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b. Patient Teaching and Learning Resources
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d. Waterloo Wellington Integrated Wound Care Program Evidence-Based Wound Care Arterial Clinical Pathway

7. Arterial Leg Ulcer Toolkit
**RNAO's**

**Assessment and Management of Venous Leg Ulcers**¹,²

**Levels of Evidence**

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>A</td>
<td>Evidence obtained from at least one randomized controlled trial or meta-analysis of randomized controlled trials</td>
</tr>
<tr>
<td>B</td>
<td>Evidence from well-designed clinical studies but no randomized controlled trials</td>
</tr>
<tr>
<td>C</td>
<td>Evidence from expert committee reports or opinion and/or clinical experience or respected authorities. Indicates absence of directly applicable studies of good quality</td>
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**RNAO's**

**Strategies to Support Self-Management in Chronic Conditions: Collaboration with Clients**¹²

**Levels of Evidence**

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<tr>
<td>la</td>
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<tr>
<td>lb</td>
<td>Evidence obtained from at least one randomized controlled trial</td>
</tr>
<tr>
<td>Iia</td>
<td>Evidence obtained from at least one well-designed controlled study without randomization</td>
</tr>
<tr>
<td>Iib</td>
<td>Evidence obtained from at least one other type of well-designed quasi-experimental study, without randomization</td>
</tr>
<tr>
<td>II</td>
<td>Evidence obtained from well-designed non-experimental descriptive studies, such as comparative studies, correlation studies and case studies</td>
</tr>
<tr>
<td>IV</td>
<td>Evidence obtained from expert committee reports or opinions and/or clinical experiences of respected authorities</td>
</tr>
</tbody>
</table>

**RNAO's**

**Integrating Smoking Cessation into Daily Nursing Practice**¹⁴

**Levels of Evidence**

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Requires at least two randomized controlled trials as part of the body of literature of overall quality and consistency addressing the specific recommendations</td>
</tr>
<tr>
<td>B</td>
<td>Requires availability of well conducted clinical studies, but no randomized controlled trials on the topic of recommendations.</td>
</tr>
<tr>
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1. Objectives

The objectives\(^8\) of the development and implementation of these resources is to help Health Care Providers to:

- Find practical, evidence-based resources to use when caring for individuals that have or who are at risk of developing, arterial leg ulcers
- Perform a comprehensive patient assessment including assessing for indicators of arterial leg ulcers that will not heal in the inpatient and outpatient care settings (Acute Care, Long Term Care and Community Care Settings)
- Identify the correct etiology of lower leg ulcers
- Arrange for a holistic Lower Leg Assessment (LLA) including ABPIs in order to identify patient’s ability to heal or need for referral to vascular surgeon. If patient is a diabetic, toe pressures should also be obtained.
- Perform accurate wound assessment including progress towards healing
- Recognize signs & symptoms of infection and identify treatment interventions
- Increase the use and implementation of evidence-based arterial leg ulcer treatment plans including pain management using pharmacological and non-pharmacological interventions
- Identify and implement appropriate topical wound care
- Improve the coordination and communication between care providers/care institutions regarding the transfer/discharge plan for patients with arterial leg ulcers

2. Background

Peripheral vascular disease (PVD) is any disease that affects the blood flow through veins and arteries distal to the heart. Peripheral arterial disease affects the arteries only.\(^3\) Peripheral arterial disease (PAD) is a life-threatening condition which results from the narrowing of the blood vessels."\(^3\)

Patients with arterial disease often have a history of cerebral vascular accident (stroke), coronary artery disease or diabetes.\(^4,\,5,\,6\) Cigarette smokers, the elderly and those with high blood pressure are at particular risk for developing PAD. Arterial leg ulcers usually result from trauma, pressure, thermal extremes, chemicals, blood clot/embolus or infection in this susceptible population.\(^3\) Ischemia is a restriction of blood supply caused by stenosis (narrowing) or occlusion (blockage) of the blood vessel leading to damage of the surrounding tissue. Hypoxia occurs when tissue is deprived of oxygen. Both ischemia and hypoxia can cause critical limb ischemia which can lead to the need for limb amputation and/or death.\(^3\)

It is estimated that between 14-20 % of the adult population will develop peripheral arterial disease in their lifetime.\(^7\) Nearly 10% of all patients that present with leg or foot ulcers have ‘pure arterial insufficiency’.\(^8\) Critical limb ischemia occurs in approximately 3% of patients that develop PAD.\(^9,\,10\) The ten year mortality rate of those with PAD is 60%. The five year mortality rate of those patients that experience critical limb ischemia is 50 to 70%.\(^9,\,10\)

Inadequate tissue perfusion can result in formation of arterial ulcers due to partial or complete blocking of arterial flow. These ulcers, which are usually found on the lower legs and feet, are very often painful and difficult to heal.\(^33\)
Patients with arterial ulcers often suffer from a significant decreased level of quality of life. Pain, which can be described as ‘worst pain possible’, can make mobility and sleep difficult or nearly impossible. Independence can be affected, often rendering caregivers to become care receivers. Physical limitations can cause issues with performing housework, employment requirements and other activities of daily living. Difficulty working can have a financial impact on patients’ lives, affecting job security and possibly causing the need to retire earlier than planned. Problems sleeping can create a negative state of well-being, anxiety and depression. Personal hygiene can be a challenge for patients with arterial ulcers. Limited mobility and fear of further injury may lead to a decrease in personal hygiene. Wound odour may leave the patient with a sense of uncleanliness. Many feel that their sex life is negatively affected by having an arterial ulcer.

The diagnosis and prognosis of arterial disease can cause patients to become very fearful of the possibility of amputation, discrimination and social rejection. Self-image can be affected as concerns of tissue decay and body weakness are known to cause feelings of discomfort, shame and fear. Patients often go out less frequently, reducing interaction time with family and friends. Social isolation can result in feelings of embarrassment, sadness, anger and decreased self-esteem. These patients often develop avoidance strategies to prevent further injury or pain. They may avoid crowds, having children on their laps, interaction with pets, taking vacations, gardening and other leisure activities.

From April 2013 until March 2014, arterial leg ulcer nursing care in Waterloo Wellington cost home and community care over one hundred thousand dollars. A significant number of nursing visits were required for over 56 patients with arterial leg ulcers at an average cost per client of $1944. The average length of stay requiring community wound care for patients with arterial leg ulcers in Waterloo Wellington was 129 days.

**Best Practices for Assessment, Prevention, and Treatment of Arterial Leg Ulcers**

Evidence-based practice can be defined as a “process for making informed clinical decisions. Research evidence is integrated with clinical experience, patient values, preferences and circumstances.” This process allows for professional judgement to become professional standards of practice.

Although the Registered Nurses Association of Ontario (RNAO) does not have best practice guidelines specific for arterial leg ulcers, some very useful information regarding best practice recommendations for arterial leg ulcers can be found in the RNAO Assessment and Management of Venous Leg Ulcers guidelines and the 2007 supplement.

Recently in 2014, Sibbald et al published two peer-reviewed articles in Advances in Skin and Wound Care addressing clinical diagnosis, investigation and treatment of arterial disease ulcers. Information gleaned from these two papers can be found throughout these recommendations.
Wound Bed Preparation Paradigm

The wound bed preparation (WBP) \(^{17}\) paradigm is used to assess, diagnosis, and treat wounds while considering patient concerns. It links evidence-based literature, expert opinion, and clinical experiences of respected wound care specialists. The framework is beneficial because the components are interrelated and can be re-evaluated if the wound deviates from the care plan. Furthermore, the interprofessional team is able to collaborate together through shared discussion to classify a healable, maintenance, and non-healable wound.

![Wound Bed Preparation Paradigm Diagram](image)

Figure 1: Adapted from:


3. **Address Patient-Centered Concerns**¹²,¹³ (see Toolkit Item #6 for worksheet)  
   (Level B, C: RNAO’s Assessment and Management of Venous Leg Ulcers)  
   (Level Ia, Ib, III: RNAO’s Strategies to Support Self-Management in Chronic Conditions: Collaboration with Clients)

   a. **Assess Psychosocial Needs /Pain and Quality of Life (QOL)**
      - Communicate with patients, their caregivers and significant others to identify patient-centered goals to determine realistic expectations for healing or non-healing outcomes.
      - Assess pain and in collaboration with patient and caregivers, create a pain relief plan.⁶
      - Assess quality of life (QOL) (see Toolkit Item #10a and #10b for assessment forms) and screen for mental health concerns (i.e. depression see Toolkit Item #11 for assessment forms)
      - Encourage and provide ongoing support for smoking cessation if applicable (see Toolkit Item #7a for Smoking, Chronic Wound Healing, and Implications for Evidence-Based Practice – McDaniel and Browning, Toolkit Item #7b for Checklist to readiness to quit smoking, see Toolkit Item #7c for Applying 5 A’s to smoking cessation, see Toolkit Item #7d for WHY test, see Toolkit Item #7e for smoking cessation medication comparison chart and see Toolkit Item #7f for Strategies to avoid relapse).¹⁴

   b. **Socioeconomic Determinates of Health** (see Toolkit Item #5 for Canadian Nurses Association *Social Determinants of Health and Nursing: A Summary of Issues*)
      - Provide education to patients, caregivers and significant others for care and the management of arterial disease.
      - Assess for the presence or absence of social support system for treatment and preventions of arterial leg ulcers.

      Health is a resource for everyday life and is influenced by the determinants of health: income, social status, support networks, education, employment and working conditions, health services, healthy child development, physical environment, gender, culture, genetics, and personal health practices.¹⁵ Unemployment, lack of sick benefits, job insecurity, low income, and homelessness can deter healing and cause more stress. For example, money is needed to purchase adequate food that is vital for wound healing. Patient may need a referral for a social worker to assist with finances.

      The following questions could assist in assessing your patient’s financial concerns:
Do you have benefits from any other sources to cover cost of compression stockings, medical drugs, parking fees, food allowance (e.g. work place or private Insurance, Veterans Affairs Canada, Aboriginal Affairs, Workers Safety and Insurance Board (WSIB), Trillium Drug Plan, Ontario Disability Support Program (ODSP))

- Are you the sole bread-winner in your family?
- How often have you used the food bank or soup kitchen this month?
- Do you have sick-time benefits or unemployment insurance?
- Would you like a referral to Meals on Wheels or information on food bank/soup kitchen?

Social Supports

There is evidence to suggest that strong supportive networks improve health and healing. Patients who have limited social support are more at risk for depression, greater risk for complications, decreased well-being, poor mental health and physical health. Furthermore, patients who are disabled, migrants from other countries, ethnic minorities and refugees are vulnerable to racism, discrimination and hostility that may harm their health. Patients who have stigmatizing conditions such as mental health, addictions (street drug use, methadone patients and cigarette smokers), and diseases such as HIV/AIDS suffer from higher rates of poverty and limited supports.

The following questions could assist in assessing your patient’s support system:

- Do you have someone to help you? Friend, family, neighbor, church member?
- Does patient seem depressed or suicidal?
- Do you have transportation to receive medical follow-up and to obtain groceries?
- Do you have someone to help you with your personal care such as showering?
- Do you have someone to get your groceries, housekeeping and other necessities?
- Are you afraid of your partner or family member?
- Would you like a referral to a social worker or case worker?

Chronic Disease Self-management

- Assess level of patient’s self-management skills

Chronic Disease Self-management

Self-management promotes and strengthens the confidence (self-efficacy) of the patient to be able to care for their chronic disease. The focus of self-management is to allow the patient to self-identify concerns and to address these concerns collaboratively with nurses and health professionals. Fostering and promoting independence is strongly encouraged but the patient and caregiver will need to be assessed by health professional for cognitive and physical ability.
The Self-management Initiative, through the Ontario Ministry of Health and Long-Term Care (MOHLTC), is an integrated, comprehensive strategy aimed at preventing and improving management of chronic conditions in Ontario. The goal of this cost-free program is to provide education and skills training workshops to both health care providers and patients with chronic conditions. For more information, please call 1-866-337-3318 or www.wwselfmanagement.ca.

