

# Best Practice Recommendations For Skin Health and Wound Management 2025

## CHAPTER 13

## Prevention and Management of Wounds Related to Lower Limb Lymphedema

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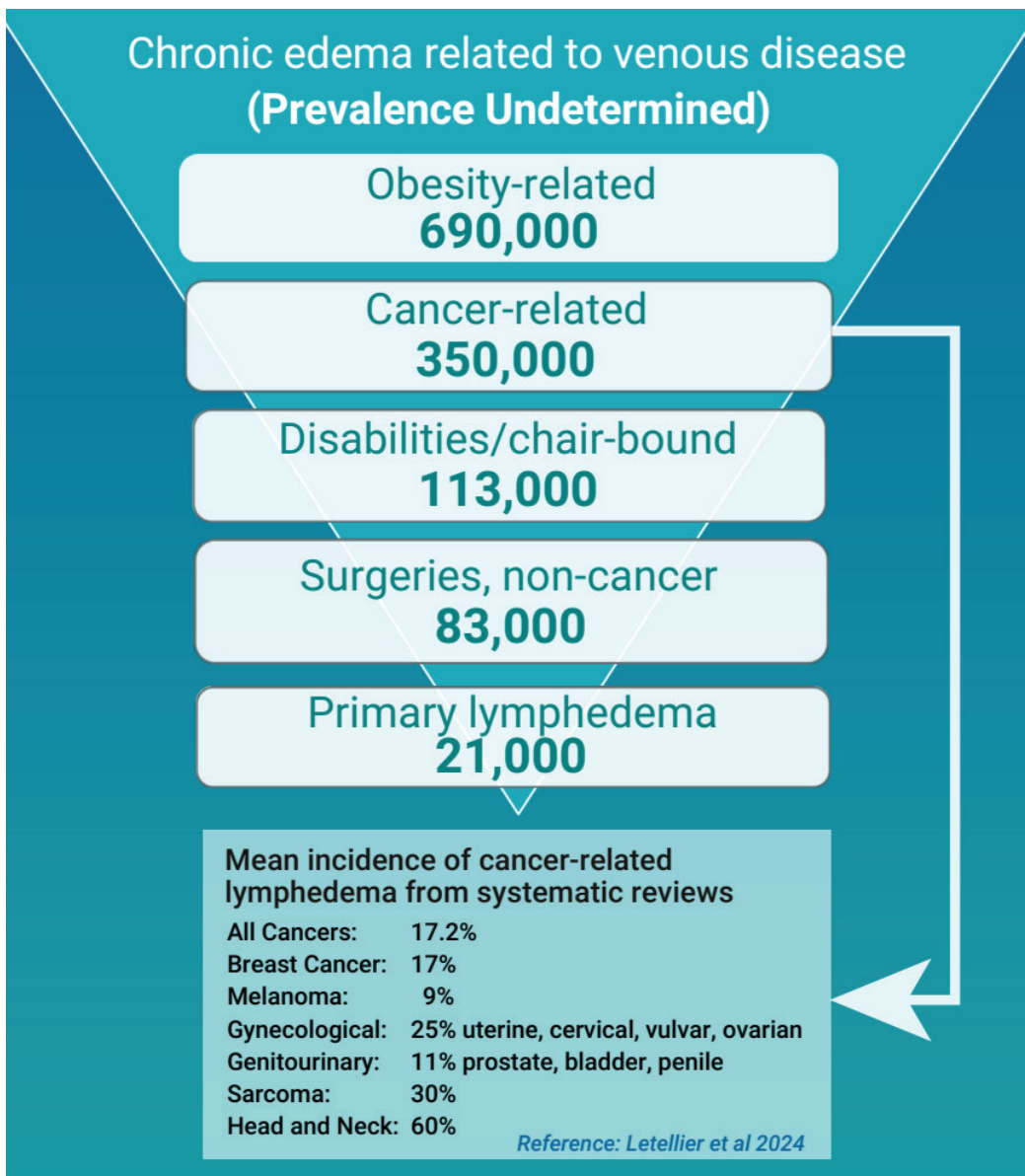
# INTRODUCTION

Lymphedema, often termed a hidden disease, is generally under-assessed and under-appreciated by health-care providers.<sup>1,2</sup>

Edema that persists for more than three months and is minimally responsive to limb elevation and/or diuretics is defined as chronic edema. All chronic edema involves lymphatic dysfunction and is appropriately classified as lymphedema (LE).

Lymphedema affects more than 200 million people worldwide.<sup>3</sup> In the United States, it is estimated that 35 million individuals have the condition.<sup>4,5</sup> The prevalence of LE in Canada is approximately 1.25 million (based on 41.5 million population), but the condition is underdiagnosed and undertreated.<sup>146</sup> LE is associated with obesity, the rates of which are increasing in Canada.<sup>6,7,146</sup> Because of these factors it is important that patients receive timely assessment, diagnosis and referrals for activation of treatment, with an important focus on skin health and the prevention and management of wounds related to LE. This is crucial, as wound care is a costly concern to the health-care system and more research is needed to fully appreciate the impact of LE on this issue.<sup>8,9</sup> Figure 1 presents information on potential prevalence of LE and its associations with other health conditions.

**Figure 1:** Lymphedema and Chronic Edema Potential Prevalence, Canada 2024



## What is Lymphedema?

Lymphedema, whether congenital or secondary, is a serious, debilitating and progressive condition that develops when protein-rich fluid accumulates because the ability of the lymphatic system is inadequate to transport the excessive interstitial fluid. The fluid accumulation is most commonly seen in the extremities.<sup>4,10</sup> The condition may range from mild to serious and affect patients of all ages, impacting quality of life, employment/employability, mobility and social and emotional wellness. Individuals who develop LE live with chronic, progressive swelling, skin changes, risk of infection, emotional distress and pain. Therefore, a holistic approach to lifelong care is required, including multiple referrals and reports from an interprofessional team whose members may represent lymphology, rheumatology, dermatology, endocrinology (diabetes mellitus), orthopedics and internal medicine (renal, cardiac, respiratory, bariatric) to determine causality.

Early diagnosis of LE is critical, as the disease is progressive. In the past, chronic leg edema (over three months) was not identified as LE. Recently, international experts have determined that though the pathology of chronic edema and LE may differ, the disorder is to be considered similar, as the overload or impairment of the lymphatics is the constant factor.<sup>11</sup>

Patients diagnosed with lower limb LE often live with other co-occurring diseases/disorders such as obesity.<sup>1</sup> To understand the state of LE in Canada, Wang and Keast (2016) reviewed 326 LE patients and found an average of 7.3 comorbid conditions that were potentially related to the development of chronic edema; hence the term *complex* lower extremity edema.<sup>11</sup> Of importance is that they reported that 45% of patients were found to be morbidly obese. They state, “it is conservatively estimated that over half those with a BMI  $\geq$  40 will have lymphedema and if BMI  $\geq$  50 the risk increases to 100%.”<sup>6</sup>

Other causes of lower extremity LE include phlebo-lymphedema, most commonly known as chronic venous insufficiency (CVI) (41.8%), cancer-related lymphedema (33.9%), primary lymphedema (12.5%) and lipedema with secondary LE (11.8%).<sup>12</sup>

**Lipedema versus Lymphedema:** One of the challenges for clinicians is understanding the differences between lipedema and LE. Lipedema is an, “abnormal fat accumulation [and] is not a lymphatic-related disease (at least in the early states), and conventional imaging results demonstrate normal lymphatic functioning”.<sup>13</sup> Based on the patient’s lipedema history, hormone changes and genetics, secondary LE may develop as a complication.

The Canadian Lymphedema Framework states lipedema, “is caused when higher than normal fat deposits build up on the buttocks, legs, ankles and feet. This is not obesity and weight control makes no difference. Like LE, lipedema is a lifelong condition. But, they are different conditions and lipedema is often misdiagnosed as lymphedema.”<sup>14</sup> Lipedema tissue is very painful, as is often noted on assessment.<sup>15</sup>

For more information on lipedema, see Appendix A: Lipedema.

Quere et al. explored the prevalence of patients with LE or chronic edema in acute care hospitals internationally. In the study of participants (n=1905), LE or chronic edema was identified in 723 (38%) of patients. Risk factors associated with chronic edema were age, morbid obesity, heart failure, immobility (chair bound) and neurological issues. Patient history of cellulitis was more frequent in patients with chronic edema and wounds (24.8%) and in those with chronic edema alone (14.1%), when compared with the 1.5% prevalence in patients without chronic edema.<sup>16</sup>

When reviewing the studies for LE prevalence it is important to note the methodology used to collect data.<sup>17</sup> Keast notes that in Canada, we are dependent on self-reported census data, of which obesity rates may not be accurate.<sup>6</sup> More research is needed to accurately understand the LE incidence.<sup>18</sup>

The focus of this chapter is on adults with LE, therefore the specific challenges of pediatric LE are beyond its scope.

## Pathophysiology

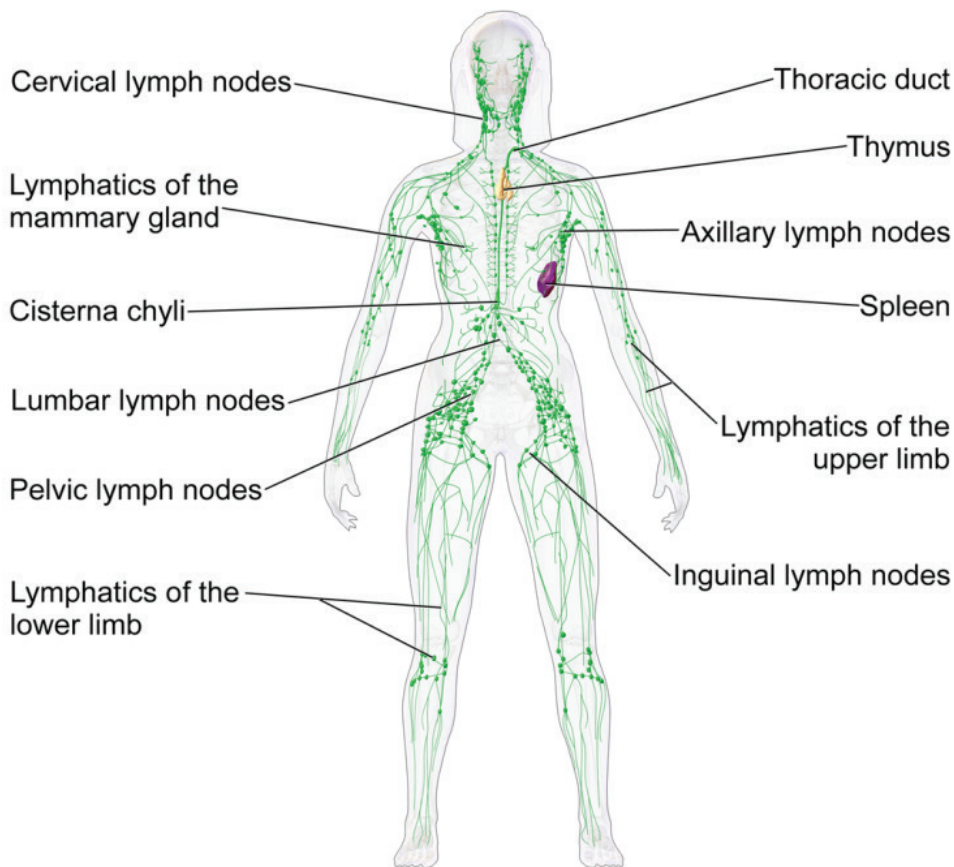
Understanding the pathophysiology of LE is important for successful assessment and management of the disease. It is important to consider the lymphatics, arteries and veins together.<sup>6</sup> The lymphatics are responsible to, “mobilize all

excess tissue fluid...have an immune function and a key role in fat metabolism. Lymphatics absorb fat from the digestive system and transport it as chyle to the circulatory system. It is known that LE and fat metabolism are linked".<sup>6</sup>

The lymphatic system consists of lymph vessels, lymph nodes, spleen, thymus, tonsils and Peyer's patches. The lymphatic system has a major role in the functioning of the immune system. It is now recognized that the vascular capillaries, the extracellular matrix and the lymphatics act as a co-ordinated unit and play a key role in regulating fluid and molecular transport.<sup>19</sup> The lymphatic system also plays a role in regulating the function of such organs as the brain, kidneys and liver. See **Chapter 3: Skin: Anatomy, Physiology and Wound Healing**<sup>25</sup> for additional information on the lymphatic system.

The lymphatic capillaries connect to common lymphatic collectors that merge into a single lymph vessel (lymphangion). Smooth muscle in the lymphangion contracts once distended to propel lymphatic fluid through the valves in a peristaltic manner. Normal lymph propulsion is aided by adjacent arterial pulsations, muscle contractions, body movements, respiration and skin distention. The lymph vessels ultimately connect to the thoracic duct, which empties into the subclavian vein (See Figure 2).

**Figure 2:** The Lymphatic System



Source: Medical gallery of Blausen Medical 2014. Blausen 0623. Lymphatic system in the female - English labels. At AnatomyTOOL.org by Blausen.com staff (2014), license: Creative Commons Attribution. Available at: [https://en.wikiversity.org/wiki/WikiJournal\\_of\\_Medicine/Medical\\_gallery\\_of\\_Blausen\\_Medical\\_2014](https://en.wikiversity.org/wiki/WikiJournal_of_Medicine/Medical_gallery_of_Blausen_Medical_2014)

Water, glucose, amino acids and oxygen filter out of the capillaries into the interstitial space, nourishing the cells and supporting metabolism, thereby creating waste products. Large molecules such as proteins do not easily cross the semipermeable membranes of the walls of the capillaries. Filtration and reabsorption by the capillaries are dynamic processes, and proteins may be partially reabsorbed. However, lymphatic capillaries have a unique structure that allows the absorption of these large protein molecules and waste products. The cells of the lymphatic capillaries have anchoring filaments and are able to separate from one another to create an opening through which fluids, proteins and macromolecules can flow into the lymphatic capillary. The resulting fluid is known as lymph. Lymphatic fluid

also may include lipids (that are absorbed in the intestine), waste products of metabolism, matrix metalloproteinases (MMPs), cytokines, polysaccharides and fibronectin.

There is no net reabsorption by the capillaries, and all residual tissue fluid is handled by the lymphatics. While lymphatics have significant reserve capacity they can be blocked, absent or overwhelmed. When there is an imbalance between filtration and absorption, fluid will accumulate in the interstitial space and is assessed clinically as edema. All chronic edema lasting more than three months is defined as LE.

### **Lymphedema and the Development of Wounds**

Slow- and non-healing wounds associated with LE are more likely to be identified in the lower extremity than upper limbs (most upper limb LE is related to breast cancer treatment). The higher intravascular hydrostatic pressure related to gravitational forces, chronic dependency and failed calf-muscle pump action in the lower limb result in higher filtration rates. This then leads to accumulation of tissue fluid, overwhelms the lymphatic capacity and results in subsequent inflammatory lymphatic dysfunction.

