PRINCIPLES & PRACTICE OF
SUPPORTIVE ONCOLOGY
UPDATES
Vol. 2, No. 4 1999

Lymphedema

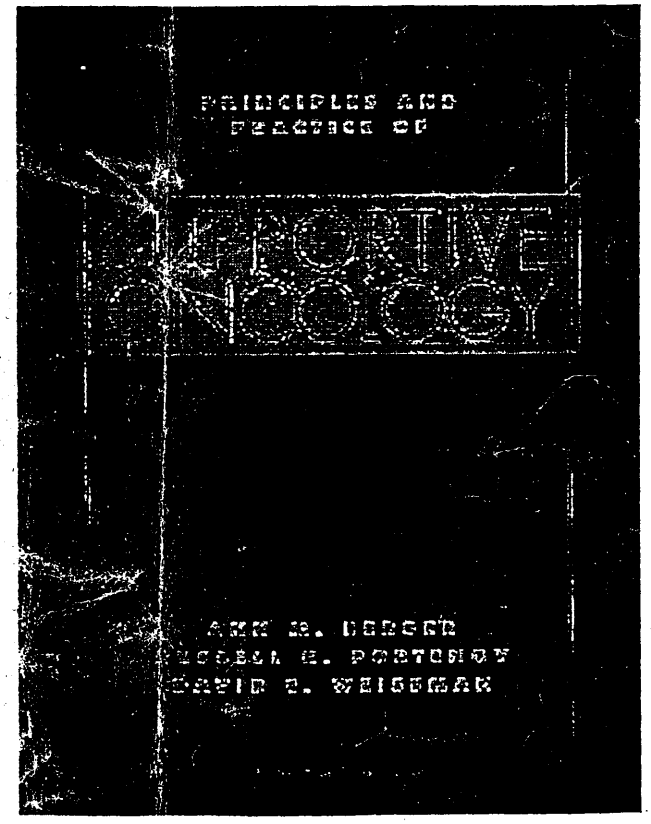
Patricia O'Brien, M.D.

INTRODUCTION

Lymphedema has a broad spectrum of presentations, as does cancer. In the past, many clinicians did not think about lymphedema as a source of pain or frustration for cancer patients until they presented with obvious disfigurement. As we learned more about the pathophysiology of cancer, we focused on early diagnosis and changed the way we treat it. Now, as we are learning more about the pathophysiology of lymphedema, we must also reassess how and when to treat it. Lymphedema must be considered in the differential diagnosis when the etiology of pain in cancer patients is evaluated (Figure 1, page 2). With early diagnosis and treatment, we can attempt to prevent the development of chronic lymphedema.[1-3]

Lymphedema can be defined as a high-protein edema caused by decreased lymphatic transport or increased lymphatic load.[4,5] This swelling of soft tissues is caused by the accumulation of protein-rich fluid in the extracellular spaces due to decompensation of the lymphatic system.[5-7]

Cancer patients are at particularly high risk for development of lymphedema, for a variety of disease- and treatment-related reasons.[8-10] Surgical incisions disrupt the natural lymphatic pathways. Therefore, surgery for primary tumor excision, lymph node dissection, or staging protocols affects the ability of the lymphatic system to move fluid out of the affected extremity.[3-5] A bulky tumor load that exter-



Patricia O'Brien, M.D., is Clinical Assistant Professor, University of Vermont College of Medicine, South Burlington, Vermont.

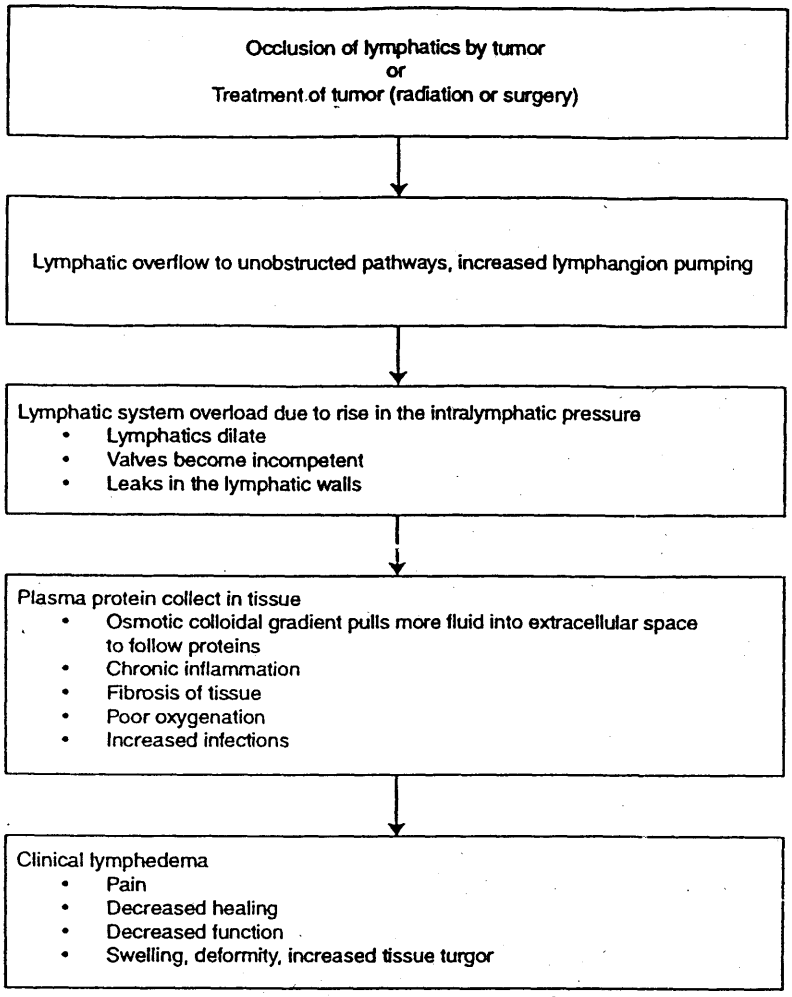


FIG. 1. Lymphedema pain: from subclinical to clinical.

