FRONTLINE VASCULAR CARE 2025

SPECTRUM VASCULAR & GENERAL SURGERY 光谱外科与血管专科

FARRER PARK HOSPITAL

Deep Vein Thrombosis: Contemporary Endovascular Interventions

Dr. Tay Jia Sheng
MBBS (Singapore), M.Med (Surgery), FRCSEd (Gen Surg), FAMS
MCR No. M11772B
Vascular, Endovascular & General Surgeon

COMFORT · FAIRNESS · VALUE

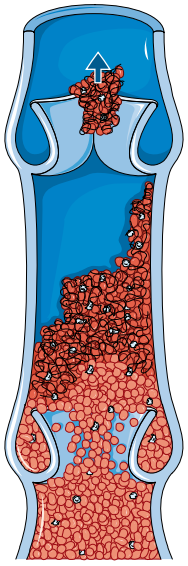
1

Background of DVT

- Annual incidence of 1st episode of DVT
  - Western population ~ 50-100 per 100 000
  - Asian population[1] ~ 13.8-19.9 per 100 000
  - 2x increase per 10 year age increase
  - Slightly greater in females aged 20-45 years
  - Men have a higher incidence aged 45-60 years
- First-time DVT ~ 30-day mortality 4.6%
- First-time PE ~ 30 day mortality 9.7%

  - Unprovoked vs Provoked DVT

- **Unprovoked (Idiopathic) Deep Vein Thrombosis (DVT):** A DVT that occurs **without any identifiable provoking factor**.



1. Lee LH, Gallus A, Jindal R, Wang C, Wu CC. Incidence of Venous Thromboembolism in Asian Populations: A Systematic Review. Thromb Haemost. 2017 Dec;117(12):2243-2260. doi: 10.1160/TH17-02-0134. Epub 2017 Dec 6. PMID: 29212112.

2

ACQUIRED Risk factors for Provoked DVT

- Cancer
- Acute medical illness
- Surgery
  - 0.08 % (0-2.9 %)
- Trauma
- Immobility (often in hospital and lasting at least 3 days)
- Obesity
- Infection
- Hormone therapy (oestrogen containing)
- Pregnancy
- Long distance travel
- Primary varicose veins
- Prolonged computer related "seated immobility syndrome"
- Antiphospholipid antibodies

1. Yeo DX, Junnarkar S, Balasubramaniam S, Tan YP, Low JK, Woon W, Pang TC. Incidence of venous thromboembolism and its pharmacological prophylaxis in Asian general surgery patients: a systematic review. World J Surg. 2015 Jan;39(1):150-7. doi: 10.1007/s00268-014-2763-0. PMID: 25189450.

3

HEREDITARY Risk factors for Provoked DVT

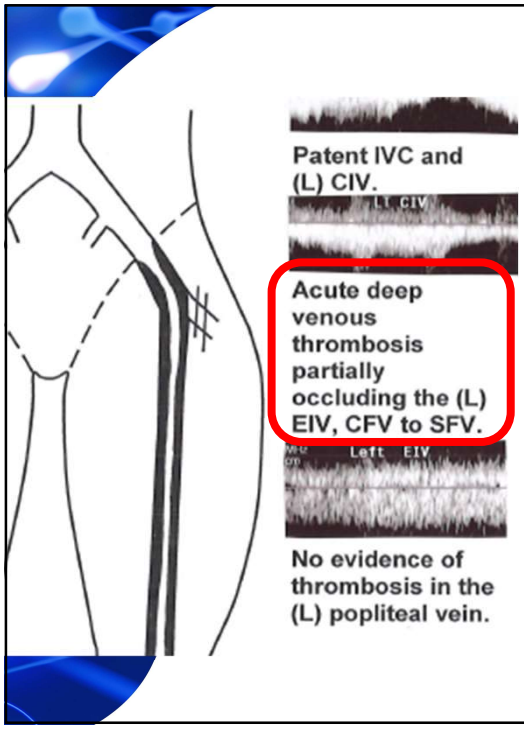
- Non-O blood type (2x risk)
- Heterozygous Factor V Leiden gene polymorphism
- Homozygous Factor V Leiden deficiency
- Antithrombin III deficiency
- Protein C deficiency
- Protein S deficiency

4

Clinical Presentation

- More severe symptoms and signs as thrombosis extends more proximally due to worse outflow obstruction
  - Iliofemoral > femoropopliteal > Calf DVT
- Pain
- Swelling
- Phlegmasia cerulea alba
- Phlegmasia cerulea dolens

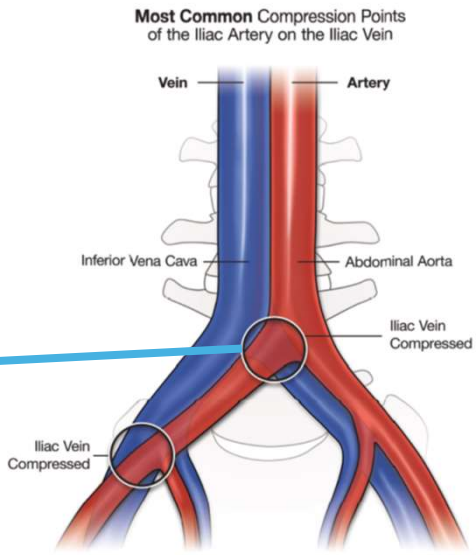
5



Investigations

- Ultrasound venous duplex
- CT venogram
  - Evaluate iliac veins for May Thurner pathology
  - Look for CIV to IVC thrombus extension
  - Detect other conditions / abdomino-pelvic masses / occult malignancy
- CT pulmonary angiogram
  - 30-66% have silent PE especially in proximal DVT
  - Detect occult malignancy

6



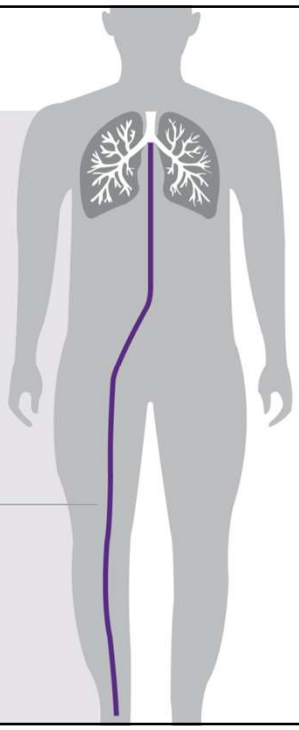
7

Indications for Acute Iliofemoral DVT Intervention

- Acute iliofemoral / iliocaval DVT <= 2 weeks
- Low risk of bleeding
- Acute limb threatening circulatory compromise
  - (phlegmasia, venous gangrene)
- Moderate to severe symptoms of pain + swelling
- Good functional/ambulatory status
- No persistent provoked DVT risk factor

8

Outcomes after Deep Vein Thrombosis (DVT)



Up to **50%**	expected to develop **Post-thrombotic Syndrome (PTS)**[1]
~**90%**	**of PTS patients are unable to work** 10 years after diagnosis[2]
>**10%**	**of PTS patients develop venous leg ulcers.**[3] Patients w/ severe PTS have QoL comparable to congestive heart failure or cancer[4]

1. Kahn, Susan R. The post-thrombotic syndrome. Hematology Am Soc Hematol Educ Program. 2016 Dec 2; 2016(1): 413–418
2. Kahn, et al. Relationship between deep venous thrombosis and the postthrombotic syndrome. Arch Intern Med. 2004;164:17-26
3. Galanaud, et al. Predictors of Post-Thrombotic Ulcer after Acute DVT: The RIETE Registry. Thromb Haemost 2018; 118(02): 320-328
4. Kahn, et al. Determinants of health-related quality of life during the 2 years following deep vein thrombosis. Journal of Thrombosis and Haemostasis, 6: 1105-1112.

9

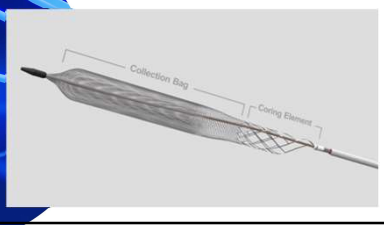
Goals of DVT intervention

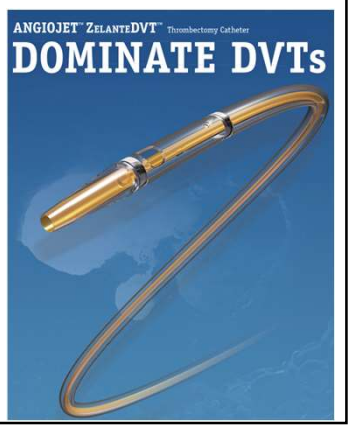
- Physiological
  - Reduce swelling
  - Restore venous outflow
  - Remove thrombus
  - Address underlying compression
- Clinical Outcomes
  - Improve mortality (reduce risk of PE)
  - Improve quality of life
  - Faster recovery
  - Reduce adverse outcomes (PTS, Recurrence, PE, phlegmasia, CVI)

10

Endovascular Interventions

- Pharmacomechanical thrombolysis/thrombectomy: Boston Scientific Angiojet Zelante DVT catheter
- Aspiration thrombectomy: Penumbra Indigo Lightning ± Flash (Computer Assisted Vacuum Thrombectomy)
- Mechanical thrombectomy: Inari Medical ClotTriever
- Manage risk of pulmonary embolism
  - IVC filter?
- Intravascular Ultrasound to guide stent placement