In a review of international studies, the prevalence of persons with LE (n= 2,200) and chronic wounds mostly involved persons in developed countries.<sup>1</sup> Approximately half of all individuals with LE in acute care, long-term care or community nursing settings develop slow- or non-healing wounds.<sup>1</sup>

When the lymphatic system is impaired, blocked or overloaded the skin is affected, making it more susceptible to breakdown.<sup>19</sup> Immune system involvement leads to a triggered inflammatory response.<sup>20</sup> Risk for repeated episodes of acute and chronic cellulitis increases.<sup>21</sup> The “stagnant, protein-rich lymph initiates an inflammatory response that leads to adipocyte proliferation, fibrous tissue deposition, and increased susceptibility to infections.”<sup>22</sup>

### **The Quintuple Aim for Health-care Improvement**

This chapter is written with the intent to encompass the quintuple aim for health-care improvement (See Table 1) to enhance the patient experience, reduce costs, improve population health, improve the clinician experience and enhance equity. The health equity element is particularly important for patients living with skin issues and wounds related to LE. Ensuring all patients receive care, appropriate supplies and ongoing preventative strategies needs to be recognized and communicated to policy makers.<sup>23</sup>

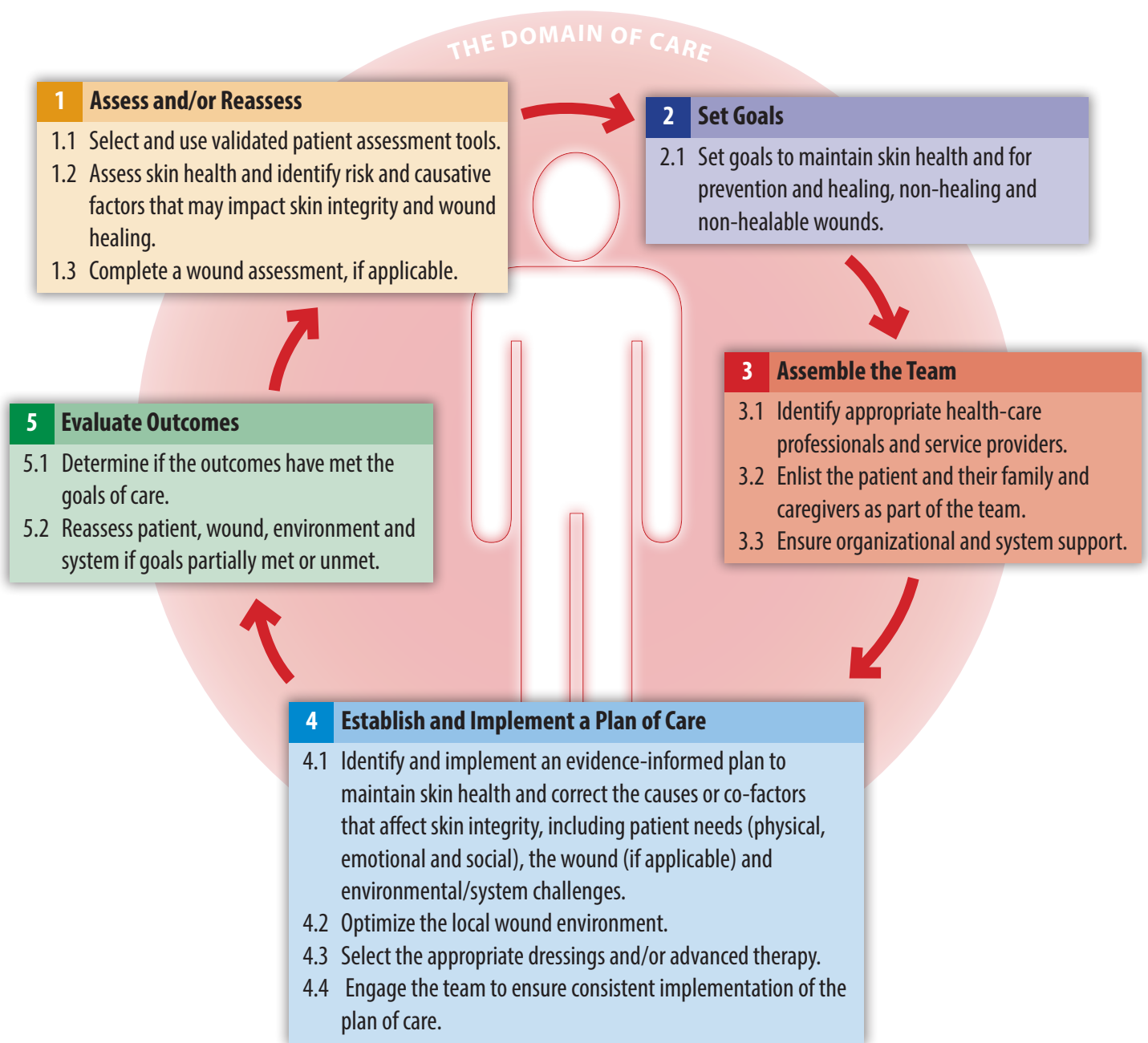
**Table 1:** Quintuple Aim and Management of Lymphedema

<b>Five Components</b>	<b>Application to Lymphedema</b>
Improving population health	Prevention, education and self-management strategies
Reducing costs	Application of best practice to ensure most effective treatment Appropriate use of resources: examples include compression therapy designed for each individual, bandaging, dressings, exercise and weight management programs
Advancing health equity	Application of principles to all those at risk for or affected by LE
Care team wellbeing	Provision of clinically usable information for frontline clinicians
Enhancing the patient experience	Provide a supportive process of care for all those with LE and associated skin and wound issues

## **THE WOUND PREVENTION AND MANAGEMENT CYCLE**

This chapter offers a practical, easy-to-follow guide that incorporates the best available evidence. It outlines a process, or series of consecutive steps, that supports patient-centred care. This process, called the Wound Prevention and Management Cycle (See Figure 3), guides the clinician through a logical and systematic method for developing a customized plan for the prevention and management of wounds from the initial assessment to a sustainable plan targeting self-management for the patient.

**Figure 3:** The Wound Prevention and Management Cycle



The recommendations in this chapter are based on the best available evidence and are intended to support the clinician, the patient, their care partners and family and the health-care team in planning and delivering the best clinical practice. Two foundational chapters supplement this chapter with additional evidence-informed information and recommendations that are general to all wound types: [Chapter 3: Skin: Anatomy, Physiology and Wound Healing](#)<sup>25</sup> and [Chapter 4: Best Practice Recommendations for the Prevention and Management of Wounds: An Overview](#).<sup>24</sup>

Three guiding principles within the best practice recommendations (BPRs) chapters support effective prevention and management of skin breakdown:

1. The use of the Wound Prevention and Management Cycle, regardless of the specifics, to prevent and manage skin breakdown
2. The constant, accurate and multidirectional flow of meaningful information within the team and across all care settings, and
3. The patient as the core of all decision making.

# Step 1: Assess and/or Reassess

## Recommendations

### 1.1 Select and use validated patient assessment tools

**Discussion:** Complete a comprehensive patient assessment as outlined in Chapter 4: Best Practice Recommendations for the Prevention and Management of Wounds: An Overview.<sup>24</sup> The use of validated and standardized risk assessment tools is essential for skin health and wound management. Currently, there are no specific validated assessment tools for identifying LE risk factors that may affect intact skin; therefore clinicians should use general skin and wound assessment tools. Circumferential (limb) measurements are used to monitor progress in reducing chronic edema. The most common method is to measure with a tape measure at the ankle, knee and at a defined distance in centimeters above and below the knee. The points used depend on the areas of the limb that are most edematous.

For general skin assessment tools, see Chapter 4: Best Practice Recommendations for the Prevention and Management of Wounds: An Overview.<sup>24</sup>

### Quality of Life

There are validated health-related quality of life (HR-QoL) tools focused on LE (upper and lower limb). It is important to use validated tools to screen for depressive symptoms, depression, anxiety, feelings of worthlessness, change in sexual function (e.g., hydrocele, genital LE) and reduced hope. Cermal et al. conducted a review exploring quality of life for persons with LE secondary to cancer. They reported the need for high-quality research and for clinicians to screen for risk of mental health changes.<sup>26</sup> Mental health factors are important to consider as they impact the patient's ability to engage in complete decongestive therapy and other therapeutic modalities and potentially burden the care partner and family.<sup>27,28</sup>

In a 2022 review, researchers identified 12 health-related quality of life (HRQoL) tools focused on LE arm and leg.<sup>29</sup> Out of the HR-QoL tools available, the Lymphoedema Quality of Life Tool (LYMQOL) is the tool most commonly used.<sup>30</sup> (Keeley, 2007). The Lymphedema Life Impact Scale may also be used to assess for LE impact on a patient's life.<sup>31</sup> For a full description of lymphedema-related quality of life tools and further information, see Lim et al. 2022 at [https://rees-france.com/wp-content/uploads/2022/05/Health\\_related\\_Quality\\_of\\_Life\\_Measurement\\_Tools.pdf](https://rees-france.com/wp-content/uploads/2022/05/Health_related_Quality_of_Life_Measurement_Tools.pdf)

In addition to the above assessment, continence status (fecal, urinary and/or both) should be assessed using validated tools. There is an association between lower limb LE and pelvic floor surgery (e.g., gynecological), continence and changes to the patient's body image and quality of life.<sup>32,33</sup>

Evidence supports the use of validated venous-disease-specific quality-of-life indicators, which can be found at <https://www.woundscanada.ca/health-care-professional/resources-health-care-pros>

For disease-specific assessment tools that focus on health-related quality of life while living with a chronic lower limb wound, see Chapter 4: Best Practice Recommendations for the Prevention and Management of Wounds: An Overview.<sup>24</sup>

**Wound assessment tools:** Assessment of any wound and documentation of findings also require a standardized approach using a comprehensive, validated and reliable wound assessment tool. Such tools not only provide a baseline of wound characteristics, but also identify wound change over time, which helps determine if a wound is progressing toward closure or is deteriorating. See Chapter 4: Best Practice Recommendations for the Prevention and Management of Wounds: An Overview<sup>24</sup> for more on wound assessment tools.

**Pain assessment tools:** Pain assessment tools for persons living with LE provide a systematic approach for assessing and documenting pain, as well as the factors that are causing or exacerbating wound-related pain. The accurate and regular assessment of pain is essential to ensure patients experience effective pain management. Clinicians should use validated pain assessment tools, such as the visual analogue scale, the numeric rating scale, non-verbal pain scales and verbal rating scale, the Brief Pain Inventory and the McGill pain questionnaire. See Chapter 4: Best Practice Recommendations for the Prevention and Management of Wounds: An Overview<sup>24</sup> for more on pain assessment tools.

**Nutrition and activity screening:** Nutritional screening tools provide a standardized approach for identifying patients with LE who are at risk of compromised nutrition and who require further nutritional assessment and



intervention. For patients with LE, nutritional assessment may focus on anti-inflammatory and anti-edema diets and weight management alongside physical activity.<sup>34</sup> As part of an integrated team, the registered dietitian and physiotherapist work closely with the patient to co-develop life-long nutritional support and activity plans.<sup>34</sup> More research to fully understand links between nutrition and LE is required.

For more information on nutrition screening tools see Appendix 1: Nutrition for Skin Health, Wound Prevention and Wound Healing in Chapter 4: Best Practice Recommendations for the Prevention and Management of Wounds: An Overview.<sup>24</sup>

## 1.2 Assess skin health and identify risk and causative factors that may impact skin integrity and wound healing

**Discussion:** Given the complex nature of LE there are many risk factors that impact the health of the patient that clinicians considered while conducting the holistic patient assessment.<sup>1</sup>

### 1.2.1 Patient: Physical, emotional and lifestyle

**Discussion:** Lower limb LE requires early diagnosis to support goal setting, care planning and the implementation of preventative strategies that include patient education focused on risk factors.

A comprehensive physical and lower limb assessment should be completed and communicated to the team members. For steps on completing a lower limb assessment see Chapter 12: Best Practice Recommendations for the Prevention and Management of Venous Leg Ulcers.

Independent risk factors to consider are outlined in Table 2.

It is important to have an appropriate examination table, blankets, gowns and assessment tools (blood pressure cuffs) appropriate for the person's size. A second clinician may need to be present to support patient comfort, turning and positioning during the physical examination.

**Table 2:** Assessment and Impact of Risk Factors

Assessment	Factor(s)	Considerations
Complete a detailed history	Congenital predisposition	Inherited or congenital condition, e.g., Milroy's disease
	Volume overload (e.g., heart failure)	Volume overload must be managed to reduce filtration pressure
	Diabetes mellitus (duration)	Uncontrolled blood sugars delay healing
	Trauma (e.g., sprains, musculoskeletal abnormality; venipunctures, injections, wound and drainage complications; breast/ lymph node dissection or surgery)	May have removed or damaged lymphatics
	Venous leg disease, varicose vein surgery (e.g., vein stripping, vein harvesting)	May have damaged lymphatics Chronic venous insufficiency with associated leg edema
	Abdominal or lower extremity surgery	May have damaged lymphatics (seroma) Consider continence status (urine, fecal)
	Hip or knee surgery (e.g., implants, hardware)	Increases risk in some patients Ruptured Baker's cysts <sup>35</sup>
	Chronic inflammatory diseases	Chronic inflammation may affect lymphatic function Löfgren syndrome
	Malignancy, melanoma (e.g., pelvic and abdominal surgery)	Surgery, radiation or drugs may affect lymphatics
	Infections (e.g., cellulitis, lymphangitis)	Rule out infectious causes. Cellulitis history <sup>13,36</sup>
	Neurological problems	May alter gait May lead to chronic limb dependency
	Osteoarthritis (e.g., mobility, gait pattern, devices used)	May alter calf-muscle-pump function
Mental health and wellness	Depression, anxiety, history of engaging in health activities <sup>37,38</sup>	

*cont'd...*

Medications (prescribed, over the counter, other)	Edema-causing medications (list not inclusive)	<p>Anti-hypertensive:</p> <ul style="list-style-type: none"> <li>• Calcium channel blockers e.g., amlodipine</li> <li>• Beta-blockers</li> <li>• Clonidine</li> <li>• Hydralazine</li> <li>• Minoxidil</li> <li>• Methyldopa<sup>35</sup></li> </ul> <p>Nonsteroidal anti-inflammatory drugs (NSAIDs), e.g., ibuprofen</p> <p>Corticosteroids, e.g., prednisone</p> <p>Alpha blockers, e.g., doxazosin</p> <p>Hormones and related compounds, e.g., tamoxifen<sup>39,40</sup></p> <p><b>Additional drugs that often cause peripheral edema:</b></p> <p>Anticonvulsants for pain management, e.g., pregabalin</p> <p>Opioids, e.g., analgesics, fentanyl, hydromorphone, morphine oxycodone, tramadol, replacement therapy methadone<sup>41</sup></p> <p>Antidepressants, e.g., trazodone<sup>39</sup>; escitalopram, mirtazapine, paroxetine, venlafaxine<sup>41</sup></p> <p>Anti-diabetes, e.g., rosiglitazone; insulin<sup>41</sup></p> <p>Antipsychotics, e.g., risperidone</p> <p>Bisphosphonates, e.g., zoledronic acid<sup>39</sup></p>
	Chemotherapeutic treatment and agents	<p>May suppress wound healing: e.g., docetaxel<sup>39</sup></p> <p>Targeted cancer therapies: mitogen activated protein kinase inhibitors<sup>39,41</sup></p> <p>Anti-cancer agents, e.g., rapamycin inhibitors<sup>39</sup>; Gemcitabine, pemetrexed, cyclophosphamide, clofarabine ATRA/taxanes<sup>41</sup></p>
	Radiotherapy	<p>May develop radiodermatitis, scarring</p> <p>Radiotherapy in the regions of the lymph nodes, mammary glands or pelvis (postoperative)</p>
	Immunosuppressive drugs	<p>May suppress wound healing (e.g., sirolimus)<sup>39</sup>; calcineurin inhibitors, ciclosporin, tacrolimus<sup>41</sup></p>
Social history	Substance use	<p>Smoking (cigarette, other), alcohol, recreational drug use may delay wound healing; contaminated illicit/illegal drugs (e.g., xylazine)</p>
	Living conditions/travel	<p>Availability of formal/informal care partners</p> <p>Challenges in living conditions, space, safety</p> <p>Travelling to regions with filariasis</p> <p>Insect/animal bites<sup>35</sup></p>
	Access to services	<p>Barriers to accessing services or treatments (e.g., travel costs, finances, employment)</p>
Employment	Ability to work or be employed	<p>Assess ability to work, adapt and maintain employability<sup>42</sup></p> <p>Clothing, footwear<sup>43</sup></p>

cont'd...

Examination	Height, weight, body mass index (BMI)	BMI >40 associated with 50–60% increased risk BMI >60: 100% lymphatic dysfunction <sup>44</sup>
	Blood pressure	Uncontrolled hypertension may increase filtration
	Joint mobility, fixed ankles, gait	All may decrease calf-muscle pump function Hip and knee surgery increase risk
	Arterial/vascular assessment	Cardiovascular risk factors identified Ankle brachial pressure index (APBI) must be done to rule out significant peripheral arterial disease <sup>45</sup>
	Limb skin assessment	Acute cellulitis, erythema, chronic infections Look for positive Stemmer's sign and pitting test, skin creases, papillomatosis and fibrosis (See Figure 4) Presence of hemosiderin staining Presence of dermatitis and loss of barrier function Consider biopsy if suspicious for skin malignancy Hyperkeratosis (scaly, thicker)
	Nail/foot assessment	As per limb skin assessment Nail/foot condition(s) including footwear
	Wound assessment	Refer to Chapter 4 <sup>24</sup>
	Compression therapy	History of compression therapy, garments, device use Self-bandaging method and products used Present compression being used (day and nighttime) Barriers to access due to funding/insurance Donning/doffing devices used
Laboratory	Screening laboratory	Anemia, poor nutritional status, hyperglycemia may affect healing
Pain assessment		Type of pain (nighttime rest pain, intermittent claudication) <sup>46</sup> Does pain interfere with adherence to care plans? Strategies used to manage

*Adapted by Dr. D. H. Keast with permission.*

**Pain:** Patients with lower limb LE describe heaviness, pain and a feeling of tightness and swelling in their limbs and feet.<sup>47</sup> This may be related to peripheral arterial disease (PAD) and associated intermittent claudication, chronic and acute ischemic pain, neuropathic and/or musculoskeletal pain.<sup>47</sup> In addition, patients may describe numbness, stiffness, tightness, tenderness due to compression therapy that leads to dysesthesia and tingling in the lower limbs.<sup>48</sup> Patients with LE in the genital region—a rarer form of LE—may experience pain and swelling that may interrupt sexual functioning, lead to incontinence and affect quality of life.<sup>49</sup>

### **Ankle Brachial Pressure Index (APBI)**

The British Lymphology Society published a position paper to support clinician understanding of the role of ankle brachial pressure index (APBI) when planning application of compression therapy for patients living with LE.<sup>47</sup> Obtaining an accurate ABPI may be challenging because of the presence of edema, hyperkeratosis and tissue thickening.<sup>45,47</sup> An APBI is needed to rule out PAD, which is a contraindication for use or level of compression therapy. Clinical assessment skills must be added to any APBI assessment to prevent inaccurate readings from affecting care planning decisions.<sup>45,47</sup> It is important to note that clinicians conducting an APBI must be conscious of selecting the correct size of blood pressure cuff to ensure tolerance in patients with LE.

