Technical Considerations & Emerging Technology for Chronic Venous Occlusions

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Disclosure Statement of Financial Interest
Within the past 12 months, I or my spouse/partner have had a financial interest/arrangement or affiliation with the organization(s) listed below.

Company                                      Affiliation/Financial Relationship
- Abbott Vascular                           • Scientific Advisory Board
- Medtronic                                 • Consulting agreement
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Chronic Venous Occlusions: Techniques and Emerging Technology

Technical Considerations
- Imaging
- Access
- Basic concepts
- Controversial Issues

Emerging Technology
- Optimal stent design and current products
- Novel stent devices
- Crossing Tools

Chronic Venous Occlusions: Techniques and Emerging Technology

Technical Considerations

- Duplex Ultrasound
  - Highly accurate and sensitive for infrainguinal venous findings
  - Patency of non-visualized iliac veins can be inferred based on flow patterns

Respiratory Phasicity
- Continuous flow pattern
- Patency of non-visualized iliac veins can be inferred based on flow patterns
Chronic Venous Occlusions  
Technical Considerations: Imaging

- Axial Imaging with MRV and CTV
  - External compression syndromes
  - Iliacaval occlusions: identifies reconstitution point
  - Infrainguinal: mapping of PFV vs FV access
  - Identification of congenital anomalies

Chronic Venous Occlusions  
Technical Considerations during Treatment

- Access:
  - Guided by preop/on-table duplex imaging
  - Access in area of good inflow (ie. mid FV)
  - Dual access (IJ, femoral, bifemoral)

Chronic Venous Occlusions  
Technical Considerations: Venous Access

- Adhere to Basic Principles:
  - Correct all significant disease
  - Good inflow to good outflow is essential
  - Stents are required for recanalized lesions; angioplasty alone is insufficient
  - IVC filters should be removed

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Technical Considerations: IVC Filter Impact

- Spectranetics 14Fr SLS II Laser Sheath Lead Extraction System
- 14F 45cm Cook Performer Sheath
- Calibrated at 60mJ/mm²
- 2-5sec activation time

Double-barrel stents through IVC filter
Controversial Issues:
- Stenting the CFV (across the inguinal ligament)
- Stenting of femoral and popliteal veins
- Anticoagulation / antiplatelet management

Stent fractures and restenosis is not the same in the CFV as it is in the CFA
- Stenting across the inguinal ligament is less of a concern than leaving untreated stenotic disease

54-month Secondary Patency
- Non-thrombotic pts = 100%
- Thrombotic pts = 84%

DVT 3 months ago with occlusion of femoral and popliteal veins
Axialization of flow to profunda
Wire traversing femoral vein
After 24 hrs of EKOS assisted lysis and balloon angioplasty

Healthy "inflow" segment of popliteal vein
Patient now > 3 years s/p intervention and remains patent and free from venous symptoms
Chronic Venous Occlusions: Techniques and Emerging Technology

### Emerging Technology

What are the Characteristics of the Ideal Stent?
- High crush resistance
- Uniform crush resistance
- Low profile
- Conformability
- Wide range of lengths/diameters
- Large diameters

**Ideal Venous Stent Properties**

Potential for increased radial force (including at ends), better conformability, with lower profile device delivery system in diameters appropriate for venous applications

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### Chronic Venous Occlusions

#### Emerging Technology: New Stent Design

- **Wallstent (Boston Scientific)**
  - 14-24mm Diameter
  - 60-120mm length
  - 10Fr
  - Braided stainless steel

- **Sinus-Venous (Optimed)**
  - 12-18mm Diameter
  - 60-150mm length
  - 10Fr
  - Laser-cut Nitinol

- **Vici Venous (Veniti)**
  - 14-16mm Diameter
  - 60-140mm length
  - 7Fr
  - Laser-cut Nitinol

- **Zilver Vena (Cook)**
  - 12-18mm Diameter
  - 60-150mm length
  - 10Fr
  - Laser-cut Nitinol

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### Chronic Venous Occlusions

#### Emerging Technology: New Stent Design

- **Veniti VIRTUS Trial**
  - Veniti Vici Venous IDE trial
  - Full enrollment (200 pts) completed Nov 2016
  - 12mo feasibility results presented at Charing Cross 2016
    - 30 patients, multicenter international trial
    - Symptomatic improvement (VCSS>2) in 85%
    - Primary patency at 12 months >90%
    - No major adverse events

- **Cook VIVO Trial**
  - Cook Zilver Vena stent IDE Trial
  - 243 patients (enrollment began Dec 2013)
  - VIVO-EU completed full enrollment
  - Update presented by G. O’Sullivan at VEITH 2016
  - 12mo outcomes pending
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Emerging Technology: Crossing Tools

- Basic Tools:
  - Stiff wires (0.035, 0.018)
  - Support catheters
  - Long sheaths (coaxial use w/ support cath)
  - Long balloons

Technique: Escalating strategy of increasingly supportive wire platforms and coaxial sheath / support catheters, followed by sequential dilatation and stenting.

Chronic Venous Occlusions
Emerging Technology: Crossing Tools

- Co-axial support sheath/catheter
- Curved / Straight catheter & sheath
- 55cm and 90cm lengths in 0.035in

Cook TriForce Peripheral Crossing System

Conclusions
- Adherence to a few basic principles can result in effective percutaneous recanalization of patients with venous occlusive lesions
- The tools and techniques for venous intervention continue to evolve and allow increasing numbers of patients to be effectively treated.