11

Case of ANGIOJET THROMBOLYSIS/THROMBECTOMY

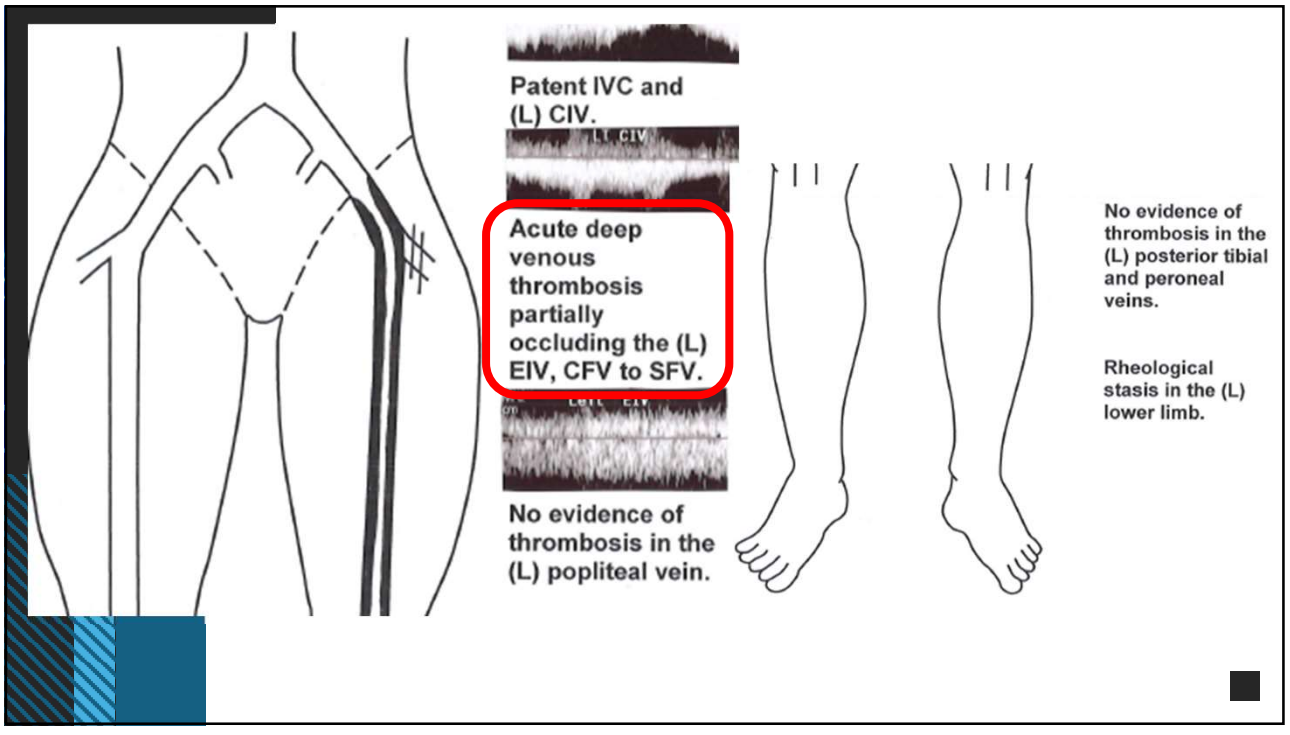
16

Clinical Case

- 70 Female
- PMH
  - IHD on clopidogrel
  - Hypertension
  - Hyperlipidaemia

  - Stopped clopidogrel in preparation for colonoscopy
  - Severe left hip to LL pain + swelling x 2 days

17



18

Operative Steps

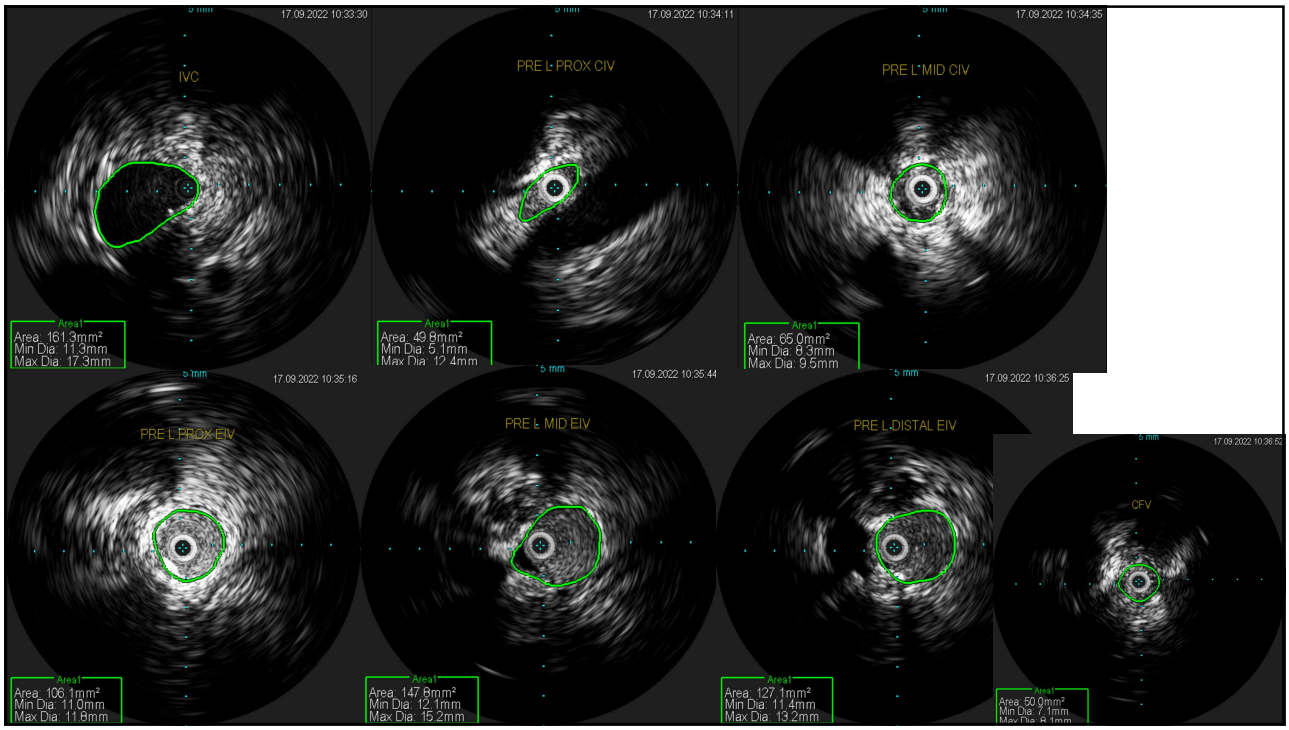
- GA Supine
- Left ankle PTV USG micropuncture
  - 5Fr sheath
  - 6Fr sheath if need to Angiojet Pop to PTV
- Cross from PTV to CIV lesion to IVC
  - 4Fr BER2 / CXI catheter
  - Terumo 0.035" glidewire
  - Amplatz/Supracore 0.035" wire

19

Operative Steps

- Right CFV USG puncture
  - 6Fr sheath
  - Preclose Proglide
  - IVC sheath + filter insertion e.g. Bard Denali
- Left thigh FV puncture
  - 5Fr sheath (look for Suprawire)
  - Preclose Proglide
  - 9-10Fr sheath
- IVUS

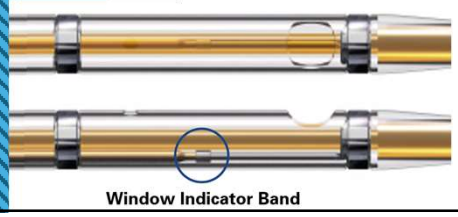
20

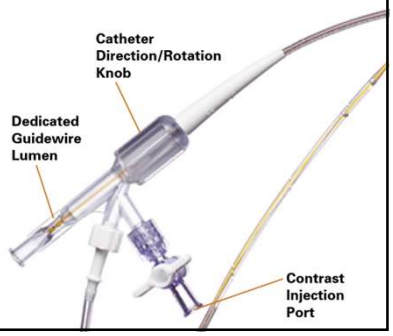


21

Operative Steps

- PowerPulse Thrombolysis using Angiojet ZelanteDVT
  - 2 passes minimum – remember to change the catheter facing
  - Dwell time 15-20 minutes
- Rheolytic thrombectomy
  - 240 seconds run time with b
  - 480 total run time

