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FRONTLINE

VASCULAR CARE

2026

Deep Vein Thrombosis:
Contemporary Endovascular
Interventions



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COMFORT • FAIRNESS • VALUE

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Background of DVT

- Annual incidence of 1st episode of DVT
 - Western population ~ 50-100 per 100 000
 - Asian population¹ ~ 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%

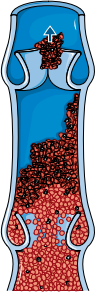
Unprovoked

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.

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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;39(4):150-7. doi: 10.1007/s00268-014-2763-0. PMID: 25180450

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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

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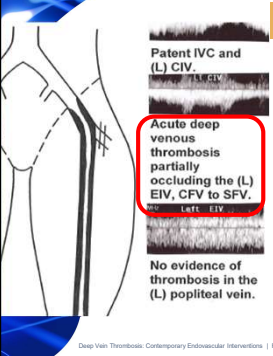


Clinical Presentation

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

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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

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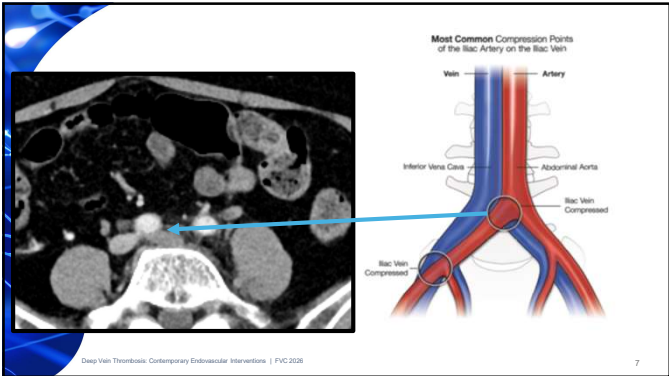
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Indications for Acute Iliofemoral DVT Intervention

- Acute iliofemoral / ilio caval 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

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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 diagnosis²

>10%

of PTS patients develop venous leg ulcers.³

Patients w/ severe PTS have QoL comparable to congestive heart failure or cancer⁴

1. Kahn, Susan R. The post-thrombotic syndrome. Hematology Am Soc Hematol Educ Program. 2018 Dec 2; 2018(12): 413-418.
2. Kahn, et al. Relationship between deep venous thrombosis and the postthrombotic syndrome. Arch Intern Med. 2004;164:17-26.
3. Galanoud, et al. Predictors of Post-Thrombotic Complications after Acute DVT: The REVE Registry. Thromb Haemostasis. 2018; 138(2): 329-338.
4. Kahn, et al. Determinants of health-related quality of life during the 2 years following deep vein thrombosis. Journal of Thrombosis and Haemostasis. 2010; 10:1105-1112.

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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)

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Endovascular Interventions

- Pharmacomechanical thrombolysis/thrombectomy: Boston Scientific Angiojet Zelante DVT catheter
- Ultrasound-assisted thrombolysis: Boston Scientific EkoSonic (EKOS)
- 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

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>70% of clot removed at time of treatment is resistant to lytics (non-fibrin).¹

Time Point	Clot Composition
DAY 3	Fibrin-Rich Matrix ²
DAY 7	~20% Collagen ²
DAY 15	Considered chronic ²
DAY 21	~80% Collagen ²

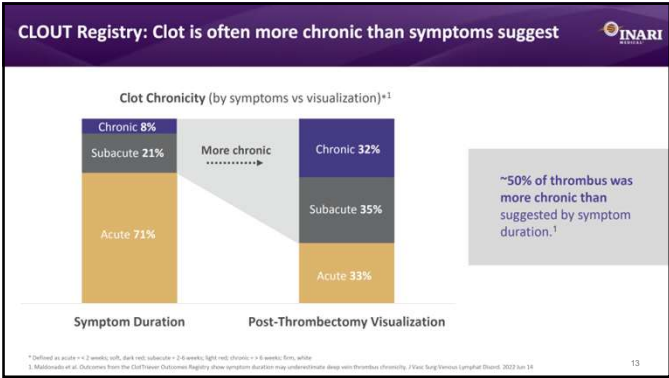
1. Silver, et al. Histopathologic analysis of extracted thrombi from deep venous thrombosis and pulmonary embolism: Mechanisms and timing. Catheter Cardiovasc Interv. 2003 Jun 19;72(142):1429.
2. Caporaso, et al. Can thrombus age guide thrombolytic therapy? Cardiovasc Diagn Ther. 2017 Dec 7;7(4):618-626.

