Managing wounds in the treatment of lymphedema can prove challenging to even the most experienced health care professionals. Not only are there concerns about the development of infections, but wound care of lymphedematous limbs also presents its own unique difficulties.

Before discussion of the issues unique to wounds in lymphedematous limbs, it is important to understand the principles of wound management in general. The constituents of skin include the epidermis (most superficial layer), the dermis, and the subcutaneous tissue (see Figure 1). Usually, the severity of a wound is determined by how deeply it penetrates these layers; a superficial wound affects only the epidermis, while a full-thickness wound extends into subcutaneous tissues.

In epidermal injury, epithelial cells re-epithelialize the wound by actively dividing at the wound edge, rolling over each other and migrating across the basement membrane*, which is formed by the sequential synthesis of bullous pemphigoid antigen*, laminin* and Type IV collagen*. The epithelial cells depend upon the nutrients of the basement structures and, therefore, cannot migrate without viable tissue as a base. Migration also occurs more readily in a moist environment. Eschar, or scabbing, will impede epithelium. Thus, moist, occlusive dressings are critical for optimal healing.

In wounds affecting the dermal layer, the extracellular matrix* is restored by the proliferation of perivascular* fibroblasts*, which synthesize collagen, elastin*, glycosaminoglycans*, and proteoglycans*. Angiogenesis, or growth of new blood vessels, is an essential component of the healing process of the dermis. Lymphangiogenesis (growth of new lymphnodes) is also important, however, the lymphatics are often damaged beyond repair and edema and infection can occur.

For the epidermis and dermis to begin repair in full-thickness wounds, the underlying tissues must contract to close the wound - a process accomplished by myofibroblasts*.

Many factors can influence wound healing including drugs (steroids, chemotherapy, aspirin, etc.), ischemia (reduced blood flow from atherosclerosis or prolonged pressure), infection, or trauma. Neuropathy (disease of the peripheral nerves), foreign bodies embedded in the skin, skin diseases (i.e. psoriasis), chronic illness, malnutrition, diabetes, old age, vasculitis (inflammation of the blood vessels) and smoking are other factors which can reduce healing. In order to encourage wound healing, it is important to significantly improve those factors that can be successfully modified such as nutrition, drugs, infection, smoking and diabetes.

In the early stages of lymphedema, there are few occurrences of wounds that result directly from the presence of the lymphedema. Instead, wounds are usually acquired in the day-to-day
routines of living. Some examples are: scratches from gardening; burns from cooking; a nail infection or wound from an over-zealous manicure or pedicure; or an insect bite. Due to the stagnation of the lymph fluid resulting from lymphatic disruption and the pooling of lymph fluid (which serves as an excellent bacterial medium) beneath the skin, meticulous local care is imperative. Initially, careful cleansing with mild antibacterial soap and water or half-strength hydrogen peroxide is employed, followed by application of a topical antibiotic such as Bactroban, Neosporin, or Silvadene. A sterile dressing should be used such as a Band-aid, Tegaderm or thin Duoderm for more sensitive skin, or gauze pads secured with roll gauze (Kerlix) taped to itself for very delicate skin that cannot tolerate adhesive. Any signs of redness or infection should be followed by prompt treatment with systemic antibiotics. Since most cellulitis is caused by Strep A, or less often, Staph aureus, initial treatment options usually include oral cephalosporins, penicillins, quinolones, or the mycins. If no acute infection is present, it is of great importance to continue ongoing compressive therapy for lymphedema. Uncontrolled lymphedema can hamper healing and may contribute to further infection. Patients often experience difficulties donning garments or bandages over the wound dressings. An Easy Slide donning assistant can be helpful in this case. Another option is placing a queen size knee high stocking (with the band cut off) over the dressing.

In more advanced cases of lymphedema, the skin can be fibrotic and develop openings from craking or shear. These openings then become portals for bacteria and can result in cellulitis. In addition, if skin folds are present, fungal infection of the skin can cause maceration and secondary infection. In very advanced cases, lymphorrhea (lymph leakage from the skin) can occur, resulting in maceration and secondary bacterial and fungal infections, or papilloma (blister-like bubbles in the skin) can open leading to chronic oozing and infection risk. In general, the most severe wounds occur in the most advanced stages of lymphedema.

Once the wound has been carefully assessed, topical therapy principles include the removal of necrotic (dead) tissue. Local debridement (removal of the dead tissue) can be accomplished with a gentle scrubbing, a scalpel, or irrigation. The Pulse-a-Vac is a pulsed wound irrigation device that gently cleanses and removes loose necrotic tissue with no more than 10 mmHg. A whirlpool can also be used; be careful that the temperature is less than 97 degrees. Rarely, enzymatic debriding agents such as Santyl, Accuzyme or Panafil may be necessary if slough (dead tissue) has developed at the base of the wound. Next, it is important to identify if infection is present and treat any infection aggressively. Note that wound colonization (defined as the presence of replicating bacteria, which cause no harm to the host organism) does not warrant treatment with antibiotics.