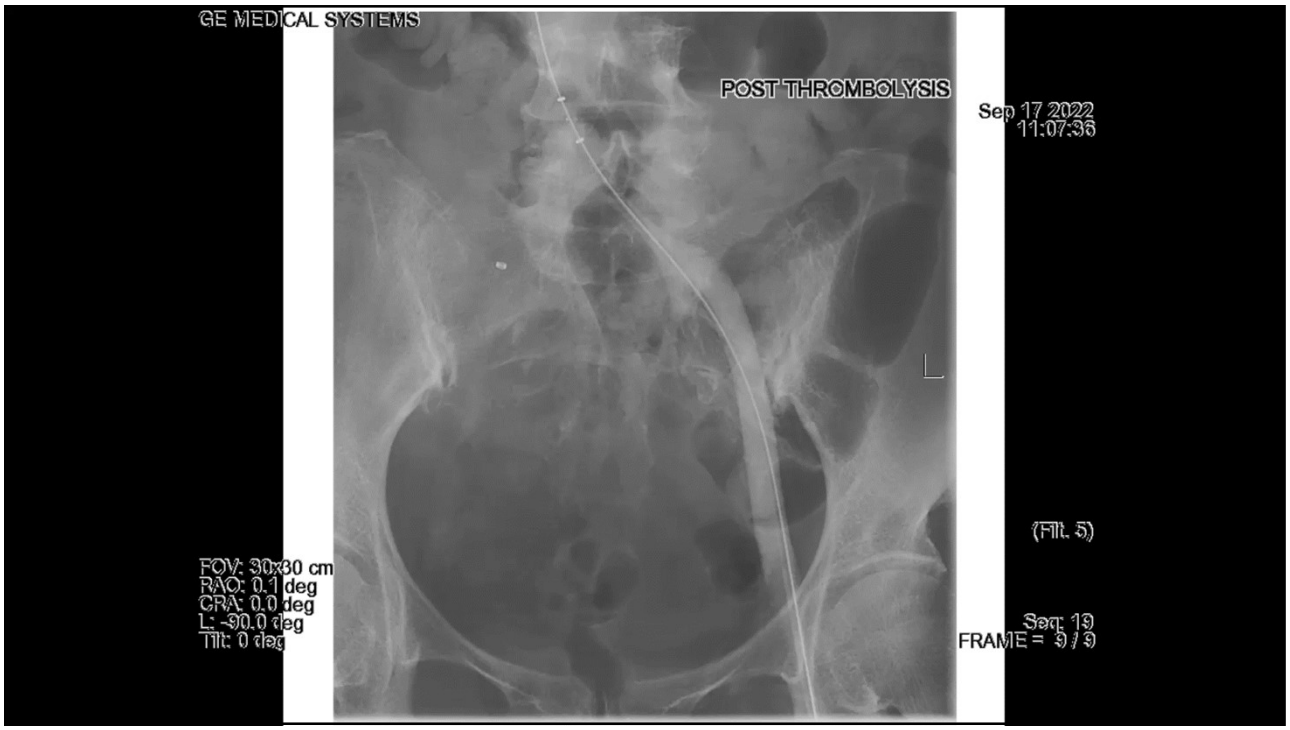




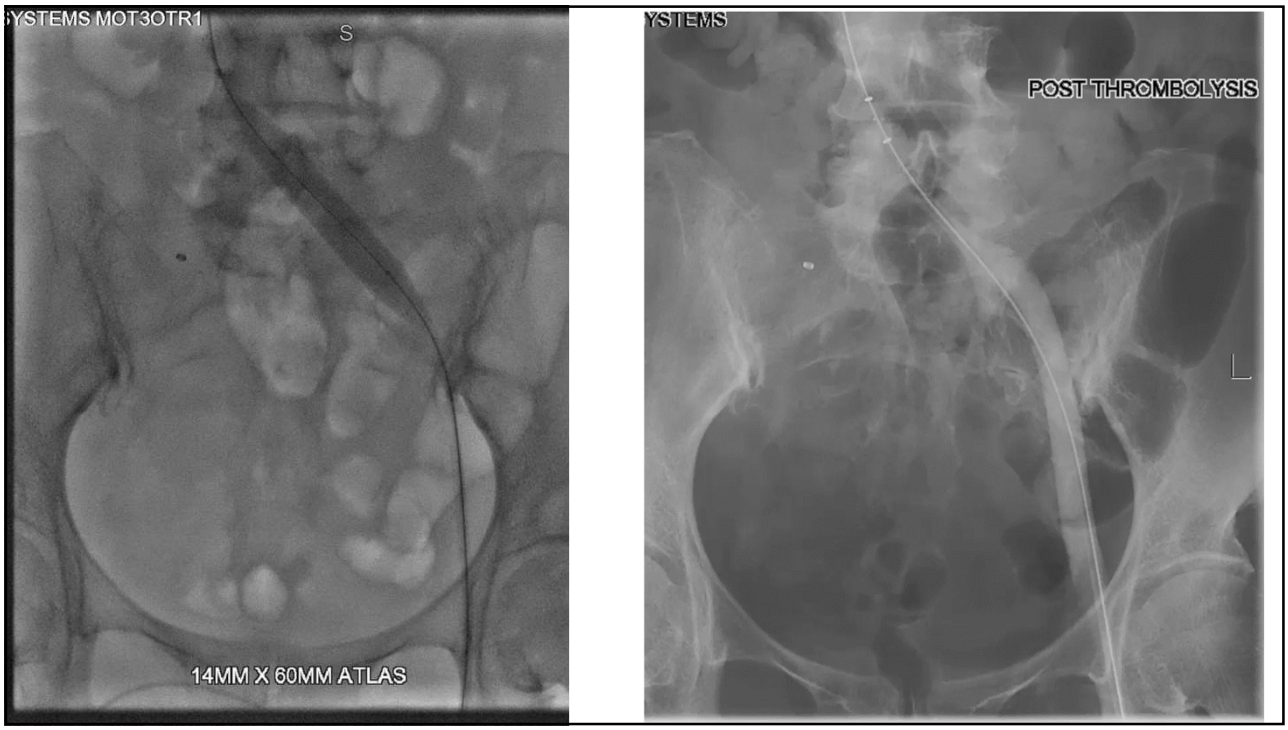
22


GE MEDICAL SYSTEMS
Fluoro Loop
Sep 17 2022
10:43:15
L
FOV: 30x30 cm
RAO: 0.1 deg
CRA: 0.0 deg
L: -90.0 deg
Tilt: 0 deg
Seq: 13
FRAME = 21 / 25

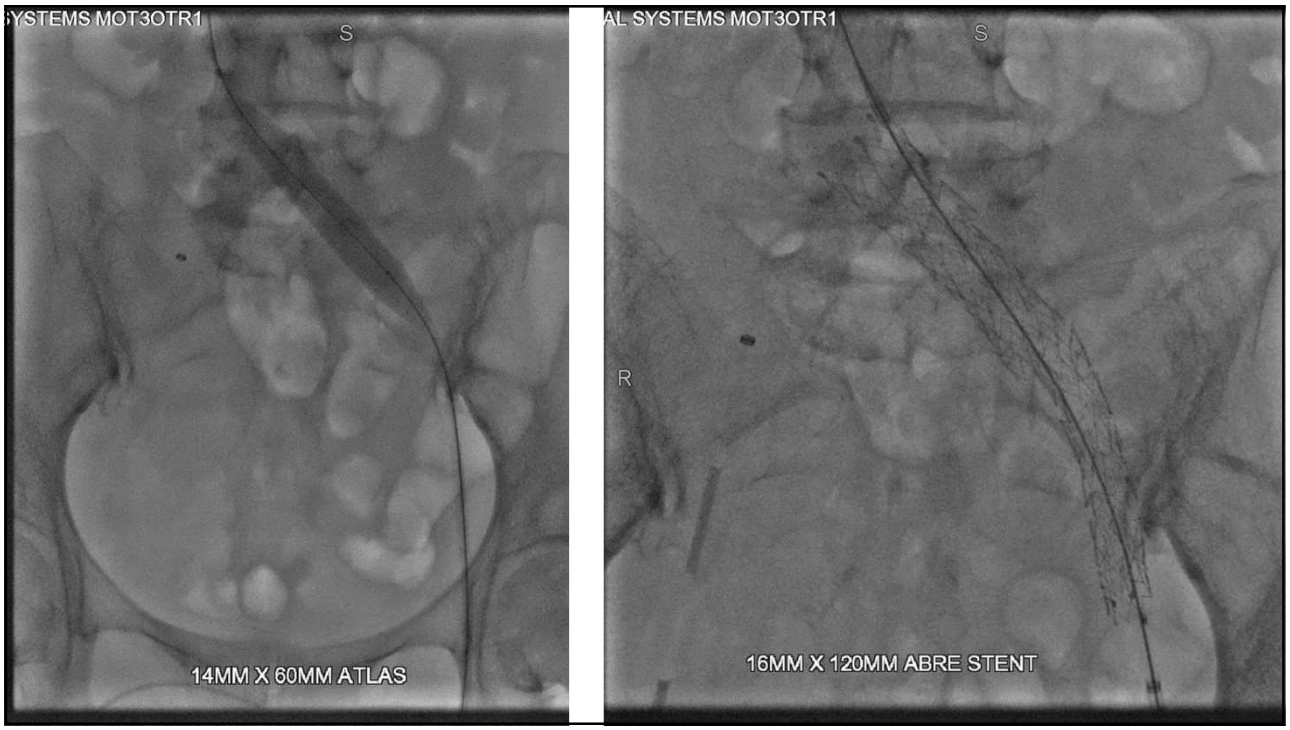
23


GE MEDICAL SYSTEMS
POST THROMBOLYSIS
Sep 17 2022
11:07:36
L
(Filt. 5)
FOV: 30x30 cm
RAO: 0.1 deg
CRA: 0.0 deg
L: -90.0 deg
Tilt: 0 deg
Seq: 19
FRAME = 9 / 9

