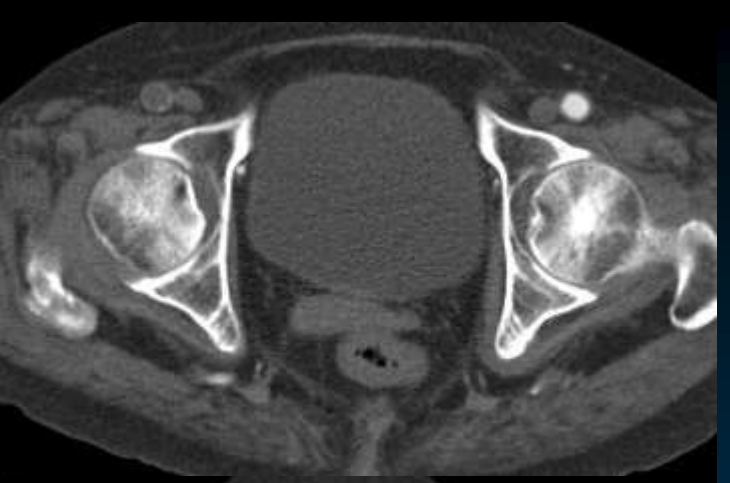
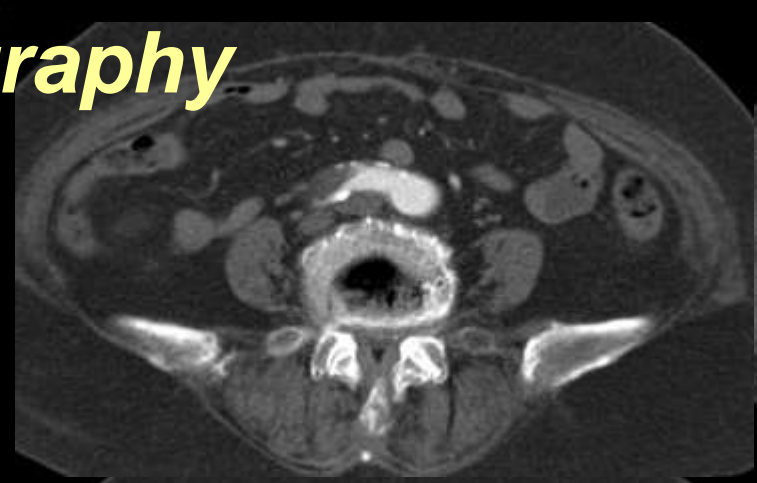
Comments/Revising point for measurement

* Remasurement was done. Right Ank. BP was not measured accurately. Unstable R-R Interval. baPWV, UT, MAP cannot be measured accurately.

4 months ago



CT angiography



L/E angiogram



Iliac and femoral thrombectomy



Additional BTK Intervention and Toe Amputation



Initial



3 days after surgical
thrombectomy of
Iliac & femoral a.

Toe amputation after
BTK intervention



One year later

- ◉ Anticoagulation with warfarin ~
- ◉ Femur neck fracture, left
 - Bipolar hemiarthroplasty
- ◉ C-spine laminoplasty
- ◉ Warfarin discontinued during two consecutive surgery
 - Left 1st toe pain and gangrene developed during admission

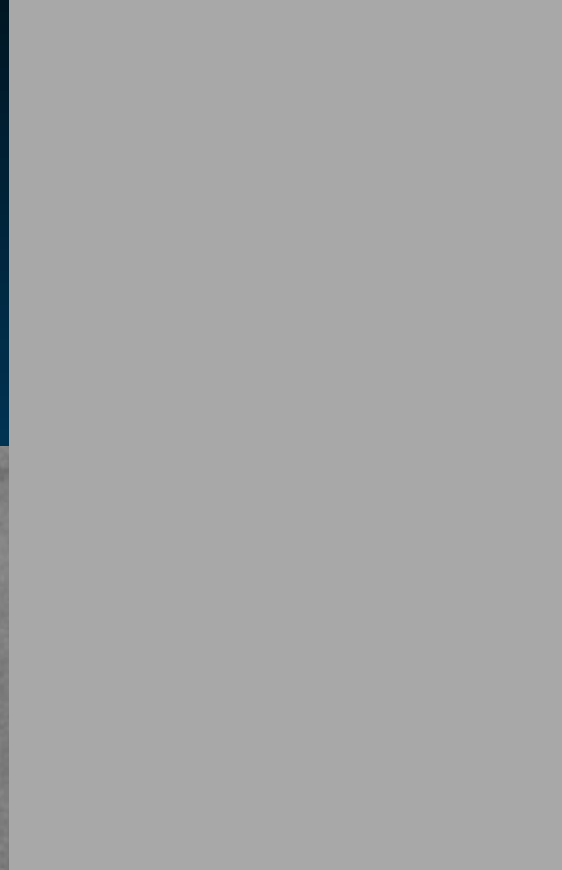
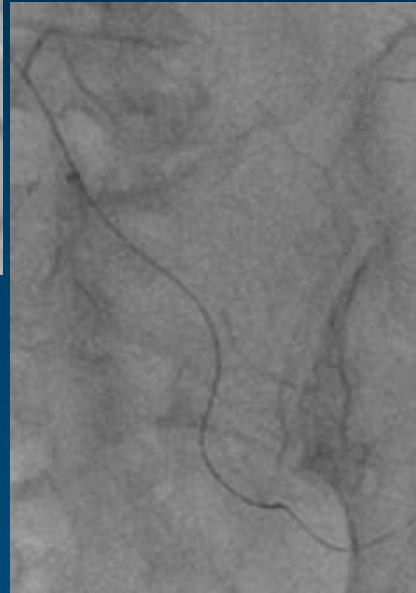
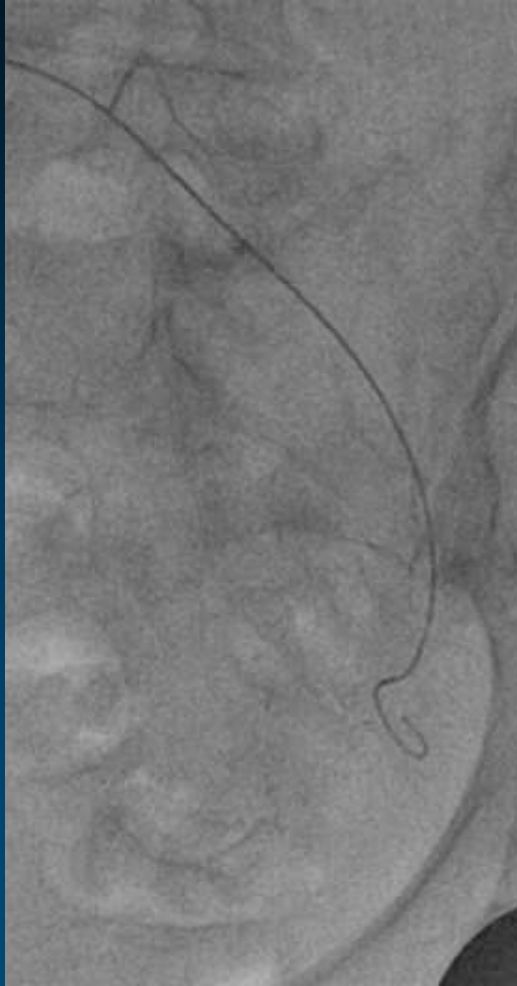


