Management of Acute Deep Venous Thrombosis

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Vascular and Interventional Radiology
Introduction

- **DVT Incidence**
  - 50/100 000
  - Approximately 150 000 people/year

- **Diagnosis**
  - Ultrasound
Treatment

➢ Goals
  • Prevent thrombus propagation
  • Prevention of recurrence
  • Decrease risk of pulmonary embolic complications

➢ Cornerstone
  • Anticoagulation
Diagnose DVT by US

Identify any contraindications to anticoagulant therapy

No

Yes

History of HIT

No

Need for hospitalization?

No

Administer LMWH or UFH, treat for at least for 5 days (check platelet count at 3 days)

Yes

Administer Warfarin

Alternative anticoagulant
Duration of Treatment

- 3 months
  - Major transient risk factor
- 6 month
  - Minor risk factor and no thrombophilia
  - Idiopathic event with no thrombophilia or RF
- Indefinite
  - Thrombophilia
  - Recurrence
  - Cancer
What about thrombolysis?

**Recommendations**

1.5.1. In patients with DVT, **we recommend against** the routine use of IV thrombolytic treatment (Grade 1A).

1.5.2. In selected patients such as those with massive ileofemoral DVT at risk of limb gangrene secondary to venous occlusion, we suggest IV thrombolysis (Grade 2C).

**Patient Management Recommendations: Indications for fibrinolytic treatment in patients with lower-extremity DVT**

- **Level A recommendations**: None specified.
- **Level B recommendations**: None specified.
- **Level C recommendations**: Consider fibrinolytic therapy in patients with **limb-threatening thrombosis** of the iliofemoral system in whom the benefits of treatment outweigh the risks of serious bleeding complications.
Thrombolysis: A closer look

Metanalysis of 14 studies (414 pts)
- 8 studies – SK versus UFH (229 patients)
- 2 studies – UK versus UFH (37 patients)
- 3 studies – tPA versus UFH (148 patients)

Similar
- Inclusion – Acute DVT
- Outcomes – Venograms
Efficacy

- Thrombolytic more effective than Heparin
- No difference in drug, route or dosage

Table 1. Post-treatment lysis rates from randomized trials*

<table>
<thead>
<tr>
<th>Thrombolytic agents</th>
<th>Unfractionated heparin</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Patients with &gt;50% lysis</td>
</tr>
<tr>
<td>t-PA</td>
<td>45</td>
</tr>
<tr>
<td>UK</td>
<td>48</td>
</tr>
<tr>
<td>SK</td>
<td>99</td>
</tr>
<tr>
<td>Total</td>
<td>192</td>
</tr>
</tbody>
</table>

*Table modified from [Reference](https://www.journal.com).
Major risk of bleeding 9% versus 5%

One large study had an increased risk of PE
  - 4.5% (9/200) – unique among all studies

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**Table 2. Rates of major hemorrhage from randomized trials**

<table>
<thead>
<tr>
<th>Patients with major bleed</th>
<th>Thrombolytic agents</th>
<th>Unfractionated heparin</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>t-PA</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>169</td>
<td>61</td>
</tr>
<tr>
<td></td>
<td>8%</td>
<td>3%</td>
</tr>
<tr>
<td>UK</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>119</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>0%</td>
<td>22%</td>
</tr>
<tr>
<td>SK</td>
<td>24</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>175</td>
<td>124</td>
</tr>
<tr>
<td></td>
<td>16%</td>
<td>5%</td>
</tr>
<tr>
<td>Total</td>
<td>41</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>463</td>
<td>253</td>
</tr>
<tr>
<td></td>
<td>9%</td>
<td>5%</td>
</tr>
</tbody>
</table>

*Schweizer, J Am Coll Card 2000*
? Long Term Treatment

- Goals
  - Prevent thrombus propagation
  - Prevention of recurrence
  - Decrease risk of pulmonary embolic complications

- Sequelae
  - Pulmonary embolus
  - Post Thrombotic Syndrome
    - Never evaluated in multiple large clinical studies
    - Anticoagulation relies on endogenous fibrinolytic system to dissolve clot
What is PTS?