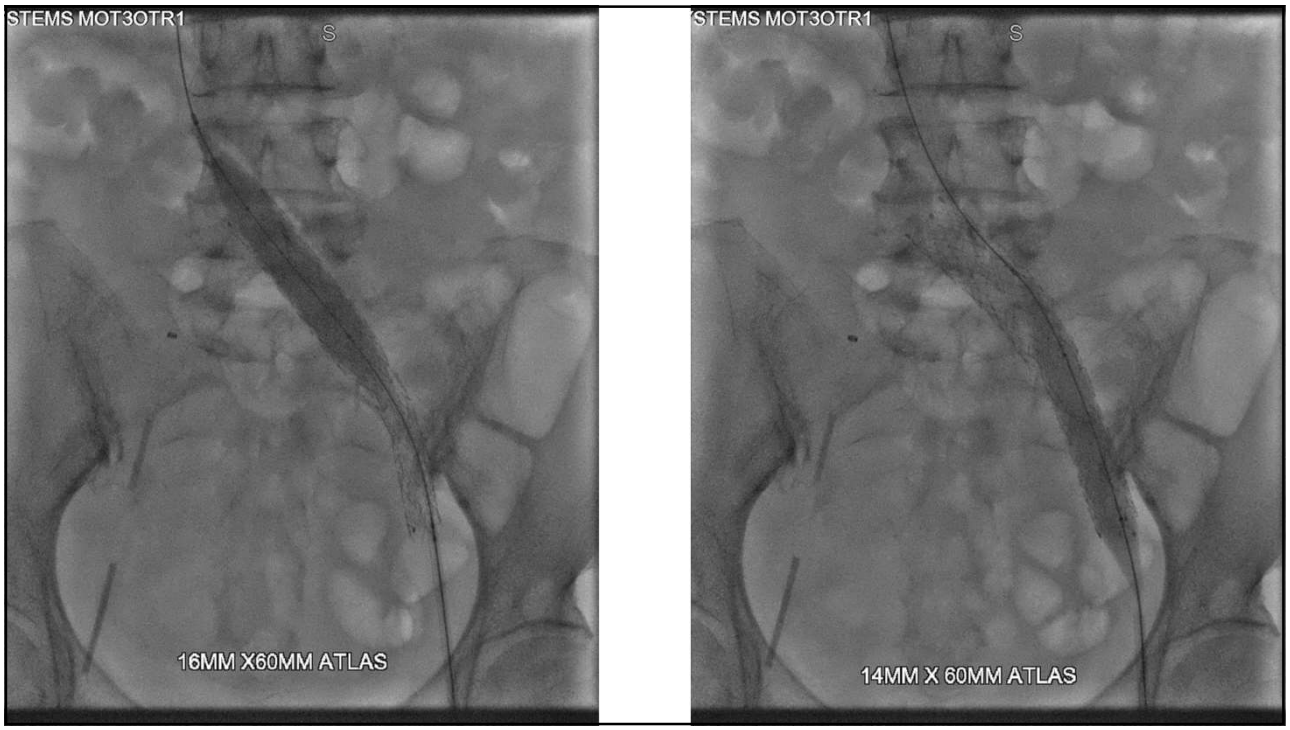
24


SYSTEMS MOT3OTR1
S
14MM X 60MM ATLAS
YSTEMS
POST THROMBOLYSIS
L

25


SYSTEMS MOT3OTR1
S
14MM X 60MM ATLAS
AL SYSTEMS MOT3OTR1
S
R
16MM X 120MM ABRE STENT

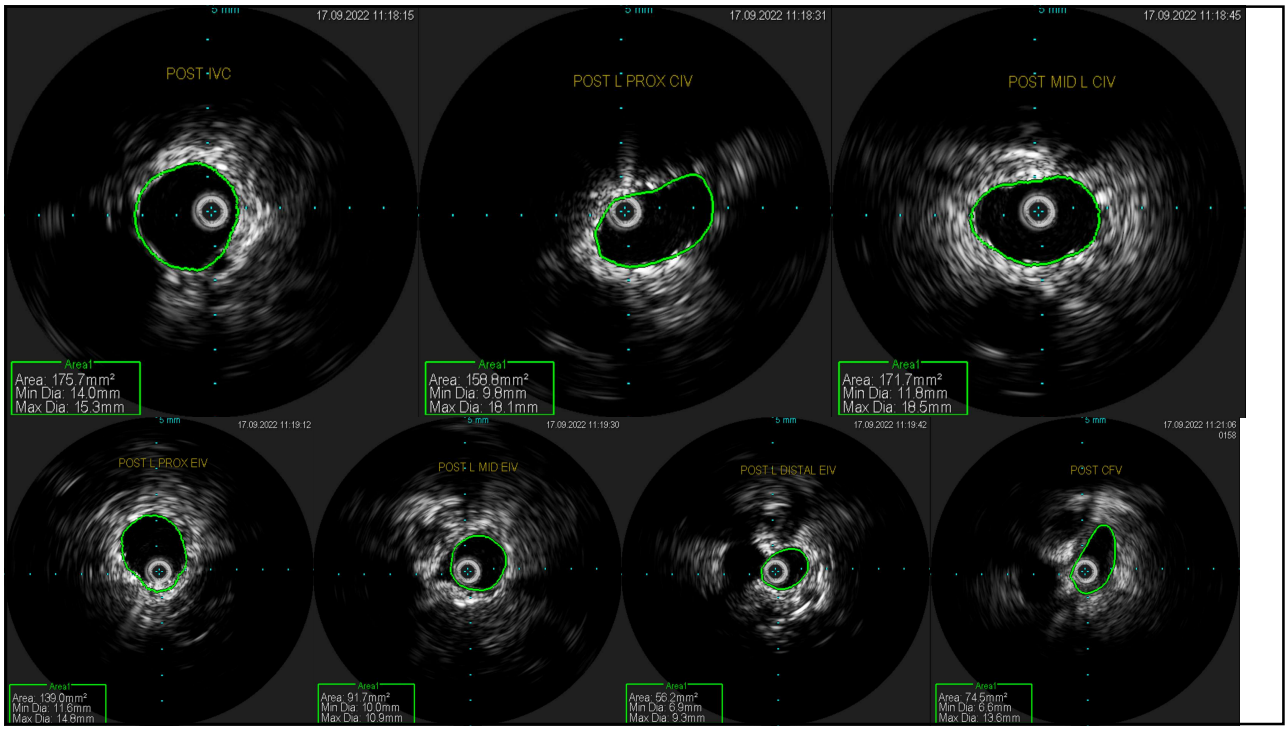
26


STEMS MOT3OTR1
S
16MM X60MM ATLAS
STEMS MOT3OTR1
S
14MM X 60MM ATLAS

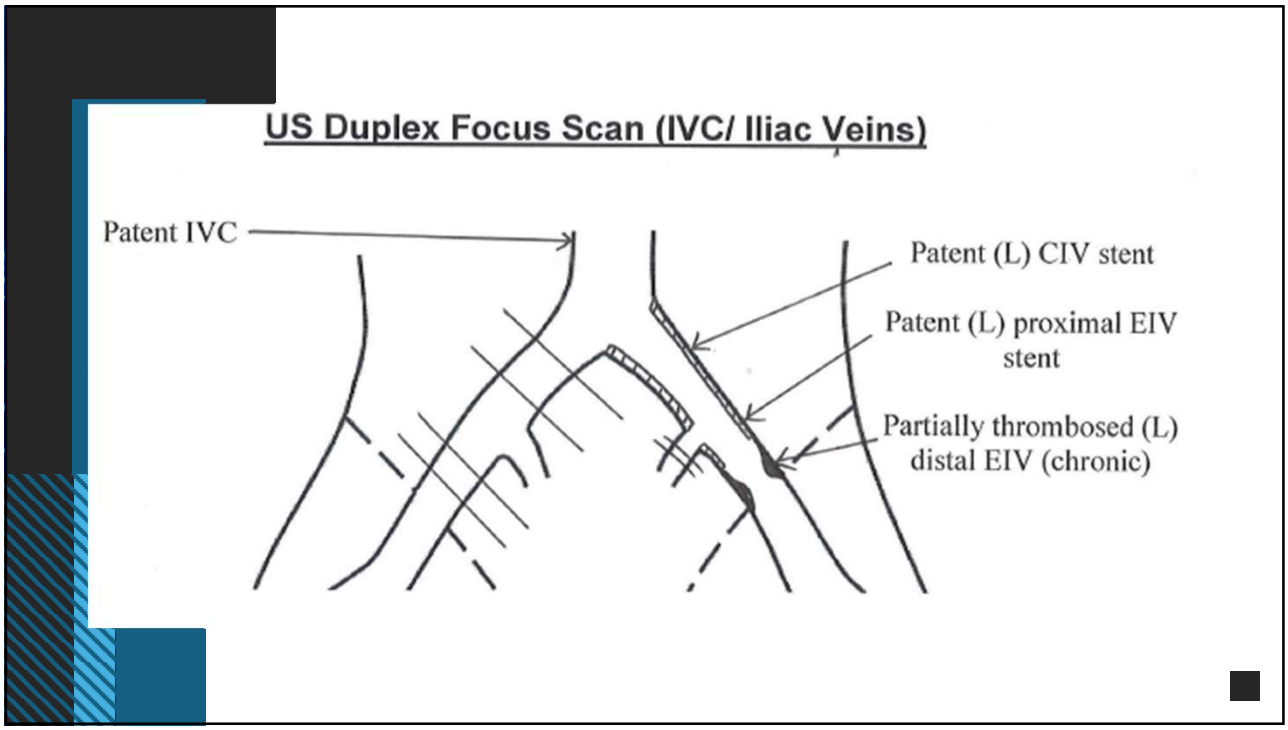
27


POST THROMBOLYSIS
Sep 17 2022
11:07:36
L
(Fil. 5)
FOV: 30x30 cm
RAO: 0.1 deg
CRA: 0.0 deg
L: -90.0 deg
Tilt: 0 deg
Ser: 19
FRAME = 9 / 9

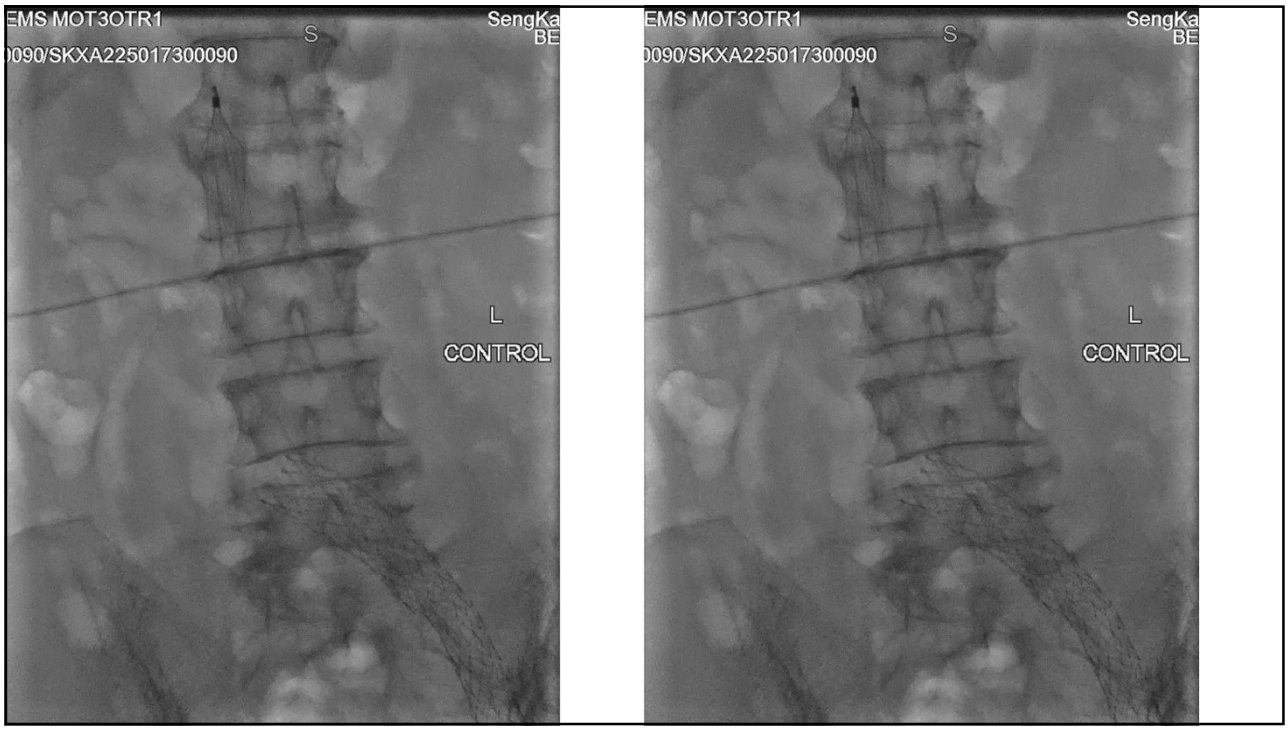
28


POST IVC
Area: 175.7mm²
Min Dia: 14.0mm
Max Dia: 15.3mm
POST L PROX CIV
Area: 158.8mm²
Min Dia: 9.8mm
Max Dia: 18.1mm
POST MID L CIV
Area: 171.7mm²
Min Dia: 11.8mm
Max Dia: 18.5mm
POST L PROX EIV
Area: 139.0mm²
Min Dia: 11.6mm
Max Dia: 14.8mm
POST L MID EIV
Area: 91.7mm²
Min Dia: 10.0mm
Max Dia: 10.9mm
POST L DISTAL EIV
Area: 58.2mm²
Min Dia: 6.9mm
Max Dia: 9.3mm
POST CFV
Area: 74.5mm²
Min Dia: 6.6mm
Max Dia: 13.6mm

29


US Duplex Focus Scan (IVC/ Iliac Veins)
Patent IVC
Patent (L) CIV stent
Patent (L) proximal EIV stent
Partially thrombosed (L) distal EIV (chronic)