Angiogram

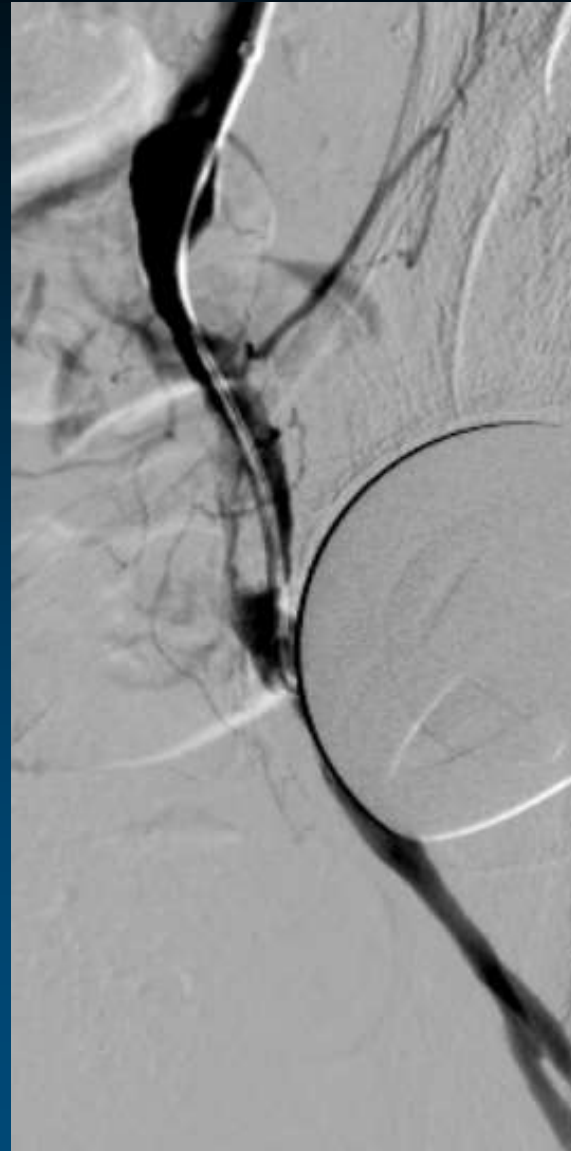
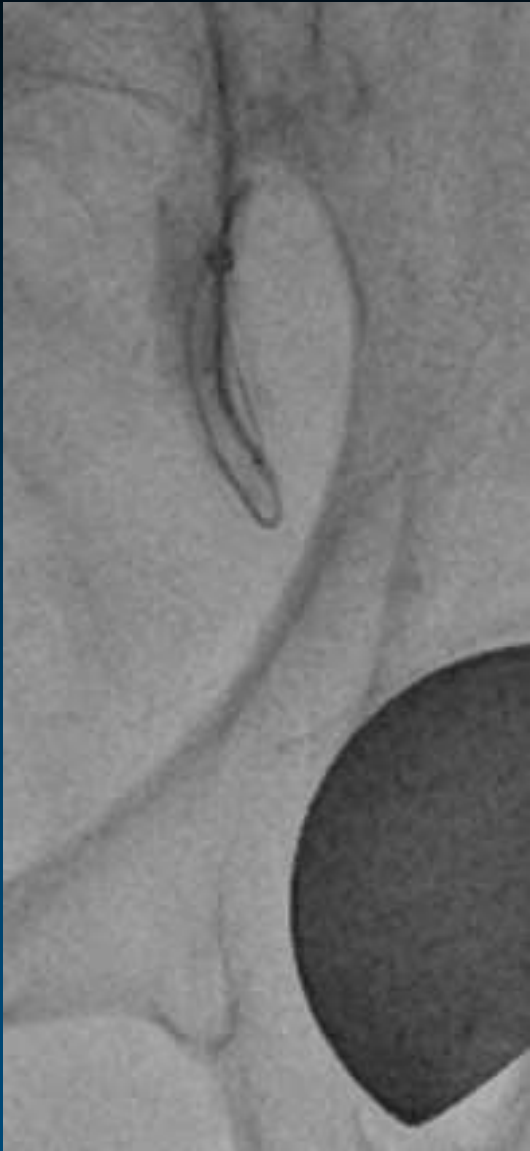


Surgeon gave a skeptical response.

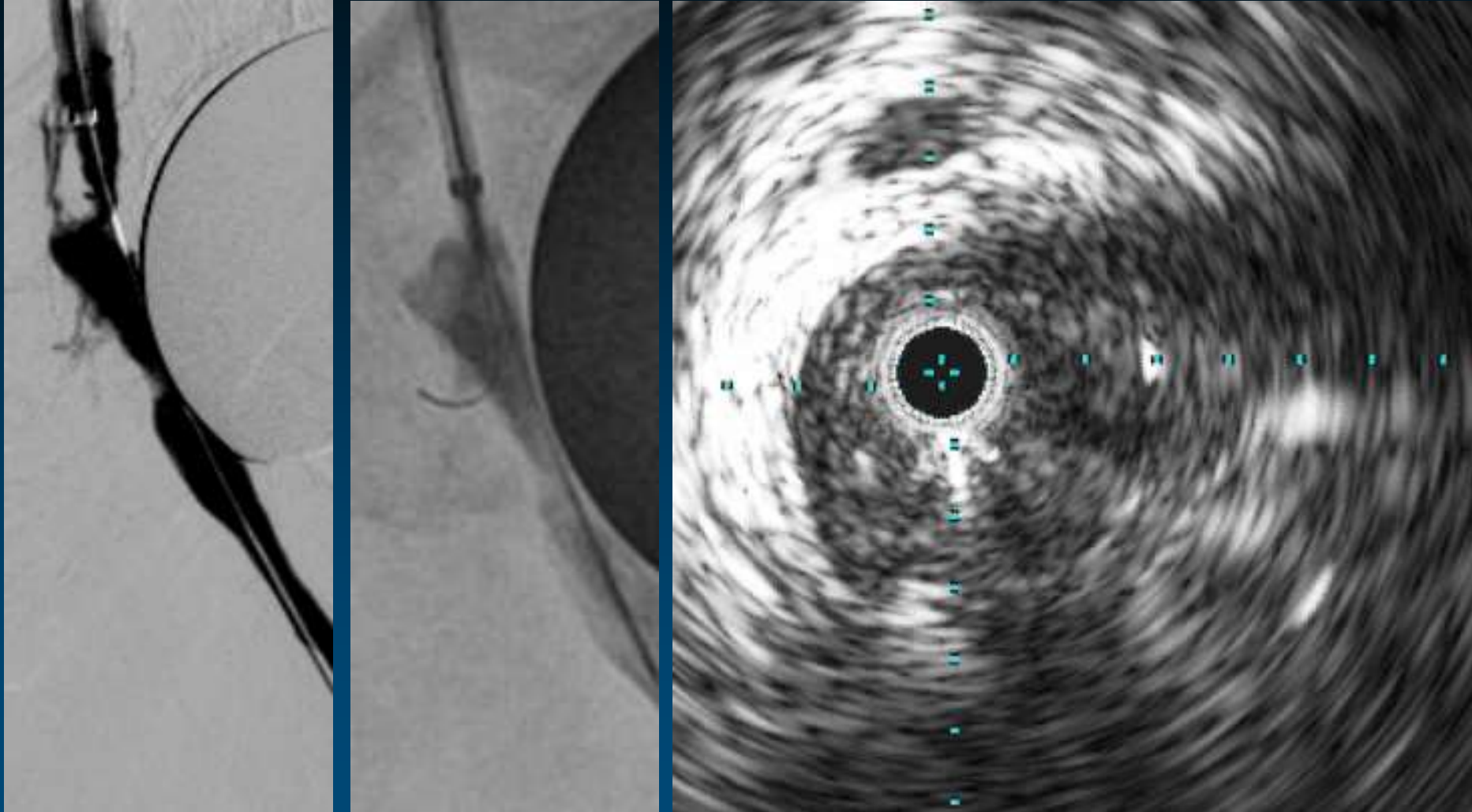
***External and Internal iliac Aspiration
with a 6 Fr Shuttle sheath + 0.035" Amplatzer extrastiff GW***



