

Foot ulceration is a dreaded complication of diabetes that often results in diminished quality of life. By 'A rule of 15' 15% of people develop an ulcer, 15% of ulcers will develop osteomyelitis and 15% ulcers result in amputation. 85% amputations result from non-healing ulcer. Approximately half of amputated patients will have contralateral amputations within 3 years and half will die within 5 years.

Every 20 seconds, a limb is lost due to diabetes, and one million limb amputations occur yearly worldwide. In our country, one lakh legs are amputated every year and the commonest cause of amputation is infected neuropathic foot which in a majority of cases is preventable.

Every break in the skin in diabetic foot is a portal of entry for bacteria and has the potential for disaster. Many patients go for amputation following a trivial lesion. A diabetic foot lesion should never be considered as trivial until it is healed and has remained healed for at least a month.

The underlying cause of diabetic foot ulcer will have a significant bearing on the clinical management and must be determined before care plan is put into place. So in most patients peripheral neuropathy and peripheral arterial disease play a central role. The diabetic foot ulcers are commonly classified as 1. Neuropathic, 2. Ischaemic, 3. neuro ischaemic.

Neuro ischemia is a combined effect of diabetic neuropathy and ischaemia. Where by macro vascular disease and in some instances micro vascular dysfunction, impair perfusion in a diabetic foot.

### NEUROPATHIC ULCER

Neuropathic ulcer is usually painless and common site is the apex of the toe, which when associated with a claw toe deformity, develop callus on a plantar pressure site and there in breaks down.

Callus also forms over the dorsal aspect of the toes due to the constriction pressure of footwear on the flexed interphalangeal joint and also on the planter aspect of prominent metatarsal heads. Failure to remove the callus leads to ulceration.

Ulcers on the plantar aspect of the heel are usually caused by acute trauma, particularly treading on foreign bodies. On initial observation the neuropathic ulcer may seem shallow but it is always important to probe an ulcer as this may reveal hidden depths and also demonstrate a sinus down to bone suggesting osteomyelitis.

### NEUROISCHAEMIC ULCER

Ulceration in the neuroischaemic foot usually occurs on the margins of the foot.

The first sign of neuroischaemic ulceration is a red mark which blisters and then develops into shallow ulcer with a base of sparse pale granulations or yellowish closely adherent slough. In ischaemia there is a hallow of erythema around the ulcer.

Although ulcers occur on the medial surface of the first metatarsophalangeal joint and over the lateral aspect of the 5<sup>th</sup> metatarsophalangeal joint. The commonest sites are the apices of the toes and beneath any toe nails if allowed to become overly thick.

Feature	Neuropathic	Ischaemic	Neuroischaemic
Sensation	Sensory loss	Painful	Degree of sensory loss
Callus/necrosis	Callus present and often thick	Necrosis common	Minimal callus prone to necrosis
Wound bed	Pink and granulating surrounded by callus	Pale and sloughy with poor granulation	Poor granulation
Foot temperature and pulses	Warm with bounding pulses	Cool and absent pulses	Cool with absent pulses
Other	Dry skin and fissuring	Delayed healing	High risk of infection
Typical location	Weight-bearing areas of the foot, such as metatarsal heads, the heel and over the dorsum of clawed toes	Tips of toes, nail edges and between the toes and lateral borders of the foot	Margins of the foot and toes
Prevalence (based on 35)	35%	15%	50%

Classification systems	Key points	Pros/Cons	References
Wagner	Assesses ulcer depth along with presence of gangrene and loss of perfusion using six grades(0-5)	Well established Does not fully address infection and ischaemia	Wagner 1981
University of Texas (Armstrong)	Assesses ulcer depth, presence of infection and presence of signs of lower-extremity ischaemia using a matrix of four grades combined with four stages	Well established Describes the presence of infection and ischaemia better than wagner and may help in predicting the outcome of the DHU	Lavery et al 1996 Armstrong et al 1998
PEDIS	Assesses Perfusion, Extent (size), Depth (tissue loss), Infection and sensation (neuropathy) using four grades (1-4)	Developed by IWGDF User-friendly (clear definitions, few categories) for practitioners with a lower level of experience with diabetic foot management	Lipsky et al 2012
SINBAD	Assesses Site, Ischaemia, Neuropathy, Bacterial infection and Depth Uses a scoring system to help predict outcomes and enable comparisons between different settings and countries	Simplified version of the S(AD) SAD classification system includes ulcer site as data suggests this might be an important determinant of outcome	Ince et al 2008

## SPECIAL CATEGORIES OF ULCERS

These include

1. Decubitus heel ulcers caused by unrelieved pressure.
2. Ulcers of Charcot osteoarthropathy associated with rocker bottom deformity, medial convexity and hind foot deformity.
3. Ulcers over the Achilles tendon
4. Puncture wounds caused by standing on sharp objects
5. Traumatic wounds, including burns
6. Artefactual ulcers caused deliberately by patients
7. Iatrogenic ulcers caused by tape, tight bandage
8. Malignant ulcers

## CLASSIFICATION OF DIABETIC FOOT ULCERS

Classification systems grade ulcers according to the presence and extent of various physical characters such as size, depth and location. They can help in the planning and monitoring of treatment and predicting outcome and also research and audit.