30



31

Postoperative Day 0 + 1

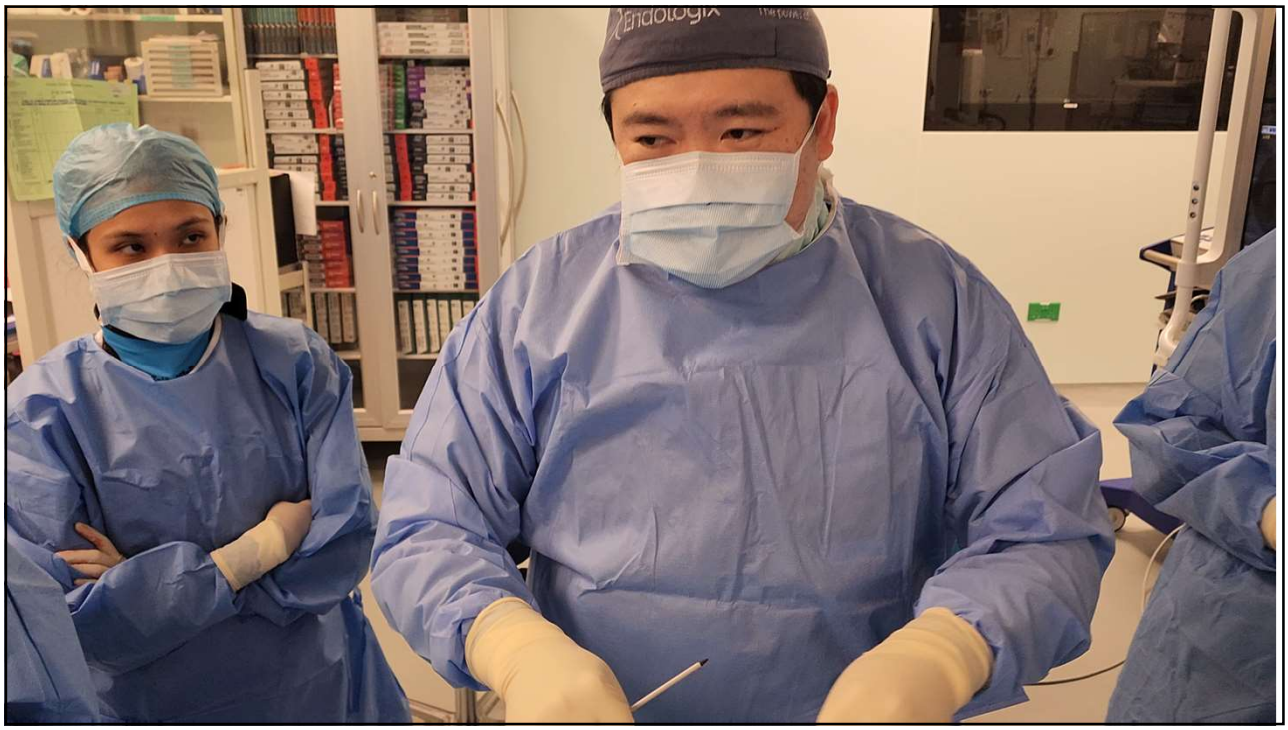
- Compression bandaging of affected leg
- Calf compressors over compression bandaging
- IV hydration 2-2.5L/day
- Warn staff of urine appearing dark reddish brown due to haemolysis / haemoglobinuria
- DOAC postop

32

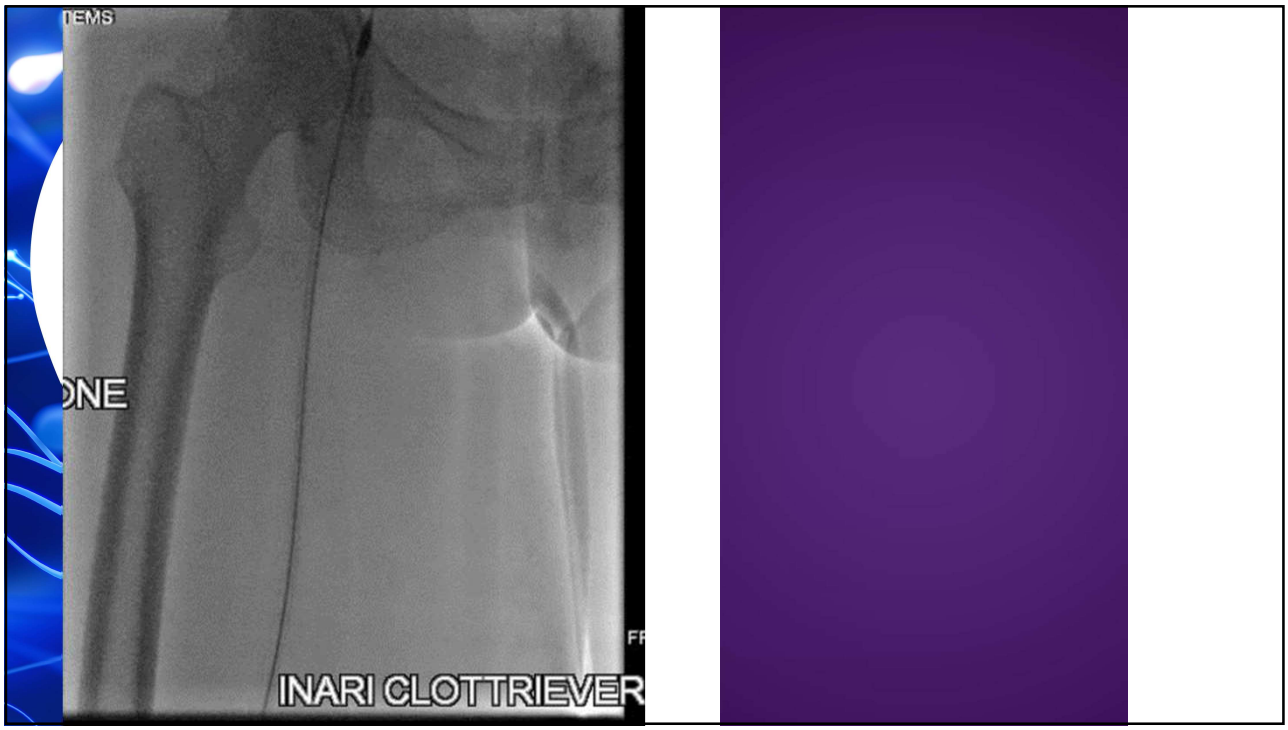
MECHANICAL THROMBECTOMY

34

35



36



37

38

Postoperative

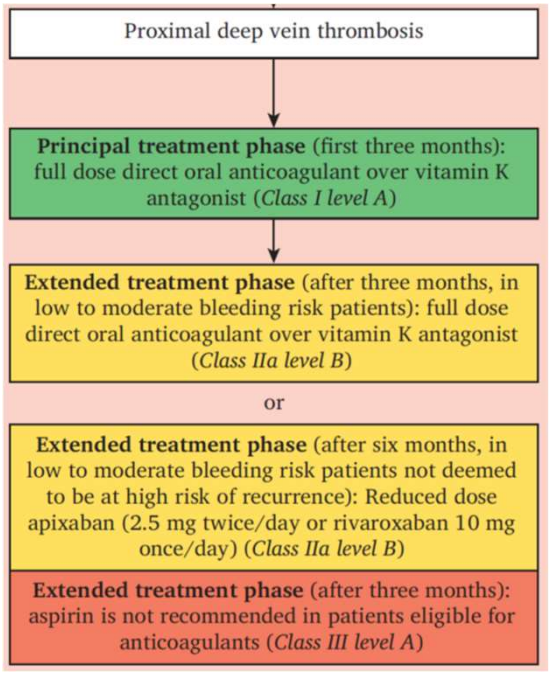
- Ultrasound surveillance of iliac vein stent (ESVS 2022 Guidelines)
  - POD1 as baseline
  - 2 weeks → 6 weeks → 3 month → 6 month → Yearly
- Schedule IVC filter retrieval at 1 month mark based

47

Postoperative

- Anticoagulation
  - DOAC 6 months minimum
- Ultrasound surveillance of iliac vein stent (ESVS 2022 Guidelines)
  - POD1 as baseline
  - 2 weeks → 6 weeks → 3 month → 6 month → Yearly

Recommendation 75			
Patients undergoing iliofemoral venous stenting for deep venous disease should be considered for an individualised antithrombotic regimen considering the risk of bleeding associated with more aggressive antithrombotic strategies.			
Class	Level	References	ToE
IIa	C	Notten *et al.* (2021)[427]	