nally compresses the lymphatics may obstruct the lymphatic pathways. Extension of micrometastatic disease into the lymphatics can also lead to lymphedema.[6] Moreover, radiation therapy can cause diffuse fibrosis in the superficial tissues, blocking lymphatic drainage.[6,11,12] Depending on the dose of radiation and the wavelength used, there may also be more significant deeper fibrosis, blocking alternative lymphatic pathways. There is also growing concern that some drugs used in chemotherapy may increase the risk for localized fibrosis and therefore for lymphedema.[6] Decreased mobility is common in cancer patients owing to fatigue, pain, or postoperative healing, further increasing the risk for lymphedema.[5,6]

Lymphedema care is not yet standardized. It is often considered an "orphan disease."[13] Dr. Robert Lerner summed up the issue when he stated, "There is much confusion among American medical professionals regarding the treatment of lymphedema. Much has to do with the fact that lymphedema 'falls between the cracks' of all standard specialties in modern American practice. Partially for this reason and because of a general misconception among American physicians that lymphedema is not a 'serious' problem, the condition has been virtually ignored."[14] There are few lymphologists practicing in the United States, and treatment protocols have been inconsistent or controversial.[3] The recent interest in sentinel node surgical procedures for cancer has brought about a renewed interest in the study of lymphatics.[15]

A variety of myths, e.g., that lymphedema is rare, is not painful, and cannot be treated, have hindered development of lymphedema treatment programs.[14] In the past, surgeons have often referred to this condition as merely a cosmetic problem.[3,14,16] Patients were led to believe that this was an unusual complication and was something that they would simply have to learn to live with.[16] Research has shown that patients with lymphedema do report sensory changes and pain.[17] Health care professionals not familiar with lymphedema have often trivialized these complaints. If a patient with new-onset pain is not evaluated for lymphedema, then identification of a reversible cause of pain may be missed. Narcotics cover up the symptoms but do not address the underlying pathophysiology. Lymphedema is not rare; this chronic disease afflicts 1% of the population.[18] Lymphedema pain and symptomatology deserve further systematic study. Research is needed so that the outdated myths can be dispelled and evidence-based comprehensive programs can be developed.[3,16]

Published by Lippincott Williams & Wilkins Healthcare, a division of Lippincott Williams & Wilkins, 2 Ridgedale Avenue, Suite 300, Cedar Knolls, NJ 07927. Phone (973) 455-1121; Fax (973) 285-5595. *ISSN 1522-1873.*

NORMAL LYMPHATIC FUNCTION

The role of the normal circulatory system is to bring nutrients to tissue and to remove the byproducts of metabolism. One role of the lymphatics is to assist in the removal of proteins from the peripheral tissue.[5-7] The lymphatics begin their function at the level of the microcirculation. Under normal conditions, proteins are guided out of the microcirculation through the lymphatics. The initial lymphatics are the entry point for these proteins.[5-7]

The lymphatic system is unique and interesting because it is powered by lymphangion (Figure 2), pumping units that are composed of a muscular collecting area and inlet and outlet valves.[5-7] These one-way valves allow passive movement of the lymphatic fluid as it travels from the distal periphery to the central circulation. The lymphatic vessel, unlike the vessels of the venous system, has its own pumping ability, which is triggered by vessel distention.

The lymphatic system, like the arterial and venous systems, is rich in overlapping fluid-transport pathways. This duplication provides alternative drainage pathways if an obstruction occurs. These overlapping pathways are referred to as watershed areas, and can act as safety valves to prevent vessel overload. The redundancy of the system is designed to protect tissue integrity by enabling tissues to receive the degree of lymphatic flow required to meet their demands. If the demand changes, the network can compensate by changing flow patterns.[5-7]

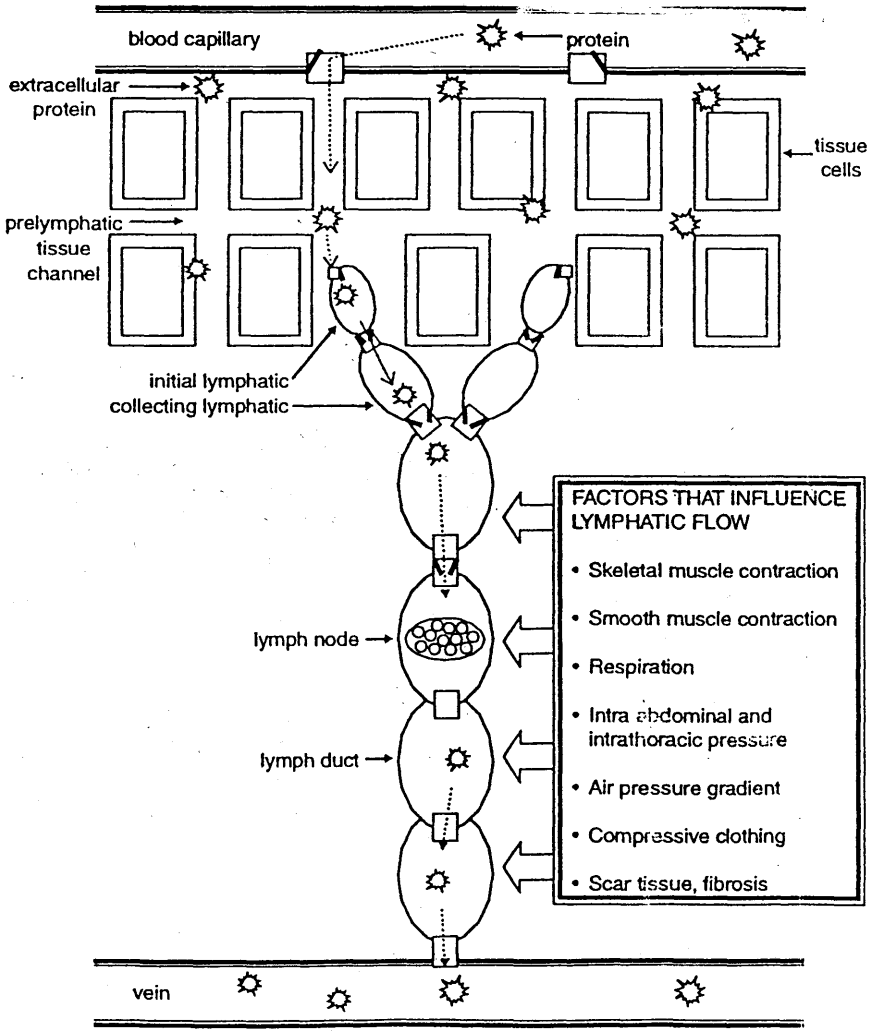


FIG. 2. Lymphatic protein pathway.

