

Breast and Truncal Lymphedema Its Nature and Treatment

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Woodland Hills, CA

Emerging Awareness of Breast Lymphedema

Professor Waldemar L.Olszewski, M.D, PhD* comments on Joe Zuther's Lymphedema Blog Column "Lymphedema Affecting the Breast and Trunk", October 6, 2011

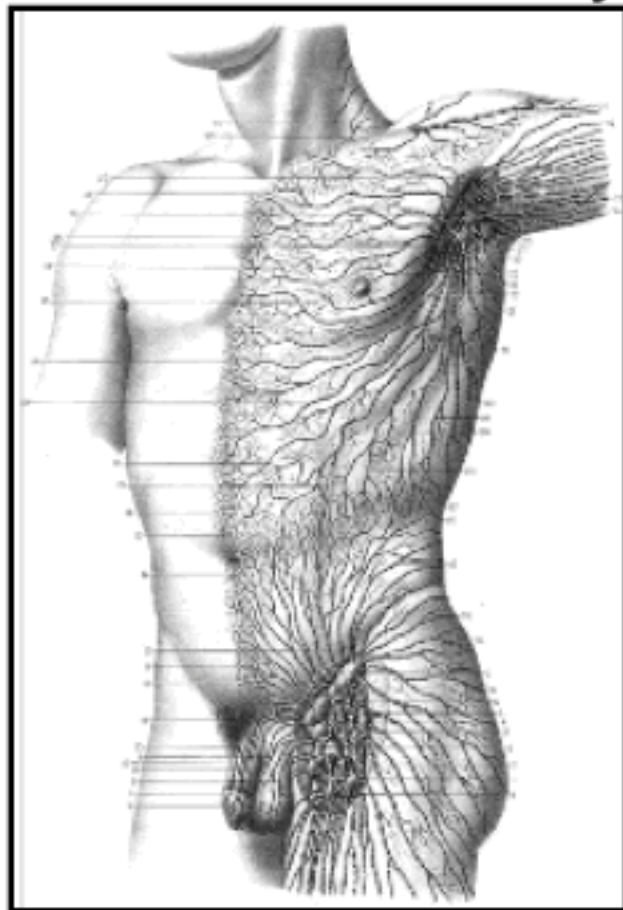
“Swelling of the breast after sentinel node procedure followed by lumpectomy is seen more and more frequently.”

*Chief, Department of Surgical Research and Transplantology, Medical Research Center, Polish Academy of Sciences, Warsaw, Poland,
Editor of "Lymph Stasis: Pathophysiology, Diagnosis and Treatment" CRC Press 1991

Outline

- Lymphatic drainage of the breast and upper limb
- Long-Term morbidities from surgery and radiotherapy
- Breast Lymphedema
 - Incidence
 - Diagnosis
 - Measurement
 - Delayed breast cellulitis
- Physiology and Function of the Lymphatic System
- Important New Study: Johansson et al. “Breast Edema Following Breast Conserving Surgery and Radiotherapy”
- Treatment of Breast Lymphedema
- Selected References for Further Study

Breast Lymphatic Draining into the Axillary Nodal Basin



Sappey MPC: "Anatomie, Physiologie, Pathologie des vaisseaux Lymphatiques considérés chez L'homme et les Vertebres"
A. Delahaye and E. Lecrosnier, Paris, 1874.

