Chronic Venous Insufficiency
Recognition, Prevention and Management

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Disclosures

Will discuss off-label Use
Cook VIVO Stent Trial Site PI
TXTONOMY Co-founder
Objectives - Chronic Venous Insufficiency

• Pathophysiology of chronic venous insufficiency (CVI)
• Recognize the clinical findings
• Summarize major clinical trials in CVI management and prevention
• Understand the role of imaging
• Describe endovascular options for veno-occlusion/reflux
• Discuss the importance of a multidisciplinary approach to CVI care
Evolution in Evaluation and Management

• Recognition
• Imaging
• Endovascular options
  – Pharmaco-mechanical Thrombolysis (PMT)
  – Endovenous Ablation
  – Embolization
  – Revascularization

Acropolis in Athens circa 4 BC
Chronic Venous Insufficiency

• Superficial
  • Obstruction
  • Reflux

• Deep
  • Obstruction
  • Reflux
# Demographics of Venous Insufficiency

<table>
<thead>
<tr>
<th>Age</th>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-29</td>
<td>8%</td>
<td>1%</td>
</tr>
<tr>
<td>40-49</td>
<td>41%</td>
<td>24%</td>
</tr>
<tr>
<td>60-69</td>
<td>72%</td>
<td>43%</td>
</tr>
</tbody>
</table>
CVI Insufficiency Risk Factors

• Female > Male
• Childbearing
• Family history
• History of venous thrombosis
• Occupation
• Pelvic venous congestion
CEAP Classification

- CEAP
  - Clinical severity
  - Etiology (primary, secondary)
  - Anatomy
  - Pathophysiology

- Clinical severity
  - C0 Normal
  - C1 Spider/reticular Veins
  - C2 Simple varicose veins
  - C3 Ankle edema
  - C4 Hyperpigmentation (lipodermatosclerosis)
  - C5 Healed stasis ulcer
  - C6 Open stasis ulcer
Venous Stasis Ulcerations

• Poor healing
• Often mistreated
• $$$

Not an infection. This is a plumbing problem.

Which is better?
Can we prevent PTS?
Iliac Vein Obstruction

- Compression by adjacent artery
- Thrombosis and subsequent scarring
- Cancer
- Aneurysm
- Fibroids
- Abscess
- Osteophyte
- Retroperitoneal Fibrosis
- Pregnancy
Virchow Triad

- Endothelial injury
  - Trauma
  - Surgery
- Stasis of blood flow
  - Immobility
  - CHF
  - Obesity
  - Travel
- Hypercoagulability
  - OCP’s
  - Cancer

Virchow R. Uber die Erweiterung kleiner Gefasse. Arch Path Anat 1851;3:427
What do we know about iliofemoral DVT?

• Despite anticoagulation . . .
  – May be a lower incidence of recanalization.
  – Associated with venous hypertension and post-thrombotic syndrome.

• Amenable to thrombolysis

What do we know about anticoagulation?

• Prevents
  – Clot recurrence and propagation
  – PE and pulmonary hypertension
  – Reduces, but does not eliminate risk of PTS

• Not a thrombolytic

Iliofemoral DVT

What do I need to know?

- Most central extent
- Outflow obstruction
- Status of the IVC
- Extrinsic pathology
<table>
<thead>
<tr>
<th>Definition</th>
<th>Phelgmasia Alba Dolens</th>
<th>Phelgmasia Cerulea Dolens</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition</td>
<td>Massive DVT without gangrene</td>
<td>Massive DVT with ischemia</td>
</tr>
<tr>
<td>Extent</td>
<td>Spares superficial collaterals</td>
<td>Involves superficial collaterals</td>
</tr>
<tr>
<td>Signs &amp; Symptoms</td>
<td>Edema, pain, blanching, w/o cyanosis</td>
<td>Edema, pain, cyanosis</td>
</tr>
</tbody>
</table>
My Experience

• Consider CT pre-procedure
• Game-changer: 8F Angiojet
  • Power Pulse (10 mg tPA in 100 ml NS)
  • Wait 30-45 min, f/u PMT

• 10F Pronto Aspiration
• Fully anticoagulated patients lyse faster
• Popliteal inflow highly predictive of success
• Early, aggressive measures
• Lovenox transition
• Close follow up
AVF Practice Guidelines

1. We recommend precise characterization of the most proximal extent of DVT as involving the iliofemoral, femoral-popliteal, or calf veins

2.1. We suggest a strategy of early thrombus removal in patients with a) a first episode of IF thrombosis, b) symptoms ≤ 14 days, c) low bleeding risk, d) good life expectancy

2.2. We recommend early thrombus removal as the treatment of choice in patients with limb threatening ischemia due to IF thrombosis

3.1. We suggest catheter-directed lysis (CDT) as first line therapy for early thrombus removal

3.2. We suggest a strategy of pharmacomechanical thrombolysis be considered over CDT alone if resources are available
ATTRACTION

• Control Arm Treatment: Initial anticoagulant therapy with unfractionated heparin or enoxaparin for at least 5 days overlapped with long-term oral warfarin (target INR 2.0-3.0).

