

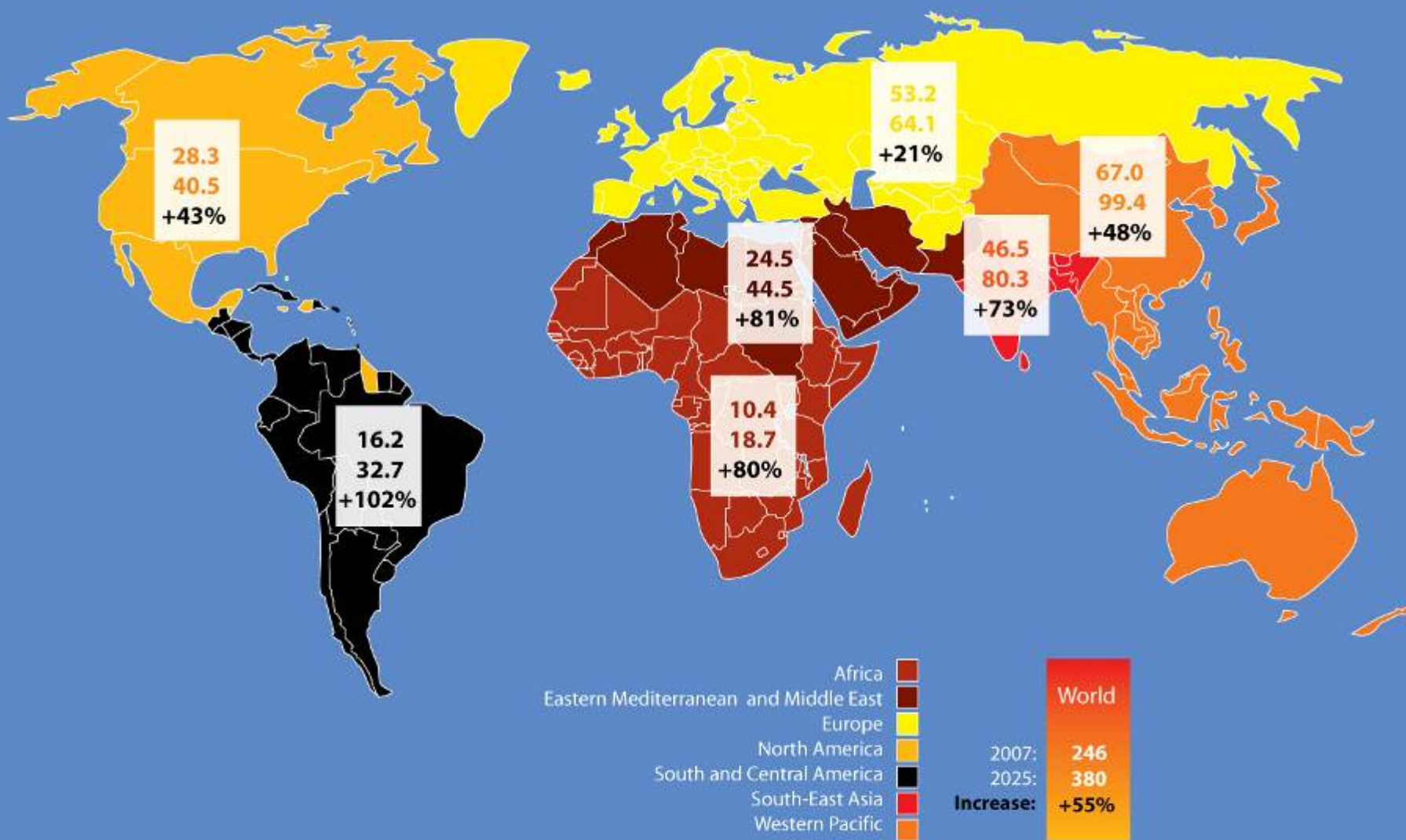
The Foot in Diabetes

Session 1

Learning Objectives

- Be able to discuss the epidemiological importance of diabetic foot disease
- Know how to assess risk of diabetic foot

Global projections for the number of people with diabetes (20-79 age group), 2007 and 2025 (millions)

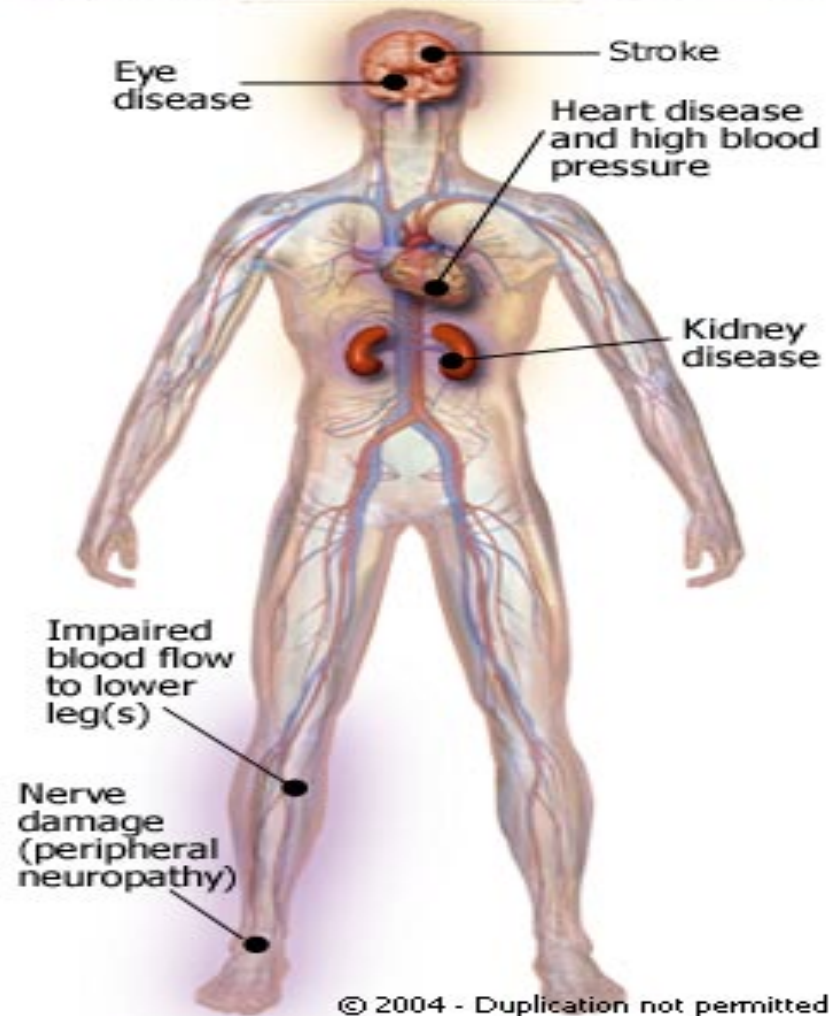


General epidemiology

- 252 million diabetics worldwide
- Foot problems account for largest number of hospital bed days used for diabetic patients
- 1-4% of diabetics develop foot ulcer annually, 25% in lifetime
- 45-75% of all lower extremity amputations are in diabetics
- 85% of these preceded by foot ulcer
- Two-thirds of elderly patients undergoing amputation do not return to independent life
- Studies have shown less costs for saving a limb cf. amputation

Diabetes-related Complications

Over time, high levels of blood sugar can lead to the following:



- The devastating complications of diabetes, such as blindness, kidney failure and heart disease, are imposing a huge burden on healthcare services.
- It is estimated that diabetes accounts for between 5% and 10% of a nation's health budget.
- £3600 is the average annual cost of treatment of a diabetic foot ulcer
- A lower limb amputation costs £10 960 (York Economics Health Consortium 1997)
- UK costs per year may be £17 million

- The term 'diabetic foot' implies that the pathophysiological processes of diabetes mellitus does something to the foot that puts it at increased risk for tissue damage". (Payne & Florkowski, 1998)
- The diabetic foot is a group of conditions (or syndrome) in which these pathophysiological process lead to tissue breakdown and the resultant increase in morbidity and maybe amputation.

Natural history of the diabetic foot

1. No evidence that the pathophysiological process of diabetes have put the foot at increased risk for tissue damage
2. Evidence that the pathophysiological process of diabetes have put the foot at increased risk for tissue damage
3. Tissue damage has occurred and the foot is at risk for end stage complications (ie amputation)

Facts and Figures

- Hospital admission for diabetic foot disease is the single largest cause (47-50%) of diabetes-related admissions (CREST 1998)
- The incidence of foot complications is 5-10%
- There is a 15 fold increase in the risk of amputation
- Of all the complications of the diabetes, those that occur in the foot are considered the most preventable.

Diabetic foot - Ireland

- 12 month audit of one hospital's admissions
- 30 foot ulcer cases admitted
- mean age 68 yrs
- mean duration of stay 20 days
- total cost €705,000: cost per patient €23,500
- 27% required amputation
- Smith et al, Ir J Med Sci. 2004;173;89-92



Managing the Diabetic Foot

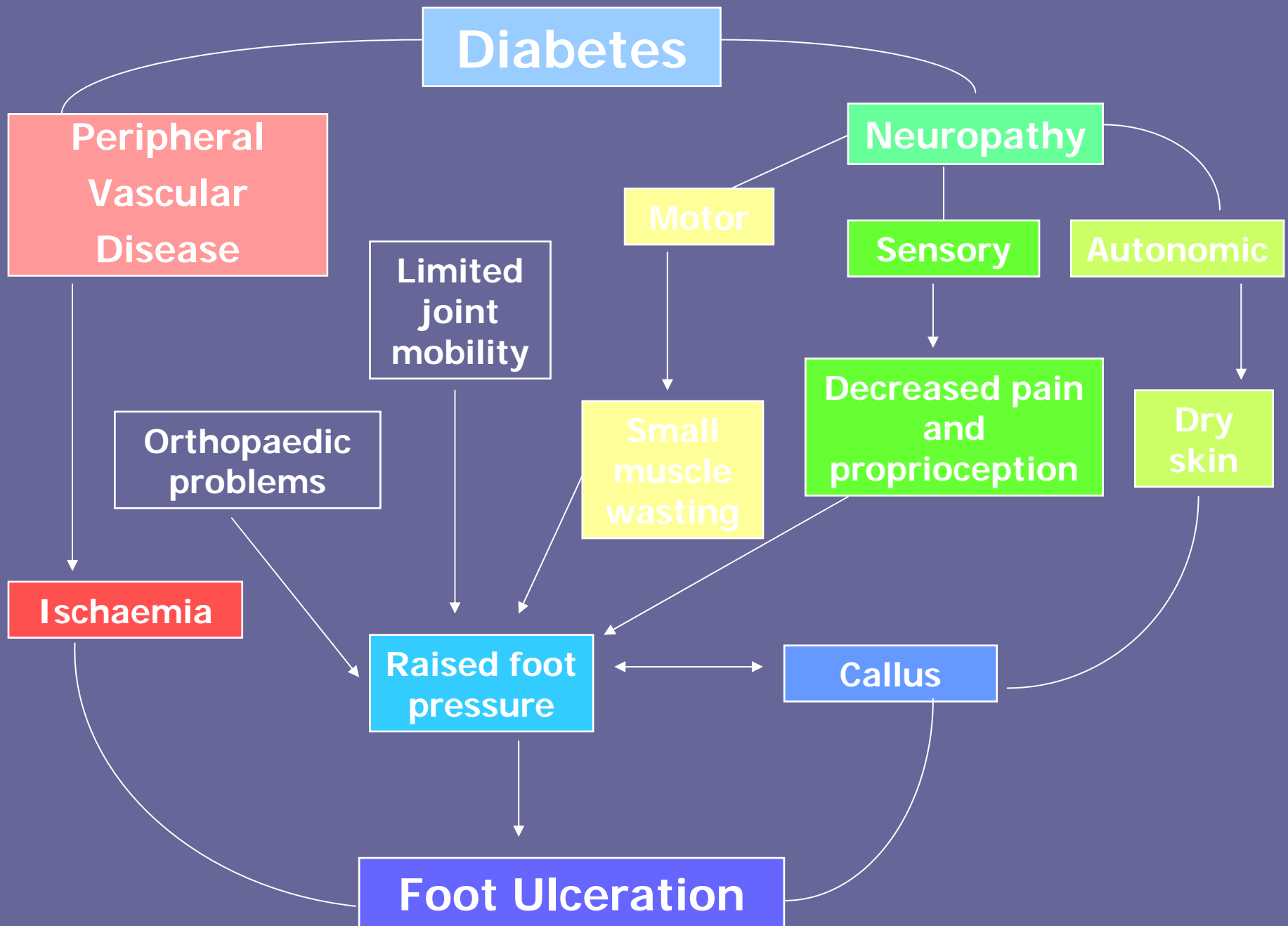
- Mechanical control
- Metabolic control
- Microbiological control
- Vascular control
- Wound control
- Educational control



Assessment

- You should **NEVER** attempt to treat a diabetic foot without first assessing it!





