Peripheral Arterial Disease
Disclosures:

Nothing to Disclose
PAD - Prevalence

- 5% < 50 years
- 10% at age 65
- > 25% at 80yrs or older
PAD – Epidemiology - ABI

- ABI < 0.9
- Compared with invasive angiogram and correlates
- Higher risk of claudication and mortality
Figure 18-5 Measurement of the ankle-brachial index (ABI). Brachial artery systolic blood pressure can be measured with a standard sphygmomanometer (A). A Doppler probe is placed on the dorsum of the foot to measure the systolic blood pressure at the ankle (B). The ABI is calculated as the ratio of the ankle systolic pressure to the brachial systolic pressure (C).
PAD - Risk factors

- Smoking
- DM
- HTN
- Hyperlipidemia
- Hyperhomocystinemia
- Chronic inflammatory conditions
Diagnostic Studies

- ABI
- Segmental limb and Pulse volume recordings
- Arterial Duplex Study
- CT Angiogram
- MR Angiogram
Non Enhanced QISS MR Angiography

- Evaluation of Aortoiliac region in 6.4 minutes
-Insensitive to motion
- Useful in renal dysfunction
- 85-90 sensitivity
- 95-97% sensitivity
# TABLE 18-1  Fontaine Classification

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Asymptomatic, ABI &lt; 0.9</td>
</tr>
<tr>
<td>II</td>
<td>Intermittent claudication</td>
</tr>
<tr>
<td>III</td>
<td>Daily rest pain</td>
</tr>
<tr>
<td>IV</td>
<td>Focal tissue necrosis</td>
</tr>
</tbody>
</table>

ABI, ankle-brachial index.
<table>
<thead>
<tr>
<th>Grade</th>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>Asymptomatic</td>
</tr>
<tr>
<td>I</td>
<td>1</td>
<td>Mild claudication</td>
</tr>
<tr>
<td>I</td>
<td>2</td>
<td>Moderate claudication</td>
</tr>
<tr>
<td>I</td>
<td>3</td>
<td>Severe claudication</td>
</tr>
<tr>
<td>II</td>
<td>4</td>
<td>Ischemic rest pain</td>
</tr>
<tr>
<td>III</td>
<td>5</td>
<td>Minor tissue loss</td>
</tr>
<tr>
<td>IV</td>
<td>6</td>
<td>Major tissue loss</td>
</tr>
</tbody>
</table>
Nonatherosclerotic Causes of Exertional Leg Pain

- Nonatherosclerotic arterial disease
- Atheroembolism
- Vasculitis
- Extravascular compression
- Popliteal artery entrapment
- Adventitial cysts
- Fibromuscular dysplasia
- Endofibrosis of the internal iliac artery
- Venous claudication
- Compartment syndrome
- Lumbar radiculopathy
- Spinal stenosis
- Hip/knee arthritis
- Myositis
Endovascular Treatment - Indications

- Lifestyle and vocational limiting CLAUDICATION
- REST PAIN
- ULCERS
- GANGRENE
- ACUTE ISCHEMIA
Endovascular Treatment - Access

- Radial
- Brachial
- Femoral
- Popliteal
- Pedal, DP, ATA, PTA and Peroneal
- Graft
Diagnosis of SCA Stenosis / Occlusion

- Bilateral upper extremity BP difference > 20 mm
- US Duplex: Reversal of flow in Vertebral Artery
- CTA
- MRA
Subclavian Artery Stenosis/Occlusion

- Usually asymptomatic
- Subclavian Steal Syndrome (SSS)
- Upper extremity Claudication
- Coronary Steal Syndrome  In pts with IMA graft
Endovascular Treatment – SCA Stenosis

- Primary stenting
- Technical success 93-96%
- Restenosis 6-12%
Occurrence of Chronic Mesenteric Ischemia

- Pace of lesion progression
- Ability to develop collaterals (DM, CRF)
- Site of lesion
Chronic Mesenteric Ischemia

- Atherosclerosis
- Median Arcuate Ligament Compression Syndrome
- Takayasu Arteritis
- FMD
- TAO
- Vasculitis
Renovascular Hypertension

- 1% HTN
- Often presents as Recurrent Flash Pulmonary edema
- Atherosclerosis, FMD, Dissection
LERICHE SYNDROME

- Chronic Aortic Occlusion
- Claudication
- Impotence
Right
Outback LTD®
RE-ENTRY CATHETER

22 gauge nitinol re-entry cannula
Viance™ Crossing Catheter
Finesse over force.