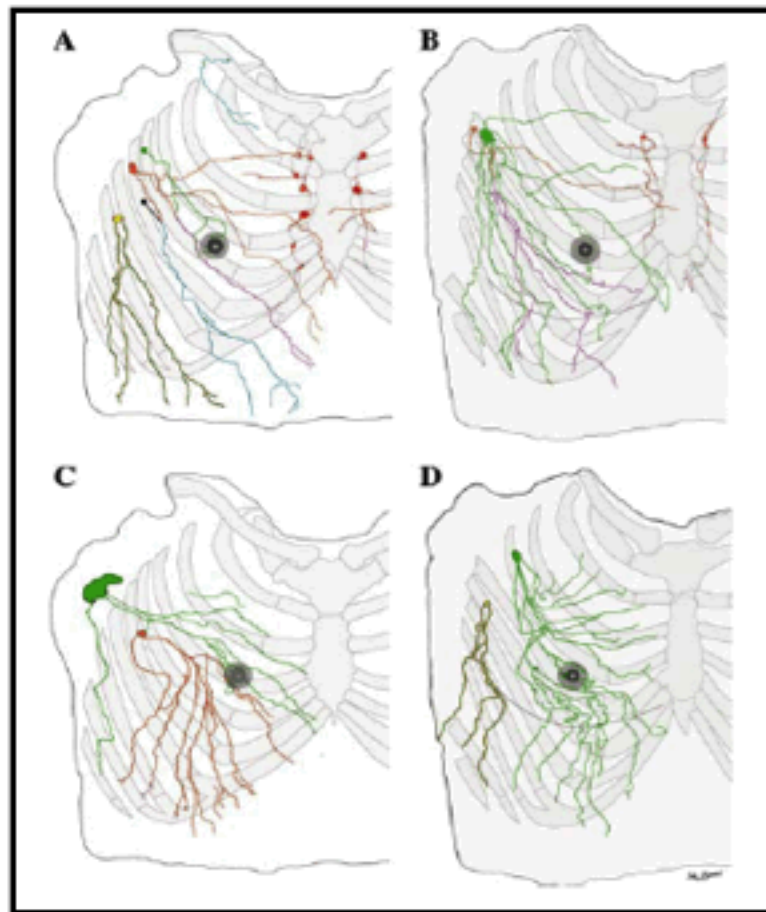


FIG. 4. Tracing distally of lymphatics of both hemi upper torsos (male: A and C, female: B and D)*

*Suami H, Pan W-R, Mann B, & Taylor GI: "The Lymphatic Anatomy of the Breast and its Implications for Sentinel Lymph Node Biopsy: A Human Cadaver Study" *Annals of Surgical Oncology* 2008;15(3):863-71.

Long-Term Morbidities of Breast Irradiation, ALND and SLNB

- **IPSILATERAL BREAST**
 - Lymphedema [Beadle 1984, Fehlaer 2003, Lawenda 2008]
 - Infection (Cellulitis, inflammation, ulceration) [Fehlaer 2003]
 - Telangiectasia [Huang 2002]
 - Radiation fibrosis [Borger 1994, Böhler 1992 Delanian 2004, Gothard 2004]
 - Induration, atrophy, retraction [Fehlaer 2003]
 - Pain [Tasmuth 1995, Fehlaer 2003]
 - Angiosarcoma, genetically-independent carcinoma [Sachs 2005, Brenner 2007, Majeski 2000]
- **CONTRALATERAL BREAST**
 - Carcinoma [Boice 1992, Gao 2003]

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*Surveys & Overviews

Incidence of Breast Lymphedema

Researcher	Date	Number	Conditions	Axillary Treatment	Incidence % Mild/Med/Sev
Clarke	1982	74	Breast Irradiated No Mastectomy	None/SLNB ALND	6/25 79
Beadle	1984		@6 months @5 years		32/3/0 23/0/0
Senofsky	1991	133		RT/NoRT ALND	21/5 12
Meek	1998			Limited Dx Full Dx	8-25 15-80
Bosompra	2002	148	@2-4 years Patient survey		14
Goffman	2004	240	>1.5 years Clinical exam	SLNB 5% ALND 76%	8.3//1.3
Rönkä	2004	160	@1 year, US skin thickness	SLNB ALND	*28/17 *70/54-59
Rönkä	2005	109	@1 year Self-reported	SLNB ALND	16/7/0 41/15/2
Leidenius	2005	139	@3 years Self-reported	SLNB ALND	6/1/0 21/4/0

* Note: Ultrasonic skin thickness measurement = subcutaneous edema/interstitial fluid

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Diagnosis of Breast Lymphedema

- Clinical
 - Breast edema
 - Breast erythema
 - Painful to the touch
 - Heightened temperature
- Self-scored breast symptoms
 - Swollen appearance or feel
 - Heaviness
 - Redness
 - Tenderness, discomfort
 - Fullness or numbness
 - Pain