Risk Factors 1

- **Demographic risk factors**
 - Age (older at greater risk)
 - Gender (male is at 2x greater)
 - Social situation (living alone 2x greater risk)
- **Ethnicity**

Risk Factors 2

- **Other risk factors**
 - Body weight
 - Smoking
 - Footwear - can be protective (if appropriate) or precipitating (if inappropriate)

Risk Factors 3

Diabetes related risk factors

- Duration of diabetes
- Immune/ Defence mechanisms (infections are more common; the immune responses are impaired due to vascular supply factors, chemotatic factors and a reduced neutrophil response)
- Previous ulceration (this is **THE** main risk factor for ulceration)

Risk Factors 4

- Glycaemic control
- Loss of protective sensation - main risk factor; permissive of unperceived injury
 - Motor neuropathy
 - Autonomic neuropathy
 - Peripheral vascular disease (4x more common in those with diabetes)
 - Increased plantar pressures
 - Limited joint mobility

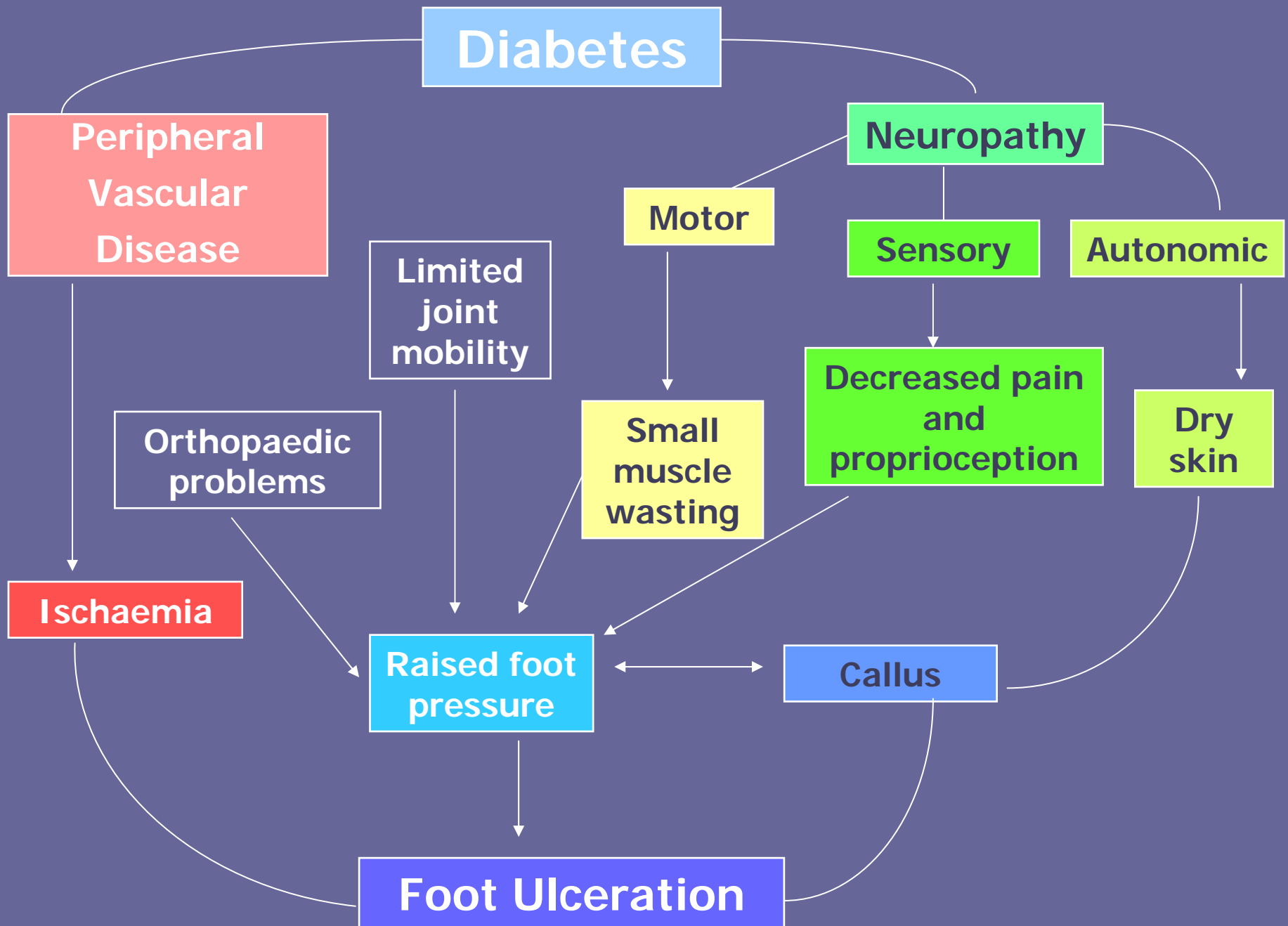


- A reduction in joint mobility due to glycosylation of collagen may also lead to abnormal pressures (Fernando et al 1991).
- This limited joint mobility can be determined using the 'prayer sign test' – this is the inability to complete palmar apposition

Risk Factors 5

Behavioural risk factors

Self management skills are highly correlated to the presence of diabetic foot complications



Assessment of the Diabetic Foot

Neuropathy

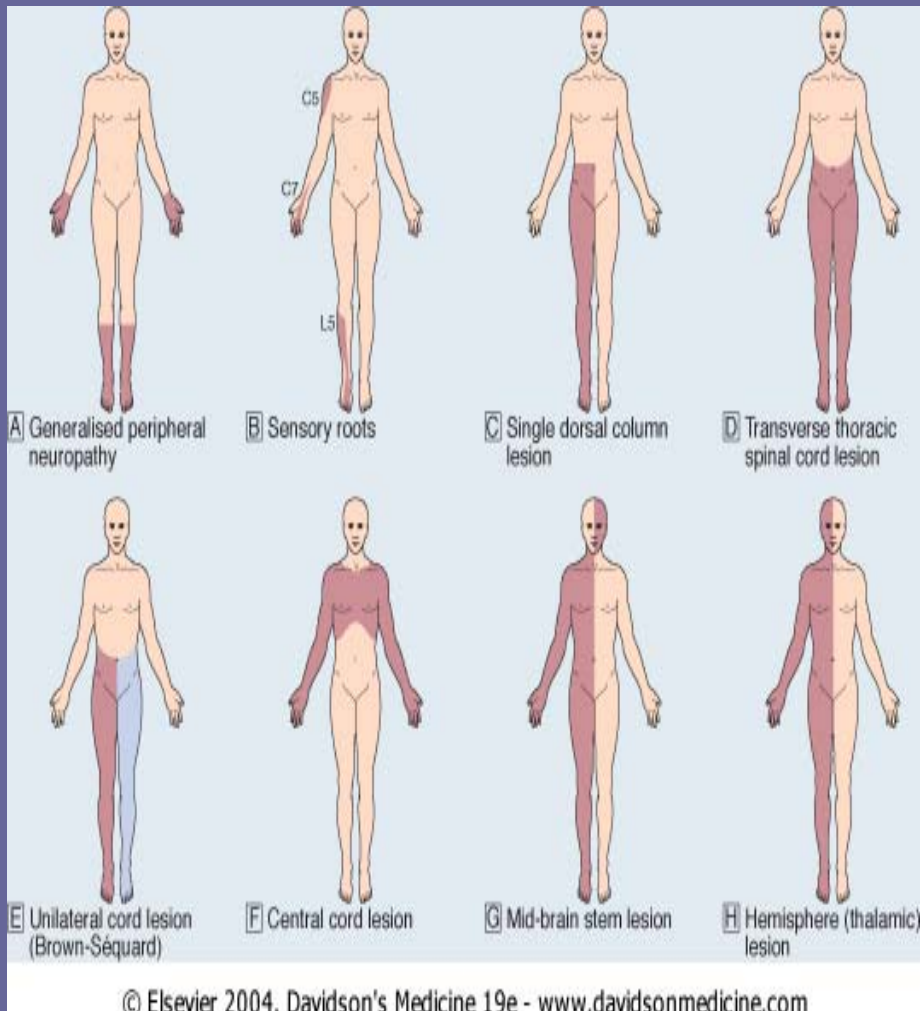
Diabetic neuropathy has been defined as:

“the presence of symptoms and/or signs of peripheral nerve dysfunction in people with diabetes after the exclusion of other causes”

(Boulton et al 1998).

- Peripheral neuropathy usually presents as a bilateral symmetrical polyneuropathy which firstly affects the more distal parts of the lower extremities.

Diabetic peripheral neuropathy



- symmetric neuropathy, classically presenting in a 'stocking and glove' distribution, indicating that the lower extremities are affected initially in a symmetrical way while, in more severe cases, the upper extremities are also affected

(Thomas and Brown 1987
Borsey *et al* 1983).

Aetio-pathogenesis

Proposed mechanisms.

- nerve hypoxia and metabolic abnormalities related to the sorbitol pathway (Teskaye et al 1994).
- What is known is that poor glycaemic control will contribute to the development of sensory loss (UKPDS 1998).

Neuropathy

- Prevalence 28.5 - 50% in diabetic population (Young 1993, Kumar 1994).
- Most common component cause of diabetic foot ulcers, and in one study, present in 78% of ulcer causal pathways.(Reiber 1999).

Pathogenesis of Neuropathy

- Abnormalities of the sorbitol pathways
- Defects in myoinositol, glutathione and related pathways may also be important.

Bessman and Sapico (1992)

The Neuropathic Foot



Neurological Assessment

- **Autonomic:** observation.
- **Motor:** observation.
- **Sensory:** pressure perception, sharp touch, vibration perception.

Motor Neuropathy

- neuropathic foot with high medial arch and prominent metatarsal heads

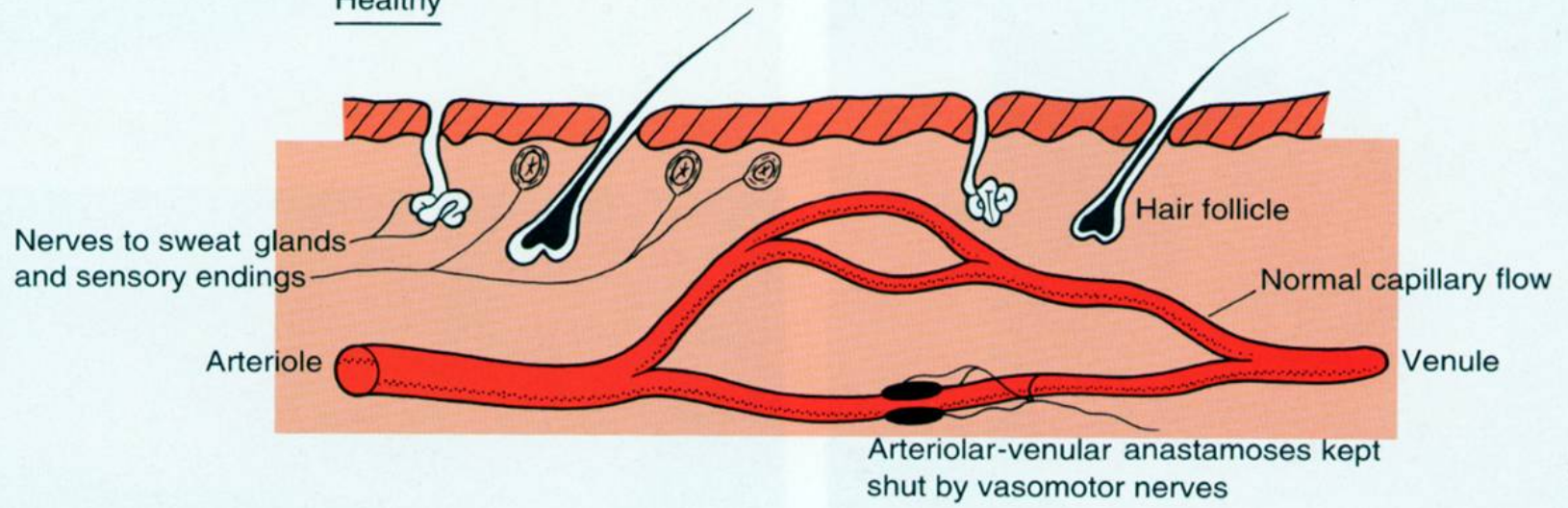


Autonomic Neuropathy

- classical signs are dry skin with fissuring
- distended veins over the dorsum of the foot