A precision instrument designed to quickly and safely deliver a guidewire, the Viance crossing catheter puts the control of crossing where it belongs: in your hands.

Providing an effective frontline option for CTOs, the Viance catheter enables you to utilize a proactive technique to cross total occlusions into the true lumen.

- Fast-spin torque handle
- 150cm working length
- OTW 0.014" guidewire compatible
- Atraumatic 0.037" distal tip
- Multi-wire coiled shaft
PTA

- Plaque is fractured and redistributed radially
- Enlargement of lumen due bowing of EEL and Adventia outward
Restenosis

- 30-50%
- Symptomatic in < 12 months
- 50% or more luminal diameter loss
Vascular Remodelling - PTA

- Perfect – Adventitia bowed out sufficiently to accommodate plaque and NIH

- Favorable - wall enlarged enough to accommodate plaque and NIH, but there is hemodynamically insignificant stenosis

- Unfavorable – artery cannot expand and NIH causes stenosis
NEO INTIMAL HYPERPLASIA - NIH

- Activated Fibroblast in adventitial layer
- Phenotype change to SMC
- SMC migrates to Intima
- SMC Produces Matrix, Which is Neo intimal hyperplasia
- Process starts in 30 minutes and continues up to 2 months
Instent Restenosis

- 19-37% in Femoro popliteal segment
- Tosaka classification
  - Class 1 < 5 cm
  - Class 2 > 5 cm
  - Class 3 occlusion
ISR Treatment options

- Directional Atherectomy
- Laser Atherectomy
- Jetstream Atherectomy
- Placement of Viabahn
- Zilver PTX Stent- DES
- Drug coated balloon Angioplasty (DCB)
ISR - DCB

- 39 Patients
- Technical success 100%
- Primary patency at 12 months 92%
ISR – Zilver PTX Stent

- 119 Patients
- Lesion length, <15 cm, 34%, > 15 cm 33 %
- Occlusions 31%
- Technical success 98%
- Primary patency at 12 months 78.8%
IN PACT SFA- Randomised study
Drug coated vs Standard balloon Angioplasty

- IC or Rest pain
- 331 Pts 2:1
- Lesion lengths 8.9 cm DCB and 8.81 cm PTA
- Success rates 99.5% DCB and 98% PTA
- Primary Patency 82.2% for DCB, and 52.4% for PTA
Sirolimus,

- Immunosuppressive drug
- Inhibits proliferation and migration of SMC
- Blocks cell cycle at G1-S phase
- Endothelialisation at 30 days
Paclitoxol

- Anti neoplastic drug
- Inhibits proliferation and migration of SMC
- Blocks cell cycle at G2-M cell cycle
- Delayed endothelialisation up to 90 days
Figure 44. Illustration of chronic total occlusion CAPs and the various challenges they present.
Filter the risk™

For the ultimate in embolic protection.
Critical Limb Ischemia

- Tibial vessel stenotic and occlusive disease
- Additional Iliac, femoral and popliteal disease
Critical Limb Ischemia

- Prevalence 1.2% in 60-90 years age
- Diabetics have 4 fold increase in amputation
- Smokers > 15 cigarettes, amputation rates 21%
  - < 15 cigarettes, amputation rates 2%
- DD – Atheroembolic disease, palpable pulses
Critical Limb Ischemia

