Chronic DVT/PTS Management What we've learned

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What's really important

* PTS -deep vein obstruction and superficial reflux
  * Importance of preservation of deep vein valvular function is overestimated
* Accurate stent sizing and placement is critical
  * If the stents are placed incorrectly patients will be persistently symptomatic

Algorithm to live by

* Open the deep system
* Close the superficial system
* Use good medical and physical therapy adjuvant treatments
* Know your anticoagulants
* Pray someone smarter than I figures out the deep valvular reflux issue and be grateful it's rarely the root cause of incurable venous disease

ATTRACT

* 2009 Vendantham published a compilation of data suggesting that valvular dysfunction and venous obstruction are the culprits in PTS
* Patients do better with thrombus removal
* Ambulatory venous hypertension can be relieved by venous stenting
* The procedure has a “very low likelihood of harming the patient and when successful tends to produce dramatic clinical improvement”

Vendantham, S. Valvular dysfunction and venous obstruction in the post-thrombotic syndrome. Thrombosis. Research (2009) 123 Suppl.4, S62-S65

Clinical Outcomes:

Symptom Relief

Raju & Neglén Experience:

Outcome 2.5 years Following Stenting	NIVL with Reflux	NIVL without Reflux
No Pain	82%	77%
Ulcer Healed	67%	76%
No Swelling	47%	53%
Good/Excellent Outcome	75%	79%

Patient Characteristics

NIVL with Reflux (n=151)

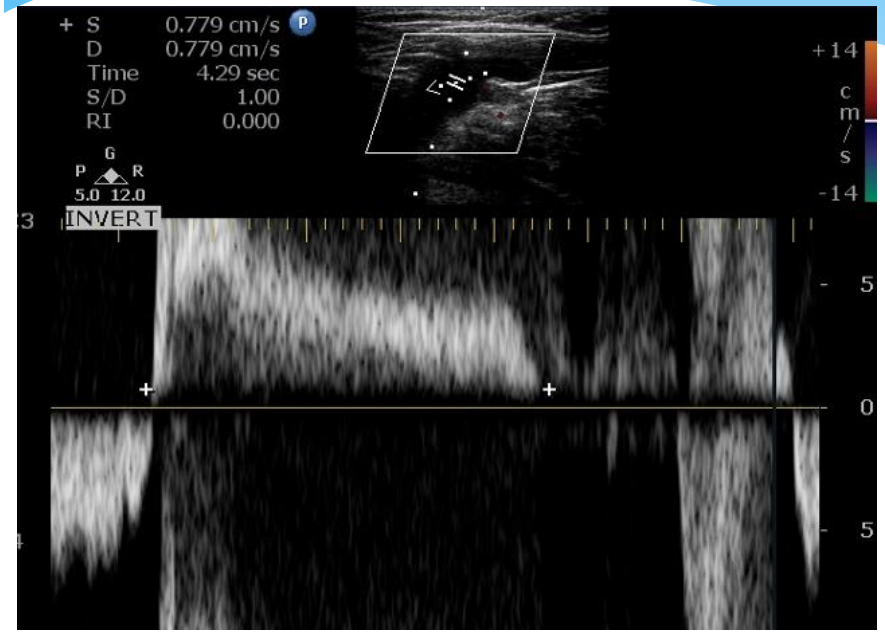
- 36% Superficial reflux
- 21% Deep reflux only*
- 44% Combined superficial & deep reflux*

*Axial deep reflux to the calf in 30% of limbs

NIVL without Reflux (n=181)

Raju S and Neglén P. High prevalence of nonthrombotic iliac vein lesions in chronic venous disease: a permissive role in pathogenicity. J Vasc Surg 2006;44:136-43; discussion 144.

Deep Reflux



CFV reflux before ablation
4.3 seconds- symptomatic

CFV reflux after ablation
1.6 sec - asymptomatic

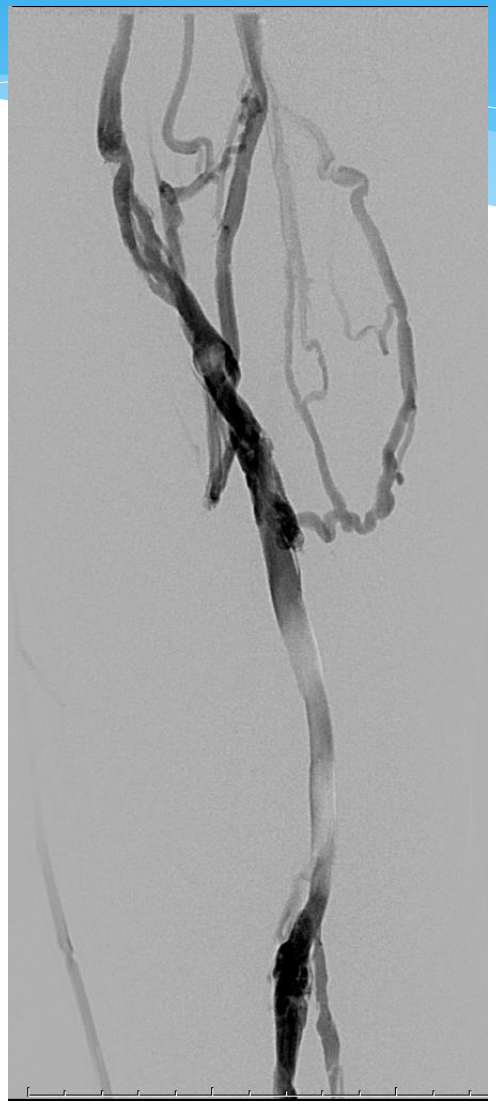
Puggioni A, Lurie F, Eklof B. How Often is deep venous reflux eliminated after saphenous vein ablation? J Vasc Surg 2003;38(3):517-521.

Fem pop recanalization gaining favor

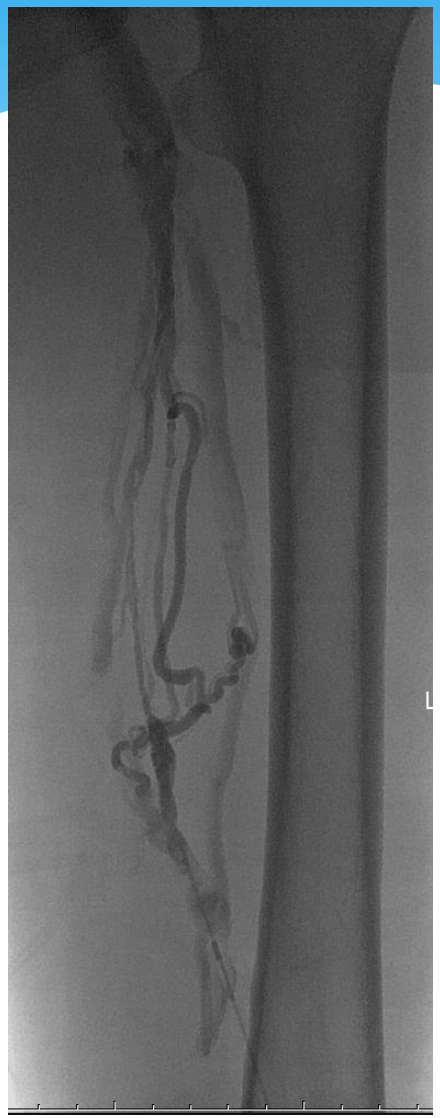
* Garcia presented data 106 pts with prolonged balloon angioplasty of fem pop occlusions with EKOS infusion
  * US primary patency at 1 yr 78%
  * Us primary patency at 2 years 58%
* 2014 Spencer et. al. wrote technical paper in TVIR on recanalization of fem pop DVT after performing many cases with ulcer healing

Spencer et al. Novel Treatment Techniques for Recanalization of Femero-popliteal Deep Venous Occlusion from Chronic Thrombosis 17:114-120.2014

Case 1 – Chronic Fem-pop



Case 1 – Chronic Fem-pop



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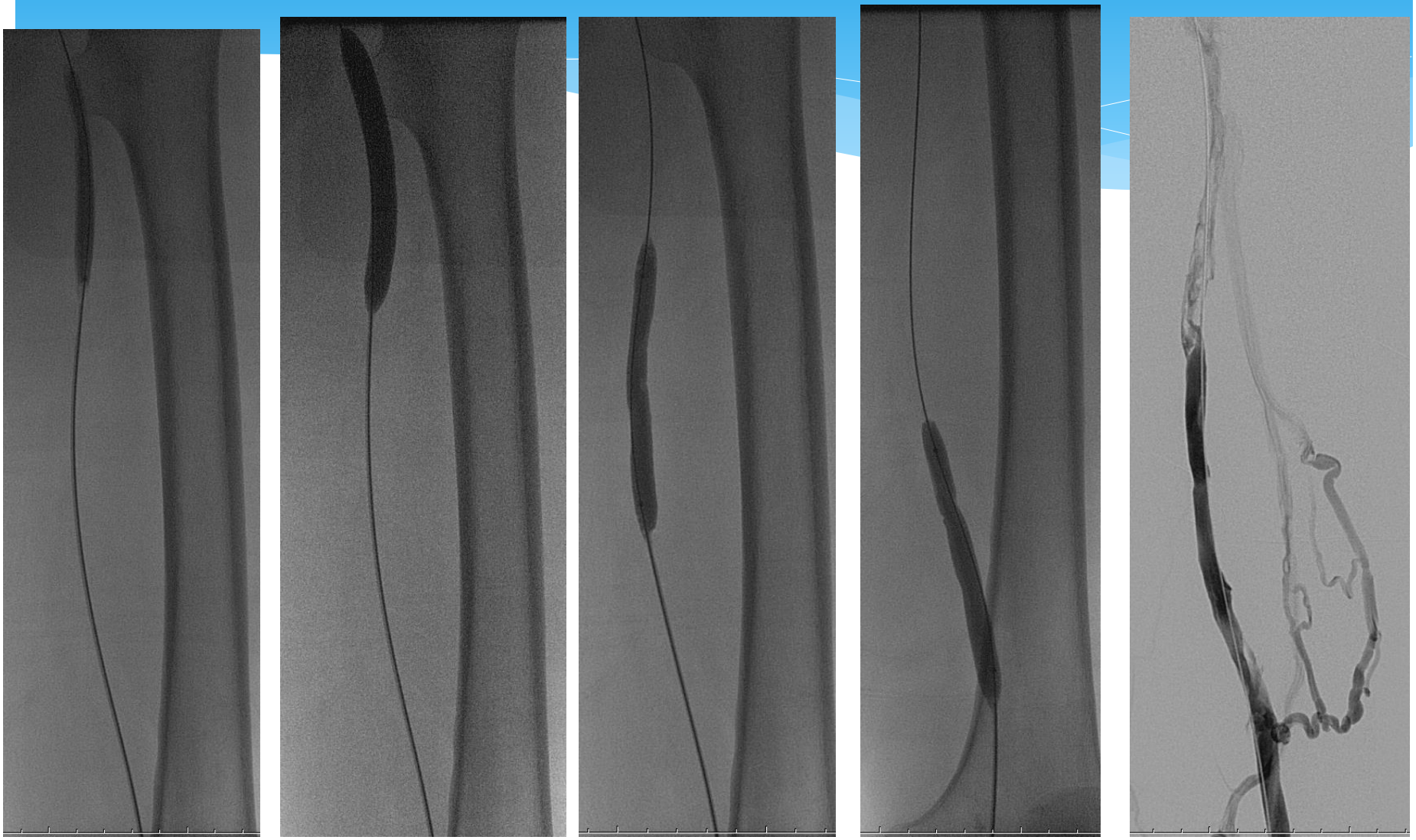

