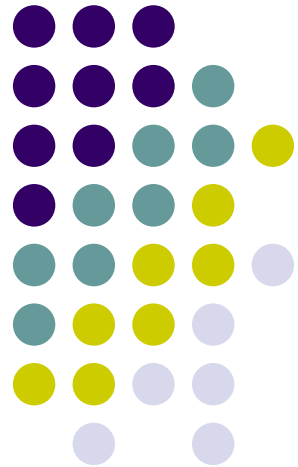
The Nasty Feet



- F/61
- Non-smoker and ex-drinker

- Known type II DM 30+ years, requiring insulin since 1980
- DM complicated with retinopathy (+vitreous hemorrhage with vitretomy and laser done 2002), nephropathy (recent creatinine level ~450umol/l, pending dialysis) and neuropathy.
- She also has HT, gout, hyperlipidemia, obesity
- 1st seen in RH DM clinic in Nov 1997

- Poor compliance and defaulted FU
- Admitted in Sept 2000 for infected R. right toe after trimming of callus in China
- Wound swab grew E.coli and pseudomonas

- Intensive ulcer debridement, antibiotics and dressing done by podiatrist and ulcer healed in about 2 months.

- Developed L foot plantar neuropathic breakdown secondary to Charcot arthropathic changes on her mid-foot since July 2006.
- Wound culture grew pseudomonas

- Intensive wound care, antibiotics treatment and pressure off loading management conducted.


L

Apparent disorganization and partial remodeling seen in most of the intertarsal and TMTJs of the L foot.

With normal or increased bone density.

Features could be due to neuropathic joints.

- Diabetic Foot Ulcer
- Diabetic Charcot Joint Disease

Diabetic Foot Ulcer

- Size of the problem
  - People with diabetes has a 12-25% lifetime risk of developing a foot ulcer. (Lancet 2005;366:1725-35)
  - Foot ulcers cause substantial morbidity, impair quality of life, engender high treatment costs, about US$ 17500-27987) (Lancet 2005;366:1725-35)
  - Diabetic patients accounts for 50% or more of the nontraumatic amputations (Drugs Aging 2004;21:833-850)
  - Cost of amputation range from US$20,000 to 60,000 annually per patient. (Plastic & Reconstructive Surgery, 2006;117:193-206)

Wound assessment

BMJ 2006; 332: 285-8

- **A detailed clinical history**
  - Duration of ulcer
  - Pervious ulceration
  - History of trauma
  - Family history of ulceration
  - Ulcer characteristics (site, pain, odour, and exudate or discharge)
  - Limb temp
  - Underlying medical conditions (e.g. DM, PVD)
  - Smoking
  - Medications
  - Allergies to drugs and dressings

Diabetic Foot ulcers

BMJ 2006;332:407-10

- **Neuropathic foot ulcer**
  - Warm, well perfused with palpable pulses
  - Sweating is diminished and the skin may be dry and prone to fissuring

- **Neuroischaemic foot ulcer**
  - Cool, pulseless
  - Skin is thin, shiny and without hair
  - Atrophy of the subcutaneous tissue
  - Intermittent claudication and rest pain may be absent because of neuropathy

- Crucial difference between the two types of feet is the absence or presence of ischaemia.

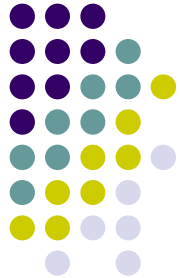
- The presence of ischaemia may be confirmed by ankle brachial pressure < 1

- As many diabetic patients have medial arterial calcification, giving an articially raised ankle systolic pressure, it is important to examine the doppler arterial waveform.

