

Introduction to Lymphedema

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Financial Disclosure and Off Label Discussion

- I have no significant relationships to disclose



Objectives

Upon completion of this presentation each participant will be able to:

- Verbalize the differences between primary and secondary lymphedema.
- State advantages and disadvantages of current diagnostic and measurement methods.
- Discuss therapeutic interventions for lymphedema and associated symptoms.



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WHAT IS LYMPHEDEMA?



Classic Definition

- The collection of fluid and protein in extravascular and interstitial spaces. ¹
- It is a sign of an underlying disease state and it can be associated with conditions such as Rosacea, Turner's Syndrome, Lymphangiomatosis, and Noonan's Syndrome.



“Incidence, Treatment Costs, and Complications 2 Years After Treatment”²

- Examined claims data following an incidence cohort of 1,877 patients for 2 years after breast cancer treatment
- 1997-2003 Medstat MarketScan Health and Productivity Management Database.
- Matched Cohort Analysis:
 - Lymphedema Group significantly higher medical costs (\$14,877-\$23,167).
 - Twice as likely to have infections.
 - Outpatient mental health services, diagnostic imaging, and office visits with moderate to high complexity accounted for the difference.



Suggested Definition

- A condition in which fluid and protein accumulate in the extravascular and interstitial. This accumulation of fluid and debris contributes to the development of associated physical (e.g., pain, altered sensations, reduced function) and psychosocial (e.g., psychological distress, body image disturbance, social isolation) symptoms.



Who Has Lymphedema?

9

Those with Primary Lymphedema

- Primary lymphedema is related to genetic and familial abnormalities in lymphatic structure or function.
- Occurs in 1 of every 10,000 people in the general population.³
- Classifications by Age of Onset
 - Congenital-present at birth.
 - Praecox-after birth <35 yrs. old.
 - Tarda - >35 yrs. old.



Those with Secondary Lymphedema

- Secondary lymphedema is caused by trauma to the lymphatic system or supporting structures (e.g., cancer treatment, accidental injuries).
- 120 million individuals world-wide may have filarial (parasitic) infection induced lymphedema.⁴
- Rates vary greatly based on cause.
- Most common type seen in the United States and other developed Countries.



Cancer Patients

- Could have BOTH primary and secondary lymphedema.
- Could have filarial driven swelling if they are from a tropical climate.



Lymphatic System

ONCOLOGY

Factors Influencing Secondary Lymphedema in Cancer Patients

- Anatomical Disruption.
- Radiation.
- Infection.
- Inflammation,
- Hemodynamics.

ONCOLOGY

Hemodynamic Factors – Breast Cancer

- Both arterial and venous components may be altered in the lymphedema arms when compared to healthy normal arms and contralateral arms in the breast cancer survivors.
- "Average arterial blood flow in lymphedema-affected arms was higher than in arms of healthy volunteers or lymphedema-unaffected arms. Time of venous outflow period of blood flow pulse was lower in lymphedema-affected arms than healthy or lymphedema-unaffected arm. Amplitude of the venous component of blood flow pulse signal was lower in lymphedema-affected arms than healthy or lymphedema-unaffected arms. Index of venular tone was also lower in lymphedema-affected arms than healthy or lymphedema unaffected arms."⁵

ONCOLOGY

Challenges to Healthcare Providers

- Risk Reduction.
- Diagnosis and Measurement.
- Treatment.
- Symptom Management.
- Self-Care.
- Research.

ONCOLOGY

Challenge 1

- Risk Reduction:
 - Primary.
 - Secondary.

ONCOLOGY

Primary

- Genetic Research.
- Family Planning.

ONCOLOGY

Secondary

- Accident Avoidance.
- Minimization of Surgical Trauma.
- Minimization of Radiation Exposure.
- Risk Reduction Behaviors.
- Early Treatment.

