Clinical Update and Practical Management of Diabetic Foot and Venous Stasis Ulcers

September 2016

Dr. Tessa Laubscher, Family Physician and Co-chair LEW Pathway Clinical Implementation Committee
Ms. Carolyn Morin, Enterostomal Therapy Nurse, Saskatoon Health Region
Dr. Hugh Juma, Podiatrist, Saskatoon Health Region
Faculty/Presenter Disclosure

Presenters:  Tessa Laubscher, Carolyn Morin, Hugh Juma

Relationships with Commercial Interests:  None

Disclosure of Commercial Support:  None

Potential for Conflict(s) of Interest:  None
Pre-course Questionnaire

Current barriers to optimal management of venous stasis ulcers and diabetic foot ulcers
Objectives

At the end of this session participants will:

• Be able to describe key clinical features and differential diagnosis of lower extremity wounds.
• Be familiar with wound dressings, compression wrapping and orthotics/offloading devices.
• Be able to identify when urgent referral for specialty care is required.
• Be knowledgeable about the Saskatchewan Clinical Pathway for LEW – referral form, antibiotic protocols, levels of care.
Primary References

• 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.


Saskatchewan Lower Extremity Wound Pathway

Clinical pathway developed for the standardization and improved management of chronic wounds:
- Venous ulcers
- Arterial ulcers
- Diabetic ulcers – neuro-ischemic
- Mixed etiology ulcers

Does not include pressure ulcers.
Why is this important?

High number of acute care interventions:

- 189 amputations due to diabetic foot wounds in Saskatchewan in 2014/15.*
- Over 6,000 days of hospitalization for diabetic foot wounds in 2014/15.*
- Over 1,700 days of hospitalization for venous wounds.*
- ER visits/homecare hours – provincial data not currently available, but probably high!

* Saskatchewan Health Data
Why is this important?

Growing problem

- Estimated 7.2% of persons with diabetes will develop foot ulcers this year.
Why a Pathway?

Clinical Challenges identified:

• Inconsistent access to wound care services.

• Primary care providers lack information about local/regional resources for wound care or prevention.

• Wide variation in treatment plans and referral patterns for wound care patients.

• Number of acute care interventions (hospitalization, amputations) unacceptably high.
Potential benefits to health care providers

• Standardized protocols for assessment & treatment of wounds in primary care.

• Access to standardized wound care resources in the community.

• Clear criteria for specialist referral.

• Improved teamwork and communication among care providers.

• Prevention of wounds in people with diabetes and foot at high risk for ulceration.
Potential benefits to patients

- Improved teamwork and communication among care providers.
- Resources for patient education.
- Faster healing, avoid hospitalization or amputation.

Worldwide data suggests that 50% of diabetic foot amputations could be avoided with early identification and multidisciplinary clinical care. *

* Charing Cross International Vascular Symposium 2014
Most common chronic lower extremity wounds

Diabetic Foot

Venous Ulcers – about 70-80% of LEW’s
Venous wounds
Venous Insufficiency – Stasis dermatitis and Venous Leg Ulcers (VLU)

- Lower leg between knee and ankle, usually proximal to medial malleolus – most commonly antero-medial calf.
- Gaiter or sock distribution.
- Lower leg edema (toes to knee) – worse by end of day; less with leg elevation.
- Sensation usually normal.
- Pedal pulses may be difficult to feel due to edema.
Venous Insufficiency – Stasis dermatitis and Venous Leg Ulcers (VLU)

**Ulcer**

- typically shallow ulcer base, dark red with yellow adherent slough
- irregular border
- large amount of wound exudate/drainage, especially when leg edematous
- relatively painless – achy, dull pain worsening as day progresses; increased pain if infected
- surrounding skin features of stasis dermatitis
Venous Insufficiency – Stasis dermatitis and Venous Leg Ulcers (VLU)

Stasis dermatitis

- **Acute**: erythematous maculopapular rash, vesicles, pruritic, skin edema
- **Chronic**: post-inflammatory skin changes/scarring, hemosiderin deposition in skin, dry scaling skin, erythema, dependant edema
Venous insufficiency/stasis
Cause of Venous Stasis Dermatitis/Ulcers

- In healthy leg veins, valves keep blood circulating up to heart.
- When valves become damaged/worn out, pressure increases in peripheral veins.
- Fluid leaks out of veins leading to swelling, irritation of the skin, and eventually skin breakdown.
- Once skin has broken down, ulcers are likely to recur if venous insufficiency not treated with compression stockings.
Venous Leg Ulcers

- **Risk factors:**
  - Older age
  - Varicose veins and incompetent venous valves
  - Previous DVT
  - Damage to lower leg veins – e.g. surgery, trauma
  - Obesity

- **Primary Prevention:**
  - Graduated compression (≥ 20mmHg) knee-high stockings
Venous Leg Ulcer Treatment

1. **Refer for compression bandaging**
   - First need to exclude significant PAD.
   - Graduated compression wrapping if adequate arterial flow to feet (ABPI ≥ 0.8)