- Chronic condition
- Variable severity
- No Gold standard diagnosis
  - 3-6 months
- Some objective tests
  - Ultrasound
  - Plethysmography

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Signs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heaviness</td>
<td>Edema</td>
</tr>
<tr>
<td>Pain</td>
<td>Telangiectasia</td>
</tr>
<tr>
<td>Swelling</td>
<td>Venous ectasia</td>
</tr>
<tr>
<td>Itching</td>
<td>Varicose veins</td>
</tr>
<tr>
<td>Cramps</td>
<td>Venous dilatation</td>
</tr>
<tr>
<td>Paresthesia</td>
<td>Hyperpigmentation</td>
</tr>
<tr>
<td>Bursting pain</td>
<td>Redness</td>
</tr>
<tr>
<td></td>
<td>Venous ulcer</td>
</tr>
<tr>
<td></td>
<td>Lipodermatosclerosis</td>
</tr>
</tbody>
</table>
# Clinical Scores

## Table 2. Clinical Scales for the Diagnosis of Postthrombotic Syndrome

<table>
<thead>
<tr>
<th>PTS Scale</th>
<th>Criteria Used to Diagnose PTS</th>
<th>Test Characteristics</th>
<th>Developed Specifically for PTS</th>
<th>Rates Severity of PTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ginsberg et al[^22]</td>
<td>Pain and swelling of limb of ≥1-mo duration, typical character (worse at end of day or with prolonged sitting/standing, better after night's rest and leg elevation) that occurs ≥6 mo after acute DVT and Objective evidence of valvular incompetence (diagnosed via plethysmography or venous Doppler) • If both criteria are present, PTS is diagnosed • Global Rating Questionnaire to rate overall improvement or worsening of PTS over time</td>
<td>Not assessed</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Villalta et al[^4][^6]</td>
<td>5. Symptoms (pain, cramps, heaviness, pruritus, paresthesia) 6. Signs (edema, skin induration, hyperpigmentation, venous ectasia, redness, pain during calf compression) Each rated as 0 (absent), 1 (mild), 2 (moderate), or 3 (severe) Points are summed Total score: 0-4: No PTS 5-14: Mild/moderate PTS ≥15, or presence of ulcer: Severe PTS</td>
<td>Interobserver agreement: ( \kappa = 0.80 ) for symptoms, 0.77 for signs, 0.75 for total score</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>CEAP classification[^4][^6][^4]</td>
<td>Patients with chronic venous disease classified into 1 of 7 clinical classes (class 0-6) according to presence of clinical signs; each class may include signs present in lower-order class Class: 0. Symptoms only; no visible or palpable signs of venous disease 1. Telangiectasias, reticular veins, malleolar flare 2. Varicose veins 3. Edema, no skin changes 4. Skin changes (eg, pigmentation, eczema, lipodermatosclerosis) 5. Skin changes with healed ulcer 6. Skin changes with active ulcer Each clinical class is then subclassified as to: Etiology (congenital, primary, secondary) Anatomy (superficial, deep, perforator veins) Pathophysiology (reflux, obstruction, both)</td>
<td>Area under ROC curve: None vs mild/moderate, 0.93 Mild/moderate vs severe, 0.98</td>
<td>Not assessed</td>
<td>Not†</td>
</tr>
</tbody>
</table>
PTS - Pathophysiology

- Thrombus
  - Thrombus
  - Inflammation
  - Vein recanalization
- Valvular Incompetence +/- Persistent obstruction
- Venous Hypertension
  - Edema
  - Tissue hypoxia
  - Skin ulceration

Edema
Tissue hypoxia
Skin ulceration
Impact of PTS - Incidence

- Dependent on incidence of DVT
- Difficult to enumerate
  - Varying definition
  - Tendency to undercode chronic conditions
- Prandoni et al
  - Cohort observed for 8 years
  - Objective score (Villalta)
  - Compression stockings
  - PTS incidence of approximately 30%
- Brandjes et al
  - Mild-Moderate PTS (with/without stockings)
    - 20% versus 47%
  - Severe PTS (with/without stockings)
    - 11% versus 23%
Impact of PTS - Incidence