NAPBC – Education for Lymphedema Risk ⁶



Risk Reduction Behaviors ⁷

NLN Guidelines

- Skin Care
- Activities/Lifestyle
- Limb Constriction
- Compression Garments
- Temperature Extremes



Risk Reduction ⁷

I. Skin Care - Avoid trauma / injury to reduce infection risk

- Keep skin extremity clean and dry.
- Apply moisturizer daily to prevent chapping/chafing of skin.
- Attention to nail care; do not cut cuticles.
- Protect exposed skin with sunscreen and insect repellent.
- Use care with razors to avoid nicks and skin irritation.
- If possible, avoid punctures such as injections and blood draws.
- Wear gloves while doing activities that may cause skin injury (i.e., washing dishes, gardening, working with tools, using chemicals such as detergent).
- If scratches/punctures to skin occur, wash with soap and water, apply antibiotics, and observe for signs of infection (i.e., redness).
- If a rash, itching, redness, pain, increased skin temperature, fever or flu-like symptoms occur, contact your physician immediately for early treatment of possible infection.



Risk Reduction ⁷

II. Activity / Lifestyle

- Gradually build up the duration and intensity of any activity or exercise.
- Take frequent rest periods during activity to allow for limb recovery.
- Monitor the extremity during and after activity for any change in size, shape, tissue, texture, soreness, heaviness, or firmness.
- Maintain optimal body weight.



Risk Reduction ⁷

III. Avoid Limb Constriction

- If possible, avoid having blood pressure taken on the at-risk extremity.
- Wear loose-fitting jewelry and clothing.



Risk Reduction ⁷

IV. Compression Garments

- Should be well-fitting.
- Support the at-risk limb with a compression garment for strenuous activity (i.e., weight lifting, prolonged standing, running) except in patients with open wounds or with poor circulation in the at-risk limb.
- Consider wearing a well-fitting compression garment for air travel - NLN Position Paper: Lymphedema Risk Reduction Practices.



Risk Reduction ⁷

V. Extremes of Temperature

- Avoid exposure to extreme cold, which can be associated with rebound swelling, or chapping of skin.
- Avoid prolonged (greater than 15 minutes) exposure to heat, particularly hot tubs and saunas.
- Avoid placing limb in water temperatures above 102°Fahrenheit (38.9°Celsius).

NOTE: Given that there is little evidence-based literature regarding many of these practices, the majority of the recommendations must at this time be based on the knowledge of pathophysiology and decades of clinical experience by experts in the field.

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Early Treatment

Abstract (from PUBMED) ⁸

BACKGROUND:

■ The incidence of breast cancer (BC)-related lymphedema (LE) ranges from 7% to 47%. Successful management of LE relies on early diagnosis using sensitive measurement techniques. In the current study, the authors demonstrated the effectiveness of a surveillance program that included preoperative limb volume measurement and interval postoperative follow-up to detect and treat subclinical LE.

METHODS:

■ LE was identified in 43 of 196 women who participated in a prospective BC morbidity trial. Limb volume was measured preoperatively and at 3-month intervals after surgery. If an increase >3% in upper limb (UL) volume developed compared with the preoperative volume, then a diagnosis of LE was made, and a compression garment intervention was prescribed for 4 weeks. Upon reduction of LE, garment wear was continued only during strenuous activity, with symptoms of heaviness, or with visible swelling. Women returned to the 3-month interval surveillance pathway. Statistical analysis was a repeated-measures analysis of variance by time and limb ($P < .001$) comparing the LE cohort with an age-matched control group.



Early Treatment

Abstract (from PUBMED) ⁸

RESULTS:

■ The time to onset of LE averaged 6.9 months postoperatively. The mean (+/- standard deviation) affected limb volume increase was 83 mL (+/-119 mL; 6.5% +/- 9.9%) at LE onset ($P = .005$) compared with baseline. After the intervention, a statistically significant mean 48 mL (+/-103 mL; 4.1% +/- 8.8%) volume decrease was realized ($P < .0001$). The mean duration of the intervention was 4.4 weeks (+/-2.9 weeks). Volume reduction was maintained at an average follow-up of 4.8 months (+/-4.1 months) after the intervention.

CONCLUSIONS:

■ A short trial of compression garments effectively treated subclinical LE.



Challenge 2

- Diagnosis and Measurement Issues



NLN Breast/Lymphedema Position Paper ⁹

- "Objective measurement: Pre-treatment baseline measurement of arms is essential, as this serves as the baseline data to which subsequent measurements can be compared. Regular measurements following treatment are indicated for the remainder of the patient's life. Surgeons and medical oncologists who treat breast cancer and follow breast cancer patients/survivors should conduct these measurements at every patient visit. Such measurements should also be conducted in cases where primary care physicians or advanced practice nurses provide follow up care in lieu of the treating surgeons or oncologists."