Healthy



Sensory Assessment

- Neurotip
- 10g Monofilament
- Neurothesiometer

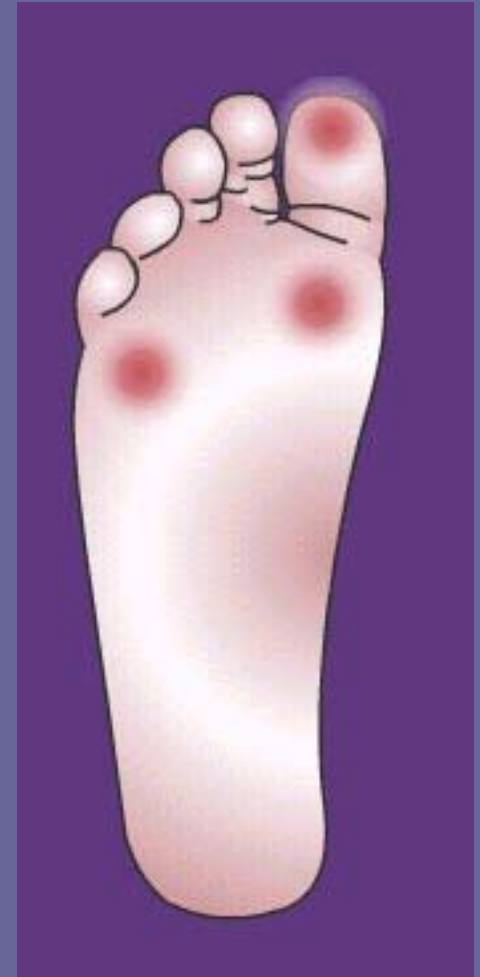


Sensory Assessment

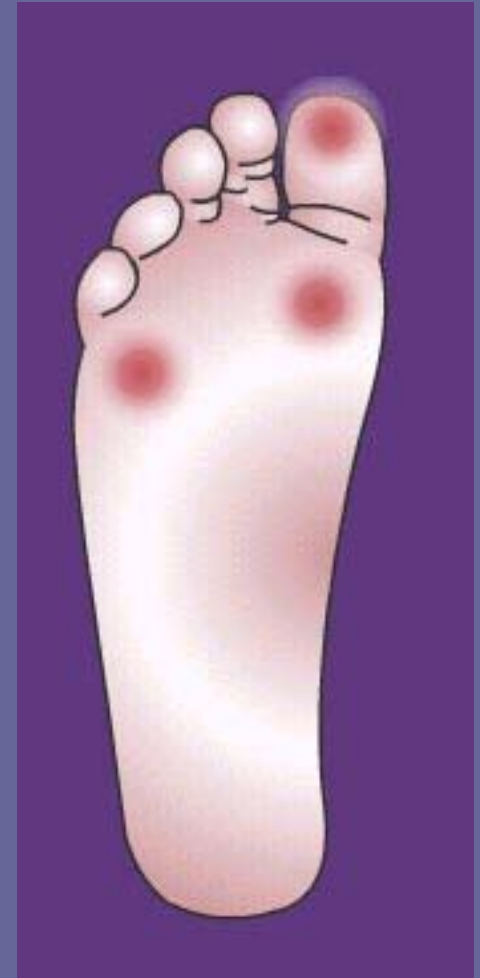
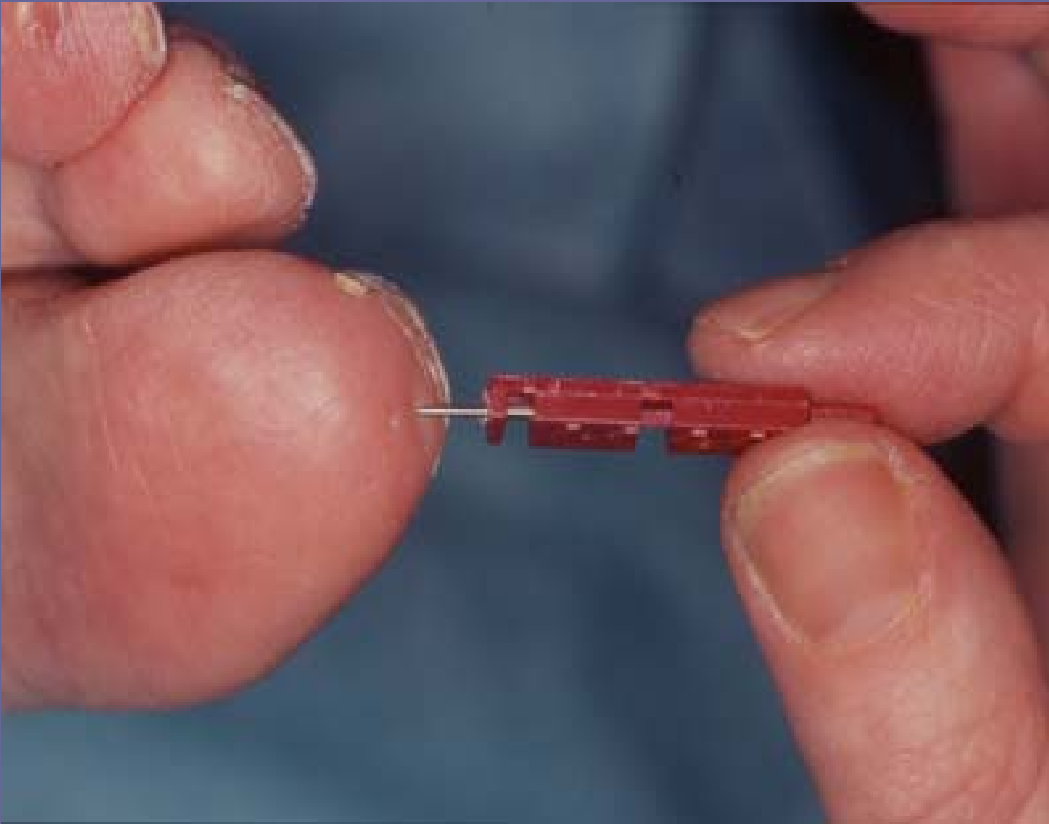
- Neurotip
- 10g monofilament
- Neurothesiometer
- Young M.J., Matthews C. 1998, *The Diabetic Foot* 1 1 22-25



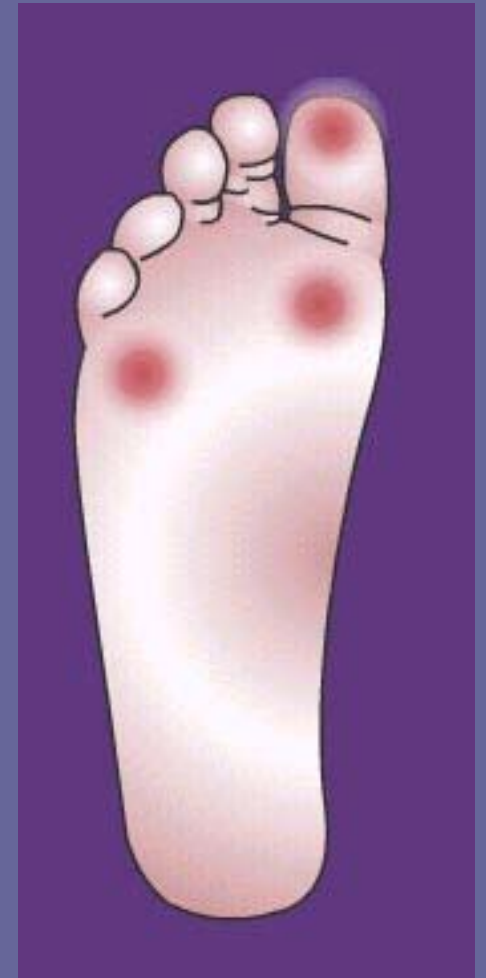
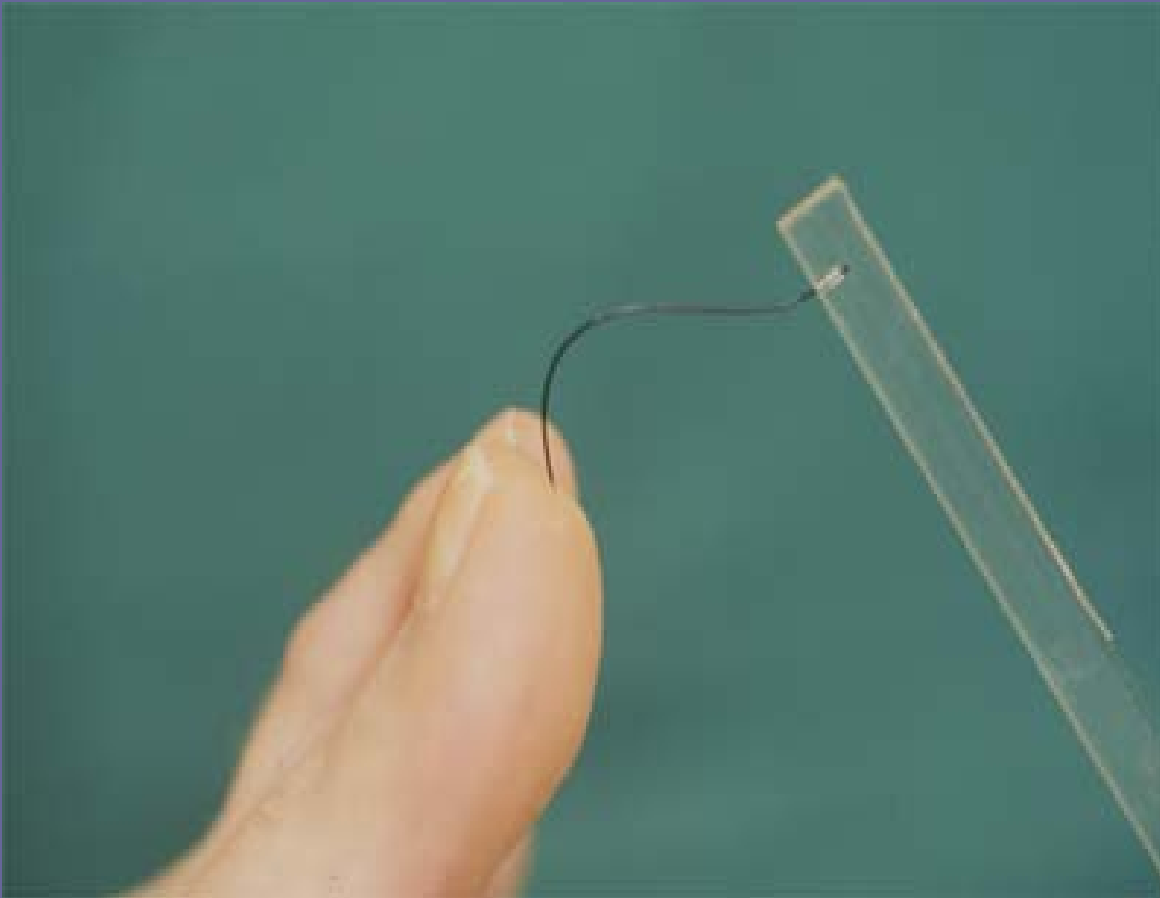
Neurotip



Neurotip



10 g Monofilament



Kumar S.*et al.*(1991). *Diabetes Res. Clin.Pract.* 13
1-2 63-67

Testing Pressure Sensation with a Monofilament

- Monofilaments are designed to deliver a standard stimulus independent of the pressure applied
- Test a total of 10 sites: 1st, 2nd, 3rd & 5th plantar metatarsal heads and plantar aspect of great toe, in both feet
- If the patient is able to feel $\leq 8/10$ touches with a monofilament, then the risk of foot ulceration is increased 5-10 fold

- The proper procedure for performing monofilament testing includes:
- Apply the monofilament to the palm of the tester two or three times before applying it to the patient, to allow any extra stiffness to be removed.
- Apply it to the test site on the patient, perpendicular to the surface to be tested.
- Keep it applied until the monofilament bends by approximately one cm.
- Remove the monofilament pressure.
- Allow a couple of seconds to pass before applying the monofilament to the next test site

10 g Monofilament



Practice Points

1. Areas of calluses are to be avoided
2. Monofilament needs “resting”
3. Should NOT be used if damaged
4. Should be replaced on a regular basis (every 100 uses)

Booth J., Young M.J. 2000 Differences in the performance of commercially available 10-g monofilaments
Diabetes Care 23:7;984-988.

Suggested Neuropathy Testing Sites



Drawing reproduced with kind permission
of The Oxford Wound Healing Institute, UK



10g monofilament test



40g sharpness test





Neurothesiometer



A vibration perception threshold greater than 25 volts carries a seven fold increase in ulceration risk.



