Approach to Acute Limb Ischemia

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Disclosure slide

Speaker name: Koen Deloose, MD

- I have the following potential conflicts of interest to report:
  - *Consulting:* Medtronic, Spectranetics, Biotronik, Abbott, Bard, iVascular, Bentley, Cook, GE Healthcare
  - *Employment in industry*
  - *Stockholder of a healthcare company*
  - *Owner of a healthcare company*
  - *Other(s)*

- I do not have any potential conflict of interest
Acute Limb Ischemia (ALI)

- Sudden decrease in limb perfusion
- Acute new or acute worsening symptoms (pain, pallor, pulselessness, poikilotherm, paresthesia, paralysis)
- Threatening limb viability
- If no urgent diagnosis & treatment -> limb loss / dead

- Incidence 0.014%/yr in US
Acute Limb Ischemia (ALI)

- In situ thrombosis 85%
  - Atherosclerosis/rupture art plaque
  - Hypercoagulable states
  - Trauma, dissection, external compression, arteritis....

- Embolization 15%
  - Cardiac 90% (AF, AMI, valvular heart disease...)
  - Aneurysm (PA...)
# Acute Limb Ischemia (ALI)

- Adapted from Rutherford RB et al. J Vasc Surg 1997;26:517

<table>
<thead>
<tr>
<th>Class</th>
<th>Prognosis</th>
<th>Sensory loss</th>
<th>Motor deficit</th>
<th>Arterial Doppler</th>
<th>Venous Doppler</th>
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<tbody>
<tr>
<td>I: Viable</td>
<td>No immediate threat</td>
<td>None</td>
<td>None</td>
<td>Audible</td>
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<tr>
<td>IIA: Marginally threatened</td>
<td>Salvageable if promptly treated or none</td>
<td>Minimal (toes) or none</td>
<td>None</td>
<td>Inaudible</td>
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<td>IIB: Immediately threatened</td>
<td>Salvageable if immediately revascularized</td>
<td>More than toes, rest pain</td>
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<td>III: Irreversible</td>
<td>Major tissue loss, permanent nerve damage</td>
<td>Profound, anesthetic</td>
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**CT angiography lower limbs**
# Acute Limb Ischemia (ALI)

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## No time & tissue loss: on table angiography

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<th>Clinical Manifestations</th>
<th>Vascular Status</th>
<th>Neurological Status</th>
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Acute Limb Ischemia (ALI)

- SURGICAL THROMBOEMBOLECTOMY
  + additional surgical/endovascular procedure

- CATHETER DIRECTED THROMBOLYSIS (CDT)
  or ultrasound accelerated thrombolysis

- PERCUTANEOUS ASPIRATION THROMBECTOMY (PAT)

- PERCUTANEOUS MECHANICAL THROMBECTOMY (PMT)
Surgical thromboembolectomy

• 1963: introduction Fogarty catheter

• Fast removal of large amounts of material

• Invasive, increased mortality/morbidity
• Endothelium damage
• More difficult to treat small arteries/collaterals
• Residual thrombus/underlying disease
Catheter directed thrombolysis

- 1980: r-TPA & Urokinase in loko
Catheter directed thrombolysis

- Minimal invasive
- Gentle preservation of endothelium
- Complete clot removal
- Also cleans smaller arteries/collaterals/branches
- Additional definitive treatment easy

- Prolonged time to revascularization
- The older the clot, the more incomplete the lysis
- Hemorrhagic complications
- Expensive: ICU requirements
Catheter directed thrombolysis vs Surgery

• **Rochester trial** (Ouriel K et al. J Vasc Surg 1994;19:1021-1030)
  - 114 patients, limb threatening ischemia <7 days
  - Limb salvage @1yr **no difference**
  - Cumulative survival rate @1yr was significantly higher in CDT group

• **STILE trial** (Ann Surg 1994;220:251-266)
  - 393 patients
  - **No difference** in death/major amputation
Catheter directed thrombolysis vs Surgery


  ✓ 454 patients, <14days ischemia
  ✓ No difference in amputation free survival rates @6 & 12 m
  ✓ Higher incidence of major hemorrhages in CDT group

The risk of complications increases with the duration of the infusion from **4% at 8 hours to 34% at 40 hours**, dosage of thrombolytics & with the association with **Heparin**
Percutaneous Aspiration Thrombectomy (PAT)

- Simple concept: specially designed aspiration catheter & syringe
  - Pronto extraction catheter (Vascular solutions)
  - Export Advance aspiration catheter (Medtronic)
  - Eliminate Aspiration catheter (Terumo)
  - Capturer thrombus aspiration catheter
Percutaneous Aspiration Thrombectomy (PAT)

- Ease of use, quick set-up
- Deliverability to small-caliber distal vasculature
- No hemolysis
- No distal embolization

- Residual clot ++ : efficacy for big amounts?
- Side branches, collateral cleaning?
- Blood loss?
Percutaneous Mechanical Thrombectomy (PMT)

- First line therapy for ALI patients
- Based on rapid streams of fluids, creating hydrodynamical forces

- Fast & efficient removal of larger clot amounts
- Cheaper than CDT : no ICU need

- Vessel wall damage
- Risk of distal embolization
- Risk of hemolysis – hyperkalemia – fluid overload
Percutaneous Mechanical Thrombectomy (PMT)

- **AngioJet rheolytic thrombectomy system** (Possis)
Percutaneous Mechanical Thrombectomy (PMT)

- **AngioJet rheolytic thrombectomy system** (Possis)
  
  - Aspirating $>75\%$ of thrombus
    
    (Rogers et al. Circulation 2007;116:2072-2085)
  
  - Multicenter Registry 99 pts
    
    ✓ $70\%$ substantial revascularization ($<50\%$ residual defect)
    
    ✓ $<5\%$ in-hospital and 30 d mortality
    
Percutaneous Mechanical Thrombectomy (PMT)

- **Rotarex S thrombectomy system** (Straub Medical AG)

- Aspiration into the side cutting windows
- Shredding of the occlusion material into miniscule particles
- Transport of debris out of the blood vessel
Percutaneous Mechanical Thrombectomy (PMT)

- **Rotarex S thrombectomy system** (Straub Medical AG)

Technical success rate was 97.7%
Percutaneous Mechanical Thrombectomy (PMT)

- **Rotarex S thrombectomy system** *(Straub Medical AG)*

Robinson study: Belgian prospective, non-randomized multicenter (5) study; 30 pts

- 16/30 < 30% residual stenosis – 14/30 additional treatment
- 1/30 perforation – 4/30 distal embolization
- Rotarex alone: 4012 euro
- Rotarex + Additional treatment: 4800 euro
- CDT: 8406 euro
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Treatment algorithm ALI

Class I Viable
- Class IIa
  Marginally threatened
- Class IIb
  Immediately threatened
- Class III
  Advanced/Irreversible

CDT – PAT – PMT

PAT – PMT
  Surgery if (access) problems

Additional endovascular work

Additional surgical work