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School of
MEDICINE

Surgical Aspects of diabetic foot

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4th year lectures 2024

Surgical management of diabetic foot

Magnitude of the problem

Every 30 seconds, a lower limb is lost somewhere in the world as a consequence of diabetes

5-year mortality rate after limb amputation is **68%**

5-year mortality of some cancers:

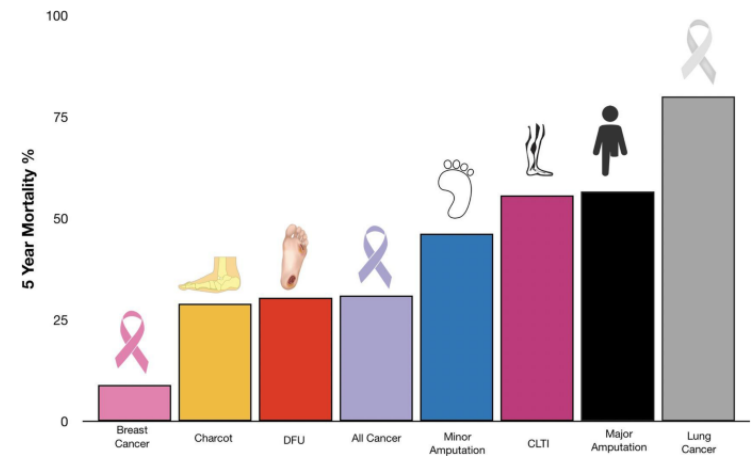
Lung: 86%

Colorectal: 39%

Breast: 23%

Hodgkin's Lymphoma: 18%

Prostate cancer: 8%

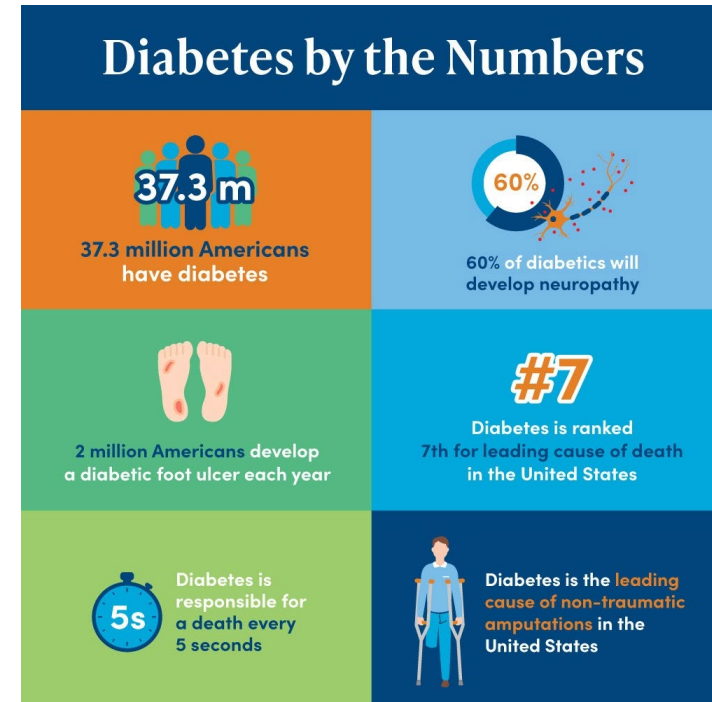


Boulton AJ, Vileikyte L, Ragnarson-Tennvall G, Apelqvist J. The global burden of diabetic foot disease. *Lancet*. 2005 Nov 12;366(9498):1719-24. doi: 10.1016/S0140-6736(05)67698-2.

Alavi A, Sibbald RG, Mayer D, et al. Diabetic foot ulcers: Part II. Management. *J Am Acad Dermatol*. 2014;70(1):21.e1-46. doi:10.1016/j.jaad.2013.07.048

Surgical management of diabetic foot prevalence

- Diabetes is estimated to affect approximately 530 million adults worldwide
 - Global prevalence of **10.5%** among adults aged 20 to 79 years
 - The prevalence of diabetes in Jordan has exhibited an increasing trend over the past three decades and its prevalence is one of the highest, not only regionally but also globally, which reached **23.7%** in 2017.
 - Given the **marked increase in childhood obesity**, there is concern that the prevalence of diabetes will continue to increase substantially.
- The lifetime risk of a foot ulcer for patients with type 1 or 2 diabetes may be as high as **34%**
- The worldwide incidence of diabetic foot ulcer is approximately 18.6 million people per year



Surgical management of diabetic foot

definitions

- **IWGDF (2019) - Diabetic foot:** Infection, ulceration, or destruction of tissues of the foot of a person with currently or previously diagnosed diabetes mellitus, usually accompanied by neuropathy and/or PAD in the lower extremity.
- **IWGDF (2023) - Diabetes-related foot disease:** Disease of the foot of a person with current or previously diagnosed **diabetes mellitus** that includes *one or more of the following:*