1. Self-Management Initiative Link for Patients with Chronic Conditions
2. Self-Management Initiative Link for Health Care Providers
The 5 A’s of Behavioural Change

Assess
Beliefs, Behavior and Knowledge

Arrange
Specify plan for follow-up (e.g. visits, phone calls, mailed reminders)

Advertise
Provide specific information about health risks and benefits of change

Assist
Identify personal barriers, strategies, problem-solving techniques and social/environmental support

Agree
Collaboratively set goals based on patient’s interest and confidence in their ability to change the behaviour

Personal Action Plan
List specific goals in behavioral terms
List barriers and strategies to address them
Specify follow-up plan
Share plan with practice team and patient’s social support

These activities are not necessarily linear with each step following the other sequentially. The goal of the 5 A’s, in the context of self-management support, is to develop a personalized, collaborative action plan that includes specific behavioural goals and a specific plan for overcoming barriers and reaching those goals. The 5 A’s are elements that are interrelated and are designed to be used in combination to achieve the best results especially when working with patients in complex health and life situations.

Figure 2: RNAO Clinical Best Practice Guideline: Strategies to Support Self-Management in Chronic Conditions: Collaboration with Clients
1. **ASSESS**

Beliefs, Behavior and Knowledge

- Establish rapport with patients and families
- Screen for depression on initial assessment, at regular intervals and advocate for follow-up treatment of depression
- Establish a written agenda for appointments in collaboration with the patient and family, which may include:
  a) Reviewing clinical data
  b) Discussing patient’s experiences with self-management
  c) Medication administration
  d) Barriers/stressors
  e) Creating action plans
  f) Patient education including assessing learning style
- Consistently assess patient’s readiness for change to help determine strategies to assist patient’s readiness for change to help determine strategies to assist patient with specific behaviours
- Identify patient specific goals

2. **ADVISE**

Provide specific information about health risks and benefits of change

- Combine effective behavioural, psychosocial strategies and self-management education processes as part of delivering self-management support
- Utilize the “ask-tell-ask” (also known as Elicit-Provide-Elicit) communication technique to ensure the patient receives the information required or requested
- Use the communication technique “Closing the Loop” (also known as “teach back”) to assess a patient’s understanding of information
- Assist patients in using information from self-monitoring techniques (e.g., glucose monitoring, home blood pressure monitoring) to manage their condition
- Encourage patients to use monitoring methods (e.g., diaries, logs, personal health records) to monitor and track their health condition
- Identify community resources for self-management (e.g., support groups)

3. **AGREE**

Collaboratively set goals based on patient’s interest and confidence in their ability to change the behaviour

- Collaborate with patients to:
  a) Establish goals
  b) Develop action plans that enable achievement of SMART goals (see below)
  c) Establish target dates for success of goals and reassessment
  d) Monitor progress towards goals
SMART Goals

Specific
A specific goal is detailed, focused and clearly stated. Everyone reading the goal should know exactly what you want to learn.

Measurable
A measurable goal is quantifiable, meaning you can see the results.

Attainable
An attainable goal can be achieved based on your skill, resources and area of practice.

Relevant
A relevant goal applies to your current role and is clearly linked to your key role responsibilities.

Time-limited
A time-limited goal has specific timelines and a deadline. This will help motivate you to move toward your goal and to evaluate your progress.

4. ASSIST
Identify personal barriers, strategies, problem-solving techniques and social/environmental support

- Use motivational interviewing with patients to allow them to fully participate in identifying their desired behavioural changes
- Teach and assist patients to use problem-solving techniques
- Be aware of community self-management programs in a variety of settings, and link patients to these programs through the provision of accurate information and relevant resources

5. ARRANGE
Specify plan for follow-up (e.g., visits, phone calls, mailed reminders)

- Arrange regular and sustained follow-up for patients based on the patient’s preference and availability (e.g., telephone, email, regular appointments). Nurses and patients discuss and agree on the data/information that will be reviewed at each appointment and share with other interdisciplinary team members involved
- Use a variety of innovative, creative and flexible modalities with patients when providing self-management support such as:
  a) Electronic support systems
  b) Printed materials
  c) Telephone contact
  d) Face-to-face interaction
e) New and emerging modalities

- Tailor the delivery of self-management support strategies to the patients’ culture, social and economic context across settings
- Facilitate a collaborative practice team approach for effective self-management support
- Share with caregiver/family members/circle of care

### Stages of Change Model

<table>
<thead>
<tr>
<th>Stage in Transtheoretical Model of Change</th>
<th>Patient Stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-contemplation</td>
<td>Not thinking about change May be resigned Feeling of no control Denial: does not believe it applies to self Believes consequences are not serious</td>
</tr>
<tr>
<td>Contemplation</td>
<td>Weighing benefits and costs of behavior, proposed change</td>
</tr>
<tr>
<td>Preparation</td>
<td>Experimenting with small changes</td>
</tr>
<tr>
<td>Action</td>
<td>Taking a definitive action to change</td>
</tr>
<tr>
<td>Maintenance</td>
<td>Maintaining new behavior over time</td>
</tr>
<tr>
<td>Relapse</td>
<td>Experiencing normal part of process of change Usually feels demoralized</td>
</tr>
</tbody>
</table>

Table 1: RNAO Clinical Best Practice Guideline: Strategies to Support Self-Management in Chronic Conditions: Collaboration with Clients

There are 3 self-management strategies that health professionals can use to promote self-management in patients with arterial leg ulcers
1. **Motivational Interviewing** (assess patient-centered concerns)  
   (see Toolkit Item #6 for worksheet)

The following questions could assist in assessing your patient’s concerns:

- What is your most important problem or concern? (It may not be related to the disease)
- Do you have a history of depression? Are you depressed now?
- What has worked in the past and what did not work?
- Why do you want to change and how hard are you willing to work?
- Are you willing to make the changes in your lifestyle to improve your health?
- What might prevent you from working hard on this (e.g., barriers that are present)

Choose the one area that you would like to work on:

- Improve physical activity
- Perform wound care
- Practice leg exercises
- Purchasing, wearing and caring for my prescribed compression stockings
- Donning and doffing prescribed compression stockings using aids
- Nutrition
- Leg elevations
- Skin care of my legs
- Control weight
- Stop smoking
- Prevention of new ulcers
- Managing co-morbidities
- Alternative therapy modalities
- Work modifications
- Meet new people

How willing are you to set goals and make changes in lifestyle on a scale of 1-10?

What is it that you find most difficult about living with arterial disease and how can I help you?

2. **Goal Setting**

- Provide specific health information and health risks requested from patient and family. Here is a sample of topics to discuss: ABPI, prescribed compression bandaging, stockings for life, wound treatment, managing pain, nutrition, smoking cessation, vascular consult, benefits of walking, ankle/leg exercises.
- Collaboratively develop a Personal Action Plan (see below)
- Set SMART Goals (specific, measureable, achievable, relevant and timely)  
  Try to make goals small enough to achieve success or patient may not try again if she/he fails

**Personal Action Plan**
1. List specific goals in behavioral terms
2. List barriers and strategies to address them
3. Specify Follow-up Plan
4. Share plan with practice team and client’s social support

3. Problem Solving

- Assist with problem solving to help identify barriers and enlist family/social support
- Ascertain financial barriers
- Arrange for follow-up visits to review goals and discuss challenges
- Encourage healthy coping such as yoga, music, counselling, friends, and family support

4. Identify and Treat the Cause
   (Level C: RNAO’s Assessment and Management of Venous Leg Ulcers ¹ ²)

4.1 Assessment

Should be undertaken by healthcare professional(s) trained and experienced in leg ulcer management

a. Identify Risk Factors and Etiology of Arterial Leg Ulcers (ALUs) ³ ²⁰

   History of:

   - Smoking
   - Diabetes mellitus
   - Hyperlipidemia
   - Hypertension
   - Poor nutrition
   - Low hemoglobin
   - Obesity
   - Decreased thyroid function
   - History of vascular surgery or deep vein thrombosis
   - Bleeding disorders
   - History of cerebral vascular accident (CVA)
   - Autoimmune diseases
   - Chronic renal disease
   - Congestive heart failure
   - Impaired liver function
   - Coronary artery disease (CAD)
   - Psoriasis
   - Use of systemic steroids, immunosuppressives and chemotherapy
b. Odds Ratio of Arterial Leg Ulcer NOT Healing in 24 weeks\textsuperscript{1,2}

Research demonstrates that several factors will influence whether the ulcer is going to heal, which include the initial size of the ulcer and the length of time that the ulcer has been present. These ulcers often do not follow the trajectory of venous ulcers (venous ulcers should be 30% smaller at week 4 and should be closed by week 12). Further consultation with a wound care specialist and/or vascular surgeon should be considered if healing is not improving with conservative treatment in 4 to 6 weeks\textsuperscript{1,2}.

Factors that may affect healing potential

Local
- Presence of necrosis, foreign body and/or infection
- Disruption of microvascular supply
- Cytotoxic (toxic to cells) agents

Host
- Co-morbidities (i.e. inflammatory conditions, nutritional insufficiencies, peripheral vascular or coronary artery disease)
- Adherence to plan of care by patient and caregivers
- Cultural and personal belief systems

Environment
- Access to care
- Family support
- Healthcare sector
- Geographic
- Socioeconomic status

Predictors of delayed healing
- ABPI < 0.8
- Fixed ankle joint
- Wound base has more than 50% yellow fibrin
- Wound has been present longer than 6 months
- Wound is larger than 5cm\textsuperscript{2} (L x W=>5cm\textsuperscript{2})
- Patient had previous hip or knee surgery
- Patient has history of vein ligation or stripping

c. Common Signs and Symptoms of Peripheral Arterial Disease (PAD)\textsuperscript{3}
Peripheral vascular disease (PVD) is any disease that affects the blood flow through veins and arteries distal to the heart. Peripheral arterial disease affects the arteries only. Peripheral arterial disease (PAD) is a life-threatening condition which results from the narrowing of the blood vessels.