Elwell and Snodden discuss the challenges of obtaining a satisfactory vascular assessment. They state the following: “Unfortunately, the presence of peripheral edema may render a reading impossible or grossly inaccurate. Relying solely on ABPI assessment is potentially harmful to patients, who may be denied appropriate treatment or experience complications and deterioration of their condition due to delayed treatment. The BLS recognizes a need to focus more on clinical assessment skills to determine vascular status, rather than relying on ABPI alone.”<sup>45</sup>

## Factors that May Affect Obtaining an ABP<sup>147</sup>

Available from: <https://lymphoedemaeducation.com.au/wp-content/uploads/2018/10/BLS-ABPI-A4.pdf>

- Inadequate preparation, e.g., room temperature
- Inexperience of the practitioner
- Patient anxiety
- Repeated inflation of the cuff moving Doppler probe during the procedure
- Poor patient positioning
- Prolonged inflation of the cuff or re-inflation mid procedure
- Inappropriate gel
- Releasing sphygmomanometer cuff too rapidly
- Incorrect size of sphygmomanometer cuff
- Excessive pressure on a vessel during the procedure
- Wrong size of doppler probe
- Miscalculation of reading
- Incorrect positioning of the doppler probe over the vessel.

See [Chapter 10: Best Practice Recommendations for the Prevention and Management of Peripheral Arterial Ulcers](#) for further information on arterial diagnostics.

## Diagnostic Testing

Researchers state 90% of LEs can be accurately diagnosed with a comprehensive physical examination and detailed history.<sup>50</sup> This process requires time and may take several hours or patient visits to fully complete. The assessment should include an ABPI<sup>146</sup> or clinical vascular assessment (see above) and baseline blood tests that include: complete blood count, metabolic panel, white count for infection, atrial natriuretic peptide, albumin level and thyroid panel. In addition, a routine urinalysis may be completed to rule out other causes of the lower extremity edema.<sup>2,50</sup> Liver function and blood urea nitrogen (BUN/creatinine) levels and liver function tests may be checked as well as neoplastic markers, if required.<sup>50</sup>

Diagnostic imaging may be completed with the goal of understanding what is causing the lymphatic blockage, compression or dysfunction.<sup>51,52</sup> These may include:

- Ultrasound (US) to rule out deep vein thrombosis (DVT); also useful to exclude other etiologies such as venous insufficiency. In addition, the US may help in identifying tissue changes and masses that might be the cause of lymphatic compression<sup>50,53</sup>
- Magnetic resonance imaging (MRI) and computerized tomography (CT) scan can help investigate causes of soft tissue edema, hematomas, cellulitis and cysts<sup>54</sup>
- Magnetic resonance lymphoscintigraphy (MRL) involves intradermal injection of radiolabeled colloid and subsequent imaging of the lymphatic system, with the goal of visualizing lymphatic function, anatomy and as a step in determining if tumor cells are present.<sup>54,55</sup> MRL can also aid in diagnosing certain diseases or conditions, such as lymphoma or LE<sup>55</sup>
- Indocyanine green (ICG) test and fluorescence imaging more commonly assist with LE diagnosis by analyzing the functional and anatomic lymphatics. This test involves the, “activation of molecules in tissue to generate high-resolution images. The short half-life of the ICG not only makes it safe for patients but also allows for repetitive application preoperatively, intraoperatively, and postoperatively”.<sup>54</sup>

**Note:** these diagnostic tests are most commonly used to determine outcomes of treatment through reduction of limb volume particularly in upper extremity LE. Bioimpedance spectroscopy (BIS), bioimpedance analysis (BIA), tissue dielectric constant (TDC) and additional measuring devices may assist with early assessment of tissue fluid accumulation.<sup>13</sup>

Perometry (perometer software) and three-dimensional techniques may be used to measure limb volume;<sup>56</sup> each has limitations.<sup>57</sup> In a specialized clinic, these two tests may be completed using advanced technological devices.

## Risk Considerations Specific to the Pediatric Populations

Though not the focus of this chapter, in the pediatric population (infant and child), primary LE (congenital) and secondary (caused by an injury or event) LE are considered relatively rare, yet it is still a progressive and chronic

condition.<sup>58-60</sup> Lymphedema carries with it the lifelong burden of aiming to manage LE swelling and the risk of secondary complication.<sup>61</sup> In this population, LE may or may not be visible and the swelling may only, “develop later in childhood or adolescence; others still will first develop symptoms of LE as an adult, usually after some aggravating lymphatic event such as weight gain, injury or infection”.<sup>61</sup>

Lymphedema is usually associated with surgery and various syndromes; therefore, genetic testing for certain cases should be considered.<sup>13,60</sup> Recent research has implicated specific abnormalities in the genes that control development of lymphatic valves. All pediatric lymphedemas should be referred to a pediatric LE specialist, certified lymphedema therapist and a garment fitter trained in the support of pediatric populations.

### **Risk Considerations Specific to the Population with Cancer**

Patients who have cancer and are undergoing cancer-related treatments (e.g., chemotherapy, radiation, surgery) may be at risk of developing LE. Cancer tumors that grow in size not only impair organ function but also impair the lymphatic system, including lymph nodes and vessels. Chemotherapy treatments and anti-cancer medications may also contribute to the development of LE (See Table 2). For example, one of the greatest concerns with melanoma cancer along with the extensive surgical excision required, is the patient may have already developed underlying metastatic disease with lymphatic involvement. When advanced-stage melanomas occur, they require sentinel lymph node biopsy (SLNB) and occasionally lymph node dissections (LND).<sup>62</sup> Researchers report that after an inguinal SLNB is completed, LE may occur, and when inguinal LND is done the rates of lower limb LE increases. What is interesting in this study is the growing role of lymphatic reconstructive surgery. The researchers discuss the importance of pre-operative diagnostics (Indocyanine green lymphography) and the role of super-microsurgical lymphaticovenular anastomosis (LVA) with the goal of maintaining the lymphatic flow throughout the body.<sup>62</sup> Chen et al. studied patients (n=85) undergoing inguinal lymphadenectomy (greater than 10 nodes), and this significantly increased LE in patients, especially women, who were at greater risk.<sup>62</sup>

Cibul et al. explored the risk of developing lower limb LE after SLNB in patients diagnosed with cervical cancer.<sup>63</sup> In this study, patients (n=150) underwent preoperative lower limb LE assessments using both limb volume measurements and asking patients their perception of limb swelling. The study results revealed that at 24 months the incidence of LE was 17.3% for mild LE, 9.2% for moderate LE, and only one patient developed severe LE.<sup>63</sup> They concluded that the, “replacement of standard pelvic lymph node dissection (PLND) by bilateral SLN biopsy in the surgical treatment of cervical cancer does not eliminate the risk of mild to moderate LE, which develops irrespective of the number of SLN removed”.<sup>63</sup>

Patients with cancers of the abdomen, including gynecologic malignancies vulvar, cervical, endometrial and ovarian, are at risk of developing lower limb LE; up to 70% in select populations.<sup>64</sup> These study results remind us of the importance of understanding the pathophysiology and risk factors, especially when the patient is undergoing cancer treatments before and after surgery and the need for long-term follow-up. There is a need for more research to follow these populations long-term to determine the best post-operative lower limb LE supports and measures.<sup>64</sup>

**Lifestyle Considerations:** In Canada we have the challenge of understanding the role of recreational drugs such as cannabis and the associated risk of cerebrovascular and neurological (neurovascular) perspectives.<sup>65</sup> Researchers in a narrative literature review reported recreational use of cannabinoids is related to, “both cardio and cerebrovascular events such as ischemic and hemorrhagic stroke...and neurological diseases that result from structural and functional changes in the brain, cognitive dysfunction and behavioral disorders”.<sup>65</sup> More research is needed, especially related to LE and cannabinoids as they interact with skin, the immune system, bone marrow and liver.

### **1.2.2 Environmental: Socio-economic, care setting and potential for self-management**

**Discussion:** Health-care professionals must have knowledge about the environmental factors that can impact the skin health of a person living with LE. These factors include the ability for self-care, socio-economic conditions (employment type, income and benefits to fund bandaging system or compression garment design), living situation and environmental factors.<sup>1,9</sup> The understanding of self-management specific to LE is growing, but more research is needed to focus on patient-centred outcomes and the impact of clinicians and systems.<sup>1,66</sup> The key challenge with self-care approaches is how much the patient and the care partner can manage without it leading to emotional, physical and financial burden overload.

### 1.2.3 Systems: Health-care support and communication

**Discussion:** Health ministries and health-care professionals are responsible for addressing the prevalence of LE, its association with multiple chronic illness and the burden to the health-care system.<sup>1</sup> Yet not all provinces/territories capture the diagnosis consistently using the International Statistical Classification of Diseases and Related Health Problems (ICD codes).<sup>67</sup> For example, some provinces/territories use different billing codes or have no billing codes for lymphedema (assessment and management). As a result, data for research may not be fully available, and prevalence and incidence rates may be significantly underreported.

**Note:** ICD is a system of codes that classify medical diagnoses. The current version is ICD-10. The current main code is 457, but there are subcodes and other vascular codes that can apply.

To improve the care of patients with LE, awareness programs, early screening and assessment are necessary at the individual, community and population health levels. In a recent review (12 studies) Yarmohammadi et al. explored health-care providers' knowledge of LE. Overall, practitioner knowledge was low, including their understanding of pathophysiology, signs and symptoms, management and referral support.<sup>68</sup> Manrique et al. state LE education is limited or minimized in clinical practice and academic programs and needs to be improved.<sup>54</sup> See Appendix C: Lymphedema/Chronic Edema Clinician Certification and Education for a list of courses in Canada focused on LE assessment and management.

### 1.3 Complete a skin and wound assessment, if applicable

**Discussion:** Complete a baseline skin/wound assessment as part of the comprehensive lower limb assessment.

**Skin Assessment:** In a systematic review, Fife et al. identified skin disorders related to LE<sup>19</sup>

- Directly caused by LE:
  - LE-related inflammatory processes leading to disfigurement of the associated limb or affected limb, and/or
  - Lymphorrhea – lymphatic fluid that drains directly through the skin that leads to tissue maceration and breakdown
- Indirectly related to LE:
  - Pressure ulceration from the weight of the limb(s)
  - Venous leg ulcers with a mixed venous/lymphatic origin, such as venous stasis
- Associated with the diseases causing LE, such as cancer
- Associated with LE treatment, such as poorly wrapped bandaging and ill-fitting compression garments and/or devices.<sup>19</sup>

Figure 4 presents some of the key lower limb findings that aid in LE diagnosis: pitting edema, and positive Stemmer's sign.


**Figure 4:** Diagnosis of Chronic Edema/Lymphedema






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Table 3 outlines examples of skin changes that may be seen as the protein-rich fluid accumulates and initiates the inflammatory response that often leads to adipocyte proliferation, fibrous tissue deposition and increases the risk of infections.<sup>22</sup>

**Table 3:** Skin Changes Associated with Lymphedema<sup>19</sup>

Skin Change	Description	Cause	Image
<b>Cellulitis</b>	<p>Acute onset, increase in swelling and pain; tenderness, erythema, fever, malaise</p> <p><b>Note of caution:</b> Bacterial cellulitis is often over diagnosed and over treated with antibiotics. It is usually unilateral, shows a deeper erythema and it progresses quickly. Bacterial cellulitis has an acute onset (measured in hours rather than many days). It is often accompanied by general malaise, fever and occasionally by GI symptoms. The neutrophil count would be elevated on a blood test.</p> <p>Chronic accumulation of edema fluid will cause chronic inflammation. It is often bilateral and diffusely erythematous. Neutrophil counts are usually not elevated</p>	Acute bacterial infection often caused by <i>Streptococcus pyogenes</i> or <i>Staphylococcus aureus</i>	 <p>Used with permission from Dr. D. H. Keast.</p>

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<p><b>Dermal fibrosis</b></p>	<p>Thickened plaques within the area of lymphedema, usually associated with Stage II or beyond</p>	<p>Fibrosis is a consequence of the longstanding protein-rich fluid and associated inflammation</p>	 <p><i>Used with permission from Dr. D. H. Keast.</i></p>
<p><b>Hyperkeratosis and nodular fibrosis</b></p>	<p>A large fibrotic nodule within the area of lymphedema</p>	<p>Directly related to the ongoing fibrosis in lymphedema</p>	 <p><i>Used with permission from Dr. L. Parsons.</i></p> <p><i>Used with permission from Dr. D. H. Keast.</i></p>
<p><b>Necrobiosis lipoidica</b></p>	<p>Occurs in the skin of persons with type 1 and 2 diabetes</p> <p>Collagen degeneration leads to skin lesions on anterior shin</p> <p>Carries a risk of ulceration</p>	<p>Cause unknown. May include changes to blood vessel walls, collagen deterioration, formation of granulomas and deposition of fat</p>	 <p><i>Used with permission from Dr. D. H. Keast.</i></p>

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<p><b>Lymphoceles or lymphectasia</b></p>	<p>Dilated lymphatics that form dome-shaped papules on the skin</p>	<p>Directly related to areas of chronically dilated lymphatics</p>	<p>Acquired lymphectasia</p>  <p><a href="https://dermnetnz.org/topics/acquired-lymphangiectasia">https://dermnetnz.org/topics/acquired-lymphangiectasia</a></p>
<p><b>Massive localized lymphedema</b></p>	<p>Pendulous nodules, polyps or tumours found within the areas of lymphedema (this patient probably has lipedema with secondary LE; note cuffing at the ankle)</p>	<p>Gravity and fibrosis +/- compressible fluid</p>	 <p><i>Used with permission from Wounds Canada</i></p>  <p><i>Used with permission from Dr. L. Parsons.</i></p>

*cont'd...*




<p><b>Lymphorrhea</b></p>	<p>Clear fluid that seems to seep spontaneously from skin affected by lymphedema</p>	<p>Microscopic skin defects leak fluid under pressure</p>	<p>Lymphorrhea</p>  <p><i>Used with permission from Dr. R. Evans.</i></p>  <p><i>Used with permission from Dr. D. H. Keast.</i></p>
<p><b>Lymphagiosarcoma (Stewart-Treves syndrome)</b></p>	<p>A rare, aggressive malignant tumour associated with longstanding lymphedema. Probably more common in untreated lymphedema</p>	<p>Chronic inflammation can lead to malignant transformation</p>	 <p>Early stage <i>Used with permission from Dr. D. H. Keast.</i></p>  <p>Late stage (post radiation treatment) Images taken from the lateral thigh <i>Used with permission from Dr. D. H. Keast.</i></p>

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<b>Elephantiasis (usually stage III)</b>	Extreme or end stage lymphedema with enlargement of the affected limb and often with one or more of the above-mentioned skin changes, seen in conjunction with the increase in size	End stage of chronic, untreated lymphedema  Almost exclusive to lower limb lymphedema	Stage 3 elephantiasis nostras verruciformis (ENV)    <i>Used with permission from Dr. D. H. Keast.</i>
<b>Papillomatosis</b>			  <i>Used with permission from Dr. D. H. Keast.</i>

**Lymphedema Classification:** Lymphedema can be classified in several ways, with the goal of identifying the disease progression and severity.<sup>13</sup> Two staging systems are available for use: The International Society of Lymphology (ISL)<sup>13</sup> and the National Lymphedema Network (NLN). See Appendix B: National Lymphedema Network (NLN) Staging of Lymphedema. In this best practice recommendations chapter we discuss the ISL staging system. See Figure 5.