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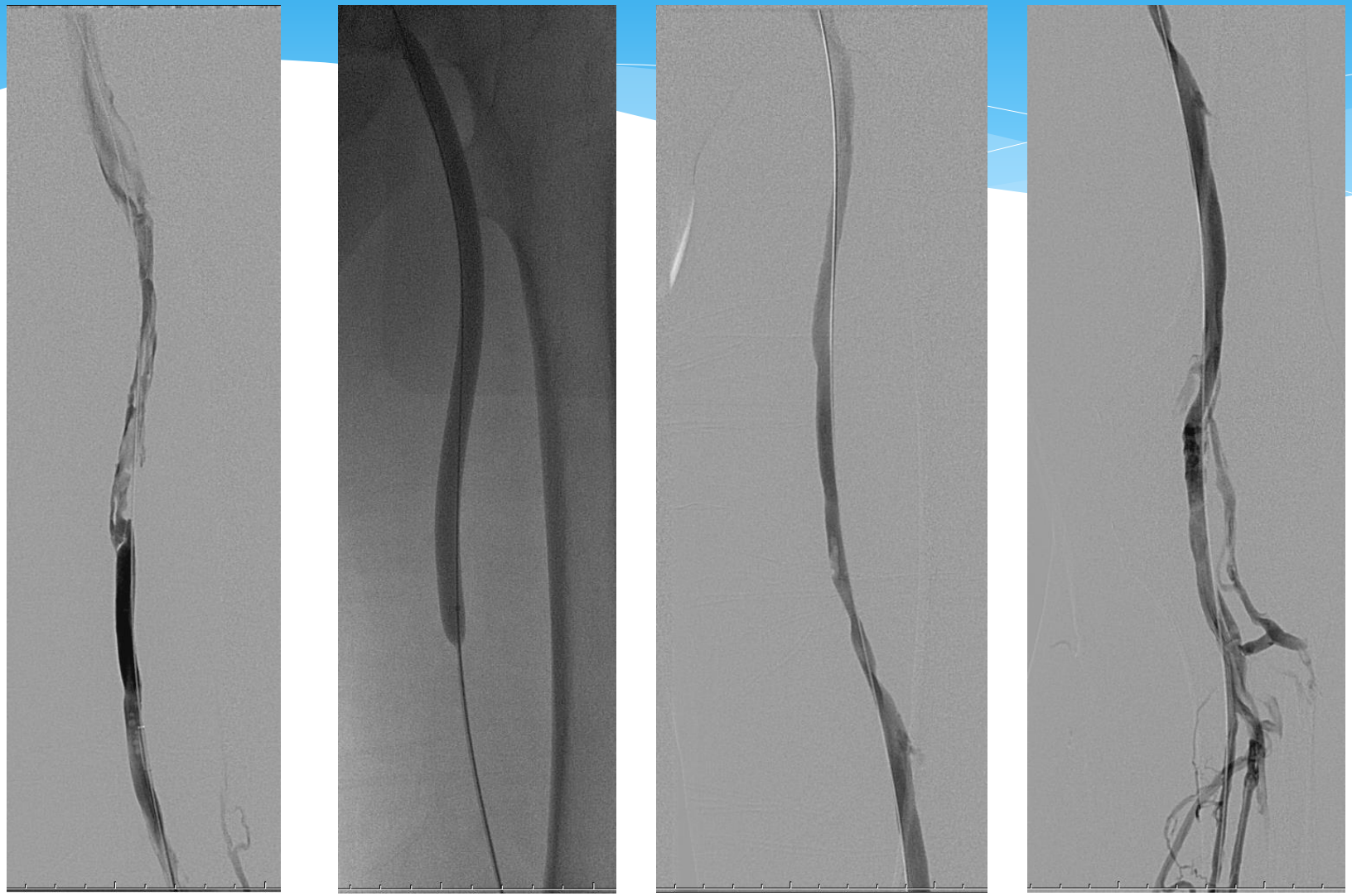
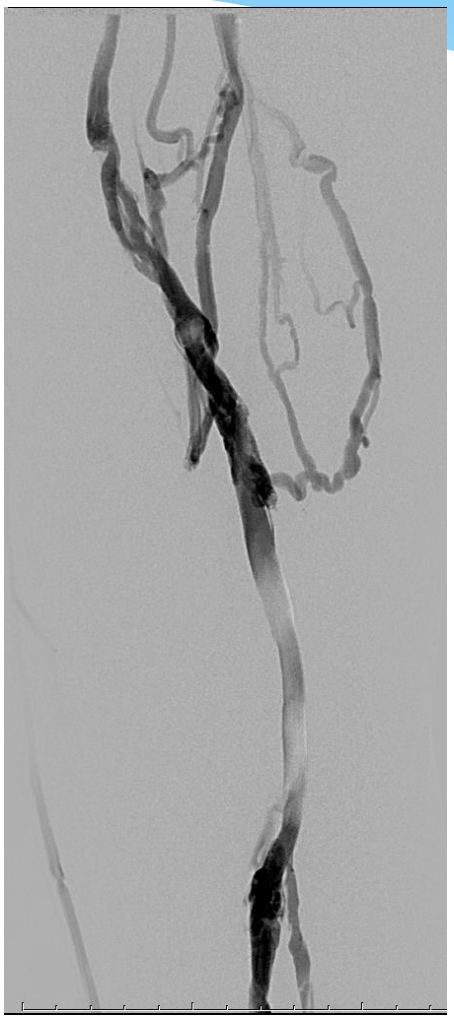
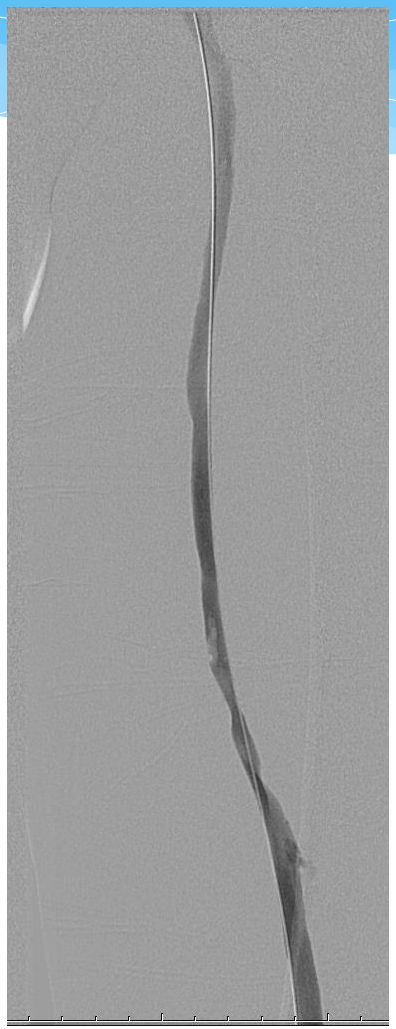
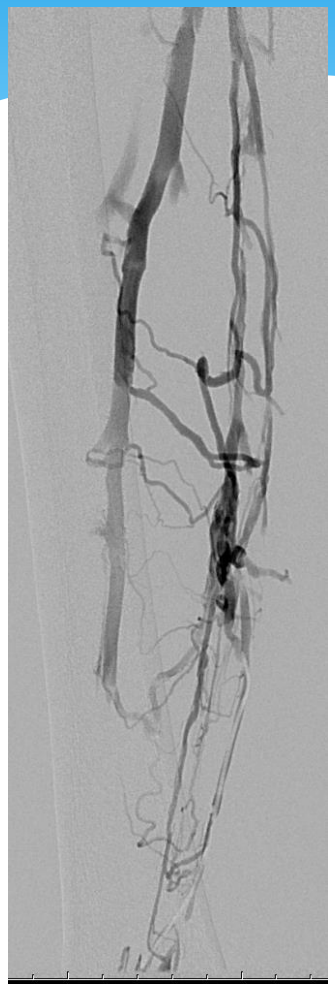


