Diagnosis and management of peripheral vascular disease in the diabetic

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Pathophysiology of Diabetic Foot Infections

Transmetatarsal Amputation

- Results in a good walking foot
- Patient can wear a regular shoe with no prosthesis
- Stuff the toe of the shoe with lambs wool to prevent the foot sliding forward

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Results Of Transmetatarsal Amputation - 60’s and 70’s

- **Ischemic Patients** (Not revascularized)
  - Early Success: 85%
  - Three Years: 61%

- **Neuropathic Patients**
  - Early Success: 97%
  - Three Years: 88.5%

Role of the Podiatrist

- Provides basic foot care with education of patient monitoring of neuropathic changes
- Trims calluses and provides nail care.
- Ensures proper shoeing
- If foot deformity severe may change shape of foot eg tenotomy, MT head resection etc
- Complex Charcot reconstruction

Changing Amputation Rates in Eighties
Evaluation of wound infection

- Requires thorough probing of wound to determine extent
- Aerobic and anaerobic wound cultures taken at this time unless infection mild

Treatment of Infection

1. Complete drainage of infection important with excision of all non viable tissue
2. Appropriate antibiotic coverage

Antibiotic of choice for outpatient treatment of mild infection?

- Dicloxacillin
- Keflex
- Cipro
- Bactrim
Joslin Diabetes Center
Advances in Diabetes and Thyroid Disease 2013
Diabetes and Men's Health: Testosterone and Sexual Dysfunction

<table>
<thead>
<tr>
<th>Gram Positive</th>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
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<tbody>
<tr>
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<td>9</td>
<td>23</td>
<td>22</td>
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<td>S. Epidermidis</td>
<td>6</td>
<td>14</td>
<td>13</td>
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<tr>
<td>Streptococcus</td>
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<td>19</td>
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<td>Enterococcus</td>
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<td>Diphteria</td>
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<table>
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<td>E. Coli</td>
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<td>Proteus</td>
<td>2</td>
<td>2</td>
<td>7</td>
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<tr>
<td>Klebsiella</td>
<td>1</td>
<td>4</td>
<td>4</td>
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<tr>
<td>Enterococcus</td>
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<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Strep.</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Pseudomonas</td>
<td>1</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>Enterococcus</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Aerobic</td>
<td>9</td>
<td>14</td>
<td>29</td>
</tr>
<tr>
<td>Clostridium</td>
<td>0</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>Bacteroides</td>
<td>8</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>Pasteure Cocci</td>
<td>9</td>
<td>13</td>
<td>6</td>
</tr>
</tbody>
</table>

Ave. No. Isolates Per Patient: 3.0 2.8 3.2

Antibiotics in 80’s

- Minor infections – dicloxacillin or cephalosporin
- Serious infections – Gentamycin Clindamycin and Ampicillin till culture results allowed for more rational antibiotic therapy

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MRSA What antibiotics to use

- Vancomycin
- Linezolid (Zyvox)
- Daptomycin (Cubicin)
- Tigecycline (Tygacil)

Vancomycin Resistance

- GRSA 2 isolates contained gene from VRE
- GISA (MIC, 4-16 micro g/ml)
- Vancomycin treatment failures possibly more frequent in patients whose MRSA exhibits MIC 1.0-2.0 compared to an MIC 0.5 (Saloukas et al J.Clin Mic Bio 2004)
- "MIC Creep"

Community–Acquired MRSA

Prevalence of MRSA Among 422 ED Patients with SSTI

Table 2: Comparison of Hospital- and Community-Acquired MRSA

<table>
<thead>
<tr>
<th></th>
<th>Hospital Acquired MRSA</th>
<th>Community Acquired MRSA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total reports</td>
<td>1970s</td>
<td>1990s</td>
</tr>
<tr>
<td>Type of infection</td>
<td>Mostly surgical, rarely skin and soft tissue</td>
<td>Skin and soft tissue</td>
</tr>
<tr>
<td>Source of infection</td>
<td>Soft tissue infections</td>
<td>Soft tissue infections</td>
</tr>
<tr>
<td>Isolation sites</td>
<td>Bone</td>
<td>Foot</td>
</tr>
<tr>
<td>Antimicrobial resistance</td>
<td>SCC mec (IV)</td>
<td>SCC mec (IV)</td>
</tr>
<tr>
<td>Other antibiotics</td>
<td>Multiresistant</td>
<td>Other antibiotics other than MSSA</td>
</tr>
<tr>
<td>Virulence factors</td>
<td>None</td>
<td>Surface-fimbriae</td>
</tr>
<tr>
<td>Clinical features</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Colonization</td>
<td>Multiple</td>
<td>Teratoma viruses</td>
</tr>
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Perioperative Antibiotics in Elective Vascular Surgery