Young M.J.et al.1994 Diabetes Care 557-561

Neuropathy

- Clinical diabetic neuropathy affects up to 30% of all patient with diabetes.

Prevalence increases with:

age

duration of diabetes

high blood sugars

height

smoking

gender

The Neuropathic Foot

- Well-perfused with bounding pulses
- Distended dorsal veins
- High arch: clawed toes
- Plantar callus, Plantar ulceration
- Lacks protective pain sensation
- Patient will not perceive trauma or infection

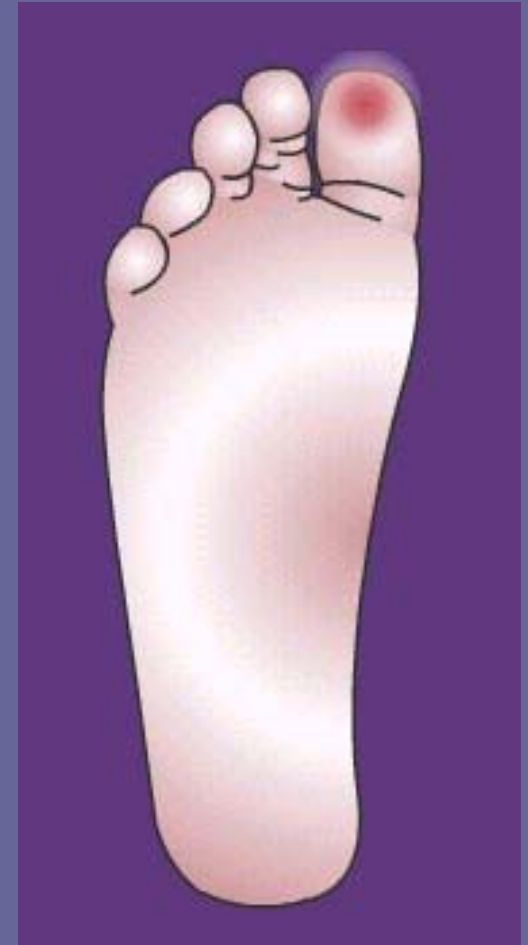
Neuropathy



Neuropathic foot – four complications

- Plantar ulceration (often associated with neglected callus)
- Gangrene (the result of uncontrolled infection which damages arteries)
- Charcot's osteoarthropathy – destructive disease of bone and joint
- Neuropathic oedema

Neurothesiometer



- **A vibration perception threshold greater than 25 volts carries a seven fold increase in ulceration risk.**

Young M.J.et al.1994 Diabetes Care 557-561

Murray HJ et al. (1996)

The association between callus formation,
high pressures and neuropathy in diabetic
The presence of callus in a neuropathic diabetic
carries an eleven fold increase in ulceration
foot ulceration.
risk.



The Neuropathic Foot

- Well-perfused with bounding pulses
- Distended dorsal veins
- High arch: clawed toes
- Plantar callus, Plantar ulceration
- Lacks protective pain sensation
- Patient will not perceive trauma or infection



Painful Neuropathy



Painful Neuropathy

- Longer duration of diabetes.
- Glycaemic control is not an independent predictor of pain.
- VPT $>30v$ - Independent variant.

Neuropathic Pain

- **Pain** - burning , walking generally helps
- **Allodynia** - excess pain due to normal stimulus - socks bed clothes.
- **Hyperpathma** - pain due to painful stimulus
- **Nocturnal exacerbation** - worse in bed with heat

Management Approaches

- Opsite film —

(Foster AV. *et al.* 1994

Diabetic Medicine. 11(8):768-72)

- Axian- capsican cream
- Gabapentin
- Amitryptylene



Vascular Disease

Ischaemia

- Decreases the ability to fight infection by impairing the delivery of oxygen , nutrients and antibiotics to the infected area.



Peripheral Vascular Disease

- Contributes to limb ulceration ,gangrene and impaired wound healing.
- Incidence is at least x4 higher in the patient with diabetes.
- Increases with age and duration of diabetes.
- Hypertension ,smoking, hyperlipidaemia, family history and obesity are also risk constituents in the patient with diabetes.

Neuro-ischaemic feet

- The absence of pulses doubles the risk of amputation

Fowler and Mitchell (1998). *Diabetic Foot* 1 3 105 — 107

- Ischaemic pain is a poor prognostic sign

PVD and Foot Ulceration

- Decreases tissue resilience.
- Causes rapid tissue necrosis.
- Impairs tissue regeneration.
- Rarely initiates ulceration in isolation.
- Major role via impaired wound healing.
- Risk factor for gangrene.

Sumpio, 2000

Peripheral Vascular Disease

- Associated with 62% non healing foot ulcers.
- Causal factor in 46% of amputations.
(Pecoraro *et al.*1990)
- Because of neuropathy patients with diabetes may first present with tissue loss or gangrene as the first sign of severe PVD.

- Occlusive disease affects the tibial and peroneal arteries between the knee and ankle.
- D.Pedis artery and foot vessels are usually spared.
- No occlusive microvascular disease - endothelial injury and thickening of the capillary basement membrane do not = occlusive disease.(Gibbons *et al.* 1995)

- 90% of patients with diabetes presenting with ischaemic foot ulceration or gangrene are found to have surgically correctable occlusive disease.



PVD and Foot Ulcer Prevention in type 2 diabetes

**“No studies in patients with
diabetes were found addressing
screening for lower limb
ischaemia and subsequent risk
of ulceration.”**

Mason *et al.* 1999

PVD

- Women with diabetes develop PVD at the same rate as men and are not spared its increased morbidity and mortality.



Vascular Assessment

VASCULAR ASSESSMENT

- Medical history
- Symptoms
- Observational assessment
- Non invasive testing

Neuroischaemic Foot



- cool/cold
- pulseless
- hairless

Skin can be

- thin, shiny and hairless
- dusky red or cyanotic blue in colour



Vascular assessment – Practice Point

- Comparative skin temperature
- Presence of pedal pulses
- Ankle Brachial Pressure Index (ABPI)



Vascular Assessment

- Signs and symptoms.
- Pulse palpation.
- Doppler ABPI assessment.

Palpation of dorsalis pedis

- the dorsalis pedis pulses is lateral to the extensor hallucis longus tendon.



Posterior tibial pulse

- this pulse is found above and behind the medial malleolus.



The absence of pulses doubles amputation risk.

Vascular Assessment

Research indicates that one should not take pulse palpation in isolation but in combination with other assessments such as a Doppler ABPI assessment.

Ankle brachial pressure index

- **ABPI** = $\frac{\text{highest pedal pulse pressure}}{\text{highest brachial pulse}}$
- Normal range is 0.8 - 1.2



ABI: Correct Calculation

Above 0.90—Normal

0.71–0.90—Mild obstruction

0.41–0.70—Moderate obstruction

0.00–0.40—Severe obstruction

Right ABI

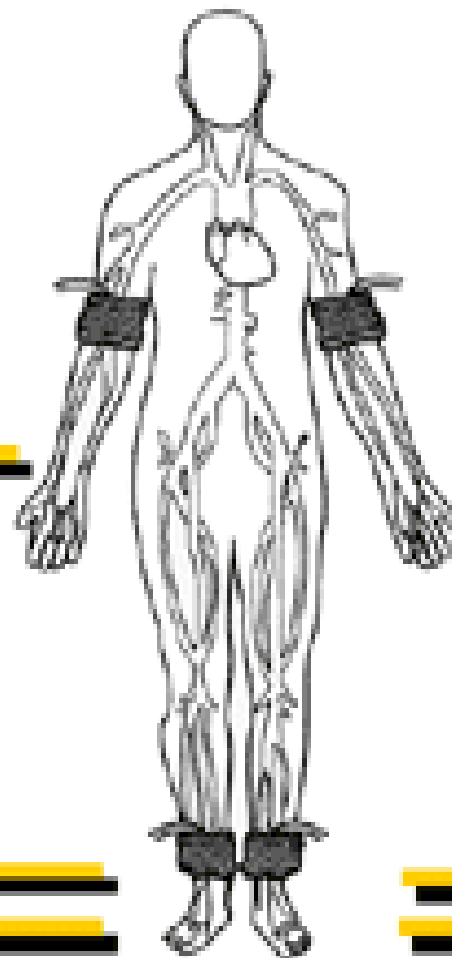
$$80/160 = .50$$

Left ABI

$$120/160 = .75$$

160
Right Arm
Pressure:

120
Left Arm
Pressure:



Pressure:
40 PT
80 DP

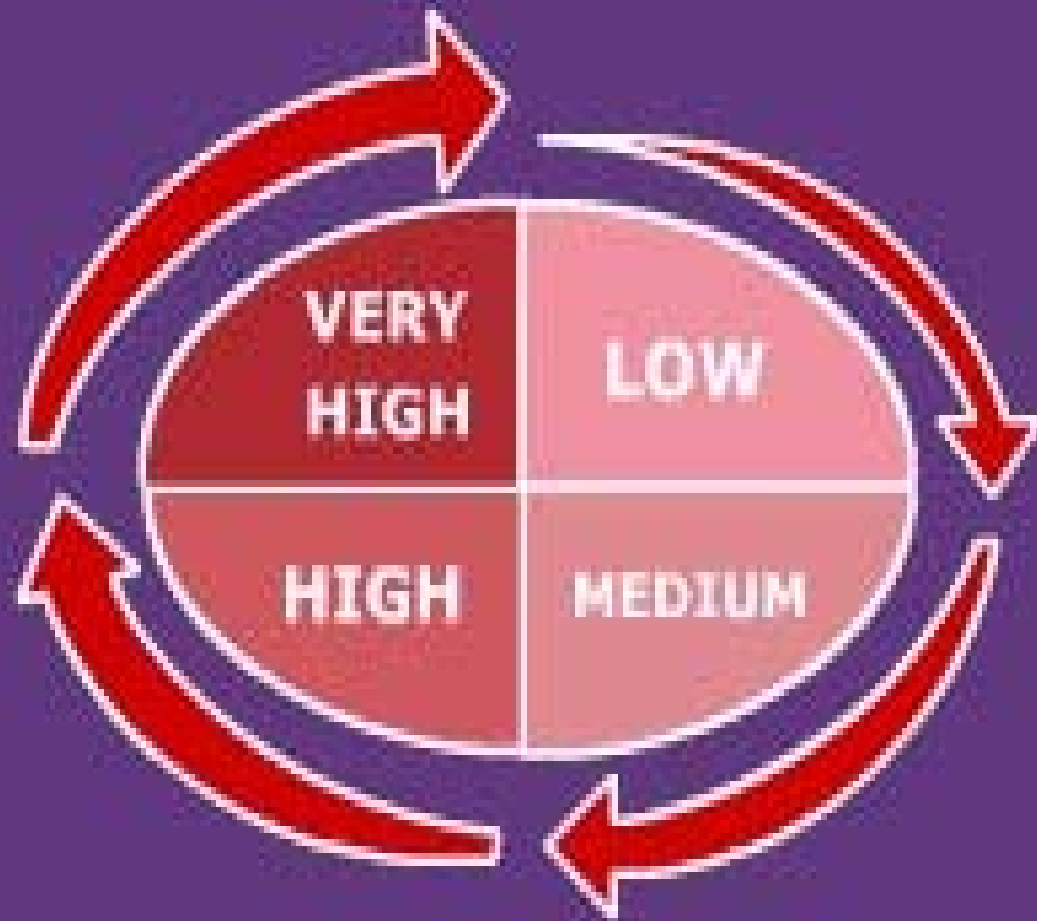
Pressure:
120 PT
80 DP

Adapted with permission from Hiatt WR.
N Engl J Med. 2001;344:1608

- An ABPI should be carried out by an experienced practitioner.
- Both brachial readings should be taken and the higher systolic reading should be used to calculate the ABPI. Pressures should be taken at both dorsalis pedis and posterior tibial vessels.
- 30% of patients with diabetes are prone to calcification of the artery wall and this leads to incompressibility of the artery so giving an artificially high reading.
- In some cases it is possible that arterial occlusion cannot be obtained at 200mm Hg and it is not recommended that the cuff should be inflated higher than this.
- If a patient has a reading higher than 1.2 and has symptoms of claudication or rest pain and or ulceration then referral to the vascular surgeon is recommended. The patient with an ABPI less than 0.8 should also referred to this service.
- NOTE: Patients with neuropathy may not have the symptoms of claudication or rest pain.

