High Risk Podiatry in a Vascular Setting; A new paradigm in Diabetic Foot Disease?

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A new paradigm?

- Foot ulceration 101
- Assessing Perfusion – a new challenge
- Pressure Injuries
Stairway to an Amputation

Fig. 1. The “Stairway to an Amputation” depicts the most common compounding stage leading to limb loss in those with diabetes (Lee C. Rogers, DPM)
Figure 1. Five-year mortality (%). Perhaps now is the time to change our discussion with health-care administrators, policy makers and especially ourselves. The disease state that many of us treat routinely is, quite literally, killing our patients at a rate comparable to cancer. Addressing this issue aggressively may alter this and make a difference for millions of people worldwide.

Diabetes and feet

- Peripheral Neuropathy – greatest risk factor for plantar foot ulceration
  - Unnoticed injury
- Structural deformity – increased pressure
- Peripheral Arterial Disease – poor healing
UKPDS – 13% of patients at T2DM diagnosis had severe sensory loss

Peripheral sensory neuropathy primary factor in 60-90% of all diabetic foot ulcers

Glove and stocking distribution

Daily foot inspections/examinations

Poor glycaemic control and duration of disease

Pain is God’s greatest gift to mankind
  * Paul Brand
Peripheral Neuropathy

- Sensory
- Motor
- Autonomic
  - Charcot Foot

- Numerous causes (eg diabetes, ETOH abuse, Syphilis, Leprosy, renal failure, HIV, CMT, spina bifida, spinal cord injury, stroke and Rheumatoid Arthritis, chemotherapy etc)
- Painful Neuropathy
Sensory Neuropathy

* Loss of temperature, pain and pressure sensation
* Increases chance of unnoticed foot injury
  * Burns (physical, chemical)
  * Cuts (accidental, self inflicted)
  * Pressure lesions (corn, callus, blisters)
* Wounds may develop and progress to a lower extremity amputation
* Inability to sense foot position (falls-trauma)
Motor Neuropathy

- Loss of intrinsic muscle function
  - Decreases foot stability
  - Muscle atrophy
  - Altered foot structure
  - Development bony prominences
  - Increased focal pressure areas

- Fat pads pushed upwards proximally (fullness noted at base of toes)
Loss of flare response
  * Infection may not present clinically
Loss of function of skin structures
  * Sweat glands, atrophic skin changes
Arterio-venous shunting
  * May lead to neuropathic osteoarthropathy (Charcot)
Peripheral Arterial Disease

- Increased risk of ulceration
  - Tissue ischaemia
  - Atrophic skin changes
  - Less resilient

- Following ulceration development
  - Retards wound healing
  - Increases risk of infection
  - Increases risk of amputation

- Increased morbidity and mortality
Peripheral Arterial Disease

- **Macrovascular disease**
  - Occlusive
  - Often repairable
  - Atherosclerosis of arteries
  - Calcification of arteries
  - Always check pulses lower limb

- **Microvascular Disease**
  - Not occlusive, basement membrane thickening, not repairable
  - Caused by changes in the structure of the arteries and blood cells
  - Plays a component in the development of peripheral neuropathy
  - Leads to poor O2 perfusion in tissues and delays healing of wounds
Assessing perfusion and managing ischaemia; a new paradigm?
Why is PAD important in DFD?

- A changing disease pattern
  - Femoral vs tibial disease
- Evolving goals/end points
  - Pain management/QoL vs Wound healing
- Improved techniques
  - Stents, DCB, DEB, DES etc

- FMC 2013 40% Endovascular vs 60% Open
- FMC 2016 70% Endovascular vs 30% Open
- FMC 2017 91% Endovascular vs 8% Open
<table>
<thead>
<tr>
<th>Open</th>
<th>Endovascular</th>
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<tbody>
<tr>
<td>* Longer patency rates</td>
<td>* Shorter patency rates</td>
</tr>
<tr>
<td>* Not always targeted</td>
<td>* Shorter hospital stay</td>
</tr>
<tr>
<td>* Need a target vessel</td>
<td>* No need for GA</td>
</tr>
<tr>
<td>* Need a suitable conduit</td>
<td>* Targeted revascularisation</td>
</tr>
<tr>
<td>* GA</td>
<td>* Minimal wound</td>
</tr>
<tr>
<td>* Large wound</td>
<td>* Can traumatisate/’trash’ distal</td>
</tr>
<tr>
<td>* Lengthy recovery</td>
<td>vessels</td>
</tr>
</tbody>
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Angiosome concept

