Diabetic Foot: Vascular Surgeon’s View

Peacock’s Annual Conference

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  – Infection
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The Diabetic Foot

In UK in 2011 2.9m people DIAGNOSED with Diabetes (>4m by 2025)

Worldwide in 2010 estimated 285m (438m in 2030)

Foot problems: one of the commonest complications of diabetes
  – 15% patient will develop an ulcer in their lifetime

Foot complications account for more hospital admissions than any other complication of DM
Cause considerable morbidity and mortality

- Patients with DM are 8-24x more likely to have a lower limb amputation
- In 2005 International Diabetes Federation said every 30 seconds a leg is lost to Diabetes
- Up to 70% patients die within 5 years of having an amputation if Diabetic

SUGGESTED that 85% amputations could have been avoided by EARLY detection and involvement of a Specialist Foot Team

Guidelines and Groups

NICE: Foot Protection Team and MDT, when to refer, how to manage
Diabetic foot

Neuropathy

Vasculopathy
   – Microvascular
   – Macrovascular

Infection

Complications
   – Peripheral neuropathy and pain (20-40%)
   – Peripheral vascular disease (20-40%)
   – Ulceration (5% DM per year)
   – Infection and Osteomyelitis (22-66% all foot ulcers)
   – Charcot’s neuroarthropathy (0.1-0.4% DM per year)
   – Lower limb amputation (0.5% DM per year)
   – Death
Neuropathy

Unclear
- Microvascular->nerve hypoxia
- Hyperglycaemia->direct effects on neuronal metabolism

Linked to poor glycaemic control
- 30% patients in hospital with DM
- 20% patients in population with DM
- Up to 50% if looking purely at elderly population

Sensory -> joint proprioception and vibration/pain and temperature
Motor -> intrinsic muscles, wasting, altered foot shape, clawed toes, prominent MT heads
Autonomic -> vasodilatation, shunting risking skin/collaterals, reduced sweating
Diagnosis
- History
- Examination (10g monofilament, 128Hz tuning fork)

<table>
<thead>
<tr>
<th></th>
<th>Neuropathic pain</th>
<th>Intermittent Claudication</th>
<th>Ischaemic rest Pain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site</td>
<td>Foot/shin</td>
<td>Calf/Shin</td>
<td>Foot/calf</td>
</tr>
<tr>
<td>Nature</td>
<td>Tingling, burning, shooting</td>
<td>Cramping</td>
<td>Aching</td>
</tr>
<tr>
<td>Exacerb factors</td>
<td>Night time</td>
<td>Exercise</td>
<td>Elevation</td>
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<tr>
<td>Relieving factors</td>
<td>Exercise</td>
<td>Rest</td>
<td>Dependency of foot</td>
</tr>
<tr>
<td>Clinical signs</td>
<td>Warm, bounding pulses</td>
<td>Weak/absent pulses</td>
<td>Cold/pulseless</td>
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</tbody>
</table>
Neuropathic Ulcers

- Warm, well perfused, bounding pulses, distended veins
- Site of repetitive trauma
  - dorsum shoe rub or MT heads high pressure
- Hidden under callus? Foreign body present
- Management
  - PRESSURE RELIEF and OFFLOADING
  - Debridement of Callus
  - Follow up, Glycaemic control, Podiatrist, Orthotics, Orthopaedics, Drugs (NICE, DCCT, UKPDS)
Infection

Not all ulcers are infected
– All are colonised
– Polymicrobial (typically 3-6 organisms per ulcer)
– Superficial wound swabs unhelpful, deep tissue required

Extent of infection variable
– Superficial cellulitis to deeper infection of ST and bones
– 20% Osteomyelitis
– Difficulties in diagnosing extent
  • Systemic upset may be absent
  • Local signs important (inflammation, swelling, pus)
  • Severe infection (crepitus and fluctuance)
  • XR for OM (late signs); MRI foot
Diagnosis
- History, examination (including assessment of circulation)
- Investigations (microbiology samples, imaging-XR/MR)

Management
- Superficial infection: debridement/oral Abx
- Deep infection: urgent surgical debridement, IV Abx and revascularisation
- Infection rapidly spreads along fascial compartments
  - Ensure adequate drainage
- Debridement (surgical, topical, larvae)
- Dressings including negative pressure dressings
- Offloading
- Addressing medical problems
  - Diabetic control, IHD, nephropathy, autonomic neuropathy
  - Anaesthetic assessments and pre-op optimisation (esp cardiac)
  - Pressure ulcers
Vasculopathy: Peripheral Vascular Disease

Atherosclerosis probably present in all patients with long standing diabetes (clinical or subclinical)
- 44% deaths in patients with Type 1 Diabetes
- 52% deaths in patients with Type 2 Diabetes

Other Risk factors: HTN, hyperlipidaemia, smoking

PVD present in 49% patients with a foot ulcer (Eurodiale)

Narrowing of blood vessels due to atherosclerosis

Intermittent Claudication
- Reproducible pain on walking, eases with rest
- Stable, BMT