Measurement of Breast Lymphedema

- Clinical observation [Fehlauer 2003]
- Optical skin erythema measurement [Russell 1994]
- Tissue tonometry [Clodius 1976]
- Skin visco-elasticity [Gorodetsky 1999, Marcenaro 2004]
- Ultrasonic skin thickness measurement [Shukla 1984, Warszawski 1998, Mellor 2004, Rönkä 2004]
- Magnetic Resonance Imaging of skin [Idy-Paretti 1998]
- Dual-beam X-ray absorptiometry [Cluzan 1998]
- Lymphangioscintigraphy [Weissleder 1988, Szuba 2003]
- Indocyanine Green–Enhanced Lymphography [Yamamoto 2011]
- Bioelectrical impedance measurement [Mikes 1999, Cornish 2001]
- Tissue Dielectric Constant skin fluid measurement [Lahtinen 2006]

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Delayed Breast Cellulitis

- “Delayed breast cellulitis, the most severe form of breast lymphedema, may pose problematic diagnostic and management dilemmas.” [Rönkä quoting Zippel 2003]
- Distinct from infection following lumpectomy [Zippel 2003]
- Pathogen usually not identified [Baddour 1999, Zippel 2003]
- Mechanism probably involves lymph stasis [Miller 1998]
- Upper limb lymphedema significant risk factor for breast cellulitis [Brewer 2000]
- Characterized by erythema, edema, tenderness, warmth, pain [Indelicato 2006, Brewer 2000]
- Incidence 3-8%
- Median time to onset 190 days after surgery, 109 days from radiotherapy [Brewer 2000], 226 days [Indelicato 2006]
- 22% had recurrent episodes

References, Delayed Breast Cellulitis

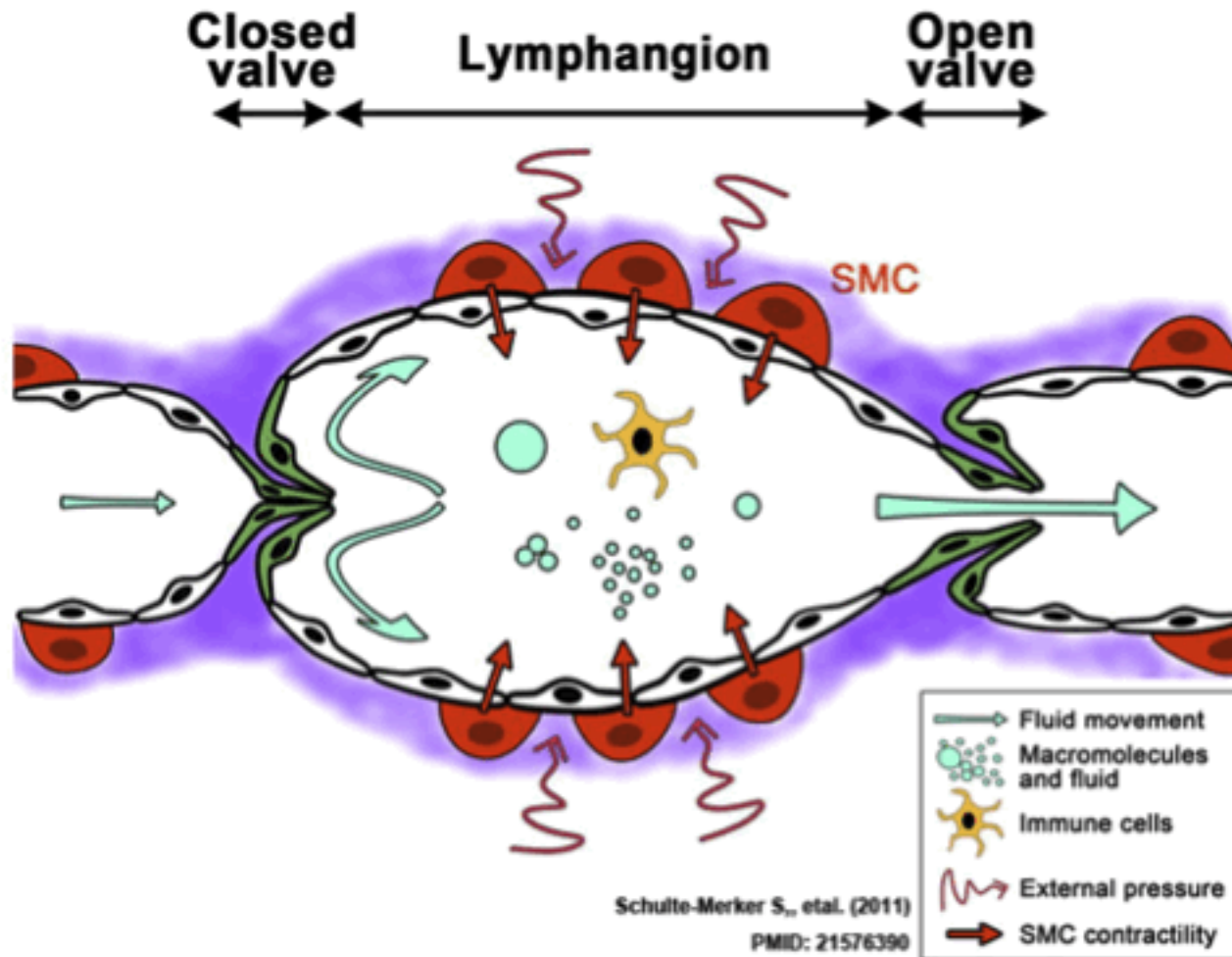
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Structure of the Lymphangion