48

FRONTLINE VASCULAR CARE 2025

FARRER PARK HOSPITAL

Question & Answer

COMFORT · FAIRNESS · VALUE

49

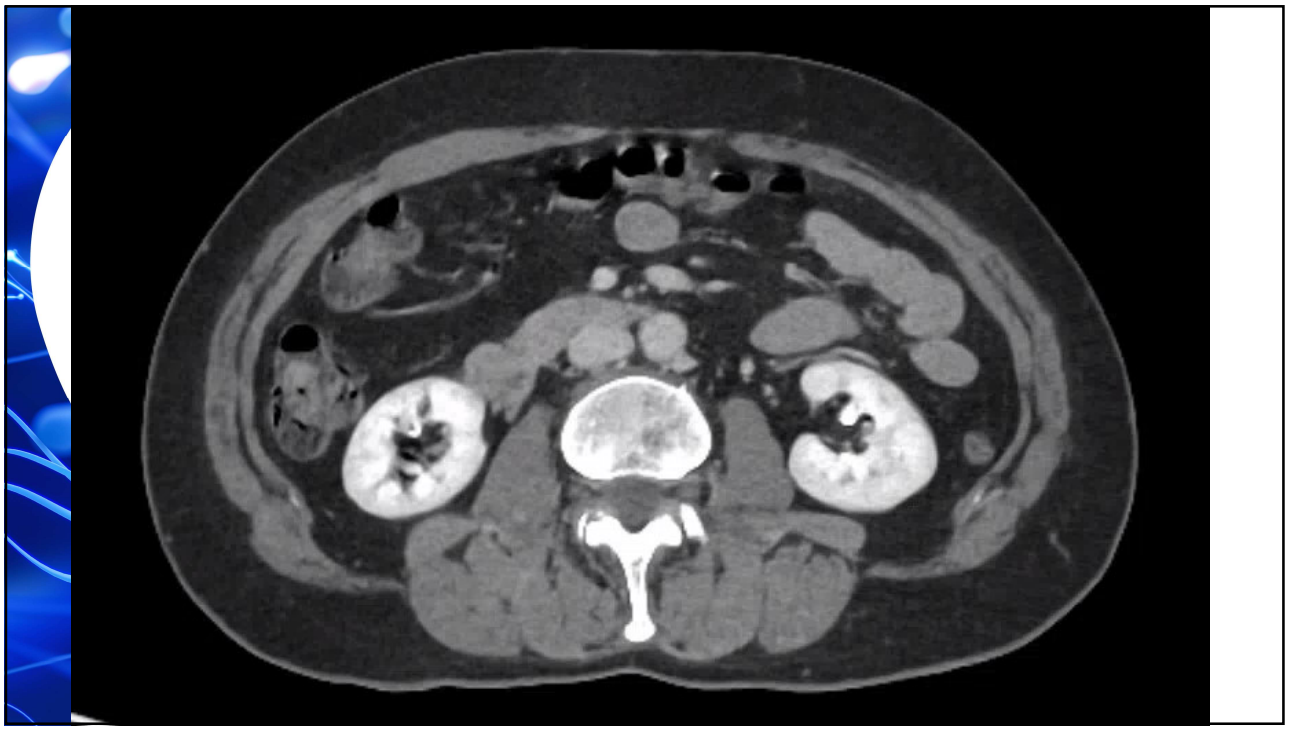
Clinical Case

- 59 Female
- Left LL DVT 15 years ago – warfarin anticoagulation
- Left lower limb chronic venous insufficiency C6
- S/P Left iliac vein bare metal stenting 3 years ago
- S/P Left lower limb Venaseal ablation 1 year ago

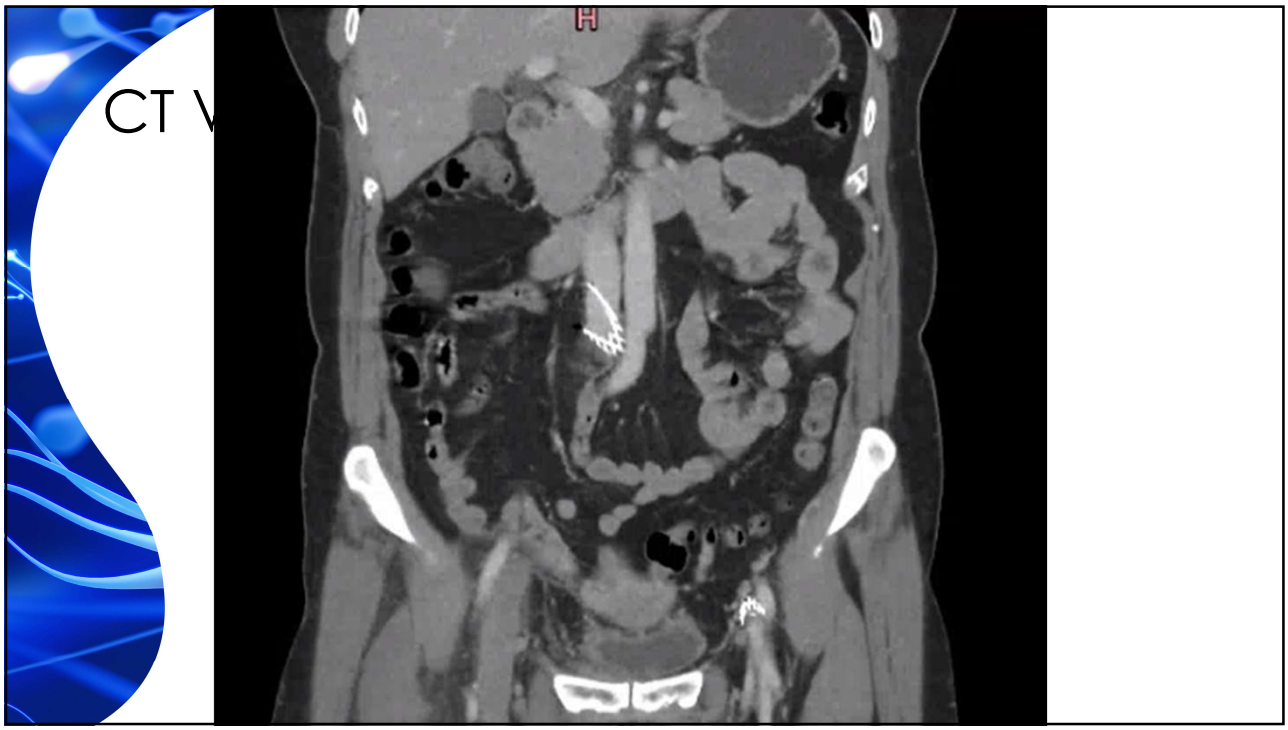
p/w
Right LL pain, swelling, bluish discolouration x 3 days
Left LL chronic venous ulcer x months

Diagnosis:
Right LL phlegmasia cerulea dolens due to acute on chronic iliofemoral DVT
Left LL C6 chronic venous insufficiency due to in-stent restenosis (ISR) or in-stent occlusion (ISO)