Peripheral
Neuropathy

Infection

Neuro-
osteoarthropathy

Amputation

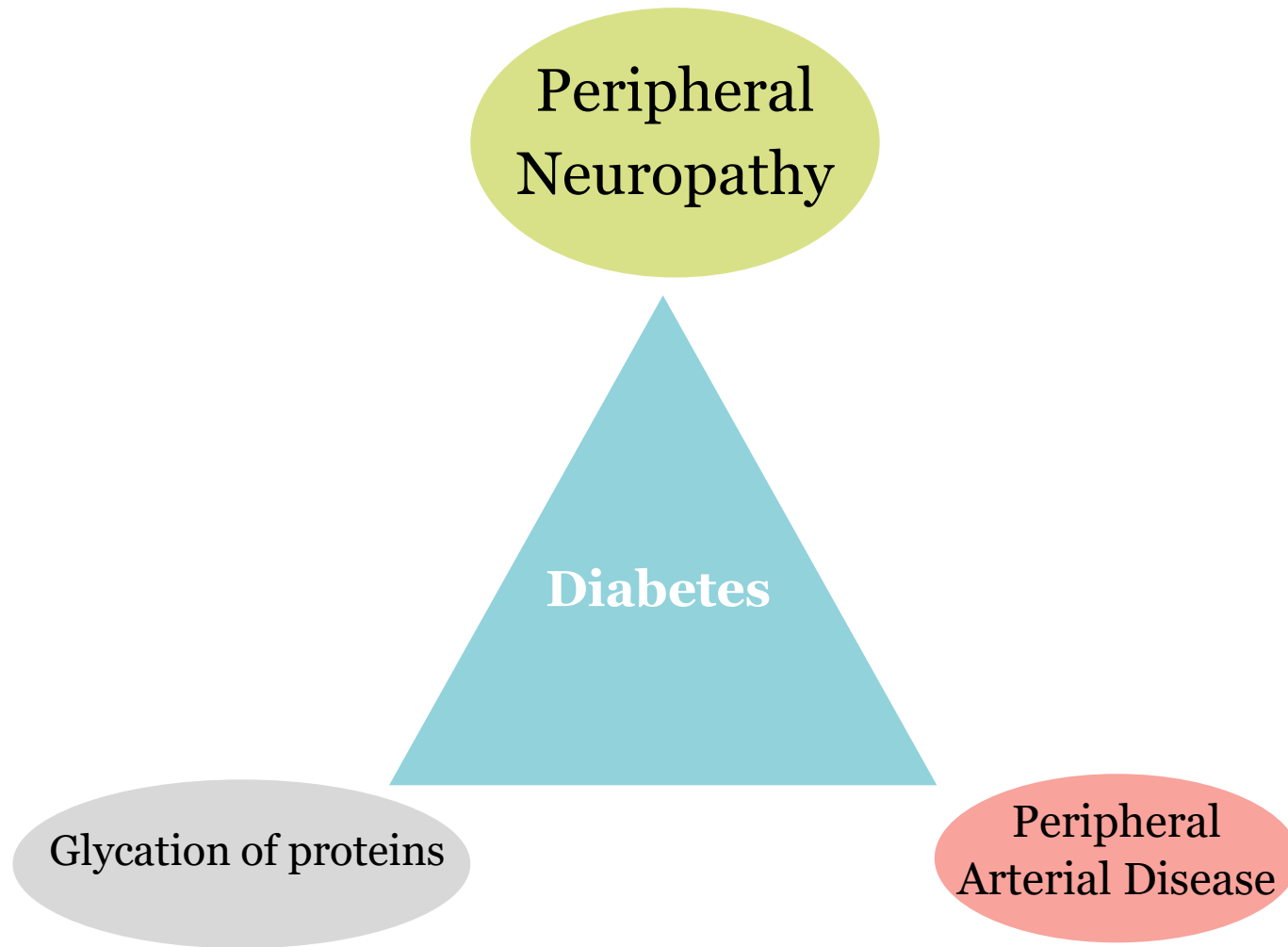
Peripheral
Artery Disease

Ulcer(s)