The following are common signs and symptoms of PAD:

- Pain or cramping with elevation of lower limbs usually described as gnawing, aching, throbbing or tenderness (nociceptive pain)
- Rest pain (pain present without exercise) is indicative of advanced PAD (90% occlusion)
- Nocturnal Pain: Sleep in a recumbent position (legs at same level as the heart) causes the blood pressure in the legs to drop, therefore perfusion to the extremities in decreased causing ischemic neuritis (patients often dangle affected leg over side of bed or sleep sitting up in chair)
- Intermittent Claudication: the patient has enough blood flow to meet needs at rest, but exercise causes an increase in metabolic demands and the calf muscle becomes ischemic. Patients may complain of pain or cramping in legs when walking with early disease. This indicates mild to moderate PAD
- Pain may not be experienced or may be described as burning, stabbing, stinging or shooting (neuropathic pain) if extensive sensory neuropathy is present
- Intense hyperesthesia (cannot tolerate light touch)
- Limb muscle may appear wasted from ischemic atrophy
- Pulselessness (weak or absent)
- Delayed capillary refill (normal refill time is less than 3 seconds)
- Temperature difference between legs
- Dependent rubor (redness) in lower legs and feet
- Pallor in feet on elevation
- Thick, yellow or flaking toenails (onychogryphosis)
- Dry, shiny skin on lower legs
- Hairless lower legs and feet
- Edema subsequent to leg being dependent
- Distal gangrene of toes with palpable pulse and/or adequate circulation may indicate microemboli from proximal atheromatous plaques (small pieces of debris or lipids on the innermost portion of an artery)
- Erectile dysfunction in men
- Non-healing wound

Arterial Leg Ulcers occur due to insufficient arterial blood supply (APBI<0.8 or TBPI <0.7) resulting in the following:

- A lack of oxygenated blood reaching the tissue especially in the lower limbs
- Tissue ischemia and necrosis
- Need increased blood supply for healing to occur
- Diagnostic studies are needed to identify the cause

“Time is Tissue”

Acute arterial occlusion is a life and limb-threatening situation which requires immediate emergency intervention

Signs and symptoms include sudden pain in the leg or foot that may become severe associated with the following:

- Pale or blue skin
### Signs and Symptoms of Peripheral Arterial Disease (PAD)\(^{20}\)

<table>
<thead>
<tr>
<th></th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hairless</strong></td>
<td><img src="http://www.medetec.co.uk/slide%20scans/leg-ulcer-images/target66.html" alt="Image" /></td>
</tr>
<tr>
<td>- Little or no hair on the lower legs or feet</td>
<td></td>
</tr>
<tr>
<td><strong>Thin skin</strong></td>
<td><img src="http://www.medetec.co.uk/slide%20scans/leg-ulcer-images-2/target32.html" alt="Image" /></td>
</tr>
<tr>
<td>- Skin appears thin and fragile and shiny on legs and feet</td>
<td></td>
</tr>
<tr>
<td>- May be pale in colour unless dependent rubor is present</td>
<td></td>
</tr>
<tr>
<td><strong>Dependent rubor</strong></td>
<td>![Image] '**'</td>
</tr>
<tr>
<td>- Occurs in the presence of arterial compromise and can mimic cellulitis</td>
<td></td>
</tr>
<tr>
<td>- Disappears when the foot is elevated, which would not happen with cellulitis</td>
<td></td>
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<tr>
<td>- Can be bilateral</td>
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<tr>
<td><strong>Blanching on elevation</strong></td>
<td>![Image] '**'</td>
</tr>
<tr>
<td>- Occurs in the presence of arterial compromise and represents decrease in arterial flow without the gravitational effect of having the foot below the level of the heart</td>
<td></td>
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<tr>
<td>- Can be bilateral</td>
<td></td>
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<tr>
<td><strong>Feet cool/cold/blue:</strong></td>
<td></td>
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<tr>
<td>------------------------</td>
<td></td>
</tr>
<tr>
<td>• Often just involving one leg or foot in comparison to the other, but both can be involved to some degree</td>
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<thead>
<tr>
<th><strong>Toes cool/cold/blue:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Blue toes may be caused by mechanical obstruction (secondary to emboli or atherosclerosis) or mechanical damage to blood vessels.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Lower temperature in one leg compared to other</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• One leg feels cooler than the corresponding area on the other leg – this generally suggests the presence of PAD in the cooler leg, but can also be from increased temperature in a leg with infection or cellulitis.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Capillary refill time: &gt; 3 seconds</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Delayed capillary refill time (CFT) is suggestive of peripheral arterial disease</td>
</tr>
<tr>
<td>• Normal CFT is less than 3 seconds.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Ulcer located on foot</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Heels and malleoli</td>
</tr>
<tr>
<td>• Tips of toes</td>
</tr>
<tr>
<td>• Between the toes where the toes rub against one another</td>
</tr>
<tr>
<td>• Any area where bony prominences rub against bed sheets, socks or shoes</td>
</tr>
<tr>
<td>• Toes where the toenail cuts into the skin</td>
</tr>
<tr>
<td>• Aggressive toe nail trimming/removal of an ingrown toenail</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Ulcer located on leg</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• usually associated with trauma (fall, car door, shopping cart, wheelchair)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Ulcer base pale and dry &amp;/or contains eschar</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Yellow, brown, grey, pale pink or black color</td>
</tr>
<tr>
<td>• Usually does not bleed</td>
</tr>
<tr>
<td>• Minimal exudate unless edema and infection are present</td>
</tr>
<tr>
<td>• May initially have grey or purplish tissue that bleeds very little and will turn to eschar if allowed to dry out</td>
</tr>
</tbody>
</table>

---

Image links:
- [Foot Ulcers](http://www.medetec.co.uk/slide%20scans/foot-ulcers/target21.html)
- [Leg Ulcers](http://www.medetec.co.uk/slide%20scans/leg-ulcer-images/target45.html)
- [Foot Ulcers](http://www.medetec.co.uk/slide%20scans/leg-ulcer-images-2/target5.html)
Ulcer round and punched out in appearance
- Do not usually have irregular edges and the edges do not slope gently down to the wound bed
- “punched out” appearance with straight sides to the wound
- If irritation or infection are present, there may or may not be swelling and redness of the periwound skin

Gangrene dry/wet
- Dry gangrene (ischemia) may start out red in colour and cool to touch, then turn blue or brownish and then becomes black and will dessicate if allowed to dry
- Wet gangrene (infection causing ischemia) starts out with swelling and putrifies, may have foul smelling exudate, fever

Table 2: Adapted from SWRWCF Toolkit: Section B.2.1 Purpose and Instructions for the Lower leg Assessment Tool. Revised March 2014. Used with permission.

Photographs/Graphics References
* http://www.medetec.co.uk
** Used with permission from Mavis Hicknell
*** http://www.angiologist.com (need permission)
**** Used with permission from Laura Rowbotham
4.2 Obtain a Comprehensive Patient History and Perform a Physical Assessment
(Level C: RNAO’s Assessment and Management of Venous Leg Ulcers \(^1,2\))

Information obtained should be documented in a structured format assessment form for a patient presenting with either their first or recurrent leg ulcer and should be ongoing thereafter.

a. **Complete a comprehensive patient history including:**
   - Medical history including history of arterial/venous insufficiency
   - Family history of venous, arterial or mixed ulcers
   - History of deep vein thrombosis (DVT) and/or lower leg injury
   - History of episodes of chest pain, hemoptysis or pulmonary embolus
   - History of heart disease, stroke or transient ischemic attack (TIA)
   - Comorbidities (diabetes, peripheral vascular disease, intermittent claudication, rheumatoid arthritis or ischemic rest pain)
   - Pain (in calves, buttocks or thighs especially with walking and/or with elevation of leg above level of heart)
   - Where patient sleeps at night (e.g. if patient sleeps upright in chair at night, could indicate pain if leg elevated in bed)
   - Smoking history
   - History of ulcer and past treatments
   - Current and past medications
   - Nutritional status
   - Allergies
   - Psychosocial status including quality of life
   - Functional, cognitive, emotional status and ability for self-care
   - Lifestyle (activity level, interests, employment, dependents, support system)

b. **Complete a comprehensive physical examination including:**
   - Blood Pressure, height, weight, pulses in foot and ankle
   - Review bloodwork that should include the following:

<table>
<thead>
<tr>
<th>Protein-Calorie Malnutrition</th>
<th>□ Pre-albumin if available (low scores indicate risk for malnutrition)</th>
<th>□ Serum albumin level (&lt;30g/l will delay healing; &lt;20g/l will be non-healable)</th>
<th>□ C-reactive Protein (CRP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check for anemia</td>
<td>□ CBC (including RBC, Hct, Hgb, MCV, Platelets etc.)</td>
<td>□ Serum Iron</td>
<td>□ Total Iron Binding</td>
</tr>
<tr>
<td></td>
<td>If anemic, proceed to checking →</td>
<td>□ Ferritin</td>
<td>□ Transferrin</td>
</tr>
<tr>
<td>Kidney function</td>
<td>□ BUN</td>
<td>□ B(_12)</td>
<td>□ Red blood cell folate level</td>
</tr>
<tr>
<td>(To check hydration)</td>
<td>□ Creatinine</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>□ Potassium</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
c. **Lower Leg Assessment**  
(Level A: RNAO’s Assessment and Management of Venous Leg Ulcers\(^1,2\))

Perform a **BILATERAL** lower leg assessment including ABPI/TPBI

“All clinicians involved in the management of patients with lower limb ulcers should have direct access to an 8 MHz hand held Doppler device. This should not be considered a special investigation limited to vascular laboratory”\(^3\)

Assess for the following:

- ABPI/TPBI completed within last 3 mths and results documented
- If unable to obtain ABPI/TPBI, referral to vascular surgeon is recommended
- Assess pulses (popliteal – behind knee, dorsalis pedis – top of foot, posterior tibial – medial ankle)
- Measurement of edema
- Assess capillary refill (normal less than 3 seconds)
- Leg measurements (foot, ankle, calf, thigh)
- Ankle range of motion (ROM)
- Foot deformities
- Ankle flare
- Skin temperature (compare both legs)
- Skin colour (dependent and on elevation)
- Presence of pain
- Nail changes
- Presence of hair on lower leg, feet and toes
- Presence of varicosities (varicose veins)
- Dermatological changes due to impaired blood flow
- Repeat ABPI/TPBI assessment every 3 months if healing is not progressing

---

**Acute arterial occlusion is a life and limb-threatening situation which requires immediate emergency intervention**

**Signs and symptoms that may become severe may be associated with the following:**

- Pale or blue skin
- Skin cold to the touch
- Sudden decrease in mobility
- No pulse where one was present prior to this
- Sudden and severe pain

---

Link to Lower Leg Assessment Form  
Link to Video for Performing ABPI & Waveform Identification
d. Assess the Wound and Peri-wound

Wound and Peri-wound Assessment is best performed using a validated and reliable wound assessment tool. (See Toolkit item #8a for Bates-Jensen Wound Assessment Tool and #8b Leg Ulcer Measurement Tool (LUMT).)

A comprehensive wound assessment should include observation and documentation of the following: 1, 2

1. Location: Arterial leg ulcers are usually situated on the lateral malleolus, mid tibia, phalangeal heads, toe tips or web spaces
2. Odour
3. Sinus Tracts (including undermining and tunneling): Measurement can be obtained by gently inserting small probe into sinus tract, marking probe with end of finger and measuring length from end of probe to finger end
4. Exudate: Comment on amount and colour of exudate present. Arterial wounds usually have low to no exudate
5. Pain: Usually more painful than expected
6. Wound bed appearance: colour and type of tissue present (fibrin, granulation or epithelial tissue) and presence of eschar or slough. Arterial ulcers generally have a pale wound base and a ‘punched-out’ appearance
7. Condition of peri-wound (surrounding skin) and wound edges
8. Document percentage of healing since last visit
9. Obtain photos following best practice

4 P's of Arterial Ulcers

Pale wound base
Punched-out appearance
Painful
Parched (low to no exudate)

1. Link to Bates-Jensen Wound Assessment
2. Link to Leg Ulcer Measurement Tool (LUMT)

Link to Suggested Reading for Obtaining Photos
e. Wound Measurements  
(Level B: RNAO’s Assessment and Management of Venous Leg Ulcers $^{1,2}$)  

1. Measure and document the surface areas of ulcers at regular intervals to monitor progress  
2. Measure depth of wound  
3. Measure size of wound: Area of wound measured by multiplying length (longest measurement) and width (shortest measurement) of wound

f. Comparison of Venous versus Arterial versus Mixed Venous/Arterial Leg Ulcers  
(Level C: RNAO’s “Assessment and Management of Venous Leg Ulcers”$^{1,2}$)