<table>
<thead>
<tr>
<th>Source</th>
<th>DVT Type</th>
<th>No.</th>
<th>Duration of Follow-up, y</th>
<th>% Regular Stocking Use</th>
<th>Definition of PTS</th>
<th>Frequency of PTS, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strandness et al, 1983</td>
<td>Any</td>
<td>65</td>
<td>3 (Mean)</td>
<td>74</td>
<td>Pain, edema, skin changes, ulcer</td>
<td>67</td>
</tr>
<tr>
<td>Kakkar and Lawrence, 1985</td>
<td>Any</td>
<td>97</td>
<td>2 (Total)</td>
<td>NR</td>
<td>10-Point scoring system based on symptoms and signs</td>
<td>84</td>
</tr>
<tr>
<td>Monreal et al, 1993</td>
<td>First episode</td>
<td>84</td>
<td>3 (Total)</td>
<td>NR</td>
<td>10-Point scoring system based on symptoms and signs</td>
<td>56</td>
</tr>
<tr>
<td>Johnson et al, 1995</td>
<td>Any</td>
<td>83</td>
<td>3 (Median)</td>
<td>47</td>
<td>Edema, skin changes, ulcer</td>
<td>41</td>
</tr>
<tr>
<td>Prandoni et al, 1996</td>
<td>First episode</td>
<td>355</td>
<td>8 (Total)</td>
<td>Villalta et al scale</td>
<td>29</td>
<td>29</td>
</tr>
<tr>
<td>Brandjes et al, 1997</td>
<td>First episode</td>
<td>194</td>
<td>6 (Median)</td>
<td>Villalta et al scale</td>
<td>31/70</td>
<td>31/70</td>
</tr>
<tr>
<td>Franzek et al, 1997</td>
<td>Any</td>
<td>39</td>
<td>12 (Mean)</td>
<td>54</td>
<td>CEAP scale</td>
<td>36</td>
</tr>
<tr>
<td>AbuRahma et al, 1998</td>
<td>First episode</td>
<td>87</td>
<td>5 (Mean)</td>
<td>Edema, skin changes, ulcer</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>Masuda et al, 1998</td>
<td>Distal</td>
<td>23</td>
<td>3 (Median)</td>
<td>NR</td>
<td>CEAP scale</td>
<td>57</td>
</tr>
<tr>
<td>Meissner et al, 2000</td>
<td>First episode</td>
<td>73</td>
<td>4½ (Mean)</td>
<td>NR</td>
<td>CEAP scale</td>
<td>73</td>
</tr>
<tr>
<td>Saarinen et al, 2000</td>
<td>Any</td>
<td>28</td>
<td>2 (Total)</td>
<td>12</td>
<td>Pain, edema, skin changes, ulcer</td>
<td>73</td>
</tr>
<tr>
<td>Ginsberg et al, 2001</td>
<td>First episode</td>
<td>110</td>
<td>1</td>
<td>0</td>
<td>Chronic persistent leg pain and swelling and valvular incompetence</td>
<td>27</td>
</tr>
<tr>
<td>Haenen et al, 2001</td>
<td>Any</td>
<td>79</td>
<td>2 (Total)</td>
<td>NR</td>
<td>CEAP scale</td>
<td>77</td>
</tr>
</tbody>
</table>

Adapted from Kahn SF, Arch Intern Med 2004
Impact of PTS - QOL

➢ Few studies, but dramatic

➢ 1970’s
  • Approximately 90% unable to work 10 years after iliofemoral DVT

➢ 1990’s
  • 6-8 years after DVT
    • Poorer health perception,
    • Worse physical function
    • Severe role limitations

PTS - What about stockings?

- **Common recommendation**
  - Elastic compression stockings with a pressure of 30-40 mmHG at the ankle for 2 years after an episode of DVT

- **Mainly based on 2 large studies by Brandjes and Prandoni**

- **Controversial recent study**
  - Symptomatic PPS
    - 18 active stockings = 11 treatment failures
    - 17 to placebo stockings = 10 treatment failures
PTS – Systemic Thrombolytic therapy

- Metaanalysis of 13 studies
  - Complete lysis:
    - Thrombolysis (45%) > UFH (4%)
  - Thrombolysis associated with lower incidence of PTS