The peripheral lymphatics flow into lymph nodes. The immunologic processing and the role of the lymph nodes in the immune response are beyond the scope of this article and will not be discussed.

From the lymph nodes, the lymphatics drain into progressively larger proximal channels. In the lower extremities they drain into the inguinal plexus and then into the cisterna chyle.[5-7] The upper extremities, head, and neck drain from the periphery to the axilla and then to the subclavian vein.[5-7]

ABNORMAL LYMPHATIC FUNCTION

Lymphedema occurs when the deposition of extracellular protein exceeds the carrying capacity of the lymphatics. When this happens the protein is not removed from the extracellular space.[4,5,9] Owing to osmotic pressure, fluid remains in this extracellular space with the protein and the tissue begins to swell, disrupting normal tissue anatomy and integrity.[4,5,9,18]

Overdilatation of the lymphangion causes the one-way valve to become incompetent. The pump is then incapacitated and is no longer able to move lymph fluid forward. Like an incompetent venous valve, the retrograde flow of fluid further complicates the circulatory load.[5,6] The overextended lymphatic vessels leak protein. Osmotic pressure drives more fluid into the interstitial space and the swelling expands, causing further functional anatomic changes (Figure 3).[5-7]

The next step in this destructive cascade is the immune response to the protein. Macrophages increase in numbers and attempt to clear the extracellular protein burden by proteolysis,[5-7,18] a futile response because there is no functioning lymphatic circulatory system to remove the debris. This sets up a chronic inflammatory cycle leading to fibrosis, which further impairs lymphatic function by strangulating the outflow tracts. This vicious cycle leads to chronic progressive lymphedema and eventually to elephantitis.[6,18] Because of impaired immunity, decreased oxygenation, and high protein content are present, the swollen, lymphadematous tissue is at high risk for infection.[5-7,18] Even minimal breaks in the skin can lead to severe, life-threatening sepsis.[19,20]

PREVENTION OR RISK REDUCTION

The most obvious way to avoid lymphedema in oncology patients is prevention. It is hoped that continued advances in sentinel node research will obviate the need for extensive lymph node dissection in many patients.[15,21]

The National Lymphedema Network (NLN) believes that any patient at risk for lymphedema should be taught routine precautions.[22] However, few oncology programs institute routine comprehensive preventative education for all patients at risk,[23] typically waiting until the problem develops before beginning patient education.[13] The NLN recommendations are listed in their entirely (see Resource Listing section).

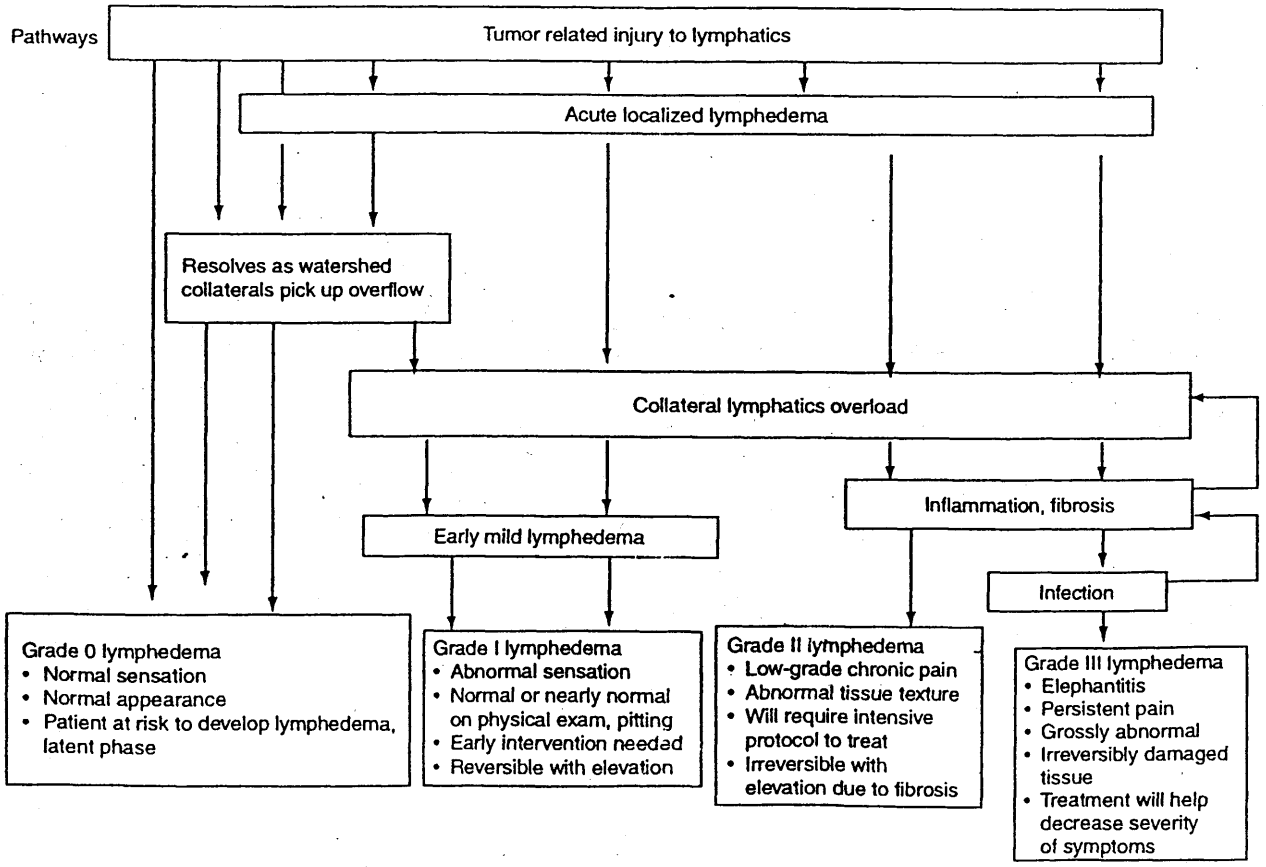


FIG. 3. Variable presentations of lymphedema.

