The diabetic foot and lower limb
How does it affect you?

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www.hsfcs.co.uk

Agenda

- What is diabetes
- Statistics
- Its affect on you as practitioners
- Reduction of risk
- How the body works in diabetes
- Practical steps
- Summary

What is diabetes?

- **Diabetes is the 3rd largest cause of death in the UK and increasing rates does not bode well.**
- 1996 to 2012 diagnosis increased from 1.4 m to 2.9 m
- Globally a diabetic amputation every 30 secs!

General diabetes facts

- The full medical name for diabetes is *Diabetes Mellitus*
- There are 3 main types of diabetes: type 1, type 2 and gestational diabetes
- Type 1 diabetes is sometimes called juvenile diabetes or insulin-dependent diabetes
- Type 1 diabetes is managed using insulin injections or an insulin pump
- 90% of people with diabetes have type 2 diabetes
- Type 2 diabetes used to be called non-insulin dependent diabetes
- Type 2 diabetes is managed by diet, exercise and sometimes medication and insulin

Diabetes.co.uk

Prevalence

- Diabetes UK March 2013

Country	Prevalence	Number of people
England*	5.8 per cent	2,566,436
Northern Ireland	4.0 per cent	75,837
Scotland	4.4 per cent	234,871
Wales	5.3 per cent	167,537

Prevalence

- By 2025 estimated that 5m people will have diabetes in the UK.
- Most of these cases will be Type 2 diabetes
- Why?

Why?

- Because of ageing population
- Rapidly rising numbers of overweight and obese people.

Diabetes worldwide

- Diabetes affects around 370 million adults worldwide
- The global diabetes rate is expected to grow to 552 million by 2030, or 9.9% of the adult population
- Diabetes is rapidly increasing in low- and middle-income countries
- China has the largest diabetes population, with 90 million diabetes sufferers, followed by India (61.3m) and the USA (23.7m)
- Africa is projected to see the largest growth in diabetes prevalence between now and 2030, with rates forecast to rise from 14.7 million to 28 million (90% increase)

What should we do?

- We need to increase awareness of the risks;
- Bring about wholesale changes in lifestyle;
- Improve self-management among people with diabetes;
- Improve access to integrated diabetes care services.

How does it affect you?

- What part of the body shows first signs?
- What are those signs?
- Whose problem is it?
- Whose responsibility is it?

Signs

- Thirst
- Frequent urination
- Unusual hunger
- Dry mouth
- Weight gain or loss
- Headaches
- Blurred vision
- Impaired healing
- Dry skin
- Hairless legs
- Cold feet
- Bulging veins
- Lack of sensation
- Sexual dysfunction
  - Damaged blood vessels
  - Decreased sensation
  - Erectile dysfunction
  - Vaginal dryness

How does it affect you?

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Understanding can help!

- The ‘At Risk’ foot

What makes a ‘foot at risk’?

- A loss of tissue viability, usually by an intrinsic cause.
- Tissues unable to withstand environmental stress
- Healing may be delayed or incomplete.
- Severely compromised may lead to stasis, deterioration and the spread of infection.

