CTV, MRV, Venography and IVUS for CVD

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Disclosure

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I disclose the following financial relationship(s):

• Ownership Interest: Veniti Ltd;
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Faculty Disclosure

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Wallstents and nitenol stents are used “off-label,” e.g., the use for iliac venous stenting is not described on the product’s label.
Duplex ultrasound –
a test for segmental reflux and obstruction

• Initial choice of test
• Erect or supine position
• Manual vs mechanical compression
• Duration of reflux - >0.5s
  • Fem-pop segment >1.0s ?
  • Perforator outflow >0.35s ?
• Only morphologic criteria for obstruction
• Pattern of reflux and obstruction
Complete Profunda Vein Transformation (Grade 4)

Partial Profunda Vein Transformation (Grade 3)

Ascend venogram - Inflow and an access site
How do I find patients with femoro-ilio-caval obstruction?

• At what degree a venous obstruction is hemodynamically significant is not defined!
• Not possible to hemodynamically quantify venous outflow obstruction!
• No reliable non-invasive study is available!
• Invasive pressure tests are insensitive!
  • hand/foot pressure differential
  • reactive hyperemia pressure increase
  • femoral vein pressure
  • femoro-caval vein gradient
Morphologic Diagnosis

• **Dx is morphologic, not hemodynamic**

• Ultrasound scanning of the lower extremity has to be complemented by transfemoral venography, MRV, CT-V or IVUS in C₃₋₆ cases

• **IVUS is the standard for all other imaging**
  - Transfemoral venogram
  - Multi-plane venograms
  - MRV
  - CTV

**IVUS-verified area stenosis of >50% is considered significant**
Duplex ultrasound and iliac vein chronic obstruction

>50% stenosis = post/pre stenotic peak velocity ratio >2.5

IVUS vs. VENOGRAM AP
(comparison of diameter stenosis)

Venographic stenosis >70% stenosis (n=304)

- Normal venogram findings in 25%
- On average, venogram underestimated the degree of stenosis by 30%

- sensitivity 45%
- negative predictive value 49%

IVUS vs. VENOGRAM AP
(comparison of diameter stenosis)

Venographic stenosis >50% stenosis (n=104)

• 44% Venogram and IVUS negative
• 56% Positive IVUS
  • 17% normal venogram
  • 41% inaccurate location or extent on venogram

  – sensitivity 43%
  – negative predictive value 56%

[Hingorani et al, J Vasc Surg 2011;52:804]
Compression in the frontal plane

Compression in the sagittal plane
IVUS vs. Venogram Oblique
(comparison of area vs diameter stenosis)

Venographic stenosis >50% diameter stenosis (n=37)

• 41% Venogram and IVUS negative
• 51% Positive IVUS (7/19 <50% on venogram)

  – sensitivity (43% AP) 63%
  – negative predictive value (56% AP) 68%
Magnetic Resonance Venogram

Profunda Transformation

Occluded iliac vein

Profunda vein
CT Venogram

Courtesy of Dr William Marston
CT – Venogram 3D reconstruction
Intravascular Ultrasound - IVUS

- Superior to venography for diagnosis of degree and extent of obstruction
- Essential for adequate stent placement in the femoro-ilio-caval venous outflow
Non-occlusive Non-thrombotic Obstruction
(NIVL = nonthrombotic iliac vein lesion)

Pre-stenting
Non-occlusive Postthrombotic Obstruction

Pre-stenting
Role of IVUS in Venous Interventions

- Standard for imaging venous obstruction
- Premier diagnostic tool
- Decreases use of contrast

Mainly used in
- Femoro–ilio–caval stenting
- Placement of IVC filters
- Adjuvant to surgical TE/thrombolysis of iliofemoral DVT
IVUS modifies stenting

IVUS show 46% of compression lesions extend below the CIV into the EIV


IVUS of 16 limbs with iliac compression revealed findings not seen on venogram:

- 68% had lesions extended into EIV or CFV
- 25% had non-occlusive thrombi
- 44% had synechia

IVUS modified the intervention in 50% of limbs

Practical Implications for Management of Chronic Venous Disease

• A comprehensive workup and classification is mandatory prior to treatment

• CVI ($C_{3-6}$) – think ilio-femoral vein obstruction!

• Complement ultrasound scanning of the lower extremity with transfemoral venography, MRV, CT-V or IVUS depending on local accessibility
Generous Use of IVUS

• “High grade of suspicion”

• Positive indicators of obstruction
  stenosis/occlusion on venogram, MR-V, CT-V (77%)
  presence of collaterals (62%)
  positive pressure test (36%)

• Clinical signs and symptoms
  pain out of proportion to lesion
  postthrombotic disease
  no detectable lesion explaining symptoms

IVUS-verified stenosis of >50% is considered for stenting
Intravascular Ultrasound - IVUS

NIVL left