Neuropathic foot ulcer

- Usually occur on plantar aspect of foot under the metatarsal heads or on the plantar aspect of toes
- Most common cause of ulceration is repetitive mechanical forces of gait, which lead to callus
- Callus will press on the soft tissues underneath and cause ulceration
- If the callus is not removed, inflammatory autolysis and haematomas develop under the callus

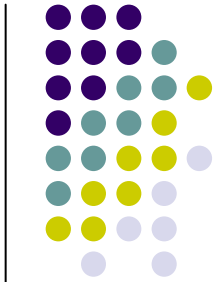
Neuroischaemic foot ulcer



- Often seen on the margins of the foot, especially on the medical surface of the 1st MTP jt or over the lateral aspect of the 5th MTP jt. Also, develop on the tips of the toes and beneath any toe nails

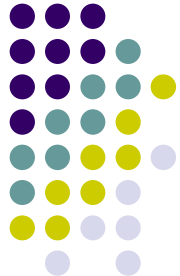
- First sign of ischemic ulceration is a superficial blister, usually secondary to friction. It then develops into a shallow ulcer with a base of sparse pale granulation tissue or yellowish closely adherent slough

Management of Diabetic Foot Ulcer



- Wound control
- Mechanical control
- Vascular control
- Microbiological control
- Metabolic control
- Education
- Adjunctive Treatments

Wound control



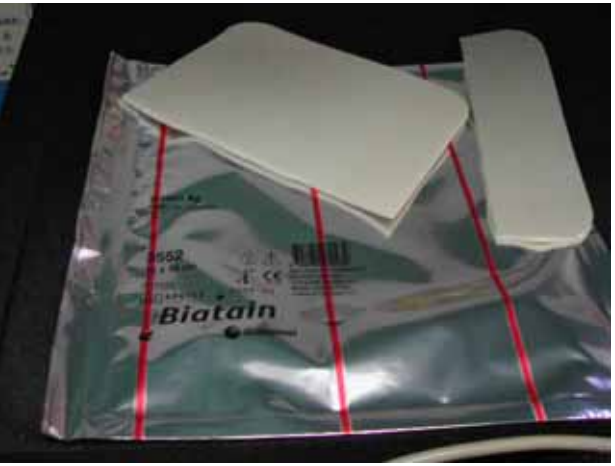
- Neuropathic foot
  - All callus surrounding the ulcer is removed with scapel, together with slough and non-viable tissue
  - Probe the ulcer as this may reveal a sinus extending to bone (suggesting osteomyelitis) or undermining edges

- Neuroischaemic foot
  - Slough and dried necrotic material should be removed from the ulcer by sharp debridement
  - Some ischaemic ulcers develop a halo of thin glassy callus that dries out, becomes hard and curls up. These areas need to be smoothed off

- Wound debridement
  - Objectives
    - to prevent infection caused by the presence of pathogenic organisms
    - to realize the full extent of tissue damage
    - To facilitate/achieve wound healing

- Debridement techniques
  - Surgical/sharp
  - Mechanical (wet to dry dressing, whirlpool)
  - Chemical (streptokinase/collagenase/papain/fibrinolysin)
  - Autolytic (hydrogel/hydrocolloid)
  - Biosurgical (maggot therapy)

- Function of Dressing
  - Protect from contaminations
  - Protect from trauma
  - Keep wound moist and warm
  - Absorb drainage or debride necrotic tissue
  - Control bleeding
  - Apply medication


Biatain


Biatain


SeaSorb Soft
10 x 10 cm
STERILE
SeaSorb
Coloplast


mepilex border
7.5 x 7.5 cm/3 x 3 in


ALLEVYN
Non-Adhesive

Mechanical control

- In neuropathic feet the aim is to redistribute plantar pressures, whereas in neuroischaemic feet is to protect the vulnerable margins of the foot

- Semicompressed adhesive felt padding may be used to divert pressure.

- Acceptable methods of offloading include crutches, walkers, wheelchairs, custom shoes, depth shoes, shoe modifications, custom inserts, custom relief orthotic walkers (CROW), diabetic boots, forefoot and heel relief shoes, and total contact casts.