<table>
<thead>
<tr>
<th>Wound Appearance</th>
<th>Venous Disease</th>
<th>Arterial Disease and Ischemia</th>
<th>Mixed Venous/Arterial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base</td>
<td>ruddy red; yellow adherent or loose slough; granulation tissue may be present</td>
<td>pale; granulation rarely present; necrosis, eschar, gangrene (wet or dry) may be present</td>
<td>Ulcers may have elements of both kinds of disease: Venous shape Yellow/black fibrous base Wound bed may be dry (if no edema or infection)</td>
</tr>
<tr>
<td>Depth</td>
<td>usually shallow</td>
<td>may be deep</td>
<td></td>
</tr>
<tr>
<td>Margins</td>
<td>irregular</td>
<td>edges rolled; “punched out” appearance, smooth</td>
<td>may be present</td>
</tr>
<tr>
<td>Undermining</td>
<td>is rare. If present, further assessment should be undertaken to rule out other etiologies (i.e. arterial)</td>
<td>may be present</td>
<td></td>
</tr>
<tr>
<td>Exudate</td>
<td>moderate to heavy</td>
<td>minimal</td>
<td></td>
</tr>
<tr>
<td>Surrounding Skin</td>
<td>Venous dermatitis, hemosiderin, lipodermatosclerosis, atrophy blanche</td>
<td>Pale or blue feet, pallor on elevation, dependent rubor Shiny, taut, thin, dry Hair loss over lower extremities Atrophy of subcutaneous tissue</td>
<td>Possible cool skin, edema, pallor on elevation, dependent rubor</td>
</tr>
<tr>
<td><strong>Edema:</strong> pitting or non-pitting; may worsen with prolonged standing or sitting from legs being in a dependent position</td>
<td><strong>Edema:</strong> atypical</td>
<td><strong>Edema:</strong> variable</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td><strong>Scarring:</strong> from previous ulcers, ankle flare, tinea pedis (athlete’s foot)</td>
<td><strong>Nails:</strong> Dystrophic</td>
<td><strong>Nails:</strong> Thickened toenails</td>
<td></td>
</tr>
<tr>
<td><strong>Nails:</strong> Usually normal unless infection present</td>
<td><strong>Temperature:</strong> normal; warm to touch</td>
<td><strong>Temperature:</strong> decreased/cold</td>
<td></td>
</tr>
<tr>
<td><strong>Temperature:</strong></td>
<td><strong>Infection:</strong> less common but chronic venous ulcers are prone to biofilms, induration, cellulitis, inflamed, tender blisters</td>
<td><strong>Infection:</strong> can have signs and symptoms of both venous and arterial disease</td>
<td></td>
</tr>
<tr>
<td><strong>Location</strong></td>
<td><strong>Infection:</strong> frequent (signs may be subtle)</td>
<td><strong>Infection:</strong> cellulitis, necrosis, eschar, gangrene may be present</td>
<td></td>
</tr>
<tr>
<td>Ulceration is usually on the medial lower leg superior to malleolus in gaiter region but can be on lateral aspect as well or may encircle the entire ankle or leg. Ulcers occurring above the mid-calf or on the foot likely have other origins, but may be caused by trauma in a leg with existing venous insufficiency</td>
<td>Areas exposed to pressure or repetitive trauma, or rubbing of footwear</td>
<td>Same as venous or ulcer may be circumferential</td>
<td></td>
</tr>
<tr>
<td><strong>Pain</strong></td>
<td><strong>Pain</strong> with elevation</td>
<td><strong>Pain</strong> with elevation</td>
<td></td>
</tr>
<tr>
<td>Described as throbbing, sharp, itchy, sore, tender, heaviness Worsens with prolonged dependency. Some relief on elevation of limb.</td>
<td>Increased with elevation of limb. Pain may also be incurred with walking. This is usually due to the presence of intermittent claudication which will be relieved with 10 minutes of rest</td>
<td>Intermittent claudication (early) Night time rest pain (late disease)</td>
<td></td>
</tr>
</tbody>
</table>


Photos courtesy of:http://www.medetec.co.uk

g. **Ankle Brachial Pressure Index (ABPI) / Toe Brachial Pressure Index (TBPI)**
Perform ABPI/TBPI to rule out the arterial disease. If patient is a diabetic, toe pressures should be obtained.

An Ankle Brachial Pressure Index (ABPI) measurement should be performed by a trained practitioner to rule out the presence of peripheral arterial disease, particularly prior to the application of compression therapy. ABPI measurement offers valuable information as a screening tool for lower extremity peripheral arterial disease.\textsuperscript{16}

### Ankle Brachial Pressure Index (ABPI) / Toe Brachial Pressure Index (TBPI) Interpretations\textsuperscript{17,18}

#### ABPI

- \(> 0.9-1.2\) ....Normal \((1.2\) or \(>\) could indicate calcification, seen in diabetes, patients that smoke, hypertension, rheumatoid arthritis, systemic vasculitis or advanced age \)
- \(0.80-0.9\) ......Mild ischemia \((\text{inflow disease may be present})\)
- \(0.50-0.79\) ....Moderate ischemia \((\text{Would benefit from vascular surgeon consult to expedite wound healing})\)
- \(0.35-0.49\) ....Moderately severe ischemia \((\text{Urgent vascular surgery consult recommended})\)
- \(0.20-0.34\) ....Severe ischemia \((\text{Urgent vascular surgery consult recommended})\)
- \(<0.20\) ..........Likely critical ischemia, but absolute pressure and clinical picture must be considered \((\text{Urgent vascular surgery consult recommended})\)

#### TBPI:

- \(> 0.7\) ........Normal \(> 0.7\)
- \(0.64 - 0.7\).....Borderline
- \(< 0.64\)........ Abnormal indicating arterial disease \((\text{Urgent vascular surgery consult recommended})\)

<table>
<thead>
<tr>
<th>Lower Leg Vascular Assessment</th>
<th>Right</th>
<th>Left</th>
</tr>
</thead>
<tbody>
<tr>
<td>RNAO recommends a 3 month complete reassessment if no evidence of healing and a 6 month reassessment for resolving and healing ((\text{but not yet healed})) wounds \textsuperscript{1,2}</td>
<td>ABPI:</td>
<td>TBPI:</td>
</tr>
<tr>
<td>If ulceration does not heal or show improvement after 3 months and patient has an Ankle Brachial Pressure Index (ABPI) of (&gt; 0.8) to (1.3), a referral to a vascular surgeon to review potential surgical interventions is recommended</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
An Ankle Brachial Pressure Index (ABPI) >1.2 and <0.8 warrants referral for further medical assessment. People with abnormally low or abnormally high ABPI should be further investigated for peripheral arterial disease. For example, an ABPI >1.3 is considered indicative of non-compressible vessels that are found in individuals with diabetes, chronic renal failure and who are older than 70 years of age. In these cases, compression therapy may not be recommended.

Referrals to vascular lab may be required for the following investigations:\(^3\):

**Transcutaneous oxygen (TCP\textsubscript{2})**
- Measures partial pressure in adjacent areas of the wound
- Considered reliable method to measure the viability of tissue except where acute edema or inflammation is present
- Tissue hypoxia results TCP\textsubscript{2} <40 mmHg
- Critical ischemia TCP\textsubscript{2} <30 mmHg

**Laser Doppler Flowmetry**
- Useful in cases where false readings obtained in TCPO\textsubscript{2} (where acute edema or inflammation is present)

**Doppler Arterial Waveforms**
- Non-invasive
- Demonstrates the normal tri-phasic signal of the pulse

**Segmental Doppler Pressures**
- Determines location of vascular lesion
- Pressures measured at thigh, above knee, calf and ankles
- Results compared with each other and with other leg

**Imaging Studies (Angiography)**
- Determines location and extent of disease
- Used by surgeon to provide roadmap in deciding and planning revascularization of the limb
h. Determine if the wound is “Healable, Maintenance or Non-Healable”

**Healable:** Have sufficient vascular supply, underlying cause can be corrected, & health can be optimized

**Maintenance:** have healing potential, but various patient factors are compromising wound healing at this time

**Non-healable/Palliative wound:** has no ability to heal due to untreatable causes such as terminal disease or end-of-life

i. **Nutritional Assessment**

*(Level B: RNAO’s Assessment and Management of Venous Leg Ulcers)*

The following assessments and blood work should be considered when investigating nutritional status of a person with a wound:

<table>
<thead>
<tr>
<th>Protein-Calorie Malnutrition</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Pre-albumin if available (low scores indicate risk for malnutrition)</td>
</tr>
<tr>
<td>□ Serum albumin level (&lt;30g/l will delay healing; &lt;20g/l will be non-healable)</td>
</tr>
<tr>
<td>□ C-reactive Protein (CRP)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Check for anemia</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ CBC (including RBC, Hct, Hgb, MCV, Platelets etc.)</td>
</tr>
<tr>
<td>If anemic, proceed to checking →</td>
</tr>
<tr>
<td>□ Serum Iron</td>
</tr>
<tr>
<td>□ Total Iron Binding</td>
</tr>
<tr>
<td>□ Ferritin</td>
</tr>
<tr>
<td>□ Transferrin</td>
</tr>
<tr>
<td>□ B12</td>
</tr>
<tr>
<td>□ Red blood cell folate level</td>
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</tbody>
</table>

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<tr>
<th>Kidney function (To check hydration)</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ BUN</td>
</tr>
<tr>
<td>□ Creatinine</td>
</tr>
<tr>
<td>□ Potassium</td>
</tr>
</tbody>
</table>

In addition to inquiring about recent weight loss, signs of dehydration, and assessing the Braden Scale Nutritional sub-scale, which helps to capture protein intake, there are several signs of micronutrient deficiencies that are easy to detect when you know what to look for.

**Signs of micronutrient deficiencies:**

- Reddish tongue with a smooth surface (Vitamin B deficiency)
- Magenta flank-steak appearing tongue with cracks at corners of the mouth (called angular stomatitis) (Vitamin B₂ deficiency)
- Dementia, diarrhea, dermatitis (pellagra)—crepe paper skin with wrinkles in the skin and flat surfaces between the wrinkles—also associated with bullous pemphigoid and granuloma annulare (Vitamin B₃ deficiency)
- Prominent “snowflake” exfoliation of the epidermis of the lower legs (Essential Fatty Acid deficiency)
- Skin and capillary fragility with purpura, skin tears, increase risk of pressure ulcers, severe collagen deficiency so that the skin is like plastic wrap, and extensor tendons and venous plexus is easily seen through the transparent epidermis (Chronic Scurvy/Vitamin C deficiency)
Reddish, scaly, itchy skin lesions (Vitamin A, E, and K deficiency)
Seborrheic-like rash that is red, flaky seen along the lateral eyebrows, nasal labial folds and chin (Zinc deficiency)
Prolonged tenting of the skin in the presence of adequate fluid intake

If the presence of any of these signs of micronutrient deficiencies is noted, a referral should be made to a Registered Dietitian who can work with the primary care provider for screening of dietary deficiencies and treatment.

The Nestle Mini-Nutritional Assessment (MNA) (Toolkit item #9) is a screening and assessment tool that identifies individuals age 65 and above who are malnourished or at risk of malnutrition, allowing for earlier intervention to provide adequate nutritional support. It has not been validated for use with younger individuals. The screening tool consists of 6 questions.

- Complete the screen by filling in the boxes with the appropriate numbers.
- Total the numbers for the screening score.

The screening score (max 14 points):

- 12-14 points = normal nutritional status
- 8-11 points = at risk of malnutrition
- 0-7 points = malnourished

Nutritional Supplementation

Nutritional supplementation should be provided to a patient only after a thorough nutritional assessment has been completed and the reason for malnutrition has been identified.

Macronutrients

Macronutrients such as carbohydrates, proteins and lipids (fats) are required in adequate amounts to provide the body with total energy needs. Caloric intake of 30-35 kcal/kg of body weight is recommended for patients with chronic wounds. Patients that are underweight may require a caloric intake of 35-40% kcal/kg of body weight.