Comparison of symptoms of neuropathic and neuroischaemic pain

	Claudication	Ischaemic rest pain	Symptomatic neuropathy
Sensation described	Cramp	SEVERE Cramp/ache/ burning	Burning/tingling/pins and needles
Site	Lower limb- buttocks to toes	Often affects the forefoot	Feet (usually both)
When experienced	On walking - note distance	Anytime, often worse in bed	May be constant, often worse in bed
How relieved	Rest	Eased by hanging legs out of bed	Standing / walking around



Low-general and/or local riskfactors

Medium-+neuropathy+ischaemia

High-+infection

Very high-Multiple factors and/or Renal disease

Renal Disease & Diabetes

From the podiatric point of view limb-threatening ischaemia in patients with end-stage renal disease (ESRD) represents a challenging therapeutic problem. Furthermore, diabetes mellitus is frequently associated with ischaemic gangrene, persistent infection and impaired wound healing.



Calcification of the arteries is most commonly noted in the distal vessels, however, calcification of other arteries such as the posterior tibial can occur resulting in necrosis of the heel tissue.



- The typical renal foot presents initially with cyanotic spots on the skin.
- These areas of cyanosis progress overtime to discrete necrotic lesions. Patients report severe levels of pain with this pathology



Renal Transplant



Although ESRD is less common among transplant recipients than among dialysis patients, amputation is the most common vascular complication after renal transplantation, occurring in 13 to 25% of renal allograft recipients within 5 years after transplantation

Manske et al. 1997 Kidney Dis 29: 601–607

Meticulous foot care is critical for the prevention of amputation. Foot care programs have been demonstrated to be extremely effective in reducing foot complications among diabetic patients without ESRD.

O'Hare A., Johansen k. 2001 J Am Soc Nephrol 12:2838-2847.

Renal Patient & Diabetes



Calcification of the peripheral blood vessels can also affect the blood vessels of the hand/s resulting in gangrene of the fingers and in turn loss of function.

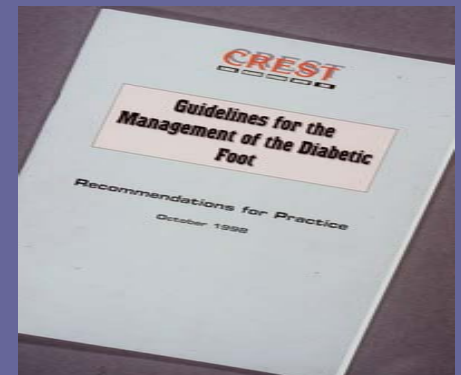
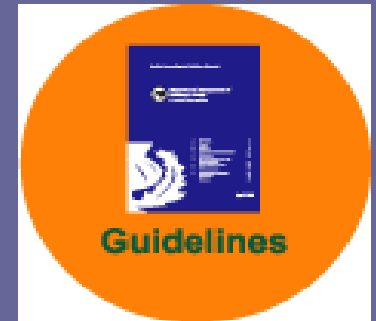
Classifying the diabetic foot

- There are two types of high-risk diabetic foot:
- The Neuropathic Foot
and
- The Neuroischaemic Foot

Screening / Reassessment

There is no evidence to support the frequency of screening-

- International Consensus(2003)
- SIGN (2001)
- CREST(1998)

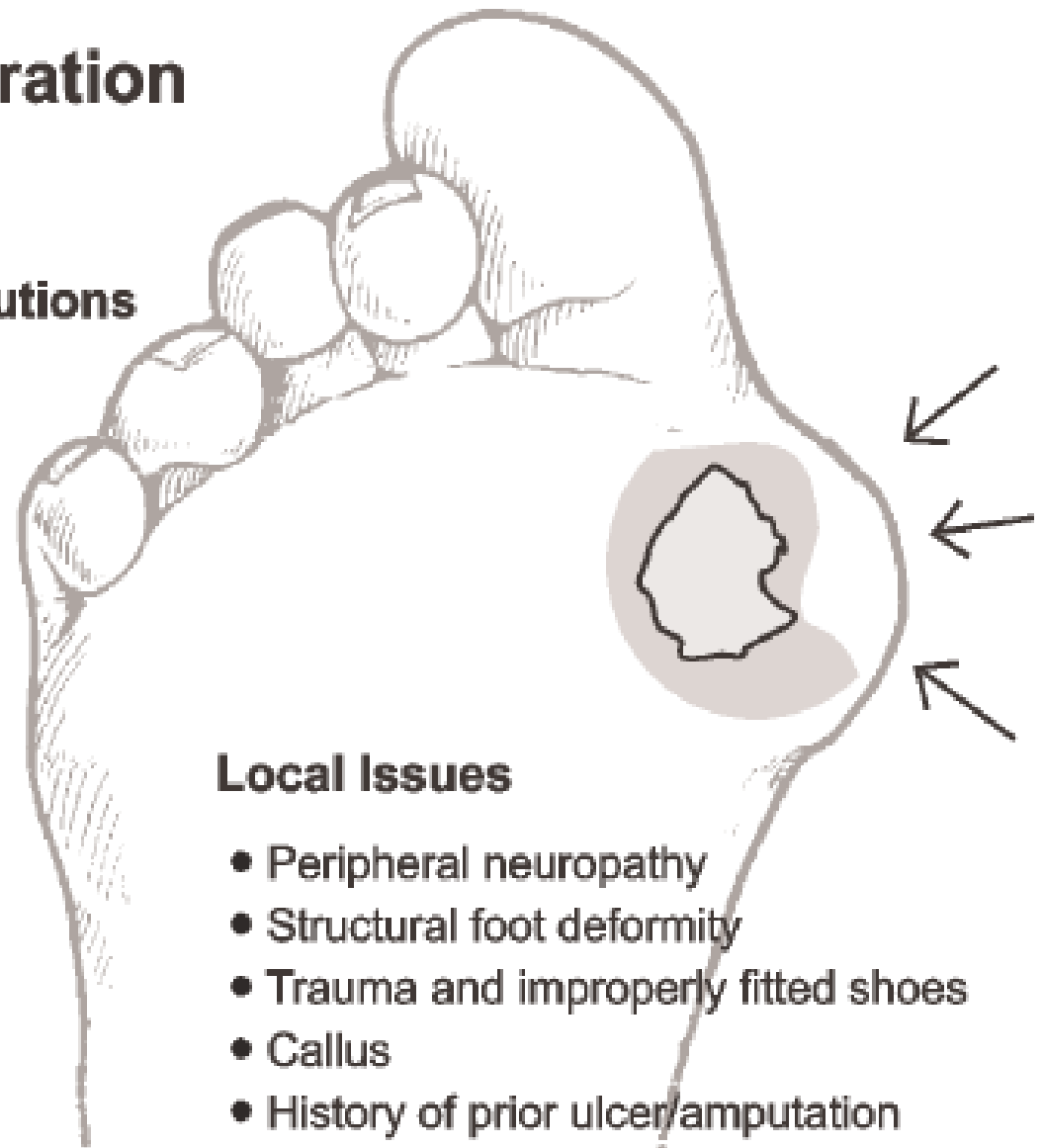


- 47% of patients who had undergone an amputation had not had complete foot evaluation carried out in year preceding initial ulceration or gangrene.
- (Deerochanawong 1992).

Risk Factors for Ulceration

General or Systemic Contributions

- Uncontrolled hyperglycemia
- Duration of diabetes
- Peripheral vascular disease
- Blindness or visual loss
- Chronic renal disease
- Older age



Local Issues

- Peripheral neuropathy
- Structural foot deformity
- Trauma and improperly fitted shoes
- Callus
- History of prior ulcer/amputation
- Prolonged elevated pressures
- Limited joint mobility



Session 2

Learning Objectives

- Know how to identify the key pathologies in the diabetic foot
- Be able to discuss the 6 aspects requiring management diabetic foot disease

Risk Status

- Low
- Medium
- High

Low Risk

- No neuropathy/ischaemia
- No ulceration
- No deformity

Management of the Low Risk Foot

- metabolic control
- mechanical control
- education

The Medium Risk Foot

- neuropathy and /or ischaemia
- no ulceration



Management of the Medium Risk Foot

- metabolic control
- mechanical control
- vascular risk assessment and control
- education

Principles of Management

- metabolic control
- education
- dressing selection
- debridement
- vascular intervention
- management of
- infection / cellulitis
- reduction of pressure
- footwear

The High Risk Foot

- ulceration
- cellulitis
- gangrene
- chronic renal failure
- ABPI < 0.5



Managing the Diabetic Foot – 6 aspects of taking control

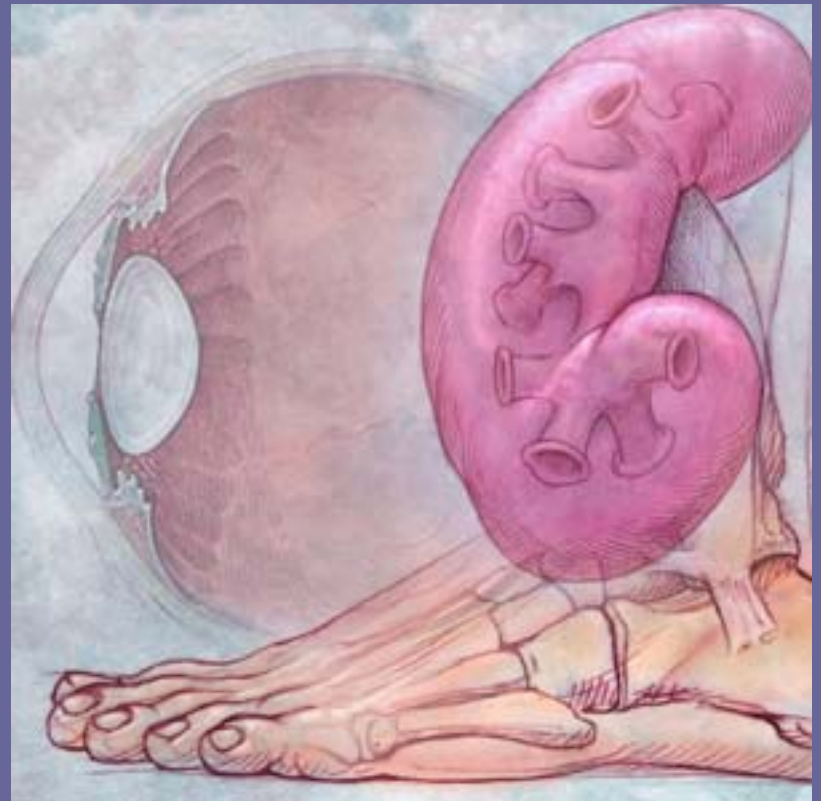
- Metabolic control
- Mechanical control
- Microbiological control
- Vascular control
- Wound control
- Educational control

Managing the Diabetic Foot – 6 aspects of taking control

- Metabolic control

Metabolic control

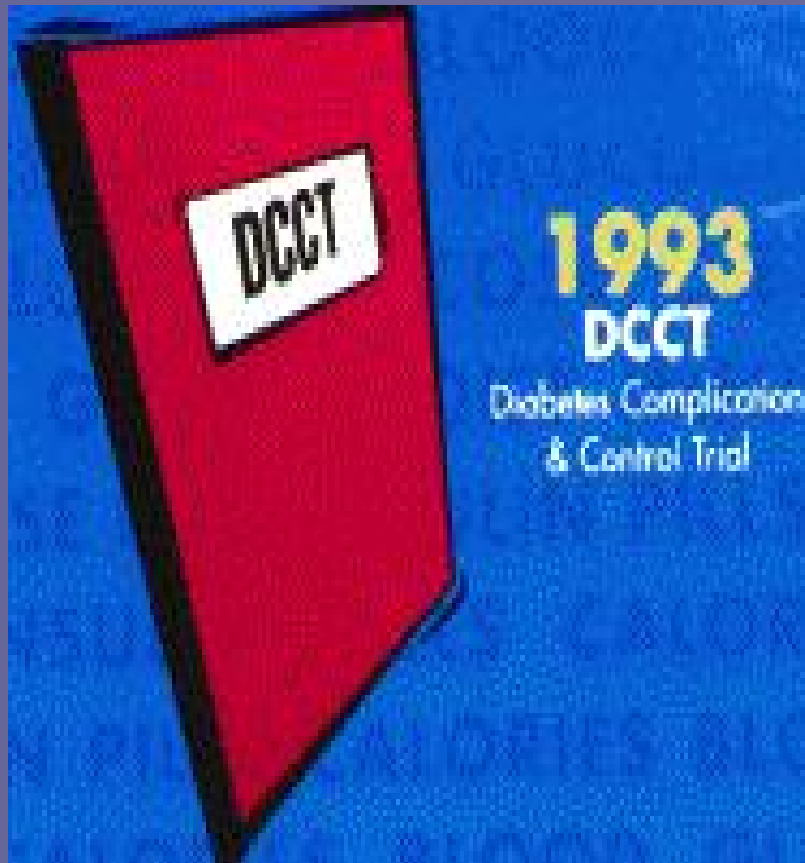
- Hyperglycaemia
- Hypertension
- Hyperlipidaemia
- Smoking



Metabolic Control



DCCT



- The Diabetes Control and Complications Trial (DCCT) looked at the effectiveness of intensive control of blood glucose as a means of preventing microvascular complications in people with Type 1 diabetes.