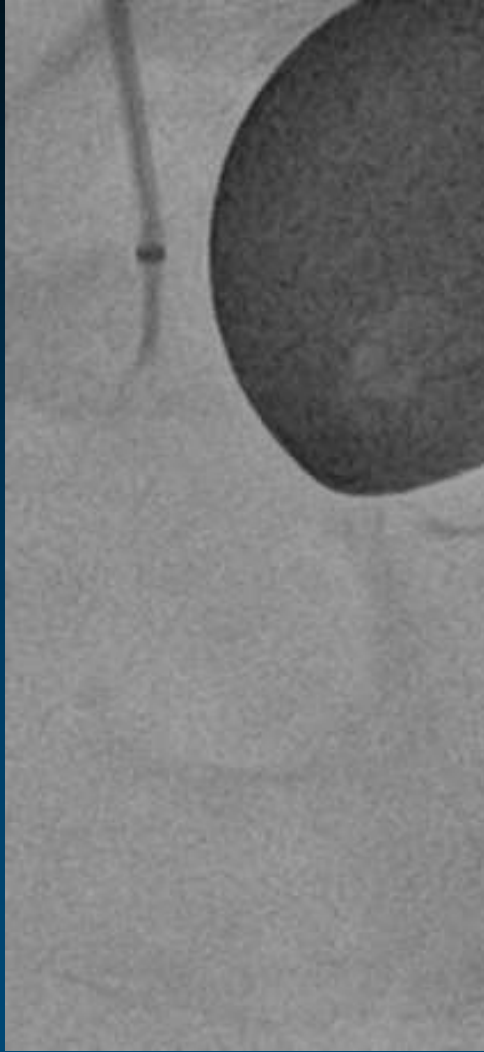
Iliac to DFA recanalization



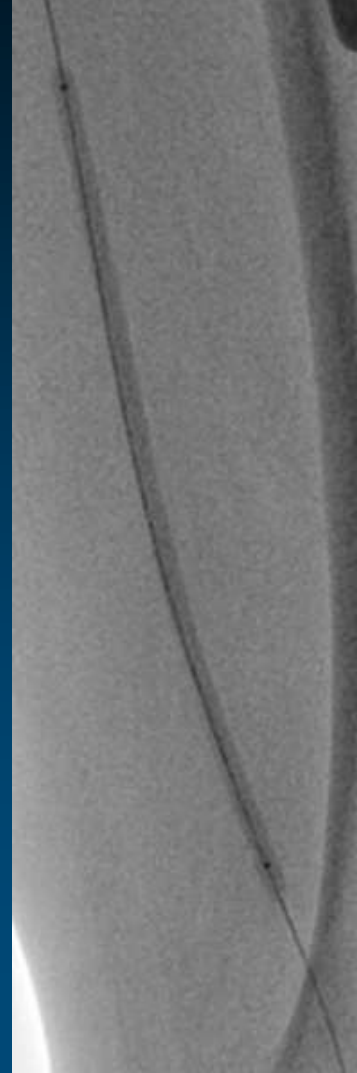
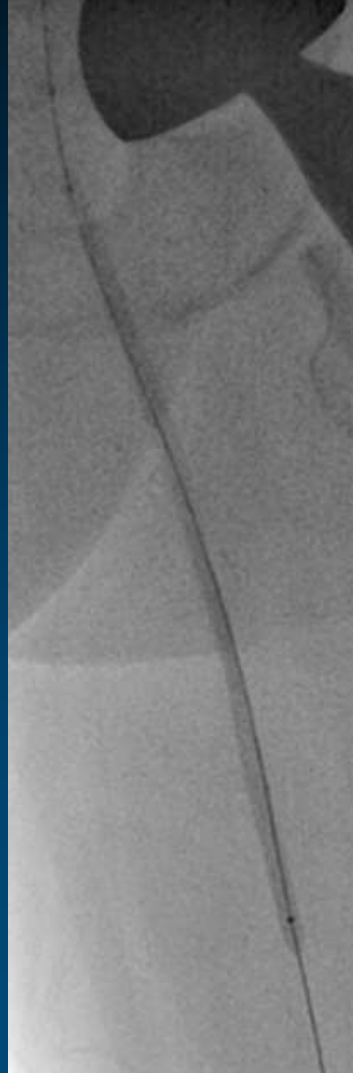
IVUS evaluation to find SFA ostium



Wiring to SFA



Thrombi aspiration as much as possible
→ Intralesional UK infusion for 6 hrs
→ Balloon angioplasty, 5.0x150mm