The next step is to choose a dressing that fills the hollow space in the wound and absorbs the exudate. Dressings include transparent films which, although seldom used on the typically exudative wound in lymphedema, can be used to cover a more absorptive dressing such as an alginate (an absorptive dressing made from seaweed), or a hydrogel (a synthetic colloid that can absorb water). Hydrogels and hydrocolloids have minimal to moderate absorptive capacity, whereas foams and alginates are moderately absorptive. Dry gauze can be used for heavily exudative wounds and we often have paired gauze with infant’s diapers to maximally absorb exudate. These dressings share the virtue of maintaining a moist environment for the wound without maceration, which allows for more rapid healing.

Compressive wraps are a critical part of healing a wound in lymphedema and must be paired with the appropriate dressing. They have the advantage of providing thermal insulation and reducing risk of trauma in addition to increasing oxygen tension in the tissues by controlling the fluid in the interstitium.

After topical therapy has been initiated, it is important to assess the nutritional status of the patient. While healing a wound, most persons require 30-35 calories/kg/day and 1.25-2 grams of protein/kg/day. In addition, vitamin and mineral supplements can aid in healing the wound more quickly. These include a multi-vitamin, vitamin C for collagen synthesis, Vitamin A for promotion of cell development, and zinc for wound healing.

If cellulitis develops, all compression must be discontinued and the leg elevated in combination with the use of the wound care methods outlined above. Occasionally, cellulitis may cause blistered areas over the limb, which can de-roof and cause large denuded areas. These open areas can be painful and result in further infection. Appropriate antibiotics should be initiated for a full 10-14 day course and appropriate dressings for the wound applied. Once the cellulitis has resolved, Dr. Weissleder, in his book Lymphedema: Diagnosis and Therapy, recommends resumption of manual drainage and compressive wrapping. At the Charlotte Institute of Rehabilitation, we often resume compressive bandages about 2 to 3 days after the acute inflammation has resolved.

Large exudative wounds (wounds with a large amount of drainage) tend to result in maceration of the surrounding skin, which can lead to fungal skin infections. These are best treated by keeping the area surrounding the wound as dry as possible and treating with antifungal agents. In our center, we combine topical agents such as antifungal creams or powders with oral antifungal agents such as Diflucan.
In the case of phlebo-lymphedema, wounds can be chronic due to venous insufficiency. Treatment of the underlying vascular condition may be necessary to heal the wound. Compressive therapies are very effective in treating these wounds and have healed wounds of multiple years’ duration within periods of 6-8 weeks. A recent study by Falanga, et al, demonstrated that pentoxyfilline (Trental) is useful in the treatment of venous ulcers due to its fibrinolytic and antithrombotic properties. An experimental agent, sulodexide, also has recently shown promise for similar reasons. Another approach is to employ adjunctive therapies such as electrical stimulation, which has demonstrated accelerated wound-healing properties, or laser therapy. Recent research, published by Anodyne Therapy Systems, indicates that near infrared may be effective in the treatment of both lymphedema and wounds by enhancing circulation through the release of nitric oxide.

Another condition of which to be aware and consider in the assessment of your patient is diabetes, which can adversely affect the healing of a wound. Regranex has been approved for use in diabetic foot ulcers by the FDA and can be used in conjunction with careful wrapping and frequent skin inspections to heal these difficult ulcers.

Psoriasis is another factor that can cause significant skin involvement and may lead to difficult management issues when complicated by the presence of lymphedema. However, with careful application of prescribed topical steroids and the use of plastic sheeting such as Saran Wrap over the affected areas prior to wrapping, excellent healing can occur with wrapping.

In summary, the steps to wound care complicated by lymphedema include:

TOPOICAL THERAPY PRINCIPLES

MAXIMIZING NUTRITION

AGGRESSIVE TREATMENT OF INFECTIONS

Although the steps outlined above are good guidelines for wound healing, wounds in a lymphedematous limb can be difficult to heal and may take months to years of effort or may never completely heal, even when these principles are followed closely.

Terms marked with an asterisk are listed in the following glossary.

GLOSSARY

Basement membrane: an amorphous extracellular layer, which is closely applied to the epithelium. It is composed of three layers; lamina lucida, lamina densa and lamina fibroreticularis, a matrix of Type IV collagen and several glycoproteins.

Bullous pemphigoid antigen: a substance that promotes the adherence of the epithelial cell to the basement membrane.

Collagen: the major protein of connective tissue, cartilage and bone which has a unique triple helix configuration formed by three polypeptide subunits known as alpha-chains. There are 11 types of collagen. The most common types are Type I, II, III, and IV. Type IV has fewer fibrils and forms the basement membrane.

Elastin: a yellow elastic fibrous mucoprotein that is the major protein of elastic structures such as blood vessels.

Fibroblast: a cell present in connective tissue that can produce collagen fibers.

Glycosaminoglycan: a protein-polysaccharide complex formed from proteoglycans and a large amount of polysaccharide (up to 95%)

Laminin: a large glycoprotein component of the basement membrane.

Matrix: a surrounding substance within which something is contained or embedded.

Myofibroblast: a cell, which, due to its contractile properties, is able to aid in the contraction of wounds. It may also form Type III collagen.

Perivascular: surrounding a blood or a lymph vessel.

Proteoglycans: glycosaminoglycans bound to protein chains, which form the extracellular matrix of connective tissue.

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REFERENCES