- Useful Findings
  - No difference in agents
  - No difference between systemic and “locoregional”
  - Improved results with acute versus chronic DVT
# PTS – Systemic thrombolysis

<table>
<thead>
<tr>
<th>Source</th>
<th>Type</th>
<th>Years followed</th>
<th>Intervention/#</th>
<th>Frequency of PTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common et al (1976)</td>
<td>RCT</td>
<td>0.5</td>
<td>SK – 25 UFH - 25</td>
<td>33% 50% (NR)</td>
</tr>
<tr>
<td>Arnesen et al (1982)</td>
<td>RCT</td>
<td>6.5</td>
<td>SK – 21 UFH – 21</td>
<td>24% 67 (NR)</td>
</tr>
<tr>
<td>Schulman et al (1986)</td>
<td>RCT</td>
<td>5</td>
<td>SK – 19 UFH – 17</td>
<td>35% 61 (NR)</td>
</tr>
<tr>
<td>Schweizer et al (2000)</td>
<td>RCT</td>
<td>1</td>
<td>Tpa/sk – 200 UFH - 50</td>
<td>46-78% 82 (&lt;0.01)</td>
</tr>
</tbody>
</table>
Systemic Thrombolysis –
Other side

- Schwieder et al
  - Lysis rate = 33%
  - Complication rate = 33%

- Goldhaber et al
  - Lysis rate = 29%
  - Complication = 1 intracranial hemorrhage
PTS – Systemic thrombolysis

- Inconsistent results
- Long treatment times
- High reported complication rates
Catheter directed thrombolysis
the beginning

- **Semba and Dake et al**
  - 21 patients – UK
    - Complete lysis – 72%
    - Partial lysis – 20%
  - No major complications

- **Bjarnason et al**
  - 77 patients – UK
    - Iliac veins – 78%
    - Femoral veins – 51%
  - No intracranial hemorrhage
  - 2 access site bleeds requiring transfusion

SAFER
MORE EFFECTIVE
Venous Registry

- Multicenter prospective study
  - 63 centers
  - 473 patients with symptomatic lower extremity DVT
  - January 1995-December 1996

- Non-uniform
  - Study protocol
  - Dosing regimen
  - Technical approach
Venous Registry

- Data – 287 patients (61%)
- 312 UK infusions in 303 limbs

  - Length of symptoms
    - Acute (< 10 days) – 66%
  
  - Position
    - Iliofemoral – 71%
    - Femoral-popliteal – 25%

  - Dosage
    - 0.5 – 44.0 million iU UK
    - 2.0 – 147.3 hours
Venous Registry

- Outcome associated with 1 year patency
  - Complete lysis (31%) = 79%
  - Partial (52%) = 58%
  - No lysis (17%) = 32%

- Outcome associated with location
  - Iliofemoral (64%) > Femoralpopliteal (47%)

- Complications
  - 11% - Majority access related
  - 1 ICH
  - 2 PE
# CDT Studies