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INTERVENTION FOR COMPRESSION

- Address underlying stenosis/obstruction e.g. May Thurner pathology
 - IVUS
 - Dedicated venous stents (Medtronic ABRE, BD Venovo)
 - Bard Atlas large diameter balloons
- Anticoagulation
 - DOAC

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intervention FOR COMPRESSION

- Ultrasound surveillance of iliac vein stent (ESVS 2022 Guidelines)
 - POD1 as baseline
 - 2 weeks → 6 weeks → 3 month → 6 month → Yearly
- Compression therapy

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Case of ANGIOJET THROMBOLYSIS/THROMBECTOMY

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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

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Patent IVC and (L) CIV.

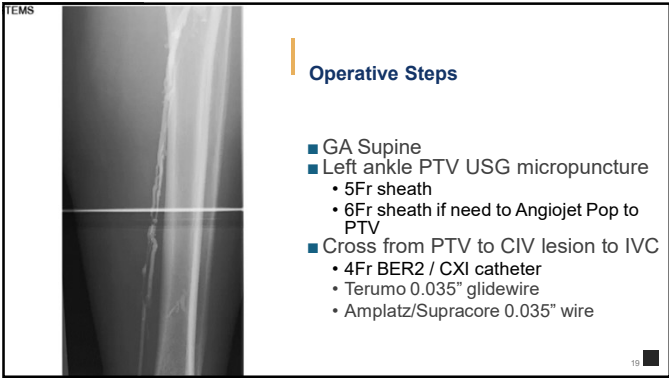
Acute deep venous thrombosis partially occluding the (L) EIV, CFV to SFV.

No evidence of thrombosis in the (L) popliteal vein.

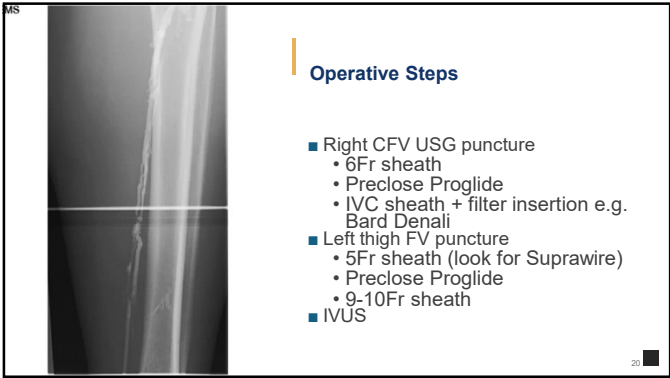
No evidence of thrombosis in the (L) posterior tibial and peroneal veins.

Rheological stasis in the (L) lower limb.