These macronutrients should be consumed daily in the following amounts:

- Carbohydrates 45-60%
- Fat 25-30%
- Protein 15-20% (1.25-1.5 g/kg of body weight)

Protein needs are increased in order for healing to occur. Diets that include inadequate amounts of protein can be blamed for “increased skin fragility, decreased immune function, poorer healing and longer recuperation after illness”. Caution should be taken when administering protein to patients with liver or kidney failure. Consultation with a Registered Dietician is recommended with this patient population.
Arginine and Glutamine are amino acids that are needed in the production of collagen. Collagen is required for healing to occur. Although supplementation of Glutamine is controversial, it is believed to be helpful in those patients where malnutrition and chronic wound healing are being addressed. Arginine is required by the body when under metabolic stress. Supplementation of Arginine has been shown to improve healing. It is important to note that both Arginine and Glutamine require adequate protein intake to be of any value.\(^{30}\)

**Fats** are an integral part of a healthy diet required for healing to occur. Omega 3 fatty acids are antithrombotic, vasodilators and anti-inflammatory. Omega 6 fatty acids are responsible for platelet aggregation, inflammation and vasoconstrictors. Further research is required before supplementation of Omega 3 or Omega 6 should be recommended.\(^{30}\)

**Micronutrients**\(^{30}\)

**Zinc**
- Should only be supplemented if deficiency is determined
- Recommended dose: 40mg of elemental zinc/day (176 mg zinc sulfate) for up to 10 days to enhance wound healing

**Asorbic Acid (Vitamin C)**
- Recommended dose: 500 to 1000 mg daily in divided doses

**Vitamin A**
- Recommended in patients taking corticosteroids
- Recommended dose: 10,000-25,000 IU daily for 10-14 days
- Use with caution in patients with protein deficiencies or liver failure

### 4.3 Optimize Medical Therapy\(^9,10,20,27,28\)

The two strategies of caring for patients with arterial wounds are to improve circulation and improve oxygenation

- **Smoking and nicotine cessation**

  Barriers to cessation should be addressed at each patient visit
  Educational, pharmacological and behavioral techniques should be utilized

  See Toolkit Item #7a for Smoking, Chronic Wound Healing, and Implications for Evidence-Based Practice – McDaniel and Browning, Toolkit Item #7b for Checklist to readiness to quit smoking, see Toolkit Item #7c for Applying 5 A’s to smoking cessation, see Toolkit Item #7d for WHY test, see Toolkit Item #7e for smoking cessation medication comparison chart and see Toolkit Item #7f for Strategies to avoid relapse.\(^{14}\)
- Suggest initiating statin therapy
- Control hypertension
- Control blood sugar if diabetic
- Suggest antiplatelet therapy (caution when used with Trental – increased chance of bleeding)
- Avoid extremes that can impair blood flow and oxygen delivery
  
  Avoid very hot or very cold contact
  Avoid very tight or very loose fitting clothing and footwear

- Encourage exercise
  
  Minimum of 30 minutes/3 times week is recommended

- Address dehydration
  
  Can impair blood flow and oxygen delivery

- Control Pain
  
  The most effective pain control with arterial ulcers is to improve the blood supply
  
  Encourage use of analgesics (pain medication) at regular intervals (eg. Every 3-6 hours) instead of taking only as needed

Recommendations for nociceptive pain (described as sharp, aching or throbbing)

Non-Opioids – eg. ASA or Acetaminophen
Mild Opioids – eg. Codeine
Strong Opioids – eg. Morphine or Oxycodone

Recommendations for neuropathic pain (described as burning, stinging, shooting, stabbing or hyperesthesia – sensitivity to touch)

Second generation tricyclic agents – eg. Nortriptyline or Desipramine

If pain is not relieved try using Gabapentin or Pregabalin

Other recommendations for pain control include:

- Positioning of leg in a dependent position may increase arterial blood flow
- Calm patient’s fears (anxiolytic may be required)
• Patient may benefit from the head of their bed being elevated. Caution: protect from pressure
• Spinal cord stimulation may reduce pain
• Prostanoids may help with rest pain
• Amputation may have to be considered for pain control and quality of life issues

4.4 Pharmacological Treatment:

a. **Pentoxifylline (Trental)**\textsuperscript{20,21}

• It is a haemorheological agent, thought to increase red and white cell filterability by altering the shape and flexibility and therefore the flow of cells, and decrease whole blood viscosity, platelet aggregation and fibrinogen levels\textsuperscript{18}
• Influences microcirculatory blood flow and oxygenation of ischaemic tissues
• May increase blood flow for patients with vasospastic disorders such as Raynaud phenomenon
• Would have very little effect in advanced peripheral arterial disease
• The full product monograph should be consulted re: precautions when using with anticoagulants such as Plavix, as Trental may increase the risk of bleeding
• In a Cochrane review of 11 randomised trials comparing Pentoxifylline with placebo or other therapy in the presence or absence of compression, in people with venous leg ulcers, Pentoxifylline was seen to be an effective adjunct to compression bandaging for treating arterial ulcers and may be effective in the absence of compression\textsuperscript{19}
• The majority of adverse effects were gastrointestinal disturbances
• If woody fibrosis and induration are present in the peri-wound area or in the leg, Pentoxifylline (Trental) 400mg TID helps to soften fibrosis and allows the wound to heal.
• **Start with a BID dosage and increase to TID as tolerated,** with appropriate precautions with individuals with known history of indigestion or GERDs.
• Be aware that it may take two months before benefit can be seen

b. **Nifedipine**\textsuperscript{20}

• May increase blood flow for patients with vasospastic disorders such as Raynaud phenomenon

4.4 Surgical and Medical Intervention Strategies\textsuperscript{20}

Interventions are aimed at reversing ischemia

a. **Endovascular Perfusion Strategies (catheter-based revascularization)**

**Angioplasty**

• Least invasive
• Cannula with guidewire inserted into artery guided by fluoroscopy
• Diseases section of artery is dilated using an angioplasty balloon
• Stent MAY be used to maintain the lumen

Potential Complications include:

• Hemorrhage
• Thrombosis
• Restenosis
• Occlusion

Catheter-directed Thrombolytic Therapy

• Thrombus dissolved using catheter

b. Surgical Perfusion Strategies

Endarterectomy

• Open surgical procedure
• Lesions are removed from the artery
• Can be performed under local anesthetic
• Appropriate for higher risk surgical patients

Arterial Bypass

• Used for extensive vascular pathology
• Creates autogenous (natural) or prosthetic (artificial) vein that bypass obstruction
• Restores circulation to ischemic tissue
• Autogenous vein is usually preferred (saphenous vein)
• Higher risk of infection if prosthetic graft used
• Successful in 85-89% of patients with critical limb ischemia

c. Oxygenation Strategies

Used for patients with incomplete arterial obstruction to increase dissolved blood oxygen

Normobaric Oxygen (can increase plasma-dissolved oxygen by 40%)
### Oxygen Delivery Methods

<table>
<thead>
<tr>
<th>Mask Type</th>
<th>Oxygen Delivery</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Venturi Mask</td>
<td>Delivers 24 to 60% oxygen</td>
<td></td>
</tr>
<tr>
<td>Nasal Cannulas</td>
<td>Delivers 24 to 40% oxygen</td>
<td>Requires nasal breathing</td>
</tr>
<tr>
<td>Nonrebreather Mask</td>
<td>Delivers 80 to 90% oxygen</td>
<td>Use should be limited to 24-36 hours</td>
</tr>
</tbody>
</table>

### Hyperbaric Oxygen Therapy (Level of Evidence 2)

- Can increase dissolved blood oxygen by up to 6 mL/dL
- Can benefit angiogenesis, fibroblast growth and collagen production
- Enhances removal of carbon monoxide from hemoglobin
- Decreases neutrophil adherence to vessel walls
- Reduces edema
- Should be considered in patients with non-reconstructable anatomy or where ulcer is not healing despite revascularization

5. Provide Local Wound Care

   a. Intervention Algorithm Figure 3
b. Signs and Symptoms of Wound Infection\textsuperscript{22,23}

(Level A, B and C: RNAO’s Assessment and Management of Venous Leg Ulcers\textsuperscript{1,2})
Arterial ulcers, like most chronic wounds, can become infected with superficial or spreading bacteria. The validated mnemonics “NERDS” and “STONEES” classify the signs and symptoms of localized infection (NERDS) and spreading infection (STONEES). Increased localized pain is a significant predictor of deep compartment infection.

**Presence of Superficial Bacteria**

- □ **N**- Non-healing wound
- □ **E**- Exudate increased
- □ **R**- Red friable (fragile tissue that bleeds easily)
- □ **D**- Debris (presence of necrotic tissue (eschar/slough) in wound
- □ **S**- Smell

**Presence of Spreading Bacteria (< 3 low bacteria count, >3 high bacteria count)**

- □ **S**- Size increasing
- □ **T**- Temperature increased (> 3 degrees F difference)
- □ **O**- Os (probes to bone or bone is increased)
- □ **N**- New areas of breakdown
- □ **E**- Exudate present
- □ **E**- Erythema and/or Edema
- □ **S**- Smell

In addition to recognizing the signs and symptoms of infection in arterial leg ulcers, it may be helpful to obtain a culture and sensitivity (C&S) using a validated method of sampling to quantify bacteria in wounds. Tissue biopsies are considered the gold standard but unfortunately are not practical in many settings. Fortunately, a linear relationship between quantitative tissue biopsy and swab for C&S taken using the Levine method of sampling (see below) has been validated and is recommended for assessing any open wound. Swabs for C&S are important in determining the type of bacteria and the appropriate antibiotics, but are not necessary to confirm the presence or absence of infection. The C&S results may not reflect the presence or absence of biofilm.

**Levine Method for obtaining C&S laboratory swab**

1. Cleanse wound thoroughly
2. Place swab on granulation tissue (must be granulation tissue only –if none present, tissue aspiration or biopsy may be required)
3. Apply enough pressure to extract fluid
4. Turn swab 360 degrees on fluid (avoid slough or debris)
5. Place swab in transport medium

**Recommendations for the use of antiseptics and antiseptic dressings**
An international consensus panel studied use of silver in healable wounds. This panel recommended that silver be used for a two week period if infections is suspected and then be reassessed. It is the opinion of Dr. David Keast, a leading wound care specialist that these recommendations can be extended to the use of all antiseptics and antiseptic dressings (e.g. iodine and PHMB).

### Choices for after initial two weeks using antiseptics or antiseptic dressings

<table>
<thead>
<tr>
<th>Healable wounds</th>
<th>Bacterial burden has been reduced and the wound is progressing to healing</th>
<th>Discontinue use of antiseptics and antiseptic dressings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacterial burden has been reduced the wound is progressing but there are patient risk factors that put them at risk of re-infection</td>
<td>Continue to use and monitor</td>
<td>Suggest: Low adherent knitted viscose fabric impregnated with a polyethylene glycol (PEG) base containing 10% Povidone Iodine</td>
</tr>
<tr>
<td>Bacterial burden is controlled but the location of the wound is such that it is at risk of recontamination e.g. perianal, or exit sites for g-tubes etc</td>
<td>Continue to use as an antimicrobial barrier.</td>
<td></td>
</tr>
<tr>
<td>No effect</td>
<td>Discontinue and change strategy such as systemic antibiotics or a change of the topical antiseptic or better debridement. As always factors such as adequate plantar pressure redistribution in neuropathic foot ulcers or compression therapy for venous disease must be in place.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Slough/Eschar</th>
<th>No slough or obvious biofilm present</th>
<th>Suggest: Iodine gel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slough is present</td>
<td>Topical antiseptic to remove biofilm needed</td>
<td>Suggest: Periodic debridement provided arterial blood supply is adequate</td>
</tr>
</tbody>
</table>

| Maintenance or Non-healable Wounds | Eschar to be kept dry | No real limit to use Use as long as required | Suggest: Povidone iodine is best as an antiseptic with drying properties. Use it as long as required to keep dry |

### Signs and symptoms of Lower Leg Cellulitis

24
• Cellulitis is a spreading bacterial infection of the dermis and subcutaneous tissues, where the edge of the erythema may be well-defined or more diffuse and typically spreads rapidly.