Diagnosis

- Lymphedema is challenging to diagnose.
- A thorough health history and a complete physical examination is needed make a differential diagnosis.
- Potential differential diagnoses include but are not limited to: myxedema, lipedema, deep vein thrombosis, chronic venous insufficiency, cellulitis, cancer recurrence or spread, and infection.
- It is important to determine if there is a family history of abnormal swelling, what the course of the swelling (new onset or gradual or sudden worsening over time) has been, and if there are any medications or co-morbid conditions that could be contributing factors.



Diagnosis

- Lymphoscintigraphy is the primary diagnostic tool.
- This procedure must be conducted in a nuclear medicine setting by a clinician experienced with the procedure. It is useful in determining the structural cause of lymphedema and, in some situations, is used to monitor the effectiveness of treatment.
- Magnetic resonance imaging (MRI), duplex scanning, or paleography can be used to rule out deep vein thrombosis.
- MRI, ultrasonography, or phlebography findings can rule out chronic deep venous insufficiency.
- Computerized Tomography scans can be used to identify lymphatic obstructions.
- Caution should be used in ordering these tests if they will not directly impact patient treatment, particularly in end-of-life situations. Potential risks such as possible discomfort and cost, must be balanced with possible benefits.
- Extensive time spent in a tropical climate.

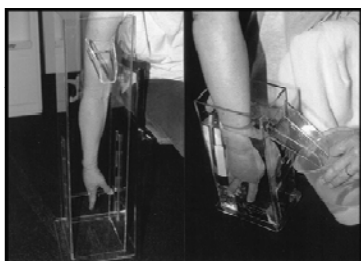


Measurement-Limb

- No single, valid, accepted “gold standard” for objective measurement of swelling associated with lymphedema.
- Multiple methods, none of which are ideal, can be used to measure swelling in affected limbs:
 - Water displacement.
 - Girth measured in cm with a tape measure.
 - Infra-red laser scanning by an optoelectronic device to assess limb volume and shape.
 - Measurement of extracellular fluid (lymph) by bioelectrical impedance.



Measurement – Water Displacement



Measurement – Water Displacement

Advantages

- Do not have to calculate volume.
- Traditional “gold standard.”

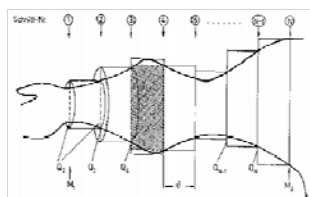
Disadvantages

- Cumbersome.
- Messy.
- Not suited to clinic or home use.
- Clothing must be removed from limb.
- Contraindicated in patients with open skin lesions.
- Patient may be too frail to stand with limb extended.



Measurement-Limb Tape

- Measurements are taken at pre-identified intervals, such that the non-stretch, flexible tape is snug against the skin but not constricting.



Measurement-Limb Tape

Advantages

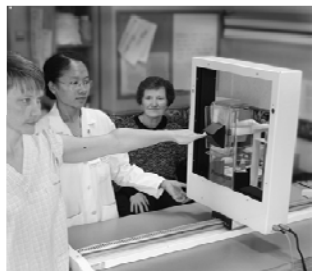
- Inexpensive.
- Comparable to water displacement.

Disadvantages

- Time-consuming.
- 0.2 cm variance in standard of measurement difficult to achieve.
- Cannot easily be used for self-measurement.
- Limitations where skin damage exists.
- Clothing must be removed from limb.



Perometry



Measurement-Perometry

Advantages

- Quick.
- Hygienic.
- Accurate.
- Can be used with broken skin.

Disadvantages

- Price.
- Size of Perometer.
- Difficulty in measuring frail or unsteady patients.
- Clothing must be removed from limb.
- Standard Protocol required.



Bioelectrical Impedance



Used in Arm and Leg Lymphedema.¹⁰



Measurement-Bioelectrical Impedance

Advantages

- Portable.
- Can be used at for self-measurement.
- Takes less than one minute.
- Clothing does not have to be removed from limb.

Disadvantages

- Cannot be used by individuals with pacemakers or metal implants.
- Patients may have sensitivity to electrode pad adhesive. (Rare)
- Fluid intake immediately prior to measurement discouraged.