The self-care education instructions are highly variable.[14,16,23] Components of a prevention program might include teaching patients about the risk factors, life-style modification, compression wrapping, self-massage, self-circumference monitoring, symptom recognition, early detection of cellulitis, and exercise guidelines (see Figures 4 and 5).

CLINICAL IDENTIFICATION

Lymphedema can present in a variety of ways and should be regarded as a continuum. The earliest point on the continuum is subclinical Stage 0, with no symptoms. This stage represents the initial overload of the localized lymphatics.[5-7] If the overload exceeds the carrying capacity of alternative pathways, the clinical appearance of lymphedema will slowly become more obvious. It is during this stage that some patients report the most frustrating pain symptoms, when the tissue is first being stretched.[24] Sensory changes and pain may be present even though the extremity appears normal on inspection except for sur-gical and radiation-induced changes. Patients describe their discomfort with adjectives such as heavy, tense, throbbing, achy, inflated, swollen, dull, spongy, or annoying.[17] After the patient has lived with the progressive lymphedema for some time, it eventually becomes obvious to the examiner. However, by that time the patient has "learned to live with it" and therefore may no longer complain.

In collecting a patient's subjective history of pain, it is important to consider lymphedema as a potential cause. It is also important to determine if the pain is related to exercise, increased muscle use, or to other activities that would increase the lymphatic load. Pain can also be related to an activity that constricts lymphatic flow, e.g., wearing clothing that restricts flow in the axilla, groin, or affected body part.[25] A breast cancer survivor may report that she develops breast pain if she vacuums while wearing an underwire bra. Vacuuming increases her lymphatic load,

NLN

18 Steps To Prevention For Upper Extremities

For the patient who is at risk of developing lymphedema, and for the patient who has developed lymphedema.

WHO IS AT RISK?

At risk is anyone who has had either a simple mastectomy, lumpectomy or modified radical mastectomy in combination with axillary node dissection and, often, radiation therapy. Lymphedema can occur immediately postoperatively, within a few months, a couple of years, or 20 years or more after cancer therapy. With proper education and care, lymphedema can be avoided or, if it develops, kept well under control.

The following instructions should be reviewed carefully pre-operatively and discussed with your physician or therapist.

1. Absolutely do not ignore any slight increase of swelling in the arm, hand, fingers, neck or chest wall (*consult with your doctor immediately*).
2. Never allow an injection, IV or a blood drawing in the affected arm(s).
3. Have blood pressure checked in the unaffected arm.
4. Keep the edemic arm, or "at-risk" arm, spotlessly clean. Use lotion (Eucerin) after bathing. When drying, be gentle, but thorough. Make sure it is dry in any creases and between the fingers.
5. Avoid vigorous, repetitive movements against resistance with the affected arm (scrubbing, pushing, pulling).
6. Avoid heavy lifting with the affected arm. Never carry heavy handbags or bags with over-the-shoulder straps.
7. Do not wear tight jewelry or elastic bands around affected fingers or arm(s).
8. Avoid extreme temperature changes when bathing or washing dishes (no sauna or hot tub). Keep the arm protected from the sun.
9. Avoid any type of trauma (bruising, cuts, sunburn or other burns, sports injuries, insect bites, cat scratches).
10. Wear gloves & long sleeves while doing housework, gardening or work that could cause even minor injury.
11. When manicuring your nails, avoid cutting your cuticles (*inform your manicurist*).
12. Exercise is important, but consult with your therapist. Do not overtire an arm at risk; if it starts to ache, lie down and elevate it. Recommended exercises: walking, swimming, light aerobics, bike riding, and specially designed ballet or yoga. (*Do not lift more than 15 lbs.*)
13. When travelling by air, patients with lymphedema (or at risk) must wear a compression sleeve. Additional bandages may be required on a long flight. Increase fluid intake while in the air.
14. Patients with large breasts should wear light breast prostheses (heavy prostheses may put too much pressure on the collarbone/shoulder area). Soft pads may have to be worn under narrow bra straps. Wear a well-fitted, supportive bra: not too tight; no wire support.
15. Use an electric razor to remove hair from axilla. Maintain electric razor properly, replacing heads as needed.
16. Patients with lymphedema should wear a well-fitted compression sleeve during all waking hours. At least every 4-6 months, see your therapist for follow-up. If the sleeve is too loose, most likely the arm circumference has reduced or the sleeve is worn. Unfortunately, prevention is not a cure. But, as a cancer and/or lymphedema patient, you are in control of your ongoing cancer checkups and the continued maintenance of your lymphedema.
17. Warning: If you notice a rash, blistering, redness, increase of temperature or fever, see your physician immediately. An inflammation or infection (lymphangitis) in the affected arm could be the beginning or a worsening of lymphedema.
18. Maintain your ideal weight with a well-balanced, low sodium, high-fiber diet. Avoid smoking and alcoholic beverages. Lymphedema is a high protein edema, but eating too little protein will not reduce the protein element in the lymph fluid—rather, this will weaken the connective tissue and worsen the condition. The diet should contain protein that is easily digested, such as chicken, fish or tofu.

Unfortunately, prevention is not a cure. But, as a cancer and/or lymphedema patient, you are in control of your ongoing cancer checkups and the continued maintenance of your lymphedema.