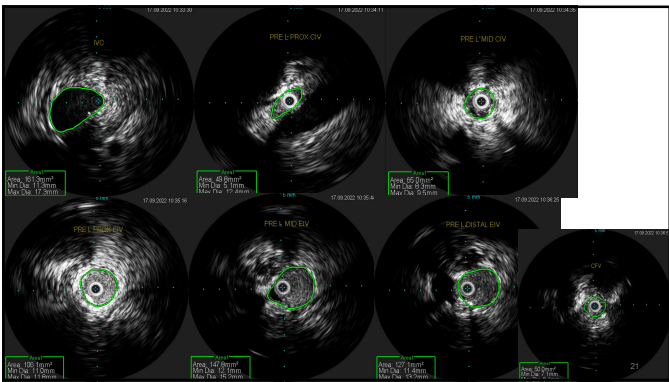
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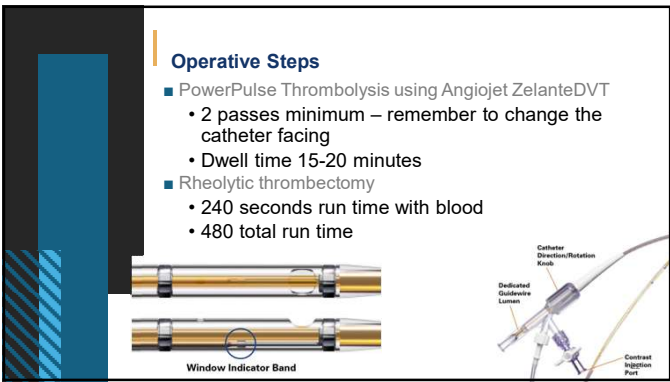
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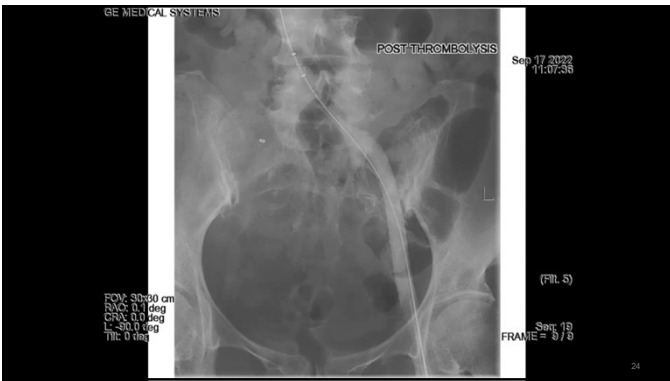
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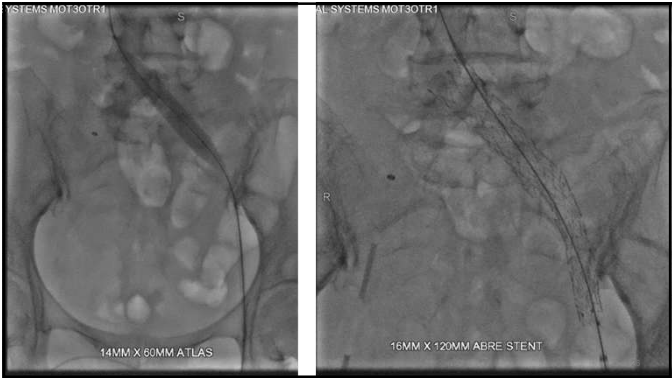
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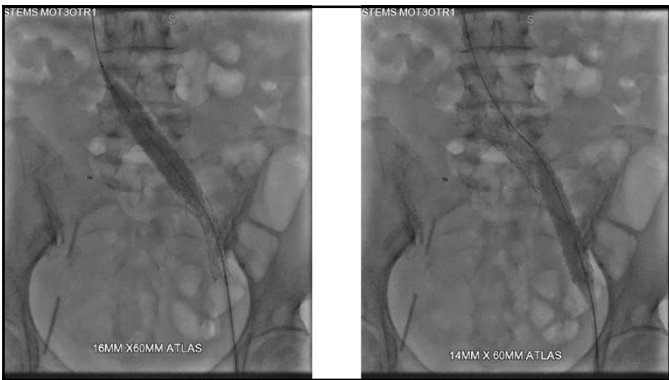
