



The Diabetic Foot

Why?



Epidemiology of the Diabetic Foot

- 40 – 60% of non-traumatic amputations of the LL are performed in DM patients.
- 80% of DM related LL amputations are preceded by a foot ulcer.
- 80% of ulcers in the foot are precipitated by external trauma.
- Prevalence among DM population is 4 - 10%



Factors associated with foot ulcer formation in DM

- Neuropathy
 - > sensorimotor
- Trauma
 - > poor footwear
 - > walking barefoot
 - > falls / accidents
 - > foreign objects in shoes
- Biomechanics
 - > limited joint mobility
 - > bony prominences
 - > foot deformity / osteoarthropathy
 - > callus
- Peripheral Vascular Disease
- Socioeconomic status
 - > poor education
 - > non-compliance / neglect
 - > diffidence of health care



Pathophysiology of ulceration

Neuropathy (sensory, motor and autonomic) is most important cause.

- Sensory
 - >loss of pain
 - >pressure awareness
 - >temperature
 - >proprioception
- Motor
 - >atrophy
 - >intrinsic muscle weakness
(toe deformity and abnormal walking pattern)
 - >increased pressure areas
- Autonomic
 - >reduction or absence of sweating causes dry cracks, fissures
 - >AV shunting may lead to oedema, warm foot with distended veins



Pathophysiology of ulceration (cont.)

- PVD with minor or trivial injury
>>>> painful ischemic lesion
- PVD and neuropathy
Often present concurrently with combination of factors precipitating ulceration and hindering good healing.
- Relative minor oedema caused by trauma, septic thrombosis or infection can result in total occlusion of already compromised toes >>>> gangrene.
Therefore infection further complicates ulceration and can lead to deterioration.



Signs and Symptoms of Neuropathy

- Definition:** presence of symptoms and/or signs of peripheral nerve dysfunction after exclusion of other causes.
- Loss of pain and large fibre sensation (vibration, pressure, touch) are major risks.
 - Burning/stabbing pain, paraesthesia, hot/cold sensation, hyperaesthesia: all prone to increase nocturnally.
 - Warm (AV shunting) insensate foot is high risk.



Signs and Symptoms of Neuropathy (cont.)

Therefore SCREENING is essential

- Ask for symptoms
- Examine
 - > pressure
 - > pin
 - > monofilament (10g)
 - > temperature
 - > tuning fork (128 Hz)



Peripheral Vascular Disease

- Most important factor in determining outcome of a lesion.
- Atherosclerosis leads to ischemia by narrowing and blocking.



Examination for PVD

1. Intermittent claudication: distinguish from pain of neuropathy
2. Pulse palpation
3. Buerger's test
4. Skin condition / hair loss

Further examination:

Ankle brachial pressure index

Doppler

Trans cutaneous O₂ pressure



Characteristics of atherosclerosis in DM as opposed to non DM

- More common
- Younger
- No sex difference
- Faster progress
- Multi segmental
- More distal

Unknown why DM more prone to PVD but thought to be related to:

- Nephropathy
- Changes in circulating lipoproteins >>> atherogenic lipid profile



Symptoms

May not be present at rest (case of collateral) but shows up on increased demand.

Stages:

- Occlusive arterial disease without symptoms
- Intermittent claudication
- Ischemic rest pain
- Ulceration / gangrene

Neuropathy may impede manifestation.



Conservative measures for patient with PVD

- Walking if no ulcer (contra lateral)
- Good footwear
- Stop smoking
- Treat hypertension, high cholesterol

Referral if necessary to vascular surgeon



Biomechanics and Footwear

- Frequently a consequence of neuropathy thus abnormal foot pressure.
- Foot deformity and neuropathy >>> increased risk of ulcer.
- Shoes and inserts should be frequently inspected.
- Shoes that have caused lesions should be put away.
- Proper footwear adapted to the abnormal foot should be encouraged.



Factors contributing to abnormal foot pressures and shearing stresses

Intrinsic

- Bony prominences
- Limited joint mobility
- Joint deformity / Charcot
- Callus
- Altered tissue properties
- Previous foot surgery +/- osteoarthritic joints

Extrinsic

- Bad footwear
- Walking barefoot
- Falls and accidents
- Foreign objects in shoes
- Increased activity



Factors contributing to abnormal foot pressures and shearing stresses

- Therefore
 - Examine
 - Educate about footwear and care
 - Refer for shoes / inserts
(problem of compliance)



Outcome of ulceration

Depends on:

- Infection control / oedema / metabolic control.
- Appropriate wound care, vascular management, pressure relief, rest.
- Consider type, site and cause.
- Continuity of care / lifelong observation.



Highlights of DM foot care

1. Regular inspection and examination of footwear and feet.
2. Identify "At Risk Foot".
3. Education of patient and relatives and health care providers.
4. Good footwear.
5. Treat non-ulcerative pathology (callus, fungal infection nails etc).