**Figure 5:** Staging of Lymphedema

<b>Stages of Chronic Lymphedema (Severity)</b>		
<b>Stage 1</b>	<b>Stage 2</b>	<b>Stage 3</b>
		
<b>Moderate stage:</b> <ul style="list-style-type: none"> <li>• Edema is pitting</li> <li>• Edema is soft and reduces with elevation</li> </ul>	<b>Moderate stage:</b> <ul style="list-style-type: none"> <li>• Pitting is manifested</li> <li>• Edema rarely reduced by elevation</li> <li>• In later stages: development of fat tissue and fibrosis</li> </ul>	<b>Severe stage:</b> <ul style="list-style-type: none"> <li>• Tissue is fibrotic and pitting is absent</li> <li>• Significant skin changes:               <ul style="list-style-type: none"> <li>• fat deposition</li> <li>• warty skin (papillomatosis)</li> <li>• hyperkeratosis</li> <li>• hyperpigmentation</li> <li>• increases skin folds</li> </ul> </li> </ul>

*Used with permission from Dr. D. H. Keast.*

According to the International Society of Lymphology, it is important to note that patients may, “exhibit more than one stage, which may reflect alterations in different lymphatic territories.”<sup>13</sup> See Table 4 for the specifics of staging.

**Table 4:** Clinical Stages of Lymphedema<sup>13</sup>

Stage	Symptoms	Protein-rich fluid accumulation	Pitting edema	Non-pitting edema	Scar tissue formation	Hardening of dermal tissues	Skin papillomas
<b>Stage 0:</b> Refers to a latent or subclinical condition where swelling is not yet evident despite impaired lymph transport, subtle alterations in tissue fluid/composition and changes in subjective symptoms. It can be transitory and may exist months or years before overt edema occurs (Stages 1 – 3). Assessment of early fluid changes can be accomplished using BIS, BIA or TDC analysis	Yes	No	No	No	No	No	No
<b>Stage 1:</b> Represents an early accumulation of fluid relatively high in protein content (e.g., in comparison with “venous” edema), which subsides with limb elevation. Pitting may occur. An increase in various types of proliferating cells may also be seen	Yes	Yes	Yes	No	No	No	No
<b>Stage 2:</b> Stage 2 involves more changes in solid structures. Limb elevation alone rarely reduces tissue swelling, and pitting is manifest	Yes	Yes	Yes	No	Yes	No	No
<b>Late Stage 2:</b> The limb may not pit as excess subcutaneous fat and fibrosis develop	Yes	Yes	No	Yes	Yes	No	No
<b>Stage 3:</b> Encompasses lymphostatic elephantiasis where pitting can be absent and trophic skin changes, such as acanthosis, alterations in skin character and thickness, further deposition of fat and fibrosis and warty overgrowths have developed	Yes	Yes	No	Yes	Yes	Yes	Yes

*Adapted from: Manrique OJ, Bustos SS, Ciudad P, Adabi K, Chen WF, Forte AJ, Cheville AL, Jakub JW, McLaughlin SA, Chen HC. Overview of Lymphedema for Physicians and Other Clinicians: A Review of Fundamental Concepts. Mayo Clin Proc. 2022 Oct;97(10):1920-1935. DOI: 0.1016/j.mayocp.2020.01.006*

## Wound Assessment

When completing a comprehensive wound assessment it is important to know the underlying LE causes and factors and know the other co-morbidities with which the patient has been diagnosed. To accurately assess all wounds, plan assessment when compression bandaging and garments are being applied as part of the patient's routine. Document wound(s) using validated tools to promote clear communication among team members. Monthly photography (approved by your organization) assists with the documentation of the full scope of the lower limb LE and associated wound issues.<sup>69</sup> Burian et al. recently studied wounds and chronic leg edema. Of the 7077 patients studied with leg edema, 12.7% had wounds. Independent factors included, "PAD, cellulitis within the past 12 months, secondary LE, being male, being over 85 years of age, underweight, bed bound, chair bound, diabetes, and walking with an aid".<sup>70</sup> Of importance is that 43.22% of those with wounds had clinically defined well-controlled edema and that hard/fibrotic tissue and a positive Stemmer's sign were associated with wounds.<sup>70</sup> This study reminds clinicians of the importance of initiating interventions to control edema because well-controlled edema was shown to result in a 50% lower risk for the development of wounds.<sup>70</sup>

Determine if the wound is healing or non-healing, healable or unhealable.

**A healing wound** is progressing through the normal stages of healing on an appropriate timeline.

**A wound is considered healable** if the LE-related cellulitis of the lower limb is localized and has sufficient vascular supply, underlying causes such as infection can be corrected and overall skin health and compression therapy can be optimized.

**A wound is considered to be non-healing** if the cellulitis is extensive, healing has stalled and the wound has healing potential, but various factors—such as smoking, high body weight and/or uncontrolled edema—are compromising skin health and wound healing. The patient may not tolerate the compression therapy or compression bandaging or devices may not be available to, or affordable for, the patient.

**A wound is considered non-healable** when it has no ability to heal due to untreatable causes such as terminal disease, significant peripheral arterial disease, smoking, obesity (morbid) that cannot be treated surgically, end stage malignant disease (such as extensive, inoperable tumours) or end-of-life status.<sup>71,72</sup> If the wound is deemed to be non-healable, goals should be set that reflect management strategies for activities that prevent infection, protect the fragile periwound and other skin to prevent further skin breakdown and provide comfort for the patient.

For more information on wound assessment tools see Chapter 4: Best Practice Recommendations for the Prevention and Management of Wounds: An Overview.<sup>24</sup>

## Step 2: Set Goals

### Recommendations

#### 2.1 Set goals for skin health and for prevention, healing, non-healing and non-healable wounds

**Discussion:** Prior to, or in the presence of, diagnosed LE, the primary goal for the integrated team is to promote skin health, prevent the progression of LE and support patient engagement in compression therapy, medical management of underlying co-morbid diseases, physical exercise, weight and medication management and mental health. Though LE is not fully preventable, progression can be slowed.<sup>1</sup> Holistic goal setting with patients who have LE must involve the integrated team and be based on consistent and effective communication. Goals must be developed according to the SMART principle<sup>73</sup> in collaboration with the patient, family and/or care partner, and adjusted as needs change over time. For more information on SMART goal setting, please see Chapter 4: Best Practice Recommendations for the Prevention and Management of Wounds: An Overview.<sup>24</sup>

##### 2.1.1 Identify goals based on skin health, prevention or healability of wounds

**Discussion: Goals should be developed to support the management of skin, edema reduction and the prevention, healing or prevention of recurrence of wounds. Due to the risk of infection (e.g., cellulitis, infection, sepsis) and hospitalization, it is a priority to promote skin health and hand hygiene.<sup>13</sup> Wound-specific goals are determined by healability. See Table 5 for examples of goals.**

**Table 5:** Examples of Goals for Patients with Lymphedema

Area of Focus	Examples of Goals
Underlying co-morbidities	<ul style="list-style-type: none"> <li>• Manage volume overload conditions such as heart failure within 2–3 weeks</li> <li>• Manage glycemic levels in persons with diabetes within 2 weeks</li> <li>• Vascular consult within 2 months</li> </ul>
Complete Decongestive Therapy (CDT)	<ul style="list-style-type: none"> <li>• Vascular status assessed to permit compression therapy within 2 weeks</li> <li>• Implement compression bandaging to reduce edema once vascular status is assessed (show patient edema reduction using measurement tape)</li> <li>• Once edema is reduced, implement wearing of garments to maintain/control edema within 3 days; Intermittent pneumatic compression can supplement bandaging in some cases; Reusable (hook and loop) systems (wraps) that are adjustable can be worn</li> </ul>
Medication	<ul style="list-style-type: none"> <li>• Have edema-related drugs reviewed by physician/pharmacy within 3 days</li> </ul>
Skin care	<ul style="list-style-type: none"> <li>• Establish skin care routine within 2 days</li> <li>• Perform hand hygiene instruction on first visit</li> <li>• Reduce and manage wound-related pruritus within 5 days</li> <li>• Provide instruction within 2 days to patients with diabetes and/or neuropathy to frequently inspect skin at pressure points from footwear, bandaging, garments;<sup>13</sup> attention must be paid to the toe and forefoot regions<sup>74</sup></li> </ul>
Wound care	<ul style="list-style-type: none"> <li>• Healing: Provide optimal wound care and compression therapy within 7–14 days</li> <li>• Non-healing: Control pain and skin sensitivity within 2 days</li> <li>• Non-healable: Manage odour and drainage within 7–10 days and review ongoing</li> </ul>
Exercise/mobility	<ul style="list-style-type: none"> <li>• Refer to physiotherapist (PT) to promote calf-muscle pump/ankle activity within 7 days</li> <li>• Promote education of appropriate exercise within 7–14 days</li> <li>• Support donning and doffing of day and nighttime compression within 7 days<sup>13</sup></li> </ul>
Lifestyle change/choices	<ul style="list-style-type: none"> <li>• Make smoking cessation program referral within 7 days</li> <li>• Refer for diabetes mellitus management within 7 days</li> <li>• Review substance use (e.g., alcohol) within 14 days</li> <li>• Refer to a registered dietitian within 14 days for weight management</li> </ul>
Pain management	<ul style="list-style-type: none"> <li>• Pain is managed (nociceptive and neuropathic pain) within 5 days</li> <li>• Adjunct pain management strategies are discussed within 30 days</li> </ul>
Social/employment	<ul style="list-style-type: none"> <li>• Refer to occupational therapist (OT) to promote independence (restore, modify) within 30–40 days</li> <li>• Return to/modify employment, home, school, leisure activities within 30–60 days</li> <li>• Support access to clothing and footwear</li> </ul>
Offloading	<ul style="list-style-type: none"> <li>• Refer for offloading footwear (for diabetic foot ulcers and pressure injuries) within 7 days</li> </ul>
Psychological/spiritual	<ul style="list-style-type: none"> <li>• Refer for psychosocial and spiritual support in place within 30 days</li> <li>• Engage in mental health and wellness promotion such peer as support, web-based support, counselling and therapy as appropriate within 14 days<sup>75</sup></li> </ul>

Used with permission: Dr. D. H. Keast.

### 2.1.2 Identify quality-of-life and symptom-control goals

**Discussion:** Quality-of-life and symptom-control goal setting requires that the integrated team set realistic goals around smoking cessation, appropriate garment use, medication management, ADLs such as exercise and physical activity and the impact of skin changes and CDT on the patient’s daily life.<sup>75</sup> See Table 5 for examples.

## Step 3: Assemble the Team

### Recommendations

#### 3.1 Identify appropriate health-care professionals and service providers

**Discussion:** Health-care providers working with patients and their caregivers need to be trained in LE assessment and management. When caring for patients living with LE, clinicians need to understand anatomy and physiology, pathophysiology, multi-organ systems (skin, cardiac, renal, respiratory), mental health, mobility and exercise and collaborative care.<sup>13</sup>

Ideally, clinicians would all be in a specialized centre, but in reality patients will be assessed by individual clinicians and specialists using in-person, online, web-based and tele-medicine approaches. Through use of technology and strong communication skills, clinicians specialized in LE can create a community of practice in which the patient and care partner are the centre. Table 6 lists team members and describes their roles.

It is important to note that certified lymphedema therapists<sup>76</sup> come from various disciplines and can be registered massage therapists, nurses, physicians, physiotherapists and occupational therapists. For information on clinician-focused LE certification, education and training see Appendix C: Lymphedema/Chronic Edema Clinician Certification and Education.

**Table 6:** Team Members and their Roles in Managing Lymphedema

Team member	Roles
Certified lymphedema therapist (CLT) <sup>76</sup>	<ul style="list-style-type: none"> <li>• Assess for stage of LE (stages may be overlapping)</li> <li>• Co-create goals for treatment and maintenance with patient</li> <li>• Assess strengths and ability to conduct self-care such as manual lymph drainage (MLD), exercise, nutrition, skin care</li> <li>• Monitor compression therapy progress</li> <li>• Assess for LE compression therapy for day/night wear</li> <li>• Provide education on hand hygiene, skin care and hygiene, anatomy and physiology, garment management</li> </ul>
Primary care provider, physician, nurse practitioner, specialists such as clinical lymphologist, infectious disease <sup>13</sup>	<ul style="list-style-type: none"> <li>• Diagnosis of LE (within scope of practice) supports access to funding for compression garments (in some provinces/territories); may be a specialist or designated primary care physician</li> <li>• Provide care based on their specialty (dermatology, cardiac, respirology, vascular and diagnostic) based on patient need</li> <li>• Assist with management of edema, pain, infection</li> <li>• Provide referrals and support</li> </ul>
Garment fitter (certified to authorize and order garments)	<ul style="list-style-type: none"> <li>• Assess compression therapy (most appropriate) and reassess long term</li> <li>• Assesses funding/insurance support</li> <li>• Assess comfort of compression for day/nighttime</li> <li>• Refer for adaptive clothing and footwear</li> <li>• Communicate with care partners and provide education</li> </ul>

*cont'd...*

Physiotherapist (PT), physiotherapy assistant (PTA)	<ul style="list-style-type: none"> <li>• Provide education on prevention, anatomy, physiology</li> <li>• Assess compression therapy (most appropriate) and reassess long term</li> <li>• Assess functional status and provide exercise plans</li> <li>• Support deep breathing exercises</li> <li>• Prescribe and facilitate exercise and motion exercise</li> <li>• Evaluate strength and administer treatment</li> <li>• Prescribe gait aids/devices</li> <li>• Communicate with family members and provide education</li> </ul>
Pharmacist	<ul style="list-style-type: none"> <li>• Educate the patient and their care partners, family members about medications that contribute to LE and the use of diuretics for underlying co-morbidities</li> <li>• Assist with management of edema, pain, infection</li> <li>• Provide medication reconciliation, information, education or teaching, monitoring for medication interactions that cause edema</li> <li>• Communicate with care partners and provide education</li> </ul>
Occupational therapist (OT), occupational therapy assistant (OTA)	<ul style="list-style-type: none"> <li>• Provide education on functional activities of living</li> <li>• Assess for adaptive clothing and footwear</li> <li>• Assesses activities of daily living (ADLs) and instrumental activities of daily living (IADLs)</li> <li>• Prescribe adaptive devices/equipment</li> <li>• Support vocational/employment goals and activities</li> <li>• Communicate with care partners and provide education</li> </ul>
Pedorthist, chiropodist, foot care nurse	<ul style="list-style-type: none"> <li>• Educate patient and care partners on prevention of foot complications</li> <li>• Assess for appropriate footwear</li> <li>• Provide hand and foot nail care and promote skin health</li> </ul>
Registered dietitian; nutrition, weight management clinics	<ul style="list-style-type: none"> <li>• Assess baseline health</li> <li>• Monitor dietary needs and provide nutritional support</li> <li>• Provide nutritional education to the patient and their care partner – this may include education on anti-inflammatory and anti-edema nutritional approaches</li> <li>• Communicate with care partners and provide education</li> </ul>
Respiratory therapist	<ul style="list-style-type: none"> <li>• Assess baseline respiratory status</li> <li>• Support activity/exercise in partnership with physiotherapy</li> <li>• Provide rehabilitation therapy</li> <li>• Communicate with care partners and provide education</li> </ul>
Counselor, social worker, psychologist, psychiatrist	<ul style="list-style-type: none"> <li>• Address anxiety and/or psychological stress</li> <li>• Contribute to understanding cause of LE (health choices)</li> <li>• Support the patient to develop and/or enhance coping skills</li> <li>• Assist with social and financial supports (funders, insurance)</li> <li>• Support sexual health discussion</li> <li>• Link patient to peer support groups (local, online, web-based)</li> <li>• Communicate with care partners and provide education</li> </ul>
Wound care nurse/specialist	<ul style="list-style-type: none"> <li>• Co-ordinate in-patient care and transitions in care</li> <li>• Provide skin and wound care and positioning, complete and assist with wounds assessment and dressing changes</li> <li>• Support patient and care partners to access compression donning/doffing devices as needed</li> <li>• Do monthly review of photography</li> <li>• Communicate and assist to co-ordinate care activities with health-care providers (e.g., timing of bathing and bandaging/compression therapy)</li> <li>• Deliver patient, care partner and family education</li> </ul>

*cont'd...*



Spiritual care professional	<ul style="list-style-type: none"> <li>• Support and counsel those with LE and slow-to-heal, non-healing and non-healable wounds</li> <li>• Link patients' to their spiritual, faith-based community of support</li> <li>• Provide palliative support if required</li> </ul>
Specialized physician, surgery	<ul style="list-style-type: none"> <li>• Discuss surgical options with patient and care partners – and other team members as needed</li> </ul>

### 3.2. Enlist the patient and their family and care partners as part of the team

Proactive skin health should be a priority for patients living with lower limb LE. For patients who develop skin complications and wounds, healing is often a complex process because of related underlying co-morbidities. Providing early encouragement and education to patients and their care partners enhances their engagement and understanding of how they can participate effectively in the LE care process.

