

# MODULE 5:

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Diabetic Foot Complications:  
Managing the high risk foot  
(Approx 30 mins)

# Learning Objectives

At the end of this module, learners will be able to:



Describe how diabetes affects lower extremity skin, nerves, muscles and circulation



Identify early stages of diabetic foot complications and manage them to prevent ulceration



Educate patients about the importance of shoes and foot care

# Diabetic foot complications

Result from a combination of:

## Diabetic peripheral neuropathy (DPN)

- Loss of protective sensation in feet
- Changes in blood circulation to skin
- Motor weakness in foot muscles, resulting in deformities

## Peripheral arterial disease (PAD)

- Lack of arterial blood flow in small and/or large vessels
- Leads to deterioration of quality of tissues in feet
- Leads to slow healing

# Non-ulcerative diabetic foot complications

## Skin changes

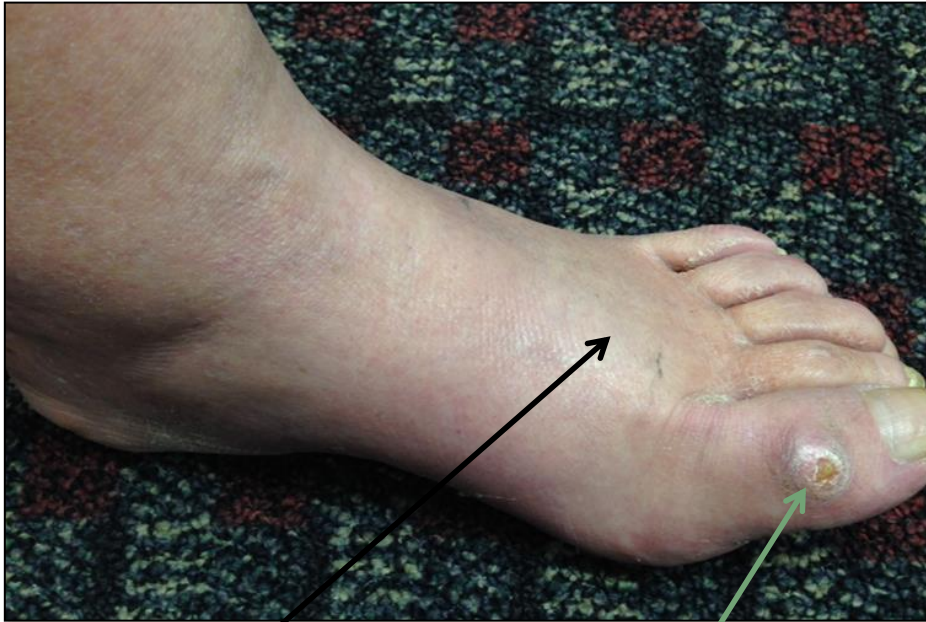
- Autonomic neuropathy affects the innervation of sweat glands, resulting in dry skin and hyperkeratosis.
- It also affects blood circulation to the skin, resulting in reduced nutritive blood flow.
- This causes increased inflammatory changes in skin: thin, dry, erythematous/dusky skin with loss of hair.

## Management

- Patient education on self care and risk of ulceration/infection
- Podiatry referral useful in high risk patients with LOPS, foot deformities
- Appropriate footwear

**Dry cracked skin and calluses increase risk of ulceration,** especially combined with minor trauma and sensory neuropathy.

# Typical diabetic foot skin and structural changes



smooth dry skin,  
loss of hair on  
dorsum foot

callous and  
early  
ulceration  
over medial  
aspect big  
toe



toe deformities

skin wound  
over pressure  
point

# Non-ulcerative diabetic foot complications

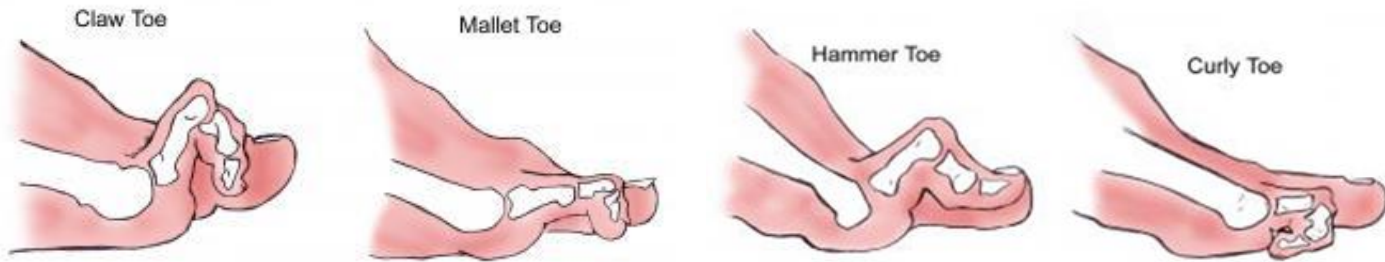
## **Foot deformities**

- Motor neuropathy / weakening of intrinsic foot muscles results in muscle imbalance, changes in foot structure and gait patterns
- Toe deformities – claw toe, hammer toe, hallux rigidus, bunions, over-riding toes
- Risk of callus formation and ulceration over pressure points