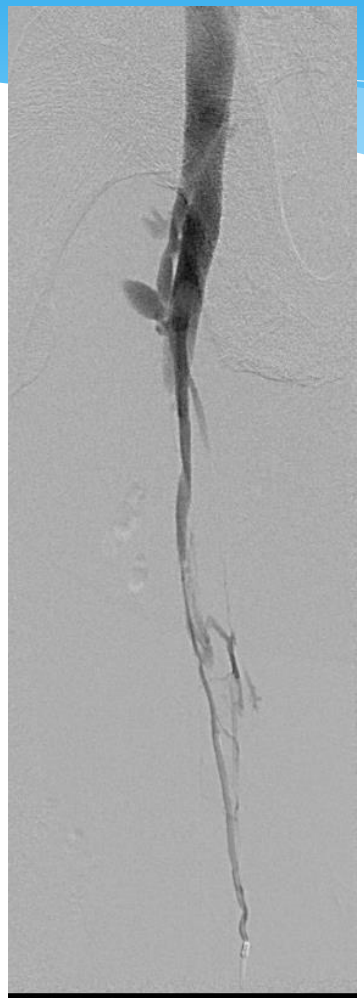
Before and After

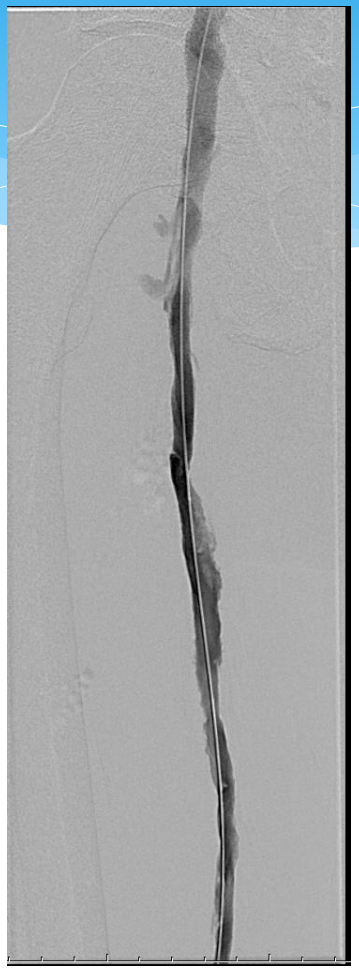




Case 2 Chronic Fem-pop



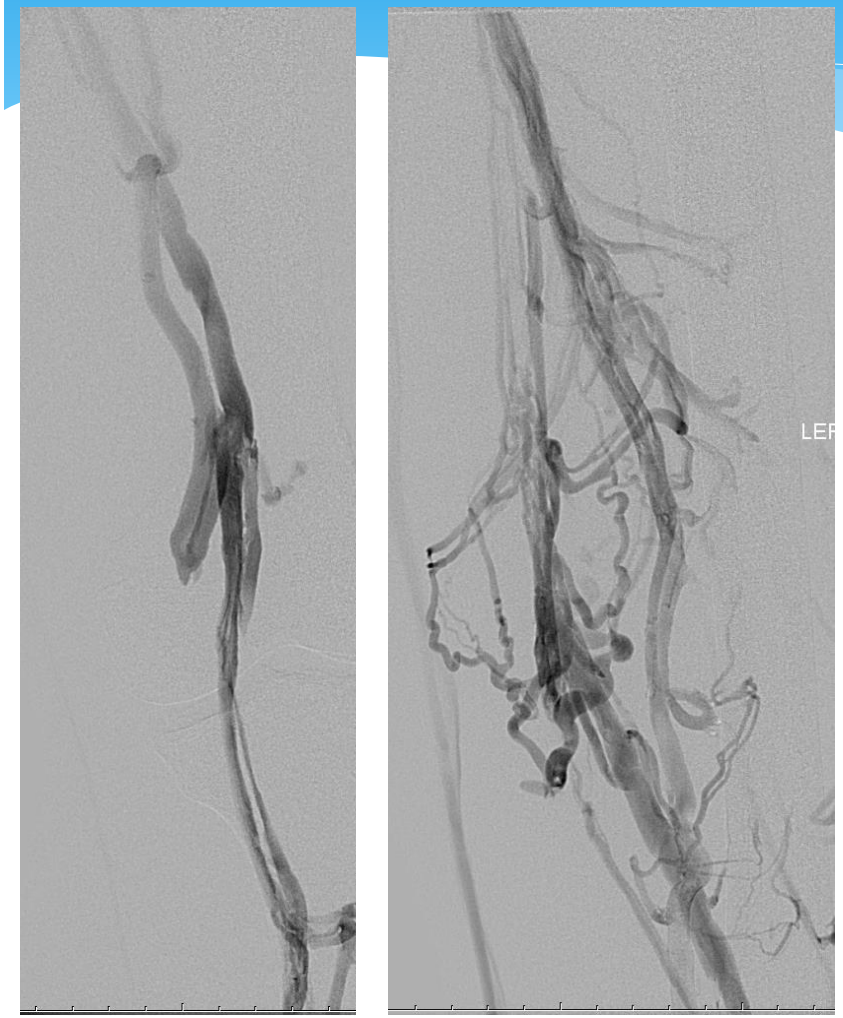


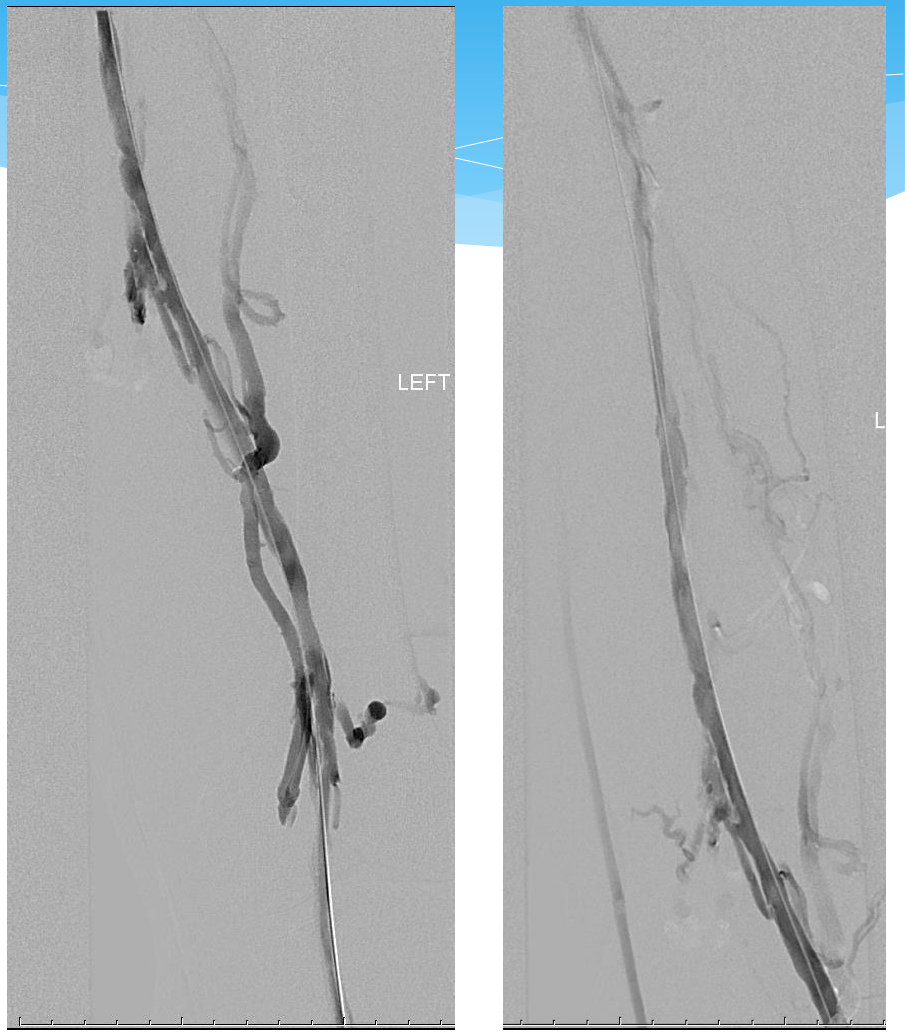


Before

After

Case 3 Chronic Fem-pop





Before

After

D000124855/A

Simplified

* Fix symptomatic deep venous occlusion
* Ablate symptomatic superficial venous reflux
  * Complete therapy with phlebectomy/foam
* Recognize that deep venous reflux usually improves or resolves with these measures and is NOT a contraindication to these venous therapies

Seeing Venous Disease Differently

* Superficial venous reflux
* Deep venous obstruction
* Deep veins trump the superficial every time

Causes of deep vein "obstruction"

* Work from the heart back
  * Cardiomyopathy/heart failure
  * Morbid obesity
  * Pulmonary arterial hypertension/ right heart failure
  * IVC – post thrombotic, surgical ligation, IVC filters
  * Iliac May- Thurner, post thrombotic obstruction, XRT
  * Chronic fem pop DVT

Tools for ruling out deep venous "obstruction"

* Echocardiogram
* CT or MR Venogram
* US

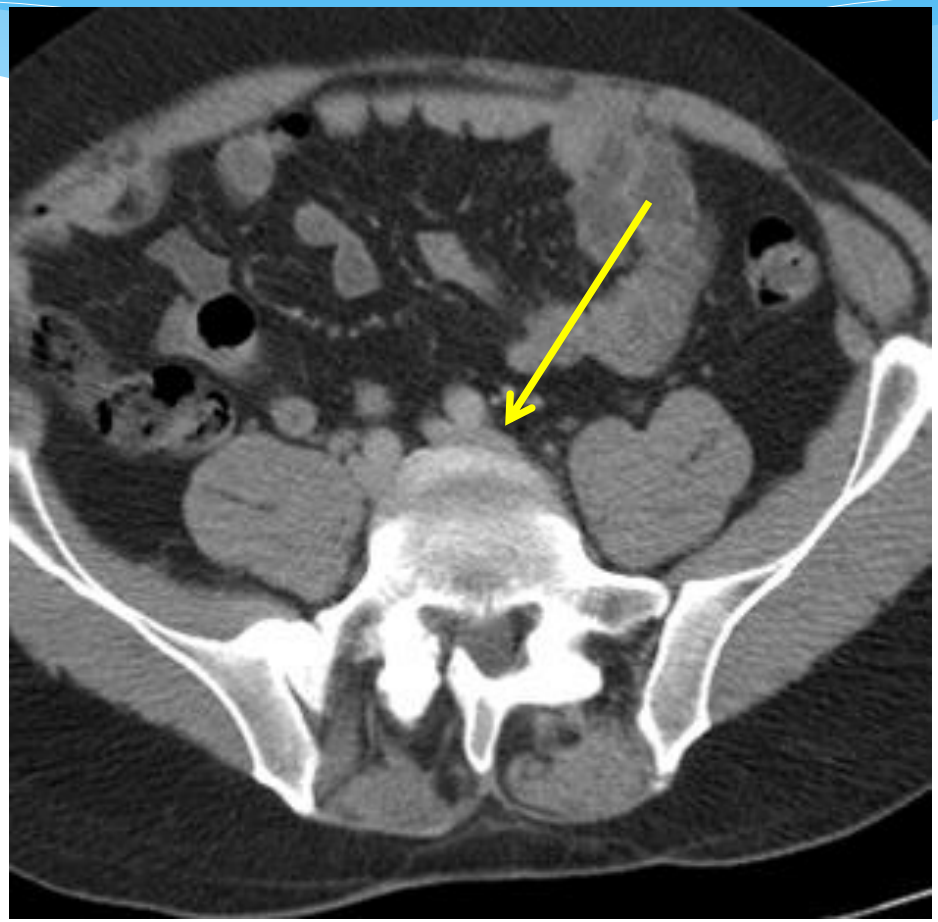
MT with superficial Reflux

* 44 yo male with strong family history of superficial venous disease
* No history of prior DVT
* Non-healing ulcer anterior left shin 5 months
* Bilateral truncal saphenous reflux for 6 seconds with 1 cm saphenous veins and large varices

CTV

CTV – IV only at 120 second delay

* Look for stenosis at CIV and measure transverse diameter
* Evaluate vein all the way down
* If concern for significant stenosis or equivocal consider venography and IVUS