• Systemic upset with fever and malaise occurs in most cases, and may be present before the localising signs such as the local symptoms seen with STONEES\textsuperscript{23}.

• Lower leg cellulitis can be extremely serious with long-term morbidity, including lower leg edema. It requires prompt recognition by health care providers and appropriate interventions.

• Note that lower leg cellulitis usually affects only one leg, not both. If both legs are affected, it is likely venous dermatitis or allergic contact dermatitis, but this does not mean that it could never be cellulitis in both legs\textsuperscript{25}.

### Signs and Symptoms of Cellulitis of Lower Legs

<table>
<thead>
<tr>
<th>Risk Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>
Symptoms:
- May have fever
- May have flu-like symptoms before cellulitis develops
- Area very painful or tender
- May not tolerate current compression esp. elastic types

Signs:
- Appears as a diffuse, bright red, hot leg or may have streaking. This will spread if untreated. Mark with indelible marker to determine spread or resolution of infection. IF person has darker skin, this may be difficult to determine.
- May have a clear demarcation line of pale skin against the darker red.
- Clear serous or yellow exudate will “pour” out of the small openings, saturating the dressings quickly
- May have small blisters or large bullae unrelated to venous disease
- Rapid increase of edema up the lower leg... often starts at the foot but can start in the calf
- Raised, swollen, tight shiny or glossy skin with a stretched appearance
- Skin is hot to touch

Suggested Investigations:
- High WBC, increased ESR and C-reactive protein.
- Blood culture usually negative; swabs C&S usually negative unless necrotic tissue is swabbed (which is inappropriate)
- Takes only a pin-point opening in the skin for bacteria to enter..... grazes, abrasions, cuts, puncture wounds
- Maceration between toes in web space
- Tinea Pedis (Athlete’s foot)
- Diabetes
- Liver disease with chronic hepatitis or cirrhosis
- Lower leg edema of any etiology especially lymphedema
- Obesity with swollen limbs
- Burns
- Peripheral arterial disease
- Recent surgery (especially vein harvesting for bypass grafting) and related infections
- Osteomyelitis
- Venous stasis dermatitis; eczema or psoriasis
- Shingles or chickenpox
- Severe acne
- Any blunt trauma to the leg
- Leg ulceration
- White ethnicity
- Insect, spider or animal bites
- Immuno-suppression
- Foreign objects in the skin (e.g. orthotic pins)
- Open wounds or ulcerations

Table 5: Photo courtesy of Dr. Stephan Landis: Cellulitis with blisters and bullae

c. Management of Lower Leg Cellulitis
- Swabs for c&s not usually helpful if cellulitis is dry; if wet then should be done using LEVINE semi-quantitative method

Levine Method for obtaining C&S laboratory swab

1. Cleanse wound thoroughly
2. Place swab on granulation tissue (must be granulation tissue only – if none present, tissue aspiration or biopsy may be required)
3. Apply enough pressure to extract fluid
4. Turn swab 360 degrees on fluid (avoid slough or debris)
5. Place swab in transport medium

- Mark line of demarcation on leg distally and proximally with soft-tip indelible marker (not pen) which helps caregivers and patient to visualize if the infection spreads beyond the point of first assessment

- Compression, especially elastic systems, may be too painful to tolerate until the infection starts to respond to the antibiotic therapy. Do not stop compression entirely, because the edema will increase as a result of the cellulitis. May use appropriate lower mmHg compression such as two layers of tubular support bandage (e.g. Tubigrip)

- Treat any co-existing conditions such as venous ulcer, venous dermatitis or tinea pedis in addition to the systemic antibiotics

- In some individuals, discomfort can be soothed using a compress of Burosol solution or Burrow’s solution x 15-20 minutes available from some compounding pharmacies

- Polyhexamethylene Biguanide (PHMB – e.g. AMD) antimicrobial kerlix loose-woven (11.4 cm x 3.7 m) may be used. Wrap the affected leg from the base of the toe to below the knee, overlapping each turn by 50%. If exudate amount is large, cover with absorptive secondary dressing and kling wrap, covered by appropriate lower mmHg compression such as two layers of tubular support bandage (e.g. Tubigrip)

- Another option if there is dermatitis along with the cellulitis and the individual is not allergic to sulpha or silver, is to obtain a prescription for Silver Sulfadiazine applied 3-5 mm thick. Care should be taken to prevent the spread of the cream onto non-ulcerated areas. The cream should be followed by an absorbent pad or gauze dressing, with further application of pressure bandaging as appropriate for the ulcer. The dressing should be changed every 2 or 3 days, with cleaning and debriding being performed before application of silver sulfadiazine. It is not recommended that silver sulfadiazine cream be used in leg ulcers that are very exudative.

- Combination systemic antibiotic therapy is needed for cellulitis (see table 6)

<table>
<thead>
<tr>
<th>Situation</th>
<th>Suggested antibiotics</th>
<th>If allergic to penicillin</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Waterloo Wellington Integrated Wound Care Program: Evidence-Based Care for Arterial Leg Ulcers Final May 5, 2016
Non-purulent Skin/Soft Tissue Infection (i.e. erysipelas, cellulitis, necrotizing infections)

**MILD:** Oral treatment
Penicillin VK
Amoxicillin
Cephalexin
Cloxacillin
Clindamycin

**MODERATE:** IV treatment
Penicillin G
Cefazolin or ceftriaxone
Clindamycin

**SEVERE:**
Surgical vs. empiric treatment
Surgical
Vancomycin + Piperacilin/tazobactam

Purulent Skin/Soft Tissue Infection (i.e. impetigo, ecthyma, furuncle, carbuncle, abscess)

**MILD:** Incision and drainage

**MODERATE:** Incision & drainage and culture & sensitivity, plus empiric or defined treatment
Trimethoprim/Sulfamethoxazole Doxycycline
Cephalexin
Cloxacillin

**SEVERE:** Incision & drainage and culture & sensitivity, plus empiric or defined treatment
Vancomycin
Linezolid
Trimethoprim/Sulfamethoxazole
Cefazolin
Clindamycin

Clindamycin
Or Vancomycin
Or Linezolid

Treat for about 10 to 14 days or until signs of inflammation have resolved

Table 6: Per Dr. Stephan Landis Guelph 2015

d. Venous Dermatitis: Signs, Symptoms, Prevention and Treatment
Venous Stasis Dermatitis: Signs, Symptoms, Prevention and Treatment Table 7

<table>
<thead>
<tr>
<th>Description</th>
<th>Treatment</th>
</tr>
</thead>
</table>
| Venous Stasis dermatitis (also known as “Venous dermatitis”, “Gravitational dermatitis” or “Venous, stasis eczema” describes the red, itchy rash on the lower legs which can be dry and scaly or can weep and form crusts commonly seen in people with chronic venous insufficiency. The skin may appear brown or purple in colour and the lower legs become increasingly edematous. It may be associated with acute contact dermatitis, which appears as itching, burning red areas on the lower leg corresponding to an area where a topical product has been used. | • Avoid the use of known sensitzers in individuals with venous disease (perfume, latex, dyes, lanolin or wool alcohols, balsam of peru, cetylsterol alcohol, parabens, colophony propylene glycol, neomycin, rubber, some adhesives, framycetin or gentamycin) (Sibbald et al. 2007)  
• Limit baths and showers to 15 minutes in warm not hot water  
• Avoid harsh soaps  
• Avoid vigorous use of a washcloth or towel. Blot or pat areas dry so there is still some moisture left on the skin  
• Use moisturizers immediately after bathing such as Glaxal Base (ask pharmacist if not on shelf), Cliniderm, Eucerin or Moisturel lotions (not cream) or plain Vaseline petrolatum ointment to keep the skin healthy and free of dry scales.  
• Any products containing petrolatum or alcohol should be stopped if severely dry scaly skin develops  
• For severely dry, scaly skin (Xerosis) use products containing Urea such as Uremol 20% or Attractain (contains 10% urea and 4% AHA), Eucerin 10% Urea Lotion, Lac-Hydrin 12%  
Urea works by enhancing the water-binding capacity of the stratum corneum. Long-term treatment with urea has been demonstrated to decrease transepidermal water loss. Urea also is a potent skin humidifier and descaling agent, particularly in 10% concentration  
Lactic acid (in the form of an alpha hydroxy acid) can accelerate softening of the skin, dissolving or peeling the outer layer of the skin to help maintain its capability to hold moisture. Lactic acid in concentrations of 2.5% to 12% is the most common alpha hydroxy acid used for moderate to severe xerosis.  
• Use creams and lotions as directed, and stop if any signs of dermatitis occur.  
• Only use topical corticosteroid preparations for two weeks at a time (if being applied more frequently than 2 x/ week) because they cause skin to break down or develop a rebound dermatitis  
• If dermatitis occurs and patient is using compression stockings, there is a risk that the lotions or creams will cause accelerated deterioration of the stocking material. In this case, it is best to only apply the topical products at bedtime when the stockings are removed  
• If the dermatitis is severe, there may be a need to switch to compression bandaging with a medicated wrap containing zinc or other products. Zinc products without preservatives are available if a reaction to zinc with preservative occurs (e.g. Zipzoc)  
• Systemic antibiotic therapy is not needed for acute contact dermatitis, unless cellulitis has developed  
• Referral to dermatologist for allergy patch testing is indicated if dermatitis does not respond to treatment |

Dressing Choices for Venous Stasis Dermatitis (Eczema)
• Itching and burning can be soothed using a compress of Burosol solution or Burrow’s solution x 15-20 minutes (product is no longer available over the counter (OTC) but can be obtained in powdered sachets from some compounding pharmacies

• Apply prescribed steroidal cream to all affected areas- with added Menthol ¼ % to ½ % will aid in soothing and anti-itch effect, and cream can be kept in refrigerator

• Apply Unna’s boot using a medicated zinc paste bandage* (e.g. Viscopaste) wrapped in a spiral wrap using fan-fold pleats to prevent constriction

e. **Determining Goals for Local Treatment for Arterial Leg Ulcers**
   1,2  
   (Level A, B and C: RNAO’s Assessment and Management of Venous Leg Ulcers)

**Healable Wounds:** Have sufficient vascular supply, underlying cause can be corrected, & health can be optimized

**Goal:** Principles of wound bed preparation and moist wound healing: debridement, bacterial balance, exudate control, protect periwound skin

**Maintenance Wounds:** have healing potential, but various patient factors are compromising wound healing at this time

**Goal:** Principles of wound bed preparation and moist wound healing: debridement, bacterial balance, exudate control and protect periwound skin. Avoid higher cost advanced wound treatments until factors compromising wound healing are resolved. Focus on quality of life issues, exudate and odour management

**Non-healable/Palliative wounds:** has no ability to heal due to untreatable causes such as insufficient vascular supply, terminal disease or end-of-life

**Goal:** Avoid higher cost advanced wound treatment and focus on exudate and odour management, quality of life issues.

**Calculating Current Percentage of Healing Since Admission**

\[
\text{Surface Area (admission)} - \text{Surface Area (current)} \times 100 = \text{______} \% \text{ reduction}
\]

\[
\text{Surface Area (admission)}
\]

*Surface area = length x width

**Arterial ulcers do not follow the expected trajectory that estimates a wound should be 30% smaller at week 4 and healed by week 12. Further intervention should be considered if conservative treatment does not improve ulcer healing in 4-6 weeks.**

**Treatment Plan**

---

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If arterial supply is uncertain, dressings should be based on a non-healable program with moisture and bacterial reduction until further assessments can be performed to provide objective evidence of ‘healability’.