Factors contributing to an ‘at risk’ foot

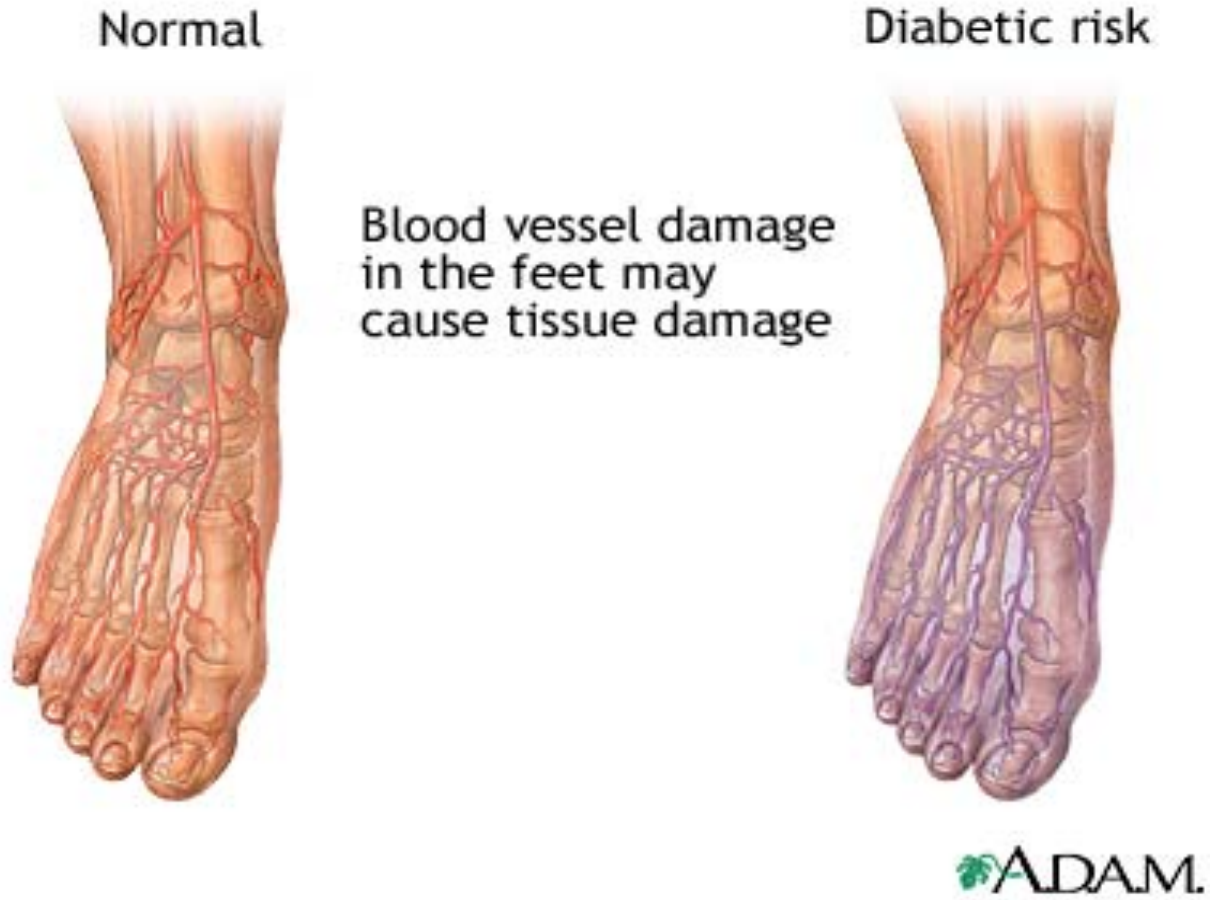
- Trauma – damage (blister/fissure/cut)
- Ulceration
- Infection (superficial – soft tissue)
- Infection (deep - osteomyelitis)
- Gangrene and necrosis
- Septicaemia.
- Amputation

Factors involved in an ‘at risk’ status

- Vascular
  - - ischaemia -
    venous stasis
- Neurological
- Neoplasia
- Infections
- Immuno-compromised
- Trauma
- Foot deformity
- Ageing

- Complications may be broadly categorised as follows
  - Macrovascular disease (large vessel)
    - Miocardial Infarction (MI)
    - Cerebrovascular Accident (CVA)
    - Amputation
  - Microvascular disease (small vessel)
    - eye, kidney and nerve damage
  - Diabetic eye disease
    - cataracts, glaucoma
  - Diabetic foot disease
    - infection
    - neuropathy
    - ischaemia
    - ulceration

Circulation



Small artery atherosclerosis

The Dorsalis Pedis vessel almost occluded by a plaque

Foot ulcers

- In diabetics, the greatest predictor of ulceration is a history of previous ulceration

(Abbot et al 2002)

Signs of high pressure areas

- Deformity
- Redness
- Callus
- Corns
- Blisters

- Abnormal pressures
- Increased shear and friction
- Callosities

Most frequent cause of an ulcer

- **Ill-fitting shoes**
- Even in patients with "pure" ischaemic ulcers
- Therefore, the shoes should be examined meticulously in all patients

Shoe trauma

Blistering caused by new bespoke shoes

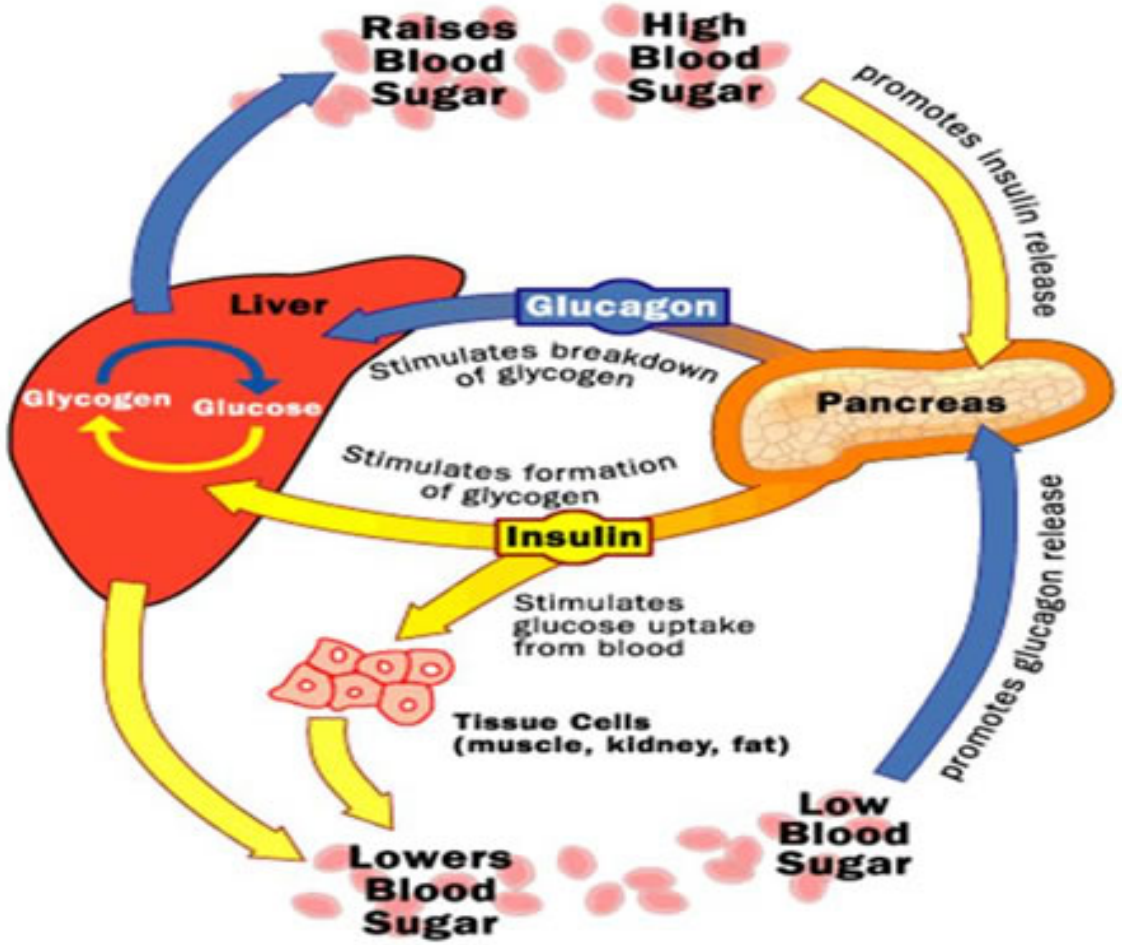
- Neuropathic patient
- Charcot deformity