- Vancomycin
- Cephalosporin
- Single preoperative dose

Neuropathy

**Diffuse Distal Neuropathy:**
Related to duration of diabetes and degree of control.

- HbA1C < 7
- 30% of patients also have an associated autonomic neuropathy.
Vascular Risk Factors and Diabetic Neuropathy
Testfaye et al EURODIAB Prospective Complications Study Group
NEJM Jan 27 2005

• Studied 1172 patients with type 1 diabetes mellitus but without neuropathy from 31 centers in Europe with follow up at 8 years.
• At follow up 276 (23.5%) had developed neuropathy.
• Cumulative incidence related to the glycosylated Hb value and duration of diabetes.
• After adjustment for these, other independent risk factors included – Total Cholesterol, LDL and TG’s, Higher body mass index, Hypertension and smoking.
• Cardiovascular disease at baseline doubled the risk of neuropathy independent of cardiovascular risk factors.

Effects of Neuropathy

• Insensate feet easily traumatized – blisters, etc.
• Intrinsic muscle paralysis results in prominent MT heads and cocked up toes with callus formation.
• Recurrent trauma may lead to major ligament and bone injury. The resultant dislocation or Charcot deformity will predispose to further injury.

Diabetic Vascular Disease

• Microangiopathy – Retinopathy, Nephropathy and Neuropathy, Basement membrane thickening and calcification of media prominent
• Macroangiopathy – Pathological process no different to lesion in nondiabetic but the presence of microangiopathy may require higher perfusion pressure
The influence of diabetes and lower limb arterial disease on cutaneous foot perfusion

- Global microcirculatory dysfunction reflected in low chest and foot transcutaneous oxygen values
- Macrovascular disease as indicated by reduced toe-brachial indices and foot transcutaneous oxygen values
- Impaired foot perfusion due to arterial disease amplified by coexisting microcirculatory disease


Arterial Insufficiency in the Diabetic

- Incidence - 15% at 10 years
  45% at 20 years
- Inflow disease less common – outflow disease, particularly tibial disease, more common.
- Neuropathy may affect symptoms at presentation. Much more likely to present with gangrene.

Age-Dependent Prevalence of Peripheral Artery Disease
Risk Factors For PAD

- From Cardiovascular health study Circ.1993
- Similar risk factors for CAD but exact relative risk differs
- Smoking and Diabetes more important in PAD
- Lipid abnormalities more important in CAD

Best Method of Diagnosis of PVD in Diabetic?

- History and Physical
- Ankle Brachial Indices
- Doppler Wave Forms

Diagnosis Of Vascular Insufficiency

Clinical History
  Claudication
  Rest Pain
Physical Exam
  Location of Lesion
  Absent Pulses
  Dependant rubor
Non Invasive Studies in PVD

- Many sophisticated tests available eg
  Ankle Brachial Indices, Segmental pulse volume recordings, Duplex ultrasound,
  Transcutaneous oxygen, Xenon flow studies.
- Most useful and cost effective is a hand held Doppler to assess wave form

Patient presents with unilateral calf pain on walking a mile relieved by standing still. Non invasives suggest SFA disease

- 1. Medical management alone?
- 2. Arteriogram with angioplasty or stent if feasible?
- 3. Arteriogram with bypass as indicated?
Medical Treatment of Claudication

- Tobacco cessation
- Statins
- Aspirin
- Cilostazol and Plavix
- Exercise
- Supervised exercise programs
- Risk factor modification
- 50% claudicants improve spontaneously over time and 30% do not deteriorate

Medical treatment versus TLA for claudication

- Edinburgh Study J Vasc Surg 1997. After 6 months TLA group ave 667m versus 172m for medical group. At 3 years no difference between groups in median walking distance (383 v 333m) or quality of life.
- Oxford Study Eur J of Vasc Surg. 1990. Compared TLA with supervised exercise program. Max improvement in TLA group at 3 months. Exercise better then TLA at 15 months (400m) and no difference between the groups at 70 months (150m)


- First multicenter randomized controlled trial demonstrating adjunctive benefit of TLA over exercise alone
- Just over 40 patients in each arm of infrainguinal group
- Maximum benefit in TLA group seen at 2 years rather than 6 months suggesting differences unrelated to TLA
- Maximum walking distance in medical group 200m versus 300m in angioplasty resulting in no changes in lifestyle

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Indication For Interventional Treatment Of Ischemia

• Disabling claudication
• Ischemic rest pain
• Non healing foot ulcer
• Gangrene