## Table 3

**Published Studies of Pharmacologic CDT for Acute DVT (>10 Patients)**

<table>
<thead>
<tr>
<th>Study</th>
<th>Year</th>
<th>Study Type</th>
<th>Patients (n)</th>
<th>Drug</th>
<th>Anatomical Success (%)</th>
<th>Clinical Success (%)</th>
<th>Major Bleeds (%)</th>
<th>Re-Thrombosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semba (1)</td>
<td>1994</td>
<td>Observational</td>
<td>21</td>
<td>UK</td>
<td>85</td>
<td>85</td>
<td>0</td>
<td>8% at 3 months</td>
</tr>
<tr>
<td>Bjarnason (51)</td>
<td>1997</td>
<td>Prospective Cohort</td>
<td>77</td>
<td>UK</td>
<td>79</td>
<td>79</td>
<td>7</td>
<td>24% at 1 month</td>
</tr>
<tr>
<td>Verhaeghe (78)</td>
<td>1997</td>
<td>Observational</td>
<td>25</td>
<td>TPA</td>
<td>76</td>
<td>76</td>
<td>24</td>
<td>21% at 1 month</td>
</tr>
<tr>
<td>Raju (52)</td>
<td>1998</td>
<td>Observational</td>
<td>24</td>
<td>UK</td>
<td>88</td>
<td>Not stated</td>
<td>8</td>
<td>Not stated</td>
</tr>
<tr>
<td>Mewissen (36)</td>
<td>1999</td>
<td>Prospective Registry</td>
<td>287 (473)</td>
<td>UK</td>
<td>83</td>
<td>Not stated</td>
<td>11</td>
<td>25% at 1 month</td>
</tr>
<tr>
<td>Patel (53)</td>
<td>2000</td>
<td>Observational</td>
<td>10</td>
<td>UK</td>
<td>100</td>
<td>100</td>
<td>0</td>
<td>10% at 1 month</td>
</tr>
<tr>
<td>O’Sullivan (42)</td>
<td>2000</td>
<td>Observational</td>
<td>39</td>
<td>UK</td>
<td>87</td>
<td>Not stated</td>
<td>0</td>
<td>6% at 1 month</td>
</tr>
<tr>
<td>Kasirajan (54)</td>
<td>2001</td>
<td>Observational</td>
<td>17</td>
<td>UK/TPA/RPA</td>
<td>82</td>
<td>82</td>
<td>0</td>
<td>24% at 12 months</td>
</tr>
<tr>
<td>Chang (46)</td>
<td>2001</td>
<td>Observational</td>
<td>10</td>
<td>TPA</td>
<td>100</td>
<td>100</td>
<td>0</td>
<td>10% at 6 months</td>
</tr>
<tr>
<td>Ourlie (60)</td>
<td>2001</td>
<td>Prospective Registry</td>
<td>11</td>
<td>RPA</td>
<td>91</td>
<td>Not stated</td>
<td>9</td>
<td>Not stated</td>
</tr>
<tr>
<td>Shortell (55)</td>
<td>2001</td>
<td>Observational</td>
<td>31</td>
<td>UK/TPA</td>
<td>80</td>
<td>Not stated</td>
<td>10</td>
<td>Not stated</td>
</tr>
<tr>
<td>AbuRahma (33)</td>
<td>2001</td>
<td>Prospective Controlled</td>
<td>51</td>
<td>UK/TPA</td>
<td>89</td>
<td>Not stated</td>
<td>11</td>
<td>6% at 1 month</td>
</tr>
<tr>
<td>Castaneda (61)</td>
<td>2002</td>
<td>Prospective Cohort</td>
<td>25</td>
<td>RPA</td>
<td>92</td>
<td>Not stated</td>
<td>4</td>
<td>Not stated</td>
</tr>
<tr>
<td>Vedantham (56)</td>
<td>2002</td>
<td>Observational</td>
<td>20</td>
<td>UK/TPA/RPA</td>
<td>89</td>
<td>82</td>
<td>14</td>
<td>Not stated</td>
</tr>
<tr>
<td>Razavi (62)</td>
<td>2002</td>
<td>Prospective Cohort</td>
<td>31</td>
<td>TNK</td>
<td>89</td>
<td>Not stated</td>
<td>6</td>
<td>Not stated</td>
</tr>
<tr>
<td>Elsharawy (34)</td>
<td>2002</td>
<td>Randomized Trial</td>
<td>35</td>
<td>SK</td>
<td>100</td>
<td>Not stated</td>
<td>0</td>
<td>Not stated</td>
</tr>
<tr>
<td>Sugimoto (57)</td>
<td>2003</td>
<td>Observational</td>
<td>54</td>
<td>UK/TPA</td>
<td>Not stated</td>
<td>85</td>
<td>0</td>
<td>Not stated</td>
</tr>
<tr>
<td>Grunwald (58)</td>
<td>2004</td>
<td>Observational</td>
<td>74</td>
<td>UK/TPA/RPA</td>
<td>98</td>
<td>Not stated</td>
<td>5</td>
<td>Not stated</td>
</tr>
<tr>
<td>Vedantham (59)</td>
<td>2004</td>
<td>Observational</td>
<td>18</td>
<td>RPA</td>
<td>100</td>
<td>96</td>
<td>6</td>
<td>9% at 1 month</td>
</tr>
</tbody>
</table>

RPA = reteplase; SK = streptokinase; TNK = tenecteplase; TPA = tissue plasminogen activator; UK = urokinase.
CDT – Recent studies