- The most efficient way to redistribute planter pressure is to use total contact cast (treatment of choice for indolent neuropathic ulcers), a prefabricated cast such as Aircast, or scotchcast boot

- Pressure over heel ulcers can be off-loaded by “pressure relief ankle foot orthoses”. It is a ready-made device that has a washable fleece liner with an aluminium and polyproprylene adjustable frame and a non-slip, neoprene base for walking

- It is used to relieve pressure over the posterior aspect of the heel and maintain the ankle joint in a suitable position, thus preventing pressure ulceration, aiding healing and preventing deformity

Vascular control

- If an ischemic ulcer has not shown progress in healing despite optimum treatment, then it may be possible to do duplex ultrasound and angiography
- This should be done if the following are present
  - An ankle brachial pressure index of <0.5 or a damped doppler waveform
  - A transcutaneous oxygen (reflecting local arterial perfusion pressure) of <30mmHg
  - A toe pressure of <30mmHg
- If lesions are too extensive for angioplasty, then arterial bypass may be considered

- Another manifestation of ischaemia is dry gangrene, particularly in the toes.
- Dry gangrene usually results from severe ischaemia secondary to poor tissue perfusion from atherosclerotic narrowing of the arteries of the leg
- Ideally, the ischaemic foot should be revascularised and the digital necrosis be removed surgically, but if revascularisation is not possible, the gangrenous parts of the toes may be allowed to “autoamputate”

Microbiological control

- In the presence of neuropathy and ischaemia, the inflammatory response is impaired and early signs of infection may be subtle

- Deep swab and tissue samples (not surface callus) should be sent for culture without delay and wide spectrum antibiotics given to cover Gram positive, Gram negative and anaerobe bacteria.

- Urgent surgical intervention is needed in certain cirumstances

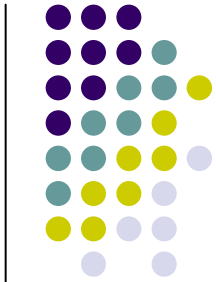
- In neuropathic feet, gangrene is almost invariably wet and is caused by infection of a digital, metatarsal, or heel ulcer that leads to a septic vasculitis of the digital and small arteries of the foot.

- The walls of these arteries are infiltrated by polymorphs, leading to occlusion of the lumen by septic thrombus

- **Osteomyelitis**
  - No consensus exists on the optimal criteria for diagnosing osteomyelitis.
  - The findings on plain radiographs are often suggestive of osteomyelitis (bone destruction or periosteal reaction), but it is quite non-specific.
  - Histological evaluation and culture of a bone-biopsy specimen are regarded as the gold standard
  - The ability to probe bone with the use of a blunt, sterile probe had a positive predictive value of 89% for osteomyelitis
  - Although white-cell scans are sensitive for the diagnosis, MRI is now considered the imaging test of choice when osteomyelitis is suspected.

- Diabetic foot infection (From Impact 3rd edition)
  - Previously untreated, no osteomyelitis (S. aureus, beta-hemolytic streptococci)
    - Augmentin or Unasyn
    - Clindamycin or cephalexin
    - For 14 days
  - Chronic recurrent, limb threatening (Polymicrobial: aerobes + anaerobes)
    - Oral levofloxacin/ciprofloxacin + Oral clindamycin or unasyn
    - Timentin or Tazocin

Metabolic control



- Wound healing and neutrophil function is impaired by hyperglycaemia, so tight glycaemic control is essential
- Patients with type 2 diabetes suboptimally controlled with oral hypoglycaemic drugs should be prescribed insulin
- Hyperlipidaemia and hypertension should be treated.
- Patient should stop smoking
- Those with neuroischaemic ulcers should take statins and antiplatelets

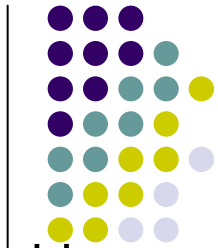
Education

- Patient who have lost protective pain sensation need advice on how to protect their feet from mechanical, thermal and chemical trauma

- Diabetic patients at risk for foot lesions must be educated about risk factors and importance of foot care including the need of self-inspection and surveilance, monitoring foot temp, daily foot hygiene, use of proper footwear, good diabetes control and prompt recognition of newly discovered lesions.