Angioplasty and Stenting

• Good for focal disease giving 50-80% 5 year patency.
• Works well in the iliac artery – less durable as the artery gets smaller
Distal Bypass BIDMC 1990-2004 By Distal Anastomosis

<table>
<thead>
<tr>
<th>Anastomosis</th>
<th>Procedures (N)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Popliteal</td>
<td>1369</td>
<td>28%</td>
</tr>
<tr>
<td>Anterior Tibial</td>
<td>753</td>
<td>15%</td>
</tr>
<tr>
<td>Posterior Tibial</td>
<td>805</td>
<td>17%</td>
</tr>
<tr>
<td>Peroneal</td>
<td>472</td>
<td>9%</td>
</tr>
<tr>
<td>Pedal</td>
<td>1345</td>
<td>28%</td>
</tr>
<tr>
<td>Tibioperoneal</td>
<td>63</td>
<td>2%</td>
</tr>
<tr>
<td>Plantar / Tarsal</td>
<td>134</td>
<td>3%</td>
</tr>
<tr>
<td>Total</td>
<td>4877</td>
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### Lower Extremity Arterial Reconstruction in the Very Elderly: Successful Outcome

Preserves not only the Limb but also Residential Status and Ambulatory Function


- 299 operations in 262 patients age 80-96 years
- 67% diabetic
- 96% operated on for limb salvage

#### Lower Extremity Arterial Reconstruction in the Elderly

<table>
<thead>
<tr>
<th>Results</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Perioperative mortality</td>
<td>2.3%</td>
</tr>
<tr>
<td>5 year primary assisted patency</td>
<td>80%</td>
</tr>
<tr>
<td>5 year limb salvage</td>
<td>92%</td>
</tr>
<tr>
<td>5 year mortality</td>
<td>66%</td>
</tr>
<tr>
<td>Ambulatory status same or improved</td>
<td>88%</td>
</tr>
<tr>
<td>Residential status same or improved</td>
<td>78%</td>
</tr>
</tbody>
</table>

#### Bypass in Dialysis Patients 2001

- **177 Bypasses over 10 years-** 92% diabetic
- **Operative Mortality-** 2.8%
- **Graft Patency-** 85% and 65% @ 1 and 3 years
- **Limb Salvage-** 91%, and 80% @ 1 and 3 years
- **Survival-** 57% at 1 year, 17% at three years
### 6533 Major Vascular Operations

<table>
<thead>
<tr>
<th></th>
<th>Diabetics</th>
<th>NonDiabetic</th>
<th>P value</th>
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<tbody>
<tr>
<td>Age</td>
<td>67.1</td>
<td>70.6</td>
<td></td>
</tr>
<tr>
<td>M/F</td>
<td>61/39%</td>
<td>62/38%</td>
<td></td>
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<tr>
<td>Mortality</td>
<td>0.96%</td>
<td>1.46%</td>
<td>0.065</td>
</tr>
<tr>
<td>MI</td>
<td>1.77%</td>
<td>1.3%</td>
<td>0.141</td>
</tr>
<tr>
<td>CHF</td>
<td>1.13%</td>
<td>1.14%</td>
<td>0.983</td>
</tr>
</tbody>
</table>

#### Dorsalis Pedis Bypass

**Limb salvage:** 1032 Pedal Bypasses

![Graph showing percentage of limb salvage over time for primary and secondary patients.](image)

**Pathcy — time (months)**


**Pathcy — time (months)**

- Primary: At risk 1032, Pedal Bypasses: 605, 454, 334, 238, 171, 107, 70, 39, 20, 12, 7, 3.

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Bypass versus stent in severe ischemia of the leg (BASIL): multicentre randomized controlled trial. Lancet Dec 2006

- 425 patients with severe ischemia randomized to surgery or PTA first
- Early results comparable with fewer complications in PTA group
- After 2 years surgical outcomes better in terms of outcome and cost effectiveness
- Authors recommend surgery for patients likely to live longer than 2 years

PVD Current Treatment Plan

- Treat claudication medically initially with Statin, ASA, Exercise, smoking cessation and Pletal as indicated for 3 months
- For extensive disease bypass where possible for better long term result
- Multiple endovascular interventions are not appropriate or cost effective
- Evidenced based medicine is the key. If there is no evidence that it works don’t do it

Peripheral Vascular Disease

- In studies on endovascular intervention 80% of procedures done for claudication while in surgical studies 80% are done for limb salvage
- Exercise programs have been shown to be as effective as angioplasty for claudication
- Multiple endovascular interventions followed by surgical bypass not cost effective

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Vascular Surgeon 2013

• Expert on medical management of vascular disease
• Runs a diagnostic vascular lab
• Diagnostic and interventional radiologist
• Performs complex surgical procedures
• Provides long term follow up in the office