- 2002, Elsharawy et al
- RCT
  - 35 patients with iliofemoral DVT
  - CDT + anticoagulation versus anticoagulation
- Outcome
- CDT
  - 72% patency with 11% reflux
- Anticoagulation
  - 12% patency with 42% reflux
Quality Improvement Guidelines for the Treatment of Lower Extremity Deep Vein Thrombosis with Use of Endovascular Thrombus Removal

Suresh Vedantham, MD, Patricia E. Thorpe, MD, John F. Cardella, MD, Chair, Clement J. Grassi, MD, Nilesh H. Patel, MD, Hector Ferral, MD, Lawrence V. Hofmann, MD, Bertrand M. Janne d’Othée, MD, Vittorio P. Antonaci, MD, Elias N. Brountzos, MD, Daniel B. Brown, MD, Louis G. Martin, MD, Alan H. Matsumoto, MD, Steven G. Meranze, MD, Donald L. Miller, MD, Steven F. Millward, MD, Robert J. Min, MD, Calvin D. Neithamer Jr., MD, Dheeraj K. Rajan, MD, Kenneth S. Rholl, MD, Marc S. Schwartzberg, MD, Timothy L. Swan, MD, Richard B. Towbin, MD, Bret N. Wiechmann, MD, and David Sacks, MD, for the CIRSE and SIR Standards of Practice Committees

J Vasc Interv Radiol 2006; 17:435–448
Definitions

- **Length**
  - Acute DVT: < 14 days
  - Subacute DVT: 15-28 days
  - Chronic DVT: > 28 days
  - Acute on Chronic DVT: Both

- **Extent**
  - Proximal: Popliteal to Iliac vein
    - Femoropopliteal: SFV/DFV/Popliteal
    - Iliofemoral: Iliac and CFV
  - Calf Vein
Definitions – Treatment Method

- Pharmacologic thrombolysis
  - Systemic
  - Flow-directed
  - Catheter directed thrombolysis (CDT)
- Percutaneous mechanical thrombectomy
- Pharmacomechanical thrombolysis
  - Pulse-spray technique
- Aspiration thrombectomy
- Balloon Maceration
Elements of Care

- Pretreatment evaluation and patient selection
- Performance of the procedure
- Post-procedure follow-up care
- Outcome thresholds
Pre-Treatment Evaluation

- History and Physical
  - Prior episodes
  - Symptoms and Signs of PE
  - Contraindication for thrombolysis
  - Medications/allergies

- Imaging confirmation
  - Ultrasound
  - MRV – confirm iliac extent
Pre-Treatment Evaluation

- Consent
  - Prolonged bed rest – 72 hours
  - Anatomic success – 90%
  - Early rethrombosis – 20%
  - Complications
    - Death < 1%
    - ICH < 1%
    - Major bleed 7-10%
    - Symptomatic PE 1%

- Blood work
  - CBC, INR, PTT, Creatinine
  - Type and screen

- Monitored bed
Contraindications to thrombolysis

- **Absolute**
  - Active bleeding
  - Active bleeding diathesis
  - Recent major surgery < 14 days
  - Recent stroke (<3 months)
- **Relative**
  - Brain metastases
  - Recent trauma
  - GI bleed
  - Severe hypertension
  - Pregnancy
Patient Selection (1)

- Limb Threatening iliofemoral DVT
- Phlegmasia cerulea dolens
  - Extensive DVT
  - Massive lower extremity edema
  - Compromised capillary blood flow with limb threatening ischemia
Phlegmasia cerulea dolens

- Rare
- High mortality: 20-41%

Treatment
- Surgical thrombectomy
- Fasciotomy and amputation

CDT
- Case reports and small series

Recommendations
- Bleeding risk – Low or Moderate
- Life Expectancy – Any
- Goal – Limb salvage/survival

Patient Selection (2)

- **Acute IVC thrombosis**
  - **Symptoms**
    - Moderate-severe pelvic congestion
    - Limb symptoms
    - Compromise of Visceral organ venous drainage
      - ARF
      - Budd-Chiari
  - **Recommendations**
    - Bleeding risk – Low or Moderate
    - Life Expectancy – Any
    - Goal – PE prevention, Symptom relief
Patient Selection (3)