After overnight UK infusion



Case of Mechanical Thrombectomy

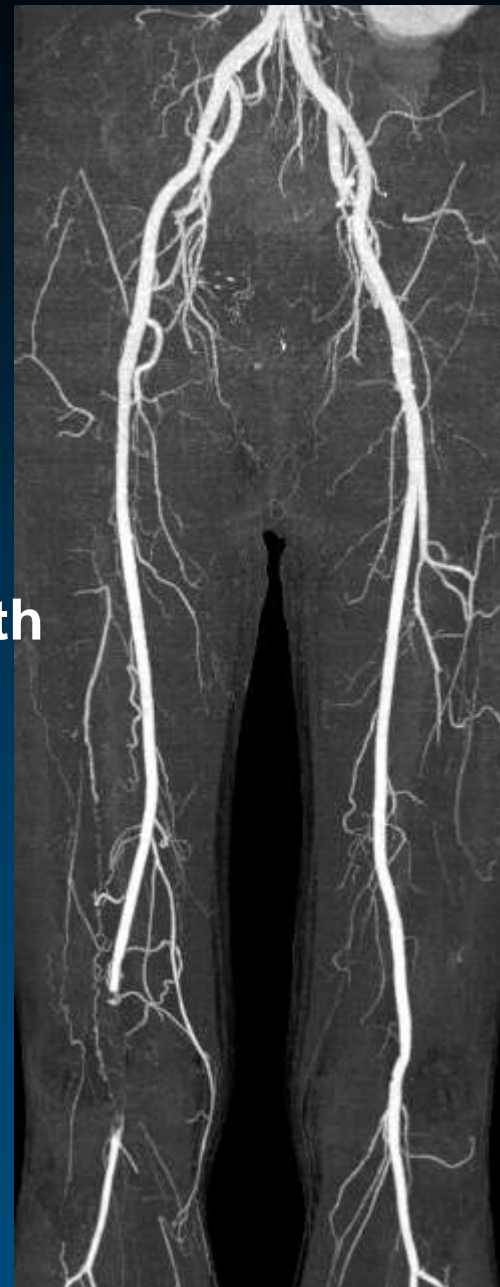
ALI case with toe gangrene - subacute course

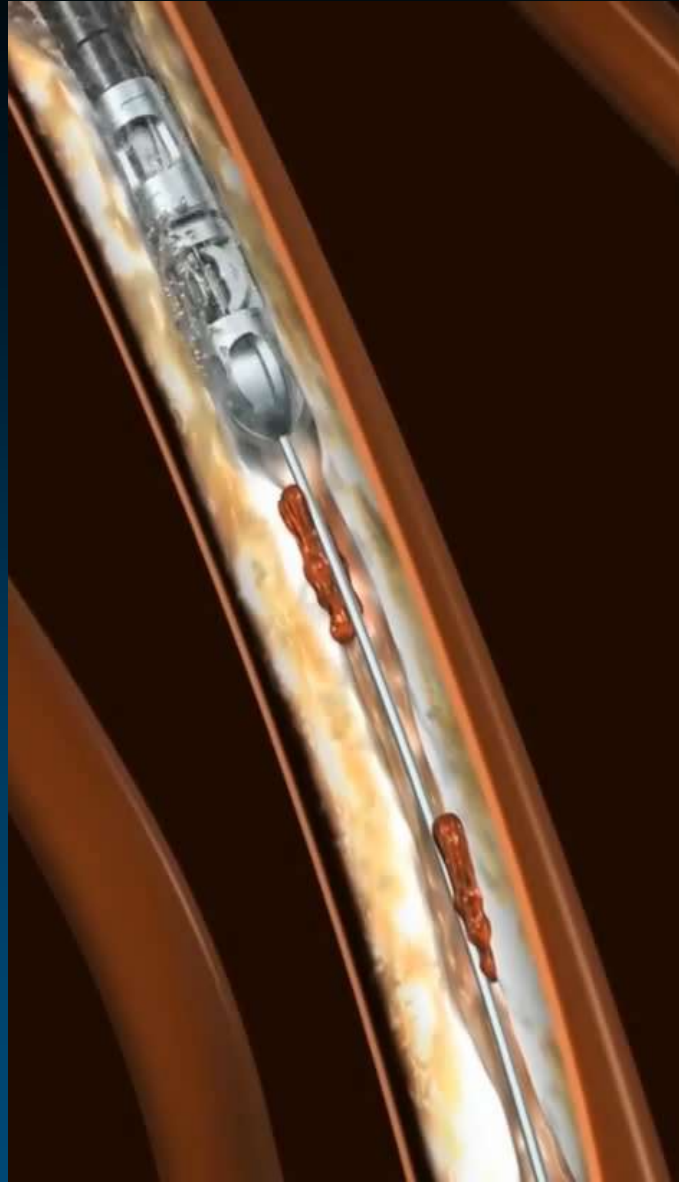
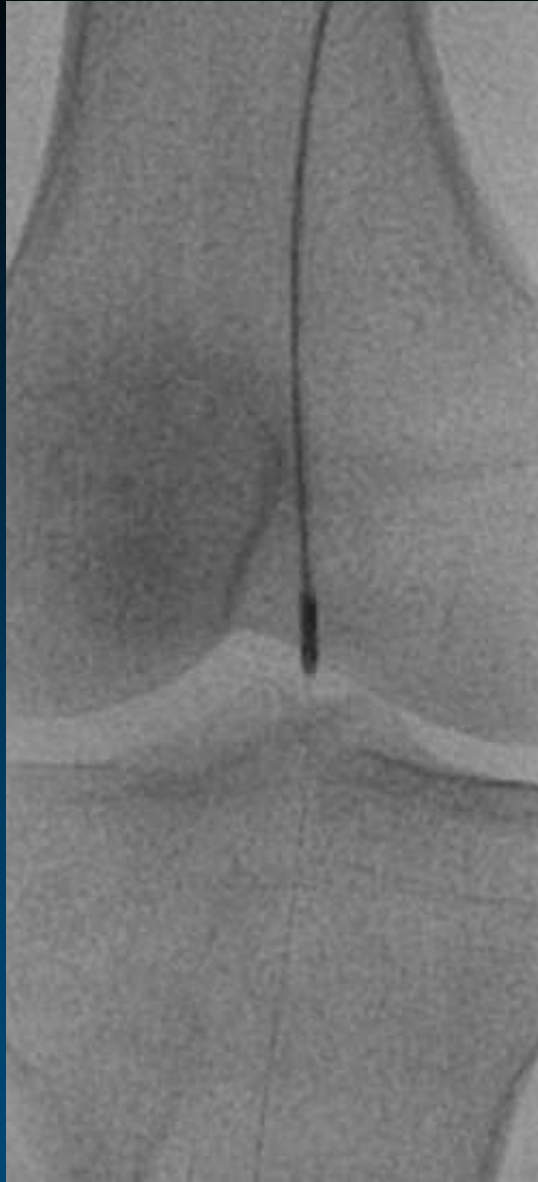
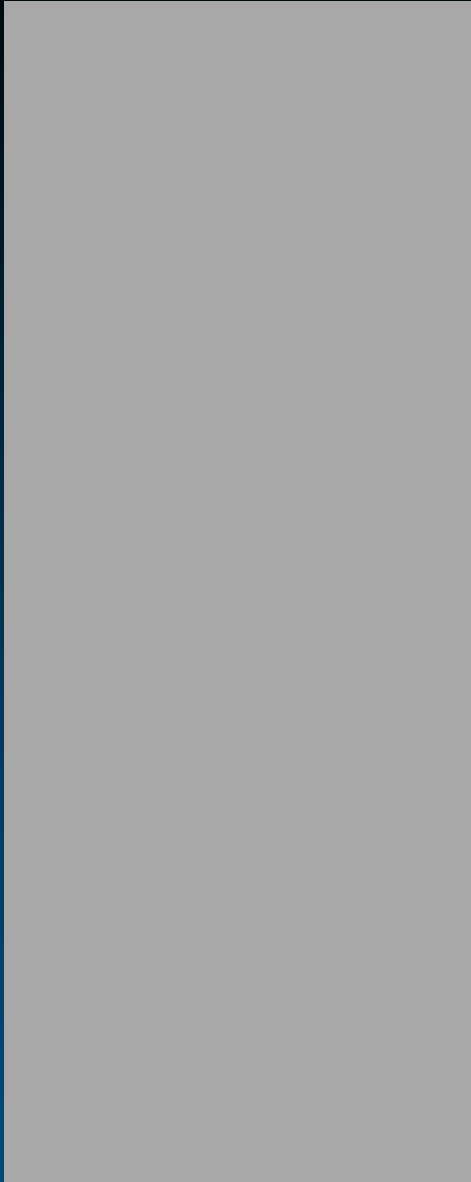
46/M