It's important to note that some patients who have had a delay in diagnosis may be frustrated when clinicians try to engage them in efforts to improve their quality of life through education and resources.<sup>10</sup>

Khong et al. explored perspectives of patients (n=6) diagnosed with morbid obesity who were identified as being disengaged in LE care. *Disengagement* was defined as the patients not attending more than 50% of appointments, living with LE for more than 90 days, and clinicians reporting low engagement in compression therapy. In this study, patients reported social, psychological and physical factors as barriers to being involved in care, overlapping with the burden of daily management of LE, especially as the person progressed to being house-bound with increased disability.<sup>77</sup> In a 2022 study (n=81), patients expressed that their needs and expectations must be heard by the team and that they should be an active part of care decisions.<sup>78</sup> They emphasized the importance of an accurate LE diagnosis and treatment options.<sup>78</sup>

To help ensure active participation, patients living with LE and their care partners should be offered consistent information that is tailored to enhance self-care strategies and management practices and behaviours. In all cases, the information should be delivered in an individualized and sensitive manner to ensure effective, trusting relationships among patients, care providers and the rest of the integrated team.

### 3.3 Ensure organizational and system support

**Discussion:** Successful LE programs are patient-centred and include an integrated team of clinical practice leaders, educators, researchers, policy makers and administrators at a local, regional, provincial/territorial and national level.<sup>13</sup> Organization and system support is required to ensure patients receive co-ordinated transition of care through community and health-care agencies. This level of collaboration and co-operation is essential as patients' needs will change as their LE progresses and as they live with other co-morbidities.<sup>13</sup> Patients with LE require relevant home and community care services focused on improving and maintaining their quality of life,<sup>42</sup> along with adapting and modifying their work and engagement in life.<sup>79</sup>

Organizations must support the education of staff so they obtain and maintain the required knowledge and skills to be effective members of the lymphedema care team. It is essential that LE health-care provider education includes a needs assessment to identify knowledge, skill and attitude gaps. Education should address the identified short and long-term gaps and be provided using the principles of adult learning.

The Canadian Lymphedema Framework lists several private schools that provide LE education and training that meet the Lymphology Association of North America<sup>76</sup> requirements.

## Step 4: Establish and Implement a Plan of Care

**Discussion:** The development and implementation of a sustainable plan of care must be based on the identified goals and be collaboratively created with the patient, their family and care partners and relevant health-care team members.

### Recommendations

#### 4.1 Identify and implement an evidence-informed plan to maintain skin health and correct the causes or cofactors that affect skin integrity, including individual needs (physical, emotional and social), the wound (if applicable) and environmental/system challenges

**Discussion:** Standard prevention and treatment of LE involves patient-centred Complete Decongestive Therapy (CDT) with the overarching principles of promoting and supporting patient engagement in daily activities.<sup>80,81</sup> The patient and care partner should receive skin health education related to handwashing and meticulous skin care to prevent skin breakdown, as well as information on the anatomy and physiology of the skin and other relevant areas of the body, management and wearing of individualized compression garments, proper footwear, exercises and management of wounds. They should also receive mental health and wellbeing support.<sup>13</sup>

There is a range of therapies to support patients living with LE. O'Donnell et al. state that firstline conservative LE therapy includes a singular or a bundle of care elements that might include manual lymphatic drainage (MLD), multi-layer bandaging, psychosocial support, skin care and LE garments.<sup>5</sup> Additional therapies include intermittent pneumatic compression devices (several are available from various manufacturers) and programmable compression devices.<sup>5</sup>

Manual Lymphatic Drainage mobilizes lymphatic fluid and is most effective when combined with compression therapy.<sup>13</sup>

The current international standard for conservative LE management is manual complete decongestive therapy (CDT) that includes skin health regimens, exercise, bandaging and manual lymphatic drainage.<sup>13,82</sup> These specific care components require attention to daily care, which can sometimes be fatiguing for the patient and care partner. Yet these routines are important. A review stated that patient hygiene-centred self-care approaches reduced acute episodes in patients living with filariasis-related LE.<sup>66</sup> As well, in Italy, as part of the LIMPRINT (Lymphedema IMPact and PRevalence INTernational) study, Cestari et al. reported that education was essential to the development of strong self-care patterns. However, in their study (1419 outpatients and 218 inpatients) only 32.4% patients received skin care instruction, and only 23 received psychological support, thereby adding to the patients' emotional burden.<sup>83</sup> Lack of education may lead to less engagement in self-care routines.

Jones et al. explored the self-management abilities required to consistently attend to one's skin, self-bandaging, garment application and care and day-to-day demands of managing LE. They report the intersection of daily hand hygiene, bandaging and LE skin care to lead to psychosocial, financial and physical burdens.<sup>84</sup> It is important for clinicians to heed the risk of over-burdening the patient and care partners. This reality is an important reminder for health-care professionals to review and reinforce self-care maintenance for life. Leard and Barrett explored unilateral lower limb LE in a 42-year-old patient with morbid obesity. Using a physiotherapy-LE approach in an out-patient setting with transportation and bandaging supports, the patient's limb was reduced to the same size as the unaffected limb by 23 weeks.<sup>85</sup> This is a strong example of the role of education, bandaging and interprofessional collaboration.

The ISL recommends treatment begin with physical therapy and adjuvants (for adults and children). Three terms are commonly used to describe LE therapy: *Complete Decongestive Therapy* (CDT), *Combined Physical Therapy* (CPT) or *Complex Decongestive Physiotherapy* (CDP), as well as others.<sup>13</sup> The ISL notes, "even widely used treatment methods have yet to undergo sufficient meta-analysis of multiple studies which have been rigorous, well controlled and with sufficient follow up".<sup>13</sup> More studies are needed to compare treatment approaches. In this chapter we use CDT.

Based on a comprehensive assessment, care approaches begin with phase 1. Treatments may include:

- Meticulous skin care using pH-balanced soaps and unscented emollients (moisturizers)

- Routine nail care<sup>86</sup>
- Education focused on using, managing and daily washing of garments
- Specific light manual massage – manual lymphatic drainage (MLD) with a therapist or taught to the patient (termed self-MLD)
- Limb elevation, range of motion and calf-muscle- and ankle-pumping exercises
- Deep-breathing exercises
- Compression therapy typically applied with multilayer wrapping (short-stretch) and hook-and-loop devices, taught by a trained therapist.<sup>13,87</sup>

Wounds Canada: Care at Home Series provides additional information for the prevention and care of wounds at home. <https://www.woundscanada.ca/patient-or-caregiver/resources/care-at-home-series>

For more information on short short-stretch compression bandaging see Appendix D: Parkwood Wound Clinic Protocol for Application of Short-Stretch Compression Bandages.

Phase 2 treatments, may include:

- Continuing phase 1 activities and optimizing education
- Compression therapy: low-stretch elastic stocking or sleeves and reusable, adjustable or fastened devices may be used once taught by a trained therapist<sup>13,87</sup>
- It is important to note that compression garments or massage therapy alone may not be effective. These approaches require further research.<sup>13</sup>

The management of patients with LE primarily occurs in the home, community and outpatient hospital settings.<sup>13</sup> When patients experience severe infections, they may need to be hospitalized. The treating team should be notified to ensure compression therapy and specific care parameters are communicated between care teams (e.g., hospital and rehabilitation providers), and particularly during transitions of care between health-care settings. Care planning and implementation for LE requires an engaged team that has a comprehensive understanding of the patient's clinical status.

The Canadian Lymphedema Framework offers tips <https://www.canadalymph.ca/hints-and-tips/> for patients and care partners to plan and improve their experiences in the areas of travel, clothing and fashion, caring for compression garments, and skin care to reduce risk of infection. There is also information on how to improve or maintain communication with health-care providers and therapists.

## Skin Care

Patients or their care partners will be doing most of the basic skin care at home, so they need to be confident about their knowledge and skills related to hand hygiene, meticulous leg skin care, lotion application (medicated, non-medicated), identifying new skin changes, completing nail and foot care and managing compression garments, including daily washing of compression (circular and flat) garments, resetting the elastic and returning the garment to its original shape.<sup>87</sup> Patients wearing reusable (hook and loop) systems need to know the 'under stocking' requires daily washing for cleanliness.

Many patients with LE stage 2 or 3 frequently have deep skin tissue folds in the lower extremity and may have loss of the normal space between their toes. Therefore, care must be taken to clean skin folds daily with a mild pH-balanced cleanser, and ensure folds are carefully dried to prevent skin breakdown. Daily inspection of these folds is necessary to prevent local and deep tissue infections as a result of disruption to the normal skin barrier function. Patients may need mirrors and personal assistance to conduct their daily lower limb inspection.

Deep skin folds, creases or interdigital toe spaces may require wicking with a moisture-wicking cloth or antimicrobial gauze strips woven between the toes.

Monthly photography of skin is encouraged to monitor for changes.<sup>69</sup> Care partners can assume some of this responsibility but should not be the sole provider due to partner fatigue and burnout.

Skin-related prevention strategies must be regularly reassessed to ensure they remain appropriate.

Wounds Canada: Caring for Your Swollen Legs at Home is an excellent patient resource that is part of the Care at Home Series: <https://www.woundscanada.ca/patient-or-caregiver/resources/care-at-home-series>. It can be used as a teaching tool and left with patients and care partners to refer to when needed.

More patient information can be found at The Canadian Lymphedema Framework: Hints and Tips <https://www.canadalymph.ca/hints-and-tips/> and Skin Care <https://www.canadalymph.ca/skin-care/>

For an expanded list of provincial/territorial patient-centred resources see Appendix E: Patient-centred Lymphedema Resources

### **Manual Lymphatic Drainage**

Manual lymphatic drainage (MLD), also called lymphatic drainage massage, is a gentle massage done to stimulate the lymphatic vessels and to relieve or reduce the swelling in the limb. This can be done by a trained therapist or the patient or care partner with training. Massage helps to move lymph into an area of the body that is less or not affected by LE. Patients and care partners should be taught by a trained therapist and monitored ongoing. The University Health Network provides a resource for patients and care partners focused on how to do lymphatic self-massage on the lower body. [https://www.uhn.ca/PatientsFamilies/Health\\_Information/Health\\_Topics/Documents/How\\_to\\_Do\\_Self\\_Lymphatic\\_Massage\\_Lower\\_Body.pdf](https://www.uhn.ca/PatientsFamilies/Health_Information/Health_Topics/Documents/How_to_Do_Self_Lymphatic_Massage_Lower_Body.pdf)

In addition, the University of Michigan offers patient education for manual lymphatic drainage for legs. <https://www.med.umich.edu/1libr/PMR/Lymphedema/BilatLEMLD.pdf>

### **Exercise**

Exercise programs should be part of a long-term commitment for a patient living with LE.<sup>13</sup> The programs should be relevant to the patient's underlying co-morbidities and stage of LE and should engage care partners and family members, as appropriate. Exercise programs should be individualized by a physical therapist and may be unsupervised or supervised, depending on the patient's health status and co-morbidities.<sup>13</sup> Although there is low-quality evidence on the direct role of exercise on LE reduction, consistent engagement in exercise is associated with improved physical and mental health outcomes (quality of life, daily functioning and wellness).<sup>13</sup>

Activating the calf-muscle pump is done through walking and exercise programs. Efforts should focus on activating the calf-muscle pump and ensuring the ankle joint is being fully mobilized for lower extremity involvement. For more information see [Chapter 12: Best Practice Recommendations for the Prevention and Management of Venous Leg Ulcers](#).

Swimming has been identified as being a benefit, as the water acts as natural compression on the limbs.<sup>13</sup> Swimming is not appropriate for persons with open wounds.<sup>13</sup>

### **Compression Therapy**

Prompt application of compression therapy is the cornerstone of LE treatment and lifelong edema management.<sup>45</sup> As stated in Step 1 (1.2.1 Patient: Physical, emotional and lifestyle), it is essential that the clinician obtain an ankle-brachial pressure index (APBI) prior to application of compression therapy to the lower limb(s). In cases where obtaining an APBI is challenging, vascular studies should be considered in collaboration with the team and patient.

After a holistic assessment, and if vascular status permits, discuss compression therapy with the patient as one of the essential components for the treatment and management of lymphedema. If the patient agrees, compression therapy can be initiated.<sup>13,69</sup>

Lymphedema needs continuous compression (See Table 7). If compression therapy is interrupted, edema will recur. When edema reduction is optimized by using a disposable compression bandage, therapy needs to be continued, using a reusable compression garment. To effectively achieve goals, choose compression garments depending on the LE stage.

**Table 7:** Selection of Compression<sup>69</sup>

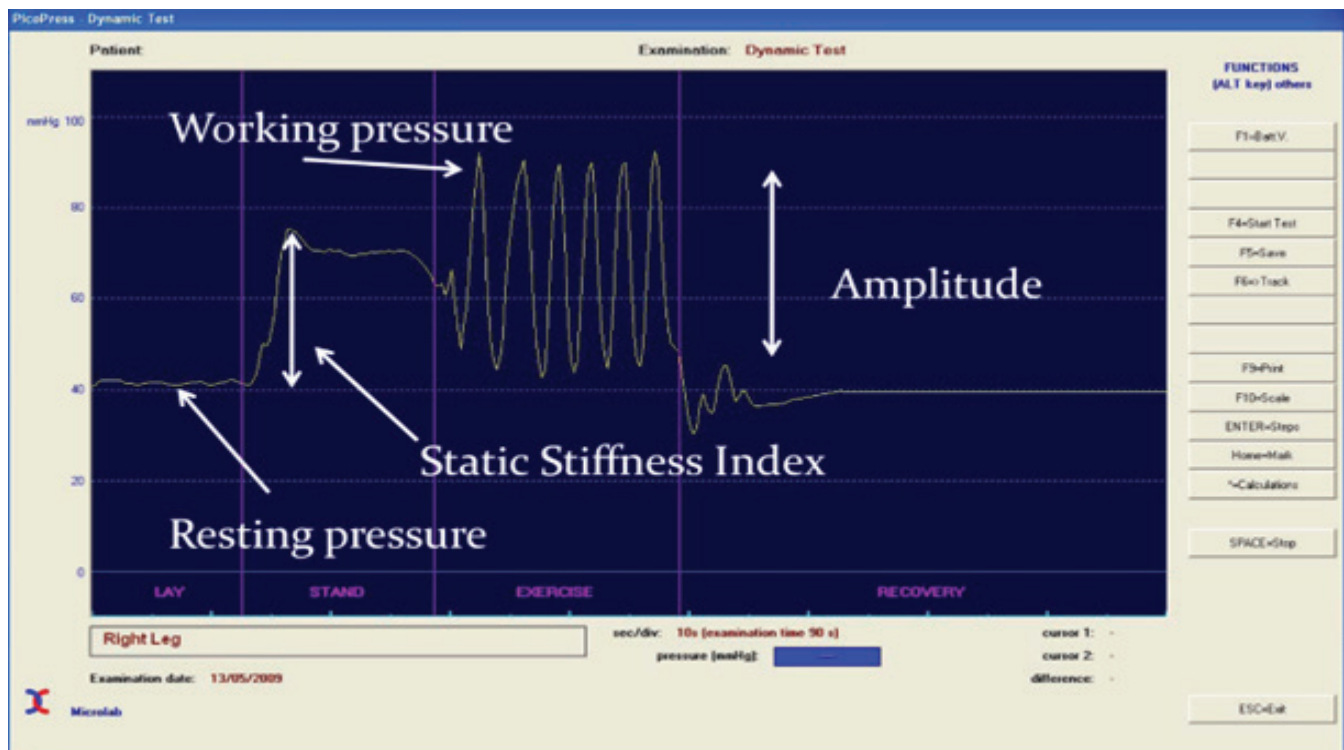
Stage	Compression and Clinical Considerations
1	Limb elevation can reduce edema. ABOVE the heart! Circular knit compression garments are usually sufficient
2	Substantial compression products are required, such as: <ul style="list-style-type: none"><li>• flat knit custom-designed compression garments, and/or</li><li>• inelastic adjustable wrap/garment</li></ul> These are preferred to circular knit, ready-to-wear compression as they are stiffer and provide better containment and hemodynamic effect
3	Due to the fibrosis and fat deposition that have occurred in this stage, elevation does not reduce the edema; there may be shape changes in the limb, with formation of lobules and/or ankle cuffs
	Substantial compression products are required, such as flat knit custom compression garments or inelastic adjustable wrap This type of compression is needed due to the skin thickening with additional development of fibrosis and fat deposition and/or development of skin papillomas and warty (verrucous) overgrowth

Source: Hettrick H, Ehmann S, McKeown B, Bender D, Blebea J. Selecting appropriate compression for lymphedema patients: American Vein and Lymphatic Society position statement. *Phlebology*. 2023 Mar;38(2):115-8.