Gangrene

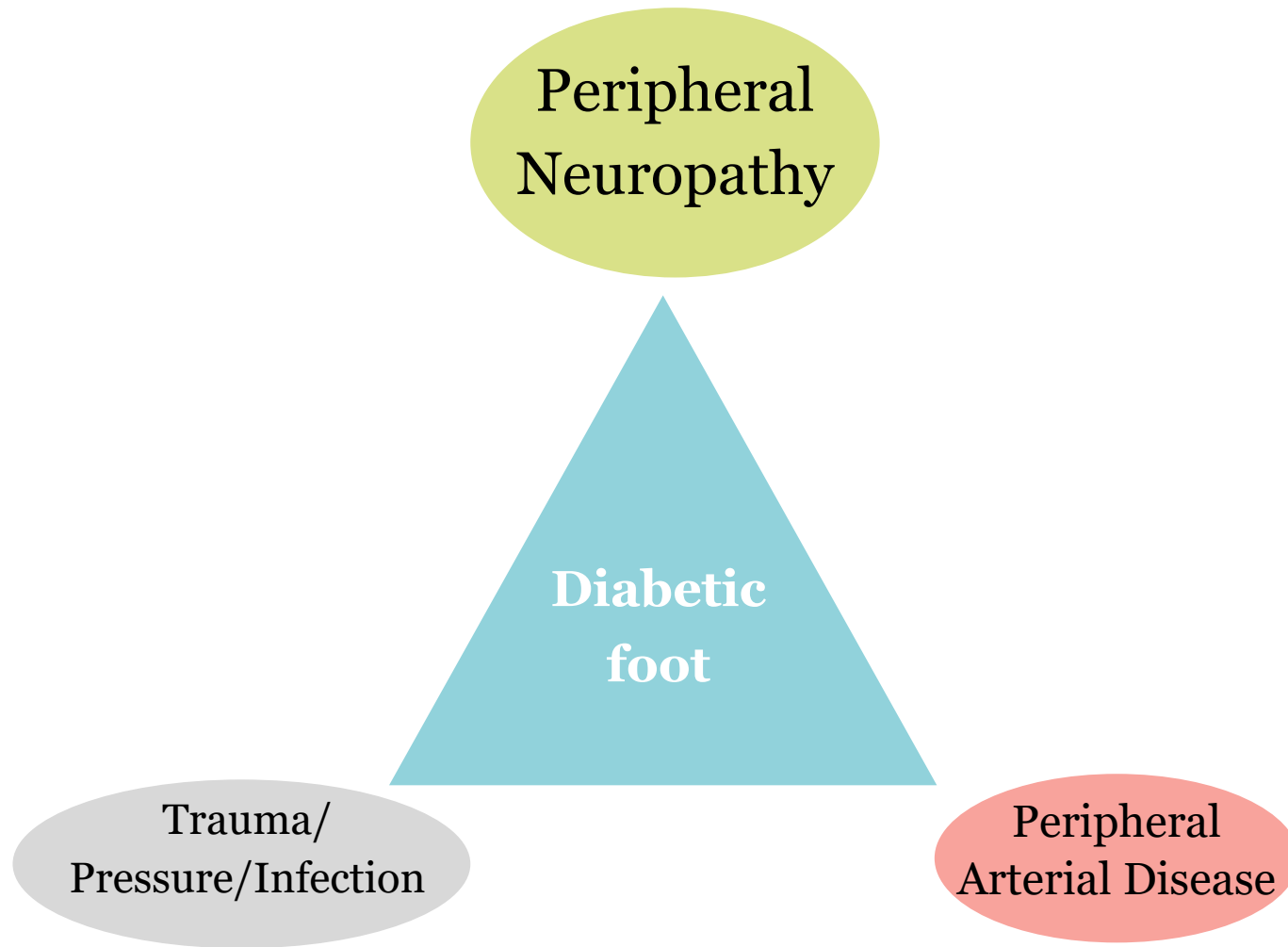
Surgical management of diabetic foot

Complications of diabetes

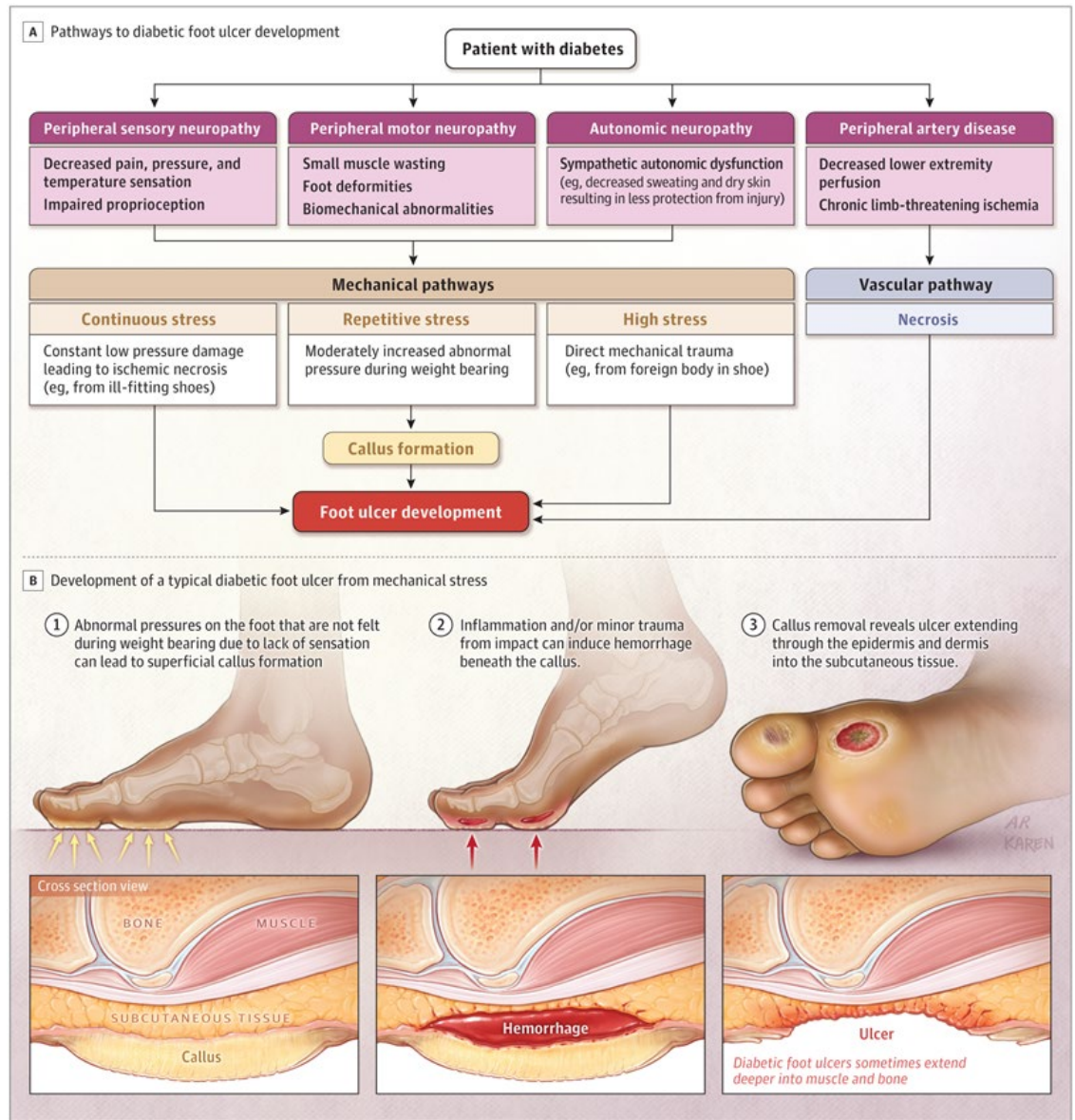


Surgical management of diabetic foot

Pathophysiology of DF



Pathophysiology



Armstrong DG, Tan T, Boulton AJM, Bus SA. Diabetic Foot Ulcers: A Review. *JAMA*. 2023;330(1):62–75. doi:10.1001/jama.2023.10578

Surgical management of diabetic foot

Clinical features of DF

- Diabetic foot ulcers most commonly occur at **sites of pressure and repetitive stress**:
 - Plantar metatarsal heads
 - Heel
 - Dorsal portion of the toes
- Clinical features
 - Usually painless (due to neuropathy)
 - Thick callus surrounding ulcer

Figure 2: Areas of the foot at highest risk for ulceration

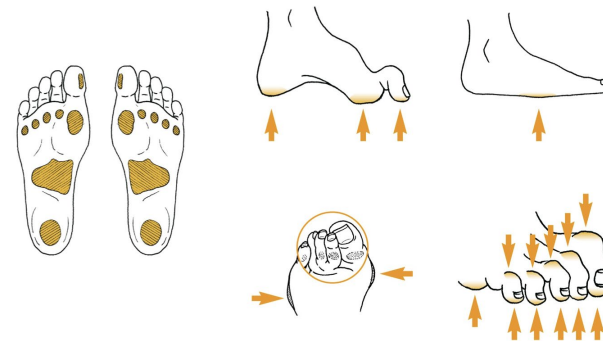


Figure 2: **Neuropathic ulcer in typical position under second metatarsal head and surrounded by callus**

All IWGDF Guidelines (2023 update)

[Home](#) > [Guidelines \(2023 update\)](#) > [All IWGDF Guidelines \(2023 update\)](#)

THE IWGDF GUIDELINES (2023 update) ARE AVAILABLE.

Download the full IWGDF Guidelines (2023 update) [here](#). Or download each chapter separately via the menus below.



Practical Guidelines

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Prevention

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Classification

Classification guideline (2023 update)

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Infection

IWGDF/IDSA Infection guideline (2023 update)

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Surgical management of diabetic foot

Foot exam

- **All patients with diabetes** should undergo basic examination of the foot regularly.
- At each visit, the following should be performed:
 1. History & Physical Exam, including:
 - Foot Inspection
 - Clinical neurologic exam
 - Clinical vascular assessment
 2. Risk Assessment
 3. Foot Care Education & Preventive Measures

Surgical management of diabetic foot

Foot exam

History	Physical Exam
History pertaining to diabetes	Inspection (check between toes!)
Duration of DM & glycemic control	Dermatologic:
Complications of diabetes (cardiovascular, end-stage renal disease , etc.)	Skin color, dryness, cracking, sweating, toenails, hair, calluses, blistering, foot hygiene
Symptoms of micro- & macrovascular disease	Signs of infection (erythema, swelling, discharge), <i>check between toes!</i>
Neuropathy: burning, paresthesias, etc	Ulcers or pre-ulcerative lesions (e.g., fissures, hemorrhage)
PAD: lower limb claudication	Musculoskeletal:
History of diabetes-related foot disease	Foot deformities (claw or hammer toes, Charcot joint) and muscle wasting
Previous ulcer	Neurologic Assessment (see upcoming slides)
Previous amputation	Vascular Assessment (see upcoming slides)