Polycythemia vera

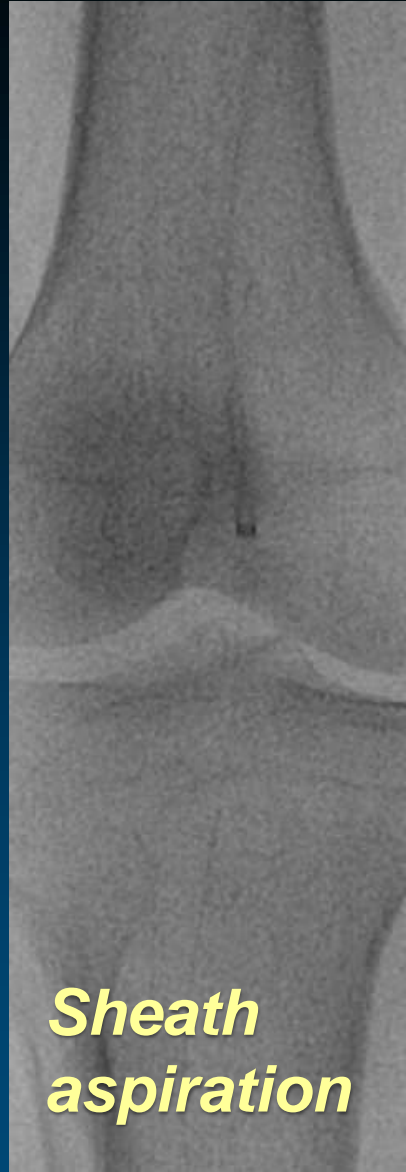
Hb 20.5g/dL, WBC 20,500/uL, PLT 512K/uL

Right calf pain, coldness and 1st toe gangrene for 1 month





Jetstream thrombectomy



*Sheath
aspiration*



DEB 6.0x120 mm

59/M, Severe resting claudication for 3 weeks



P2 occlusion



Turbohawk atherectomy

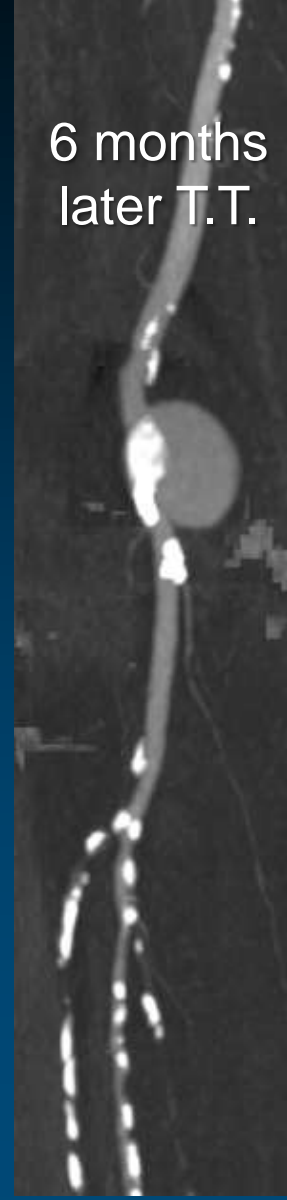
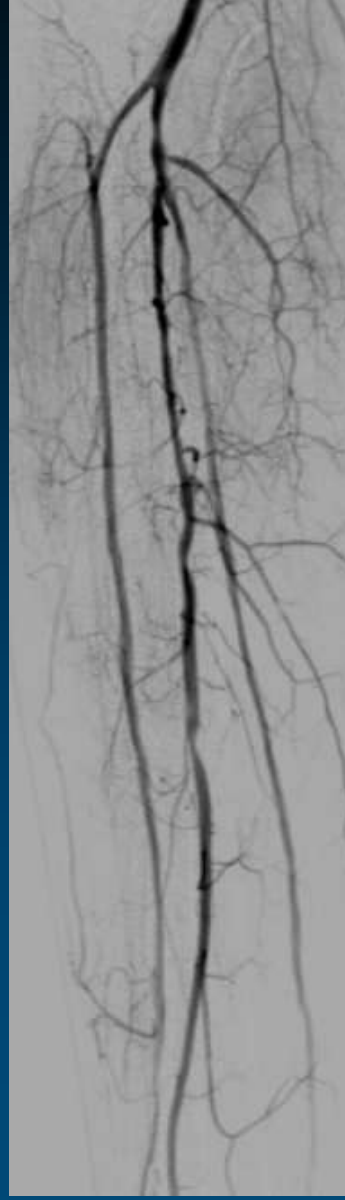