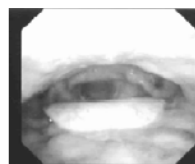


Measurement Non-Limb

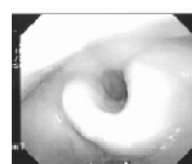
- Swelling associated with truncal, breast, genital, and head/neck lymphedema may be best monitored and assessed with subjective symptom reporting and digital photography, as objective measures are limited and not validated.
- Tape (Standard).
- 3D Cameras.
- Bioelectrical Impedance.
- CTs.
- MRIs.
- Ultrasound.
- Scopes.
- Photos.



Internal Lymphedema



No Lymphedema

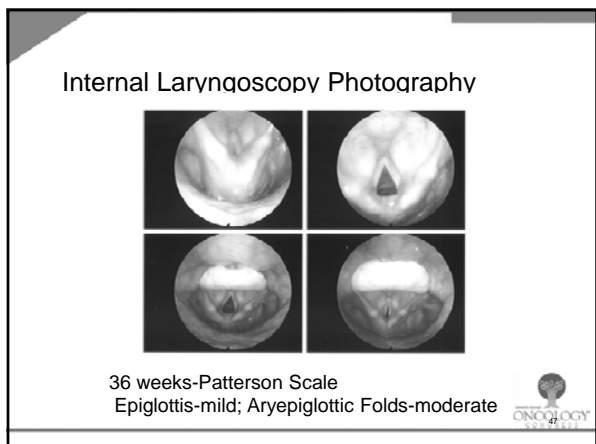
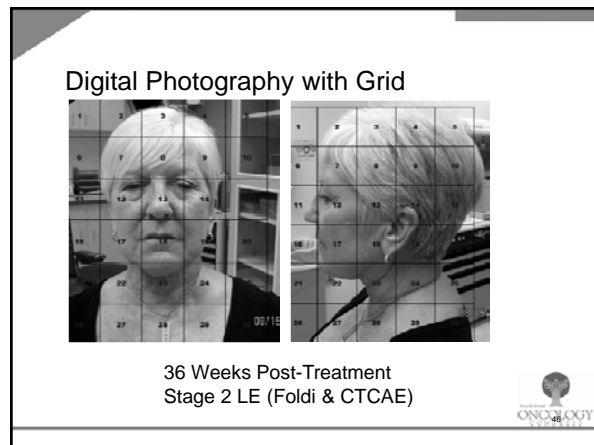
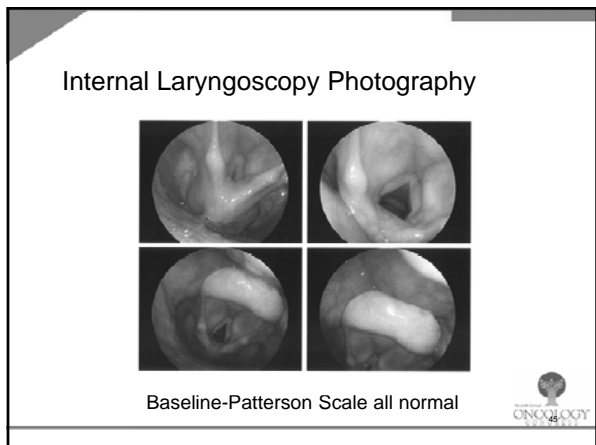
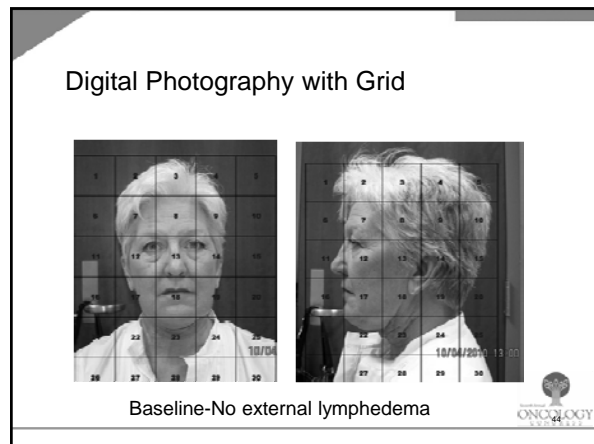


Severe Lymphedema Epiglottis (six years post-cancer treatment)