Surgical management of diabetic foot

Neurologic exam

- Loss of protective sensation (LOPS): assess with one of the following techniques:
 - Light pressure perception: **Semmes-Weinstein 10-gram monofilament**
 - Vibration perception: **128 Hz tuning fork**
 - When monofilament or tuning fork are not available, test tactile sensation with **Ipswich touch test** (lightly touch the tips of the toes of the patient with the tip of your index finger for 1–2 seconds)

Surgical management of diabetic foot

Neurological exam, Semmens-Weinstein 10 gm filament

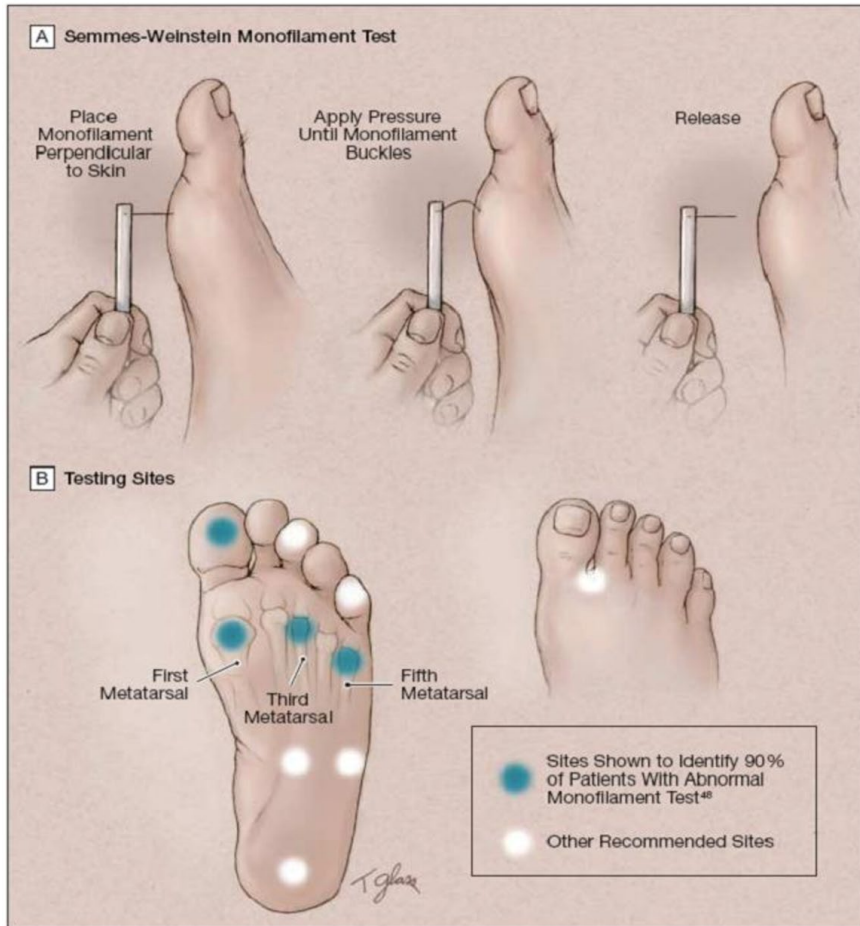
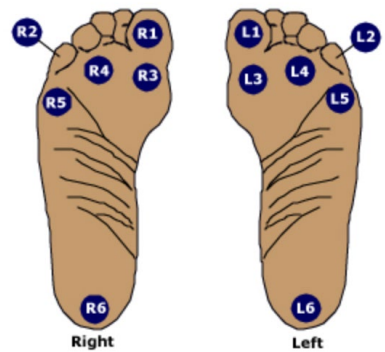
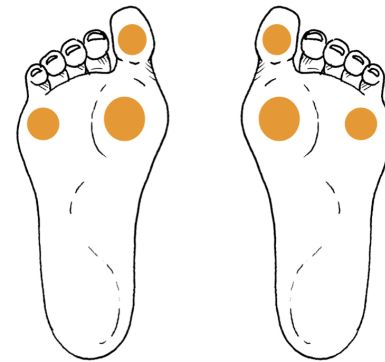


Figure 4: Sites that should be tested for loss of protective sensation with the 10g Semmes-Weinstein monofilament

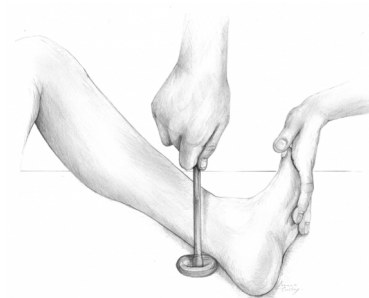
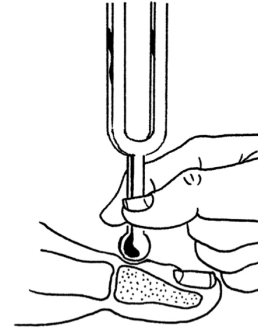


Surgical management of diabetic foot

Neurological exam, other tests

- **128 Hz Tuning fork**
- **Ipswich touch test**
- **Reflexes**
 - A neurologic exam of the lower limbs may also include assessment of reflexes
 - Ankle reflex
 - Knee jerk reflex

Figure 6: Proper method of using a 128 Hz tuning fork to check for vibratory sensation



Surgical management of diabetic foot

Vascular assessment

- Assessment of **pedal pulses**
 - Dorsalis pedis: Lateral to external hallucis longus tendon
 - Posterior tibial artery: posterior to medial malleolus
 - If absent, assess popliteal and femoral pulses
- Assess **temperature, skin hair**
- Assess for dependent rubor (late finding)
- If exam findings suggest PAD, proceed with **ankle-brachial index (ABI)** or **toe-brachial index (TBI)**

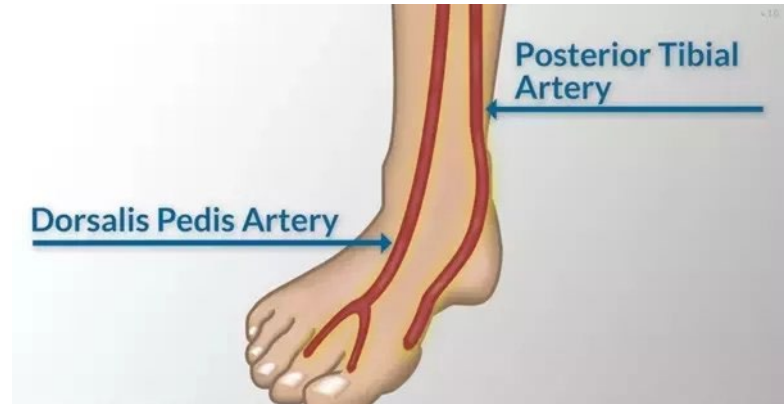


Table 4. Interpretation of the Results of Ankle-Brachial Index Measurement

ABI ^a	Interpretation
>1.30	Poorly compressible vessels, arterial calcification
0.90–1.30	Normal
0.60–0.89	Mild arterial obstruction
0.40–0.59	Moderate obstruction
<0.40	Severe obstruction

Abbreviation: ABI, ankle-brachial index.