Neuropathic ulcers caused by tight shoe straps

DM?

- What part of the body is responsible?
- What affects insulin production?
- How is it measured ?
- What is HbA1c?

Insulin cycle



How insulin works?

- What part of the body is responsible?
- What affects insulin production?
- What is measured ?
- What is HbA1c?

HbA_{1c}

- HbA1c reflects blood glucose levels over the last 2-3 months – **why?**
- Glucose in the blood binds irreversibly with Hb forming HbA_{1c} (Glycated haemoglobin) this then circulates for the lifespan of the erythrocyte
- The Diabetes Control & Complications Trial (DCCT) in Type 1 diabetes and the UK Prospective Diabetes Study (UKPDS) in Type 2 diabetes showed that the risk of microvascular & macrovascular complications increases as HbA_{1c} increases.
- HbA1c thus gives a measure of morbidity and prognosis.

HbA1c targets

HbA1c targets	Mmol/mol	%
Non-diabetics	**20 - 41 mmol/mol**	**4% - 5.9%**
Diabetics	**48 mmol/mol**	**6.5%**
Diabetics at higher risk of hypoglycemia	**59 mmol/mol**	**7.5%**

HbA1c levels between 5.7% and 6.4% indicate increased risk of diabetes (prediabetes).

Your role as practitioner

- Prevention of tissue damage?
- Heal existing foot lesions
- Maintain and monitor foot health
- Educate and advise
- Refer on ….?

Assessing the diabetic foot

- Simple assessment – search for 8 clinical factors
  - Simple inspection
  - Palpation
  - Sensory testing

Why do we assess?

- To identify feet which may be at risk
- To assess the level of complications
- To manage such patients and their complications

HOW DO WE ASSESS?.....

- History taking!!
- Neurological examination – sensory system / motor system

History taking

- Symptoms?
  - Duration
  - Site
  - Radiation
  - Quality of pain
  - Frequency of pain
  - Time of onset
  - Associated features
  - Precipitating / relieving factors
- Hereditary factors / family history
- Medical history
- Social history
- Treatment history / medication

8 Clinical factors in assessment

- Neuropathy
- Ischaemia
- Deformity
- Callus
- Swelling
- Skin breakdown
- Infection
- Necrosis