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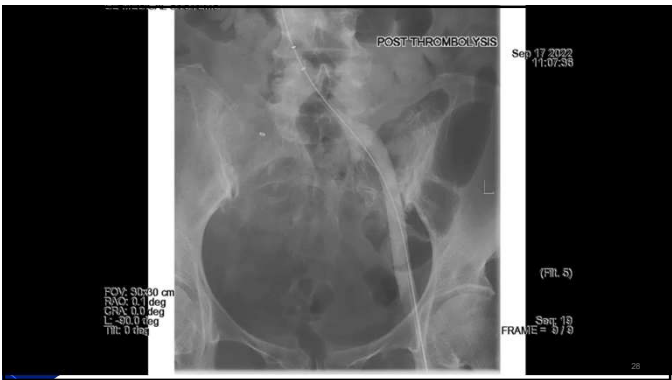
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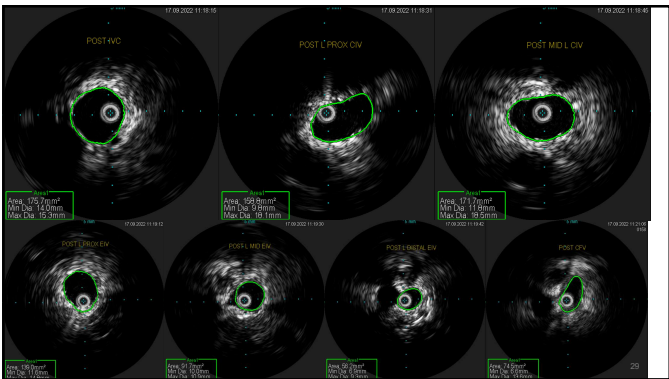
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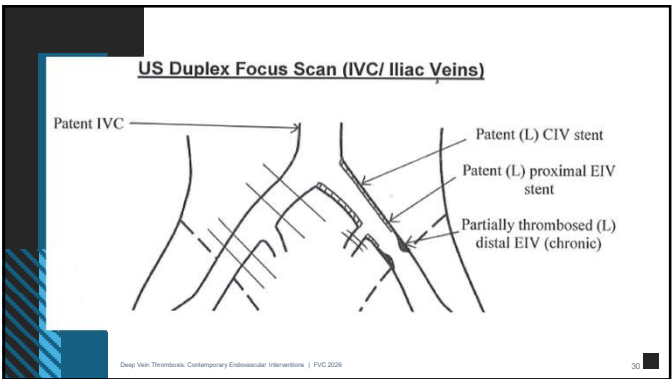
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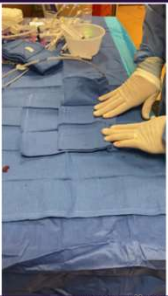


