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Learn with Dr. Nicos Labropoulos
The Use of Ultrasound in Chronic Venous Obstruction

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Use of ultrasound in chronic venous obstruction

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The role of venous outflow obstruction in patients with chronic venous dysfunction

Patients with iliofemoral obstruction have the worse hemodynamic impairment.

Venous claudication 8% 6/73

It occurred only in patients with obstruction extending in the iliac veins.
Venous obstruction

- Intraluminal
- Extraluminal
- Both

- Acute
- Chronic
- Both

- Post-thrombotic non-occlusive obstruction
- Post-thrombotic occlusive
- Non-thrombotic iliac vein lesion (NIVL)
Areas of extrinsic vein compression

Common iliac veins
RCIA on LCIV—most common
RCIA on RCIV
LCIA on LCIV

External iliac veins
REIA on REIV
RIIA on REIV
LEIA on LEIV
LIIA on LEIV
Inguinal ligament on EIV

Combinations

Iliac vein compression + symptoms: iliac vein compression syndrome
When to suspect venous obstruction

Venous claudication

When signs and symptoms do not match lower limb ultrasound findings

❖ Disproportionate pain
❖ Disproportionate swelling
❖ Recurrent ulceration
When to suspect venous obstruction

❖ Skin damage C4 to C6
❖ Previous known DVT
❖ High risk for unknown DVT
❖ History of IVC filter
❖ Minimal or no superficial vein pathology
❖ Failed ulcer healing after superficial vein treatment
Iliac vein obstruction evaluation by ultrasound

Direct
❖ Planimetric diameter stenosis
❖ Velocity ratio >2.5
❖ Luminal changes

Indirect
❖ Non-phasic flow in the proximal CFV
❖ Asymmetrical flow pattern in the CFVs
❖ Nonphasic flow during Valsalva maneuver
❖ Low or no velocity augmentation in CFV
❖ Presence of collateral veins
❖ Reverse flow in the ipsilateral internal iliac vein
❖ Cephalad flow in the inferior epigastric vein
❖ Reversed flow in the deep external pudendal vein
❖ Difficulty into compressing the CFV

Labropoulos N. Endovascular Therapy Today July 2018
Iliac vein obstruction evaluation by ultrasound

Ultrasound is the most operator dependent technique. Rigorous training and experience are necessary. Most schools and programs have no dedicated training in this area.

IVUS and venography with intension to treat is used at least in patients with high suspicion for obstruction.

CTV or MRV may be used if there is limited experience with ultrasound. CTV and MRV are also used to identify other causes and are excellent tests for differential diagnosis.
Evaluation of venous obstruction may be controversial

Symptoms are more pronounced and more often present during standing or walking.

All imaging tests are done in supine position.

Venous outflow tests
- Duplex ultrasound
- IVUS
- MRI/MRV
- CT/CTV
- Ascending phlebography
CFV, FV and DVF – evaluate femoral veins for inflow

This patient has great inflow as the ipsilateral CFV, FV and DFV are patent.

Inflow is very important for stent patency.

**Compromised inflow**

DU on April 2015

Male 49y, DVT and PE in 2008

The work by Dr. Comerota showed that veins with partial or no recanalization have luminal material consisting of Collagen type I *80-90%* and Collagen type III *10-20%*.

The image was obtained from a patient of ours who had a documented DVT and PE 7 years prior to this exam. This patient has compromised inflow with obstruction involving the CFV, FV, and DFV.
Recurrent DVT in a patient who had a documented DVT in the same veins few years back. The white luminal material is collagen from the first episode and the echolucent part is fresh thrombus for the current event.

Access was obtained through the ipsilateral popliteal vein.
Normal iliac veins

EIV, IIV and CIV on both sides are evaluated. Flow patterns and obstruction are documented. The confluences of IIV+EIV and LCIV+RCIV are imaged. Diameters from EIV and CIV are obtained. The diameter of the iliac veins even in the supine position is larger than the adjacent iliac artery.
Normal common iliac veins and arteries
Asymmetry on inferior epigastric veins and reversed flow

IEV ipsilateral to the occluded iliac vein is dilated with non-phasic flow. The flow in the IEV is reversed. The flow in this vein is from the abdomen to the groin but now if going the opposite direction. The right IEV has normal size.
Female 35y with pelvic pain and fullness

LCIV compression by the RCIA over the 5th lumbar vertebra.
LCIV diameter 1.4mm

Male 52 years with swelling and pain in left lower limb

Compression of LCIV by the RCIA
He developed iliac DVT after spine surgery.
LCIV diameter 2.5mm
Left common Iliac vein compression

One artery - most common

Both arteries - rare

V2/V1 = 5.8

17 cm/s

98 cm/s

No LCIV flow

Venous ratio is not applicable as the LCIV is occluded.

Common iliac vein union chronic luminal changes

Irregular flow channels in both common iliac veins at their union. The patient had previous DVT involving the IVC and both iliac veins. He presented with bilateral leg edema, pain and mild skin damage. The superficial veins were dilated but without reflux. The deep veins were mostly recanalized and had 1.5s to 4s reflux.
Iliac vein diameter – chronic obstruction
Female 49 years old with metastatic breast cancer diagnosed 6 years ago. She had two episodes of DVT.

The iliac vein diameter is smaller than the adjacent artery. No flow is seen in the CIV and EIV. Flow is detected in the IIV. These findings are often seen in chronic iliac vein obstruction. Even in the supine position the iliac vein has largest diameter than the adjacent artery. When the iliac vein has smaller diameter than the artery obstruction should be suspected.
Peri-procedural ultrasound

Ultrasound evaluation is helpful to

❖ Identify access site
❖ Extent of intraluminal synechiae
❖ Measure vein diameters
❖ Determine landing zone
❖ Evaluate venous inflow
Ultrasound helps determine and obtain vein access. This patient had bilateral IJV chronic obstruction so another vein had to be used.
Options for access
- Tibial vein
- Gastrocnemial vein
- Popliteal vein
- Femoral vein
- Common femoral vein
- Internal jugular vein
- External Jugular vein
- Basilic vein
- Great saphenous vein
- Small saphenous vein
4 year follow-up of a young female patient who presented with left lower limb pain and swelling. She now has only mild swelling.
Female patient present with left pain and swelling after iliofemoral DVT. She underwent thrombolysis and stenting. LT iliac vein stent is patent 5 years after the procedure.

The stent is somewhat compressed under the right CIA. There was no intraluminal obstruction.
Male 26y, LT iliac vein stent thrombosis

The patient present with acute iliofemoral DVT swelling and pain. He underwent thrombolysis and stenting of the left CIV and EIV. He had ATIII deficiency and thrombosed both stents and the CFV few months after the procedure.

Low flow augmentation was seen in the left CFV which was asymmetrical compared to the right EIV.
Left iliac vein stent thrombosis. It was placed for correcting stenosis after thrombolysis in a patient with Factor V mutation.

The patient developed recurrent DVT 6 months after the procedure. He was not compliant with the anticoagulation. He presented with swelling extending to the thigh. He underwent thrombolysis and most veins were lysed but he stents in CIV and EIV remained occluded. He had moderate swelling and refused further treatment. He is on lifelong anticoagulation.
Ultrasound is a useful method to diagnose acute thrombosis, chronic venous obstruction or both. It is used to obtain access, look at the diameter and quality of veins. It is a great tool for follow-up to demonstrate obstruction, reflux or both offering also good differential diagnosis. Currently, no much training is offered in the evaluation of IVC and iliac veins. Rigorous training is required to assess these veins.
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