### Key Points

- Compression therapy needs to be designed specifically for each patient.
- The team must be aware that compression is essential for managing LE in the long term.
- Compression therapy should be assessed for, prescribed and applied by the patient, care partner, knowledgeable clinician or certified lymphedema therapist.
- Education and training with the patient and/or care partner must be relevant and repeated to reinforce the proper use of compression therapy.
- Education for the patient must include identified risks and complications and to whom the patient and care partner should communicate any changes.

**Figure 6:** Illustrates key terminology used in compression therapy



Used with permission from Dr. D. H. Keast.

#### Terminology:

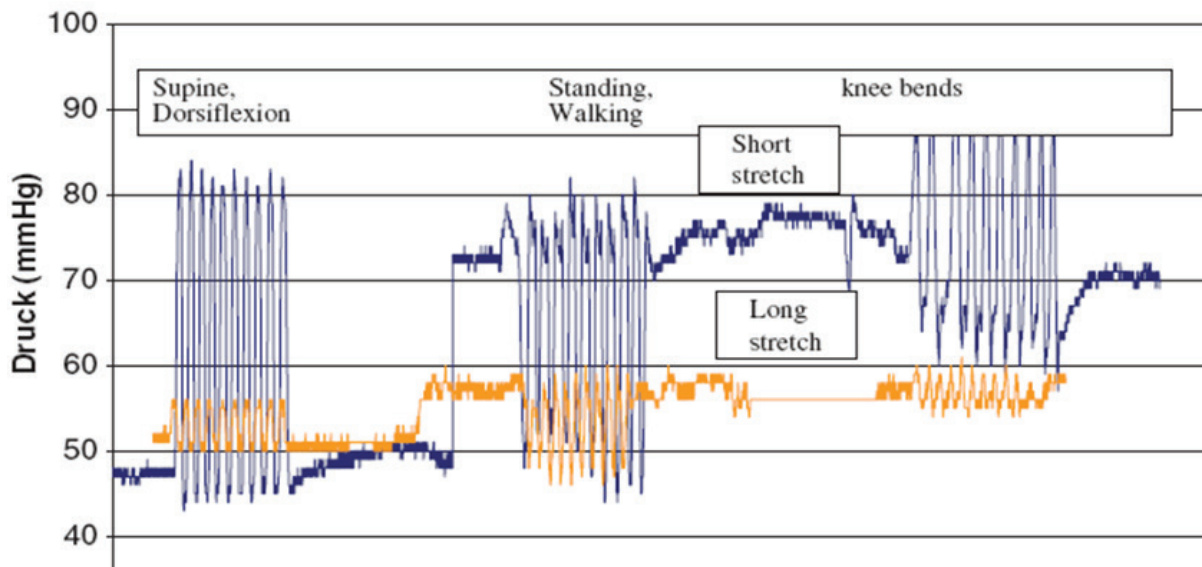
- *Sub bandage pressure* on a lower leg measured at a standard location.
- *Resting pressure* occurs when the patient is in a recumbent (lying down) position.
- *Static stiffness index*. Occurs when the patient stands. The sub bandage pressure increases due to the influence of gravity on the fluid in the leg. The stiffer the bandage the higher the sub bandage pressure because the leg cannot expand against the rigid barrier.
- *Working pressure or peak pressure*. Occurs when the patient walks. The contraction and relaxation of the calf muscle create pressure waves in the sub bandage tissue, enhancing the action of the calf-muscle pump.
- *Amplitude* is the size of the pressure wave.

Figure 7 illustrates the relative effectiveness of short-stretch versus long-stretch bandages in mobilizing edema fluid and the sub bandage pressures on a patient's leg.

The blue tracing represents a short-stretch (inelastic) bandage, and the orange tracing a long-stretch (elastic) bandage. Starting from the left side this figure demonstrates that the resting pressure of the short-stretch bandage is less than that of the long-stretch bandage, which is actively squeezing the leg. This reading was obtained with the subject lying down.

This explains the greater comfort at rest using a short-stretch bandage. The patient is then asked to repeatedly flex their foot at the ankle, generating pressure waves with the contraction and relaxation of the calf muscles. The long-stretch bandage expands to accommodate the muscle, generating much smaller pressure waves. The subject is now asked to stand. Immediately the sub bandage pressure increases. The stiffer the bandage the higher the sub bandage rises and the larger the Static Stiffness Index. The subject is now asked to walk. The contraction and relaxation of the calf muscles again create pressure waves. The pressure waves generated by the short-stretch bandage have a much larger amplitude and significantly create greater enhancement of the calf-muscle-pump function. Finally, the subject is asked to do deep knee bends, further increasing the pressure waves generated.

**Figure 7:** The Relative Effectiveness of Short-Stretch Versus Long-Stretch Bandages in Mobilizing Edema Fluid



Source: Partsch H, Clark M, Bassez S, Benigni JP, Becker F, Blazek V, et al. Measurement of lower leg compression in vivo: recommendations for the performance of measurements of interface pressure and stiffness. *Dermatologic surgery*. 2006 Feb 1;32(2):224-32.

### Key Points Regarding Short-stretch Compression

Short-stretch bandages:

- Are more comfortable at rest
- Do not squeeze the leg, but rather support the leg
- Work by enhancing calf-muscle-pump function, increasing venous return and lymphatic mobilization of tissue fluid.<sup>89</sup>

**Compression Bandaging:** The disposable compression bandage is commonly employed during the initial phase of LE management. Its primary objective is to decrease edema to ensure an optimal fit of compression garments for long-term maintenance. Inelastic disposable systems should be administered by trained health-care professionals.

**Adjustable Compression Garments/Wraps:** Adjustable or modifiable garments/wraps are also available to help reduce edema. As the volume of the limb reduces throughout the day, the garment can be modified and readjusted to provide a better fit and comfort, bringing the patient closer to a permanently fitted garment.

For more information about adjustable compression wraps see the Canadian Society for Vascular Surgery resource *Adjustable Compression Wraps: Applications & Benefits*.<sup>90</sup>

[https://canadianvascular.ca/resources/Documents/Sponsor-Showcase/MOHFocus\\_Wraps.pdf](https://canadianvascular.ca/resources/Documents/Sponsor-Showcase/MOHFocus_Wraps.pdf)

**Self-bandaging by Patients:** Self-bandaging with compression bandages, adjustable wraps or garments may be done by some patients and their care partners after they have been taught how to safely wrap by a trained team member (See Table 7). Patients need to be taught the signs and symptoms of an infection and not to wrap until they have been assessed by a health-care provider. Self-bandaging supports the patient's independence, enhances their self-management abilities, reduces the number of therapist visits and generally increases their knowledge about LE treatment and management.<sup>91,92</sup>

Teaching a patient to self-bandage takes preparation and time, and the provider must use a teaching technique most appropriate for the person. The University Health Network provides an example of a visual and written teaching tool: *How to Self-Bandage Your Legs and Feet to Reduce Lymphedema (Swelling)*. [https://www.uhn.ca/PatientsFamilies/Health\\_Information/Health\\_Topics/Documents/How\\_to\\_Self-bandage\\_legs\\_feet\\_to\\_Reduce\\_Lymphedema.pdf](https://www.uhn.ca/PatientsFamilies/Health_Information/Health_Topics/Documents/How_to_Self-bandage_legs_feet_to_Reduce_Lymphedema.pdf)

See the Wounds Canada Product Picker *Control of Venous Leg Edema*

<https://www.woundscanada.ca/docman/public/health-care-professional/1182-wc-product-picker-control-of-venous-leg-edema-ltr-1691r2e-2pg-copy/file> for information on compression options.

**Compression Garments:** A standard guideline for selecting LE compression garments includes having the affected limb measured and fitted by a professional garment fitter when the limb is in a decongested (baseline) state. There is no straightforward answer when it comes to choosing a compression garment for LE management. Various options are available in the consumer market, including circular knit, firmer circular knit, flat knit, adjustable wraps, night garments and decongestive garments.<sup>93</sup>

**Key Points about Compression:** Meticulous skin care, daily exercises and consistent application of compression garments are more important than choosing a garment with high pressure and stiffness.<sup>94</sup>

The best compression garment is the one that CONTROLS THE EDEMA and that THE PATIENT WILL WEAR daily.

Compression has been shown to have a positive impact on both lymphatic and venous function because it:

- Decreases accumulation of excess interstitial fluid by counteracting fluid filtration from blood capillaries into the tissue, consequently lowering the lymphatic burden
- Redirects lymphatic reuptake and promotes lymphangion contractions
- Enhances calf-muscle-pump activity, leading to heightened frequency and intensity of lymphatic movement.<sup>95</sup>

**Daily Care of Compression Garments:** Proper care includes washing by hand, hanging to dry, folding and storage of LE compression garments daily. Daily washing helps return the elastic in the garment to its original shape and may increase the life of the garment. The Canadian Lymphedema Framework outlines key teaching points for the handwashing, drying, storing and replacement of garments at <https://www.canadalymph.ca/hints-and-tips/> They also discuss how to protect the garments in warm weather and when travelling.

Compression garment design can be divided by technologies.<sup>69</sup> See Table 8.



**Table 8:** Compression Garment Design

Type	Properties
Circular knit garment	<p>Ready to wear (stocking, arm sleeves)</p> <p>Manufactured in a cylindrical form</p> <p>Supplied with compression gradients of 15–20 mmHg, 20–30 mmHg and 30–40 mmHg in standardized sizes for average-shaped limbs</p> <p>Due to their elastic nature, pressure variations under circular knit garments are minimal with movement</p>
Flat knit garment	<p>Custom measured and designed to fit the patient’s specific anatomical extremity dimensions</p> <p>Elastic, and the knit design provides significantly higher resistance to stretch, providing more containment of edema under the garment</p> <p>Options for compression levels for flat knit garments are similar to circular knit; however, because the garment is custom engineered specifically to accommodate the size and shape of the limb, there is a more predictable pressure distribution. The stiffer construction results in slightly larger pressure variations with movement</p> <p>Flat knit garments are typically easier to apply as they are form fitting and specific to the patient</p>
Inelastic adjustable wraps (hook-and-loop technology)	<p>Designed to provide patients with adjustable compression levels along the length of the leg</p> <p>The adjustable design, often with hook-and-loop inelastic adjustable bindings, allows for easier application of the garment by the patient or care partner and permits adjustments throughout the day as needed</p> <p>These compression devices provide the stiffest construction, producing larger pressure variations with movement. Inelastic adjustable wraps can be worn during the day and nighttime hours</p>
Nighttime garments	<p>Designed for use when the patient is supine or sleeping</p> <p>Garments are designed to provide containment of the edema with lower compression levels during sleep</p> <p>They are specifically engineered with textured fabrics to soften fibrotic tissue</p>

*Adapted from: Hettrick H, Ehmann S, McKeown B, Bender D, Blebea J. Selecting appropriate compression for lymphedema patients: American Vein and Lymphatic Society position statement. Phlebology. 2023 Mar;38(2):115-8.*

**Note:** In Canada cohesive and inelastic bandages are regularly used to reduce edema, especially when dealing with leg ulcers. While the inelastic adjustable wraps will reduce edema, stockings will not. Stockings are prescribed for prevention and long-term maintenance once the edema is reduced to a relatively stable state to enable fitting.

**Intermittent Pneumatic Compression (IPC) Therapy:** The role of IPC is usually a two-phase program that can be part of a patient’s daily care.<sup>13</sup> IPC mimics the principles of manual lymph drainage and may be used by the patient at home after being taught by a trained therapist. During the therapy the patient usually remains immobile. External compression therapy may be used with a sequential gradient pump, form-fitting low-stretch elastic stockings or sleeves to maintain LE reduction.<sup>13</sup> Some devices are available that aim to support the patient to be more independent in their LE self-care. For example, there are electronic devices that simulate manual massage with varying limb coverage.<sup>13</sup> More research is needed to fully understand the effects of combining manual lymphatic drainage (MLD) and IPC.<sup>96</sup> Funding for IPC varies across most provinces/territories. For example, in Ontario IPC is funded for primary LE only and the patient pays a portion (25%).

## Non-pneumatic Compression Device

Recent research is exploring the role of a novel non-pneumatic compression device (NPCD) for lower limb LE in which the patient remains physically active during the compression treatment. In one study, once the NPCD was applied, the patients' (n=24) QOL was measured using the LYMQOL scale. There was statistically significant improvement in their QOL, and the average reduction in the affected limb was 39.4%.<sup>97</sup>

More research is needed to explore the role of laser therapy, ultrasound/shockwaves, thermal heat in LE prevention and therapeutic treatment.<sup>13</sup>

## Nutrition

The patient's nutrition and nutritional status are important elements of LE treatment. There is no specific diet for patients living with LE. Early referral of patients with LE to a registered dietitian is encouraged. Patients may describe a roller-coaster life of weight loss and weight gain and the associated emotions that result. Of great concern is if the patient's weight increases. Added weight increases LE risk and burden of disease and co-morbidities, decreases mobility and adds extra challenges to self-management, particularly in the areas of self-bandaging and exercise.<sup>44</sup> Patients may have had negative or traumatic experiences related to weight management programs, and this needs to be acknowledged to create a new path moving forward. Consider psychosocial support when patients are having challenges with engaging with or adhering to nutrition and/or weight management plans.

The patient's nutritional plan should be individualized and continually modified throughout their lifespan taking into consideration cultural perspectives and patient preferences. Weight management is a key focus of nutritional planning for patients with LE. In a review of dietary supplements by LE Bonetti et al., the authors identified obesity as a, "comorbidity that exacerbates the risk for secondary lymphedema and constitutes a negative prognostic factor".<sup>98</sup> They suggested that weight management must be a consistent conversation with patients and their care partners.<sup>98</sup> Recent research has focused on the role of anti-edemagenic and anti-inflammatory foods and their effects on limb LE, seeking to understand the possible therapeutic role of specific diets in the long-term management of LE.<sup>34,98</sup> For more information on nutrition see Appendix 1: Nutrition for Skin Health, Wound Prevention and Wound Healing in Chapter 4: Best Practice Recommendations for the Prevention and Management of Wounds: An Overview.<sup>24</sup>

As discussed in Step 1, obesity is an identified risk factor for LE.<sup>99</sup>

## Medications

As noted in Table 3, medications play an important role in managing the patients' comorbidities. However, some medications may contribute to the development of LE. In the initial stages of LE, diuretics have limited use and should be prescribed only if indicated for a comorbidity such as congestive heart failure.<sup>13</sup> (ISL, 2020). Pharmacists can assist with medication reconciliation and monitoring for drug interactions and side effects. Regular assessment for the indications and risk/benefit profiles for medications should be done by the primary care team.

## Quality of Life

Psychosocial support is emphasized as an important component of success in long-term LE management.<sup>13</sup> Once issues such as distress, anxiety, depression and fatigue are identified, appropriate referrals and education are needed long-term, as patients living with LE require consistent psychosocial support. The level of engagement and service will vary depending on the patient's communication, coping skills and their ability to adapt to living with LE.<sup>13</sup> For patients with LE related to an underlying cancer, Bowman et al. developed a novel model for LE care that includes an integrated team with physical and psychosocial support.<sup>100</sup>

## Surgical Considerations

Surgical options to alleviate lower limb LE and improve lymph return are currently being researched and are gaining use in clinical settings.<sup>13,101</sup> For specific patient populations, micro-surgical and super-microsurgical (connecting vessels less than 0.8mm) approaches may be considered as an adjunct to complete decongestive therapy (CDT).<sup>13</sup> Recently, supermicrosurgery has advanced enough to present a viable option for the treatment of lymphedema. Specific techniques include lymphovenous bypass and vascularized lymph node transplant.<sup>101</sup> Ciudad et al., in a review focused on surgical management of lower limb LE, emphasized the importance of an accurate and early LE diagnosis to enable specialized LE teams to consider proactive rather than reactive surgical approaches. At present interventions

are focused on slowing the LE disease progression.<sup>22</sup> Recent procedures may also include lymphovenous anastomosis and vascularized lymph node transfer.<sup>22</sup> In an algorithmic approach, Ciudad et al. outline when surgery might be considered depending on a holistic assessment, ISL LE stage and patient history. For more information see: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6664851/>

## 4.2 Optimize the local wound environment

This section focuses on management of LE when a wound is present. Some aspects may be applicable to overall LE management.

**Discussion:** Local skin health and wound management strategies need to be part of the plan of care and fit within the context of the overall healability of the identified skin issue or wound. To optimize the local skin and/or wound environment, clinicians must consider periwound skin, wound cleansing and debridement, management of bacterial burden and moisture control to support prevention and healing goals.