2. **Wound dressing**
   - Dressing to wound; protect skin surrounding ulcer
   - Topical moderate potency corticosteroid if acute dermatitis of surrounding skin
   - Skin emollients – perfume and lanolin-free

3. **Oral antibiotics if ulcer infected/cellulitis**

4. **Other drugs – statin*, pentoxifylline^**

---


Wound dressings

The choice of dressing is influenced by:

- type of wound
- amount of exudate
- location of wound
- skin condition
- condition of the wound bed
- presence or absence of infection
- dressings available
- treatment goals

In VLU - wound dressings (alginites and foams) must absorb exudate produced by ulcer and protect peri-ulcer skin.
## Interpretation of ABI/TBI in Determining Compression

<table>
<thead>
<tr>
<th>ABPI Value</th>
<th>Interpretation/Clinical Significance</th>
<th>Compression Therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;1.3</td>
<td>Abnormally high range, renders ABPI test - TBI indicated, contact wound clinician</td>
<td>Incompressible arteries</td>
</tr>
<tr>
<td>1.0 – 1.3</td>
<td>Normal</td>
<td>High compression</td>
</tr>
<tr>
<td>0.8 - .99</td>
<td>Borderline to mild obstruction/peripheral arterial disease</td>
<td>High compression</td>
</tr>
<tr>
<td>0.71 – 0.79</td>
<td>Mild to moderate obstruction/ peripheral arterial disease</td>
<td>Modified compression</td>
</tr>
<tr>
<td>&lt;0.7</td>
<td>Contact wound clinician or physician/NP</td>
<td>Contra-indicated unless ordered by specialist</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TBI Value</th>
<th>Interpretation/Clinical Significance</th>
<th>Compression Therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥ 0.7</td>
<td>Normal</td>
<td>High compression</td>
</tr>
<tr>
<td>0.41-0.69</td>
<td>Mild to moderate peripheral arterial disease</td>
<td>Modified compression</td>
</tr>
<tr>
<td>&lt; 0.4</td>
<td>Severe ischemia –contact wound clinician or physician/NP</td>
<td>Contra-indicated</td>
</tr>
</tbody>
</table>
Compression therapy

Venous stasis ulcers are treated with graduated compression bandaging to reduce edema
Monitoring and surveillance

- Most venous stasis ulcers close in 3-4 months with **optimal** care.

- Non-healing wound requires specialist referral
Venous Ulcers - when to refer for specialist assessment

- Features of peripheral arterial disease (PAD) – preventing use of compression therapy
- Ulcer not healing adequately after 12 weeks of appropriate compression therapy
- Suspicion of malignancy
- Dermatitis not responding to topical steroids and compression therapy
- Frequent recurrence
Compression therapy – long term

- Once the wound has healed, the wound care team will fit the patient for graduated compression stockings (20-30 mmHg – knee or thigh high).

- A patient who has had a venous stasis ulcer can receive 2 pairs of compression stockings every six months, for life. This is covered by SAIL.

- 50% of VLU recur in 10 years.

- Graduated compression stockings
  - 18-25 mm Hg: low compression for varicose veins and mild swelling
  - 20-30 mm Hg: moderate compression for prevention/long-term management of edema related to venous insufficiency
  - 30-40 mm Hg: high compression for post-thrombotic venous insufficiency
  - 50+ mm Hg: control of lymphedema

Primary care providers - important role in promoting adherence to compression therapy.
Venous wound care protocol - sample

** Saskatchewan Lower Extremity Wound Pathway **

**TREATMENT PROTOCOL FOR VENOUS LEG ULCERS (VLU)**

<table>
<thead>
<tr>
<th>Initiate Wound Record</th>
</tr>
</thead>
<tbody>
<tr>
<td>** Contact physician/NP if urgent specialist referral is indicated.** **</td>
</tr>
<tr>
<td>□ Photograph wound and file as per regional policy</td>
</tr>
<tr>
<td>□ Initiate wound record (use NISS form # WR-145.0)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Laboratory</th>
</tr>
</thead>
<tbody>
<tr>
<td>** Swab is not normally required, but inform primary care provider if a lab test is sent in his/her name.** **</td>
</tr>
<tr>
<td>□ Swab C+S: date: ______________________________</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wound Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>** See formulary for specific product selection.** **</td>
</tr>
<tr>
<td>** Consult wound clinician nurse if concerns arise related to client comorbidities, atypical presentation. ** **</td>
</tr>
<tr>
<td>□ Cleanse and moisturize peri-wound and intact skin lower limb/foot</td>
</tr>
<tr>
<td>□ Cleanse wound with normal saline or sterile water (at least room temperature) using wound irrigation bottle</td>
</tr>
<tr>
<td>□ Gently remove loose debris/yellow slough/crusting with gauze</td>
</tr>
</tbody>
</table>
Resources for patients and providers

http://www.sasksurgery.ca/provider/lowerextremitywound.html
1. What is a venous leg ulcer?