^a Obtained by measuring the systolic blood pressure (using a properly sized sphygmomanometer) in the ankle divided by that in the brachial artery. The presence of arterial calcification can lead to an overestimate in the index.

Surgical management of diabetic foot

Risk stratification

- Following examination of the foot, **stratify each patient using the IWGDF risk stratification category system** shown below to guide subsequent preventative screening frequencies and management.

Table 1: The IWGDF 2023 Risk Stratification System and corresponding foot screening frequency

Category	Ulcer risk	Characteristics	Frequency*
0	Very low	No LOPS and no signs of PAD	Once a year
1	Low	LOPS or PAD	Once every 6-12 months
2	Moderate	LOPS + PAD, or LOPS + foot deformity or PAD + foot deformity	Once every 3-6 months
3	High	LOPS or PAD, and one or more of the following: - history of a foot ulcer - a lower-extremity amputation (minor or major) - end-stage renal disease	Once every 1-3 months

Note: LOPS = Loss of Protective Sensation; PAD = Peripheral Artery Disease; * Screening frequency is based on expert opinion, since there is no published evidence to support these intervals

Surgical management of diabetic foot

Ulcer prevention

- There are six key elements to prevent foot ulcers:

Discussed in
previous slides

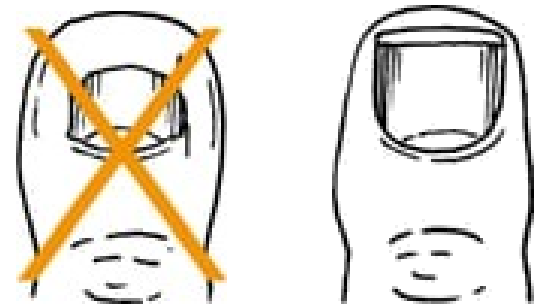
- Identify the person with an **at-risk foot**
- **Regularly inspect and examine** the feet of a person at-risk for foot ulceration.
- Provide **structured education** for patients, their family and healthcare professionals
- Encourage routine wearing of **appropriate footwear**
- **Treat risk factors** for ulceration
- **Integrated foot care**, which is a combination of these elements.

Surgical management of diabetic foot

Ulcer prevention- education

- General instructions
 - Good glycemic control
 - Avoid smoking
- Patients with IWGDF grade ≥ 1
 - Avoid going barefoot, even at home, and especially on hot decks and hot sand
 - Test water temperature before stepping into a bath
 - Trim toenails to shape of the toe, and remove sharp edges with a nail file; do not cut cuticles
 - Wash in lukewarm water, dry thoroughly (including between the toes), and check feet daily
 - Socks should fit and be changed daily

The proper way to cut toenails



Surgical management of diabetic foot

Ulcer prevention- footwear

- In persons with diabetes and IWGDF risk category 1 or higher:
 - Encourage to wear appropriate footwear at all times, both indoors and outdoors.
- Criteria for appropriate footwear
 - Inside length of the shoe should be 1-2 cm longer than the foot and should not be either too tight or too loose.
 - Internal width should equal the width of the foot at the metatarsal phalangeal joints (or the widest part of the foot), and the height should allow enough room for all the toes.
 - Evaluate the fit with the patient in the standing position, preferably later in the day (when they may have foot swelling). If there is no off-the-shelf footwear that can accommodate the foot (e.g., if the fit is poor due to foot deformity) or if there are signs of abnormal loading of the foot (e.g., hyperaemia, callus, (previous) ulceration), prescribe therapeutic footwear, possibly including extra-depth shoes, custom-made footwear and custom-made insoles. This may also include the prescription and fabrication of (toe) orthoses.



Surgical management of diabetic foot

Ulcer prevention- treat risk factors

- Provide appropriate treatment of **excess callus** on the foot, for **ingrown toenails**, and for **fungal infections** on the foot. Treat any (modifiable) **pre-ulcerative** sign on the foot including protecting blisters, or draining them if necessary.
- Consider coaching a person with diabetes who is at moderate or high risk of foot ulceration (IWGDF risk 2-3) to **self-monitor foot skin temperatures** once per day to identify any early signs of foot inflammation and help prevent a foot ulcer.
 - In case of an elevated temperature, ambulatory activity should be reduced
- The risk for foot ulceration is not a barrier to participating in a physical training program as long as appropriate footwear is worn, with a gradual increase in activity to an additional 1000 steps/day.

Surgical management of diabetic foot

Classification of ulcers

- **Many classification systems exist, which one to use?**
 - **SINBAD system:** For communication among healthcare professionals, also be used for audit of outcome of populations.
 - **WIFI (wound/ischaemia/foot infection) system:** In patients with PAD (to stratify amputation risk and revascularisation benefit).
 - **IDSA/IWGDF system:** Use it for infected foot ulcers

Surgical management of diabetic foot

Classifications/ SINBAD

Table I. SINBAD System

Category	Definition	Score
Site	Forefoot	0
	Midfoot and hindfoot	1
Ischemia	Pedal blood flow intact: at least one palpable pulse	0
	Clinical evidence of reduced pedal flow	1
Neuropathy	Protective sensation intact	0
	Protective sensation lost	1
Bacterial infection	None	0
	Present	1
Area	Ulcer < 1 cm ²	0
	Ulcer ≥ 1 cm ²	1
Depth	Ulcer confined to skin and subcutaneous tissue	0
	Ulcer reaching muscle, tendon or deeper	1
Total possible score		6