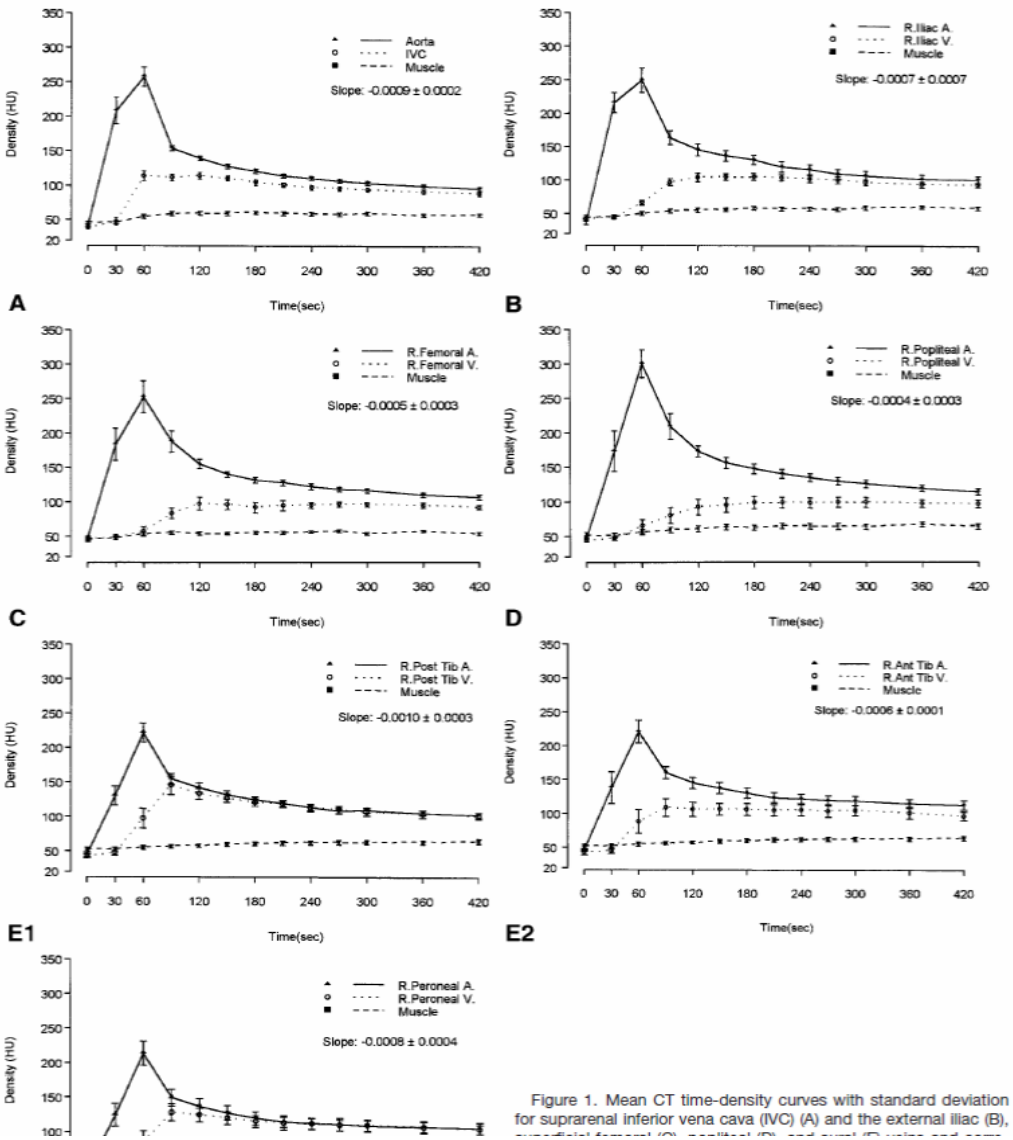
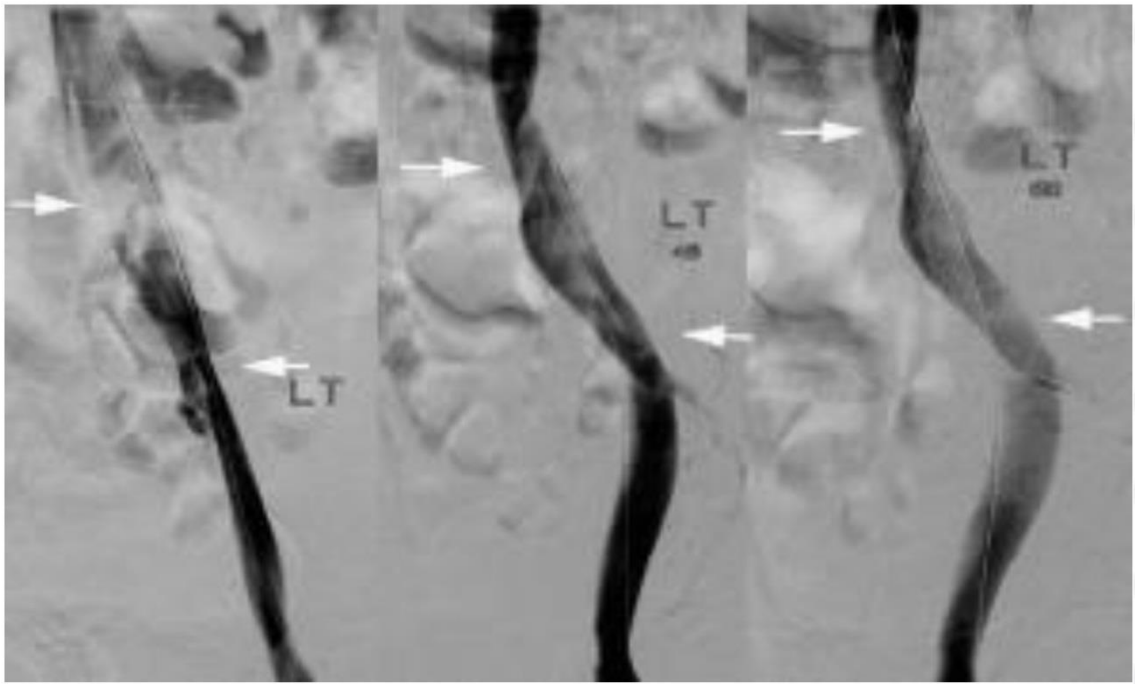


Figure 1. Mean CT time-density curves with standard deviation for suprarenal inferior vena cava (IVC) (A) and the external iliac (B),

Is Venography Alone Adequate to Evaluate the Deep Veins?

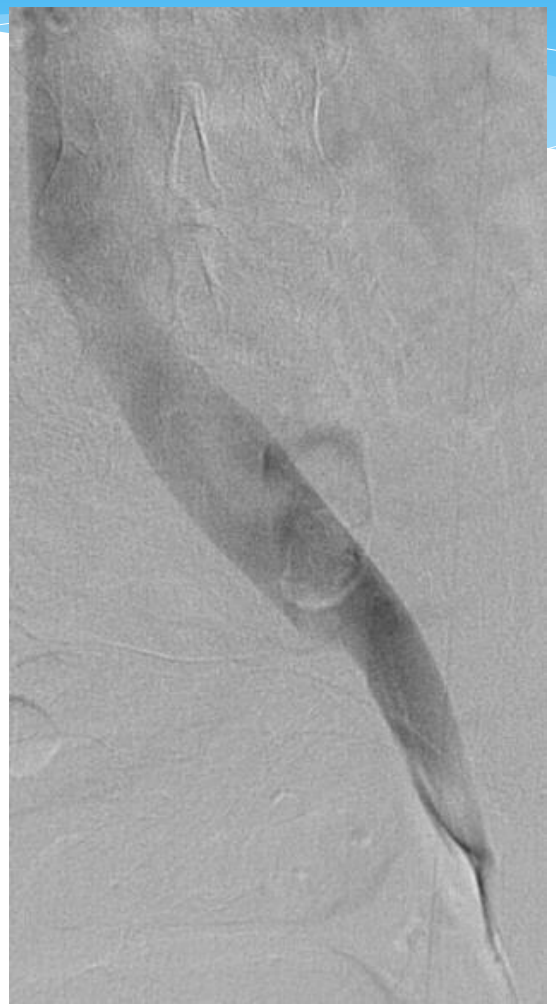
"We develop strategies to compensate for the shortcomings of [venography] and convince ourselves it's adequate." – Peter Neglén, MD, Ph.D.

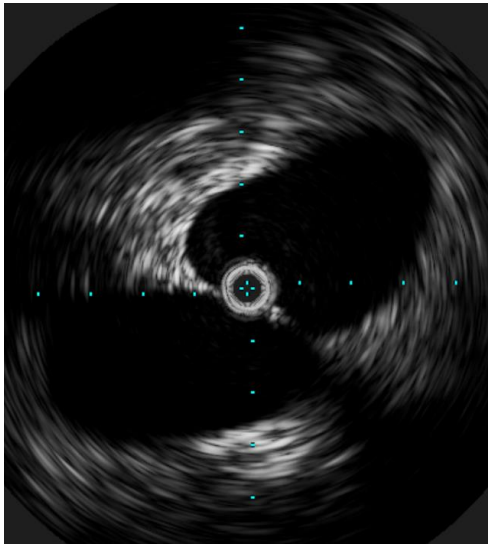
- The poor diagnostic sensitivity of venography has been well described by Negus[1]
- 34% of patients with chronic venous disease symptoms had iliac vein obstructive lesions that appeared normal on venography[2]
- Raju & Neglén observed collaterals in only 43% of limbs [that were stented][3]



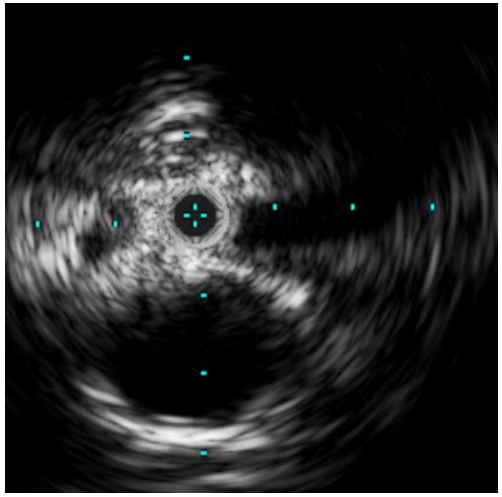
1. Negus D, Fletcher EW, Cockett FB, Thomas ML. Compression and band formation at the mouth of the left common iliac vein. Br J Surg 1968;55:369-74. 2. Raju S, Neglén P. High prevalence of nonthrombotic iliac vein lesions in chronic venous disease: a permissive role in pathogenicity. J Vasc Surg 2006;44:136-43. 3. Raju S, Darcey, Neglén P. Unexpected major role for venous stenting in deep reflux disease. J Vasc Surg 2010;51:401-9.