Prof. Michael Edmonds (Kings College –London)
Managing the Diabetic Foot 2006

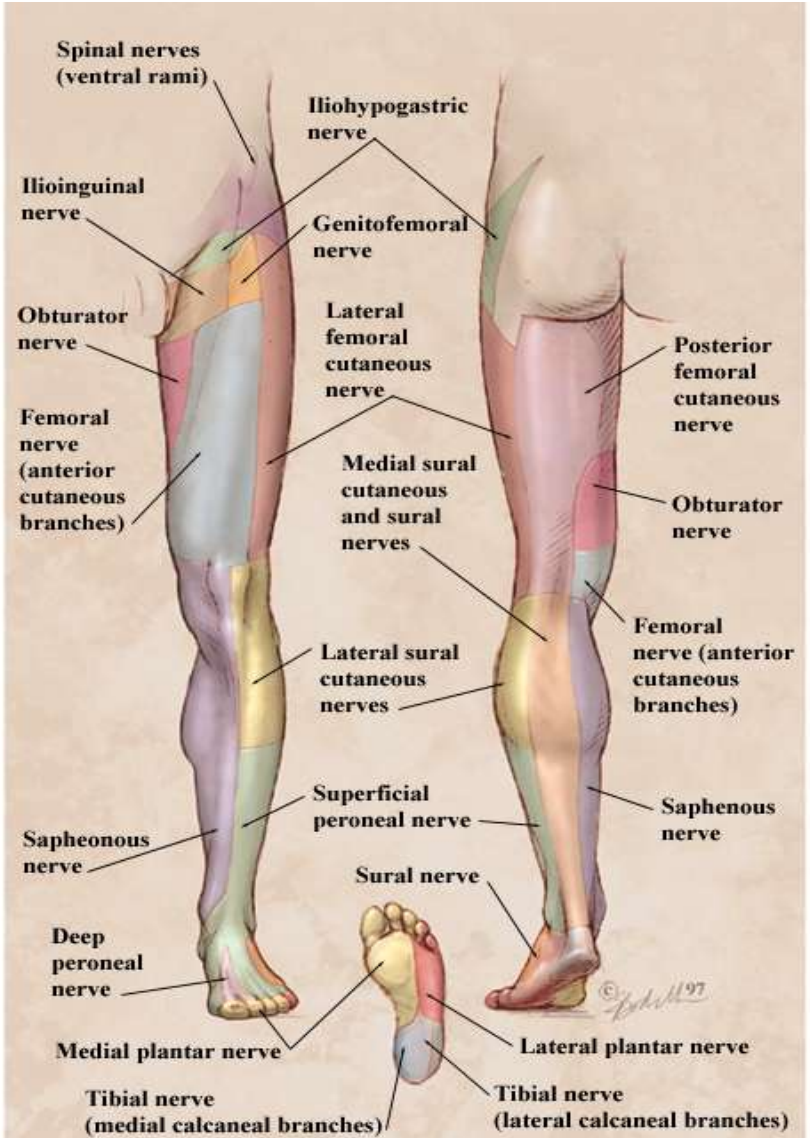
Peripheral neuropathy

- Can affect:

Sensory Motor Autonomic

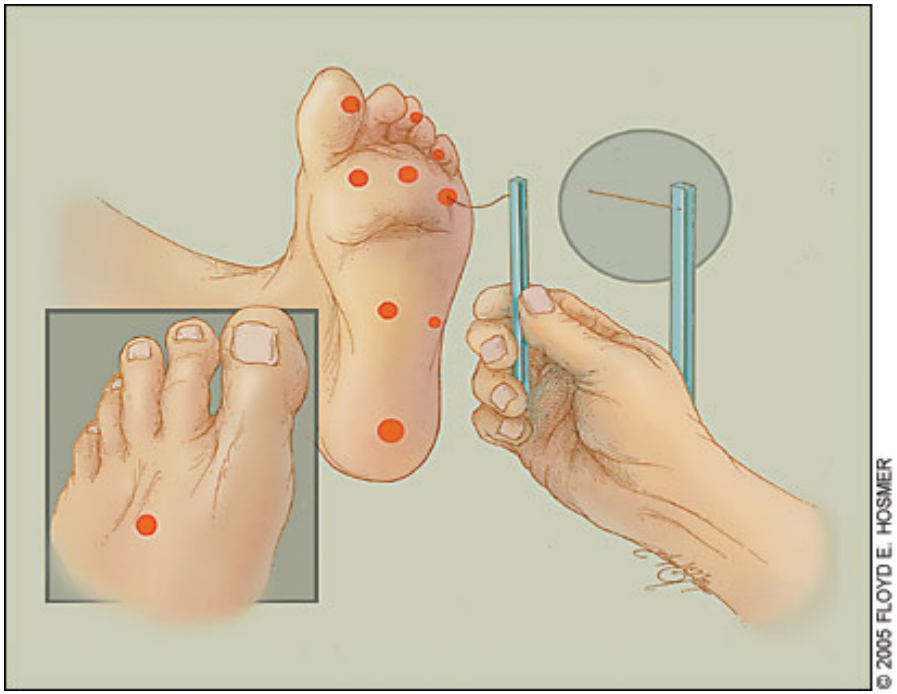
Sensory	Motor	Autonomic
•Light touch, vibration, temperature, pain reduced. •Pins & needles, numbness •Painful neuropathy may be experienced	•Muscle weakness •Diminished reflexes (AT) •Balance and proprioception reduced •Claw toes, prominent met heads, wasted intrinsic muscles	•Glandular secretion •Postural hypotension •Urinary and sexual function •Digestive tract •Signs of hypoglycaemia masked

Nerve structure



Testing for sensory neuropathy

- Semmes Weinstein Monofilament 10g
- Sharp/blunt
- Vibration perception 128Hz
- Hot/cold
- Proprioception
- Two point discrimination



The ‘Protective Threshold’

Inability to perceive the 10 g Semmes-Weinstein monofilament *or* the 128 Hz tuning fork indicates a times *seven* risk of ulceration in the next three years

(*Boulton et al 1995*)

What does a typical neuropathic foot look & feel like?