## **Management**

- Orthopedic shoes (more details later in module)
- Podiatry: offloading, padding, custom orthoses or shoes
- Physiatry: custom bracing, boot or cast walker
- Orthopedic surgery: joint fixation, arthroplasty, amputation of toes

# Toe deformities that increase risk of diabetic foot ulcers – on dorsum and plantar aspects of foot



# Non-ulcerative diabetic foot complications

## **Charcot Foot (diabetic neuro-arthropathy)**

- Characterized by joint dislocation, pathological fractures of midfoot bones and destruction of foot architecture
- Due to severe peripheral neuropathy
- Clinical features: unilateral swelling of foot, erythema, increased temperature, joint effusion, intact skin, sensory loss
- Patient may complain of some pain in an otherwise insensate foot





## Charcot Foot Investigations

- X-rays: may be normal initially; later show bony fragmentation and subluxation of affected joint.
- CBC and ESR usually normal.

## Management

- Immediate referral to Orthopedic Surgery for off-loading.
- Any person with diabetes presenting with a warm, swollen, red foot without a skin wound / portal of entry for infection should be considered to have Charcot Foot until investigations prove otherwise.



# Non-ulcerative diabetic foot complications

## Peripheral Arterial Disease

- Diabetic foot PAD usually due to microvascular and/or macrovascular arterial disease

## History

- May have leg claudication, rest pain in foot, or no pain

## Examination

- Decreased or absent pulses
- Signs of vascular insufficiency:
  - cool, dry skin
  - absence of hair
  - thickened nails
  - dependent rubor with pallor on elevation of foot



Diabetic foot with PAD –  
skin and nail changes due to chronic ischemia and dry  
gangrene of toes



Diabetic foot with PAD –  
dry thin skin with early skin infarct on heel



## Diagnostic Testing for Peripheral Arterial Disease

- Ankle-Brachial Pressure Index (ABPI) – ratio of SBP in ankles to SBP in upper arm; use BP cuff and hand-held Doppler
  - Normal ABPI is 0.8 – 1.3
  - ABPI <0.8 = PAD
  - ABPI <0.5 = severe arterial obstruction
  - ABPI >1.3 due to calcified blood vessels (common in people with diabetes and CKD)– cannot rely on this to assess PAD.
- Vascular studies and angiography – refer to Vascular Surgeon

# Treatment for Peripheral Arterial Disease

- Same principles as for all other CVD
  - Optimal glycemic and BP control
  - Anti-platelet agent – ASA, other anti-platelet agents
  - Lipid lowering drugs - Statins
  - Exercise – walking program
  - Smoking cessation
- Endovascular intervention or Surgical bypass - if severe PAD, critical ischemia (rest foot or leg pain, non-healing ulcer, gangrene)
- Arterial Bypass

Success rates for arterial bypass in people with diabetes:  
45-60% remain patent 5 years post surgery,  
50% patient survival 5 years post surgery. **Low survival rates as patients die of CAD, CVA or CKD**

# Management of early foot changes

- High-risk feet require regular foot care by a professional (podiatry, nursing, wellness clinic) and inspection of feet by patient or caregiver/partner.
- Most foot ulcers start with skin blisters, callus, fissures that go unnoticed by the patient due to sensory neuropathy.
- Many wounds can be prevented by wearing appropriate shoes that support and protect feet and accommodate deformities.
- Characteristics of appropriate shoes include:
  - Good padding to absorb shock
  - Good fit & smooth inside surfaces to reduce friction inside the shoe
  - Solid structure to stabilize and support ambulation
  - Wide enough to accommodate common foot deformities

# Features of appropriate shoes

Wide heel base and deep heel cup for stability

Laces or velcro for adjusting fit

Breathable upper and lining

To open a PDF of the patient hand-out *Features of appropriate shoes* click on the link in the sidebar. 

Thick foam insole for extra shock absorption

Slip-resistant, durable, flexible sole

Wide, extra deep toe box

Footbed provides cushioning and shock absorption – can be removed for custom inserts

Seamless lining reduces likelihood of friction

Soft interlining molds to foot, reduces friction

Rocker sole reduces forefoot pressure





# Appropriate shoes for high-risk feet



# Inappropriate shoes for high-risk feet



# Coverage for appropriate shoes

- Ordinary good-quality shoes do not need to be purchased from specialty stores.
- Most insurance plans do NOT provide coverage for ordinary shoes.
- Diabetic patients receiving social assistance benefits can get extra allowance for purchasing footwear.
- Physician/NP should provide patient with shoe prescription to facilitate interaction with social services.