A leg ulcer is an area of damaged skin where the tissue underneath is exposed. Leg ulcers develop when there is poor blood circulation in the veins of your legs.

In healthy leg veins, blood pressure is kept at the right level by the valves in your veins. These valves prevent blood from flowing backwards and keep blood moving through your veins.

When the valves become damaged, the blood pressure in the veins of your legs will rise. This causes fluid to leak out of them leading to swelling, irritation of the skin, tenderness and eventually the formation of an ulcer.

Blood moves back to heart

2. Treatment for venous leg ulcers

<table>
<thead>
<tr>
<th>Compression bandaging</th>
<th>Manage Pain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compression bandaging is the best treatment for a venous leg ulcer. The bandages work by helping push the blood in your leg veins back up to your heart. This allows the skin to heal.</td>
<td>You may or may not experience pain from your leg ulcer. If you do have pain and it prevents you from carrying out your normal daily activities, you should speak to your doctor or nurse about this.</td>
</tr>
<tr>
<td>Your nurse will put a dressing on your wound, then cover it with a compression bandage. The nurse will change your dressing and compression bandages regularly.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Elevation</th>
<th>Skin Moisturizer</th>
<th>Exercise</th>
</tr>
</thead>
<tbody>
<tr>
<td>When resting or sleeping, you should try to keep your ankles up higher than your heart. This allows the fluid to drain from your legs.</td>
<td>Dry scaly moisturizer is common. It needs to be treated with a non-perfumed moisturizer to keep the skin from drying out too much. The wound care nurse will provide information on what you do for the skin on your leg.</td>
<td>Try to keep active and continue with your everyday activities. Walking can help as it pumps blood from your lower leg up to the heart. You should avoid standing still for more than a few minutes, but if you have to stand you could exercise the muscles in your lower leg by moving your toes inside your shoes or moving your feet. You can also do some exercises when you are sitting.</td>
</tr>
</tbody>
</table>
Hands-on session with Q&A

- ABPI testing and interpretation
- Compression bandaging
- Wound Dressings used in treatment of venous leg ulcers
- Compression stockings
Diabetic wounds and the high-risk diabetic foot
Diabetic Foot Complications

• A consequence of:
  ▫ **DPN** – diabetic peripheral neuropathy - sensory, motor and autonomic
  ▫ **PAD** - peripheral arterial disease – may be small and/or large vessel involvement

• DPN causes:
  ▫ loss of protective sensation in feet
  ▫ motor weakness in foot muscles resulting in deformities
  ▫ changes in skin blood circulation and skin growth
Diabetic foot examination

Involves checking all of the following –

- **skin** – dryness, fissures, callous, loss of hair on dorsum foot/toes
- **structural deformities** and foot muscle weakness
- **blood circulation** – pedal pulses, capillary refill time
- **sensation** – to assess for loss of protective sensation
  - loss of sensitivity to 10 gram monofilament
  - 128Hz tuning fork at big toe MTP
  - Ipswich touch the toes test
Screening for diabetic neuropathy

**Peripheral sensory neuropathy** – involves testing for loss of sensitivity to 10gram monofilament or loss of sensitivity to vibration (128Hz tuning fork) at the dorsum of the first toe

- Loss of sensitivity to 10gram monofilament or 128Hz tuning fork - associated with **loss of protective sensation** (LOPS) on the foot
- *Practical tip* – 25 lb fishing line cut into 4 cm lengths may be used for the 10gram monofilament test

**Peripheral motor neuropathy** – may be done by asking the patient to do the one foot stand test. This is a sensitive test for peripheral motor neuropathy in people with DM (increased risk of falls).

**Peripheral autonomic neuropathy** – look for skin and vasomotor changes in feet.
Sensory screening options

Semmes-Weinstein Monofilament test

Steps for Monofilament Test for Neuropathy:
- Show and touch monofilament to patient’s arm or upper leg.
- Ask the patient to close their eyes and say yes when they feel the monofilament.
- Touch monofilament until filament bends in a letter “c” shape, assessing all 10 areas on diagram (Do not test over calluses, scars or ulcers)
- Lack of feeling (4 or more out of 10) - indicates a negative reaction = Neuropathy = “YES” on screening tool

Vibratory sensation test - conventionally tested with a 128-Hz tuning fork at the interphalangeal joint of the hallux

Ipswich Touch the Toes test

Vibration perception threshold testing (VPT) - performed using a handheld device (instrument costs about $700)

**Ipswich Touch-the-toes Test (IpTT)**

IpTT and 10g MF – almost perfect agreement; both showed approx. 80% sensitivity and 90% specificity in identifying at-risk feet. IpTT useful screening test for sensory neuropathy; requires no equipment.

Rayman et al. Diabetes Care 2011; 34:1517
Non-ulcerative diabetic foot complications

Skin changes

- **Autonomic neuropathy** affects the innervation of sweat glands resulting in dry skin and hyperkeratosis.

- **Autonomic neuropathy** affects blood circulation to the skin resulting in reduced nutritive blood flow and increased inflammatory changes in skin.