- Anhydrotic skin
- Intrinsic muscle wasting
- Clawing & retraction of toes.
- Bounding pulses
- Prominent dorsal venous arch
- Very warm to touch – autonomic
- Numb

Painful Neuropathy

- Nerve damage due to diabetes can present as insensate neuropathy (sensory loss) or painful neuropathy.
- The majority of people have the insensate type, however some patients with diabetes suffer chronic, often distressing symptoms of pain, pins and needles or numbness in their feet.
- Up to 10% of those affected will experience persistent neuropathic pain.

Painful Neuropathy

Burning, feeling like the feet are on fire

Freezing, like the feet are on ice, although they feel warm to touch

Stabbing like sharp knives

Lancinating, like electric shocks

Autonomic neuropathy

- Sympathetic innervation to the periphery has degenerated
- No vasoconstriction
- Arteriovenous shunting
- Engorged dorsal veins

Motor neuropathy

- High medial longitudinal arch.
- High pressure areas
- Test dorsiflexion of foot
  - Foot drop – ???? which nerve & muscles responsible

Motor neuropathy

- High medial longitudinal arch.
- High pressure areas
- Test dorsiflexion of foot
  - Foot drop – peroneal nerve & peroneal longus / brevis

Loss of Pain

- What are the effects?

Loss of Pain

- Inability to perceive pain means injury goes unnoticed.
- Tissues are damaged and healing is impaired.
- Ulcers arise and infection is likely to invade
- If infection destroys enough tissue, or if infection occurs in deep tissue i.e bone and joint, then AMPUTATION often required

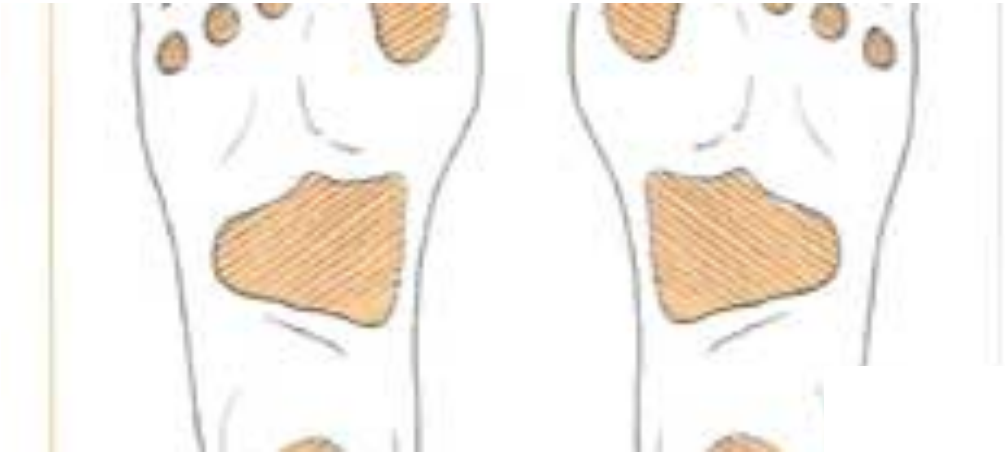
Clinical features of lower motor neurone disorders.

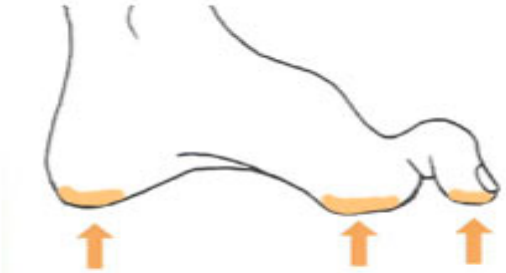
- Muscle weakness: slight weakness (paresis) to full paralysis
- Muscle wasting: in the distribution of the damaged nerve
- Fasciculation: Involuntary contractions, or twitching of groups of muscle fibres – muscles usually atrophied or weak.
- Hypotonia: Muscular tone is diminished
- Trophic changes: Partly as a result of disuse, and partly as a result of vasomotor (autonomic) involvement. Brittle nails, cold, cyanosed, dry skin.

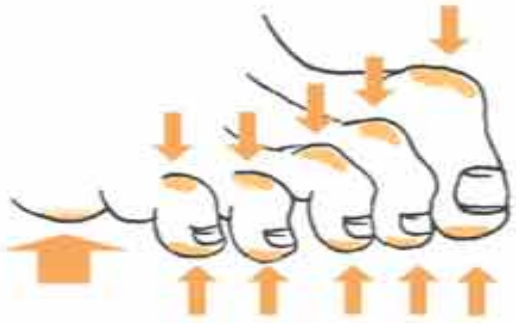
Neuropathic Ulceration

- Painless
- Deep
- Forms over pressure areas
  - Apices, dorsum of toes, metatarsal heads, heel.
- Hyperkeratosed edges
- Macerated surround
- High exudate, sloughy
- Granulating base
- Pulses present

“At risk” areas for ulceration







Neuropathic ulcers

The Charcot Foot

Charcot's Arthropathy

- **Charcot**'s **arthropathy** is a devastating condition affecting diabetic patients with peripheral neuropathy, resulting in a foot at risk for ulceration and amputation. Early diagnosis is important for the institution of appropriate treatment, which may help prevent disease progression and foot deformity.