- Mechanical
 - Elastic tube about 200um diameter
 - Unidirectional valve at each end controlled by pressure
 - Suspended from basal tissue by elastic collagen filaments
 - Generally runs in parallel bundles with arteries & veins
- Neural and Hormonal
 - Autonomous synchronized rhythmic pulsing (“little hearts”)
 - Coordinated with pulsing of neighbors
 - Internal sensing of state of stretch/fluid pressure
 - Intrinsic and extrinsic pumping mechanisms
- Ejection Fraction about 60%

Lymphangion “Little Heart”



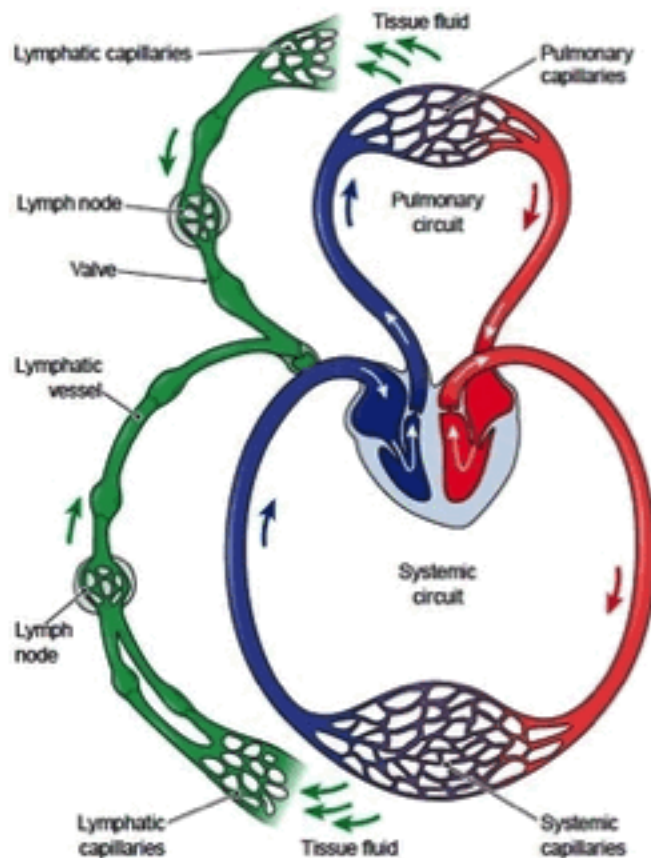
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Microstructure of Lymphatic Capillaries in the Skin.