- Dry cracked skin and calluses may be lead to ulceration and limb-threatening infection, especially if patient also has PAD.

- **Management** –
  - Patient education (self care and risk of ulceration/infection).
  - Podiatry referral useful in high risk patients with LOPS, foot deformities.
  - Appropriate footwear.
Non-ulcerative diabetic foot complications

**Foot deformities**

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

**Management** –
- podiatry - offloading, padding, custom orthoses or shoes
- orthopedic surgery – joint fixation, arthroplasty, amputation of toes.
Foot problems that cause wounds

Hammer-toe/claw-toe deformities
Fore-foot or heel pressure (due to changes in muscles and joints, atrophy of tissue)
Typical changes seen in diabetic 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.
- **Investigations** - [1] X-rays: may be normal initially; later show bony fragmentation and subluxation of affected joint. [2] CBC and ESR usually normal.
- **Treatment** – immediate referral to Orthopedic Surgery for off-loading.
Charcot foot
Charcot foot with ulcer
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 in foot.
  - Signs of chronic vascular insufficiency – cool, dry skin, absence of hair, thickened nails, dependent rubor with pallor on elevation of foot.
Non-ulcerative diabetic foot complications

Peripheral Arterial Disease

• Diagnostic Testing
  ▫ **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 0.9 – 1.3
  
  - ABPI <0.9 = PAD
  - ABPI <0.4 = severe arterial obstruction
  - ABPI >1.3 due to calcified blood vessels (common in diabetics) – cannot rely on this to assess PAD.

  ▫ **Vascular studies and angiography** – have to refer to Vascular Surgeon
Non-ulcerative diabetic foot complications

**Peripheral Arterial Disease**

- **Treatment**
  - 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 in people with diabetes:
  - 45-60% remain patent 5 years post surgery
  - 50% patient survival 5 years post surgery
Typical changes seen in diabetic foot PAD - dry gangrene
Etiology of Diabetic Foot Ulcers (DFU)

- **Critical triad** of neuropathy, deformity and minor trauma present in >60% of DFU.
- Neuropathy most important etiologic component.
- Minor trauma often preventable.
Risk factors for DFU

- Neuropathy
- PAD
- Foot deformity
- Past history of foot ulcer
- Amputation
- Poor glycemic control
- Smoking
- Diabetic nephropathy – particularly end-stage CKD on dialysis (4x increased risk of DFU compared to CKD not on dialysis)
Diabetic Foot Ulcers
Diabetic Foot Infection
Principles of DFU Management

1. **Wound dressings** - maintain moist wound healing environment

2. **Off-load** pressure from wound
   
   “It is not what one puts on a wound that heals it, but what one takes off.”
   
   Mainstay of wound healing in DFU is redistribution of pressure from the ulcerated skin.

3. **Treat infection** – LEW pathway antibiotic protocol

4. **Debridement**

5. **Improve blood supply** – endovascular intervention/surgery if large vessel PAD

6. **Optimal glycemic control** – blood sugars less than 11mmol/L
Diabetic Foot Ulcer

Clinical Pearls

• >2cm of skin erythema around a diabetic lower limb ulcer may be indicative of limb-threatening infection (need to admit for IV antibiotics, limb elevation, wound care).

• Presence of pain in a previously insensate foot can be the first and most important indicator of severe infection or underlying osteomyelitis.

• Need to consider other diabetic complications such as CKD before selection and dosing of antibiotics for diabetic foot infections.

• Selection of antibiotic must be guided by previous/recent antibiotics used by patient.

• Poor glycemic control delays ulcer healing.
Antibiotic selection for infected DFU

**KEY PRINCIPLES:**

1. **Duration of wound and bacteria**
   - short duration – mostly Staph and Strep
   - duration > 4 weeks – likelihood of anaerobic bacteria

2. **Severity of infection**
   - moderate or severe infection/cellulitis – need to consider both Gram negative and positive bacteria