• Experimental Arm Treatment: Initial anticoagulant therapy (same as Control Arm) overlapped with long-term oral warfarin (target INR 2.0-3.0) and PCDT with intra-thrombus delivery of t-PA into the DVT over a period of up to 24 hours.
Moderate-to-severe post-thrombotic syndrome was less likely with PCDT (17.9% versus 23.7%, P=0.035)
Most proximal DVT location (established?) (a)

- Isolated Distal
- Femoral and/or Popliteal
- Iliac and/or Common Femoral

ASSESS symptom severity

- Minor Symptoms
  - No propagation risk factors (a)
  - Elevated bleeding risk
  - Patient prefers no Rx
  - PERFORM serial ultrasound (Day 7 & 14)
  - Did dot propagate? (b) yes
  - PERFORM expectant management (c)

  - Significant Symptoms
    - Propagation risk factors (a)
    - Patient prefers Rx

- ASSESS symptom severity

- Mild or Moderate Symptoms
  - Elevated bleeding risk
  - Patient prefers conservative Rx

- Major Symptoms
  - Low bleeding risk
  - Patient prefers aggressive Rx
  - BEGIN IV Heparin (REFER for catheter-directed thrombolysis)

Intermountain VTE Best Practice
IFDVT Summary

• Pathophysiology of iliofemoral DVT

• Advances in endovascular DVT management
  • PMT helps achieve early thrombus removal with lower doses of thrombolytic with shorter treatment time and reduced complications
  • Ensure adequate outflow by stenting iliac pathology

• Goal is to Prevent PTS
Endovascular Options in Chronic Venous Obstruction and Insufficiency
Superficial Venous Disease
Goal of Treatment

Comprehensively address the underlying pathophysiology with minimal or no disfigurement.
Comprehensive Approach

• Accurate diagnosis
  • Absolutely crucial
  • Often neglected

• All sources of reflux must be identified and addressed if possible

• Expect the Unexpected!
Extremity Treatment Options

• Endovenous Thermal Ablation
  • Endovenous Laser
  • Radiofrequency Ablation
  • Mechanico-chemical
  • Cyanoacrylate

• Ambulatory phlebectomy

• US-guided Foamed sclerotherapy
What you see is often only the tip of the iceberg

Adapted from Olivier Pichot
Pelvic Venous Congestion Syndrome

• Pain exacerbated by
  • Intercourse
  • Menstruation
  • Prolonged Standing
  • Multiple pregnancies

• Atypical patterns of painful varicosities
  • Vulvar/Labial
  • Thigh (lateral complex)
  • Gluteal
Prevalence of PVI

10 to 15% incidence of pelvic varicosities

Most are asymptomatic

Approximately one-third of patients with chronic pelvic pain may have PVC

Differential Diagnosis in PVI

• Endometriosis
• Pelvic adhesions
• Pelvic inflammatory disease
• Fibroids
• Irritable bowel
Baseline VAS

Research Reporting Standards for Endovascular Treatment of Pelvic Venous Insufficiency


How **intense** is your overall pelvic pain?

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

How **intense** is your pelvic pain while lying down?

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

How **intense** is your pelvic pain while standing?

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

How **intense** is the pain in your leg(s) while lying down?

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

How **intense** is the pain in your leg(s) while standing?

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

How **intense** is the pain in your leg(s) with menstruation?

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

How **intense** is your pain during or following intercourse?

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

Do you have the urge to urinate more frequently than usual?

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

Do you take pain medication on a regular basis? (0 = no, 10 = daily)

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
Role of Imaging in PVI

• *Exclude Concurrent Pathology*
• Confirm the Diagnosis
• Define Anatomy
  • Vascular Anomalies
  • Technical Challenges
83% of the patients exhibited clinical improvement
Comparison of treatments for pelvic venous congestion syndrome

n=106
Diagnosis of pelvic venous congestion syndrome
Clinical diagnosis confirmed through laparoscopy and venography
No response to medication after 4-6 months medication

Three arms:
Embolootherapy (n=52);
hysterectomy/bilateral oophorectomy and hormone replacement (n=27);
hysterectomy with unilateral oophorectomy (n=27).

The visual analog scale implemented to track clinical response.