- Lymphatic capillaries are irregular shaped and stay collapsed.
- When the interstitial fluid pressure increases because of fluid accumulation, the anchoring filament bundles pull lymphatic endothelial cells and open up the cell-cell junctions so that the lymph fluids can enter the lumen of lymphatic vessels for transport.
- Source Choi I, Lee S & Hong Y-K, *Cold Spring Harb Perspect Med* 2012; 2:a006445
- (Illustration modified from Skobe and Detmar 2000.)



Changing State of our Knowledge



Circulation system is closed system

Fluid moves by virtue of a central pump (heart)

Blood pumped from the heart through arteries to capillary beds where arterial capillaries join continuously with venous capillaries and then through veins back to the heart

The venous system contains valves that prevent backflow

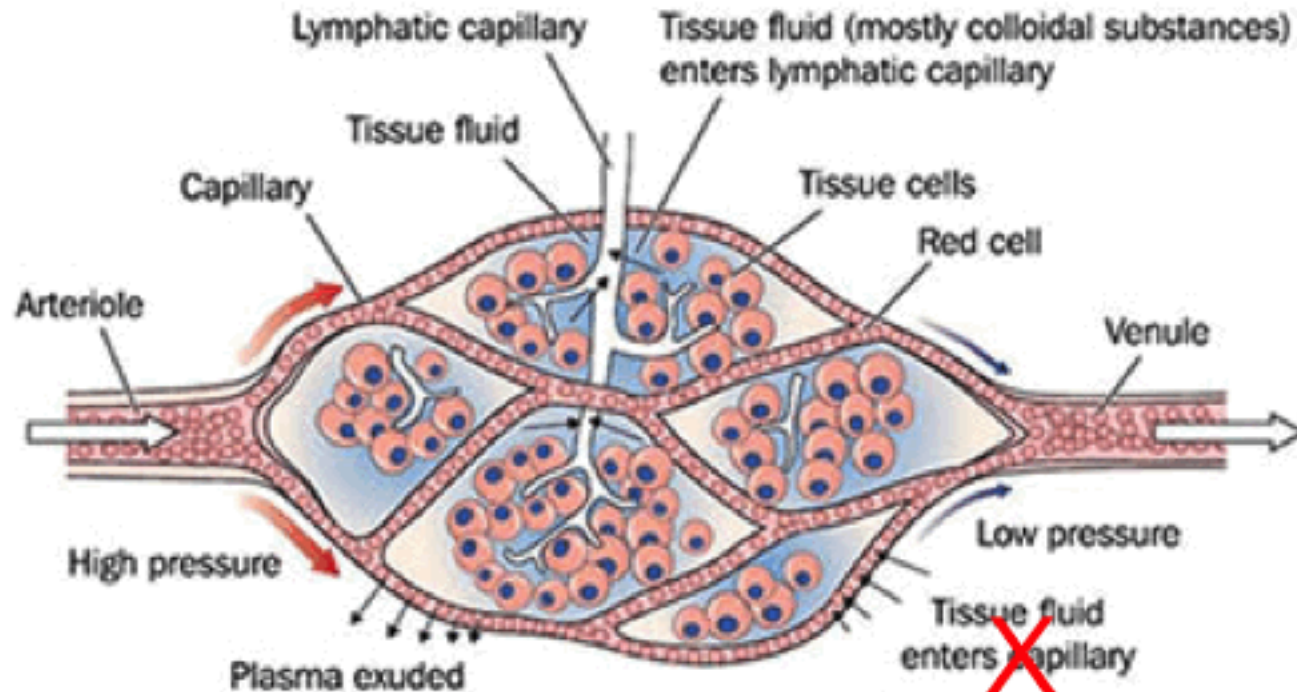
Approximately 10% of the fluid filtrates into the tissue from arterial capillaries