3. **Renal function**
   - need to adjust antibiotic dose if eGFR <30 ml/min

4. **Osteomyelitis**
   - probe-to-bone test
   - MRI

5. **CA-MRSA**
   - add septra or doxycycline if high risk
<table>
<thead>
<tr>
<th>Infection Severity</th>
<th>Preferred Empiric Regimens</th>
<th>Alternative Regimens</th>
<th>Comments</th>
</tr>
</thead>
</table>
| Mild               | Wound less than 4 weeks duration  
  ● cephalixin 500 mg PO four times daily*  
  ● sulfamethoxazole/trimethoprim 800/160 mg PO twice daily* + metronidazole 500 mg PO twice daily  
  **Wound greater than 4 weeks duration**  
  ● clindamycin 300 mg PO three times daily (only if severe β-lactam allergy)  
  **Wound greater than 4 weeks duration**  
  ● amoxicillin/clavulanate 875/125mg PO twice daily*, OR  
  ● doxycycline 100 mg PO twice daily + metronidazole 500 mg PO twice daily  | Wound less than 4 weeks duration  
  ● clindamycin 300 mg PO three times daily (only if severe β-lactam allergy)  
  **Wound greater than 4 weeks duration**  
  ● amoxicillin/clavulanate 875/125mg PO twice daily*, OR  
  ● doxycycline 100 mg PO twice daily + metronidazole 500 mg PO twice daily  |  
  ❓ Outpatient management with oral antibiotics recommended.  
  ❓ Tailor regimen based on C&S results & patient response.  
  ❓ Consider risk for CA-MRSA  |
| Moderate           | Wound less than 4 weeks duration  
  ● cefazolin 2 g IV q8h*, OR  
  ● ceftriaxone 2 g IV once daily (to facilitate outpatient management when ambulatory administration of ceFAZolin not possible)  
  **Wound greater than 4 weeks duration**  
  ● cefazolin 2 g IV q8h* + metronidazole 500 mg PO twice daily, OR  
  ● ceftriaxone 2 g IV once daily + metronidazole 500 mg PO twice daily (to facilitate outpatient management when ambulatory administration of ceFAZolin not possible)  
  **Wound greater than 4 weeks duration**  
  ● moxifloxacin 400 mg IV/PO once daily* (only if severe β-lactam allergy)  
  **Wound greater than 4 weeks duration**  
  ● moxifloxacin 400 mg IV/PO once daily* + metronidazole 500 mg PO/IV twice daily (only if severe β-lactam allergy), OR  
  ● ertapenem 1g iv daily  | Wound less than 4 weeks duration  
  ● moxifloxacin 400 mg IV/PO once daily* (only if severe β-lactam allergy)  
  **Wound greater than 4 weeks duration**  
  ● moxifloxacin 400 mg IV/PO once daily* + metronidazole 500 mg PO/IV twice daily (only if severe β-lactam allergy), OR  
  ● ertapenem 1g iv daily  |  
  ❓ Initial management with inpatient or outpatient parenteral therapy with rapid step-down to oral therapy after 48 to 72 hours based on patient response recommended.  
  ❓ Tailor regimen based on C&S results & patient response.  
  ❓ Consider risk for CA-MRSA  |
| Severe             | piperacillin-tazobactam 3.375 g IV q8h*  | moxifloxacin 400 mg mg IV once daily* + metroNIDAZOLE 500 mg PO/IV twice daily (only if severe β-lactam allergy), OR  
  ● meropenem 1 g iv three times daily  |  
  ❓ Inpatient management recommended.  
  ❓ Urgent vascular assessment if pulseless foot.  
  ❓ Tailor regimen based on C&S results & patient response.  |

*Adjust dose if eGFR ≤ 30 ml/min

If high risk for CA-MRSA: should include sulfamethoxazole/trimethoprim 800/160 mg PO twice daily (adjust dose if eGFR≤30ml/min) or doxycycline 100 mg PO twice daily for mild infections; vancomycin weight-based dosing to a target trough of 15 – 20 mg/L for moderate-severe infections.
**Clinical Pearls:**

- Always consider risk for CA-MRSA.
- **Bacteria change with duration of wound and severity of infection:**
  - In short duration ulcers - targeting Staph and Strep initially;
  - with longer duration wounds - anaerobes may be an issue;
  - with severe infections - need to think about gram negatives.
- Debridement, good glycemic control and appropriate wound care are essential for the management of diabetic foot infections.
- Cultures: prefer tissue specimens post-debridement and cleansing of wound.
- Surface or wound drainage swabs not recommended.
- Positive probe-to-bone test indicative of osteomyelitis.
- **Imaging:** recommend plain radiography; MRI if concerned about osteomyelitis (radionuclide imaging unnecessary).

**Duration of Therapy:**

- Soft tissue only – 2 weeks
- Bone involvement with complete surgical resection of all infected bone – 2 weeks
- Bone involvement with incomplete surgical debridement of infected bone – 6 weeks IV
- Bone involvement with no surgical debridement – 6 weeks IV, followed by 6 weeks PO

**References:**


Adapted from New Brunswick Health Authorities Anti-Infective Stewardship Committee 2014
Family physician role in management of DFU

• Individuals with DFU tend to possess fewer cognitive resources than individuals with similar duration DM without foot ulcer.*

• Potentially problematic as management of DFU requires increased demands for self-treatment and adherence to treatment regimens that may be complex and of long duration.

• Family physician/nurse practitioner – important role in explaining and promoting adherence; advocating for patient.

Protecting and Healing the Diabetic Foot
• Probability of DFU healing without complications is 31% without use of offloading device; increasing to 64% when an offloading device effectively used.

• If individual has foot/lower limb amputated for DFU, other foot at high risk of developing DFU.

• Death following amputation for DFU estimated at 20-40% at one year, and 60-80% at 5 years.