FIG. 4. List of steps to prevention/worsening of upper extremity lymphedema. Reproduced with permission of Thiadens.[55] [Permission is given to duplicate this figure for educational purposes only.]

the underwire decreases lymphatic outflow, and together they produce tissue swelling and pain. This represents latent reversible lymphedema.[24]

Lymphedema pain may also be referred retrogradely through the lymphatic pathway. For example, a patient who has undergone supraclavicular irradiation is at risk for lymphatic congestion at the supraclavicular node. The patient may report a sense of fullness, or pressure or pain radiating above the clavical and behind the ear.[17] It may be helpful to think of lymphatic drainage pathways in reverse to help predict the pathways of referred pain.[24]

It is also important to remember that any new sensation in a cancer patient may be associated with fears of recurrent disease.[24,26] Micrometastatic disease may be the cause of the lymphedema and the pain, and must be evaluated. Psychological stress may further complicate the pain symptoms. It is important to inform patients that the pain needs investigation to rule out recurrent disease, but that it simply may be benign lymphedema.[6]

Transition from Stage 0 to Stage I disease often is unnoticed by the medical profession. Stage I consists of mild swelling that responds to simple elevation of the extremity. The skin is filled with fluid and protein and pits on examination. Although it may appear to be a typical puffy edema, on closer inspection a positive stemmer sign can be noted. Circumference measurements will show asymmetry, but it may be mild. Ultrasound, MRI, or CAT scan will also show the distinct changes in the tissue.

Untreated, Stage I disease may progress to Stage II, whereby the fibrotic process has advanced and tissue has become harder or leather-like. The chronic inflammation and fibrotic deposition has strangulated the fine lymphatic vessels, there may be more clinical pain and deformity, and persistent inflammatory changes may be noted in the skin. Simple elevation will no longer work to decrease the swelling because fibrotic scar deposition has blocked drainage pathways.

NLN

18 Steps To Prevention For Lower Extremities

For the patient who is at risk of developing lymphedema, and for the patient who has developed lymphedema.

WHO IS AT RISK?

At risk is anyone who has had gynecological, melanoma, prostate or kidney cancer in combination with inguinal node dissection and, often, radiation therapy. Lymphedema can occur immediately postoperatively, within a few months, a couple of years, or 20 years or more after cancer therapy. With proper education and care, lymphedema can be avoided or, if it develops, kept under control.

The following instructions should be reviewed carefully pre-operatively and discussed with your physician or therapist.

1. Absolutely do not ignore any slight increase of swelling in the toes, foot, ankle, leg, abdomen, genitals (*consult with your doctor immediately*).
2. Never allow an injection or a blood drawing in the affected leg(s).
3. Keep the edemic leg, or "at risk" leg, spotlessly clean. Use lotion (Eucerin, Nivea) after bathing. When drying it, be gentle, but thorough. Make sure it is dry in any creases and between the toes.
4. Avoid vigorous, repetitive movements against resistance with the affected legs.
5. Do not wear socks, stockings or undergarments with tight elastic bands.
6. Avoid extreme temperature changes when bathing or sunbathing (no sauna or hot tub). Keep the legs protected from the sun.
7. Avoid any type of trauma (bruising, cuts, sunburn or other burns, sports injuries, insect bites, cat scratches).
8. When manicuring your toenails, avoid cutting your cuticles (*inform your pedicurist*).
9. Exercise is important, but consult with your therapist. Do not overtire a leg at risk; if it starts to ache, lie down and elevate it. Recommended exercises: walking, swimming, light aerobics, bike riding, and yoga.
10. When travelling by air, patients with lymphedema (or at risk) must wear a compression stocking. Additional bandages may be required on a long flight. Be sure to move around & increase fluid intake while in flight.
11. Use an electric razor to remove hair from legs. Maintain electric razor, replacing heads as needed.
12. Patients who have lymphedema should wear a well-fitted compression stocking during all waking hours. At least every 4-6 months, see your therapist for follow-up. If the stocking is too loose, most likely the leg circumference has reduced or the stocking is worn.
13. Warning: If you notice a rash, blistering, redness, increase of temperature or fever, see your physician immediately. An inflammation or infection in the affected leg could be the beginning or a worsening of lymphedema.
14. Maintain your ideal weight with a well-balanced, low sodium, high-fiber diet. Avoid smoking and alcoholic beverages. Lymphedema is a high-protein edema, which is not related to the protein found in foods. Eating less protein will not reduce the protein element in the lymph fluid; rather, this will weaken the connective tissue and possibly worsen the condition. The diet should contain protein that is easily digested, such as chicken, fish or tofu.
15. Always wear closed shoes (high tops or well-fitted boots are highly recommended). No sandals, slippers or going barefoot. Dry feet carefully after swimming.
16. See a podiatrist once a year as prophylaxis (to check for and treat fungi, ingrown toenails, calluses, pressure areas).
17. Wear clean socks and hosiery at all times. Avoid under-garments with tight elastic bands.
18. Use talcum powder on feet, especially if you perspire a great deal. Talcum will make it easier to pull on your compression stockings. Be sure to wear rubber gloves, as well, when pulling on stockings. Powder behind the knee often helps, preventing rubbing and irritation.

Unfortunately, prevention is not a cure. But, as a cancer and/or lymphedema patient, you are in control of your ongoing cancer checkups and the continued maintenance of your lymphedema.

FIG. 5. List of steps to prevention/worsening of lower extremity lymphedema. Reproduced with permission of Thiadens.[55] [Permission is given to duplicate this figure for educational purposes only.]

If disease progression is not stopped the vicious cycle of infection and fibrosis will proceed and the patient will develop Stage III disease, elephantitis. Although treatment can control the pain, potentially life-threatening infections, and disability, tissue will never return to normal.

DIAGNOSTIC EVALUATION

Diagnostic evaluation of lymphedema will vary with the clinical presentation. Figure 6 is a flow sheet summarizing the general steps in a lymphedema diagnostic workup. The more significant the swelling, the more obvious the diagnosis and the more challenging will be the treatment.[5–7] Normalizing the tissue will take more time, money, and commitment from the patient, the medical team, and third-party payers.[16]

MALIGNANT LYMPHEDEMA

Lymphedema that is caused by mechanically impaired lymph flow in the lymphatics and/or lymph nodes due to tumor growth is referred to as malignant lymphedema. It is often difficult to differentiate benign disease from malignant disease. Some general characteristics that tend to be associated with malignant disease include no obvious precipitating event, firm consistency of tissue, centrally located edema, and limited response to conservative intervention.[6]

OBJECTIVE LYMPHEDEMA QUANTIFICATION

Circumferential measurements constitute the easiest and least expensive way to measure lymphedema. Although this method has obvious limitations, it is a useful way to document size, the presence of asymmetry, and approximate lymphatic volume. The limitations of this system are that it does not take into account the multiple other factors that can change circumference, such as muscle mass or bulky tumor.[27,28] It is also limited to extremities and is not useful for truncal disease. Volume estimates, although gross mathematical predictions, are helpful in monitoring progress, setting treatment goals, and reimbursement documentation.