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8. Cleaning: “Romano Roll” Technique



Click to play videos: *roll technique improved with towel wrapped around bag and coring element to remove moisture as seen in video on right*

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EKOS ACOUSTIC PULSE THROMBOLYSIS FOR CHRONIC POST-THROMBOTIC SYNDROME

WHERE THE INTEREST NOW SITS — CHRONIC POST-THROMBOTIC DISEASE

Patients months to years out from an iliofemoral DVT, with established post-thrombotic syndrome and no good options once conservative therapy has failed. This is a different population from acute DVT — and the population studied in ACCESS PTS.

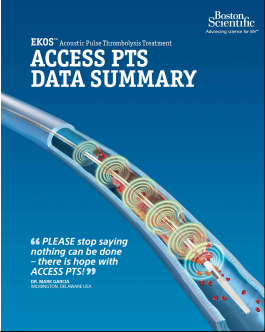
THE TECHNOLOGY

EkoSonic™ catheter with a core wire that emits high-frequency ultrasound during lytic infusion — disaggregates fibrin fibres and drives the thrombolytic deeper into thrombus.

Marketed as Acoustic Pulse Thrombolysis™ (Boston Scientific).

ACCESS PTS DATA SUMMARY

44 PI EASE stop saying nothing can be done - there is hope with ACCESS PTS! ♡



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ACCESS PTS: treating established post-thrombotic syndrome

WHO WAS STUDIED

- Ilio-femoral DVT diagnosed ≥ 6 months previously
- Post-thrombotic syndrome with Villalta score ≥ 8
- Failed ≥ 3 months of conservative therapy

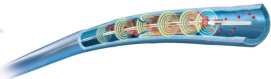
81 enrolled - 78 treated (82 limbs) - 78 patients / 79 limbs in the primary efficacy analysis - 18 centres - single-arm.

THE PROTOCOL

1. Enoxaparin 1 mg/kg BD for 48 h beforehand
2. Cross the chronic occlusion
3. Balloon dilatation to crack hard thrombus and create working space
4. ≥ 12 h ultrasound-assisted lysis, tPA 0.5–1.0 mg/h
5. Adjunctive therapy as needed; enoxaparin to 90 days
6. Patient education — Activity, Blood thinners, Compression

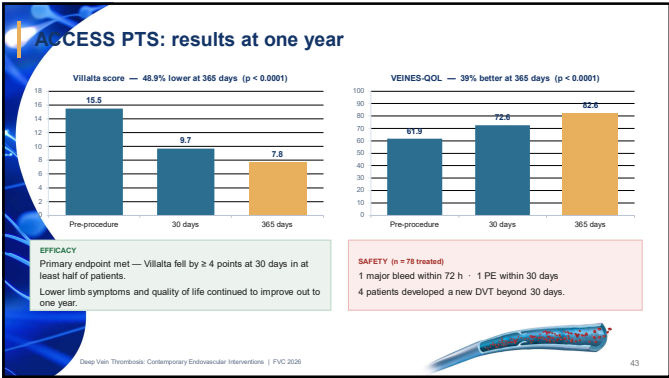
DONE ACTUALLY DELIVERED

Mean tPA 18.5 ± 7.5 mg over a mean of 23 hours of ultrasound therapy — a low total lytic dose for a chronic occlusion.