“Impact of Offloading Devices on the Cost of Diabetic Foot Ulcers in Ontario” – Canadian Diabetes Association, 2015
High risk foot - start with the shoe

- Most foot ulcers start with blisters, callous, bumps or scratches
- **Proper footwear**
  - can prevent wounds from starting
  - essential for wounds to heal
- **Proper shoes:**
  - 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
Wide heel base and deep heel cup for stability

Thick foam insole for extra shock absorption

Slip-resistant, durable, flexible sole

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

Laces or velcro for adjusting fit

Breathable upper and lining

Wide, extra deep toe box

Rocker sole reduces forefoot pressure

Seamless lining reduces likelihood of friction

Soft interlining molds to foot, reduces friction
Good shoes

Bad shoes
Coverage for ordinary proper shoes

- Most insurance plans do NOT provide coverage for ordinary shoes.
- Diabetic patients receiving social assistance benefits (including First Nations) can get extra allowance for footwear.
- Physician must provide patient with prescription.
Orthopedic shoes

- Orthopedic shoes and inserts can accommodate mild-moderate foot problems
- Measured and fitted by a pedorthist in a shoe store (or an orthotist, podiatrist if available).

Orthopedic shoes may have:
- More space in the toe box
- Room for extra inserts and/or padding in specific areas like toe or heel for offloading
- Sole modifications to stabilize gait

Orthopedic shoes and inserts can increase comfort and help to slow the progression of foot problems. But if cost is an issue, ordinary well-fitting shoes are a good alternative.
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 purchase.
Custom shoes

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

- Custom built from 3D cast of patient’s foot
- Can be built by orthotist, podiatrist, pedorthist.

Patients with significant deformity should also be referred to a specialist in orthopedics or physiatry.
Coverage for custom shoes

- Custom shoes covered by many private insurance plans, with physician 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 pedorthic programs - require prescription and appointment:

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

Private suppliers:

• Pedorthists - locate at www.cpedcs.ca
• Orthotists – find at www.opcanada.ca
• Podiatrists – find at www.saskpodiatry.org
When a wound occurs – Offloading

• Required to remove pressure from the wound.

• Proper offloading is as important as proper wound dressing.

• Should start as soon as possible.
Short term offloading

• Customized padding can be placed in the patient’s shoe – must be deep enough to accommodate this.
• Consider “healing shoe” or “post-op shoe” if patient shoes don’t accommodate padding

• Smaller (< 2 cm), less complex wounds may heal with short term offloading
Coverage for short term offloading

• No insurance coverage for these products.
• Padding may be supplied by homecare.
• Healing shoes may be provided by homecare but billed to patient.
• Healing shoes may be available for purchase from podiatrist, drugstore, shoe store or medical supply store, or order on-line.
• Cost starts at around $30.
Longer term offloading

Total Contact Cast

• Provides best wound healing
• Must be removed weekly for wound assessment and re-applied
• Should be applied by specially trained cast technician
Longer term offloading

Removable Cast/Air Walker

- Most commonly-used type of orthoses for diabetic foot
- Custom-molded by orthotist
- Removable –
  - advantages
  - Disadvantages

- Encourage patient to wear walker at all times for best results
Coverage for longer term offloading

- All custom products are covered by private insurance/public insurance/NIHB.
- Patients who see a vascular surgeon for wound assessment and require long term offloading will be prescribed custom device or casting.
- Must be prescribed by specialist and fitted by an orthotist (Regina/Saskatoon).
Hands-on session with Q&A

- Diabetic foot ulcer wound dressings
- Offloading devices
- Orthopedic shoes
Saskatchewan LEW Pathway
How will the LEW Pathway improve the management of these wounds?

- Standardized **referral form** – direct referral to:
  - local home care / wound care nurses
  - tertiary care (vascular surgery) – in Saskatoon or Regina

- **Referral forms within EMR**

- **Standardized lower leg assessment** and **wound care protocols** to be followed by home care and wound care nurses.

- Capacity building - **Wound care training program** developed by Saskatchewan Polytechnic for home care nurses.

- Standardized **antibiotic protocols** and wound tracking tools.

- Enhanced **communication** between all providers, so family physician/NP remain informed.
Pathway

1. Identify wound during patient visit
2. Medical/social history and wound assessment
3. Red flags present?
   - NO: Diabetic ulcer?
     - NO: Referral to regional wound team
     - YES: Referral for consultation with vascular specialist
   - YES: Severe infection
   - Ischemic wound
   - Deep wound/gangrene
     - Referral to emergency on-call vascular specialist
4. Family physician/RN-NP
5. Regional wound team coordinated by wound clinician RN
6. Tertiary clinic coordinated by vascular specialist
## Primary Care LEW Referral Form

### REFERRAL FORM – LOWER EXTREMITY WOUND PATHWAY

(for chronic venous/arterial wounds & diabetic foot)

**Patient Information**
- **Surname:**
- **First Name:**
- **Address:**
- **DOB:**
- **HSN:**
- **Age:**
- **Treaty:**
- **Phone:**

**Regional Home Care**
- **Fax:**
- **Phone:**

**Specialist**
- **Phone:** on-call vascular specialist

### Pertinent Medical History:
- **Medications:**
- **Allergies:**
- **diabetes**
- **peripheral arterial disease**
- **CAD**
- **hypertension**
- **CKD stage**
- **obesity**
- **smoker**
- **other**
- **heart failure**
- **varicose veins or previous DVT**