Critical Limb Ischaemia
- Rest/night pain and tissue loss
- Urgent referral

MICROvascular-medical mx/MDT
MACROvascular-we can try
PVD in Diabetics: ischaemic and neuroischameic ulcers

Different distribution of disease
- Multilevel
- Distal (calf vessels twice as likely)
- Collaterals (angiogenesis impaired/stenosis present)
- Long occlusions
- CALCIFICATION

Co-existing neuropathy or co-morbidities
- May not develop IC
- First presentation usually CLI
  - Distal ?painful, cold foot, absent pulses (or warm/swelling suggesting Charcot’s or deep infection)
Diagnosis

- History
- Examination
  - Pulses (palpable or absent), skin changes/tissue loss
  - ABPI

Toes, heel, medial aspect of 1st MT head
Ulcer surrounded by rim of ischaemia and necrotic centre

IC history + absent peripheral pulses + ABPI <0.9 predict presence of PAD with 95% sensitivity and specificity.

**BUT**...ABPI can be falsely elevated (>1.3) due to calcification of vessels => falsely reassuring (Doppler or Transcutaneous O2 tension).

**TABLE 4. Measuring the ankle-brachial pressure index (ABPI)**

<table>
<thead>
<tr>
<th>ABPI</th>
<th>Description</th>
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<tbody>
<tr>
<td>&gt;0.9</td>
<td>Normal</td>
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<tr>
<td>0.5-0.9</td>
<td>Moderate claudication</td>
</tr>
<tr>
<td>&lt;0.4</td>
<td>Critical limb ischemia</td>
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*ABPI = Ankle systolic pressure divided by brachial systolic pressure*
Management

Urgent vascular assessment
- Duplex/MRA
- Revascularisation if possible
  - Gangrenous tissue removed if present
    - If dry and clear demarcation -> auto amputation
    - If wet -> local amputation mandatory
      - Toe, Ray (toe and MT) or Trans-metatarsal
- BMT (statin, antiplatelet, antihypertensive, glycaemic control)
- Education
- Exercise
- Risk factor modification
Diabetic foot

- Multifactorial: previous ulcers, neuropathy, PVD, altered foot shape, high plantar pressures, increasing age, visual impairment, living alone

- Complex (2+ elements required)

- Interrupt pathways and address each component to manage patient and heal the ulcer

Need for MDT approach and Specialist Foot clinics
Diabetic Foot Management

Education
- Risk factor modification
- Foot care
- When and how to access advice and treatment

Examination/Assessment

GP and district nurses
Diabetic Foot Clinic and Diabetologist, Specialist Nurse
Orthotics
Podiatry
Orthopaedics for surgical correction
Vascular and Radiologists
Microbiology
TVNs
Guidelines for referral (NICE)

Life/limb threatening problem then refer to acute services
- Ulcer with fever or sepsis
- Ulcer with ischaemia
- Concerns of deep seated soft tissue or bone infection
- Gangrene

Other foot problems
- 1 day to MDT foot care service for triage

If in doubt, refer for review
Referrals to Vascular

Emergency-through to on call team (SpR)
Outpatient setting-to consultant for vetting
  - Community (GP, district nurses, specialist nurses, TVN, podiatrists)
  - A+E
  - Diabetic foot clinic
  - Other specialities

Over one month period:
  - 158 referrals to Vascular SpR
    • for all vascular problems (AAA, Thoracic disease, CEA, Extensive DVTs, post op complications, trauma…)
  - 36 patients with diabetic foot, 37 further patients with ischaemia (may have been diabetic)
  - Length of stay for patient: average 25 days
Basic principles

Stabilise patient and drain infection

Maximise blood flow

Debride necrotic tissue/amputate

Wound care

General sort out

Follow up

Regular reviews at each step
Stabilisation and control of infection

ABC approach

- BP support, Abx, glycaemic control
- Appropriate setting ?HDU ?straight to theatre
- If overtly septic then emergency drainage
  - Local control of infection
  - Tissue samples for MC&S
  - Guillotine amputation
  - Involvement with Microbiologist
Control of Ischaemia: Vascular Assessment

History of PAD

Pulses, ABPI, toe pressures etc

Imaging to assess potential for revascularisation
  – Duplex
  – MRA
  – CTA
Revascularisation

Vascular Surgeon and Interventional Radiologist
- Aim to improve blood flow and achieve inline flow
- Allows healing of tissue and alleviation of symptoms

Endovascular
- Angioplasty
  - Balloon or Stent (drug eluting, bare metal, covered)

Open
- Bypass
  - Anatomical or extra-anatomical
  - Vein or Prosthesis
- Endarterectomy and patch
Angioplasty or Bypass?

Problem:

- Multilevel disease
- Below the knee
- Long occlusions
- Small vessels
- Collaterals
- Calcified arteries
- Sick patients
- Co-morbidities
Angioplasty or Bypass?

Angioplasty

Access (needle, wire, sheath, catheter)
Appropriate vessel, ability to pass wire
Below the knee (1mm vessels)
Balloon vs Stent? drug eluting? covered

Local anaesthetic and LIE FLAT, quicker, less invasive, less cardiovascular instability
High re-intervention rates (stenosis, dissection, thromboses, emboli) may affect bypass options in future

Local expertise and access
Angioplasty

Acute ischemia of the left leg in a 68 y/o woman with chronic renal failure.