Ultrasound can also be used to measure tissue thickness.[29] Tissue tonometry is used to quantify the depth of pitting in lymphedema.[30] Although both of these procedures are noninvasive they are not readily available or standardized. Lymphoscintigraphy can be used to document obstructions and determine flow rates. This is invasive and also not routinely available.[29]

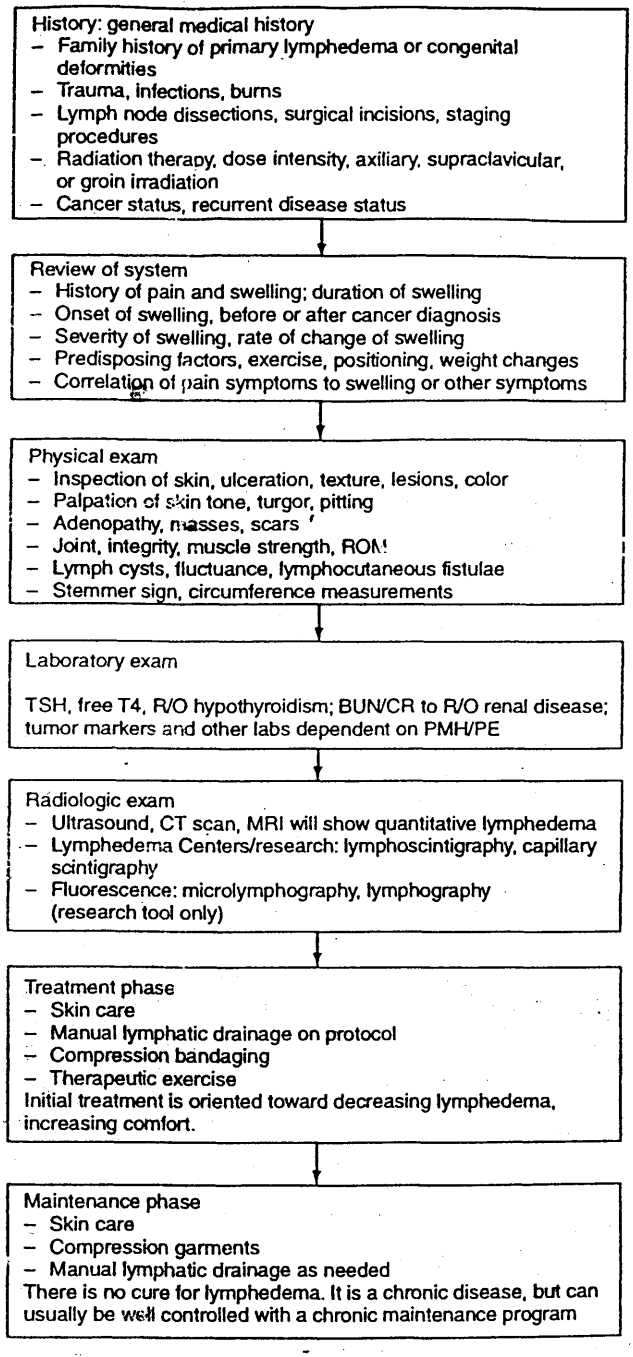


FIG. 6. Lymphedema diagnostic workup flow sheet.

COMPONENTS OF TREATMENT

The major components of treatment include meticulous skin care, compression garments, exercises, and manual lymphatic drainage (MLD). Skin care includes avoiding scratches, sunburn, punctures,

or trauma. The skin should be kept clean and moist; strong soaps are to be avoided because they may irritate skin and cause excessive dryness.[2,16] Compression is a major aspect of all treatment programs. This can be applied via bandages wrapped to encourage drainage or by graded compression garments.[2,3,31,32] The techniques for bandaging can be taught to the patient and family or applied by the lymphatic therapist. The greatest pressure is applied distally, with decreased pressure proximally, to promote central drainage.[33] Compression garments can be custom made with various amounts of pressure, designed to promote central flow of lymphatic fluid. Compression garments must be individualized according to the severity of disease and the patient's life-style, comfort, and treatment goals. Compression of distended lymphangions promotes recovery of their ability to contract and move fluid proximally (Figure 7).[5,34,35]

By using a low-stretch bandage to provide the external pressure to the tissue, contracting muscles are also compressed. With active exercise, this will cause an increase in pressure, thus stimulating lymphatic pumping (Figure 8, page 9).[5,36,37]

LYMPHANGION STIMULATION

MLD is a highly specialized type of massage that promotes lymphatic contractions. It is a very light and gentle massage. Proximal tissues are massaged first in an attempt to open drainage pathways.[2,5,6,38,39] Using knowledge of the watershed areas, the lymphatic therapist tries to encourage flow around the obstructions and into these overlapping drainage routes. Deeper massage to the affected areas may help break up fibrotic deposits and thus improve outflow.[5,6] The obstructed areas that need to be bypassed may be obvious, clearly marked by surgical scars, radiation ports, or by bulky metastatic disease.

The amount of MLD needed by an individual patient is dependent on multiple factors. In general, the greater the swelling and the longer the duration, the more treatment is required to reduce the abnormality.[2,5,6] Grade I lymphedema is considered reversible. Grades II and III are considered treatable, although normal tissue integrity will not be recovered.[5,6,40] Typically, daily treatments are needed for several weeks. Obviously, the underlying status of the tumor and the degree of recovery from tumor treatments will affect the ability to treat lymphedema. Treatment protocols must therefore be highly individualized.

This individualized treatment program requires a team approach. The oncologist, therapist, and patient must all be committed to the process.