### Ulcer Characteristics:

**NOTE:** Indications for urgent specialist referral include: severe limb-threatening infection, gangrene, acute ischemia

- **Location:**
  - Proximal to medial malleolus
  - Over bony prominence on the lower leg/foot

- **Appearance:**
  - Shallow, irregular border
  - Surrouding skin edema/induration
  - Stasis dermatitis / skin hyperpigmentation of lower leg
  - Punched out/deeper wound, well-defined border
  - Surrounding skin atrophic, shiny

- **Foot Exam:**
  - Pedal pulses present
  - Swelling/peripheral edema (reported/present)
  - Pedal pulses weak/absent
  - Features of chronic ischemia, dry atrophic skin, dystrophic nails, absent toe hair, poor capillary refill
  - Patient report of claudication/ ischemic type pain
  - Foot deformity

- **Neuropathy:**
  - No signs
  - Loss of sensation to 10g monofilament or perception of 128Hz tuning fork at big toe
  - Patient report of neuropathic pain
  - Signs of intrinsic foot muscle weakness

**Size of Wound:**
- previous ulcer
- previous amputation

**Duration of this ulcer:**
- Initiating event:

### Probable Etiology:
- **Venous**
- **Arterial**
- **Diabetic (neuro-ischemic)**
- **Mixed**
- **Uncertain**

**Signs of Infection:**
- No signs infection
- Mild – moderate infection
- Severe infection

- purulent exudate,
- skin erythema <2cm surrounding ulcer,
- no systemic signs,
- no signs significant ischemia,
- no deep tissue involvement

- systemic signs/toxicity,
- cellulitis (skin erythema >2cm surrounding ulcer),
- gangrene,
- foul odor,
- deep tissue involvement (bone, joint, abscess),
- increasing pain

**Recent Lab Tests:**
- A1C __________
- Creatinine __________
- eGFR __________

**Treatment to Date:**
- Contact on-call vascular surgeon and fax this form for URGENT REFERRALS (red flags signs/symptoms)
- FAX REFERRAL to nearest Regional Wound Care Team for initiation of treatment according to wound pathway protocols (this may include Wound care Nurse ordering wound swab in referring physician’s / NP’s name)
- FAX REFERRAL to BOTH Regional wound team AND specialist office for all DIABETIC FOOT ULCERS. Regional wound team will initiate care; specialist assessment/consult takes place within three weeks.

**Physician/RN-NP Name ___________________________ SIGNATURE ___________________________

**Phone Number ___________________________ Date ___________________________**
## Primary Care LEW Referral Form

### Pertinent Medical History:
- diabetes
- peripheral arterial disease
- CAD
- hypertension
- CKD stage ___
- obesity
- smoker
- other:
- heart failure
- varicose veins or previous DVT
- Allergies:

### Ulcer Characteristics:

**NOTE:** Indications for urgent specialist referral include: severe/limb-threatening infection, gangrene, acute ischemia

<table>
<thead>
<tr>
<th>Location</th>
<th>Proximal to medial malleolus</th>
<th>Over bony prominence on the lower leg/foot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Shallow, irregular border</td>
<td>Punched out/deeper wound, well-defined border</td>
</tr>
<tr>
<td></td>
<td>Surrounding skin edema/induration</td>
<td>Surrounding skin atrophic, shiny</td>
</tr>
<tr>
<td></td>
<td>Stasis dermatitis / skin hyperpigmentation of lower leg</td>
<td></td>
</tr>
</tbody>
</table>

| Foot Exam             | Pedal pulses present | Pedal pulses weak/absent |
|                       | Swelling/peripheral edema (reported/present) | Features of chronic ischemia: dry atrophic skin, dystrophic nails, absent toe hair, poor capillary refill |
|                       |                              | Patient report of claudication/ischemic type pain |
|                       |                              | Foot deformity |

| Neuropathy            | No signs                     | Loss of sensation to 10g monofilament or perception of 128Hz tuning fork at big toe |
|                       |                              | Patient report of neuropathic pain |
|                       |                              | Signs of intrinsic foot muscle weakness |

| Size of Wound         | previous ulcer               |
|                       | previous amputation           |

| Duration of this ulcer| Initiating event: |

### Probable Etiology:
- Venous
- Arterial
- Diabetic (neuro-ischemic)
- Mixed
- Uncertain
## Primary Care LEW Referral Form

### Signs of infection:

- **No signs infection**
- **Mild – moderate infection**
  - purulent exudate,
  - skin erythema < 2cm surrounding ulcer,
  - no systemic signs,
  - no signs significant ischemia,
  - no deep tissue involvement
- **Severe infection**
  - systemic signs/toxicity,
  - cellulitis (skin erythema > 2cm surrounding ulcer),
  - gangrene,
  - foul odor,
  - deep tissue involvement (bone, joint, abscess),
  - increasing pain

**Recent lab tests:**
- A1C
- Creatinine
- eGFR

**Treatment to date:**

- Contact on-call vascular surgeon and fax this form for URGENT REFERRALS (red flags signs/symptoms)
- FAX REFERRAL to nearest Regional Wound Care Team for initiation of treatment according to wound pathway protocols (this may include Wound care Nurse ordering wound swab in referring physician’s / NP’s name)
- FAX REFERRAL to BOTH Regional wound team AND specialist office for all DIABETIC FOOT ULCERS. Regional wound team will initiate care; specialist assessment/consult takes place within three weeks.