- Endothelia dysfunction - decreased NO and Prostaglandin production
- Abnormal hemorrhology
- Increased viscosity
- Reduced red cell flexibility
- Cellular plugs and micro thrombi
- Increased WBC count and adherence
- Increased platelet number and activation
STEM CELLS

- Ability to divide and self renew indefinitely and differentiate in to one or more cell types
- Embryonic stem cells
- Adult stem cells
- Limited differentiating ability
- From bone marrow, adipose tissue and umbilical cord blood
STEM CELL THERAPY - CLI

- Bone marrow derived ENDOTHELIAL PROGENITOR CELLS
- Intramuscular injection
- Increased ABI
- Decreased rest pain
- Increased pain free walking
- Wound healing
- Increased trans cutaneous oxygen pressures
JENALI Classification

- Class 1  0-1 patent segment
- Class 2  2-4 patent segments
- Class 3  5-8 patent segments
- Class 4  9 patent segments (normal)
Chronic Mesenteric Ischemia

- Weight loss
- Pain following ingestion of food
- Bloating sensation, occasional diarrhea
BTK- DES

- Safe and Easy to use
- Minimal procedural failure
- Decreased TLR
BTK – DES Randomised trial
Yukon- DES vs BMS

- DES Primary patency at 1 yr 81%
- BMS Primary patency at 1 yr 56%
BTK – DES Randomized trial
ACHILLES Trial- DES vs PTA

- DES Restenosis rate at 1 yr 19%
- PTA Restenosis rate at 1 yr 49%
Acute Limb Ischemia

- Sudden limb threatening decrease in perfusion less than 14 days
- 13-17 patients per 100,000 population
- Amputation rate 13%
- Mortality rate of 18%
Acute Limb Ischemia

- 6 Ps - Pulselessness, pallor, pain, poikilothermia, paresthesia, paralysis
- Aspiration of clot
- Angiojet
- Thrombolysis
- Surgical thrombectomy
Etiology of Acute limb Ischemia - Embolic

- Cardiac
- Artery to artery
- Iatrogenic
  - Catheterization, vascular closure device
- Others
Aetiology of Acute Limb Ischemia - in situ Thrombosis

- Iatrogenic
- Stenosis, restenosis
- Stent or Stent graft
- Aneurysm
- Dissection
- Low flow states
<table>
<thead>
<tr>
<th>Rutherford Class</th>
<th>Prognosis</th>
<th>Sensory Exam</th>
<th>Motor Exam</th>
<th>Arterial Doppler Signal</th>
<th>Venous Doppler Signal</th>
<th>Skin Exam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class I: viable, not threatened</td>
<td>Threatened</td>
<td>Normal sensory exam</td>
<td>Normal</td>
<td>Audible</td>
<td>Audible</td>
<td>Normal capillary return</td>
</tr>
<tr>
<td>Class IIa: marginally threatened</td>
<td>Salvageable with prompt therapy</td>
<td>Minimal sensory loss</td>
<td>Normal</td>
<td>Often audible</td>
<td>Audible</td>
<td>Decreased capillary return</td>
</tr>
<tr>
<td>Class IIb: immediately threatened</td>
<td>Salvageable if treated immediately</td>
<td>Mild sensory loss and rest pain</td>
<td>Mildly to moderately abnormal</td>
<td>Usually inaudible</td>
<td>Audible</td>
<td>Pallor</td>
</tr>
<tr>
<td>Class III: irreversible</td>
<td>Irreversible tissue and nerve damage</td>
<td>Profound sensory loss</td>
<td>Paralysis and rigor</td>
<td>Inaudible</td>
<td>Inaudible</td>
<td>No capillary return, skin marbling</td>
</tr>
</tbody>
</table>

ISR - Laser Atherectomy

- Lesion length 10.9 cm
- Technical success 98.8%
- Primary patency at 12 months 48%
ISR – Jetstream Atherectomy

- Primary patency at 12 months  33%
ISR- Directional Atherectomy

- Procedural Success 100%
- Adjunct stenting 11%
- Primary patency at 18 months 49%