(Jude and Boulton 2002)

ISCHAEMIA

DEFINITION

- A pathophysiological state where tissues are under perfused with blood in relation to their metabolic needs

Ischaemic limb

Arterial supply to limb

- Acute
  - Extrinsic - occlusion
  - Intrinsic - thrombosis
- Chronic
  - develops slowly
  - gradual loss of tissue viability
  - Peripheral Vascular Disease
- Transient
  - Raynauds phenomenon
  - Chilblains

Peripheral vascular disease

- Causes
  - Atherosclerosis
    - Fibro-fatty plaques
  - Arteriosclerosis (Monckeberg's)
    - Ageing process
    - Accelerated in diabetes, usually bilateral and distal (arteries below knees)
  - (Thromboangitis Obliterans)
    - Smokers
      - Vasculitis of small arteries and arterioles
      - Gangrene of digits
  - Vasculitis
    - RA
    - SLE
      - Many others

Peripheral Ischaemia signs

- Lack of palpable pulses
- Temperature changes
  - cold
- Colour changes / dependant rubor
- Hair loss on foot and limb
- Dry skin
- Onychauxic / onychomycotic nails
- Subungual ulceration
- FFP atrophy

Ischaemic symptoms

- Ischaemic patient may complain of
  - intermittent claudication
  - reduced walking distance
  - dangle legs out of bed at night
  - need painkillers
  - rest pain
    - Very severe sign

Ischaemic ulceration

- Shallow
- Punched out appearance
- Painful
- Dry slough base of wound
- Minimal slough/exudate
- Lack of pulses
- Apices and borders of foot

Susceptibility to infection/immunopathy

- Persons with diabetes are generally more prone to infections than non-diabetic people.
  - Due to deficiencies in the ability of white blood cells to defend against invading bacteria, diabetics have more difficulty in dealing with and mounting an immune response to the infection.
  - Infections often worsen and may go undetected, especially in the presence of diabetic neuropathy or vascular disease.
  - Often, the only sign of a developing infection is unexplained high blood sugar, even without fever

Infected ischaemic ulcers

- Systemic antibiotics are unable to reach the site of infection
- Infection can spread rapidly
- Anaerobic organisms commonly involved

- **How therefore might management be directed?**

BEWARE – Neuro-ischaemic ulcers

- Many diabetic patients present with peripheral neuropathy and peripheral vascular disease.
- In this case pain is not a reliable indicator.

Mixed aetiology ulcers

- Very common particularly in diabetic, rheumatoid and elderly patients

Neuro-ischaemic ulcers

Venous stasis ulcer

INFECTION

- Immuno-suppressed patients are most at risk
- A few examples-
  - Diabetes
  - HIV
  - Specific drug regimes

INFECTION

- Fungal
  - Tinea pedis
  - Onychomycosis
    - Risk of secondary bacterial infection
    - Early detection and treatment

Signs of infection

- Redness
- Heat
- Pain (beware of neuropaths)
- Swelling
- Malodour
- Lymphangitis
- Lymphadenitis
- Systemic effects – fever/malaise

Infection in the diabetic foot

- Requires immediate referral to specialist foot clinic (Who?)
- 85% of amputations begin with an ulcer
- Infection is nearly always involved

Image From: www.leinfections.com/category/osteomyelitis/

Risk Factors in the Diabetic Foot

- Previous history of amputation / ulceration
- Foot deformity
- Neuropathy
- Vascular impairment
- reduced visual accuity
- Social Factors

Relief of pressure

- Non weight bearing is essential
  - Limitation of standing and walking
  - Crutches, etc.

  Mechanical unloading
  - Total contact casting/other casting techniques
  - Temporary footwear - Individually moulded insoles.

Deterioration

- Be aware of your limitations as a practitioner– can you improve this patient's condition?

- Refer on

Multidisciplinary team

- Multidisciplinary teams – GP, Podiatrist, Acute Diabetic Team, Diabetes consultant, District/ Practice Nurse, vascular specialist, Orthotist, Microbiologist more……

Remember

- The patient is an important part of healing their wounds and should be included as part of the shared care approach.