UKPDS

- The UKPDS message included the compounding effect of hyperglycemia and blood pressure on complication development.
- Any decrease in blood pressure and A1c will reduce the risk of complications.



UKPDS

- Each 10-mmHg decrease in mean systolic blood pressure was associated with reductions in risk of 12% for any complication related to diabetes,
- 15% for deaths related to diabetes,
- 11% for myocardial infarction
- 13% for microvascular complications.
- No threshold of risk was observed for any end point.

Heart Outcomes Prevention Evaluation

or HOPE Study

- reinforces that diabetes is a complex disease requiring multiple strategies to reduce the risk factors including use of Ace Inhibitors.
- Studies related to diabetes risk factors may come from many specialties.
- Micro HOPE

Lancet 2000; 355: 253-259.



Managing the Diabetic Foot – 6 aspects of taking control

- Metabolic control
- **Mechanical control**

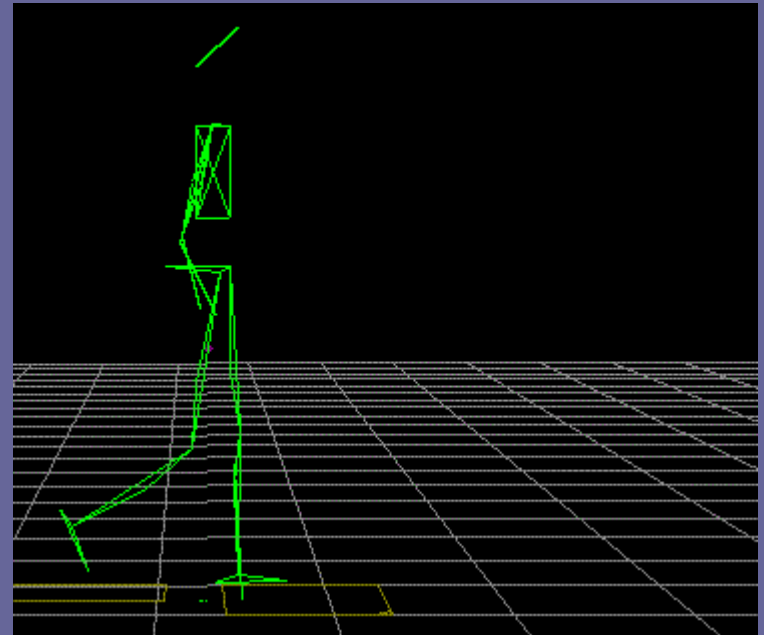
Mechanical Control



Biomechanics of Loading

Normal

- As weight increases on the forefoot...
 - External leg rotation
 - Supination
 - Heel inversion
- After the heel strikes the ground...
 - Internal leg rotation
 - Pronation
 - Heel eversion



The Diabetic Foot

- Loading is **VERY** different
- Foot is pronated
- Heel strike pronation
Stays pronated throughout gait
- Resupination does not occur



Mechanical Control

What effect does this gait pattern have?

- Forefoot loading
- Stays loaded
- Time integras

Outcome

- Tissue damage
- Skin breakdown



Foot Deformities



'foot ulcers have been shown to occur at sites of high pressure in patients with diabetic neuropathy'

Boulton et al 1987

'patients with normal peak pressures did not develop plantar ulcers'

Veves et al 1992

Callus

- Adds to the measured foot pressure
- Callus areas are 90 times more likely to ulcerate than non callus
- Haemorrhage into callus - 50% preulcer(Rosen)
- Callus should be removed
(Murray et al 1996)

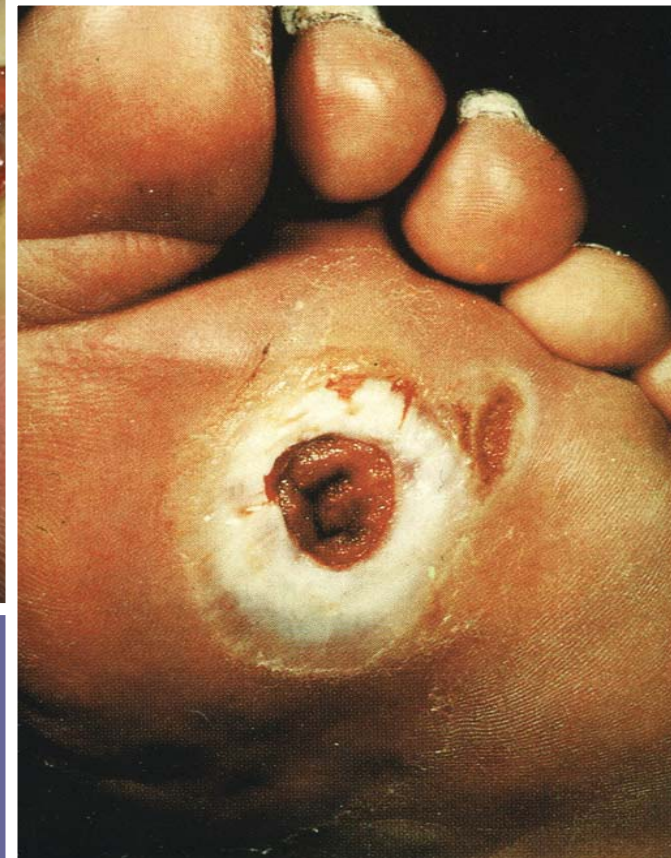
Haemorrhagic Callous



Debridement of Callous

4 reasons

1. Plantar pressures are reduced
2. The true dimensions of the ulcer are made evident
3. Drainage is established
4. Granulation of the wound edge is promoted.



Mechanical control



- Felt padding
- Padded socks, shoes, boots
- Total contact cast, “Scotchcast” boot, Aircast
- AFO , CROW (Charcot Restraint Orthotic Walker)
- Crutches, wheelchair, Zimmer, Bedrest

Felt Padding

- Useful for immediate off-loading
- Must be lifted regularly to inspect the skin under the pad
- Prevents the patient from bathing or showering unless the foot is protected with waterproof cover

Biomechanics

- Causes of ulceration
 - Increased pressure
 - Tissue changes
 - Ischaemia
 - Neuropathy
 - Increased loading



Total contact cast

- Gold standard treatment for indolent neuropathic ulcers and acute Charcot's osteoarthropathy
- Must be very carefully applied
- Monitor patients regularly





The “Scotchcast” Boot



PRAFO



“Healing shoes”



IPOS
Forefoot
Relief
Orthosis



DS Heel Relief
Orthosis



Indications for Prescription Footwear and Insoles

Previous amputation

Previous ulceration

Preulcerative callus

Peripheral neuropathy
with evidence of callus
formation

Foot deformity

Poor circulation



Footwear

- Appropriate footwear is integral to preventing ulcers.
- Prescription footwear and custom fitted orthotics have been shown to prevent occurrence and recurrence of complications and increase patients' use of shoes outdoors

Muller 1997,
Kato et al 1996,
Uccioli et al 1995,,
Janissee 1995,
Wooldridge et al.1994



The Shoes Patients Wear

-37% of diabetic patients studied were wearing shoes that were too small
(Practical Diabetes 1989:6:1:16)
-only 5 (of 26) of shoe shops visited measured feet prior to sale
(Practical Diabetes 1989:6:6:270 – 271)



Managing the Diabetic Foot – 6 aspects of taking control

- Metabolic control
- Mechanical control
- **Microbiological control**

Infection

- Polymicrobial
- Complicates ulceration
- Rapid spread



Signs and symptoms of foot infection include

Changes in tissue colour

- Purulent discharge
- Odour / malodour
- Sinus development
- Undermined ulcer edges
- Exposure of bone and tendon

Classic Signs of Infection

- Pain
 - Erythema
 - Oedema
 - Heat
 - Purulence
-
- Elevated ESR, CRP and WCC

Criteria for Infection

- Abscess
- Cellulitis
- Discharge
- Delayed Healing
- Discolouration
- Friable , bleeding granulation tissue
- Unexpected pain / tenderness
- Pocketing / bridging at base of wound
- Abnormal smell
- Wound Breakdown

(Cutting and Harding 1994, J.Wound Care 3:4:198 – 201)

- Infection often complicates ulceration in both the neuropathic and neuroischaemic foot. The ulcers are portals of entry for bacteria and it is often a polymicrobial infection that spreads rapidly through the foot causing overwhelming tissue destruction.



- 60% do **NOT** demonstrate:
 - pyrexia
 - leukocytosis
 - hyperglycaemia
 - local signs of infection





Microbiology

- All ulcers are colonised and signs of overt infection may be minimal or absent.
- Surface swabs are unreliable and unless taken promptly to a microbiology lab (<1 hour) all anaerobes will die and only dominant organisms survive.
- These are not always the pathogen.





Osteomyelitis

- under diagnosed.
- X-ray is a poor indicator.
- serious complication of diabetic foot ulceration.





Empiric Antibiotic Recommendations

Superficial Ulcer

- Flucloxacillin 500 mg qds
or
co-amoxiclav 625 mg tds
- for 7 - 14 days with frequent reassessment

Empiric Antibiotic Recommendations

Deep Ulcer

flucoxacillin 500mg qds }

ciprofloxacin 500mg bd } triple therapy

metronidazole 400mg tds }

duration of therapy depends on the severity of the ulcer but should be considered for 6 weeks.

Empiric Antibiotic Recommendations

Deep Ulcer plus active cellulitis

regimen as for deep ulcer but I.V. antibiotics are essential

this should be based on sensitivity testing seek advice from medical microbiologist.

Wagner classification

Grade 0: no open lesion, bony deformity may be noted



Grade 1: superficial ulcer without penetration into deeper layers



Grade 2: deep ulcer leading to tendon, bone, joint capsule or ligament



Grade 3: tendinitis, osteomyelitis or deep abscess



Grade 4: gangrene of toe or fore foot



Grade 5: gangrene of the whole foot

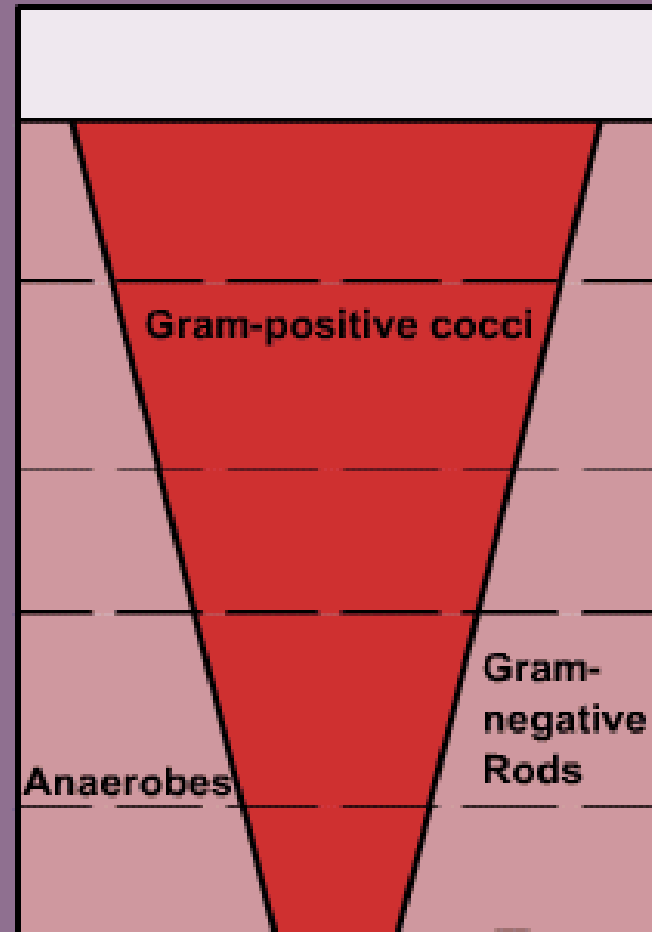






Table 10

IDSA Guidelines for the Clinical Classification of Diabetic Foot Infections

Clinical Evidence of Infection	Infection Severity	PEDIS Grade
Wound lacking purulence or any manifestations of inflammation	Uninfected	1
Presence of ≥ 2 manifestations of inflammation (purulence, erythema, pain, tenderness, warmth, or induration), but cellulitis/erythema extends ≤ 2 cm from margins of ulcer, and infection is limited to the skin or superficial subcutaneous tissues; no other local complications or systemic illness	Mild	2
Infection (as above) in a patient who is systemically well and metabolically stable but has 1 of the following characteristics: cellulitis extending > 2 cm, lymphangitic streaking, spread beneath the superficial fascia, deep-tissue abscess, gangrene, and involvement of muscle, tendon, joint, or bone	Moderate	3
Infection in a patient with systemic toxicity or metabolic instability (eg, fever, chills, tachycardia, hypotension, confusion, vomiting, leukocytosis, acidosis, severe hyperglycemia, or azotemia)	Severe	4

Infection

Usually starts as simple skin lesion

May spread rapidly leading to major limb loss despite adequate blood supply



This all happened in a matter of days !