44 yo venogram : who thinks this is abnormal?

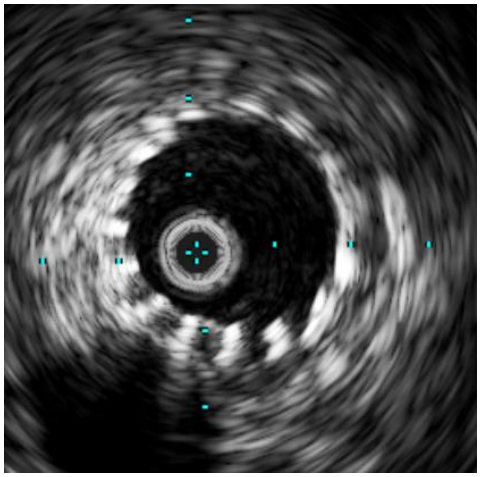




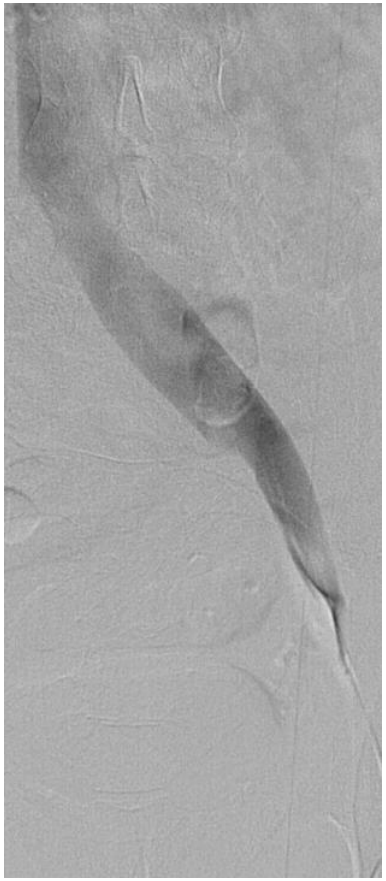
Normal proximal CIV



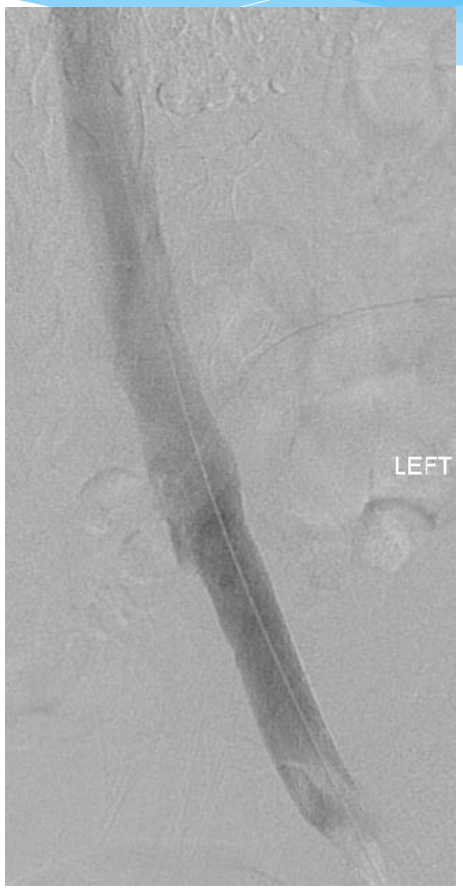
Severe compression of CIV
May-Thurner



Post stent May-Thurner



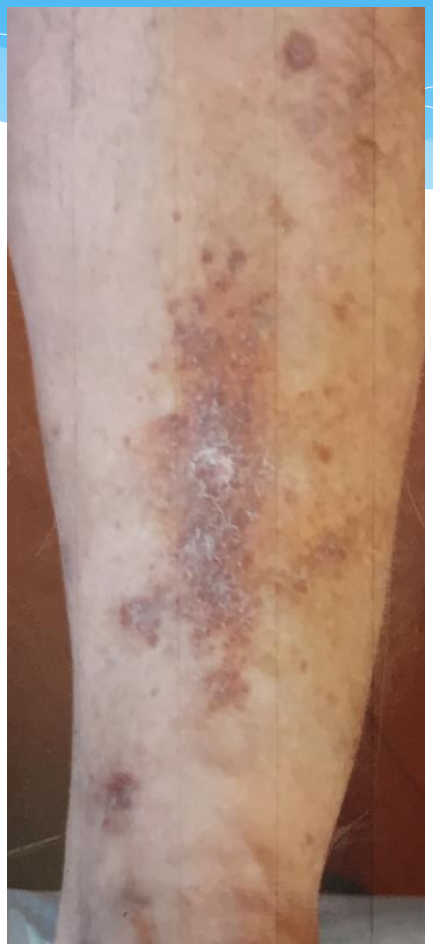
Before



After

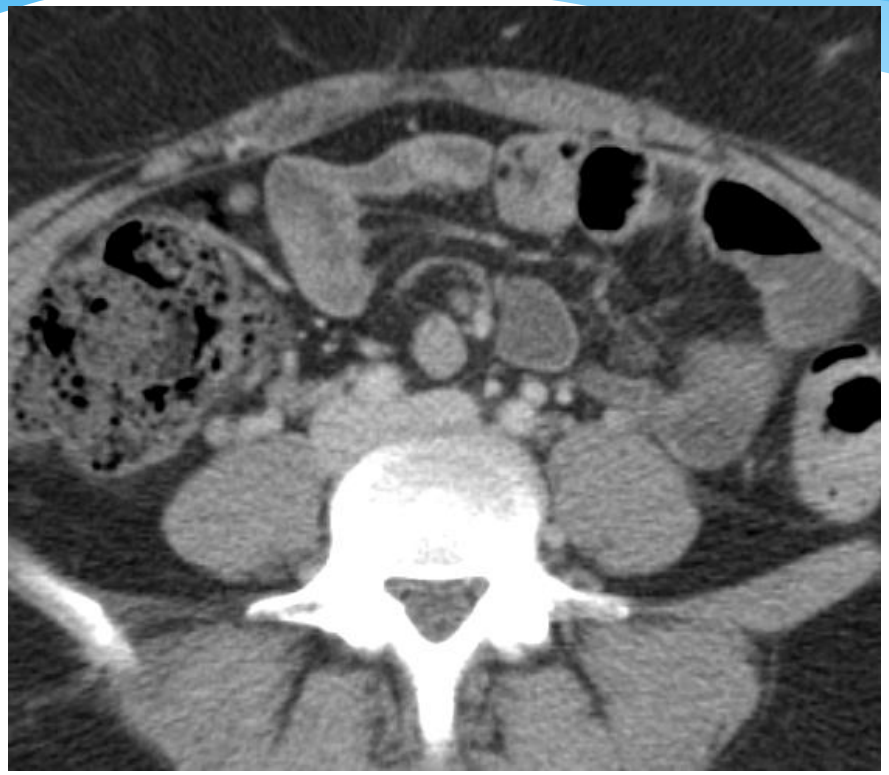
Pre and Post stenting

Pre stent



Post stent

Stent internal iliac vein and EIV jnct

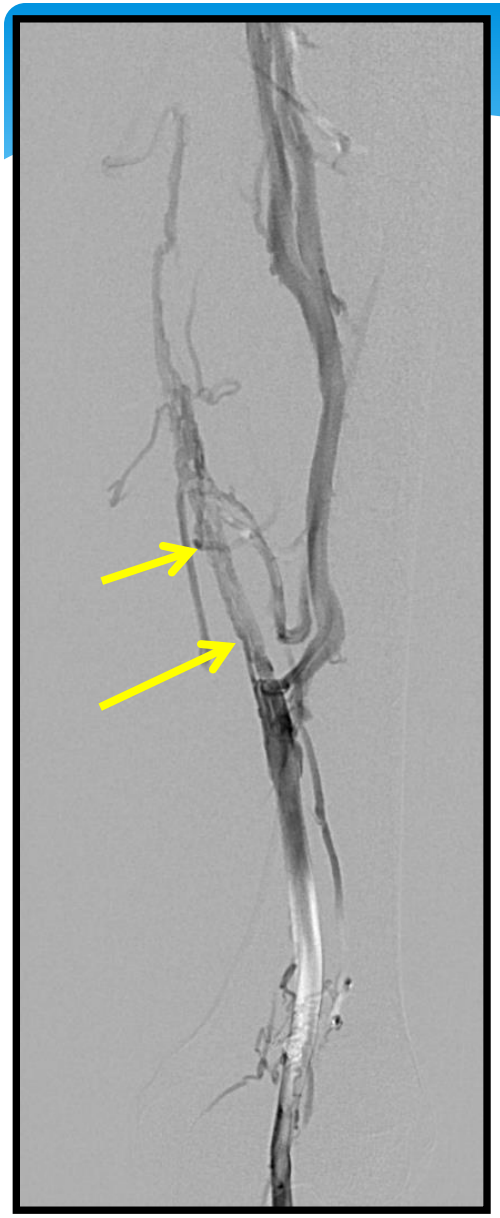


Left proximal common iliac vein is patent

