The Diabetic Foot

45 year old male

- admitted to MAU via A&E:
  - 3/52 history of “superficial ulcers” medial aspect of mid foot right
  - treated by GP with oral Flucloxacillin 250 mg QDD for 7/7
  - daily dressing
  - now c/o of feeling nauseous and unable to keep any fluid/food down
  - BM’s 15-20, ketonuria: ++

45 year old male

- PMH:
  - T1DM for 20 years
  - “retinopathy (previous lasertherapy)
  - diabetic peripheral neuropathy
- DH:
  - novorapid pre-prandially/glargine at bedtime
  - Lisinopril 20 mg o.d

45 year old male

- O/E:
  - “looks unwell”
  - BP 105/60 mmHg; P: 110/min
  - temp: 38.1 C°
  - HS: normal, Chest: clear
  - BM: 22 mmol/l
  - ketonuria: ++

Little bit about epidemiology

- 15% of patients with diabetes:
  - chronic non healing foot ulcers
    - 15-20% of those require amputation
  - 15-70x more likely to undergo amputation
- 200 day of hospital stay before and after amputation
- estimated cost:
  - 13 million pounds per year to the NHS

- Peri-operative mortality: 10-15%
- 3-year survival rate: 50-59%

- 5 years post amputation: reported mortality from 39% up to 68%

- BUT:

50% of foot ulcer are preventable!

Pathogenesis

- Peripheral vascular disease:
  - more distally
  - occurs at a younger age
  - Framingham: 50% of patients: absent foot-pulses
- peripheral neuropathy:
  - sensory and motor neuropathy
  - autonomic
- infection

Risk factors

- Previous ulcer
- foot deformity
- PVS
- diabetic neuropathy
- diabetic nephropathy
- impaired vision
- ill-fitted foot wear

PVD

- Macrovascular disease:
  - affects mainly calf vessel with sparing of proximal and foot vessels

- microvascular disease:
  - structural: thickened basement membrane, wall fragility and thrombosis
  - functional: vasomotor neuropathy and abnormal endothelial function

Neuropathy

- Sensory:
  - loss of light touch and vibration leading to loss of protective sensation
- motor:
  - affecting interossei and lumbrical muscles leading to hyperextension of metatarsophalangeal joints and flexion of interphalangeal joints
- autonomic:
  - loss of sweating and arteriovenous shunting leading to dry, fissured skin and distended veins

Infection

- Superficial and local
- soft tissue and spreading (cellulitic)
- osteomyelitis

Bacteria isolated from ulcers

- **Gram-positive:**
- Staph. Aureus
- Streptococcus B
- Enterococcus

- **Anaerobes:**
- Bacteroides, Clostrid., Peptostreptococcus

- **Gram-negative:**
- Proteus
- Klebsiella
- Enterobacter
- E. coli
- Pseudomonas aer.
- Citrobacter
- Serratia, Acinetobacter

Assessment

- Circulation:
  - palpation of foot-pulses
  - capillary refill
  - ankle/brachial pressure index (misleading in Moenckeberg sclerosis!)
  - toe-pressure
  - transcutaneous oxygen tension
  - arterial doppler
  - angiography

Assessment

- Neuropathy:
  - history and inspection
  - light touch, pin-prick sensation, vibration sense, ankle reflexes
  - 10 g monofilament
  - biothesiometry

Result of assessment

- Neuropathic foot:
  - warm and well perfused
  - reduced sweating
  - dry skin and prone to fissuring
  - callus hard and dry
  - arch of foot raised and clawed toes
  - ulceration typically at sole of foot

Result of assessment

- Neuroischaemic foot:
  - cool and pulseless,
  - colour can be pink or red
  - reduced callus formation
  - ulcer at the margin of the foot and back of the heel

Signs of infection (1)

- Ulcer:
  - base changes from healthy pink granulation to yellowish or grey tissue
  - purulent discharge
  - smelly
  - sinuses within the ulcer
  - undermined edges
  - exposed tendon or bone

Sign of infection (2)

- Mild cellulitis (<3cm):
  - erythema, warmth and swelling

- Severe cellulitis:
  - spreading of erythema and swelling
  - lymphangitis and tender LN
  - systemic symptoms
  - bluish-purple discolouration indicates s.c necrosis

Sign of infection (3)

- Osteomyelitis:
  - bone or tendon exposure
  - penetrating of a sterile probe to the bone
  - drainage of viscous, bubbly clear or yellowish fluid if joint is involved
  - sausage shaped toe in case of chronic osteomyelitis

Management

- Assessment of the severity of infection
- Determination of the need for hospitalization
- Evaluation of the vascular supply
- Determination of the need for surgery (amputation and/or revascularization) or percutaneous revascularization
- Appropriate antimicrobial therapy
- Local wound care
- Relief of pressure on the ulcer (mechanical off-loading)
- Control of hyperglycemia
- Education

Management (2)

- Even if it's busy: Take the dressing off!!
- Inspect, feel and smell
- swabs from the base of the ulcer and blood-cultures
- X-Ray of foot:
  - ?osteomyelitis
  - ?gas in the tissue
  - ?foreign body

Management (3)

- Antibiotics:
  - most of the time: intravenously

  - cellulitis: benzylpenicillin + flucloxacillin
  - severe cellulitis: levofloxacin and augmentin
  - add metronidazole if suspicion of anaerobs
  - use clindamycin if suspicion of osteomyelitis

- in severe infections: liaise with microbiologist!

Management (4)

- Wound-care:
  - debridement and cleansing
  - appropriate dressing
  - rest and avoidance of pressure on ulcer
    - (aircast, total contact cast, scotchcast boot)
  - surgical intervention

Management (5)

- Glycaemic control:
  - adequate glycaemic control is imperative to aid healing of the ulcer (poor glycamia impedes neutrophil function):
    - almost all patients with more than mild infection will require insulin (sliding scale) to optimize glycaemia

Back to our case

- examination of peripheral pulses (dp and tp at least)
- ?peripheral neuropathy
- routine bloods including ven. HCO_3
- swabs and blood culture
- X-Ray
- iv. insulin sliding scale
- iv. antibiotics (e.g Augmentin 1.2 g iv tds + iv Metronidazole 500 mg tds)
- discuss patient with vascular surgeon

Management (6)

- **Multidisciplinary approach:**

– physician, vascular surgeon, orthopaedic surgeon, interventional radiologist, tissue viability nurse, chiropodist, orthotist, DSN