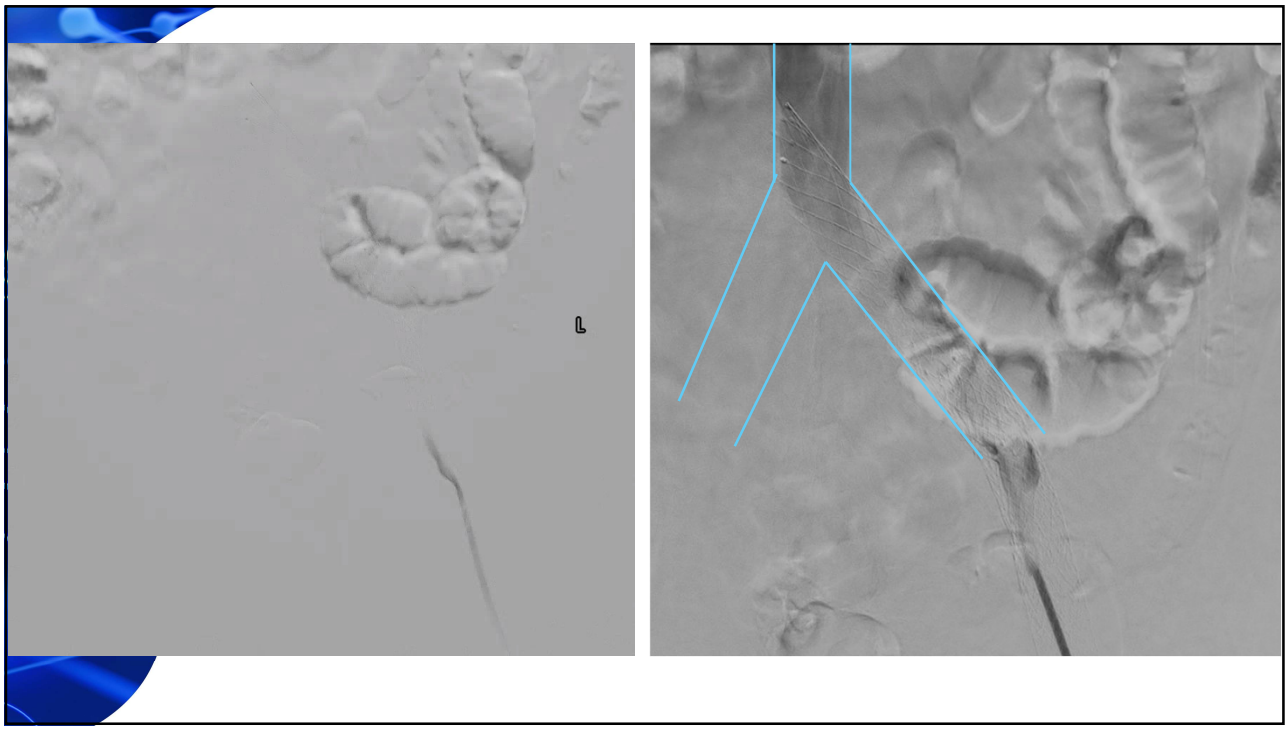
50



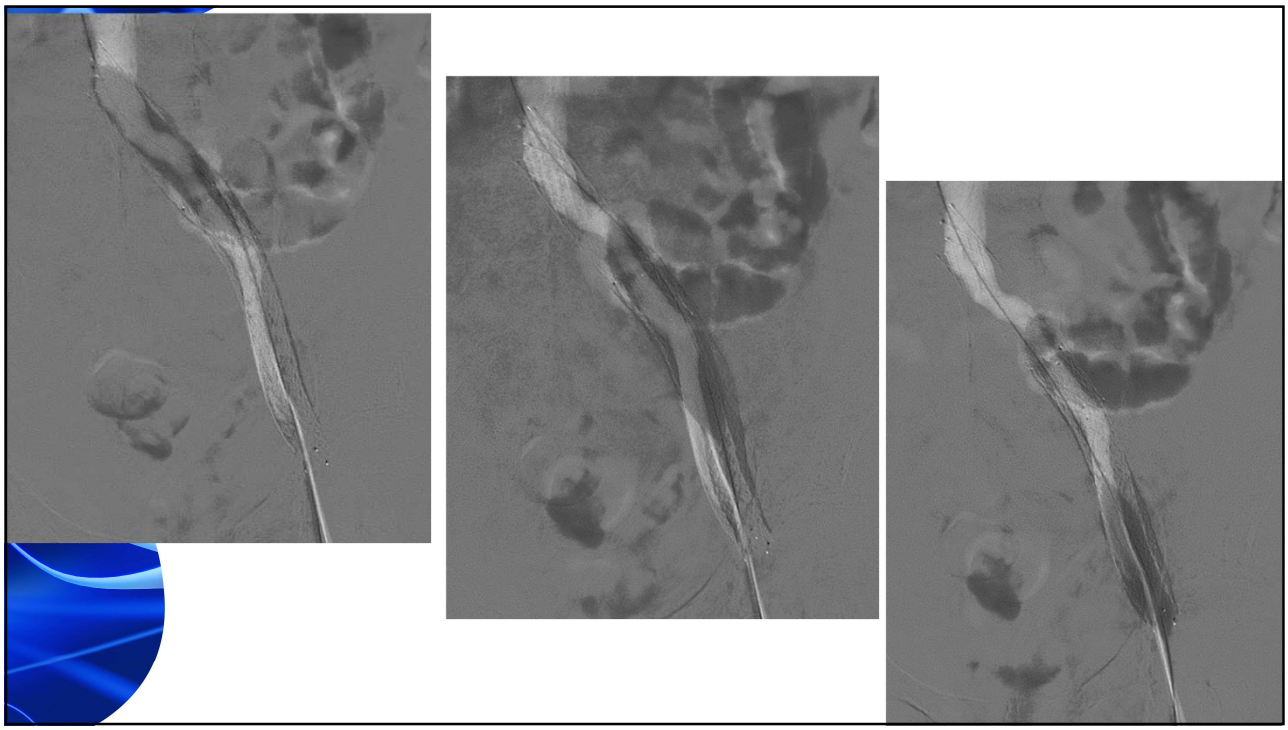
51



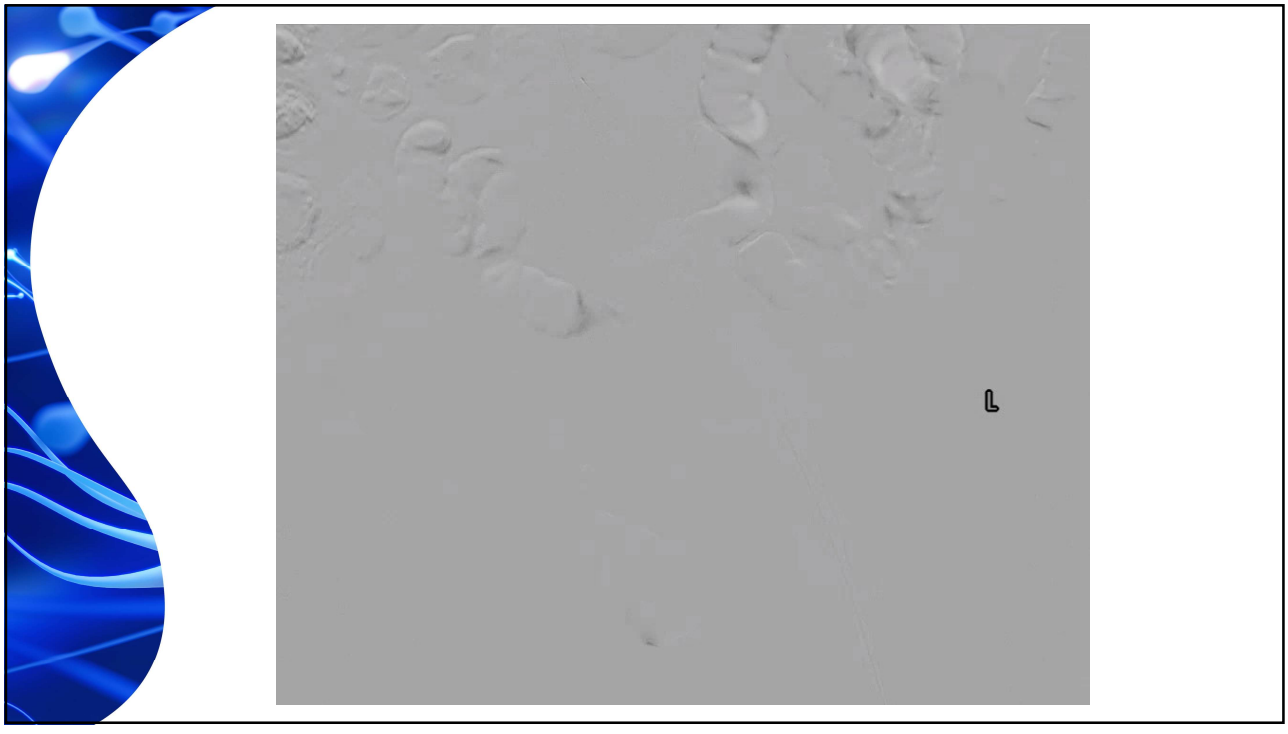
52



53

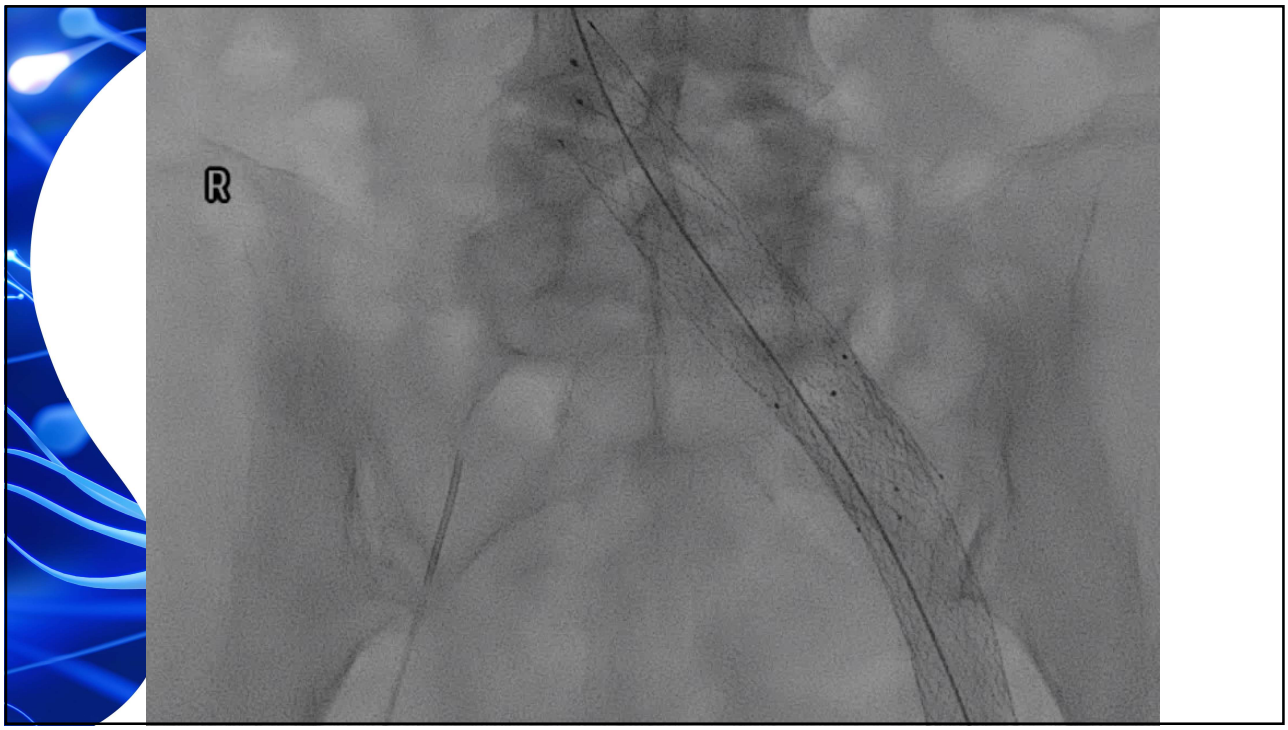


54



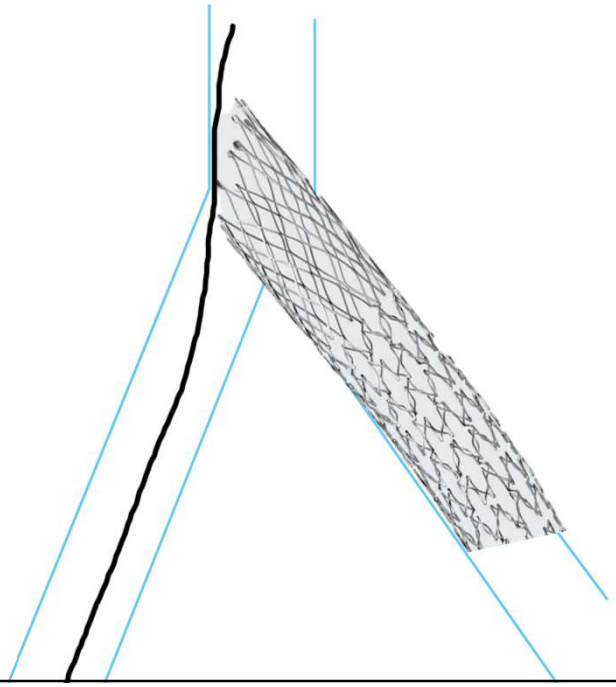
55

56

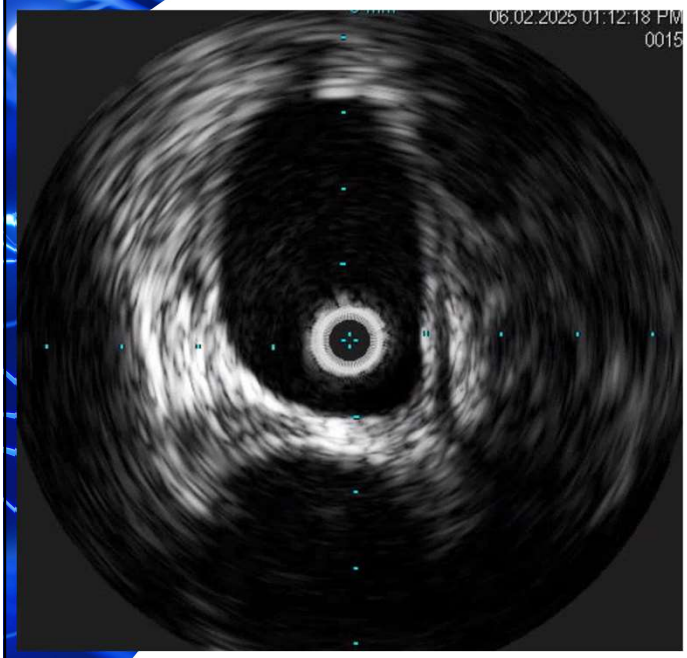


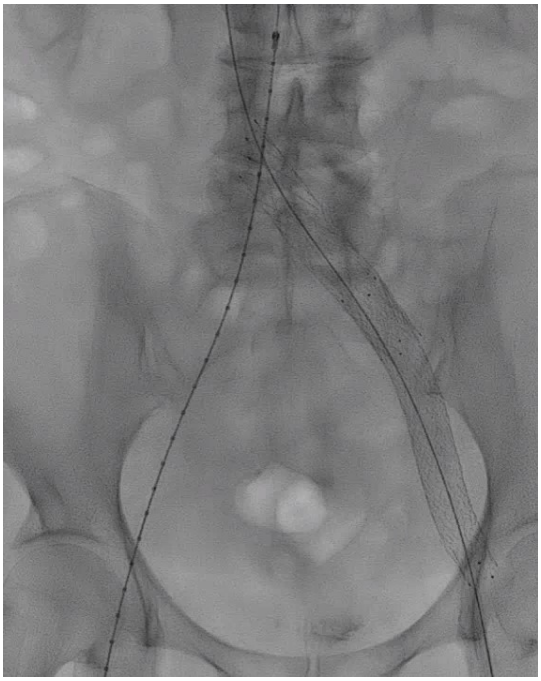
57

- True lumen wrt:
  - IVC
  - Right CIV
- Not through any stent interstices

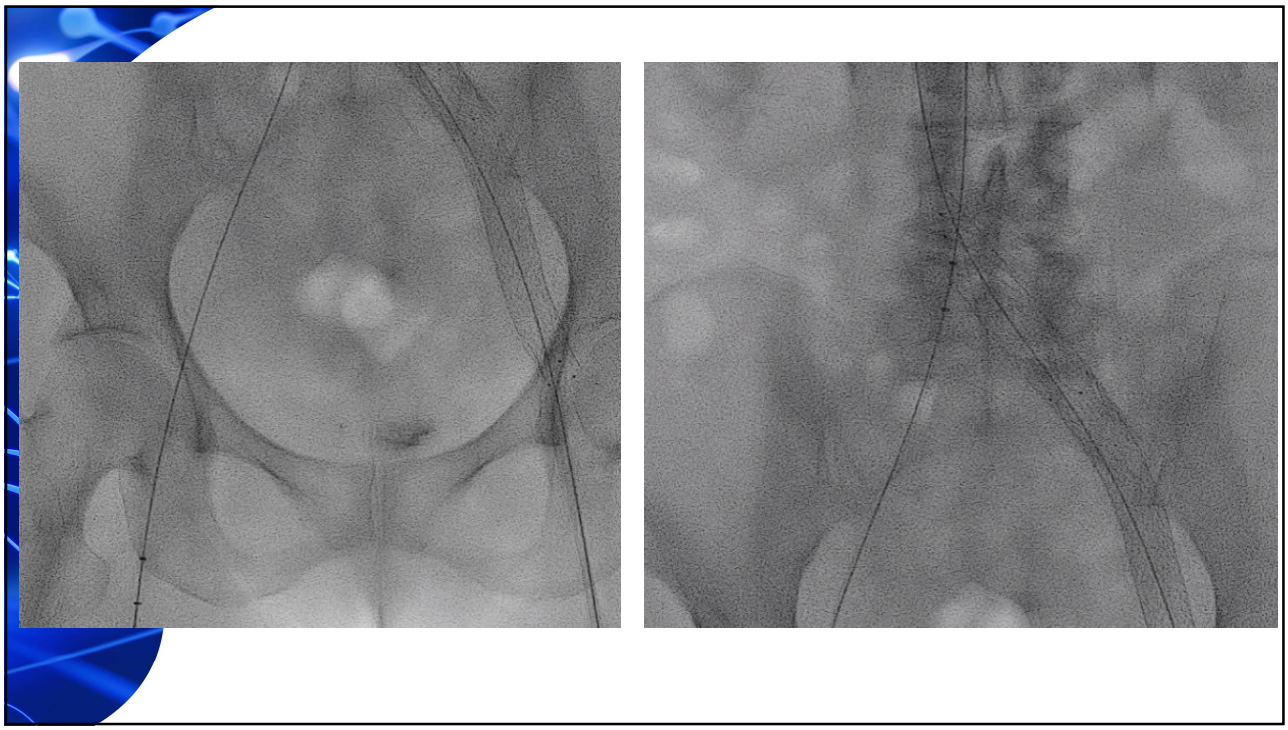


58

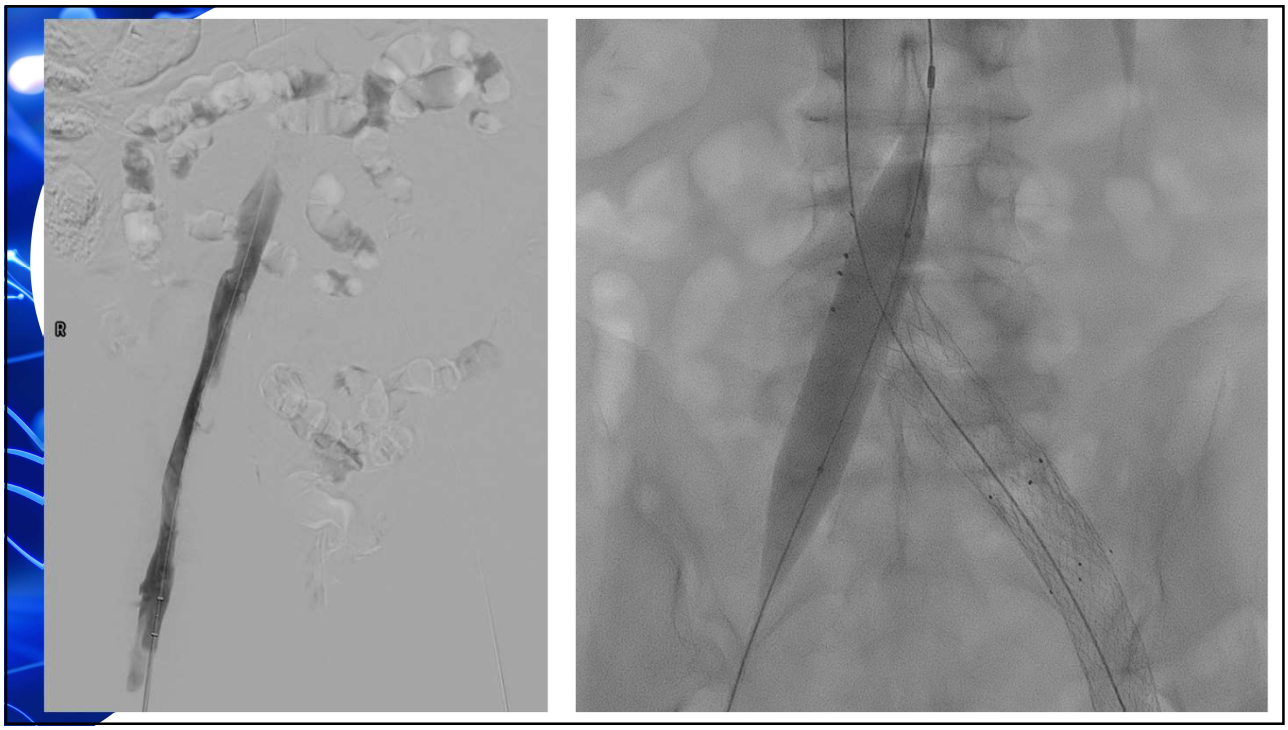