Diabetic snippets

- High intake of protein — animal protein in particular — has been linked with an increased risk of type 2 diabetes, especially among obese women. *(Diabetes Care-April 2014)*
- Active smokers have a 30% to 40% higher risk of developing type 2 diabetes *(Medscape - April 2014)*
- Adults with diabetes show a significantly greater risk for serious illness related to influenza. (*Diabetologia – Jan 2014)*
- Data from the USA indicate that 1 in 3 cases of diabetes diagnosed in those aged under 18 is now type 2 *(Medscape – March 2014)*
- Postmenopausal women with elevated estrogen levels are at increased risk of developing dementia, and those who also have diabetes may face an even greater threat of cognitive decline. (Neurology – Jan 2014)

Your Practical Assessment

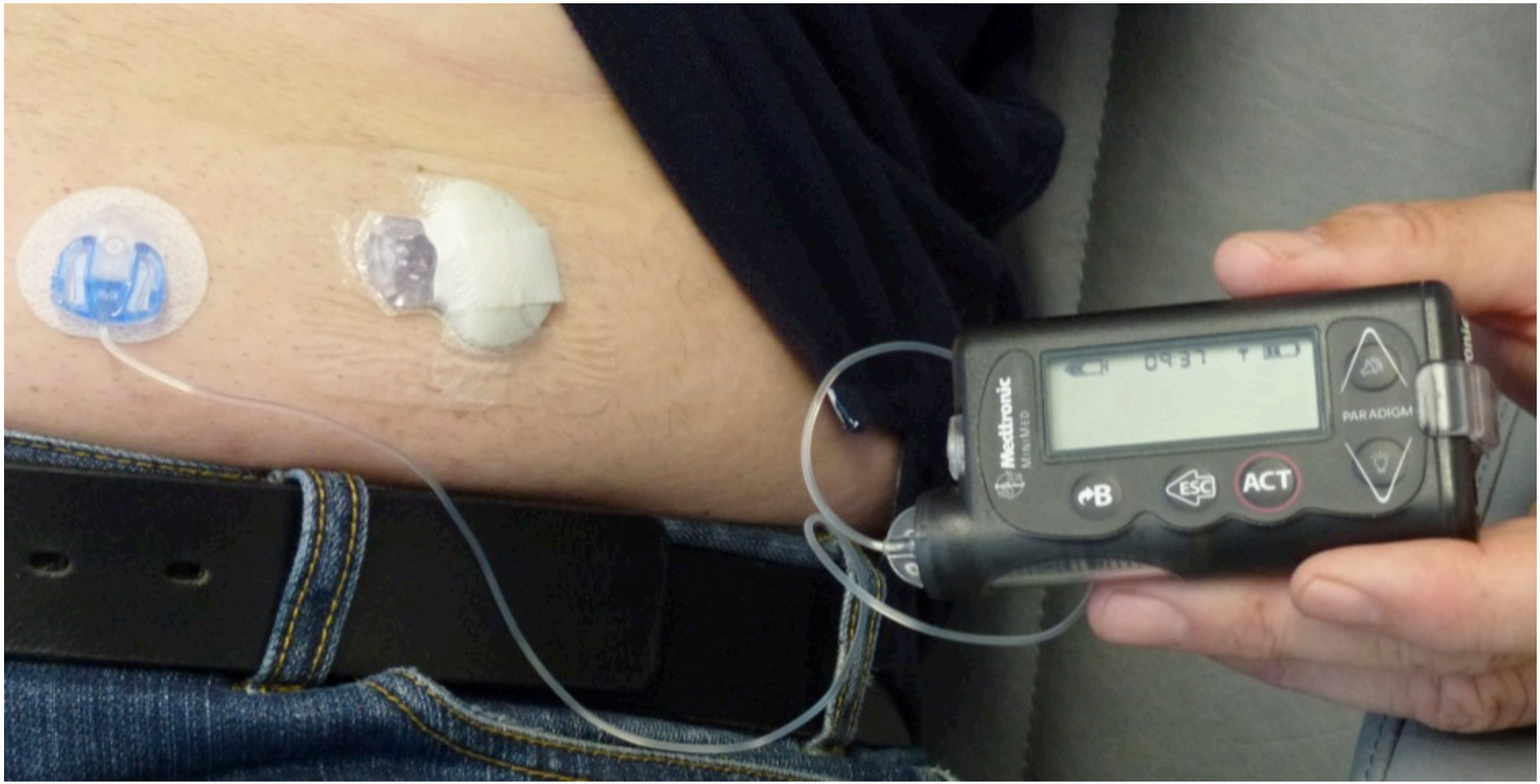
- Neuro & Vascular assessment
- 10g monofilament
- 128 MHz vibration
- Pulses (Tibialis Posterior & Dorsalis Pedis)
  - Palpable , Doppler utrasound
- Capillary refresh rate
- Proprioception
- Muscle wasting
- Blood pressure
- Blood sugar