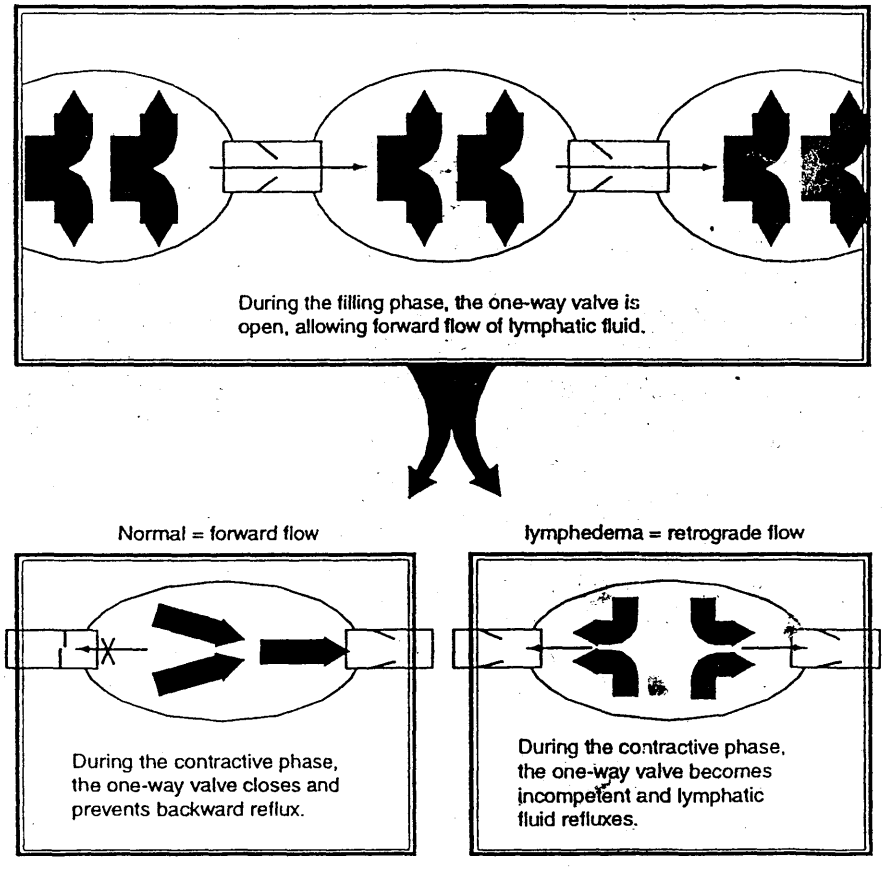


FIG. 7. Schematic showing the lymphangion as the basic pumping unit for lymphatic circulation.

Diagnostic evaluation, prognostic guidance, and aggressive treatment of infections by the oncologist are essential.[6,18,41,42] Therapists need not only excellent manual treatment skills but also a thorough understanding of lymphatic anatomy and physiology, oncology, and rehabilitation psychology.[43-46] Lymphedema is not "curable"; it is a chronic disease.[1-3] Therefore, patients must be committed to long-term self-care to achieve positive outcomes.[47] Palliative lymphedema care initiated to treat a patient with advanced disease must be practical and oriented toward short-term pain relief. Lymphedema may be more difficult to treat in the hospice patient, but a trial of treatment may give temporary symptom control, and decrease the need for narcotics.[24]

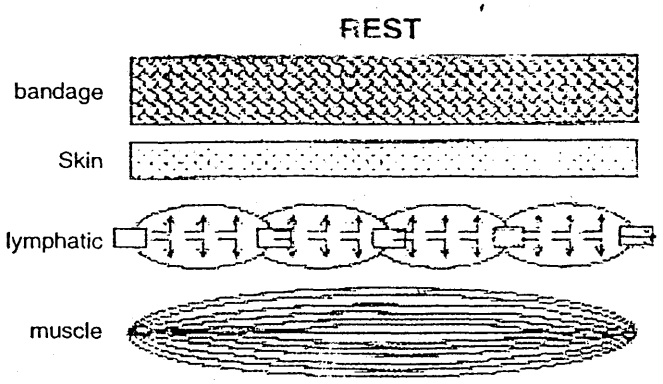
TREATMENT CONTROVERSIES

There are many treatment controversies that require further research.[14,16,48,49] Because many treatment protocols originated in Europe or Australia, multiple problems are associated with translating the care to other medical cultures. I will attempt to outline some of the controversies.

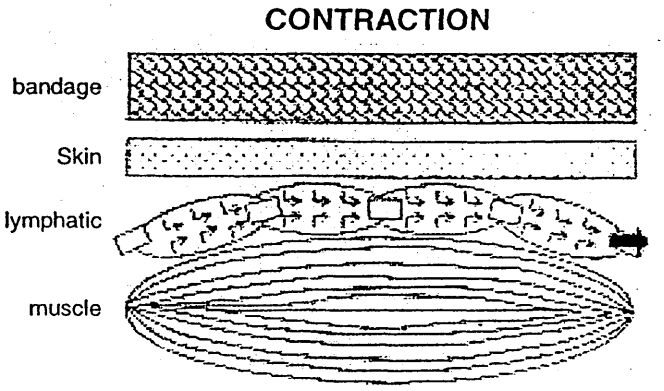
A key question is who should be providing lymphedema care. In Europe, massage therapists perform much of the MLD and work closely with physicians to provide complex decongestive physiotherapy (CDP).[14] This is the model found at many metropolitan lymphedema specialty centers. Although oncology nurses and physical therapists are learning MLD techniques in rural areas, integration into standard practice is highly variable.[16]

Drug use is also controversial. More research is needed to find a nontoxic drug that will aid in lymphedema treatment. Casley-Smith et al.,[50] an Australian research team, pioneered the use of benzopyrones for treatment of lymphedema. More recent research has brought this treatment into question because the coumarins are potentially hepatotoxic.[51] Research is being conducted on other drugs.[52,53] The use of diuretics is also considered controversial. Although in theory diuretics would help in the removal of excess fluid from the extracellular tissue, they would be unable to mobilize the extracellular protein.[5] Because it is the protein that is causing the osmotic pull of this fluid, it is unlikely that diuretics would have much impact on lymphedema.