Angiosomes of the lower extremity

- Anterior tibial angiosome
- Posterior tibial angiosome
- Peroneal angiosome

Developed by Plastic Surgeons 1987 Taylor et al.
Mr P

* 55 year old male
* Diesel Mechanic (works 12+ hour days)
* Smoker
* T2DM (Moderate control HbA1c 7-9%) 10 years duration
* Morbid Obesity (168kg)

* Chronic wound since 2012 plantar L/hallux
  * Heals and then breaks down
Mr P

- Monofilament – Absent all sites
- Vibration perception – absent
- Reflexes – reduced

- Feet warm, pink, cap refill normal
- Hair growth present
- No claudication or rest pain
6 months later...
Mr P

- Warm, pink feet
- No claudication
- No rest pain
- Hairy
- Normal capillary refill time
- Pedal pulses present
- Smoker
- Previous stent

Ischaemic

- Cool, pale feet
- Claudication
- Rest Pain
- No hair
- Reduced capillary refill time
- Absent/reduced pulses
* **ABI**
  * Ankle/brachial pressure index
    * Highest ankle pressure = ABI
    * Brachial pressure
  
* **TBI**
  * Systolic pressure >55mmHg to achieve healing

<table>
<thead>
<tr>
<th>ABI</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>&gt;1.2</td>
<td>Incompressible</td>
</tr>
<tr>
<td>0.9 – 1.2</td>
<td>Normal</td>
</tr>
<tr>
<td>0.8 – 0.9</td>
<td>Mild PAD</td>
</tr>
<tr>
<td>0.5 – 0.8</td>
<td>Moderate PAD</td>
</tr>
<tr>
<td>&lt;0.5</td>
<td>Severe PAD</td>
</tr>
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Segmental Blood Pressures and Doppler

R Post Tibial: 4 s, Monophasic

L Post Tibial: 4 s, Monophasic

R Dors Pedis: 4 s, Biphasic

L Dors Pedis: 4 s, Triphasic

Pressure Measurements:
- Right Post Tibial: 130 mmHg
- Left Post Tibial: 110 mmHg
- Right Dors Pedis: 153 mmHg
- Left Dors Pedis: 160 mmHg
- Right Femoral: 98 mmHg
- Left Femoral: 96 mmHg
- Right Arterial: 0.75 mmHg
- Left Arterial: 0.74 mmHg
6 months later...
Reassess

* Regular debridement ✓
* Appropriate dressings ✓
* Offloading ✓
* Improved glycaemic control ✓
* Improved diet ✓
* Quit smoking ✗ (but had reduced)
* Infection ✗
* Nasties (Biopsy – chronic ulcerative changes) ✗

* Wound healed ✗

* Reassess perfusion
Mr P

Sonographer: VB

Technical Quality: Satisfactory
Confidence Level: High

Comment:
Phx distal SFA Stent triphasic flow to distal SFA
Retrograde flow seen in PTA
No flow in Peron Art
ATA has good mono phasic flow origin not seen but proximal velocity appears quite high. no stenosis seen

Left Leg Arterial Ultrasound

SFA PROX: 122
SFA MID: 67
SFA DIS: 104
CFA: 132
PFA: 136
POP MID: 114
TPT: 75
ATA: 144
PER A: no flow

region of stent

single vessel runoff
6 months later...
The ideal...
Assessing perfusion is challenging!
  * Even the experts get it wrong
  * If at first you don’t succeed, try again (and again!)
  * Technology and treatments are evolving (so use them)
  * Not always successful, not always problem free
Pressure Injuries
Pressure Injuries

* Avoidable adverse event
* Amputees are encouraged to use their heel to reposition in bed
* High risk group
  * Diabetes
  * Obesity
  * Peripheral Arterial Disease
  * Renal impairment or failure
  * Anaemia
  * Smoking
Most reliable structured risk assessment scale
Not sensitive for this patient group
Patients who developed PI scored low to medium risk despite being high risk

<table>
<thead>
<tr>
<th>No Risk</th>
<th>Low Risk</th>
<th>Medium Risk</th>
<th>High Risk</th>
</tr>
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<tbody>
<tr>
<td>19-23</td>
<td>15-18</td>
<td>13-18</td>
<td>12 or below OR/13-14 and in a high risk clinical group</td>
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Preventative Offloading Measures

- Nothing
- Alternating Air Mattress
- Dressings
- Sheep Skin Heel Protectors
- Pressure Relieving Ankle Foot Orthoses
- Heelfit Suspension Boot

- No standardised approach
- No standardised education
The Injury

- Pressure, friction and shear
- Typically present as a blister
- Posterior injury usually with plantar involvement
- Worse on alternating air mattress
- Challenging to manage
Conclusion

* Multifactorial reasons for ulceration
* The role of ischaemia is often significant, yet poorly identified and managed
* Keep referring