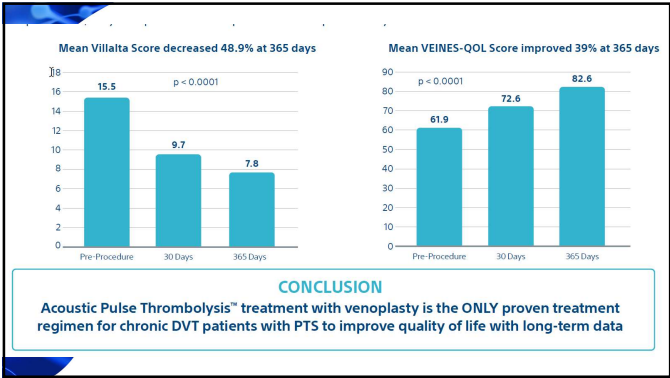


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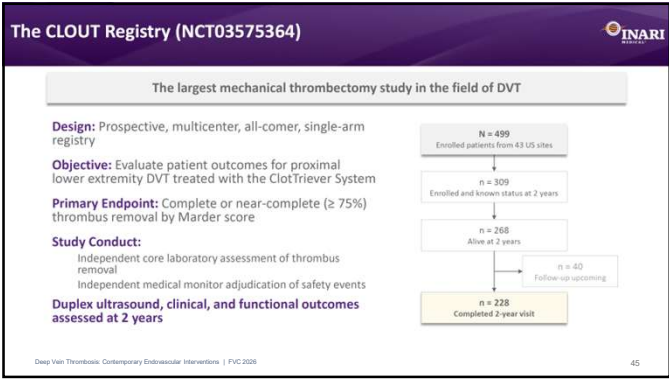
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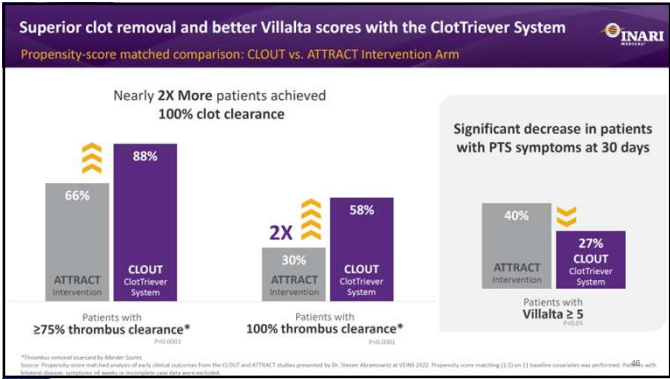
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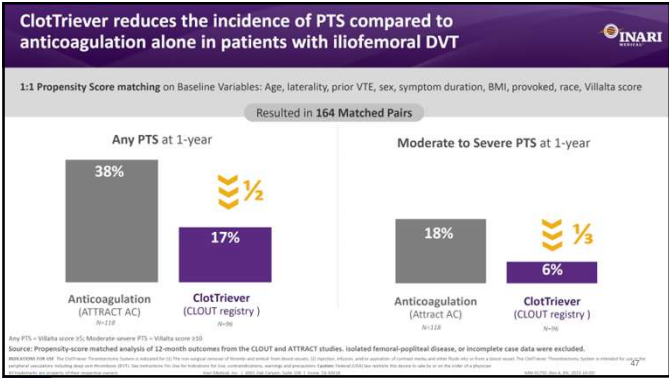
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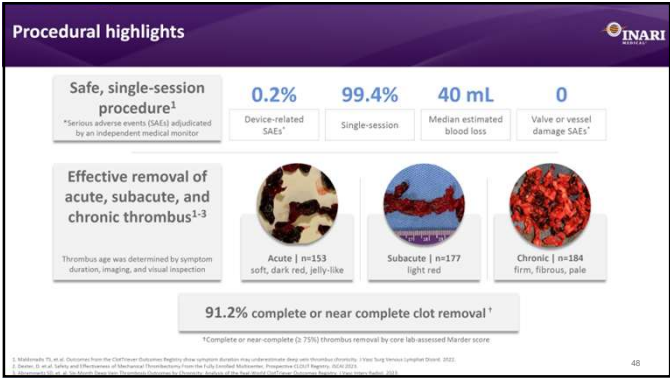
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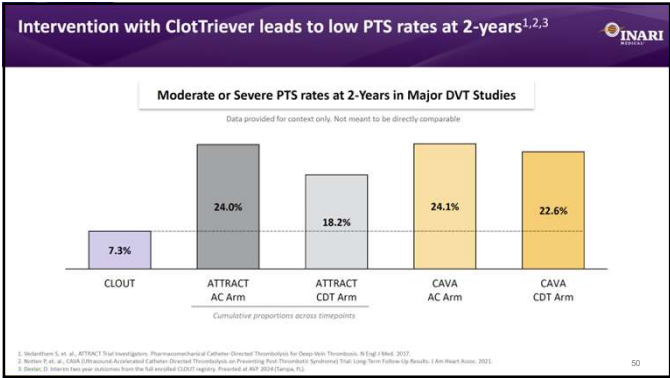
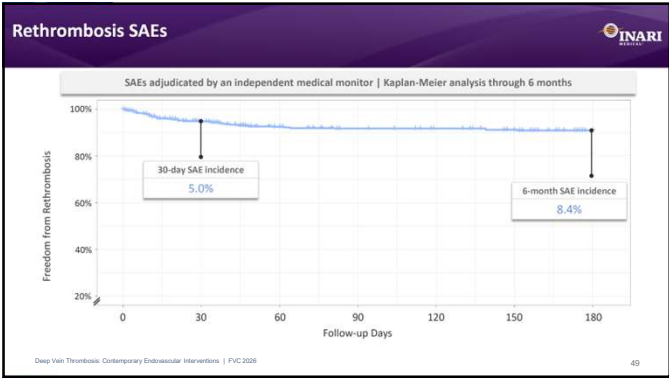
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Postoperative