Use of sequential pumps was once the standard of care in the United States. Because of concerns about increased tissue fibrosis, they are now used much more cautiously.[2,3,5] The pump can work only on the extremity.[54] Therefore, it cannot open up the central watershed areas, leading to deposition of protein material at the top of the pump cuff and for-



At rest, the lymphatic pressure is low, allowing the lymphatics to fill. Bandage compression regulates filling.



When the muscle contracts, it creates a high working pressure which stimulates lymphangion pumping. The compression bandage promotes forward flow.

FIG. 8. Therapeutic exercise using low-stretch bandages

mation of a fibrotic band. This is sometimes referred to as cuffing and is considered a complication of mechanical pumping.

Diet recommendations are variable and research is limited. However, weight control is consistently accepted as a conservative intervention.[55]

Surgical interventions have been directed toward tumor debulking or microsurgical techniques. Both remain controversial because of concerns that the lymphedematous tissue will heal slowly.[3,5]

Perhaps the only noncontroversial issue in lymphedema care is the general consensus that more research is needed. In the meantime, cancer patients are burdened with this chronic problem and need care *now*. Comprehensive oncology programs need to integrate lymphedema care as part of individualized whole-person care.

RESOURCE LISTING

There are a number of places from which physicians and patients can receive information about lymphedema. Two important sources are the following:
1. National Lymphedema Network. The address of their national office is NLN, 2211 Post Street, Suite 404, San Francisco, CA 94115-3427; telephone 1-800-541-3259.
2. American Cancer Society. Local chapters of the ACS have information, as does their website: http://www.interscience.wiley.com canceronline. The *Cancer* supplement of December 15, 1998 is dedicated to lymphedema.

REFERENCES

1. Foldi M. Treatment of lymphedema. *National Lymphedema Network Newsletter* 1995;7(3):1-3 [from NLN Article Reprints Collection 1998].
2. Foldi E, Foldi M, Weissloder H. Conservative treatment of lymphedema of the limbs. *Angiol J Vasc Dis* 1985; March:171-180.
3. Lerner R. Lymphedema: a 25 year perspective. *National Lymphedema Newsletter* 1997;9(4):1 [from NLN Article Reprints Collection 1998].
4. The diagnosis and treatment of peripheral lymphedema. Consensus document of the International Society of Lymphology Executive Committee. *Lymphology* 1995; 28:113-117.
5. Casley-Smith JR. *Modern treatment for lymphedema*. 5th rev. ed. Adelaide, Australia: Terrace Printing, 1997:4-84.
6. Weissleder H. *Lymphedema diagnosis and therapy*. 2nd ed. Bonn: Kagere R Kommunikation, 1997:15-34.
7. Casley-Smith JR. Lymphangiology. In: Foldi M, Casley-Smith JR, eds. *The structure and functioning of the blood vessels, interstitial tissues, and lymphatics*. Stuttgart: Schattauer-Verlag, 1983:27-88.
8. Mahoney ME. Axillary lymphedenectomy should never be "routine." *National Lymphedema Network Newsletter* 1997;9(2):1-2 [from NLN Article Reprints Collection 1998].
9. Mortimer PS. The pathophysiology of lymphedema. *Cancer* 1998;83(suppl):2798-2802.
10. Suneson BL, Lindholm C, Hamrin E. Clinical incidence of lymphedema in breast cancer patients in Jonkoping County, Sweden. *Eur J Cancer Care* 1996;5:7-12.
11. Meek AG. Breast radiotherapy and lymphedema. *Cancer* 1998;83(suppl):2788-2797.
12. Logan V. Incidence and prevalence of lymphedema: a literature review. *J Clin Nurs* 1995;4:213-219.
13. Jacobs L. Lymphedema an "orphan disease." *PT Magazine* 1996:54-63.
14. Lerner R. What's new in lymphedema therapy. *Am Int J Angiol* 1998;7:191-196.
15. Joseph E, Cox CE, Reintgen D. Lymphatic mapping and radioguided surgery with sentinel lymph node biopsy: a node minimally invasive procedure for cancer staging. *National Lymphedema Network Newsletter* 1997;9(2):1-2 [from NLN Article Reprints Collection 1998].
16. Swirsky J, Nanning DS. *Coping with lymphedema*. New York: Avery Publishing Group, 1998.
17. Nelson L. Incidence and prevalence of lymphedema at Fletcher Allen Health Care, Office of Patient Oriented Research Progress Report. Presented at the University of Vermont College of Medicine Family Practic Review Course, June 12, 1999.
18. Lerner R. Lymphedema. Paper presented at the Lymphedema Symposium FAHC, June 5, 1998.
19. Woodruff A, Olivero JJ. Recurrent cellulitis complicating chronic lymphedema. *Hosp Pract* 1995;30:87,91.
20. Thiadens SRJ. Lymphangitis (infection): a constent fear. *National Lymphedema Network Article Reprints Collection* 1998.
21. Krag DN, Weaver DL, Alex JC, Fairbanks ST. Surgical resection and radio localization of sentinel lymph nodes in breast cancer using a gamma probe. *Surg Oncol* 1993; 2:335-340.
22. Thiadens S. Lymphedema awareness before, during and after breast cancer surgery. *National Lymphedema Network Newsletter* 1998;10(3).
23. Rockson SG, Miller LT, Senie R, et al. American Cancer Society lymphedema workshop. Workshop Group II: diagnosis and management of lymphedema. *Cancer* 1998;83(12 suppl Am):2882-2885.
24. O'Brien P. Lymphedema Symposium. *Visiting Nurses Assoc* 1999;May 6.
25. Thiadens SRJ, and NLN Staff. Lymphedema, breast cancer and the brassiere. National Lymphedema Network Reprints Collection 1997;9(3):1.
26. Passik S, Newman M, Brennan M, Holland J. Psychiatric consultation for women undergoing rehabilitation for upper-extremity lymphedema following breast cancer treatment. *J Pain Sympt Manage* 1993;8:226-233.