CIV narrows at junction of EIV stent

Courtesy of Dr Brooke Spencer

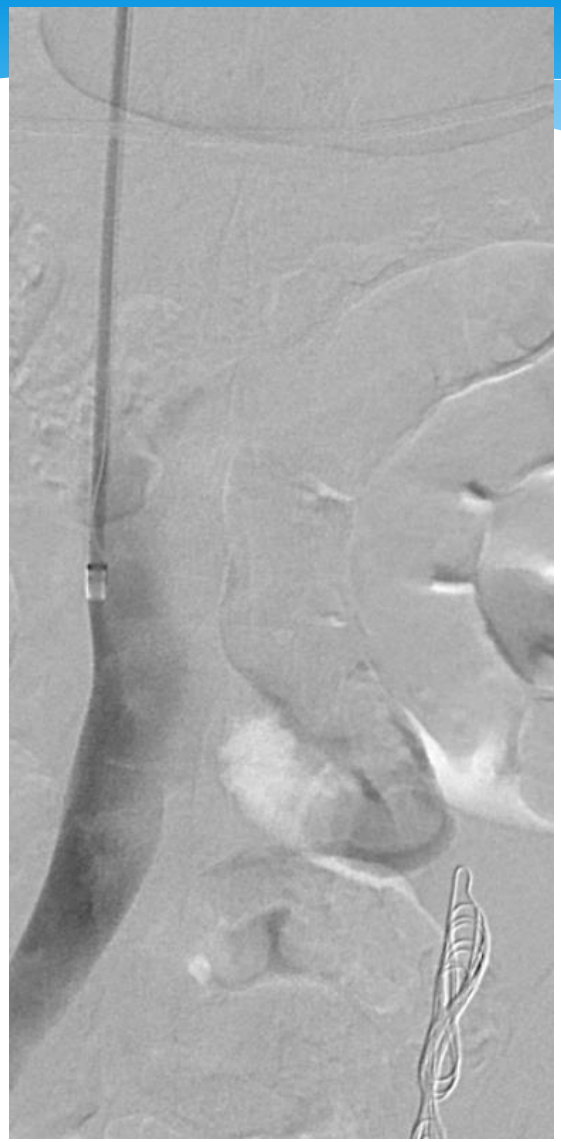
Occluded left EIV stent



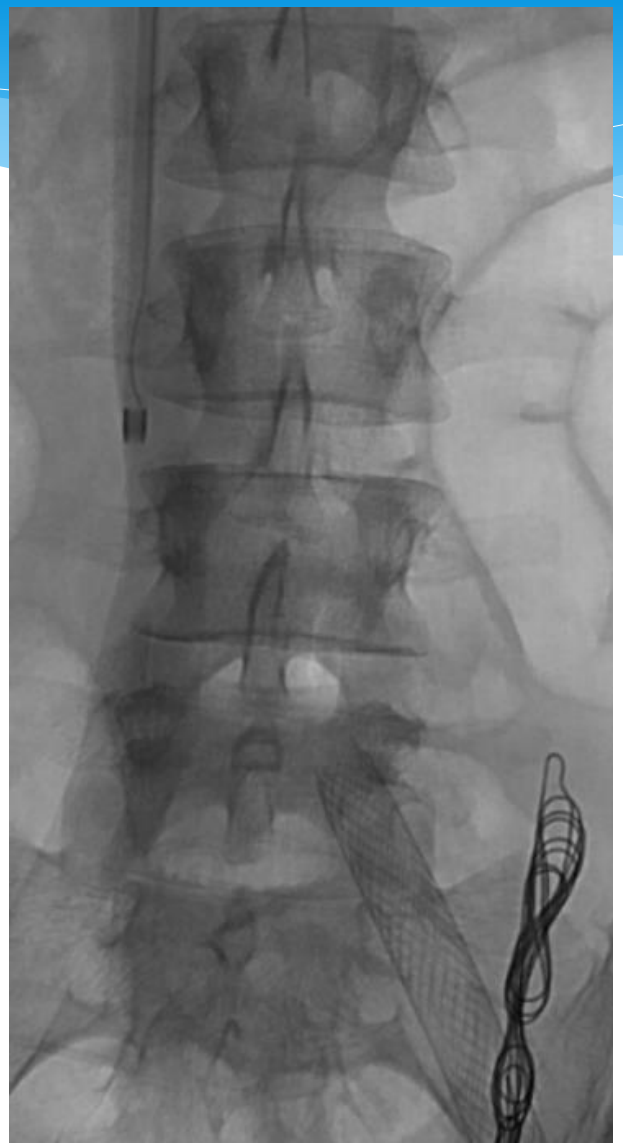
Synechiae in CFV

Courtesy of Dr Brooke Spencer

Occluded EIV stent with collaterals



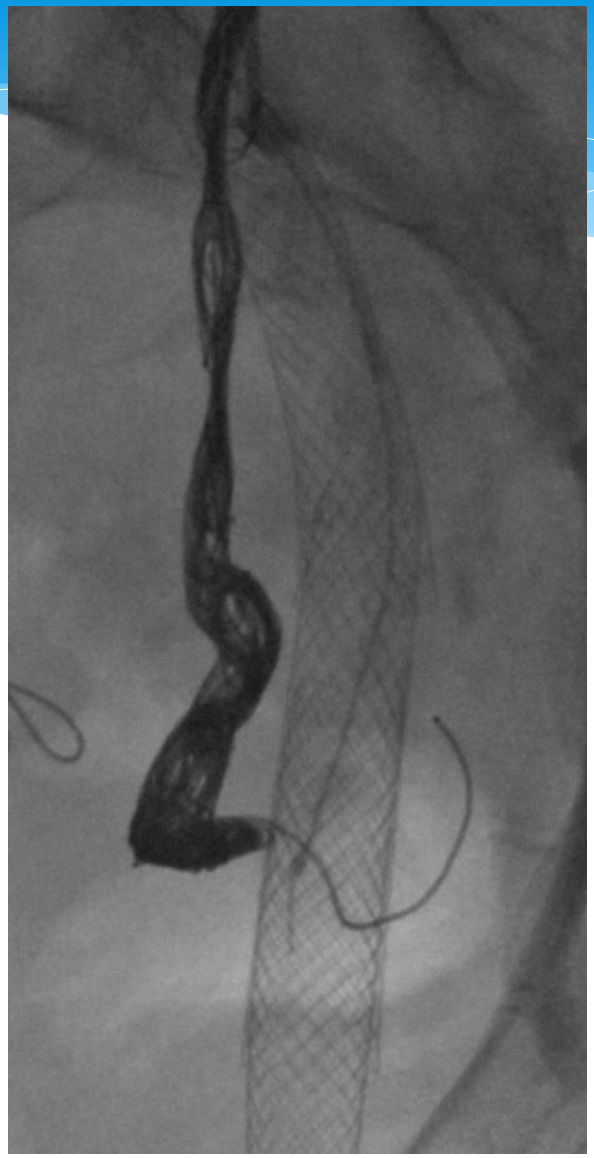
Patent right CIV



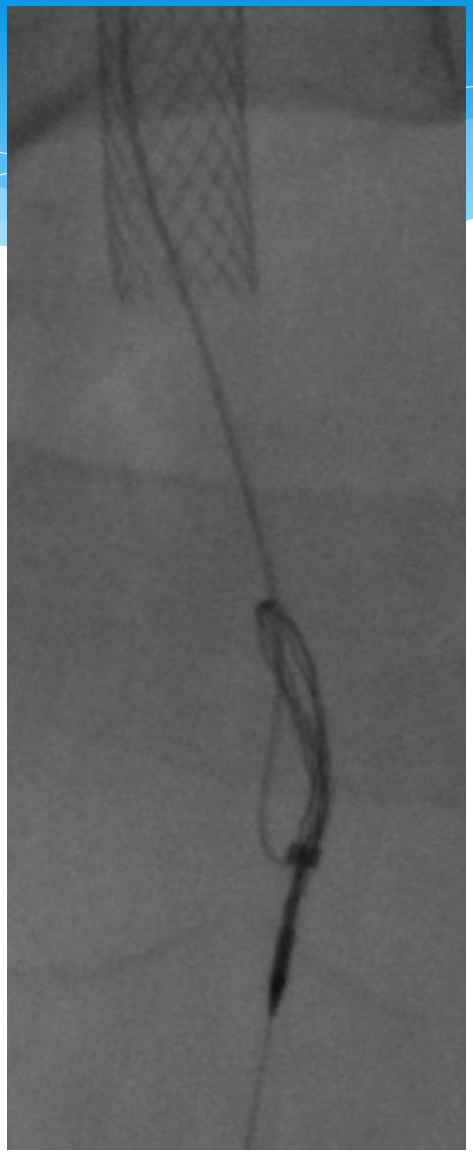
Left EIV stent is short of the IVC confluence

Courtesy of Dr Brooke Spencer

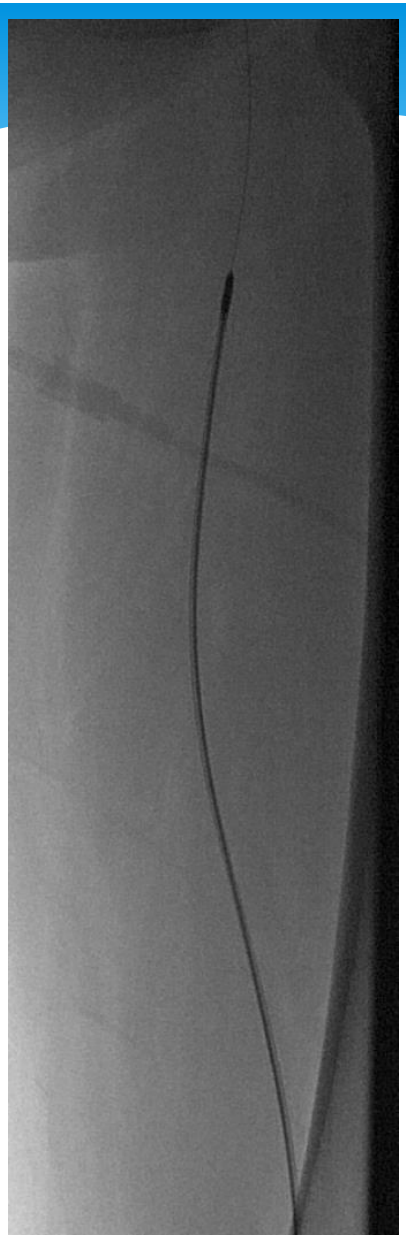
Access from above with 6 Fr sheath in 8 Fr sheath