## CERTIFICATION OF MEDICAL NECESSITY FOR THERAPEUTIC SHOES

Patient Name: \_\_\_\_\_

This patient needs special shoes to prevent further deterioration of his/her foot condition as a complication of diabetes mellitus.

### Risk factors: (Check all that apply)

- History of previous ulceration
- Callous formation
- Toe deformity (hammer-toe, claw-toe)
- Musculoskeletal deformity (hallux valgus)
- Poor circulation in legs/feet
- Diabetic neuropathy
- Other \_\_\_\_\_

### Recommendations:

Standard good-quality orthopedic or athletic shoe

- Roomy toe box (wide, rounded)
- Wide width
- Extra depth
- Seamless, non-abrasive lining
- Adjustable closure (laces or velcro)
- Rocker sole

### Preferred

- Insole cushioning
- Removable insole
- Customizable insert

Physician name (printed): \_\_\_\_\_

Address: \_\_\_\_\_

To open a PDF of  
the prescription form  
*Certification of  
medical necessity for  
therapeutic shoes*  
click on the link in  
the sidebar.



# Orthopedic shoes

- Orthopedic shoes and inserts can accommodate mild to moderate foot problems
- Measured and fitted by a pedorthist in a shoe store (or an orthotist or podiatrist if available)
- Orthopedic products may include:
  - Inserts to correct toe alignment or reduce friction
  - Padding to offload pressure in forefoot or heel
- Off-the-shelf products may be suitable for some patients, but consultation with a foot care professional is still recommended
- Orthopedic shoes and inserts can increase comfort and help to slow the progression of foot problems.

# Coverage for orthopedic shoes

- Off-the-shelf orthopedic shoes and inserts may be covered by some private insurance plans (with prescription from physician).
- Orthopedic shoes start around \$100
- Inserts around \$60
- Orthotists and podiatrists charge patient for visit consultation in addition to shoe purchase.



# Custom shoes

Individuals with significant foot deformities who can no longer wear off-the-shelf shoes require custom shoes & inserts, or shoe modifications.

- Must be purchased from specialty store
- Custom modifications can be made to existing shoe in some cases to accommodate wounds or deformities
- Custom shoe built from 3D cast of patient's foot is required for heavily involved foot
- Can be ordered by podiatrist or physiatrist; usually built by orthotist or orthopedic shoemaker

# Coverage for custom shoes

- Custom shoes are covered by many private insurance plans, with physician/NP prescription.
- Coverage for First Nations patients is provided by Non-insured Health Benefits (NIHB).
- Coverage for low-income patients is provided by Sask Drug Plan Extended Benefits (Supplementary Benefits).
- Without coverage, patient is billed (cost about \$500).
- Suppliers (pedorthists, orthotists and podiatrists) are usually knowledgeable about prior approval and billing processes.
- Advise patient to confirm insurance coverage before ordering product.

# Suppliers of custom shoes

**Public orthotic programs** - require prescription and appointment:

- Saskatoon (& Prince Albert) - Saskatchewan Abilities Council. Phone: 306-374-4400  
Email: [orthopaedics@abilitiescouncil.sk.ca](mailto:orthopaedics@abilitiescouncil.sk.ca)
- Regina - Wascana Rehabilitation Centre, Phone: 306-766-5730 or 306-766-5731

**Private suppliers:**

- Pedorthists – find at [www.cpedcs.ca](http://www.cpedcs.ca)
- Orthotists – find at [www.opcanada.ca](http://www.opcanada.ca)
- Podiatrists – find at [www.saskpodiatry.org](http://www.saskpodiatry.org)



# Management of severe foot deformities

**Patients with significant deformity should be referred to a specialist in orthopedics or physiatry.**

Surgical/specialty services may include:

- Shaving or removal of bony prominences
- Amputation or partial amputation of toes
- Tendon lengthening to reduce forefoot pressure
- Arthroplasty or joint fixation to repair fractures and stabilize bones (in Charcot foot)
- Custom brace, boot or cast walker

# Resources for patients and providers

The Lower Extremity Wound Pathway provides a web platform to house resources for providers and for patients.

On **provider pages** you can find the referral form, treatment tools and protocols for nurses.

On **patient pages** there are hand-outs and links to other sources of information about caring for wounds and high-risk legs and feet.

To open the *Lower Extremity Wound Pathway web pages*, click on the link in the sidebar.



# References

- Hingorani, Anil et al. *The management of diabetic foot: A clinical practice guideline by the Society for Vascular Surgery in collaboration with the American Podiatric Medical Association and the Society for Vascular Medicine*. Journal of Vascular Surgery, 2016: Volume 63 , Issue 2 , 3S - 21S.
- Registered Nurses' Association of Ontario (2013). *Assessment and Management of Foot Ulcers for People with Diabetes (2nd ed.)*. Toronto, ON: Registered Nurses' Association of Ontario.
- Health Service Executive, Ireland (2009). *National best practice and evidence based guidelines for wound management*.

# END OF MODULE

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Proceed to Module 5 Quiz.