All tissue fluid returns to the heart through the lymphatic system

“There is substantial evidence that with important exceptions such as the renal cortex and medulla, downstream microvessels are not in a state of sustained fluid absorption as traditionally depicted. Although doggedly persistent in textbooks and teaching, the traditional view of filtration–reabsorption balance has little justification in the microcirculation of most tissues. Tissue fluid balance thus depends critically on lymphatic function in most tissues.” [Levick 2010]

The Old Theory (What you learned in school)

Capillary bed drainage by lymphatic capillary



Breast Lymphedema Pathology

- Breast tissue still nourished by blood supply
- Breast lymphedema caused by reduced drainage of lymph
 - Interruption of drainage network
 - Surgical removal of nodes, lymphangions
 - Scar tissue blocking flow
 - Inadequate regeneration of functional lymphatic network
 - Impaired functionality of lymphatic system
 - Nerve damage enervates lymphatics
 - Fibrosis of collagen filamentary supports
 - Fibrosis or removal of lymphovenous anastomoses
 - Venous hypertension

Why is this Understanding Important?

- Aids in differential diagnosis of swelling
 - Lymphatic VS venous VS arterial/systemic
- Aids in selecting most effective therapy
 - MLD VS compression only
 - Non-elastic VS elastic compression
 - Type, operation and protocol of pneumatic device
- Unique problems with combined causes
 - Lymphovenous edema
 - Lipolymphedema

Breast Lymphedema Measurement (Johansson, Lathinen & Björk-Eriksson 2014)

- The aim of this study was to investigate tissue water content in skin and upper subcutis in women treated for breast cancer with breast conserving surgery and radiotherapy (RT) to the breast and compare the changes with respect to the healthy breast.
- One hundred eighteen patients were measured prior to, during, and 2 and 4 weeks after end of RT.
- Local edema in the four quadrants of both breasts was measured with MoistureMeterD (Delfin Technologies Ltd, Finland).
- A parameter, tissue dielectric constant (TDC), directly proportional to tissue water content to the effective depth of 2.5 mm, was calculated.
- Breast edema was defined as a TDC ratio exceeding 1.40 (mean + 2SD) between the irradiated and the healthy breast.

Breast Lymphedema Measurement Results

Difference in TDC ratio ($p < 0.001$) between the operated and healthy breast was found at each measurement time-point.

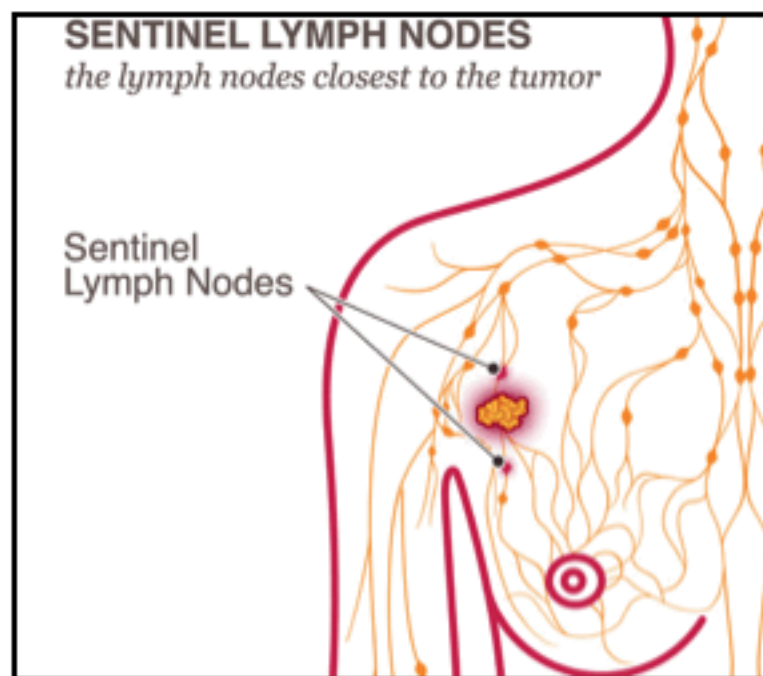
The incidence of breast edema was 31.4% before start of the RT treatment, increasing during RT and was 62.6% at 4 weeks after completion of RT.