## EXAMINATION OF THE ULCERS

Patients with diabetic foot ulcer need to be assessed in order to identify intrinsic and extrinsic factors. This should encompass full patient history including medication, comorbidities in diabetes status we should also take into consideration the history of the wound previous DFU or amputations and any symptoms suggestive of neuropathy or peripheral vascular disease.

A physical examination should determine:

Is the wound predominantly neuropathic, ischaemic or neuroischaemic?

If ischaemic, is there critical limb ischaemia?

Are there any musculoskeletal deformities?

What is the size/depth/location of the wound?

What is the colour/status of the wound bed?

---Black (necrosis)

---Yellow, red, pink

Is there any exposed bone?

Is there any necrosis or gangrene?

Is the wound infected? If so, are there systemic signs and symptoms of infection (such as fevers, chills, rigors, metabolic instability and confusion)?

Is there any malodour?

Is there local pain?

Is there any exudate? What is the level of production (high, moderate, low, none), colour and consistency of exudate, and is it purulent?

What is the status of the wound edge (callus, maceration, erythema, oedema, undermining)?

## MANAGEMENT

In the management the aim is to heal ulcers within the first 6 weeks of their development. This is the time for aggressive management and is a window of opportunity that should be taken seriously. All diabetic foot ulcers should be referred for multi-disciplinary care without

**264** delay so that the opportunity of early healing is not wasted. The ulcer is a pivotal event on the road to amputation, and the diabetic patient with an ulcer on the foot is at great risk of infection, gangrene and loss of the leg. Because it is difficult to predict which ulcers do well and which will end in catastrophic. So it is important essential to organize optimal care of all ulcers.

### GLOBAL WOUND CARE PLAN

A. Diagnosing of diabetes (+/- peripheral sensory neuropathy)

AIM: Prevent the development of a DFU

1. Implement DFU prevention care plan that includes treatment of co-morbidities, good glycaemic control and pressure offloading
2. Annually perform general foot examination:
  - Use 10mg monofilament to assess sensory status
  - Inspection of the feet for deformities
  - Inspection of footwear for wear and tear and foreign objects that may traumatize foot
  - Maintain skin hydration (consider emollient therapy) for skin health
  - Offer patient education on checking feet for trauma
3. Ensure regular review and provide patient education

Development of DFU

AIM: Treat the ulcer and prevent infection

1. Determine cause of ulcer.
2. Agree treatment aims with patient and implement would care plan:
  - Debride and regularly cleanse the wound
  - Take appropriate tissue samples for culture if infection is suspected.
  - Select dressings to maintain moist wound environment and manage exudate effectively.
3. Initiate antibiotic treatment if infection suspected and consider topical antimicrobial therapy if increased bio burden is suspected.

4. Review offloading device and ensure footwear accommodates dressing
5. Optimize glycaemic control for diabetes management.
6. Refer for vascular assessment if clinically significant limb ischaemia is suspected.
7. Offer patient education on how to self-manage and when to raise concerns.

Development of vascular disease.

AIM: Prevent complications associated with ischaemia

1. Ensure early referral to vascular specialist for arterial reconstruction to improve blood flow in patients with an ischaemic or neuroischaemic ulcer
2. Optimize diabetes control.
- B. Ulcer becomes infected.

AIM: Prevent life-or limb-threatening complications

  1. AIM: Prevent life-or limb-threatening complications
  2. For superficial (mild) infections—treat with systemic antibiotics and consider topical antimicrobials in selected cases.
  3. For deep (moderate or severe) infections—treat with appropriately selected empiric systemic antibiotics, modified by the results of culture and sensitivity reports
  4. Offload pressure correctly and optimize glycaemic control for diabetes management.
  5. Consider therapy directed at biofilm in wounds that are slow to heal.

### ACTIVE MANAGEMENT OF THE ULCER AND CO-MORBIDITIES SHOULD AIM TO PREVENT AMPUTATION

Where amputation is not avoidable:

1. Implement skin and wound care plan to manage surgical wound and optimize healing.
2. Review regularly and implement prevention care plan to reduce risk of recurrence or further DFU on contralateral limb.