**PHYSICIAN/RN-NP NAME**

**SIGNATURE**

**PHONE NUMBER**

**DATE**
Communication from Wound Care Nurse to Primary Care Provider

LOWER EXTREMITY WOUND PATHWAY (for diabetic foot, venous and arterial wounds)

Communication with Referring Physician/NP

ATTN:

Your patient was assessed by Regional Wound Team personnel as follows:
Date: __________________________ Location: __________________________
Assessed by: __________________________
☐ ABI ☐ TBI __________________________ Other investigation: __________________________

WOUND CARE NURSE REQUESTING:

Clinical follow-up: __________________________
☐ re. skin irritation: __________________________
☐ re. foot deformities: __________________________
☐ re. surgical consult: __________________________
☐ other:

TREATMENT INITIATED ACCORDING TO WOUND PROTOCOL (NO FOLLOW UP REQUIRED)

Based on wound characteristics and discussion with the patient, treatment was initiated as follows. You will be notified of any subsequent changes in your patient’s condition or treatment.

The goal of treatment: ☐ Healing ☐ Maintenance

<table>
<thead>
<tr>
<th>DIAGNOSIS</th>
<th>TREATMENT INITIATED</th>
</tr>
</thead>
<tbody>
<tr>
<td>VENOUS</td>
<td>☐ Compression __________________________________________________________________________</td>
</tr>
<tr>
<td></td>
<td>☐ Wound dressing __________________________________________________________________________</td>
</tr>
<tr>
<td></td>
<td>☐ Patient education re self care __________________________________________________________________________</td>
</tr>
<tr>
<td></td>
<td>☐ Wound swab __________________________________________________________________________</td>
</tr>
<tr>
<td></td>
<td>☐ Other: __________________________________________________________________________</td>
</tr>
<tr>
<td>ISCHEMIC/ DIABETIC</td>
<td>☐ Wound dressing __________________________________________________________________________</td>
</tr>
<tr>
<td></td>
<td>☐ Fit for offloading device __________________________________________________________________________</td>
</tr>
<tr>
<td></td>
<td>☐ Patient education re self care __________________________________________________________________________</td>
</tr>
<tr>
<td></td>
<td>☐ Wound swab __________________________________________________________________________</td>
</tr>
<tr>
<td></td>
<td>☐ Other __________________________________________________________________________</td>
</tr>
</tbody>
</table>

Wound Care RN          PHONE NUMBER        DATE       SIGNATURE
Sample of wound care nursing protocol

<table>
<thead>
<tr>
<th>Saskatchewan Lower Extremity Wound Pathway</th>
</tr>
</thead>
<tbody>
<tr>
<td>TREATMENT PROTOCOL FOR DIABETIC FOOT ULCER (DFU)</td>
</tr>
<tr>
<td><strong>Initiate Wound Record</strong></td>
</tr>
<tr>
<td><strong>Patients with diabetic wounds must be referred to a vascular surgeon.</strong></td>
</tr>
<tr>
<td>☐ Photograph wound and file as per regional policy</td>
</tr>
<tr>
<td>☐ Initiate wound record (use NISS form # WR-145.0)</td>
</tr>
<tr>
<td><strong>Laboratory</strong></td>
</tr>
<tr>
<td><strong>Swab is not normally required, but inform primary care provider if a lab test is sent in his/her name.</strong></td>
</tr>
<tr>
<td>☐ Swab C+S: date: ________________________________</td>
</tr>
<tr>
<td><strong>Wound Management</strong></td>
</tr>
<tr>
<td><strong>See formulary for specific product selection.</strong></td>
</tr>
<tr>
<td>☐ Cleanse and moisturize peri-wound and intact skin lower limb/feet/foot</td>
</tr>
<tr>
<td>☐ Cleanse wound with normal saline or sterile water (at least room temperature) using wound irrigation bottle</td>
</tr>
<tr>
<td>☐ Gently remove loose debris/yellow slough/crusting with gauze</td>
</tr>
<tr>
<td>☐ Protect peri-wound skin from moisture damage, use skin sealant or barrier as needed.</td>
</tr>
<tr>
<td>☐ Identify infection or suspected infection (note guidelines on assessment form)</td>
</tr>
</tbody>
</table>
LEW Pathway website

http://www.saskurgery.ca/provider/lowerextremitywound.html
THANK YOU

QUESTIONS

Post-course Questionnaire