CONCLUSIONS:
1. Embolootherapy more effective at reducing pelvic pain (p < 0.05)
2. Embolization appears to be a safe, well-tolerated, effective
treatment for pelvic congestion syndrome.
## The Imaging Menu for PVC

<table>
<thead>
<tr>
<th>Modality</th>
<th>Key Findings</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>US</strong></td>
<td>• Ovarian/pelvic varices&lt;br&gt;• Possible visualization of ovarian vein ectasia</td>
<td>• Non-invasive&lt;br&gt;• Availability&lt;br&gt;• Other pathology&lt;br&gt;• Real-time Valsalva</td>
<td>• Patient factors&lt;br&gt;• Technical Variability</td>
</tr>
<tr>
<td><strong>CT/CTA</strong></td>
<td>• Ovarian/pelvic varices&lt;br&gt;• Ovarian vein ectasia&lt;br&gt;• Obstructive lesions</td>
<td>• Non-operator dependent&lt;br&gt;• Anatomic definition&lt;br&gt;• Multiplanar&lt;br&gt;• Rapid acquisition</td>
<td>• Radiation&lt;br&gt;• Supine&lt;br&gt;• Limited definition of adnexa and uterus&lt;br&gt;• Expense</td>
</tr>
<tr>
<td><strong>MRI/MRV</strong></td>
<td>• Ovarian/pelvic varices&lt;br&gt;• Ovarian vein ectasia&lt;br&gt;• Obstructive lesions</td>
<td>• No ionizing radiation&lt;br&gt;• Multiplanar&lt;br&gt;• Pelvic organ definition&lt;br&gt;• Other pathology</td>
<td>• Supine&lt;br&gt;• Metallic artifacts&lt;br&gt;• Motion artifacts&lt;br&gt;• Expense</td>
</tr>
<tr>
<td><strong>Catheter Venography</strong></td>
<td>• Ovarian/pelvic varices&lt;br&gt;• Real-time Reflux&lt;br&gt;• Collateral pathways&lt;br&gt;• Obstructive lesions</td>
<td>• Intent-to-treat efficiency&lt;br&gt;• Real-time Valsalva&lt;br&gt;‘Gold Standard’</td>
<td>• Does not exclude concurrent pathology&lt;br&gt;• Radiation&lt;br&gt;• Expense</td>
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PVI Summary

• PVI is a well described entity, associated with chronic disabling pain

• Traditional medical therapy is temporary at best with no published data on long-term effectiveness

• Visible varicosities may be the "Tip of the Iceberg"

• The H&P with US have high predictive value
PVI Summary

• Venography remains the gold standard for diagnosis

• Cross-sectional Imaging helpful in select cases

• Endovascular minimally invasive embolization techniques represent the best practice state-of-the art

• Embolization for PVI is safe and effective
Central Venous Hypertension

• Review Differential Considerations
• Describe Approach
  • Diagnostic Work-up
  • Endovascular Technique
Indications for Stenting

• C4 to C6 disease
• Pain
• Edema
• Failed “conservative therapy”
The Imaging Checklist

- Anatomic Variants
- Nutcracker
- Mass
- May-Thurner
- Gonadal Veins
# The Imaging Menu for CVO

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<tr>
<th>Modality</th>
<th>Key Findings</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
</table>
| **US**            | • Ovarian/pelvic varices  
                   | • *Possible* visualization of ovarian vein ectasia  
                   | • Waveform analysis  
                   | • Non-invasive  
                   | • Availability  
                   | • Other pathology  
                   | • Real-time Valsalva  
                   | • Body habitus  
                   | • Technical Variability  
                   | • **Limited field of view**  
                   | | **CT/CTA**       | • Ovarian/pelvic varices  
                   | • Ovarian vein ectasia  
                   | • Obstructive pathology  
                   | • Anatomic variants  
                   | • Operator independent  
                   | • Anatomic definition  
                   | • Multiplanar  
                   | • Rapid acquisition  
                   | • Full field of view  
                   | • Radiation  
                   | • Supine  
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                   | • Expense  
                   | | **MRI/MRV**      | • Ovarian/pelvic varices  
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                   | • Expense  
                   | | **Catheter Venography** | • Ovarian/pelvic varices  
                   | • Real-time Reflux  
                   | • Collateral pathways  
                   | • Intent-to-treat  
                   | • Real-time Valsalva  
                   | • Does not exclude concurrent pathology  
                   | • Endoluminal view  
                   | • Radiation  
                   | • Expense  
                   |
Summary

• Endovenous thermal ablation is safe and effective.
• Venous stasis ulceration reflects hemodynamic compromise (elevated hydrostatic pressure).
• PVI is a well described entity associated with chronic, often disabling pelvic and LE pain.
• Acute iliofemoral DVT warrants aggressive work-up and possible catheter-directed thrombolytic treatment.
Summary

• Venous anatomy is highly variable. There is no one size fits all.
• Often what is visible is “the tip of the iceberg.” Treating what is visible is often the last step.
• All sources of reflux should be identified and addressed.
• Meticulous sonographic, and in some cases, venography is critical.