Patterson's Scale for Edema in Larynx and Pharynx ¹¹

Structures	Rating of Edema			
	Normal	Mild	Moderate	Severe
1) Base of tongue				
2) Posterior pharyngeal wall				
3) Epiglottis				
4) Pharyngoepiglottic folds				
5) Aryepiglottic folds				
6) Interarytenoid space				
7) Cricopharyngeal prominence				
8) Arytenoids				
9) False vocal folds				
10) True vocal folds				
11) Anterior commissure				
Spaces				
12) Valleculae	Normal	Mildly Reduced	Moderately Reduced	Severely Reduced
13) Pyriform sinus				



Challenge 3

- Treatment Issues.

Current Standard of Care

- Complete Decongestive Therapy (CDT), a two-phase treatment protocol for both primary and secondary lymphedema.
- Patients do not like this and are desperate for alternative methods.
- Adequate experimental research to support this is lacking.
- Access to Certified Lymphedema Therapists is lacking.



Current Standard of Care

- Phase One consists of professionally administered intensive manual lymphatic drainage (MLD); 24 hours a day wearing of two-way short-stretch compression bandaging, arm exercises, and skin care.
- Phase Two, the self-care phase, includes life-long wearing of day-time compression sleeves, night-time compression wrapping, and on-going exercise (self-MLD), and diligent skin care.



Compression Garments



Pneumatic Compression Devices

- Old versus new.
- Role in treatment.



Treatment-Medication

- There is no medication approved for treatment of lymphedema.
- Diuretics should not be prescribed solely for lymphedema and should be used only for treatment of co-morbid conditions such as congestive heart failure.



Treatment-Surgical

- Experimental surgical procedures.
- Node transplants-promising.
- Liposuction.

Are NOT curative.



Treatment-Laser

- LLLT (wave lengths 650-1000 nm) is believed to stimulate lymphatic motricity, lymphangiogenesis, and macrophage activity.
- Taken together, these mechanisms increase movement of pooled fluid from the extracellular spaces into the lymphatic system for transport.
- LLLT also softens fibrotic tissues, improving contractility in the tissues that assist with lymph transport through the lymphatic vessels.

Also, NOT curative.



Challenge 4

- Symptom Management Issues



Treatment of Lymphedema Associated Symptoms

- Assess for other problems and treat them.
 - Fatigue.
 - Skin Breakdown.
 - Psychosocial Issues.
 - Treatment Assistance.
 - Overweight.



Treatment of Lymphedema Complications-Infection ^{12, 13}

- Infection - If infection is present, it must be treated and resolved prior to initiating CDT.
- Patients with co-morbid medical conditions, or near end-of-life, may require hospitalization.



Treatment of Lymphedema Complications-Infection ^{12, 13}

- Once a patient experiences an infection in the swollen area, they are at risk for recurrent infections.
 - An international expert on lymphedema treatment recommends extended prophylactic, treatment with antibiotics.
- Findings suggest that in patients tested for sensitivity to penicillin, administration of long-term (3 to 12 months) intra-muscular penicillin may be warranted to prevent infection recurrence. No untoward reaction to long-term penicillin administration have been noted in those shown by allergy testing to not be sensitive to penicillin.




Treatment of Lymphedema Complications-Infection ^{12, 13}

- Orally administered erythromycin is recommended for 3 to 12 months in those with penicillin sensitivity .
- Skin bacteriological cultures from patients who have recurring episodes of dermatitis, lymphangitis and lymphadenitis may be helpful in identifying causative agents and identifying appropriate antibiotic therapy. ^{7, 8}




Pain

- Alteration in Limb Sensation ¹⁴
 - Heaviness.
 - Aching.
 - Hardness.
 - Tightness.
 - Burning.
 - Pins and Needles.
 - Swelling.
 - Stabbing.
 - Loss of Confidence in Body.
 - Decreased Physical Activity.
 - Fatigue.
 - Psychological Distress.




Volume Versus Symptoms ¹⁴

- Greater objective arm volume positively related to mean symptom intensity ($r=.23, p < .01$).
- Greater perceived difference in arm size related to:
 - Higher mean symptom distress ($r=.23, p < .01$).
 - Higher mean symptom intensity ($r=.28, p < .01$).
 - Greater total number symptoms ($r=.24, p < .01$).
- Suggests that perception of arm drives symptoms more than actual arm size.