- 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

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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

Compression therapy

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	Grade
1a	1a	[Notten et al. (2021)]	1a

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Question & Answer

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COMPLEX BILATERAL DEEP VEIN 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

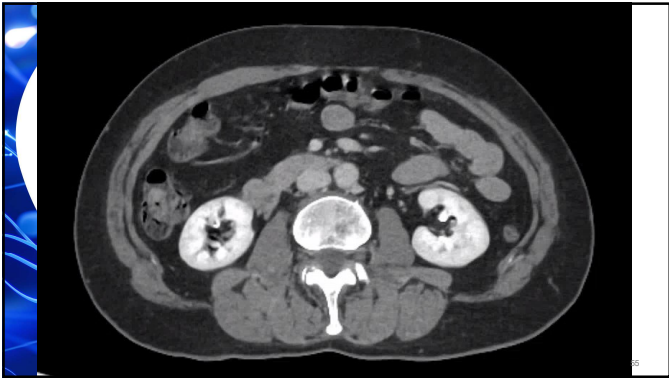
Diagnosis:
Right LL phlegmasia cerulea dolens due to acute on chronic iliofemoral DVT
Left LL C6 chronic venous insufficiency due to in-stent restenosis (ISR) or in-stent occlusion (ISO)

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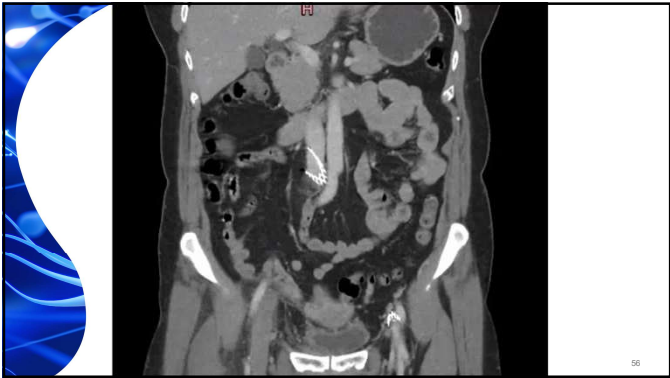
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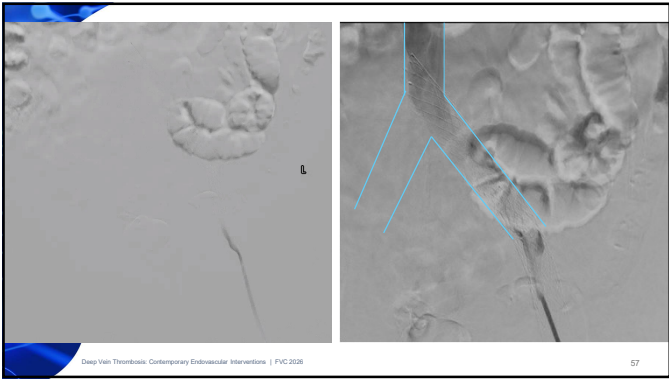
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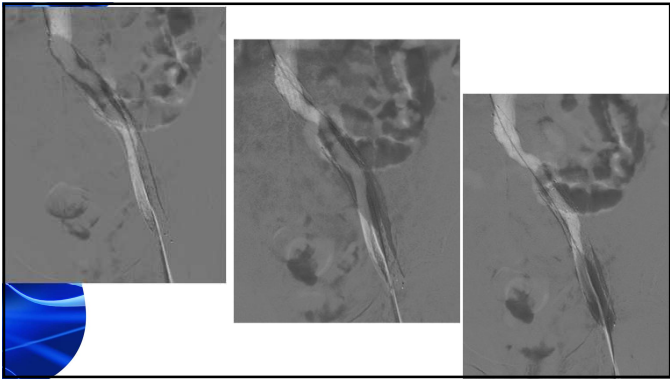