- Acute iliofemoral DVT
  - Recommendations
    - Bleeding risk – Low
    - Life Expectancy – Long
    - Goal – Prevent PTS
  - Not conclusively proven
    - Supported by numerous studies
  - Lower PTS
    - Systemic thrombolysis
    - Surgical thrombectomy
    - CDT studies
Patient Selection (4)

- **Acute femoropopliteal DVT**
  - Almost all patients experience symptom resolution with anticoagulation and compression stockings

- **Little indication for CDT**
  - Smaller margin for potential benefit
  - Lower observed patency rates of CDT
  - Risk of complication
Elements of Care

- Pretreatment evaluation and patient selection
- **Performance of the procedure**
- Post-procedure follow-up care
- Outcome thresholds
Procedure

- **Planning**
  - MRV
    - Confirm acuity
    - Extent
Procedure

Preparation

- Peripheral IV line
  - Baseline laboratory data
    - Coagulation parameters
      - Fibrinogen, PTT, INR
    - Type and screen
Procedure

- Venous access
  - US
    - 21 gauge needle
  - Sites
    - Popliteal
    - IJ
    - Tibial Vein
Procedure

- **Venography**
  - Intraluminal filling defect
  - Abrupt cut-off of vein
  - Intraluminal septation

- **Traversal of clot**
Adjunctive Procedures

- Percutaneous mechanical thrombectomy
  - Angiojet
  - Ekos
- Pharmacomechanical thrombolysis
  - Pulse-spray technique
    - With or without Angiojet
- Aspiration thrombectomy
- Balloon Maceration
Adjunctive Procedures
IVC Filter

- PE
  - Clinical PE risk greater

- UVA
  - Retrievable Filter routinely placed
  - Rt. IJ route
  - 7-8 French sheath left in place
Standard Procedure

- **Thrombolysis agent**
  - tPA
  - UK out of fashion

- **Dosing**
  - Extrapolated from peripheral arterial studies
    - tPA = 0.5–1.0 mg/hr
    - Reteplase = 0.25 – 0.75 units/hr
    - Tenecteplase = 0.25 – 0.5 mg/hr
Anticoagulant therapy

- UFH use recommended
  - Consensus opinion
- Unknown
  - Glycoprotein IIB/IIIA
  - LMWH
Monitoring

- ICU or intermediate care bed
  - Bed rest
  - Immobile extremity

- Sequential pneumatic compression

- Lab
  - CBC, platelets, PTT, Fibrinogen q6h-q8h

- Repeat Venogram
  - Q8h – Q24 h
Iliocaval venous stenosis

- Significant stenosis
  - Anatomic diameter narrowing
  - Flow stasis
  - Opacification of collateral veins
- Adjunctive diagnosis
  - IVUS
- Stents versus PTA
  - Fibrotic nature of obstruction
  - Traps thrombus
May-Thurner
Elements of Care

- Pretreatment evaluation and patient selection
- Performance of the procedure
- Post-procedure follow-up care
- Outcome thresholds
Post-Procedure Care

- **Anticoagulation**
  - UFH or LMWH
  - Followed by Warfarin

- **Anti-Platelet**
  - If stent placed

- **Elastic compression stockings**

- **Testing for thrombophilia**
  - No anatomical cause
  - or < 50 years old
Outcome Goals

- Elimination of thrombus
- Symptom resolution
- Prevention of recurrent DVT and PTS
- Preservation of PE

Complications

- SIR suggested thresholds
  - Death, ICH - < 1%
  - Major bleed - < 15%
  - PE - < 2%
Summary

- **Current Paradigm**
  - Anticoagulant therapy – cornerstone
  - IVC filter – if contraindication
  - CDT – limb-threatening DVT

- **PTS**
  - Significant but poorly evaluated impact
  - CDT for PTS prevention
    - Significant data and support among interventionalist
    - No support in broad literature
Conclusion

- Semba and Dake, 2004
  - Hurdles facing broad application of CDT
    - Lack of RCT
    - Safety and cost concerns of CDT
  - Lack of awareness by primary care physicians
  - Lack of accepted reporting system
  - No practice guidelines by interventionalists