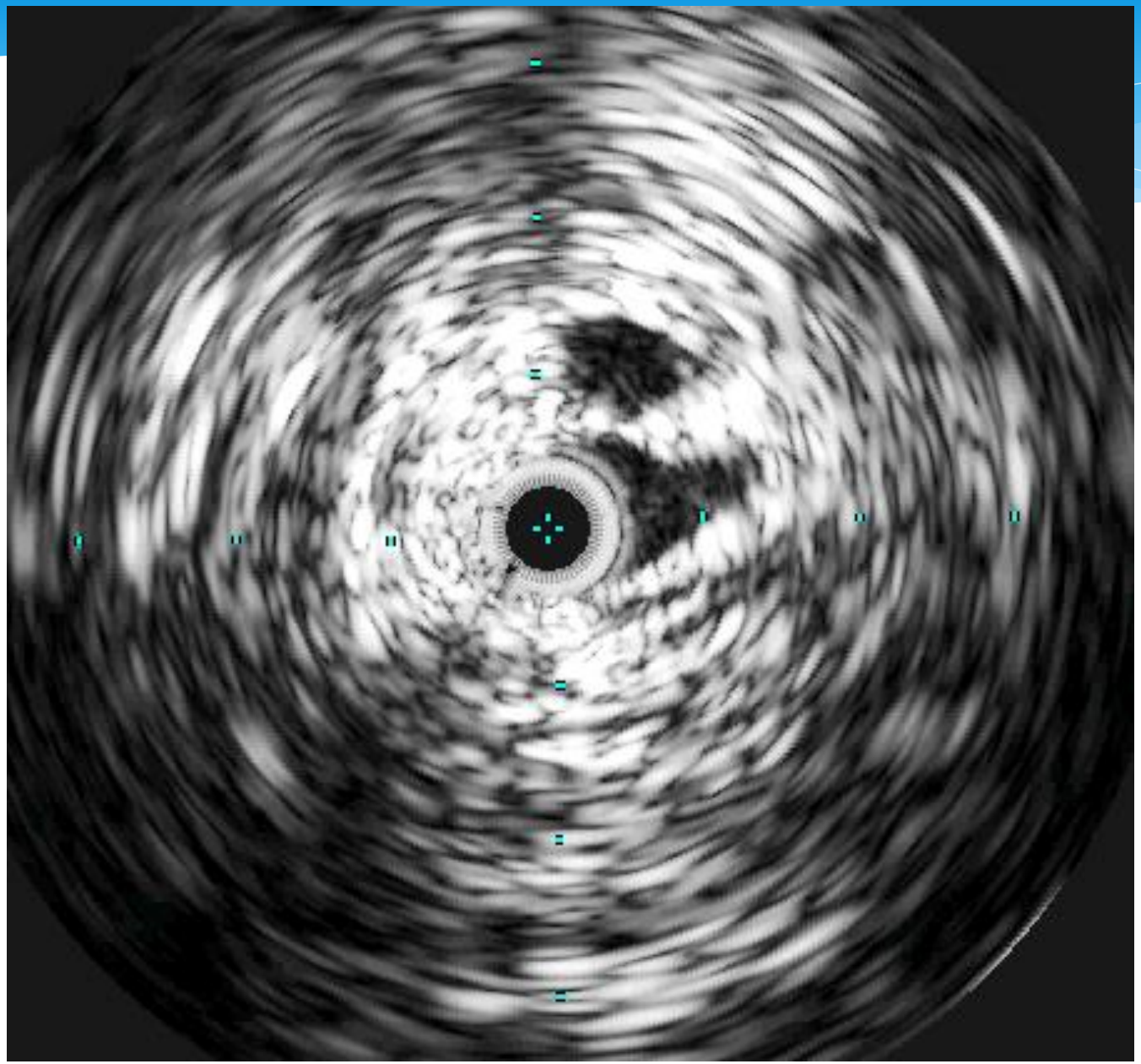
Braided tapered tip catheter and stiff glide wire



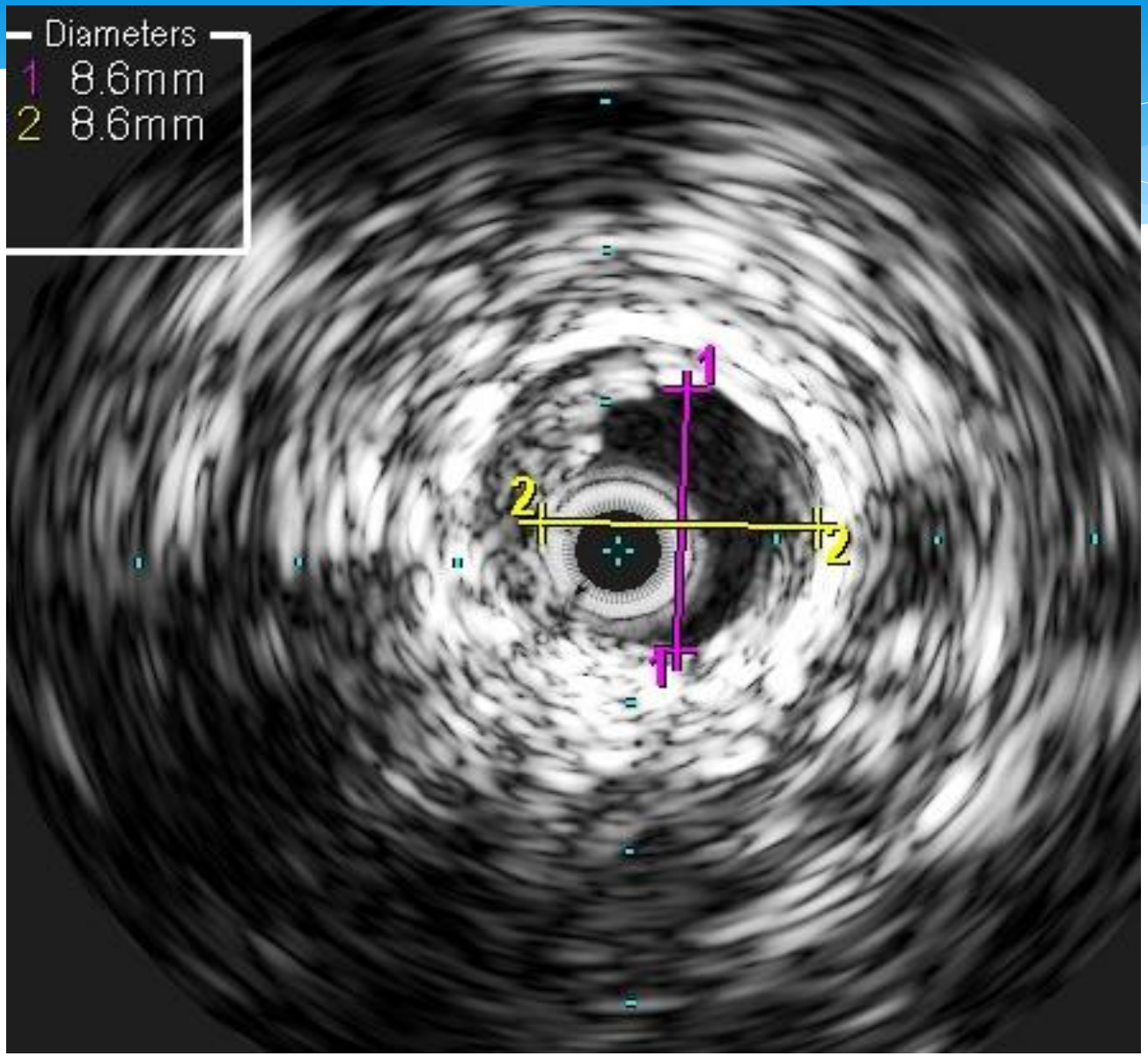
Snare glide wire and pull through and through access