Blood glucose testing

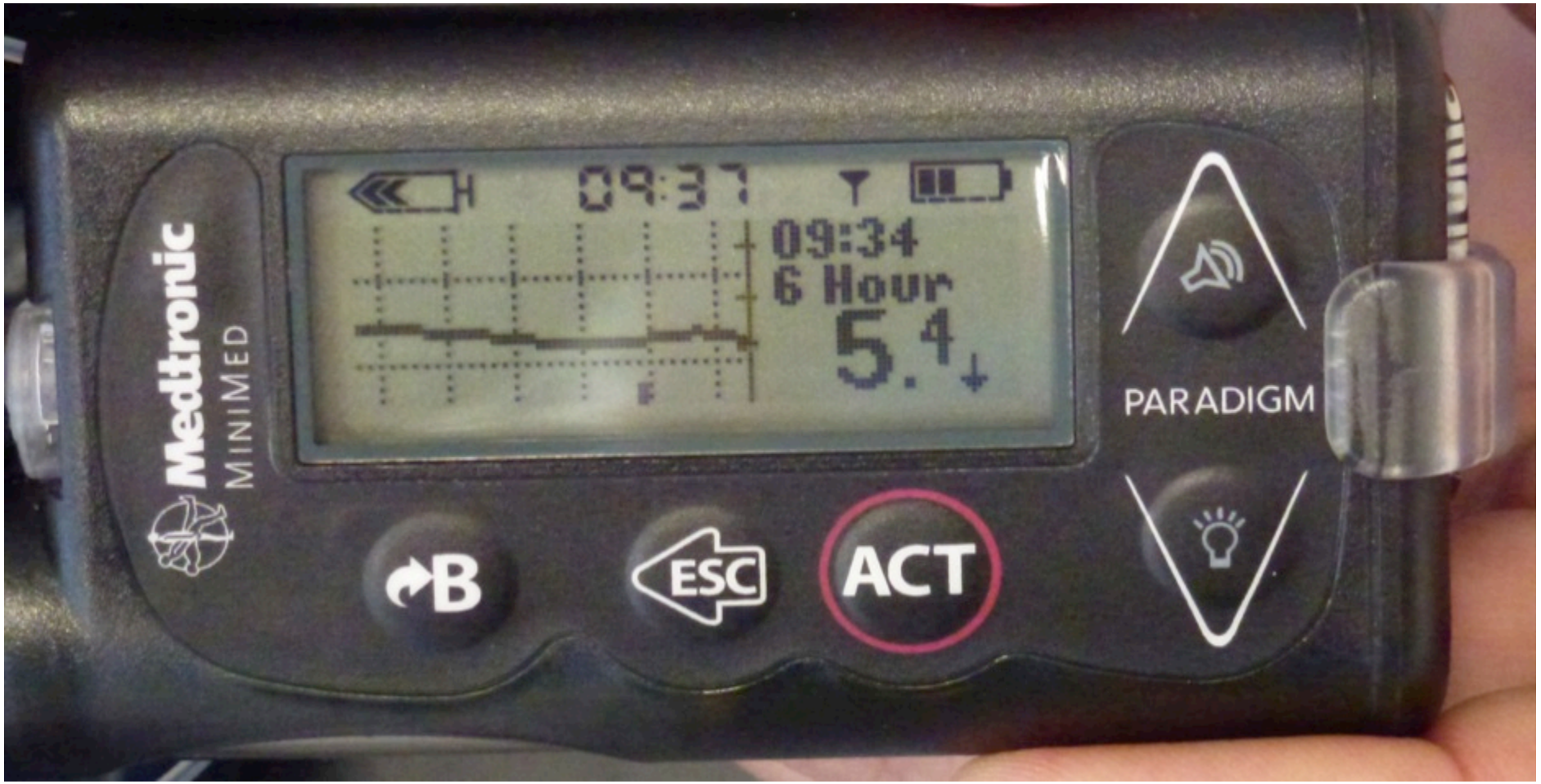
- Items kindly arranged by Jan Strefford – Alpine House GP Surgery, Mountsorrel, Leics.

Bayer Breeze 2 Blood Glucose testing

Insulin pump



Medtronic Minimed display



Volunteers

- What is your blood sugar level now?

Education

- DESMOND (Diabetes Education and Self Management for Ongoing and Newly Diagnosed) – short course (6 hours) for Type 2

- DAFNE (Dose Adjustment for Normal Eating) is a five-day course which focuses on using insulin properly

  - www.diabetes.org.uk

Diabetic advice

- Self examination (with prompt action)
- Regular professional check ups
- Avoid smoking
- Good foot hygiene
- Good glycaemic control
- Techniques for avoiding foot trauma

Techniques for Avoiding Foot Trauma

- Do not walk bare footed
- Test bath water with elbow
- Do not use chemical agents (Corn plasters) to remove corns/calluses
- Have shoes fitted
- Inspect shoes daily for foreign objects
- Do not wear shoes without stockings
- Avoid hot water bottles and electric blankets
- Do not sit too close to the fire
- Do not wear shoes with thongs between the toes

The key things we see

- Dry (anhydrotic) skin
- Pressure areas
- Hairless legs & feet
- Discoloured skin
- Bulging veins / varicsoe
- Hot feet
- Lack of sensation
- Burning / tingling feet
- Slow healing wounds
- Lack of sensation

What do you do?

- Act
- Question
- Treat or refer on!
  - There are a lot of MD teams that will help!

Summary

- Diabetes is a silent killer!
- It does affect you and your practice
- You can embrace it – or ignore it
  - Embrace it and you win confidence & respect
- You CAN affect its progress
- You CAN help your patients
  - Recognition
  - Understanding
  - Treatment
  - Management