Care at Home Series on Wound Management

<https://www.woundscanada.ca/patient-or-caregiver/resources/care-at-home-series>

### 4.2.1 Cleansing

**Discussion:** Skin care can be particularly challenging in LE due to the presence of edema and altered limb/foot shapes, creases and contours.<sup>102</sup> Patients with LE are at risk of infections such as cellulitis, which can exacerbate lymphatic dysfunction and lead to greater edema, sepsis and increased mortality.<sup>103</sup> Therefore, it is important to daily cleanse and moisturize (unscented, non-allergic) the skin of the affected areas, or more often, depending on the plan of care.<sup>88</sup>

Skin care regimes should be updated regularly depending on the skin condition(s) and when treatments (creams, ointments) need to be applied. Skin care should be done before donning garments and the skin checked upon removal of garments.

Areas with new onset of pain should be examined for evidence of deep fissures and assessed clinically for the possibility of infection.<sup>104</sup> To minimize the bacterial burden, cleanse the wound with the aim of flushing away soluble debris, surface microbes, foreign bodies and non-viable tissue. Cleanse the periwound skin and assess the limb and foot and toes (creases) for any skin changes and document findings.

#### Considerations When Cleansing

- For patients with LE and skin and wound issues, cleansing may involve the complete limb and multiple skin folds on the limb, foot and toes.
- Showering is a way to cleanse skin and may be considered in partnership with the medical team, wound care nurse, occupational therapy for equipment and safety and physiotherapy for mobility assessment.
- Some patients may need limb/foot/toe wound care conducted in their bed/chair based on mobility, safety and overall goals.
- When needed, clinicians must keep their managers and leaders apprised of the need for more than one health-care provider to be present to provide skin and wound care.

Cleansing solutions commonly used in wound management include sterile normal saline, sterile water, potable tap water, commercial wound cleansers and liquid antiseptics. Regardless of the type of cleanser chosen, solutions at room temperature should be applied in sufficient quantities to ensure the area is adequately cleaned. Safe irrigation (4–15 psi) is preferred to help flush away surface microbes, foreign bodies, soluble debris and non-viable tissue.

For more information on cleansing please see Chapter 4: Best Practice Recommendations for the Prevention and Management of Wounds: An Overview.<sup>24</sup>

The Wounds Canada Skin and Wound Clean-up Product Picker <https://www.woundscanada.ca/dhfy-doc-man/public/health-care-professional/1307-product-picker-skin-and-wound-clean-ip/file> is a useful tool to help clinicians choose the most appropriate type of wound cleanser.

### 4.2.2 Debriding

**Discussion:** Debridement serves to remove microbes, foreign bodies, debris and non-viable tissue from a wound to promote wound closure. As with wound cleansing, the appropriate method of debridement should be determined based on the patient's needs and vascular status. This includes consideration of the periwound condition, wound, the environment, available resources and the scope of practice of the health-care clinician completing the debridement.

For more information on wound debridement please see Chapter 4: Best Practice Recommendations for the Prevention and Management of Wounds: An Overview.<sup>24</sup>

The Wounds Canada Skin and Wound Clean-up Product Picker is a useful tool to help clinicians choose the most appropriate form of wound debridement. [Product Picker: Skin and Wound Clean-Up](#).

### 4.2.3 Managing bacterial balance

**Discussion:** Patients living with LE are at specific risk of soft tissue infections, which may include erysipelas, lymphangitis or cellulitis in the affected areas.<sup>13,105</sup> The stagnation of lymph limits bacterial clearance and may impair host immunity to bacteria due to limited lymphatic flow. Although these three entities (erysipelas, lymphangitis, cellulitis) have some clinical differences, they are treated similarly with directed antibiotics against usual skin bacteria of *Staphylococcus aureus* (including MRSA) and *Streptococcus* species (e.g., *S. pyogenes*). Soft tissue infections most commonly affect the limbs, but in some cases may occur in other areas affected by LE (e.g., genitals, groin area). In those cases, other bacteria may need to be considered and will guide treatment decisions.

Cellulitis is the most studied infection in the context of LE. As with other soft tissue infections, cellulitis is characterized by acute onset of new or increased pain, swelling, redness and functional loss (e.g., unable to bear weight in the affected limb/foot).<sup>106</sup> When patients present with subacute or chronic progression of symptoms such as pain, erythema or swelling or an isolated change in one of these symptoms, an alternate non-infectious diagnosis is likely. With lymphedema, patients can experience more severe infections (including with pre-sepsis/sepsis symptoms)<sup>107</sup> and may have recurrent episodes.<sup>108</sup> These infections can further damage the lymphatic system due to their extension into the dermis (erysipelas) and/or subcutaneous tissues (lymphangitis, cellulitis), setting up a vicious cycle.

Up to 50% of patients who develop cellulitis will experience repeat episodes.<sup>36</sup> Secondary prophylaxis with antibiotics can be considered in patients with recurrent lower extremity cellulitis to decrease future risk. A Cochrane review of five trials identified that antibiotic prophylaxis decreased future episodes by 69% and reduced the rate significantly until the next attack. However, the protective effect appeared to wane following therapy stoppage.<sup>109</sup> The antibiotic prophylaxis strategy appears to be helpful in people with at least two past episodes of cellulitis in a three-year timeframe. Of the agents used, penicillin was the most common. Notably, none of these studies looked at the effects of additional interventions such as protective skin care or compression. However, in specific patients, and in particular where other care strategies such as CDT have been optimized, prophylactic antibiotics may be considered.<sup>13</sup>

Patients with LE are also at risk for developing fungal (dermatophyte) infections. Fungi thrive in the moist environments that can be present in skin folds and creases common in patients with lymphedema and can be exacerbated by factors such as stasis, immobility and the patient's clinical status. This is particularly common in the lower limb. Fungal infections may be treated with antimycotic drugs.<sup>13</sup> The washing and proper drying of the skin are important steps. Other treatments may include adjunctive antihistamines or steroids in selected patients.<sup>13</sup>

For more detailed information on managing bacterial balance see Chapter 4: Best Practice Recommendations for the Prevention and Management of Wounds: An Overview.<sup>24</sup>

### 4.2.4 Managing moisture balance

**Discussion:** Managing moisture on the skin and in a wound is an important aspect of care. Lymphatic fluid can drain directly onto the skin through microscopic skin defects known as lymphorrhea.<sup>110</sup> Lymphorrhea drainage will collect in skin folds, especially if deep and in gravity-dependent areas, such as feet and toes, leading to skin irritation and excoriation. This results in moisture-associated skin damage (MASD). For more information on MASD see [Chapter 5: Best Practice Recommendations for the Prevention and Management of Moisture-Associated Skin Damage](#).

Lymphorrhea drainage often saturates the patient's clothing, footwear, bedding and surfaces,<sup>110</sup> increasing the amount of laundry, bedding and clothing changes. This adds to the burden of daily LE management in the home setting, leading to additional physical and financial burdens for the care partners and family members.<sup>111</sup>

The combination of fluid and pressure (weight of the tissue) puts patients at greater risk for the development of skin and wound complications (e.g., cellulitis, infection) and may require escalation of management strategies, including hospitalization.<sup>13,36</sup>

Wound dressings that support exudate management should be selected for patients with heavily draining skin/wounds and, whenever possible, be non-adhesive. They need to be worn under the compression therapy (bandaging, garments) and used in alignment with the manufacturers' recommendations. Wound dressing changes can coincide with compression therapy changes and be done in partnership with the patient and other team members.

For more detailed information on managing moisture see Chapter 4: Best Practice Recommendations for the Prevention and Management of Wounds: An Overview.<sup>24</sup>

### **4.3 Select the appropriate dressings, and/or advanced therapy**

**Discussion:** Advancements in technology and innovation are rapidly evolving within the wound care sector. When choosing suitable dressings for LE-related wound care, it is crucial to ensure that the wound contact layer is compatible with the compression therapy being used and that the secondary dressing has the capacity to absorb and retain significant volumes of lymphorrhea to preserve periwound skin integrity.

For further guidance on dressings refer to Chapter 4: Best Practice Recommendations for the Prevention and Management of Wounds: An Overview.<sup>24</sup>

For more information about dressing selection, see Wounds Canada's Product Picker: Wound Dressing Formulary <https://www.woundscanada.ca/health-care-professional/resources-health-care-pros/library/183-resources-industry-partner/288-product-picker> and Product Picker: Wound Dressing Selection Guide [www.woundscanada.ca/docman/public/health-care-professional/1114-product-picker-2017-selection-guide-1/file](http://www.woundscanada.ca/docman/public/health-care-professional/1114-product-picker-2017-selection-guide-1/file)

### **4.4 Engage the team to ensure consistent implementation of the plan of care**

**Discussion:** An individual who has been diagnosed with LE is living with a progressive condition that will require their entire team, including the patient themselves and their care partners, to be engaged in the plan of care. Trust, communication and collaboration among team members are essential for ensuring the success of any care plan. The team will need to encourage the patient to participate in management of underlying conditions, compression therapy, skin care, weight management, physical activity and other self-care activities while supporting their mental health throughout their lifelong journey with the LE. See Table 9 for a summary of key components of a care plan for patients with leg wounds and LE.

**Table 9:** Summary of Key Components of a Care Plan for Patients with Leg Wounds and LE

Component	Discussion
Manage underlying conditions	<ul style="list-style-type: none"> <li>• Volume overload conditions such as congestive heart failure require management and may require diuretics; otherwise, diuretics do NOT help to reduce edema</li> <li>• Manage glycemic control in persons with diabetes mellitus</li> <li>• Consider referral to vascular surgery in arterial or venous insufficiency; ligation of veins may increase wound healing and reduce risk of recurrence in eligible patients with venous leg ulcers (VLU)<sup>112</sup> - low threshold for referral in peripheral arterial disease (PAD)</li> </ul>
Compression therapy	<ul style="list-style-type: none"> <li>• Vascular status permits compression therapy and is the key intervention to reduce edema, improve the skin condition, and stimulate wound healing; in general, modified compression can be used up to the point of critical ischemia, in trained hands<sup>113</sup></li> <li>• Risks of compression therapy primarily includes skin irritation, discomfort and pain<sup>114</sup> - severe adverse events are rarely seen if compression is applied correctly, but use caution in severe cardiac heart failure (risk of decompensation), severe neuropathy and ischemia (risk of pressure injuries and/or compromised arterial function)<sup>114</sup></li> <li>• Modified/reduced compression in ABPI 0.5–0.8<sup>115</sup> - bandaging usually contraindicated <math>\leq 0.5</math> (critical ischemia). Multi-component bandage and hosiery systems are more effective than single (for VLU)<sup>116</sup></li> <li>• Garments are essential to prevent new edema formation and wounds; life-long treatment usually necessary; patient encouragement and education; renewal of garments necessary due to wear</li> </ul>
Other edema management	<ul style="list-style-type: none"> <li>• Edema-related drugs: consider change of medication (risk-benefit)</li> <li>• Intermittent pneumatic compression can supplement compression bandaging in selected cases</li> </ul>
Wound care	<ul style="list-style-type: none"> <li>• Debridement</li> <li>• Removal of non-viable tissue/slough at every dressing change where possible by clinicians with the skill and appropriate scope of practice can help prevention of overwhelming bioburden and biofilm</li> <li>• Therapeutic cleansing at every dressing change with appropriate solutions (tap water, saline, antiseptics, depending on the care setting, home, community, rehabilitation)</li> </ul>
Microbial management	<ul style="list-style-type: none"> <li>• Control of bioburden usually satisfactory with debridement and irrigation</li> <li>• In high bacterial colonization or wound infection, local dressings/products are added containing antiseptics (e.g. silver, cadexomer iodine, PHMB, vinegar); antibiotics appropriate only in presence of cellulitis or wound infection that cannot be controlled by local antiseptics; treatment supported by cultures and antibiotic resistance<sup>104</sup></li> </ul>
Exudate control	<ul style="list-style-type: none"> <li>• Main reduction of exudate production is through compression—treat infection if this is the reason for excessive exudate</li> <li>• Manage exudate through appropriate choice of dressings and frequency of dressing changes, usually from once weekly to daily</li> </ul>
Skin care	<ul style="list-style-type: none"> <li>• Proactive hand hygiene</li> <li>• Prevention of broken skin and development of cellulitis</li> <li>• Use of pH balanced soaps, cleaning and drying between toes and in all crevices to prevent fissures/ mycosis that can lead to cellulitis<sup>88</sup></li> <li>• Gentle emollients to restore skin barrier function; if the skin is dry ointments are preferably used, otherwise a cream—carbamid or salicylic acid products can be used in hyperkeratosis</li> <li>• Control excessive inflammation/dermatitis (e.g., by topical corticosteroids, zinc or tar); steroids to be applied before usage of emollients</li> <li>• Barrier films to protect periwound skin from exudate</li> <li>• Diabetics and patients with neuropathy are encouraged to frequently inspect skin at pressure points from footwear, bandaging, garments, especially between toes.</li> </ul>

*cont'd...*

Promote exercise/mobility	<ul style="list-style-type: none"> <li>• Physiotherapy consult may help to maximize calf muscle pump activity; otherwise, pamphlets and discussion of appropriate exercises can be provided</li> <li>• Support donning and doffing of day and nighttime compression<sup>69</sup></li> </ul>
Promote life-style change/choices	<ul style="list-style-type: none"> <li>• Smoking cessation program</li> <li>• Diabetes mellitus management</li> <li>• Control substance use (e.g., alcohol)</li> <li>• Adherence encouragement with compression, mobilization, exercise, weight control, nutrition, and offloading footwear</li> <li>• Weight loss, especially in obesity-induced LE<sup>44</sup></li> <li>• Sexual health<sup>49</sup></li> </ul>
Pain management	<ul style="list-style-type: none"> <li>• Nociceptive and neuropathic pain important to distinguish from each other to initiate proper treatment (See Table 2: Medications)</li> </ul>
Offloading pressure	<ul style="list-style-type: none"> <li>• Proper offloading footwear mandatory for diabetic foot ulcers, and pressure injuries - encouragement, and education are important</li> <li>• Empowerment strategies<sup>81</sup></li> </ul>
Psychological and spiritual impact	<ul style="list-style-type: none"> <li>• Psychosocial and spiritual care and referrals made in collaboration with the patient<sup>75</sup></li> </ul>

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## Step 5: Evaluate the Outcomes

### Recommendations

#### 5.1 Determine if the outcomes of the goals of care have been met

Clinicians need to determine if the skin health, limb volume, skin thickness, compression therapy and wound goals have been met, using general and specific validated tools accompanied by patient/care partners and team communications.<sup>52,117-119</sup> Where possible, practitioners should aim to co-develop and document goals of care with the patient (and/or caregiver or family member) early in the patient-health-care-professional encounter.<sup>120</sup>

It is important to remember that continued support of the patient with long-term compression therapy and psychosocial, physical activity and relevant therapies, proactive skin care and self-management strategies must take place and needs to be part of the determination of outcomes of the goals that have been set. Due to the progressive nature of LE, clinicians need to monitor care partner and family fatigue and provide ongoing support to patients and their care partners and family members.

#### 5.2 Reassess patient's skin, wound, environment and system, if goals of care are partially met or unmet

If the LE goals and response to the current therapies have been partially met or unmet, the team needs to return to Step 1 to reassess. The specific activities will depend on the skin status, wound factors and the impact on the patient's ability to manage daily activities (employment, social and home).<sup>121</sup> Re-assessment should include a holistic review that includes reviewing underlying disease processes. Further assessment may include repeating diagnostic tests and laboratory tests relevant to the patient's co-morbidities, arterial/vascular assessment and psychosocial assessment. The latter may include the patient and/or care partner, as burnout may be occurring.

For some patients, wound healing may not be the goal of care. In this case, quality of life, pain control, fewer episodes of cellulitis or wound infection or fewer hospitalizations may become the outcomes measured to determine quality of care. In 2019, 713 Canadians took part in an international survey conducted for the International Lymphoedema Framework that was distributed through the Canadian Lymphedema Framework. 64.7% of the respondents were patients and 35.7% were health professionals.<sup>122</sup> Commonly used outcome measures employed by health professionals are outlined in Table 10.

**Table 10:** Outcome Measures Most Commonly Used in Everyday Practice by Health Professionals

Measure	Percentage
Circumference measurements	70.23
Mobility	66.51
Pain	64.19
Quality of life	60.00
Patient adherence	57.21
Photography	43.72
Episodes of cellulitis	43.26
Weight/BMI	34.88
Circumference only without volume	33.95
Wound size	30.70
Complications of treatment	26.51
Wound type	24.19
Hospital admissions linked to chronic edema	22.79

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According to the survey's results, the LE outcome measures currently used focused on limb size, mobility and patient quality of life.<sup>122</sup> Interestingly, the ability to self-manage is also rated highly, whereas wound healing was rated as important by only 12% of participants.<sup>122</sup> The participants in this survey were largely patients and health professionals who were members of provincial advocacy organizations. The LIMPRINT survey of specialized lymphedema services found that less than 10% of patients with chronic edema/lymphedema had wounds.<sup>83</sup> The recent research on wounds and lymphedema clearly showed wound prevalence in upper extremity LE was about 10% while in lower extremity ranged from 50 to 75%.