Surgical management of diabetic foot

Classifications/ WIFI

Table 3: Wifi system

Wound

Grade	DFU	Gangrene
0	No ulcer Clinical description: minor tissue loss. Salvageable with simple digital amputation (1 or 2 digits) or skin coverage.	No gangrene
1	Small, shallow ulcer(s) on distal leg or foot; no exposed bone, unless limited to distal phalanx Clinical description: minor tissue loss. Salvageable with simple digital amputation (1 or 2 digits) or skin coverage.	No gangrene
2	Deeper ulcer with exposed bone, joint or tendon; generally not involving the heel; shallow heel ulcer, without calcaneal involvement Clinical description: major tissue loss salvageable with multiple (≥ 3) digital amputations or standard TMA \pm skin coverage.	Gangrenous changes limited to digits
3	Extensive, deep ulcer involving forefoot and/or midfoot; deep, full thickness heel ulcer \pm calcaneal involvement Clinical description: extensive tissue loss salvageable only with a complex foot reconstruction or non-traditional TMA (Chopart or Lisfranc); flap coverage or complex wound management needed for large soft tissue defect	Extensive gangrene involving forefoot and /or midfoot; full thickness heel necrosis \pm calcaneal involvement

Ischaemia

Grade	ABI	Ankle systolic pressure (mmHg)	TP, TcPO ₂ (mmHg)
0	≥ 0.80	> 100	≥ 60
1	$0.6 - 0.79$	$70 - 100$	$40 - 59$
2	$0.4 - 0.59$	$50 - 70$	$30 - 39$
3	≤ 0.39	< 50	< 30

Foot Infection

Grade	Clinical manifestations
0	No symptoms or signs of infection Infection present, as defined by the presence of at least 2 of the following items: <ul style="list-style-type: none"> Local swelling or induration Erythema > 0.5 to ≤ 2 cm around the ulcer Local tenderness or pain Local warmth Purulent discharge (thick, opaque to white, or sanguineous secretion)
1	Local infection involving only the skin and the subcutaneous tissue (without involvement of deeper tissues and without systemic signs as described below). Exclude other causes of an inflammatory response of the skin (e.g., trauma, gout, acute Charcot neuro-osteoarthropathy, fracture, thrombosis, venous stasis)
2	Local infection (as described above) with erythema > 2 cm, or involving structures deeper than skin and subcutaneous tissues (e.g., abscess, osteomyelitis, septic arthritis, fasciitis), and No systemic inflammatory response signs (as described below)
3	Local infection (as described above) with the signs of SIRS, as manifested by two or more of the following: <ul style="list-style-type: none"> Temperature $> 38^{\circ}\text{C}$ or $< 36^{\circ}\text{C}$ Heart rate > 90 beats/min Respiratory rate > 20 breaths/min or PaCO₂ < 32 mm Hg White blood cell count $> 12,000$ or < 4000 cu/mm or 10% immature (band) forms

ABI: Ankle-Brachial Index; PaCO₂: Partial Pressure of Carbon Dioxide; SIRS: Systemic Inflammatory Response Syndrome; TcPO₂: Transcutaneous Partial Oxygen Pressure; TMA: Transmetatarsal Amputation; TP: Toe Pressure

Surgical management of diabetic foot

Classifications/ IDSA

Table 4: IDSA/IWGDF system

Clinical manifestations	Infection severity	PEDIS grade
Wound lacking purulence or any manifestations of inflammation	Uninfected	1
Presence of ≥ 2 manifestations of inflammation (purulence, or erythema, tenderness, warmth, or induration), but any cellulitis/erythema extends ≤ 2 cm around the 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 which 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 (e.g. fever, chills, tachycardia, hypotension, confusion, vomiting, leucocytosis, acidosis, severe hyperglycaemia, or azotaemia)	Severe	4

Surgical management of diabetic foot

Principles of management

1. Treatment of infection.
2. Restoration of tissue perfusion.
3. Pressure offloading and ulcer protection.
4. Local ulcer care.
5. Person Centered Care.
6. Education for patient and relatives.

Surgical management of diabetic foot

Principles of management/ control of infection

- **Superficial ulcer with limited soft tissue (mild) infection: (1-2w)**
 - Cleanse, debride all necrotic tissue and surrounding callus.
 - Start empiric oral antibiotic therapy targeted at **Staphylococcus aureus** and **streptococci** (unless there are reasons to consider other, or additional, likely pathogens).
 - clindamycin , cephalixin , amox-clav , doxycycline.

Surgical management of diabetic foot

Principles of management/ control of infection

- **Deep or extensive (potentially limb-threatening) infection (moderate (+/-IV abx) or severe (+IV abx)): (2-3w)**
 - Urgently evaluate for need for surgical intervention to remove neurotic tissue, including infected. Bone, release compartment pressure or drain abscesses.
 - Assess for PAD; if present consider urgent treatment, including revascularization.
 - **Initiate empiric, parenteral, broad-spectrum antibiotic therapy**, aimed at common gram-positive and gram-negative bacteria, including obligate anaerobes.
 - Adjust (constrain and target, if possible) the antibiotic regimen based on both the clinical response to empirical therapy and culture and sensitivity results.

Surgical management of diabetic foot

Principles of management/ re-perfusion

- Revascularization If:
 - An ankle pressure <50 mm Hg or an ABI <0.5 then consider urgent vascular Imaging
 - A toe pressure is <30 mmHg or TcpO₂ is <25 mmHg.
 - When an ulcer fails to show signs of healing within 6 weeks, despite optimal management
- The aim of revascularization:
 - to restore direct flow to at least one of the foot arteries, preferably the artery that supplies the anatomical region of the wound.
- Select a revascularization technique based on both individual factors (the patients factor and the local operator expertise).

Surgical management of diabetic foot

Principles of management/ re-perfusion

- After a revascularization procedure effectiveness should be evaluated with an objective measurement of perfusion.
- Pharmacological treatments to improve perfusion have not been proven to be beneficial.
- Emphasize efforts to reduce **cardiovascular** risk (cessation of smoking, control of hypertension and dyslipidaemia, use of anti-platelet drugs)

Surgical management of diabetic foot

Principles of management/ offloading

- Non removable knee-high offloading device
 - A total contact cast (TCC)
- Removable knee-high offloading device.
- Ankle-high offloading device.
- If biomechanical relief are not available using felted foam, but only in combination with appropriate footwear.

Surgical management of diabetic foot

Principles of management/ offloading



Total
Contact
Cast



Removable knee-high
offloading device



Ankle-high offloading
device

Surgical management of diabetic foot

Principles of management/ local ulcer care

- Regular inspection of the ulcer by a trained health care provider is essential.
- Debride the ulcer and remove surrounding callus (preferably with sharp surgical instruments) and repeat as needed.
- Select dressings to control excess exudation and maintain moist environment.
- Do not soak the feet, as this may induce skin maceration.
- Consider negative pressure to help heal post-operative wounds.