Confined rupture

Prolonged balloon dilatation with BTK thrombectomy



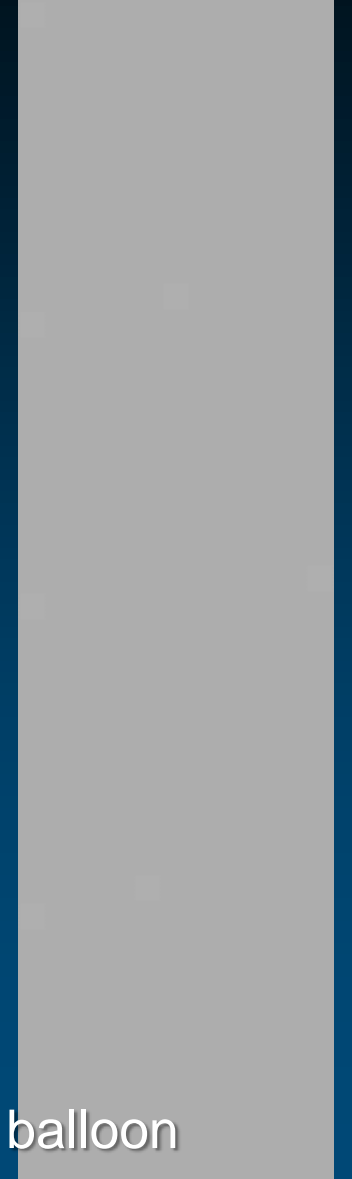
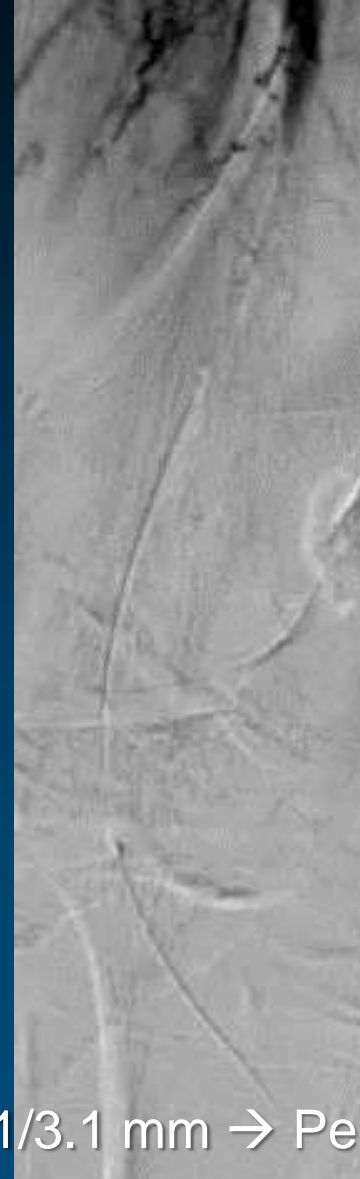
Prolonged balloon dilatation
→ BTK intervention



74/F, ALI stage IIa, 10 days ago onset



Right popliteal occlusion

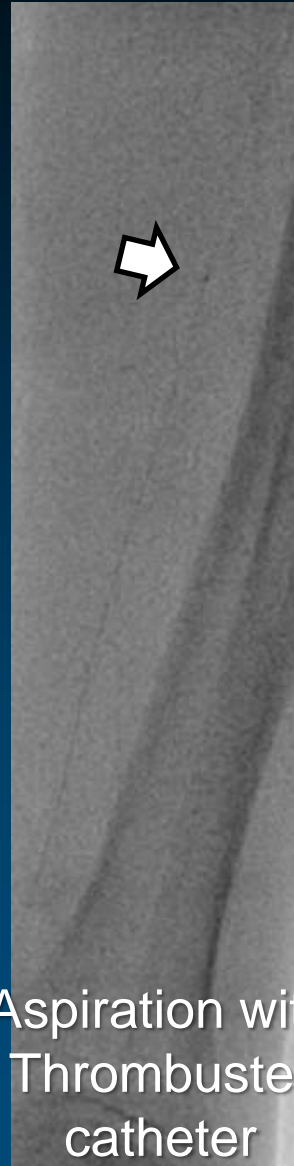
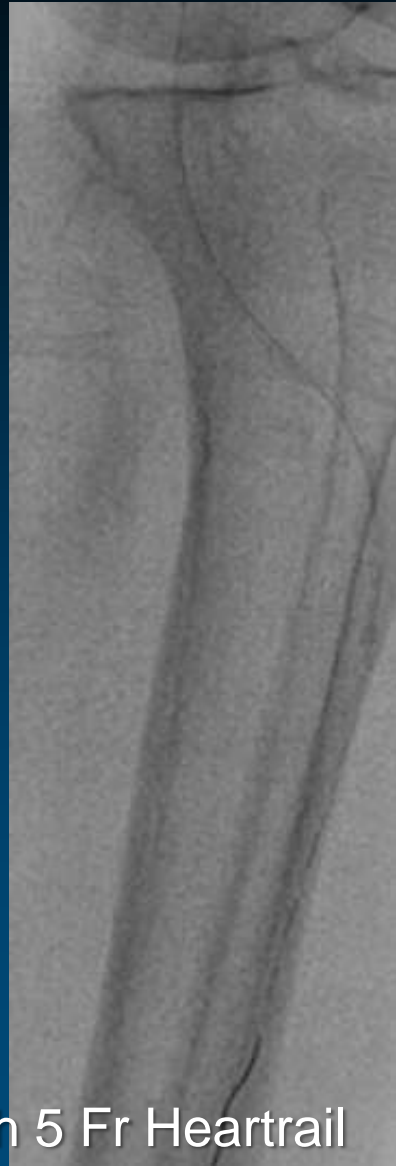