### 5.2.1 Determine if the outcomes have met the care goals of care

**Discussion:** Evaluation of patient outcomes should take into consideration factors originally set in patient goals. Goals may need change over time based on management of LE, environmental factors, access to bandaging and compression therapies and overall health status (e.g., mobility, employment). Frequent reassessment of outcomes and their intersection with patient goals of care is recommended to develop a longitudinal understanding of the patient's care context and trajectory.

Although several quantitative tools exist to aid in the assessment of whether goals have been met (See Recommendation 5.2),<sup>29, 52,117,122,123</sup> health-care professionals should also integrate patients' subjective reports to better determine whether outcomes have met the goals of care.

### 5.2 Reassess patient, wound, environment and system if goals are partially met or unmet

**Discussion:** Consider several factors when reassessing the patient, wound, environment and system. Identify whether acute physical management goals have been met through thorough reassessment of limb volume (tape measurements) and related measures using validated tools (See Figure 4).<sup>30, 31,124-126</sup> Also assess lymphorrhagia, wound exudate, allergic reaction/sensitivity to dressings, skin integrity and levels of wound comfort.<sup>29,52,117,122,123</sup>

Health-care professionals may refer for additional support regarding the patient's physical symptoms and functional status. Using quality-of-life tools will assist in reassessment of specific or general health status.<sup>29,126-136</sup> It is critical to acknowledge and adjust care to each patient's unique experience and potential wound or LE-related stressors.

These ongoing LE-related stressors may include the psychosocial burden of functional impact, social/relational factors, financial burden associated with chronic wound or lymphedema care, identity changes, cultural aspects of wellbeing and perceived physical appearance changes due to complex wounds or lymphedema.<sup>123,137,138</sup> These stressors may be



worsened by the health-care system. Patients with LE reported a relative lack of LE interest or knowledge when interacting with the medical system, which may result in delays in assessment and testing to support an accurate, timely diagnosis. It is important clinicians acknowledge this experiential context as a reminder to offer a patient-centred and tailored approach to reassessment in addition to quantitative assessments (See Figure 4).<sup>137,139</sup>

If goals of care are not met, return to Step 1 and complete the cycle. If care goals are met, proceed to Recommendation 5.3 prior to discharge or transition to another setting.

### **5.3 Ensure sustainability to support prevention and reduce risk of recurrence**

**Discussion:** Early discharge planning communications and integrated team collaboration are key in building a sustainable maintenance plan to reduce the risk of recurrence.<sup>140</sup> A detailed discharge or transition in care (setting or unit) plan should be co-designed (with the initial plan of care) to accommodate the patient's unique physical, financial, social and accessibility needs. Ensure community-based care plans and referrals for follow-up have been established prior to discharge to promote smooth transitions in care and prevent patients from returning to hospital.<sup>140</sup>

Patient education on compression therapy, manual lymphatic massage, exercise and physical activity, meticulous skin care, infection prevention practices (hand hygiene) and patient-clinical support and networks in the community should be introduced before the immediate clinical encounter is completed, and repeated often.<sup>141</sup>

Health-care providers need to recognize that certain lymphedema care practices are not covered by provincial/territorial health-care funding.<sup>11</sup> Familiarizing yourself and your patient with up-to-date local care financial coverage is important in ensuring accessible, patient-centred longitudinal care is provided. Ensuring timely referrals to support services that understand funding of LE bandaging and garments is essential. Furthermore, certain maintenance therapies, such as specialized exercises, skin care (products, prescriptions) and manual lymphatic drainage, can be tailored and introduced to patients as self-care practices in order to balance co-morbidity management and financial sustainability.

Health-care providers need to stay up to date on LE, skin and wound-related knowledge. They need to practice compression therapy, ABPI, CDT and other LE-related skills.

Leaders and organizations need to support LE education and training for health-care professionals. This includes the provision of health assessment tools and education for LE (appropriately sized blood pressure cuffs, assessment tables, Doppler assessment equipment). As well, health-care professionals require appropriate blocks of appointment time to complete complex LE assessments and, in some cases, the team may need the services of a second health-care professional to support assessment and patient positioning as diagnostic testing may cause the patient pain and discomfort.

## **Conclusion**

Outcome evaluation is a stepwise process that engages the patient and care team across several aspects of the health continuum. Health-care professionals must be mindful of the many tools that can be used in the assessment of LE and corresponding wounds, while tailoring care to the unique needs and goals of the patients they encounter. Research is needed to develop assessment tools that integrate aspects of both lymphatic health and wound care in order to optimize the wellbeing of patients living with complex, combined presentation of lymphedema and wounds.

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## Appendix A: Lipedema

Lipedema is a distinct entity from lymphedema (LE) and often occurs bilaterally and symmetrically. Lipedema is a disproportionate accumulation of fat in the lower body. A familial association has been suggested with X-linked dominant or autosomal dominant with a predilection for female sex, so it is predominantly found in women. It progresses over time.<sup>142,143</sup>

Lipedema is often misdiagnosed as obesity or LE; however, the fat deposition in lipedema has sparing of the foot at the ankle, sometimes known as the cuff sign (late sign). In lipedema, the swelling is non-compressible. It is often associated with pain with touch to the skin and easy bruising.<sup>144</sup>

## Appendix B: National Lymphedema Network (NLN) Staging of Lymphedema<sup>145</sup>

Lymphedema develops in a progressive manner, from mild to severe, making early identification of the condition important. The stages of lymphedema are:

Stage 0 (Latency)	Lymphedema begins to develop deep within the tissues and can progress very slowly. Early changes happen without obvious, noticeable swelling; however, the fluid congestion causes sensations such as tightness, heaviness, or diffuse tingling in the at-risk limb. Despite the normal appearance of the limb, there may be subclinical changes occurring that can be measured and identified. Responding to changes in this early stage can help to prevent the onset of the condition. Special imaging or other lymphatic technology is required for diagnosis in this stage.
Stage 1 (Spontaneously Reversible)	In this early stage, swelling may or may not be present all the time. Swelling may come and go intermittently. When swelling is present, the skin will 'pit', meaning the area indents with pressure and holds the indentation. Elevation of the swollen limb provides relief and reduction in the swelling. It is important to seek out treatment for lymphedema management at this early stage to help to prevent the condition from becoming progressively more swollen.
Stage 2 (Spontaneously Irreversible)	In this stage, the tissue now has obvious signs of stagnant swelling that do not go away with elevation. The tissue will be firmer and show signs of less pitting. The tissue consistency change is caused by the formation of fibrosis. Fibrosis is the scarring of the tissue due to the prolonged presence of stagnant lymph. This marks the beginning of the hardening of the limb and progressively more aggressive swelling. Seeking treatment at this stage will help to reduce limb volume and improve tissue. The treatment will be more intensive and will require more vigilant follow up to maintain the swelling.
Stage 3 (Lymphostatic Elephantiasis)	At this stage, the tissue becomes very hard (fibrotic) and may begin to develop thickening on the surface of the skin. Excess skin forms on the limb and there is greater potential for open, seeping areas. Due to the high concentration of lymph fluid, the swollen limb(s) becomes an ideal culture medium for bacteria to thrive and recurrent infections may be common. Moreover, untreated lymphedema can lead into decrease or loss of functioning of the limb(s), skin breakdown, chronic infections and, sometimes, irreversible complications. Treatment is still beneficial at this stage and can have a remarkable impact on tissue softening and decongestion of the swelling.

These stages represent the natural progression of lymphedema when the condition is left untreated. At any stage, lymphedema can be treated and the progression halted and, in some instances, reversed. The importance of early identification and early management should be stressed.

Source: National Lymphedema Network. Available from: <https://lymphnet.org/stages-of-lymphedema>



## Appendix C: Lymphedema/Chronic Edema Clinician Certification and Education

Organization	Link
Atlantic Clinical Lymphedema Network (ACLN)	The ACLN is an interprovincial network of skilled LE clinicians committed to the exploration and implementation of best practice and effective service delivery in education and management of lymphedema <a href="https://atlanticlymph.ca/en/">https://atlanticlymph.ca/en/</a>
Canadian Lymphedema Framework	Home page. Lists all provincial lymphedema associations <a href="https://www.canadalymph.ca/">https://www.canadalymph.ca/</a> Offers list of schools that offer certification and education for lymphedema <a href="https://www.canadalymph.ca/health-professionals/schools/">https://www.canadalymph.ca/health-professionals/schools/</a>
Casley-Smith International	<a href="https://www.casleymithinternational.com/">https://www.casleymithinternational.com/</a>
Chikly Lymphedema therapy Certification	<a href="https://chiklyinstitute.com/Class/LDT/CLTC">https://chiklyinstitute.com/Class/LDT/CLTC</a>
Guardian EMR	Manual lymph activation course <a href="https://www.e-his.ca/mla/">https://www.e-his.ca/mla/</a>
Lymphatic Education & Research Network	<a href="https://lymphaticnetwork.org/living-with-lymphedema/find-a-lymphedema-therapist">https://lymphaticnetwork.org/living-with-lymphedema/find-a-lymphedema-therapist</a>
International Society of Lymphology (ISL)	<a href="https://isl.arizona.edu/">https://isl.arizona.edu/</a>
International Lymphedema Framework (ILF)	<a href="https://www.lympho.org/national-frameworks">https://www.lympho.org/national-frameworks</a>
Klose Training Lymphedema Certification	<a href="https://klosetraining.com/course/in-classroom/lymphedema-certification/">https://klosetraining.com/course/in-classroom/lymphedema-certification/</a>
National Lymphedema Network (NLN)	<a href="https://lymphnet.org/stages-of-lymphedema">https://lymphnet.org/stages-of-lymphedema</a>
Niagara College, St. Catharines, Ontario	Lymphedema management course <a href="https://www.niagaracollege.ca/parttimestudies/courses/SMNR/1580/">https://www.niagaracollege.ca/parttimestudies/courses/SMNR/1580/</a>
University of Alberta	Lymphedema and chronic edema management <a href="https://www.ualberta.ca/en/rehabilitation/programs/professional-development/micro-courses/lymphedema-and-chronic-edema.html">https://www.ualberta.ca/en/rehabilitation/programs/professional-development/micro-courses/lymphedema-and-chronic-edema.html</a>
Vodder School International	<a href="https://www.vodderschool.com/manual_lymph_drainage_overview2">https://www.vodderschool.com/manual_lymph_drainage_overview2</a>
Welsh Lymphedema Framework	<a href="https://lohmann-rauscher.co.uk/wales-lymphoedema-framework">https://lohmann-rauscher.co.uk/wales-lymphoedema-framework</a>

## Appendix D: Parkwood Wound Clinic Protocol for Application of Short Stretch Compression Bandages

**Note:** This is an example of multi-layer bandaging (MLB) which is part of many recommendations for treating LE. This approach is particularly useful in heavily exuding legs as the bandaging system is washable and reusable (follow manufacturers instructions).

### STEP 1: Washing and Preparing to Wrap

- After removing dressings, please wash lower legs and feet using mild soap or plain warm water and washcloth. Pat skin dry and dry well between toes with a clean, dry washcloth
- Apply recommended moisturizer or steroid ointment as directed. Do not apply moisturizer between toes unless otherwise indicated.
- Have patient exercise ankles, knees and feet at this time

**NOTE:** Legs must not go without compression for more than 1 hour. Edema will accumulate and you will be starting all over

### STEP 2: Wound Assessment and Dressing Application

- Inspect skin for any new open areas or new red itchy areas
- Assess the wound if present and record your assessment
- Apply dressings as directed

### STEP 3: Applying Skin Protection Layer

- Starting at the base of the great toe, on the dorsum of the foot, apply cast padding once around the foot, to lock the first go-round, then continue wrapping by overlapping 50% in a spiral fashion up toward the knee to two finger breadths below the bend of the knee
- THIS STEP MUST NOT BE OMITTED as it distributes the pressure and prevents breakdown at pressure points
- You may require extra padding to protect bony prominences (pretibial, malleolus)

### STEP 4: Applying Bolster on Dorsum of Foot if Required

- If a patient has a large amount of edema on the dorsum of foot/feet, you may add foam or abdominal pads to create a bolster. You may also 'figure 8' over the foot

### STEP 5: Applying First Layer of Short-Stretch Bandage

- Use a 6 cm, 8 cm or 10 cm bandage
- Discard clips provided
- Start at the base of the great toe on the dorsum and lock the first layer around the foot. Apply at full stretch, wrapping in spiral fashion with two-thirds or more overlap up as far up leg as it goes
- DO NOT CUT THE BANDAGE
- Secure with tape

### STEP 6: Applying Second Layer of Short Stretch Bandage

- Discard clips provided
- Start at just above the malleolus (ankle bone), overlapping the first layer as much as required
- Apply at full stretch, wrapping in spiral fashion with 2/3 overlap up the leg to 2 finger breadths below the bend of the knee. You may need to adjust the amount of overlap to end at the knee
- You may require a second wrap on larger legs to reach the knee
- DO NOT CUT THE BANDAGE
- Secure with tape
- Use an 0.8 cm, 0.10 cm or 0.12 cm bandage (one size larger than the first layer)

### STEP 7: Securing the Bandage

- Use tubular bandage or a knee-high nylon over the short-stretch wrap bandages to help hold up

### STEP 8: Follow-up

- Assess the patient for comfort
- Rewrap legs as necessary, every day initially, then q 2–3 days
- Encourage rest periods of 1–2 hours daily with legs elevated above the level of the heart as tolerated
- Short-stretch bandages can be washed up to 20 times in cool water by hand or in the gentle cycle of a washing machine. Squeeze in a dry towel to remove excess moisture and drape over a towel rack to dry

*Used with permission by Dr. D. H. Keast.*

## Appendix E: Patient-centred Lymphedema Resources

Organization	Resource and Link
Alberta Lymphedema Association	A voice for lymphedema <a href="https://albertalymphedema.com/">https://albertalymphedema.com/</a>
BC Cancer Library	Lymphedema resources available from the BC Cancer Library system <a href="https://bccancer.libguides.com/pathfinder-lymphedema">https://bccancer.libguides.com/pathfinder-lymphedema</a>
Canadian Lymphedema Framework	Hints and Tips <a href="https://www.canadalymph.ca/hints-and-tips/">https://www.canadalymph.ca/hints-and-tips/</a>
Canadian Cancer Survivor Network	Lymphedema <a href="https://survivornet.ca/learn/issues-affecting-cancer-survivors/survivorship-issues/lymphedema/">https://survivornet.ca/learn/issues-affecting-cancer-survivors/survivorship-issues/lymphedema/</a>
Lymphedema Association of Saskatchewan (LAS)	Focus on resources and support for persons at risk of or who live with LE <a href="https://www.sasklymph.ca/">https://www.sasklymph.ca/</a>
Lymphedema Association of Manitoba (LAM)	Resources for those affected or at risk of primary and secondary LE <a href="https://lymphmanitoba.ca/">https://lymphmanitoba.ca/</a>
Lymphedema Association of Ontario	Resources: <a href="https://www.lymphontario.ca/LE-Resources">https://www.lymphontario.ca/LE-Resources</a>
Lymphedema Association of Quebec	Resources in French and English to support patients and care partners with the goal of lessening the burden <a href="https://infolympo.ca/en/">https://infolympo.ca/en/</a>
Lymphedema Association of Newfoundland & Labrador	What is lymphedema? Patient stories included on the website <a href="https://lymphnl.com/">https://lymphnl.com/</a>
Lymphedema Association of New Brunswick	Resources and support offering hope for persons living with LE through meetings and social media <a href="https://atlanticlymph.ca/en/find-a-therapist/new-brunswick/">https://atlanticlymph.ca/en/find-a-therapist/new-brunswick/</a>
Lymphology Associaton of North America (LANA)	<a href="https://clt-lana.org/">https://clt-lana.org/</a>
Lymphedema Association of Nova Scotia	Offers support for persons living with LE <a href="https://lymphedemanovascotia.com/">https://lymphedemanovascotia.com/</a>
Lymphedema Association of Prince Edward Island	Resources and support offering hope for persons living with LE through meetings and social media <a href="https://atlanticlymph.ca/en/find-a-therapist/pei/">https://atlanticlymph.ca/en/find-a-therapist/pei/</a>
Wounds Canada	Caring for Your Swollen Legs at Home <a href="https://www.woundscanada.ca/patient-or-caregiver/resources/care-at-home-series">https://www.woundscanada.ca/patient-or-caregiver/resources/care-at-home-series</a>