Caution: USE DRY WOUND HEALING
1. Keep eschar dry
2. No occlusive dressings
3. Do NOT debride
4. Avoid tourniquet effect when securing dressings with wraps (kling, tubigrip etc).
5. If eschar becomes wet/boggy – URGENT referral to advanced wound care specialist is recommended

Healing Treatment Plan

• Plan determined by vascular testing
• Need increased blood supply for healing to occur
• Surgery will likely be required to progress to healing
• Correction of the underlying disease process if possible
• Mutual agreement between the physician, nurses, team, and the client regarding setting goals about the “healability” of the wound
• Irrigation of wound should be avoided
• Surgical debridement should only be considered when there is objective evidence that the wound is healable (circulation and oxygenation issues have been treated and/or has been deemed to be sufficient for healing and cleared by vascular surgeon)
• Debridement can lead to wound enlargement, spread infection or lead to further necrosis
• If there is objective evidence that wound is healable, careful sharp, surgical, mechanical, enzymatic or autolytic debridement is recommended
• Recommended non-adherent dressings include: alginates, hydrogels or hydrocolloids
• Avoid ‘tourniquet affect’ when securing dressings
• Avoid nicotine and caffeine use
• Use of correct fitting footwear
• Avoid use of heating pads and ice packs due to decreased sensation
• Elevate head of bed on 4-6” blocks to keep heart above feet for ischemic pain

Maintenance/Non-healing Plan (no possibility of revascularization surgery)

• NO DEBRIDEMENT to be performed
• Minimize risk of infection with use of providone-iodine or chlorhexidine
• Health teaching regarding signs and symptoms of an infection to client and caregiver
• Moist wound healing is not recommended for arterial leg ulcer that cannot be revascularized. Dry gangrene or eschar should be left dry. Adding moisture to devitalized tissue would increase bacterial growth
• Use non-adherent dressings. Soft silicones are recommended to prevent further trauma
Care should be used when removing tape to prevent trauma
Avoid ‘tourniquet affect’ when securing dressings
Pain Control
Elevate head of bed on 4-6” blocks to keep heart above feet for ischemic pain

Compression Use

- Only to be used if there is objective evidence that arterial supply is sufficient for healing
- Used only under close supervision of very experienced wound care specialists for mixed (venous and arterial) etiologies
- Mild compression may be used after by-pass surgery to prevent edema (only with vascular surgeon’s order)
- Should be removed immediately if pain develops

Compression is typically contraindicated in the presence of peripheral arterial disease. In some circumstances light compression may be beneficial. In such cases, compression should be ordered by an advanced wound care physician, vascular surgeon or nurse practitioner only! See algorithm in guidelines.

f. Utilize Product Picker from Canadian Association of Wound Care (CAWC)

Product Picker for Classification of Dressing Products
Each organization may use the PDF Fillable CAWC Product Picker to list the products available within their organization (see Toolkit Item #12)

Link to Product Picker

g. South West Regional Wound Care Program’s Wound Cleansing Table: 8 (see Toolkit Item #13 for reference chart)
## Wound Assessment

<table>
<thead>
<tr>
<th>Clean Epithelializing Wound</th>
<th>Clean Granulating Wound, Decreasing in Surface Area 20-30% in 3-4 Weeks*</th>
<th>Clean Granulating Wound NOT Decreasing in Size 20-30% in 3-4</th>
<th>Necrotic Healable Wound (Debridement is Appropriate)</th>
<th>Necrotic Non-Healable Wound (Debridement is NOT Appropriate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrigate with &lt; 7 PSI pressure, or pour solution over the wound bed.</td>
<td>Irrigate with &lt; 7 PSI pressure, or pour solution over the wound bed.</td>
<td>Irrigate with 7-15 PSI pressure.</td>
<td>Irrigate with 7-15 PSI pressure.</td>
<td>Do not irrigate or cleanse the wound itself (the intent is to allow the necrotic tissue to dry out and stabilize).</td>
</tr>
<tr>
<td>Use at least 100cc’s of solution, at room or body temperature.</td>
<td>Use at least 100cc’s of solution, at room or body temperature.</td>
<td>Use at least 150cc’s of solution, at room or body temperature.</td>
<td>Use at least 150cc’s of solution, at room or body temperature.</td>
<td></td>
</tr>
<tr>
<td>Cleanse the periwound skin of debris, exudates.</td>
<td>Cleanse the periwound skin of debris, exudates.</td>
<td>Cleanse the periwound skin of debris, exudates.</td>
<td>Cleanse the periwound skin of debris, exudates.</td>
<td></td>
</tr>
<tr>
<td>No antimicrobial solutions.</td>
<td>No antimicrobial solutions.</td>
<td>No antimicrobial solutions.</td>
<td>No antimicrobial solutions.</td>
<td></td>
</tr>
</tbody>
</table>

**Malignant Wounds**

<table>
<thead>
<tr>
<th>Wound with Debris or Contamination/ Superficial &amp; Partial</th>
<th>Wound with Debris or Contamination/ Superficial &amp; Partial</th>
<th>* Localized And/Or Spreading Infection</th>
<th>Maintenance Wounds</th>
</tr>
</thead>
</table>

*Granulating wounds not decreasing in size may have a localized infection.

If there is exudate present on the periwound skin, gently cleanse it and pat dry.

Topical application of providine-iodine solution or Chlorhexadine to the wound surface is appropriate, i.e. paint with Proviodine.
<table>
<thead>
<tr>
<th>Thickness Burn</th>
<th>Thickness Burn</th>
<th>Thickness Burn</th>
<th>Cleansing will be dependent on characteristics of wound bed and goal of treatment.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrigate with 7-15 PSI pressure, if tolerated. Reduce pressure as needed to minimize pain and damage to friable tumor tissue. Use at least 150cc’s of solution, at room or body temperature. Cleanse the periwound skin of debris, exudates. Foul odor indicates presence of anaerobes - use an antimicrobial solution, and/or topical Metronidazole.</td>
<td>Irrigate with 7-15 PSI pressure. Use at least 150cc’s of solution, at room or body temperature. Cleanse the periwound skin of debris, exudates. May cleanse small burns with lukewarm tap water and mild soap.</td>
<td>Irrigate into tunneled/undermined area using a 5Fr catheter or “soft-cath” with a 30cc syringe. Use at least 150cc’s of solution, at room or body temperature. Cleanse the periwound skin of debris, exudates. Gently palpate over undermined or tunneled areas to express any irrigation solution that is retained. Do not force irrigation when resistance is detected. Cleanse the periwound skin of debris, exudates.</td>
<td>CLEANING will be dependent on characteristics of wound bed and goal of treatment. If goal is to prevent wound from deteriorating, cleanse as per a Necrotic Non-Healable Wound.</td>
</tr>
<tr>
<td><strong>Two week challenge:</strong> May use a 10 – 14 day cleansing regime with an antimicrobial solution to address bacterial burden.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** Normal saline and sterile water do NOT contain preservatives and must be discarded 48 hours after opening

Table courtesy of South West Regional Wound Care Program 2015
<table>
<thead>
<tr>
<th>Wound Appearance</th>
<th>Description</th>
<th>Exudate Level Depth</th>
<th>Treatment Objective</th>
<th>Cleansing (min. 100 mL of room/body temperature solution) **</th>
<th>Suggested Dressing Products and Rate Changes ***</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primarily Slough or Mixed Granulating/Slough Wound Tissue</td>
<td><em>Eschar</em></td>
<td>None → Moderate Unknown</td>
<td>Debride (unless the eschar is stable and on a heel. If stable eschar is on a heel use the maintenance enabler)*</td>
<td>7-15 PSI irrigation NS or sterile water or commercial wound cleanser</td>
<td>Have ET/WCS cross-hatch hard eschar first! Hypertonic dressing [1+] (daily) Or Hydrogel [0] (max 3 days) Or Hydrogel [0] (max 3 days) buttered with a Hydrogel [1+] (daily) Or Hypertonic dressing [1+] buttered with a Hydrocolloid Iodine [1+] Or Hydrocolloid Iodine buttered with a Hydrocolloid Iodine</td>
</tr>
</tbody>
</table>
* Only debride healable wounds.
** If antimicrobial effect is required, consider topical antiseptic cleansers, i.e. chlorhexidine 2% or 4% (for pseudomonas – must soak x 5 min. minimum), povidone-iodine, or ¼ strength acetic acid (for pseudomonas only – must soak x 5 min. minimum).
*** If antimicrobial effect is required, consider topical antimicrobial dressings, i.e. silver compounds, iodine compounds, chlorhexidine derivatives, honey, or gentian violet and methylene blue.
**** For stalled granulating or epithelializing wounds consider cadexomer iodine or povidone iodine to initiate acute inflammation or calcium alginate or protease inhibitor dressings to address chronic inflammation.
ALSO, may consider pain controlling dressings for painful exudating wounds, biologic dressings for stalled granulating +/- epithelializing wounds in the absence of infection or large drainage, charcoal dressings for odor control (once the cause of the odor has been investigated and treated if able, and adjunctive therapies as indicated.

Disclaimer: The information herein is for general informational purposes only and is not intended, nor should it be considered, as a substitute for professional medical advice. Always seek the advice of the attending physician or other qualified healthcare provider regarding a medical condition or treatment. Dressing selection cannot take place in isolation – a holistic patient assessment is MANDATORY.

Table courtesy of South West Regional Wound Care Program 2015
<table>
<thead>
<tr>
<th>Wound Appearance</th>
<th>Description</th>
<th>Exudate Level</th>
<th>Depth</th>
<th>Treatment Objective</th>
<th>Cleansing (min. 100 mL of room/body temperature solution) **</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eschar</td>
<td>Primarily Slough, Mixed Granulation/Slough, or Fibrin Wounds</td>
<td>None → Moderate</td>
<td>Partial → Full Thickness</td>
<td>Stabilize/dry necrotic tissue, prevent extension/infection, manage odor**/pain, protect</td>
<td>Cleanse exudate from periwound skin. Paint wound with Proviodine or Chlorhexadine 2%. Pat or air dry.</td>
</tr>
<tr>
<td>Granulation</td>
<td>Small → Large</td>
<td>Small → Large</td>
<td>Partial → Full Thickness</td>
<td>Absorb/dry, fill dead space, prevent extension/infection, manage odor**/pain, protect</td>
<td>POUR Proviodine or Chlorhexadine 2% solution (min. 100cc). Pat or air dry.</td>
</tr>
<tr>
<td>Malignant Wound</td>
<td>Small → Copious</td>
<td>Small → Copious</td>
<td>Partial → Full Thickness</td>
<td>Absorb/dry, fill dead space, prevent infection, manage odor**/bleeding/pain***, protect</td>
<td>POUR Proviodine or Chlorhexadine 2% solution (min. 100cc). Soak with solution if pouring is too painful. Pat or air dry.</td>
</tr>
<tr>
<td>Localized or Spreading Infection</td>
<td>Small → Copious</td>
<td>Superficial → Full Thickness</td>
<td></td>
<td>Absorb/dry, fill dead space, reduce bacterial burden, manage odor**/bleeding/pain, protect</td>
<td>7-15 PSI irrigation Proviodine or Chlorhexadine 2% solution (min. 100cc). Pat or air dry.</td>
</tr>
</tbody>
</table>
Suggested Dressing Products and Rate Changes

(Dressing change frequency depends on the wear time of the primary dressing and the ability of the dressing components to keep the wound dry)

Exudate capacity of dressings:

[0] = none
[1+] = small
[2+] = moderate
[3+] = large
[4+] = copious

Dressing wear times are found in brackets ( )

DO NOT DEBRIDE*

- Proviodine or Chlorhexadine 2% soaked non-woven gauze [1+] +/- Non-Adherent Synthetic (daily)
- Or PHMB gauzed based dressings [0-1+] +/- Non-Adherent Synthetic (max 3-7 days)
- Or Antimicrobial Non-Adherent Dressing [0] (max 7 days)

**Cover Choices:**

- Non-woven gauze [1+]
- Or Ultra-Absorbent [2-4+]

OR

After painting the eschar, leave it open to air if it is non-draining!