Surgical management of diabetic foot

Principles of management/ local ulcer care

- **Consider one of the following adjunctive treatments in non-infected ulcers that fail to heal after 4-6 weeks despite optimal clinical care:**
 - A sucrose octasulfate impregnated dressing in neuro-ischemic ulcers (without severe ischemia).
 - A multi-layered patch of autologous leucocytes, platelets and fibrin in ulcers with or without moderate ischemia.
 - Placental membrane allografts in ulcers with or without moderate ischemia.
 - Systemic oxygen therapy as an adjunctive treatment in ischemic ulcers that do not heal despite revascularization.

Surgical management of diabetic foot

Principles of management/ healing issues

- Multifactorial in origin
- Local tissue ischemia in addition to neuropathy impairs chemotaxis.
 - Tissue necrosis and infection prolongs the inflammatory phase of healing.
- Uncontrolled periwound edema and wound instability disrupts myofibroblast.
- Glycation of proteins
- Associated PVD

Surgical management of diabetic foot

Principles of management/ person centered care

- Optimise glycaemic control, if necessary, with insulin.
- Treat oedema or malnutrition, if present.
- Treat cardiovascular risk factors.
- Treat depression or other psycho-social difficulties.

Surgical management of diabetic foot

Principles of management/ education

- Instruct patients (and relatives or carers) on appropriate foot ulcer self-care and how to recognize and report signs and symptoms of new or worsening infection (e.g., onset of fever, changes in local wound conditions, worsening hyperglycemia).
- During a period of enforced bed rest, instruct on how to prevent an ulcer on the contra- lateral foot.

Surgical management of diabetic foot

Principles of management/ surgery

Emergency

- To limit progression of acute infection. incision and drainage. debridement
- To limit progression of acute ischemia. (necrotizing fasciitis)

Elective

- Promote healing (convert chronic wound to acute)
- Vascular surgery (stenting , angioplasty , ballooning)
- Skin grafting

Prophylactic

- To treat joint stiffness.
- Deformity.

Surgical management of diabetic foot

Principles of management/ surgical debridement

- Remove slough, necrotic tissue and surrounding callus with sharp debridement in preference to other methods, taking relative contraindications such as severe ischemia into account.



Surgical management of diabetic foot

Principles of management/ surgical debridement

A 60-year-old male patient with diabetic foot ulcer.

(A) A large (approximately 72 cm²), 126-week-old diabetic foot ulcer on the dorsum of the left foot.

(B) Wound debridement and acellular dermal matrix scaffold cover.

(C) Ten days after acellular dermal matrix scaffold cover and prepared for skin graft.

(D) Grafting of split-thickness autologous skin sheet.

(E) Postoperative month 3 and

(F) month 33.



Surgical management of diabetic foot osteoneuroarthropathy

- Neuropathic arthropathy (triad) is a sterile inflammatory process in persons with neuropathy (most commonly diabetic neuropathy) that results in the development of bone destruction, subluxation/dislocation, and deformity.
- 1-2:1000
- The tarsus and tarsometatarsal joints are most commonly affected.
- Clinical presentation depends on the stage.

Surgical management of diabetic foot osteoneuroarthropathy

- **Acute stage:**

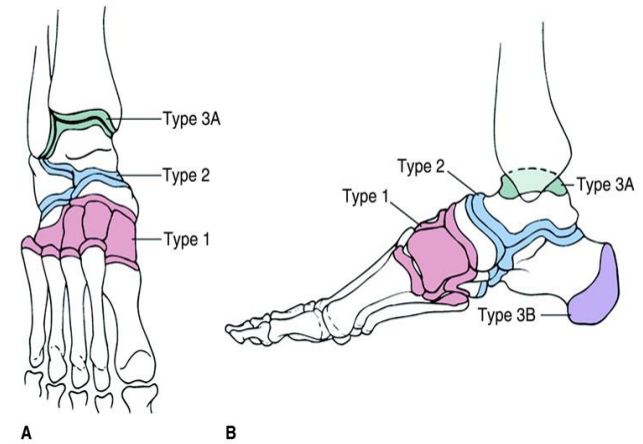
- Swelling, warmth, erythema
- Pain is typically mild-to-moderate, as the underlying peripheral neuropathy reduces sensation.

- **Subacute stage:**

- **Chronic stage:** painless bony deformities, midfoot collapse (rocker-bottom foot deformity), osteolysis, fractures.

Surgical management of diabetic foot osteoneuroarthropathy/ Brodsky classification

Brodsky Classification	
Type 1	Involves tarsometatarsal and naviculocuneiform joints
Type 2	Involves subtalar, talonavicular or calcaneocuboid joints
Type 3A	Involves tibiotalar joint
Type 3B	Follows fracture of calcaneal tuberosity
Type 4	Involves a combination of areas
Type 5	Occurs solely within forefoot



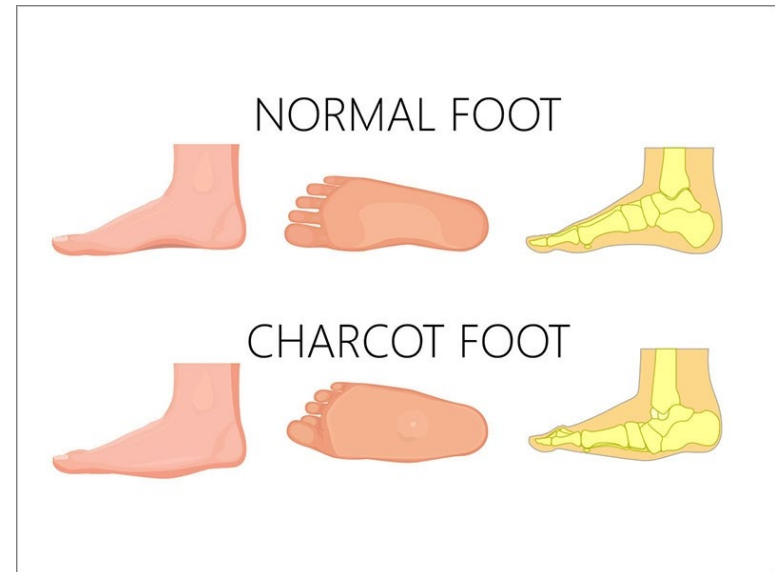
Surgical management of diabetic foot osteoneuroarthropathy/EICHENHOLTZ

Stage	Radiographic findings	Clinical findings	Treatment
0 (prodromal)	Normal radiographs	Swelling, erythema, warmth	Patient education, serial radiographs to monitor progression, protected weightbearing
I (development)	Osteopenia, fragmentation, joint subluxation or dislocation	Swelling, erythema, warmth, ligamentous laxity	Protected weightbearing with total contact casting or prefabricated pneumatic brace. Cast or brace should be used until radiographic resolution of fragmentation and presence of normal skin temperature (usually needed for 2–4 months).
II (coalescence)	Absorption of debris, sclerosis, fusion of larger fragments	Decreased warmth, decreased swelling, decreased erythema	Total contact casting, prefabricated pneumatic brace, Charcot restraint orthotic walker, or clamshell ankle-foot orthosis
III (reconstruction)	Consolidation of deformity, joint arthrosis, fibrous ankyloses, rounding and smoothing of bone fragments	Absence of warmth, absence of swelling, absence of erythema, stable joint \pm fixed deformity	Plantigrade foot: custom inlay shoes with rigid shank and rocker bottom sole. Nonplantigrade foot or ulceration: débridement, exostectomy, deformity correction, or fusion with internal fixation.