Challenge 5

- Self-Care Issues




Effective Self-care is Required to:

- 1) Reduce the impact of lymphedema on survivor well-being;
- 2) Decrease the number of exacerbations; and
- 3) Avoid disease progression.




Self-Care Study 1 ¹⁵

Activity	Number (n=64)	Percent
CDT-Phase I	1	2 %
Sleeve Only	14	22 %
Arm Elevation Only	3	5 %
Pump and Sleeve	3	5 %
Arm Elevation and Medication	1	1 %
Night Bandaging Only	1	1 %
CDT Phase II	9	14 %
Other	27	42 %
None	5	8 %



Study 2 - Purpose ¹⁶

- The purposes of this study were to:
 - 1) Examine lymphedema self-care education, and perceived self-care barriers, benefits, and burdens; and,
 - 2) Examine associations among self-care education, practices, symptoms, and quality of life.
 - 3) 51/58 returned questionnaires.



Findings: Self-Care Education

- 94% of the 51 participants had received some self-care education.
- 12% did not think it was adequate.



Education

Education Instructions	Yes N (%)	No N (%)	Don't Recall N (%)
Keep arm clean	44 (90%)	2 (4%)	3 (6%)
Use lotion daily	35 (75%)	9 (19%)	3 (6%)
Bandage arm at night	27 (63%)	14 (32%)	2 (5%)
Wear compression garment during day	44 (92%)	4 (8%)	0 (0%)
Wear compression garment at night	23 (49%)	24 (51%)	0 (0%)
Avoid sunburn	45 (98%)	1 (2%)	0 (0%)
Avoid cuts	48 (98%)	1 (2%)	0 (0%)
Don't lift heavy objects	47 (96%)	1 (2%)	1 (2%)
Perform gentle arm movements daily	39 (80%)	4 (8%)	6 (12%)
Perform self drainage/massage	31 (66%)	16 (34%)	0 (0%)
Call doctor if arm becomes hot or red	41 (89%)	5 (11%)	0 (0%)
Observe redness	41 (89%)	5 (11%)	0 (0%)
Maintain a healthy weight	32 (82%)	7 (18%)	0 (0%)
Lose weight	13 (29%)	27 (60%)	5 (11%)



Findings: Source of Self-Care Education Other Than Therapists

- 39% had never received self-care information from anyone other than their lymphedema therapist.
- Physicians (22%) followed by a variety of other sources e.g., "someone on the internet" "someone else with lymphedema".

NO ONE CITED A NURSE.



Findings: Self-Care Practices

- During 24 hours preceding completion of survey the 6 of the 51 participants (12%) reported doing no self-care.
- Wearing a compression garment was the most common self-care activity.
- 60% (N=31), were performing lymphatic stimulation activities such as self massage, use of pneumatic compression devices, and exercise.
- 33% of the 51 were spending 15 minutes or less per day on self-care.
- 35% of the 51 required self-care assistance.



Findings: Associations Among Self-Care Education, Practices, Symptoms, and QOL

- Those with more lymphedema symptoms and lower overall QOL scores were more likely to be doing lymphatic stimulation types of self-care than women with fewer symptoms and those with higher overall QOL (respectively: $r_s = -0.39$, $p = .009$; $r_s = 0.33$, $p = .020$).
- Those reporting a higher number of skin conditions were less likely to be doing compression-type activities than those with fewer skin conditions ($r_s = -0.31$, $p = .026$).




Qualitative

Categories	Theme	Exemplar Quotes
Barriers	Not enough time to do it	"It is hard just finding the time to stop and take care of yourself."
	Lack of Knowledge/Procedures/Supplies	"Knowledge and experience with massage and bandaging techniques, being able to reach for massage and just being able to manage my own arm."
	Discomfort	"Arm gets tired of manipulation."
	Lack of Visible Positive Outcome	"The arm gets bigger in hot weather anyway."
	Expense	"Not being able to buy new bandages and sleeves when needed."




Qualitative

Categories	Theme	Exemplar Quotes
Benefits	Convenience	"Can do it on my own schedule-not the therapist's."
	Volume Control/Symptom Relief	"Keeping my arm from becoming large" "My arm feels better."
	Cost Savings	"Reduces cost of therapist, gas, and parking."
	Taking Control	"Keeping my arm from becoming large and pride that I am taking care of my arm."