Jetstream 2.1/3.1 mm → Perforation → Prolonged balloon

74/F, ALI stage IIa, 10 days ago onset



Aspiration with 5 Fr Heartrail



Aspiration with Thrombuster catheter



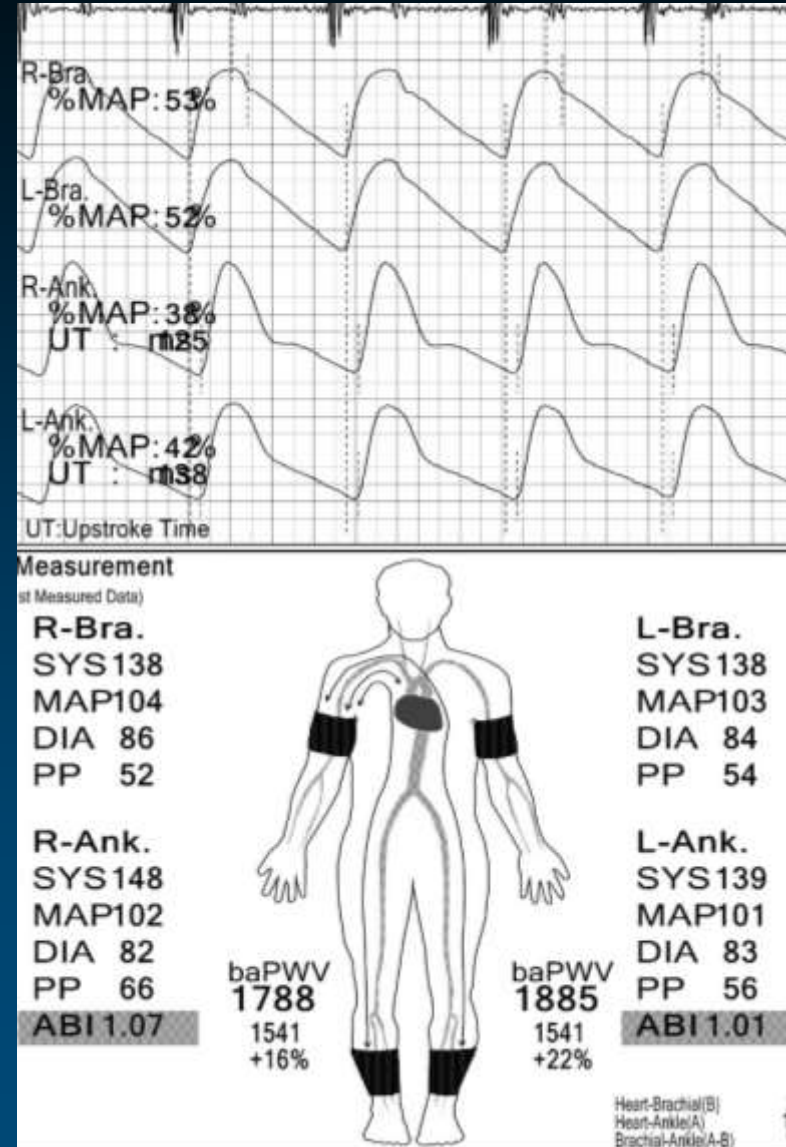
Balloon angioplasty



74/F, ALI stage IIa, 10 days ago onset



Final angiogram



6 months later, asymptomatic, but



ALI Data From Our Center - Baseline

| | Total (n=58) | Manual Aspiration (n=39) | Jetstream (n=19) | P-value |
|--------------------|------------------|-----------------------------|---------------------|------------------|
| Age | 72.5±13.5 | 68.2±12.8 | 81.2±10.5 | <0.001 |
| Sex(male) | 40(69.0%) | 28(71.8%) | 12(63.2%) | 0.505 |
| DM | 26(44.8%) | 20(51.3%) | 6(31.6%) | 0.157 |
| IHD | 26(44.8%) | 20(51.3%) | 6(31.6%) | 0.157 |
| Previous CI | 13(22.4%) | 9(23.1%) | 4(21.1%) | 0.862 |
| CKD | 13(22.4%) | 7(17.9%) | 6(31.6%) | 0.243 |
| HTN | 44(75.9%) | 29(74.4%) | 15(78.9%) | 0.702 |
| DL | 5(8.6%) | 5(12.8%) | 0(0.0%) | 0.103 |
| AF | 20(34.5%) | 12(30.7%) | 8(42.1%) | 0.394 |
| Cancer | 8(13.8%) | 4(10.2%) | 4(21.1%) | 0.263 |
| Smoking | 13(22.4%) | 9(23.1%) | 4(21.1%) | 0.862 |

Retrospective Analysis, not published

ALI Data From Our Center – Presentation & Lesion

| | Total (n=58) | Manual Aspiration (n=39) | Jetstream (n=19) | P-value |
|--------------------|--------------|--------------------------|------------------|---------|
| Sx duration (day) | 18.7±25.3 | 19.9±28.2 | 16.3±16.4 | 0.550 |
| Onset of Sx | | | | |
| Acute (<14day) | 39(67.2%) | 28(71.8%) | 11(57.9%) | 0.290 |
| Subacute (>2wk) | 19(38.0%) | 11(57.9%) | 8(42.1%) | 0.640 |
| Rutherford grade | | | | |
| I | 34(58.6%) | 25(64.1%) | 9(47.3%) | 0.225 |
| IIa | 10(17.2%) | 7(17.9%) | 3(15.8%) | 0.838 |
| IIb | 7(24.1%) | 7(17.9%) | 7(36.8%) | 0.115 |
| Proximal extent | | | | |
| Iliac | 9(15.5%) | 6(15.4%) | 3(15.8%) | 0.968 |
| Femoral | 31(53.4%) | 15(38.5%) | 16(84.2%) | 0.001 |
| Popliteal | 12(20.7%) | 12(30.8%) | 0(0.0%) | 0.007 |
| Tibial | 6(10.3%) | 5(12.8%) | 0(0.0%) | 0.103 |
| Sheath diameter(F) | 6.21±0.85 | 5.87±0.80 | 6.89±0.46 | <0.001 |

Retrospective Analysis, not published

ALI Data From Our Center – Procedure & Outcome

| | Total (n=58) | Manual Aspiration (n=39) | Jetstream (n=19) | P-value |
|-------------------------------------|--------------|-----------------------------|---------------------|---------|
| Failure | 4(6.9%) | 3(7.7%) | 1(5.3%) | 0.732 |
| Pre-TIMI flow | 0.17±0.46 | 0.26±0.55 | 0.0±0.00 | 0.047 |
| Post-TIMI flow | 2.57±0.68 | 2.54±0.72 | 2.63±0.60 | 0.606 |
| Adjunctive Tx | | | | |
| UK usage | 50(86.2%) | 34(87.2%) | 16(84.2%) | 0.758 |
| Balloon | 53(91.4%) | 35(89.7%) | 18(94.7%) | 0.525 |
| Balloon+Stent | 5(8.6%) | 4(10.3%) | 1(5.3%) | 0.525 |
| 30d primary patency | 50(86.2%) | 34(87.1%) | 16(84.2%) | 0.758 |
| Failure | 4(6.9%) | 3(7.7%) | 1(5.3%) | 0.732 |
| Any amputation | 6(10.3%) | 5(12.8%) | 1(5.3%) | 0.375 |
| Limb salvage | 52(91.2%) | 34(89.5%) | 18(94.7%) | 0.508 |
| Reintervention | 10(17.2%) | 5(12.8%) | 5(26.3%) | 0.202 |
| Time to 1 st reinterv, d | 10.5±33.4 | 8.28±31.3 | 15.05±37.7 | 0.473 |

Retrospective Analysis, not published

ALI Data From Our Center – Procedure & Outcome

| | Total (n=58) | Manual Aspiration (n=39) | Jetstream (n=19) | P-value |
|---------------------------|------------------|--------------------------|------------------|--------------|
| UK use | 48(82.8%) | 33(84.6%) | 15(78.9%) | |
| UK dose (10,000IU) | 56.5±36.9 | 64.8±35.3 | 49.3±33.3 | 0.158 |
| Procedure time (min) | 102.9±43.4 | 95.5±46.5 | 118.2±32.0 | 0.037 |
| Radiation time (min) | 40.9±19.9 | 34.6±16.6 | 53.7±20.2 | 0.057 |
| Contrast dose (cc) | 162.6±63.6 | 150.9±66.2 | 186.6±51.3 | 0.068 |
| Complication | | | | |
| Any | 19(32.8%) | 10(25.6%) | 9(47.4%) | 0.098 |
| Embolism | 20(34.5%) | 10(25.6%) | 10(52.6%) | 0.001 |
| Hematoma | 1(1.7%) | 1(2.6%) | 0(0.0%) | 0.481 |
| Bleeding | 4(6.9%) | 4(10.3%) | 0(0.0%) | 0.148 |
| Respiratory distress | 1(1.7%) | 1(2.6%) | 0(0.0%) | 0.481 |
| Perforation | 1(1.7%) | 0(0.0%) | 1(5.3%) | 0.148 |
| Mortality | 2(3.4%) | 2(5.2%) | 0(0.0%) | 0.315 |