- They should be taught the 4 danger signs: swelling, pain, colour change and breaks in the skin

Adjunctive Treatments



- **Growth Factors**
  - Individual synthetic growth factors can be generated by recombinant DNA technology
  - Growth factors stimulate cellular proliferation, chemotaxis, angiogenesis, protein expression and enzyme production
  - Bacaplermin (recombinant human platelet derived GF-BB) is a homodimer produced through recombinant DNA technology
- **Tissue-Engineered Skin**
  - Bilayer biologically active skin construct, composed of a surface layer of allogeneic human keratinocytes over a layer of allogeneic human fibroblasts, suspended within a collagen matrix
- **Negative Pressure Wound Therapy**
  - Vacuum-assisted closure device (V.A.C.; KCI, Inc., San Antonio, Texas) suggests that in complex postoperative wounds in the diabetic foot, more rapid healing occurs when compared with standard treatment.
- **Hyperbaric oxygen**
  - Can raise local tissue oxygen tensions, which can improve leucocyte function and inhibit or kill certain anaerobic bacteria.

N Engl J Med, vol 351(1), July 2004: 48-55

Charcot Joint Disease (CJD)

- CJD is a progressive, degenerative arthropathy associated with various types of neuropathic disease; however, diabetes mellitus is the leading cause of CJD today. (Ann Vasc Surg 2003; 17: 571-580)

Diagnosis of Charcot Joint Disease

- Acute CJD is often misdiagnosed as an infection or cellulitis. Differentiation between an osteoarthropathy and osteomyelitis may be challenging.

- Definitive diagnosis of CJD and osteomyelitis is by a synovial tissue biopsy and bone biopsy, respectively.

- Synovial tissue biopsy consistent with CJD will contain shards of bone and cartilage embedded deep into the synovium. However, these tests are invasive and not without risks, especially of inducing infection.

Charcot Joint Disease – Conservative Treatment

- The goal of conservative management of acute CJD is to prevent further trauma or structural deformities from developing.

- In general, complete non-weight bearing is recommended for an average of 3 months, followed by partial weight-bearing in a protective device.

- Off-loading modalities include total contact casts, custom-molded shoes, use of cam-walker, custom orthotic devices, use of a charcot-restraint orthotic walker (CROW) and wearing a patellar tendon brace.

- Total contact cast (TCC) functions by increasing total surface area of contact and evenly distributing vertical forces throughout the foot and leg and has been shown to be a effective way of off-loading the foot.

- Contraindications to the use of TCC – presence of an acute infection, osteomyelitis, uncontrolled edema or severe obesity.

Hessing, Cheyenne & CROW AFO




Take Home Messages

- Diabetic foot ulcers (neuropathic, neuroischemic) are associated with increase risk of amputation, as well as morbidity and mortality.
- Timely diagnosis (history, examination – neurological, vascular, musculoskeletal, dermatological, shoewear) and appropriate intervention are essential.
- Intervention include wound care, off-loading, vascular control, infection treatment, metabolic control, education and some adjunctive treatments.
- Early signs of diabetic foot ulcer infection may be subtle. Alert for the signs of limb threatening infection. Early treatment with appropriate type and duration of antibiotics (at least 14 days) is essential.
- A multidisciplinary approach (rehabilitation specialists, endocrinologist, podiatrist, P&O, wound nurse, surgeons) is necessary.
- Prevention is always the key and education is important.

- Diabetic charcot joint disease is a complex and devastating disease that often results in structural deformities, ulcers and ultimately limb loss.
- It is important for a physician to recognize the subtle early signs of diabetic charcot joint disease (erythema, edema and elevated temp) and initiate off-loading measures to prevent further trauma from developing.