The mean pre-RT TDC ratio was 1.30 ± 0.29

TDC increased during the first week of therapy to 1.43 ± 0.33

TDC stayed elevated through the observation period ($p < 0.001$).

Pre-RT patients with scar in quadrant 4 showed higher TDC ratio ($p = 0.02$) ($n = 71$, TDC ratio 1.36 ± 0.31) than patients with no scar tissue in quadrant 4 ($n = 46$, a TDC ratio 1.20 ± 0.23).



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Breast Lymphedema Measurement

Conclusions

- ❖ The healthy breast can act as a control to provide a ratio between the breasts.
- ❖ Based on the evaluation of the mean TDC ratio, the incidence of breast edema was found to be high (> 30%).
- ❖ The TDC values illustrating edema in the operated breast were higher compared to the healthy breast at all measurement time-points, also pre-RT, suggesting a high influence of surgery on breast edema.
- ❖ Axillary surgery did not seem to increase breast edema more than sentinel lymph node biopsy.
- ❖ Patients with scar in the fourth quadrant are more likely to have a higher TDC ratio.
- ❖ Higher weekly doses in the hypo-fractionated RT seem to induce more edema than conventional fractionation.

Breast Lymphedema Therapy

- ❖ Preoperative
 - Assessment of function and strength of shoulder
 - Measurement
 - Introduction to self-lymphatic clearance
- ❖ Postoperative (on detection of any swelling, pain, discomfort)
 - Self-manual lymph drainage
 - Compression bra
- ❖ If signs persist in spite of patient self care
 - Course of MLD
 - Stimulate lymphangions, direct fluid, reduce fibrosis
 - Scar reduction and mobilization
 - Exercise program (shoulder, ROM, thorax, breathing)
 - Skin care (skin folds, edematous areas)
 - Recommendation of appropriate compression

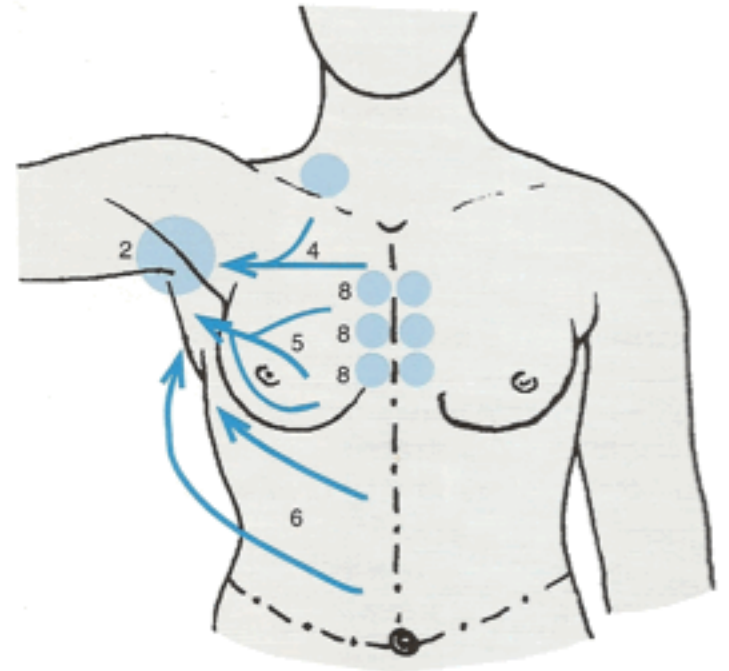


Fig. 8.2 Treatment of the breast in schematic overview. (The numbers denote strokes cited in the text.) [Source: 5.]