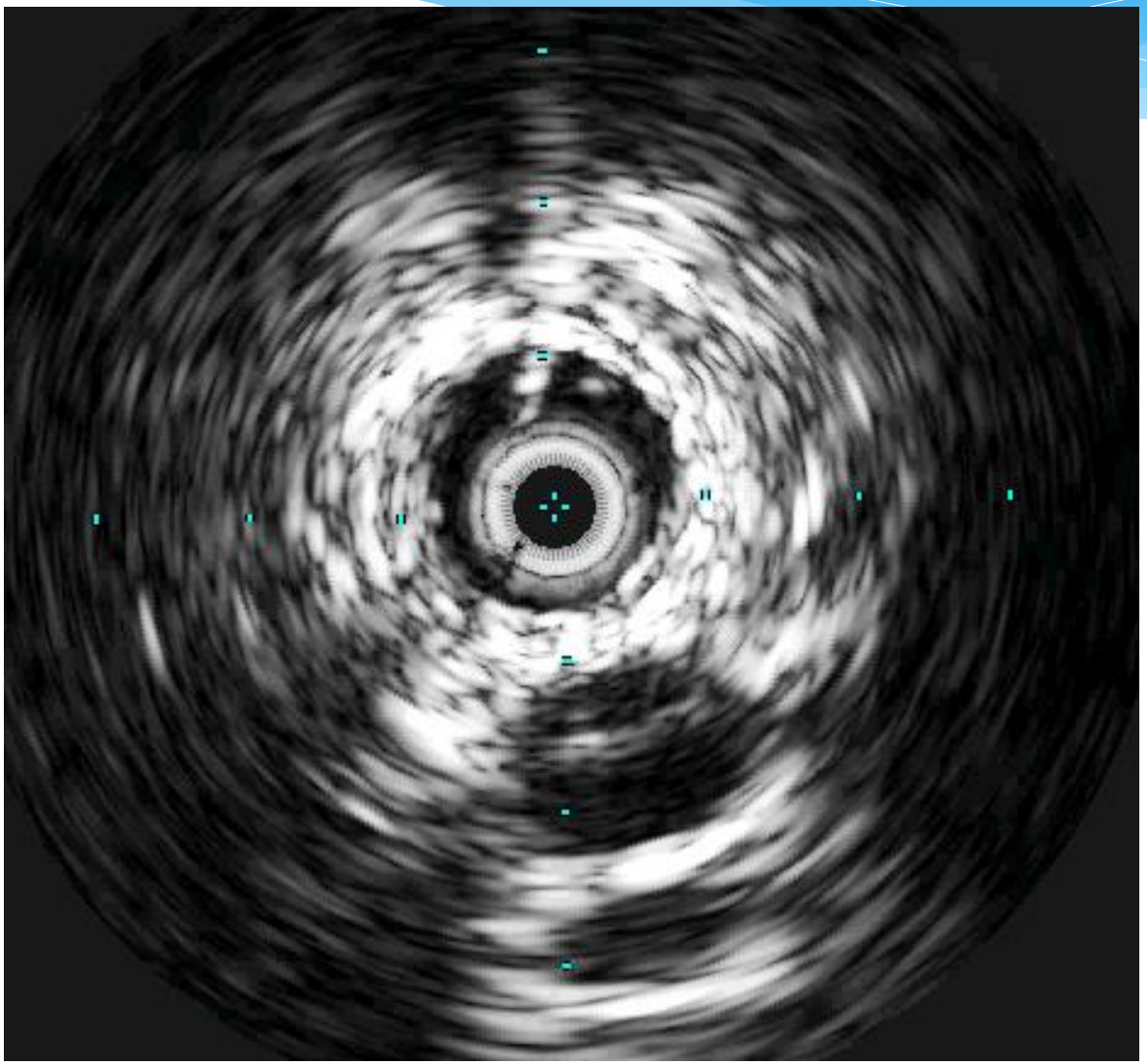
Jet stream and angioplasty



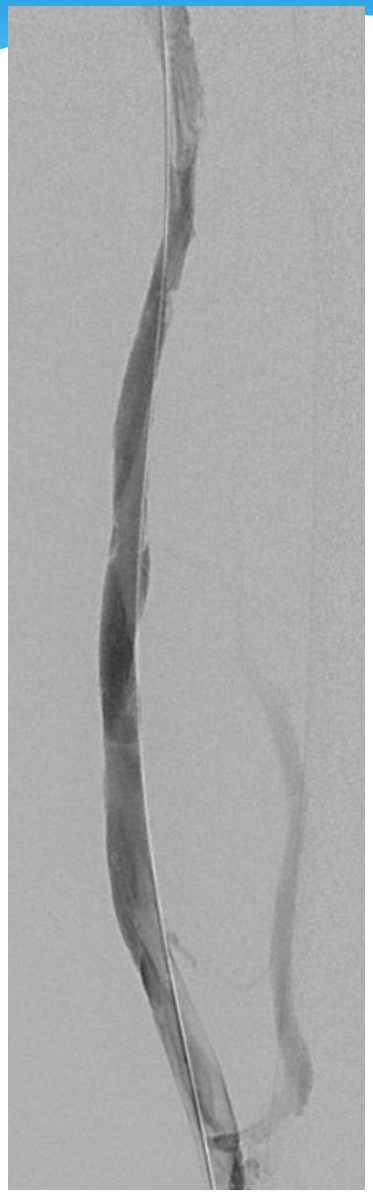
Post Jetstream IVUS



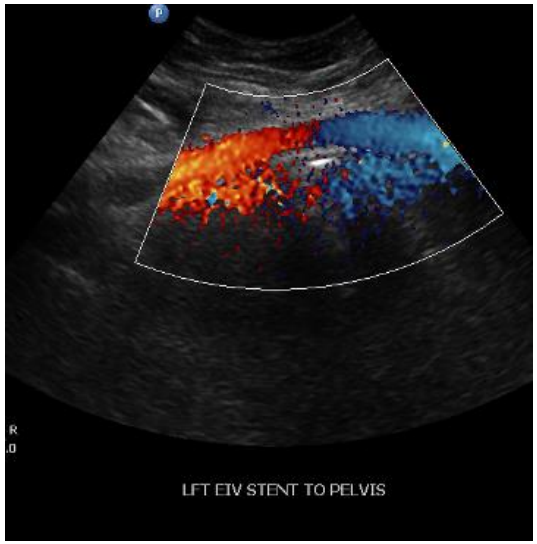
In stent residual lining after Jetstream and angioplasty

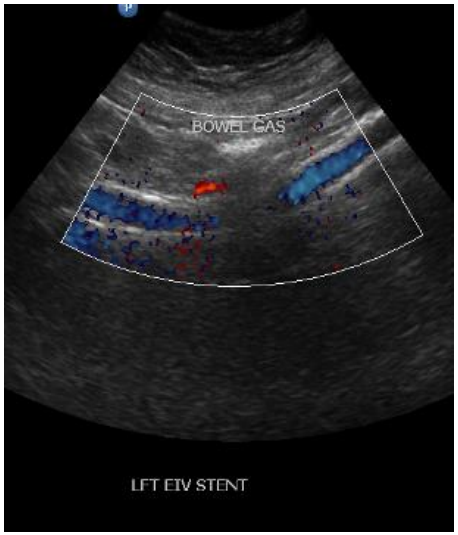


Post relining stents



3 month US





Algorithm to live by

* Open the deep system
* Close the superficial system
* Use IVUS and venography together to identify lesions and accurately place stents.

Future of DVT

* Better Stents
* Devices to remove chronic debris from the veins
* Early thrombolytic intervention to avoid PTS and the battle of treating chronic venous occlusions
* Better drugs for treating acute DVT
* Genetic markers to match best drugs to individual patients
* Access from the posterior tibial vein

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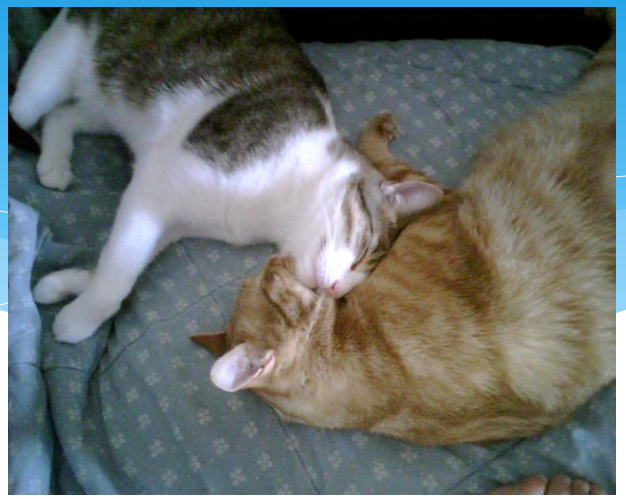

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Stent size selection

* Controversial
* Started using 10 -12 mm stents in 1990's and IR generally used Nitinol stents
* Over time, teaching has become that the bigger the better
* Also teaching that Wall stents have been successfully used

Bigger is Better??

% venous stenosis calculated based on anatomic minimums

- CIV: 16 mm Diameter; 200 sq mm Area
- EIV: 14 mm Diameter; 150 sq mm Area
- CFV: 12 mm Diameter; 125 sq mm Area

The basis of symptoms in CVD is elevation of peripheral venous pressure.

Peripheral venous pressure begins to rise with as little as 20% stenosis and becomes significant at 50% stenosis.

Raju et. al. J Vasc Surg Venous and Lymph Disorders. Anomalous Features of Iliac Vein Stenosis that Effect Diagnosis and Treatment. 2014;2:260-7.

Raju

* “In our experience the iliac veins are remarkably uniform in caliber in normal-sized adults with variation of no more than +/- 10%”
* Teleologically this is essential to maintain peripheral venous pressure (also constant) at homeostatic levels
* “As as rough guide the following diameter/area parameters are appropriate for the location in normal –sized adults” :
  * 16mm/200mm^2 – CIV
  * 14mm/150mm^2 – EIV
  * 12mm/125mm^2 - CFV

Raju et. al. J Vasc Surg Venous and Lymph Disorders. Anomalous Features of Iliac Vein Stenosis that Effect Diagnosis and Treatment. 2014;2:260-7.

Clinical Value: Diagnostic Information Applied

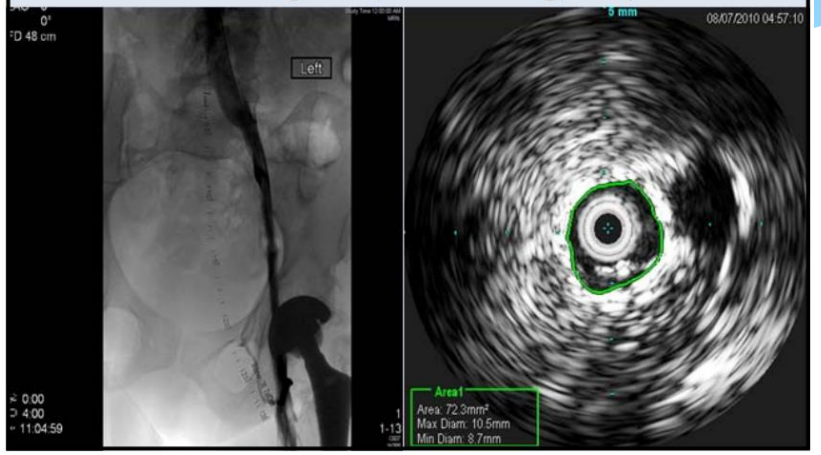
Example 1. Rokitanski Stenosis

ROKITANSKI STENOSIS: Long diffuse lesion with no focal cues. Common in the iliacs. Not apparent in venograms. IVUS definitive. This means stenosis% cannot be calculated based on comparison with adjacent segment as in arterial stenosis.

~% Stenosis = 1 – 67.7mm² / 200mm² = 66%

Example 2. Post-Thrombotic Syndrome

Normal venogram but IVUS stenosis (PTS). Note trabaculae and perivenous fibrosis on IVUS but not seen on venogram. IVUS area 72 sq mm. Difficult to tell position of iliac confluence in venograms (understenting). Easy with IVUS



~% Stenosis = 1 – 72.3mm² / 200mm² = 64%

Venographic % stenosis based on comparison to adjacent 'normal' segment does not work as diffuse stenosis involving the entire iliac vein (Rokitanski stenosis) with or w/o focal lesions are common.

Vein	Diameter (mm)	~Area (mm²)
Common Iliac Vein	16	200
External Iliac Vein	14	150
Common Femoral Vein	12	125

Raju S, "How to Measure Iliac Vein Stenosis", VEITH 2014 Symposium Presentation Physician commentary is specific to the examples being highlighted. Results from this case study are not predictive of future results.

That would make sense if the average size of a CIV was 16mm

* Kibbe et al
  * Studied 50 consecutive patients in ER abdominal pain
  * Mean age 40 years, 60% female
  * Average Vein Size by location
    * Right CIV 12.85 +/- 0.36
    * Left CIV 12.09 +/- 0.34

Kibbe et al, Iliac Vein Compression in an asymptomatic patient population. J Vasc Surg: 39;5:937-943

Sizing Iliac Stents

* Ahmed et. al. Stent placement for MT (Stanford)
* 34 patients with ave follow-up 2 years
* Technical success 100%
* 68% had clinical improvement on follow-up
* No difference in outcomes
  * Stent size (10-20mm) or type Smart vs Wall

Ahmed et al. Endovascular Stent Placement for May-Thurner Syndrome in the Absence of Acute Deep Venous Thrombosis. J Vasc Interv Radiol 2016;27:167-173.

How do we think about this in 2016

* PTS -deep vein obstruction and superficial reflux
  * Importance of preservation of deep vein valvular function is overestimated
* Accurate stenting is critical
  * If the stents are placed incorrectly patients will be persistently symptomatic or worse than before
* Clinical understanding and management
  * How you build a practice and add value beyond others just performing procedures
  * Improve the long term outcomes of your procedures

Resources

* Lymphedema physical therapists and compression
* Become a hematologist “light”
* Know how to combine anatomy and risk factors to assist in selection of anticoagulation management

Pre PT

Post PT – 2 weeks

Chronic femoral popliteal occlusion

Check Hypercoagulable Panel

* Lupus anticoagulant, factor 2 mutation, antiphopholipid antibodies
  * Be very careful about taking off anticoagulants
* Heterozygous factor V Leiden
  * Many can be managed with routine timing of anticoagulation after venous reconstruction
* MTHF mutation and hyperhomocysteinenia
  * Methylate folic acid replacement – normalizing homocysteine levels returns their risk to baseline

Aspirin Is Your Friend

* ASA overall 40% relative reduction VTED
* ASA Provides Significant Benefit for PE
  * 7% absolute reduction
  * 60% relative risk reduction
  * Hence treat 15 people with ASA after PE and prevent one recurrent symptomatic PE

Becattini C et al (WARFASA Investigators). Aspirin for Preventing the Recurrence of Venous Thromboembolism. N Engl J Med 2012;366:1959-1967