- occlusion of the proximal superficial femoral artery
- intraluminal filling defect in the proximal superficial femoral artery
- tPA was infused directly into the thrombosed segment through a multi-side-hole infusion catheter. After angioplasty and placement of a self-expanding stent, shows a widely patent artery.
Bypass

Usually GA

(spinal+sedation but infection implications);
anaesthetic input and ?HDU post op support
Exposure and control of vessels
Need SOFT arteries to clamp
Need good inflow and run off
Need a conduit

Control, better patency rates, combine local amputation/debridement
Longer (?6 hours), cardiovascular instability, respiratory risk, reperfusion injury, re-intervention, extensive wounds (?bilateral), availability of vein, infection risk, groins, pressure ulcers, rehab
Bypass
• May require multiple and hybrid procedures
• Anaesthetic support crucial
• Importance of angiosomes
• Evidence suggests NO DIFFERENCE in the long term
• In Vascular Surgery: Usually focus on patency rates, prevention of amputation (BASIL trial)
• In Diabetic Foot Patients: Aim is to HEAL ulcer/wound and improve symptoms (and reduce amputation rates)
  • Graft may occlude, restenosis may occur
  • Gives enough time to heal injury and improve other factors
  • High mortality rates
  • Frail
Amputation/Debridement

Local amputation
– Toe, Ray (toe and MT) or Transmetatarsal
– Remove all necrotic and infected tissue
– Ensure no bone is left exposed
– Part of wound open to allow drainage
– Bone sent for culture and sensitivity
– Post op XR if osteomyelitis suspected
– Can combine with arterial reconstruction if possible (not in sepsis)
– Need inline flow to the knee

Major Amputation
– Can use transcutaneous oxygen tension to help determine level
– Below knee (through knee)
– Above knee
– Higher

Clinical Judgement
Tissue at time of op
Healing
Vascular supply
Although revascularisation may be an option
- May not be possible
  • too sick/unstable, co-morbidities, patient choice

WiFi scoring system
- Wound Ischaemia Foot Infection
  • Scores for each
  • Risk of amputation at 1yr
  • Improvement in following revascularisation
  • i.e. high score for infection, low for ischaemia -> high risk of amputation, not much benefit from revascularisation

Try to reduce number of amputations and tailor care
Dressings and Wound Care

Larvae therapy
- Sterile, Greenbottle fly, water daily
- Remove necrotic tissue by secreting enzymes (liquefy dead tissue and ingest)
- ?helping with antimicrobial resistance

Dressings
- 48 hour reviews
- Moist, managing exudate, protecting surrounding skin
- Topical therapies not advised in NICE guidelines

Negative pressure dressings
- Dressing with negative pressure applied, canister for fluid collection
- Effective, helps with odour, manages exudate
- Noisy, can cause skin problems, issues with access in community
Other aspects

Orthotics for offloading

Physio and OT
  – Exercises, prosthesis, complex discharge planning

Medical problems
  – IHD, nephropathy, glycaemic control
  – Infections from other sources
  – Care of the Elderly for access to rehab if required

Regular review: often need multiple procedures

Length of Stay: Revascularisation may take up to 6 hours but average length of stay is 25 days!
Follow up

Vascular OPD
- Consultant led and/or nurse led dressing clinics

Diabetic Foot Clinic for review, assessment, education
- Podiatrist (co-ordinates)
- Diabetologist
- Orthotics

Dressings
- District nurses, Practice Nurses, TVNs

GP
- Co-ordinating community care

Physiotherapist
Idea for improvement

Referrals
- Clear guidelines as to how/where to refer
  - We do not treat asymptomatic patients (even if stenosis seen)
  - We would rather see patients sooner when we can assess and revascularise
- Access and use of email to alert Diabetic Foot Team
- Use of Medical Photography
- Assessment (ABPI, pulses)

Follow up/Aftercare
- Access
- Complex discharges (PoC, rehab beds, VAC machines take 48 hours)
Summary

Neuropathy/vasculopathy/infection

MDT required

Assessment must always include circulation but caution with high ABPIs

Management:
- Control Infection,
- Control Ischaemia (Revascularisation: angioplasty or bypass)
- Debridement (+/- amputation)
- Offloading
- Wound dressings
- Close follow up

We try not to just amputate legs!

If in doubt, please refer
References


International Working Group on the Diabetic Foot: Systematic Review


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Thank you
Assessment

If patient presents with an ulcer

– Examination
  • Sensation, Deformity, Pulses
  • ABPI
  • Assessment of footwear

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<tr>
<th>Stage</th>
<th>Grade</th>
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<tr>
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<td>o</td>
</tr>
<tr>
<td>A</td>
<td>Completely epithelialised wound</td>
</tr>
<tr>
<td>B</td>
<td>Plus infection</td>
</tr>
<tr>
<td>C</td>
<td>Plus ischaemia</td>
</tr>
<tr>
<td>D</td>
<td>Plus infection and Ischaemia</td>
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