Qualitative

Categories	Theme	Exemplar Quotes
Burdens	Time and Inconvenience	"Time-if running late, arm still has to be taken care of. If I am really tired, arm has to be wrapped before I can go to bed."
	Procedures and Equipment	"Bandaging at night and wearing the garments all day."
	Expense	"Cost of sleeves."
	Symptoms (physical and emotional)	"It hurts." "A constant reminder of breast cancer."
	Aggravation	"Annoying! Remembering to put on sleeve before putting on long sleeved shirt. Sometimes I have to take shirt off and then put sleeve on."
	Lack of Results	"Not seeing too much of a result."




Challenge 6

- Research Issues



Funding and Interest


- Money is tight.
- Lack of firm rates of incidence and prevalence.



Lymphedema Incidence/Prevalence

Estimates vary greatly


- 6% to 49% ^{17, 18}
 - Inconsistent definitions of lymphedema.
 - Subjective and objective.
 - Procedures not always accounted for.



Risk Factors-Unknown

- Obesity.
- Co-Morbidities.
- Genetics.

The possibilities are endless...



Diagnosis and Measurement

- Infant.
- Non-limb technology testing and development.



Treatment

- Randomized Clinical Trials needed.



Meeting the Challenges



Challenge 1 - Risk Reduction

- Educate at risks patients and family members.
- Emphasize healthy body weight.
- Encourage exercise within reasonable limits.



Challenge 2 - Diagnosis and Assessment

- Be alert to the possibility of lymphedema.
- Monitor know at-risk patients for onset.
- Monitor those with lymphedema closely for increased swelling and for other associated symptoms.



Challenge 3 - Treatment of Lymphedema

- May Need to be Tailored.
- Multidisciplinary Approach.
- Economic Issues.



Challenge 4 - Associated Symptoms

- Acute cellulitis, lymphangitis (dermatolymphangioadenitis-DLA) often is first symptom:
 - Flu-Like Symptoms.
 - Red Arm.
 - Swelling.
 - Pain.
 - May Happen Overnight.
- Antibiotics required
 - Benzathine Penicillin ¹²
 - Can Reoccur.



Other

- Psychologist.
- Psychiatrist.
- Dietician.
- Trainers.
- Certified Lymphedema Therapists.



Challenge 5

- Self-Care Issues



Self-Care in the Context of “Activities”

Activity	Number (n=44)	Percent
Sleeve Only	6	14 %
Sleeve and Compression Pump	2	5 %
CDT Phase II	11	25 %
CPD-SLD	12	27 %
Other	8	18 %
None	5	11 %



Self-Care in the Context of “Symptoms”

Symptom	N = (51)	%
Fatigue	42	82 %
Difficulty sleeping	29	57 %
Concerns about how you look	26	51 %
Decreased levels of physical activity	26	51 %
Sadness	24	47 %
Loss of confidence in body	18	35 %
Decrease in sexual activity	17	33 %
Being less sexually attractive	16	31 %
Permanently given up hobbies or leisure activities	16	31 %
Lack of interest in sex	15	29 %
Lack of confidence in self	14	27 %



Challenge 6 - Research

- National Lymphatic Disease and Lymphedema Patient Registry and Tissue Bank. ¹⁹

<http://www.lymphaticresearch.org/main.php?menu=&content=patient-reg-new>



Conclusions

- Many cancer survivors are at risk:
 - Risk not taken to zero by SLNB for breast cancer.
- Education:
 - What to say, when to say it, who should say it.
 - 1998 ACS statement:
 - Pre-op.
 - Post-op.
 - On-going.
 - Those with lymphedema shop internet for information NLN a major resource.



Practice Implications General

- Early Identification = better outcomes:
 - Pre-op arm measurements for breast cancer patients will be a standard.
 - Others not as fortunate.
- Refer to certified therapist for treatment.



Practice Implications Lymphedema

- Encourage at home self care if diagnosed with lymphedema and assess compliance.
- Evaluate for psychological issues.
- Exercise, diet, weight reduction/maintenance.
- Antibiotics if history of DLA.



Conclusions

- Much work remains.
- Keep abreast of research findings:
 - Read carefully.
- Under funded:
 - Treatment.
 - Research.
- Manageable condition.



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