*Source 5: Roman Strössenreuther cited in "Foundations of Manual Lymph Drainage", 3rd Edition, M. Földi & R. Strössenreuther, Elsevier, 2005

Complete Decongestive Therapy (CDT) in Treatment of Breast/Truncal Lymphedema

Notes from Joachim E. Zuther*

- ❖ In order to reduce the swelling it is necessary to re-route the stagnated lymph flow around the blocked area(s) into more centrally located healthy lymph vessels. This goal is achieved by a combination of different treatment modalities.
 - **Manual Lymph Drainage:** Lymphatic fluid is re-routed via anastomoses (lymphatic collectors) and lymphatic capillaries into adjacent quadrants and regional lymph nodes.
 - **Compression Therapy:** Compression is applied with either padded short-stretch bandages, or compression garments (vests, bras)
 - **Decongestive/Breathing Exercises:** Lymphatic return is stimulated via deep lymph vessels, thus creating a “suction effect” on the superficial lymphatic system
 - **Skin Care:** Ointments, soaps or skin cleansers used in lymphedema management should have good moisturizing qualities, contain no fragrances, be hypo-allergenic and should be in either the neutral or acidic range of the pH scale (around pH 5).

*Founder and Educational Director, Academy of Lymphatic Studies, Primary Author of “Lymphedema Management —The Comprehensive Guide for Practitioners”, Thieme, 2013.

Breast Lymphedema Therapy

Notes from Robert Harris*

- ❖ Breast edema appears to be a common consequence of both axillary dissection and sentinel lymph node removal.
- ❖ Fibrosis and other complications can develop in breast tissue.
- ❖ Treatment
 - MLD can be adapted specifically to each patient's needs and address issues such as pain and fibrosis as well as swelling.
 - Therapists need to have learned correct drainage pathways and alternate pathways in order to successfully drain the breast area, with competent and skilled techniques.
 - It is a challenging area to compress correctly with bandages due to limitations placed on a patient's respiration.
 - A compression garment can be custom made for the chest and appropriate compression bras can help.
 - Kinesio or lymph taping can assist drainage.

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Founder, Director and Senior Instructor of the Dr. Vodder School of North America

Breast and Truncal Lymphedema Treatment Notes from Bonnie Lasinski*

- ❖ Incidence poorly reported and difficult to measure
- ❖ Often ignored or minimized by Health Care Provider
- ❖ Breast and truncal lymphedema can be associated with significant pain, impairment in function and psychological distress
- ❖ Treatment
 - Validate patients symptoms/concerns
 - Skin Care/risk reduction for infection
 - Manual lymph drainage (MLD)
 - Patient Self-MLD/partner simple MLD
 - Breathing exercises
 - Elastic taping (kinesiotaping)
 - Postural/gentle stretching exercises/shoulder/cervical and thoracic spine
 - Soft tissue mobilization/scar tissue work may be indicated
 - Compression shirts/camisoles/bras/foam and fabric pads/garments

*MA, PT, CSCI, CLT-LANA, Clinical Director of Lymphedema Therapy in Woodbury, LI, NY and the Boris/Lasinski School, which teaches the Casley-Smith Method of CLT.

Breast Lymphedema Therapy Notes from DeCourcy Squire*

*Early detection → early intervention → best outcomes and less intense treatment
Later detection → requires more treatment but can still be successful*

- ❖ Mobilize any scars that are adhered, once they have healed adequately.
- ❖ Perform Manual Lymph Drainage: pathways as available to supraclavicular nodes, contralateral axillary nodes, ipsilateral inguinal nodes.
- ❖ Soften fibrosis (being careful with radiated tissue) with manual techniques and with textured padding under compression.
- ❖ Use compression options: wrapping with short or medium stretch bandages (“tube top” or “over-the-shoulder” style); bras with anti-fibrosis pads placed inside (homemade or commercially produced); compression bras; compression vests with textured foam.
- ❖ Teach exercises that include deep breathing; retraction/protraction of scapulae (emphasis on retraction/pinching shoulder blades together); hand press (“namaste”) to activate pectoralis muscles; also, if needed, exercises to regain full ROM of the shoulder joint .
- ❖ Kinesiotaping can be used as an adjunct to help with scars or to decrease edema.

These techniques should be performed by a certified lymphedema therapist whose training meets the standards set by the Lymphology Association of North America (LANA)

*PT, CLT-LANA, ALT, STAR-C, CI-CS, *Lymphedema Instructor Casley-Smith Method*

Selected References for Self-Study

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