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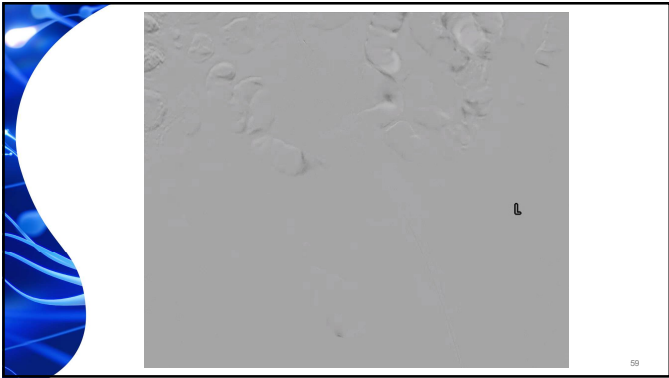
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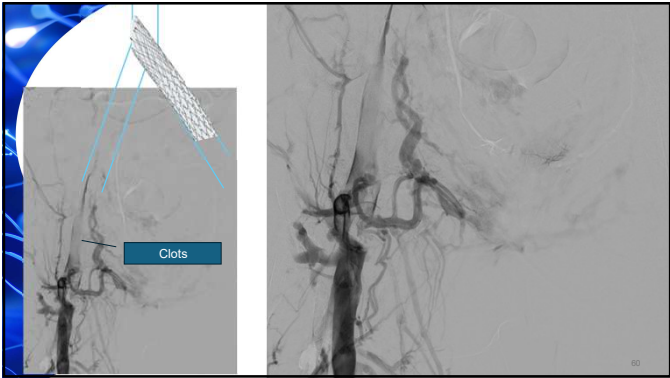
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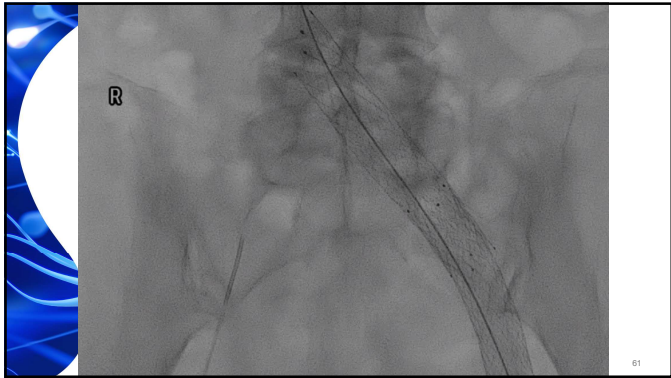
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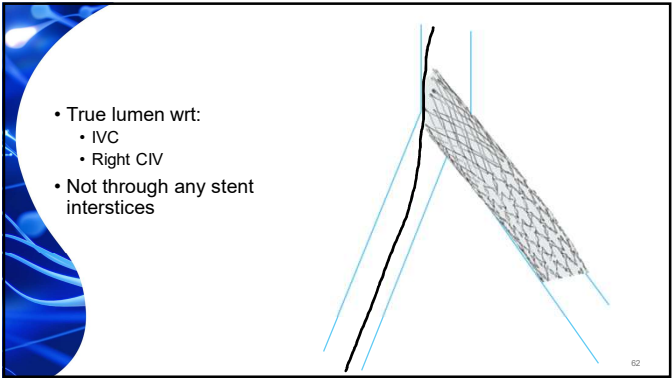
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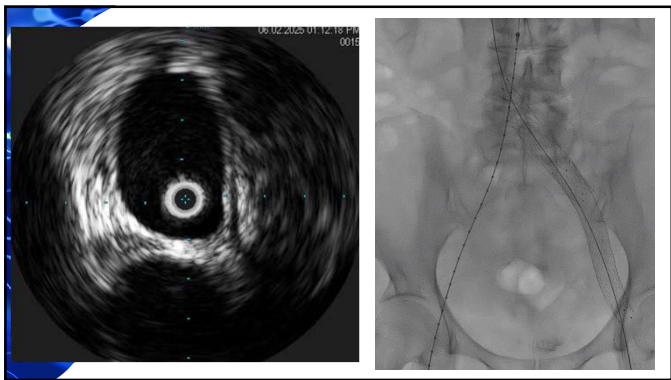
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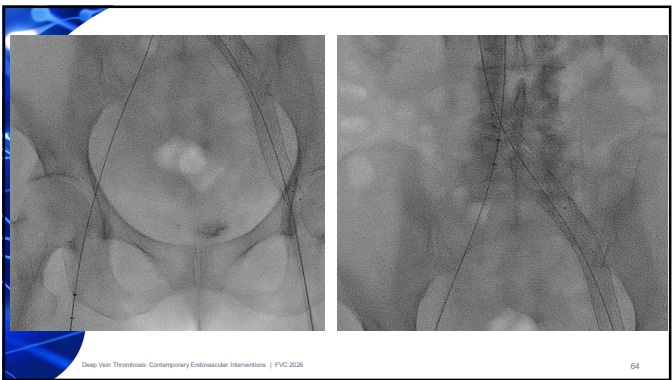
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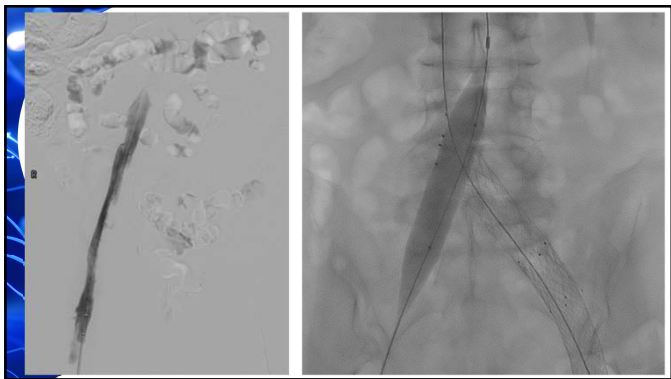
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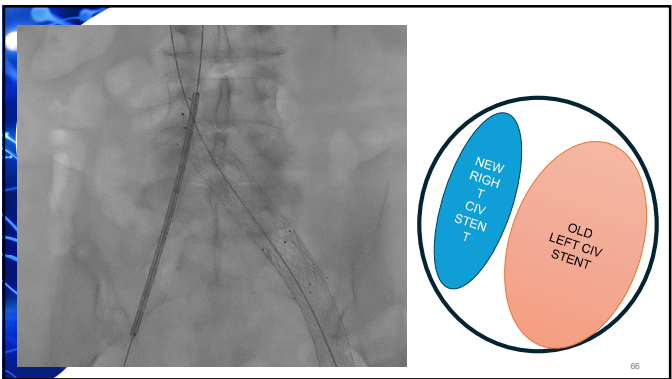
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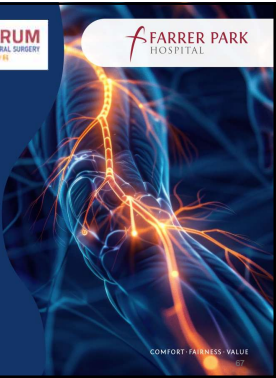
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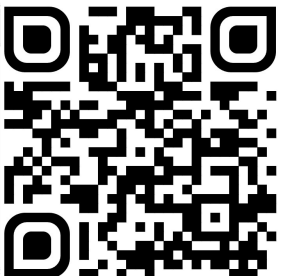
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