Stages I-III described by Eichenholtz, Stage 0 added by Shibata et al. [21], because clinical signs of Charcot arthropathy were found to precede radiographic changes.

Surgical management of diabetic foot osteoneuroarthropathy/end stage charcotic changes

- Rocker-bottom deformity in Charcot foot
- The longitudinal arch of the foot appears completely collapsed causing the midfoot to curve downwards and creating the characteristic rocker-like curvature.
- Rocker-bottom deformity develops as a result of continuous inflammation and subsequent joint destruction in patients with polyneuropathy.



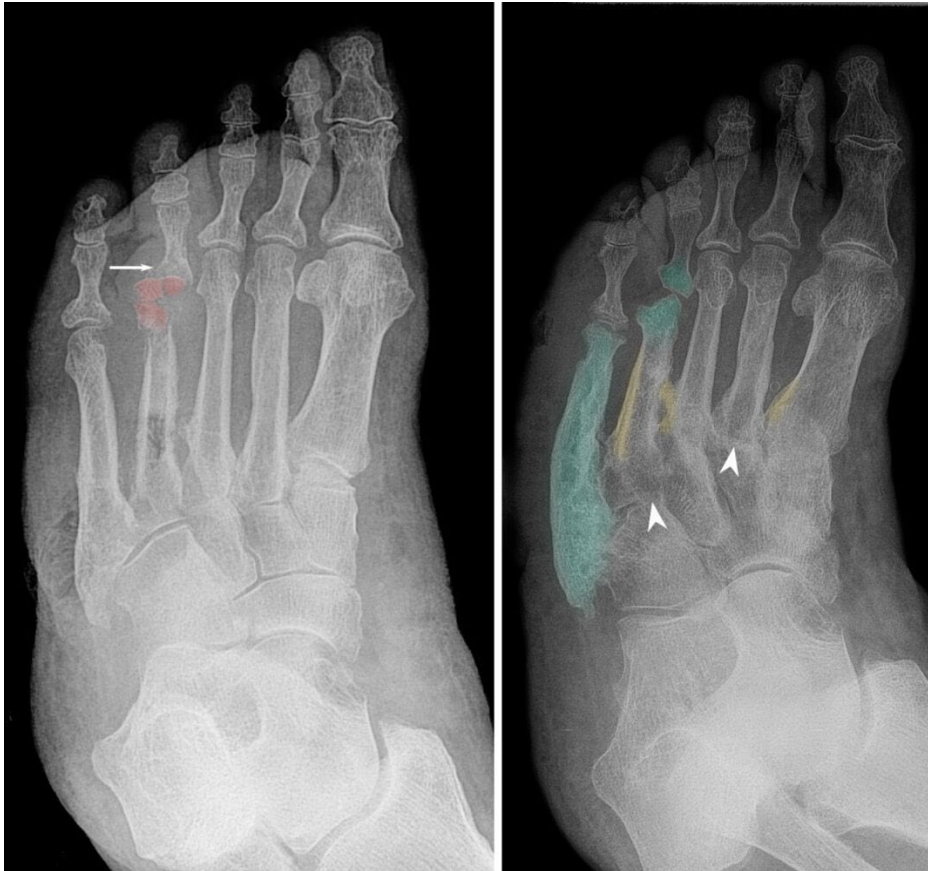
Surgical management of diabetic foot osteoneuroarthropathy/management

- **Acute phase:** 0-3 months (acute, development-fragmentation).
 - Treatment must start as soon as possible.
 - The foot must be immobilised in a plaster cast or DH walker
 - Weight must be kept off the foot so you may need to use crutches or a wheelchair.
- **Healing phase:** 4-8 months (**sub-acute**, coalescence).
 - The bones are starting to heal and fuse back together.
 - Some weight can be put on the foot.
 - The foot must remain in the plaster cast or walking brace.
- **Rehabilitation:** 8 month+ (**chronic**)
 - Gradual Weight bearing.
 - special insoles and shoes that support the foot and allow for any changes that have occurred in the shape of the foot.
 - **Surgery** is usually reserved for joint instability or severe deformity.

Active Charcot Neuro-osteopathy (CNO)

- The diagnosis is based on the mentioned clinical findings of inflammation after exclusion of other causes and abnormalities on **imaging**, if these abnormalities aren't seen on x-ray, MRI should be performed; if not possible, perform a CT scan and/or a radionucleotide scan.
- Treatment should start once the diagnosis is considered and continue until clinical remission with consolidation of fractures is achieved. If there are clinical signs of inflammation offloading should be continued.
- To promote remission of the disease and to prevent progressive deformity, the affected extremity should be **offloaded** and **immobilized**.
- Currently there is no medical therapy that can shorten the duration of disease or prevent deformities, such interventions are therefore not recommended. Vitamin D and calcium should be supplemented according to local guidelines for persons with an elevated risk of inadequate vitamin D levels.
- The knee-high cast can be stopped when there are no clinical signs of inflammation with radiographic consolidation of fractures (if present) on in X ray.

Active Charcot Neuro-osteopathy (CNO)



- Another X-ray foot (oblique view; left: initial radiograph; right: 2 years later) of a patient with diabetes mellitus.
- The initial radiograph shows diffuse osteopenia and soft tissue edema. Destructive changes involve the 4th metatarsophalangeal (MTP) joint, with fragmentation of the metatarsal head (red overlay) and medial subluxation of the proximal phalanx (indicated by arrow). The follow-up radiograph shows evidence of extensive remodeling (examples indicated by green overlay), with bony deformity accompanied by cortical irregularity (examples indicated by yellow overlay), sclerosis, and joint space narrowing (examples indicated by arrowheads). Findings are consistent with Charcot arthropathy, although it is difficult to exclude associated chronic osteomyelitis.

Thank You