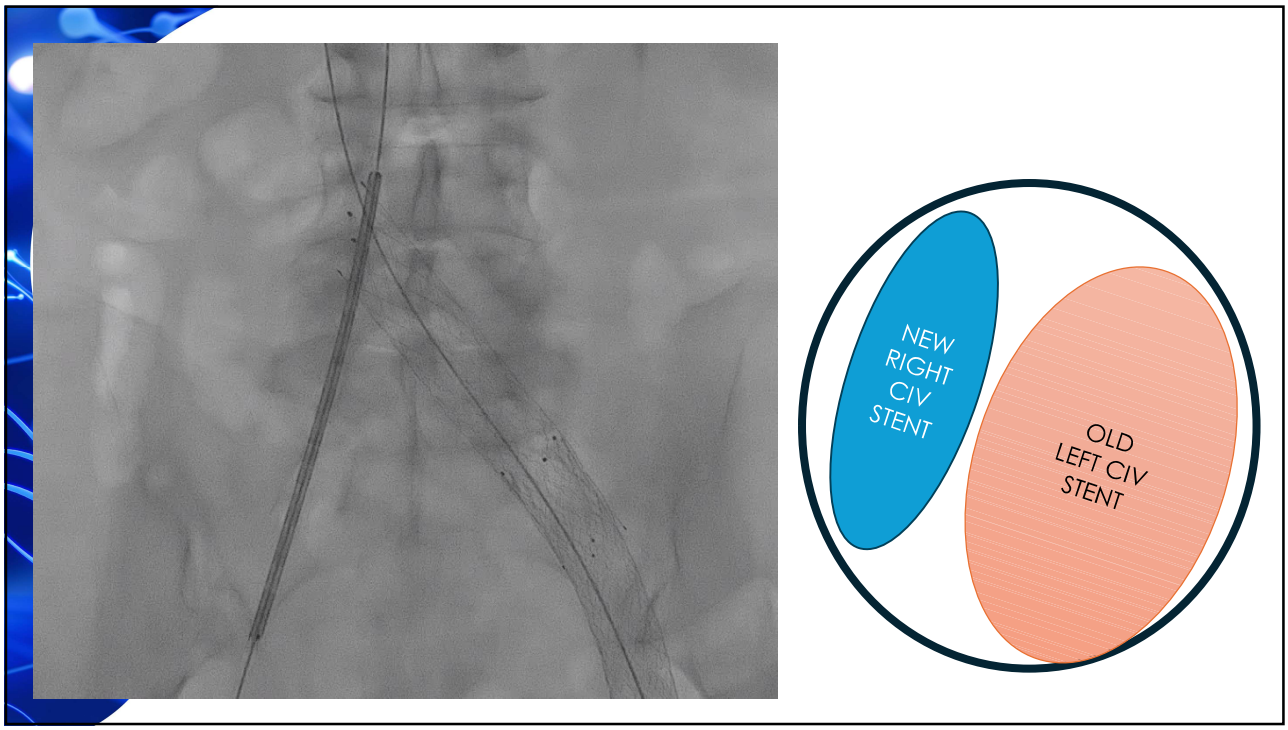
59



60



61


NEW RIGHT CIV STENT
OLD LEFT CIV STENT

62


HANDOUTS ON WEBSITE
https://spectrum-surgery.com
SPECTRUM
Home
About Us
Our Doctor
Our Services
Contact
Blog
Empower your health through tailored vascular surgical precision and care.
LEARN MORE
ABOUT OUR VASCULAR CLINIC
Need Help?
Pioneering innovation and excellence in vascular surgery and general surgery, we are dedicated to providing personalized care, fostering trust, and ensuring comfort throughout each patient's journey.

63