DO NOT DEBRIDE*

- Proviodine or Chlorhexadine 2% soaked non-woven gauze [1+] +/- Non-Adherent Synthetic (daily)
- Or PHMB gauzed based dressings [0-1+] +/- Non-Adherent Synthetic (max 3-7 days)
- Or Antimicrobial Non-Adherent Dressing [0] (max 7 days)
- Or Nanocrystalline Silver Dressings [1+] (max 7 days)

**Cover Choices:**

- Non-woven gauze [1+]
- Or Ultra-Absorbent [2-4+]

DO NOT DEBRIDE*

- Proviodine or Chlorhexadine 2% soaked non-woven gauze [1+] +/- Non-Adherent Synthetic (daily)
- Or PHMB gauzed based dressings [0-1+] +/- Non-Adherent Synthetic (max 3-7 days)
- Or Non-Adherent Synthetic +/- antimicrobial component [0] (max 7-14 days)
- Or Calcium Alginate +/- antimicrobial component [2+] (max 7 days)
- Or Hydrophilic Fiber +/- antimicrobial component [2+] +/- Non-Adherent Synthetic [0] (max 7 days)

**Cover Choices:**

- Foam [1-3+] (max 7 days)
- Or Composite [2-3+] (max 7 days)
- Or Ultra-Absorbent [2-4+]

Consider conservative sharp debridement of NON-VIABLE tissue only, by an ET/WCS, to reduce bacterial burden

- PHMB gauze based dressings [0-1+] (max 3-7 days)
- Or Antimicrobial Non-Adherent Synthetic [0] (max 7 days)
- Or Antimicrobial Calcium Alginate [2+] (max 7 days)
- Or Antimicrobial Hydrophilic Fiber [2+] (max 7 days)
- Or Nanocrystalline Silver Dressings [1+] (max 7 days)
- Or Antimicrobial Charcoal [0-2+] (max 7 days)
- Or Antimicrobial Foam [1-3+] (max 7 days – acts as secondary dressing too)

**Cover Choices:**

- Foam [1-3+] (max 7 days)
- Or Composite [2-3+] (max 7 days)
- Or Ultra-Absorbent [2-4+]
* Only debride healable wounds.
** Consider charcoal dressings or topical Metronidazole for odor control once the underlying cause has been determined and managed if possible.
*** Consider pain control foam dressing for painful, exudating wounds. Dressing must be in direct contact with wound bed.
**** Consider ¼ strength acetic acid or Chlorhexidine 4% soaks (x 5 minutes) for pseudomonas treatment.

Disclaimer: The information herein is for general informational purposes only and is not intended, nor should it be considered, as a substitute for professional medical advice. Always seek the advice of the attending physician or other qualified healthcare provider regarding a medical condition or treatment. Dressing selection cannot take place in isolation – a holistic patient assessment is MANDATORY.

Table courtesy of South West Regional Wound Care Program 2015

Note
Link to: Canadian Association for Enterostomal Therapy’s ‘Evidence-Based Recommendations for Conservative Sharp Wound Debridement’
h. **Patient Education on Skin Care**

Skin care is a vital element to promote wound healing and prevent recurrence of arterial leg ulcers.

The following information is provided to clients as recommended practices:

- Avoid harsh soaps or highly perfumed soaps.
- Soothe any local skin irritation with a moisturizing cream.
- Avoid creams with perfumes and lanolin, as these products increase the risk of dermatitis.
- Monitor skin for potential reactions, and if present, contact your care provider.
- Discuss long-term use of steroids with your care provider.
- Avoid the use of adhesive products due to increased sensitivity of people with arterial disease

i. **Adjunctive Therapies**

Consider Multi-disciplinary referrals for adjunctive therapy.

Adjunctive therapy refers to additional treatment used together with the primary treatment to achieve the outcome of the primary treatment. These should be limited to healable wounds.

**Autografts and Allografts**

- Can accelerate wound closure after adequate blood flow has been restored

**Spinal Cord Stimulation**

- Improves limb salvage and rest pain (requires physiotherapy referral)

**Intermittent Pneumatic Leg Compression**

- Increases blood flow
- May be used prior to or after revascularization

**Hyperbaric Oxygen**

- Should be considered when patient is not a surgical candidate or when vascular surgery does not result in wound healing
Insufficient evidence to use the following with arterial ulcers

- Use of biomaterials
- Ultrasound
- Electrical Stimulation
- Negative Pressure Wound Therapy (NPWT)
- Nitropatch

Note: NPWT may be used with caution with patients that have chronic limb ischemia when all other modalities have failed. If TCPO$_2$ is less than 40 mmHg, NPWT is contraindicated.

6. Provide Organizational Support $^{1,2}$

a. Multi-disciplinary Team Intervention Referral Criteria Checklist

| Identify multi-disciplinary team referrals that need to be arranged | ☐ Primary Care Physician |
| | ☐ Advanced Wound Specialist |
| | ☐ Nurse Practitioner |
| | ☐ Infectious Disease Specialist |
| | ☐ Vascular Surgeon |
| | ☐ Dermatologist |
| | ☐ Plastic surgeon |
| | ☐ Internist/Endocrinologist |
| | ☐ Mental Health Specialist |
| | ☐ Psychologists |
| | ☐ Social work |
| | ☐ Registered Dietitian |
| | ☐ Pharmacist |
| | ☐ Occupational Therapist |
| | ☐ Physiotherapy |
| | ☐ Chiropodist |
| | ☐ Certified Pedorothist |
| | ☐ Certified Orthotist |
| | ☐ Certified Prosthetist |
| | ☐ Podiatrist |
| | ☐ Lymphatic Massage |
| | ☐ Compression Stocking Fitter |

**iFUN Criteria guidelines for referral to an advanced wound specialist**

<p>| i | Intervention | If an intervention is required (i.e. ABPI, toe pressures, debridement) |
| F | Frequency | If the frequency of dressing changes is not less than 3 x a week within 4 weeks of treatment |
| U | Unknown | If the cause of the wound or the cause of the failure to heal is unknown |
| N | Number | If the size of the wound has not decreased by 20-30% in 3-4 weeks of treatment |</p>
<table>
<thead>
<tr>
<th><strong>CRITERIA</strong></th>
<th><strong>SUGGESTIONS FOR REFERRAL</strong></th>
</tr>
</thead>
</table>
| Presence of fixed ankle joint or impaired calf muscle pump in the presence of edema | Refer to physiotherapy for ankle/calf-muscle pump training and controlled exercise.  
(Level A: RNAO’s Assessment and Management of Venous Leg Ulcers ¹ ²)                                                                                                                                                                                                                                    |
| If ulcer >5cm² &/or > 6 months duration on admission, or not healed (100%) at 3 months. | Refer to physiotherapy or other qualified health professional for spinal cord stimulation or Intermittent Pneumatic Leg Compression ²⁰                                                                                                                                                                                                 |
| Patient requiring assistance to quit smoking                                  | Refer patient to smoking cessation program, pharmacist, social worker, physician and/or counsellor  
(Level A: RNAO’s Integrating Smoking Cessation into Daily Practice ¹⁴)                                                                                                                                                                                                                       |
| Medical management may include appropriate systemic antibiotic therapy for patients with bacteremia, sepsis, advancing cellulitis or osteomyelitis. | Refer to family physician or Infectious Diseases Specialist for antibiotic treatment.  
(Level C: RNAO’s Assessment and Management of Venous Leg Ulcers ¹ ²)                                                                                                                                                                                                                       |
| Prevent or manage pain                                                       | Refer to family physician, pain and symptom management team or pharmacist as needed  
(Level C: RNAO’s Assessment and Management of Venous Leg Ulcers ¹ ²)                                                                                                                                                                                                                       |
| Patient is not a surgical candidate or wound does not heal despite revascularization surgery | Refer to Hyperbaric Oxygen Therapist  
(Level 2: Cochrane Database Review ³¹)                                                                                                                                                                                                                                                         |
| Mini Nutritional Assessment (MNA) < 24  
Unable to afford or have access to nutritional food                                  | Refer to Registered Dietitian  
Refer to Social Work  
(Level B: RNAO’s Assessment and Management of Venous Leg Ulcers ¹ ²)                                                                                                                                                                                                                           |
| Contact dermatitis due to suspected sensitivity to allergens                 | Refer to dermatologist for patch testing  
(Level B: RNAO’s Assessment and Management of Venous Leg Ulcers ¹ ²)                                                                                                                                                                                                                               |
<p>| Mobility Issues                                                              | Refer to physiotherapy or occupational therapist for mobility or gait aids                                                                                                                                                                                                                     |</p>
<table>
<thead>
<tr>
<th>Need for spinal stimulation</th>
<th>Refer to physiotherapy for this adjunctive therapy&lt;sup&gt;20&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unable to complete lower leg assessment and/or ABPI</td>
<td>Refer to wound care specialist, trained nurse or vascular lab</td>
</tr>
<tr>
<td>ABPI 0.5 to 0.8 TBPI 0.64 to 0.7</td>
<td>Suggest Transcutaneous Oxygen Pressure(TcPo&lt;sub&gt;2&lt;/sub&gt;), Laser Doppler Flowmetry, Doppler Arterial Waveforms or Segmental Doppler Pressure studies be performed and vascular surgeon consult obtained</td>
</tr>
</tbody>
</table>

b. **Patient, Caregiver and Healthcare Provider Teaching and Learning Resources**

- Patient Journal

c. **Discharge or Transfer Planning and Communications**

Regardless of the method of providing the information (e.g. Care Connect, photocopy or Discharge Summary), it is agreed that the following information is critical in providing seamless care when individuals who have arterial leg ulcers are being discharged or transferred to a different care setting:

- Lower leg assessment
- Need to reassess ABPI/TBPI in 6 months
- Recent vascular study results (e.g. ABPI, TPBI, Transcutaneous Oxygen Pressure(TcPo<sub>2</sub>), Laser Doppler Flowmetry, Doppler Arterial Waveforms or Segmental Doppler Pressure studies)
- Relevant consultation notes
- Diagnostic results
- Current treatment plan

d. **Waterloo Wellington Integrated Wound Care Program Evidence-Based Wound Care Arterial Clinical Pathway**

   Placeholder for Pathway
Content Item #

1. Arterial Leg Ulcer Pathway
2. CAWC Best Practice Enabler
3. CAWC Quick Reference Guide
4. Brief Pain Inventory Short Form
5. Canadian Nurses Association Social Determinants of Health and Nursing: A Summary of Issues
6. Assessing Patient-Centered Concerns Worksheet
7. Smoking Cessation
   a. Smoking Cessation Smoking, Chronic Wound Healing and Implications for Evidence-Based Practice (Article by: McDaniel and Browning 2014)
   b. Readiness to Quit Smoking Checklist
   c. Applying 5A’s to Smoking Cessation
   d. WHY test
   e. Smoking Cessation Medication Comparison chart
   f. Strategies to Avoid Relapse
8. Patient Medical History and Physical Assessment Form
9. Lower Leg Assessment Form
10. Wound Assessment Forms
    a. Bates-Jensen Wound Assessment
    b. Lower Leg Assessment Tool (LUMT)
11. Mini Nutritional Assessment Form (MNA)
12. Quality of Life Assessments
    a. Cardiff Wound Impact Questionnaire
    b. World Health Organization QOL
13. Depression Screening Tools
    a. Geriatric Depression Screen
14. Dressing ‘Product Picker’
15. South West Region Wound Care Program: Wound Cleansing Table and Dressing Selection & Cleansing Enablers
16. Registered Nurses Association of Ontario Learning Package: Assessment and Management of Venous Leg Ulcers

17. Patient Diary

18. Arterial Treatment Algorithm
References