Managing the Diabetic Foot

- Metabolic control
- Mechanical control
- Microbiological control
- **Vascular control**

Vascular Control



PVD

- Contributes to limb ulceration ,gangrene and impaired wound healing.
- Incidence is at least x4 higher in the patient with diabetes.
- Increases with age and duration of diabetes.
- Hypertension ,smoking, hyperlipidaemia, family history and obesity are also risk constituents in the patient with diabetes.

Vascular Intervention

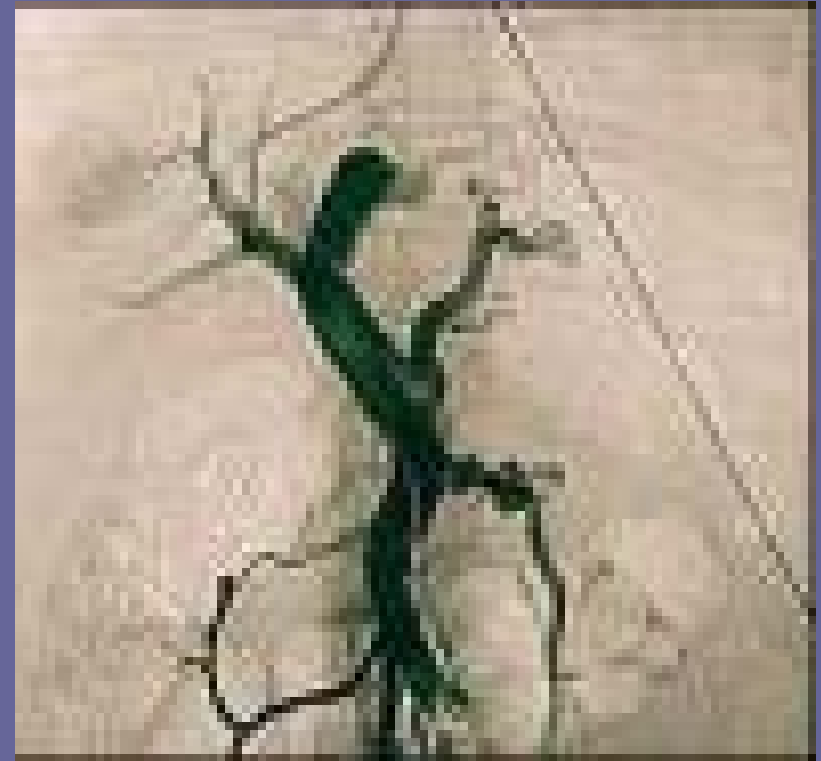
All patients with diabetes who have developed foot complications and who have an ABPI < 0.8 or > 1.2 should be referred to a vascular surgeon for assessment.



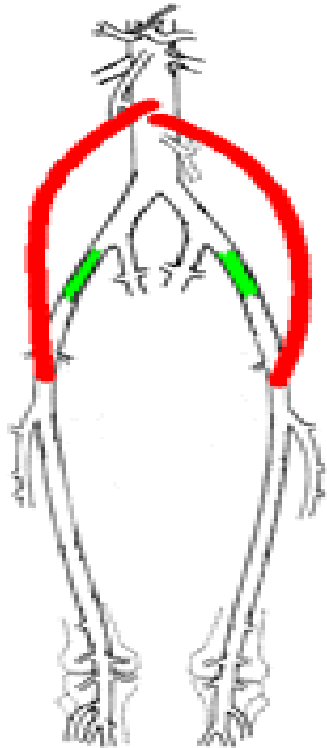
Vascular control

- Conservative care: 75% of ischaemic ulcers will heal if caught early and treated aggressively
- Angioplasty
- Distal bypass

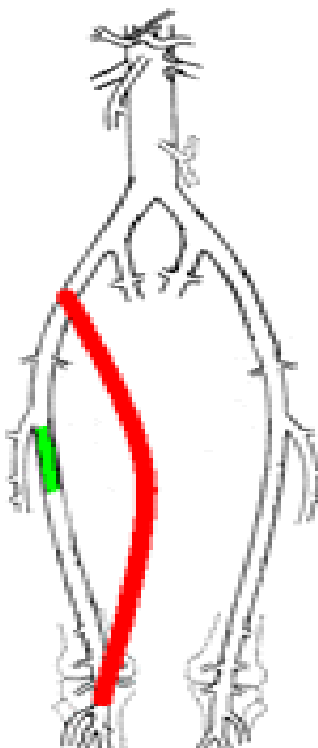
Interventional Radiology







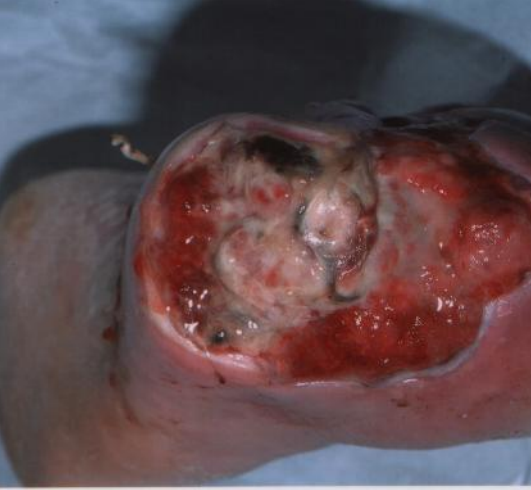
**Aorto-Bifemoral
Bypass**



**Femoral-Popliteal
Bypass**



**Femoro-Femoral
Crossover**



Ulcer healing post revascularisation



Conservative v Palliative

Active v Passive

- Exudate
- Odour
- Pain
- Skilled sharp debridement
- Post surgery – amputation site, radical debridement



Reasons for Amputation

- Intolerable pain
- Progressive gangrene
- Toxic / septic conditions **NOT** responding to medical treatment.

Figure 3 The risk factors for amputation are multifactorial and similar to those for ulceration.



Risk Factors for Amputation

- Neuropathy LOPS
- Peripheral arterial disease (PAD)
- Infection
- History of prior foot ulcer or amputation
- Structural foot deformity
- Trauma
- Charcot foot
- Impaired vision
- Poor glycemic control
- Older age
- Male Sex
- Ethnicity (greatest rates in blacks & Hispanics)



- Within 4 years of amputation approx 50% of contralateral limbs are lost.

(Ebskov & Josephen 1980)

- Within 2 years of amputation 36% lost the contralateral limb.

(Bodily & Burgess 1983)

Managing the Diabetic Foot

- Metabolic control
- Mechanical control
- Microbiological control
- Vascular control
- **Wound control**

Wound Control



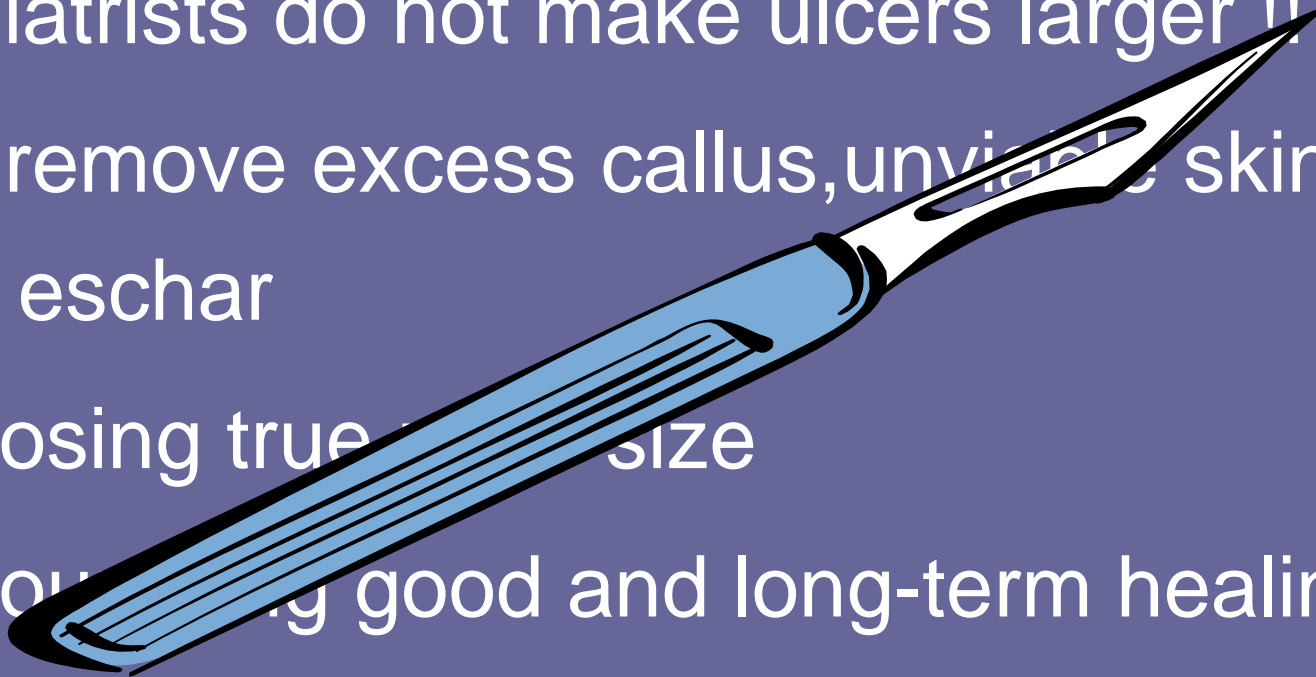
Wound Control

- Debridement
- Dressings
- Advanced techniques



Debridement

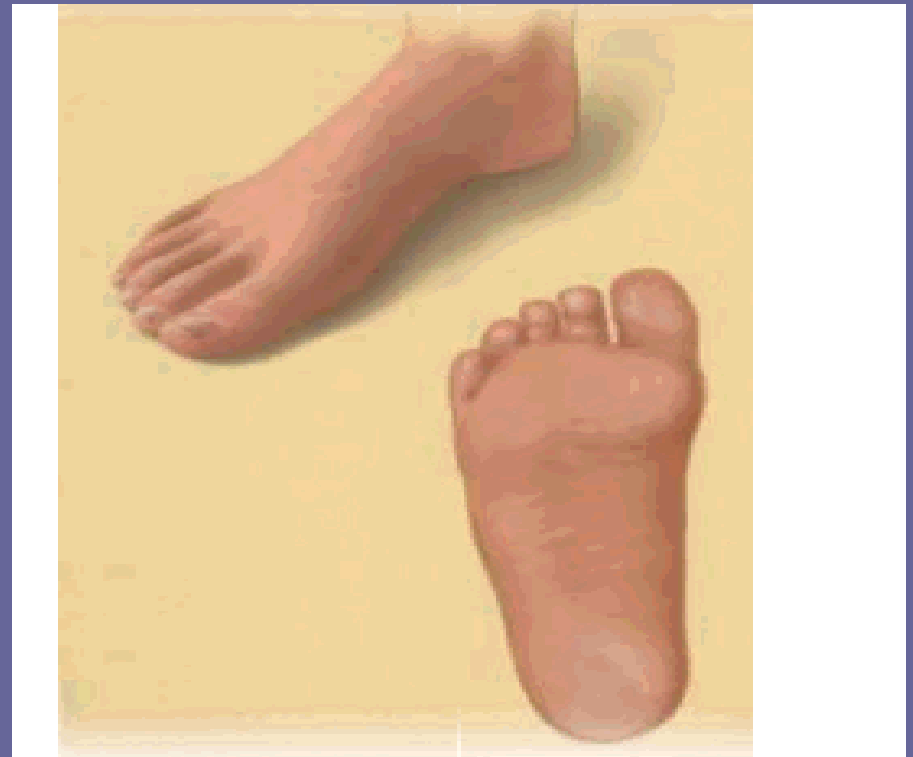
- Podiatrists do not make ulcers larger !!
- We remove excess callus, unviable skin and eschar
- Exposing true ulcer size
- Encouraging good and long-term healing





Ulceration

- It is not what you put on a diabetic foot ulcer but what you take off it!