Retrospective Analysis, not published

Manual Aspiration vs. Mechanical Thrombectomy

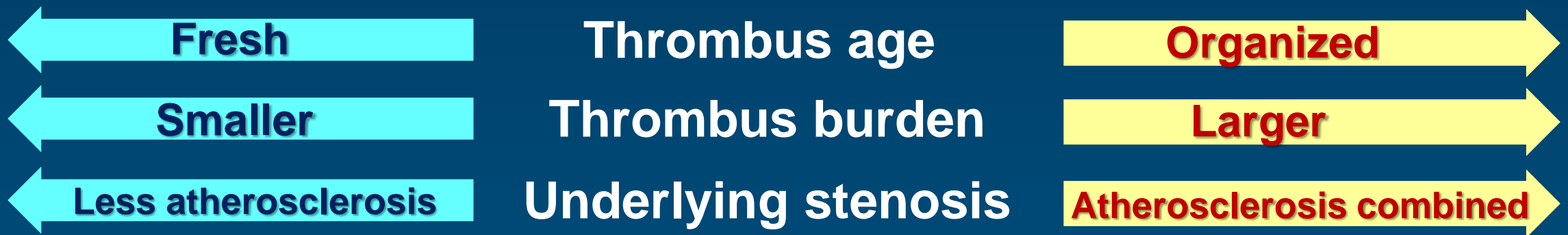
| | Manual Aspiration Thrombectomy | Mechanical Thrombectomy |
|-------------|--|---|
| Pros | <p>Less invasive, Cheaper No special device needed Smaller catheter applicable Less time consuming Smaller radiation & contrast dose</p> | <p>More efficient thrombus removal → reduce duration and amount of thrombolytic agents Rapid reperfusion More effective on organized thrombi or combined atherosclerosis</p> |
| Cons | <p>Less effective thrombus removal More thrombolytic agent needed - longer duration, larger amount - pt's inconvenience, more bleeding risk Repetitive session may be needed</p> | <p>Specialized device should always be prepared in the cath lab → \$2,000 More embolization risk Filter device sometimes needed Potential risk of vessel damage</p> |
| ? | <p>No randomized comparison, No large outcome data → Clinical outcome difference not defined yet Economic burden difference? No answer</p> | |

Manual Aspiration vs. Mechanical Thrombectomy

- We definitely need more data.
- Routine use of mechanical device is not desirable.
- We must establish an appropriate treatment strategy based on the patient and the condition of the lesion.

Manual aspiration is usually enough

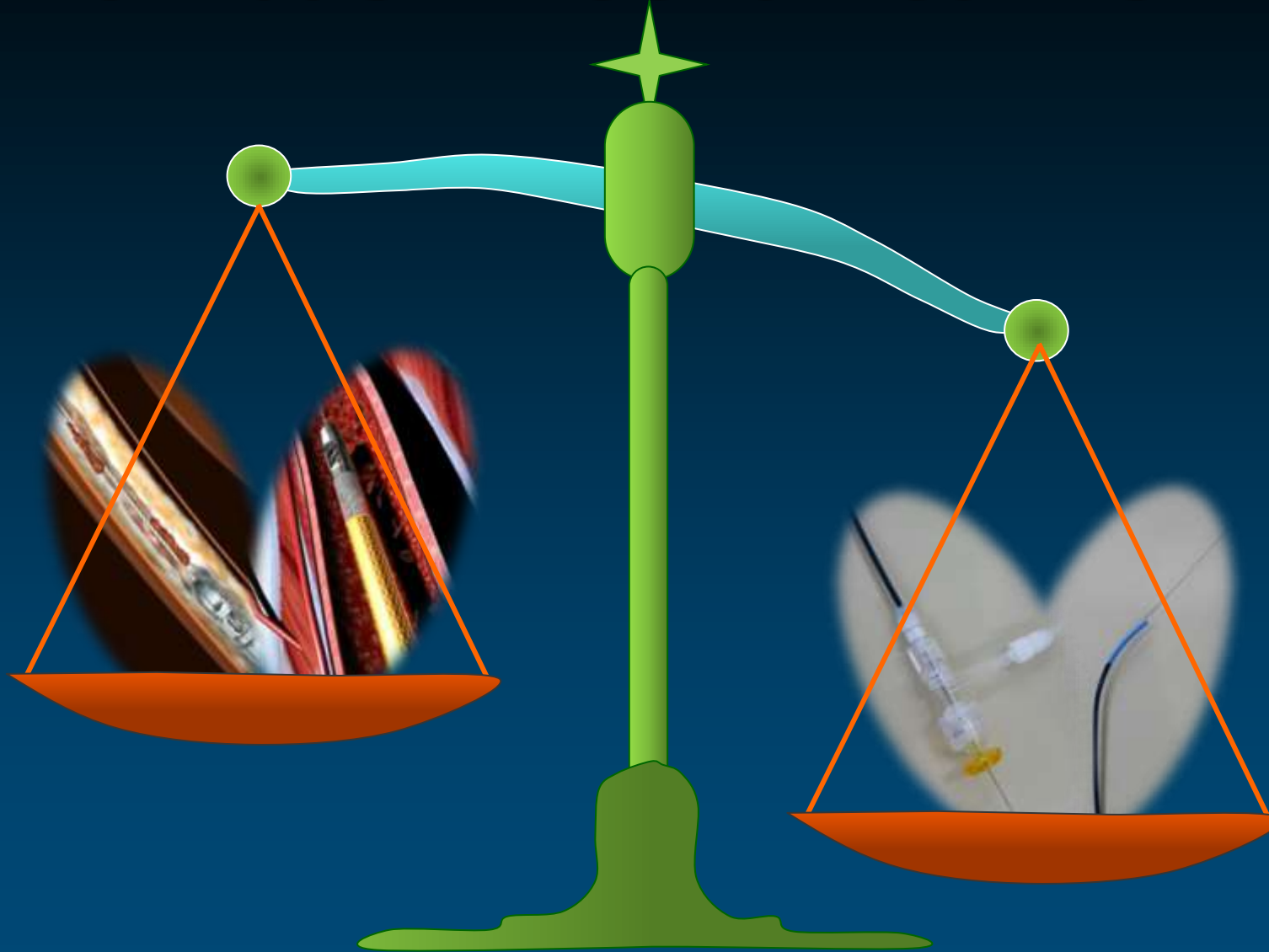
Consider mechanical device



ALI Thrombus - Mechanical vs. Manual?



ALI Thrombus - Mechanical vs. Manual?



We must compare the gain and the yarn



For Making Good Footprints

Thanks for the Time