Dressing Selection



Allows gaseous exchange

Maintains a moist environment

Meets patient's lifestyle needs

Effective barrier against micro organisms

No maceration

Optimum pH

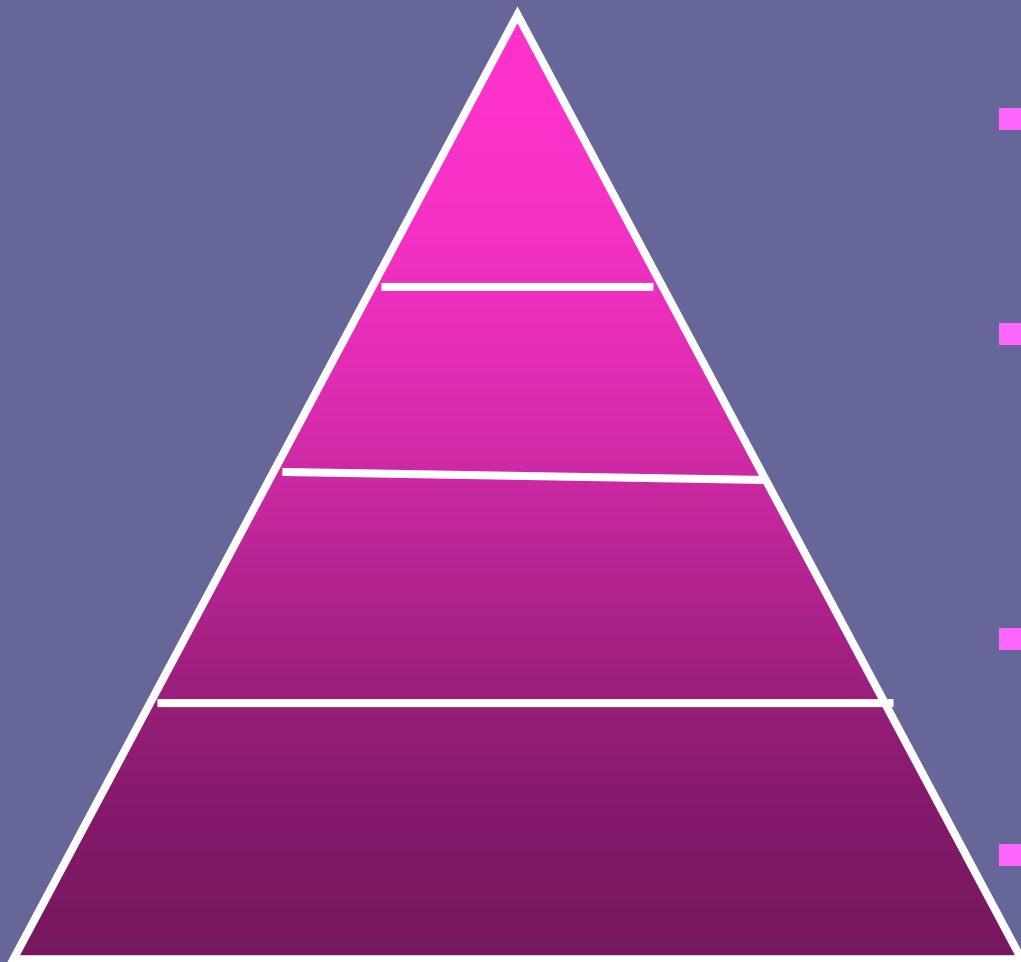
Does not introduce toxins or other noxious matter

Requires infrequent change

Maintains warmth

No trauma on removal

Dressing Selection



- Drugs
- Specialist dressings
- Dressings
- Good basic wound care



Advanced Techniques



Managing the Diabetic Foot

- Metabolic control
- Mechanical control
- Microbiological control
- Vascular control
- Wound control
- **Educational control**

Educational Control

- Patient
- Carers
- Self
- Other professionals

Health Promotion

Glycaemic control

Lifestyle:

- Smoking cessation
- Alcohol
- Exercise
- Eating habits



Health Promotion

- Needs to be realistic !
- Least effective interventions are those which are didactic.
- Patient-centred or psychologically underpinned approaches most effective.

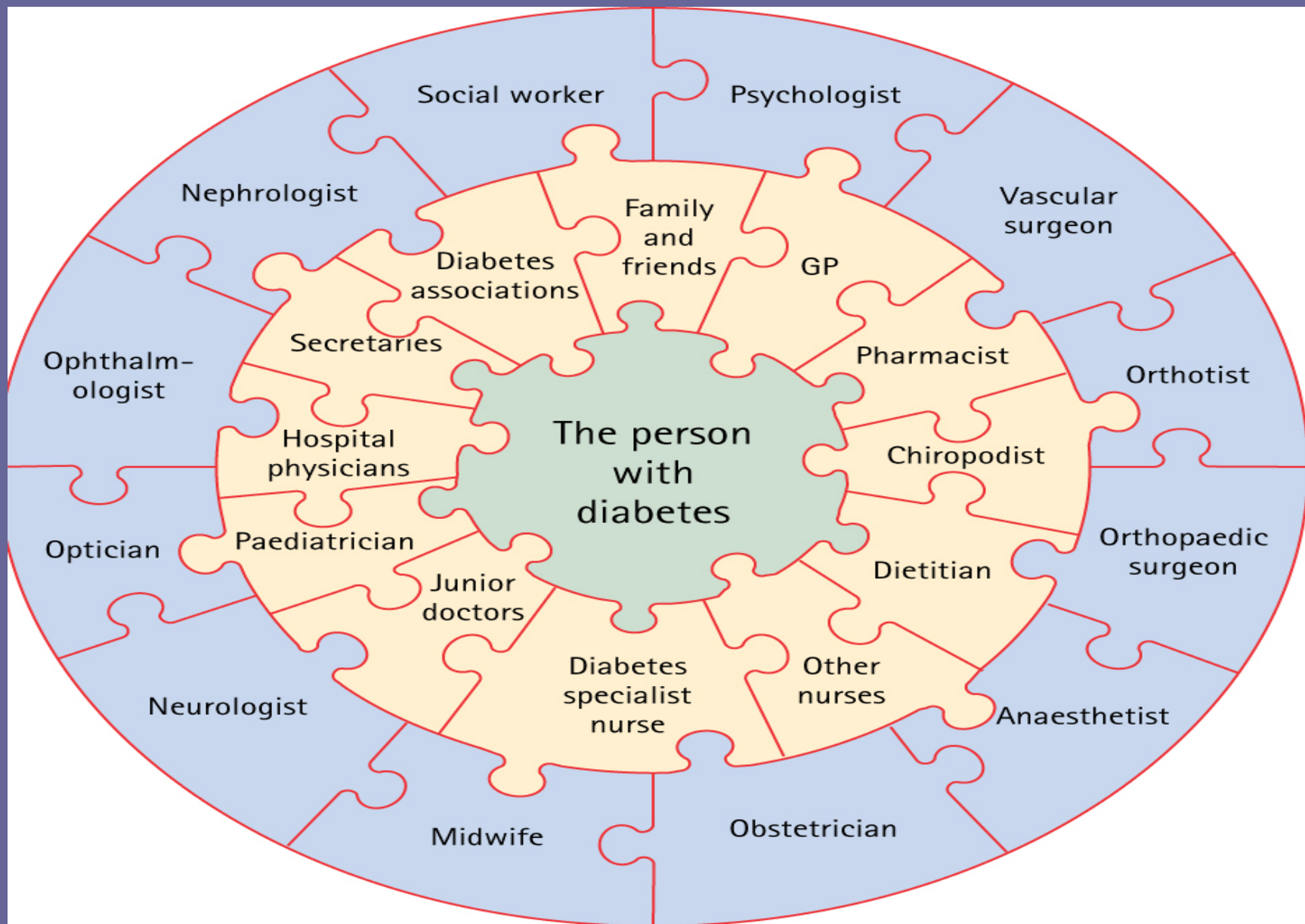
Griffin *et al* 1998
B.D.A report



Multidisciplinary Management

- No one person can do all that is required to prevent and treat diabetic foot problems.
- **It takes a team**





Quality of Life Issues

- Diabetic foot ulcers have negative effects on several components of quality of life for patients and caregivers including:
 - Daily activities
 - Emotions
 - Financial
 - Leisure
 - Physical health
 - Relationships with friends

- Healing Diabetic foot ulcers requires adequate blood supply, control of infection, excellent wound care and offloading or pressure redistribution of the ulcerative area.





And Finally

The Diabetic Foot

Triad of:
Neuropathy
Ischaemia
Infection



Management of Neuropathic Ulceration

- Rest
- Redirection of pressure
- Appropriate treatment of infection
- Appropriate dressings
- Regular sharp debridement
- Prophylactic preventative measures, patient education and podiatry



1/3A



Conservative Management of the Neuroischaemic Ulcer

- Rest
- Pain relief
- Removal of necrotic tissue
- Suitable dressings



Standard ulcer care

- Evaluate for infection
- Debride ulcer, remove callosities
- Check for sensation (monofilament)
- Check for circulation (pulses, Dopplers)
- Probe to bone?
- Adequate offloading
- Antibiotics if infected
- Secondary prevention of ulcer and of major diabetes related events

Neuropathic

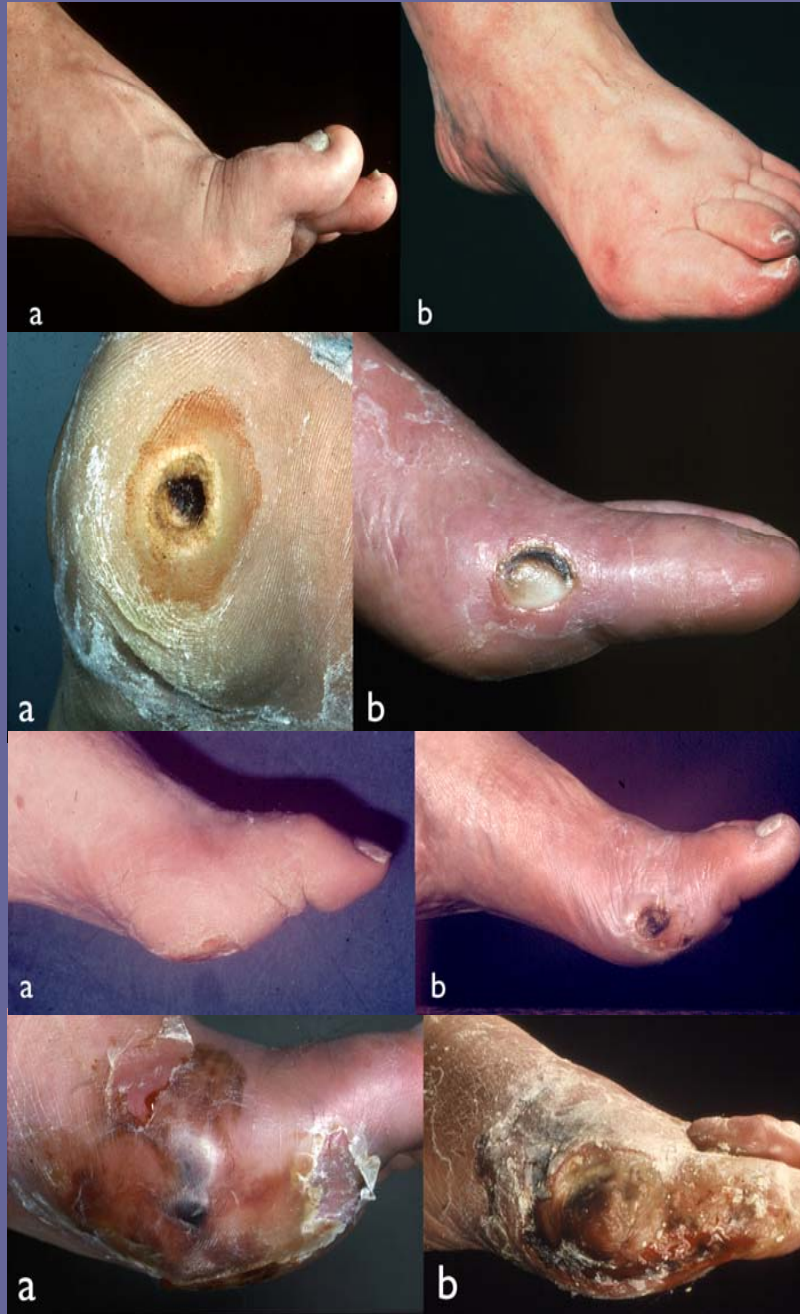
Neuroischaemic

High risk

Ulcer

Infection

Necrosis



Multidisciplinary
management

Wound
Mechanical
Vascular
Microbiological
Metabolic
Educational



- Every 30 seconds a leg is lost to diabetes somewhere in the world.

Or in the time I have been speaking to you
480 major amputations!

- Thank you
- Any questions?

