**The addition of manual lymph drainage to compression therapy for breast cancer related lymphedema: a comprehensive review and evidence summary**

**Introduction**

Lymphedema (LE) is a swelling of the soft tissues that results from the accumulation of protein-rich fluid in the extracellular spaces.1,16,18 It is associated with decreased lymphatic transport capacity and increased lymphatic load.1,6,16 In the United States, the populations primarily affected by LE are patients undergoing treatment for malignancy, particularly women treated for breast cancer.2 The etiology of lymphedema in breast cancer patients is primarily related to the severity of the axillary node dissection and subsequent exposure to radiation therapy.2,5,18 Approximately 25% of breast cancer patients develop LE following breast cancer treatment, and the risk of occurrence rises every year.3 However, most cases of lymphedema will develop within the first three years after breast cancer treatment.4 Once acquired, lymphedema is a chronic, progressive condition that impairs mobility and joint movement as the swollen limbs increase in size and weight, often causing pain, movement restrictions, decreased ability to perform activities of daily living, and can thereby alter quality of life.1,3,6,8,10 It is for these reasons that breast cancer related lymphedema is one of the most dreaded sequela of breast cancer and its therapies.

Several therapeutic interventions exist to treat this potentially disabling condition, but treatments continue to lack standardization. Currently, complete decongestive therapy (CDT) is recognized as the standard of care in LE treatment.1,6,11 Daily treatment, 5 days per week, is commonly provided over a 3 to 8 week period until the reduction of fluid has reached a plateau.9,12 The components of CDT include (1) an average of 60 minutes of manual lymph drainage; (2) multilayer, short-stretch compression bandaging (CB) of the affected limbs; (3) exercises to enhance lymphatic flow; (4) meticulous skin care of the affected areas; and (5) fitting of appropriate compression garments (CG) to maintain the volume reductions achieved through treatment.1,11,12 Additionally, patient education in hygiene and self-care is critical for successful long-term outcomes.1,11

Manual lymphatic drainage, a component of CDT, has been used alone and in combination with other modalities in the treatment of breast cancer related LE. In regards to application, there are several schools of thought including Vodder, Leduc, Földi, but they all agree on the fundamental aspects of LE management.1,3,10,13 This specialized treatment consists of massage techniques involving the skin surface and follows the anatomic lymphatic pathways of the body.3 With this technique, the therapist uses specific hand movements to provide a gentle pumping action to mobilize edema fluid from distal to proximal areas. As a result lymph flow improves without increasing capillary filtration.9 This improvement in draining capacity allows fluid to be redirected from the affected areas towards the functioning lymph nodes in unaffected areas. MLD must be applied by a trained professional and usually requires 45 to 60 minutes. It is usually carried out once daily, four to five times a week, for 2 to 4 weeks total.3

Compression bandaging, another component of CDT, is also used in the management of lymphedema. By applying several layers over each other, the multilayer bandage system as a whole attains the characteristics of a nonelastic envelope.13 This system provides low compression at rest and enhances the effect of muscular activity on the clearance of lymphatic fluid from the limb.13,14 Muscle contractions increase interstitial fluid pressure to assist the fluid out of congested areas.15 Therefore, these short-stretch bandages are applied to the affected limb after MLD to help maintain edema reduction achieved through lymphatic drainage. Standard protocols recommend that bandages be worn 24 hours daily throughout the course of therapy.10

Despite the relatively poor quality of evidence supporting the use of manual lymphatic drainage, it continues to be recommended by the International Society of Lymphology in the multimodal approach of LE treatment.16 Furthermore, most studies of lymphedema management have focused on the combined effects of CDT and have failed to evaluate each component individually.5,7,8,10,13 Rising health care costs and fiscal restraints has further fortified a need for cost-effective intervention programs. The relatively high cost of MLD compared to CB warrants evaluation concerning the potential benefit of each individual component of CDT for their effectiveness in treatment of breast cancer-related lymphedema. With that said, a need has been identified for studies of high methodological quality to establish evidence regarding the efficacy of treatment methods such as manual lymphatic drainage and compression bandaging.

The purpose of this review is to outline the effects of manual lymphatic drainage when added to compression therapy in the treatment of post mastectomy-related lymphedema. The conclusions drawn will assist clinicians in determining the most appropriate and effective treatment modality in treating patients affected by lymphedema.

**MLD Unbundled**

Relatively few studies are available examining MLD as a stand-alone therapy for lymphedema management. Andersen et al5 conducted a prospective randomized study of forty-two women with breast cancer-related lymphedema.This study examined the influence of adding MLD to standard treatment in reducing limb volume. No significant differences were found between the group that received standard therapy alone and the experimental group that received MLD in addition to standard therapy. Data from this study suggested that MLD did not contribute significantly to reduce edema; instead observed volume reduction was attributed to the use of compression sleeves in both groups. Conversely, McNeely et al6 conducted a RCT of fifty women with breast cancer-related lymphedema and found that MLD followed by compression bandaging reduced lymphedema volume to a greater extent compared with use of compression bandaging alone. In this study, individuals with mild lymphedema benefitted the most from MLD when added to compression bandaging. In a RCT crossover study involving thirty-two women with breast cancer-related lymphedema, Williams et al9 examined the effects of MLD compared with a simplified form of self-MLD. They evaluated each intervention’s effect on edema level, quality of life, and associated symptoms of lymphedema. Both groups wore compression sleeves and received advice on skin care. After six weeks, the interventions were reassigned between groups. The authors in this study found that use of MLD resulted in a significant reduction in limb volume, dermal thickness, and improved quality of life. Koul et al7 retrospectively followed 138 women with breast cancer-related lymphedema at one-year after who received treatment with MLD alone or all four components of CDT. A significant reduction in arm volume at one-year was associated with some or all components of CDT, including MLD. Finally, in a cohort study led by Leduc et al13 it was found that when using a treatment approach consisting of a combination of MLD, CB, and intermittent pneumatic compression the most significant reduction in edema occurred within the first week of treatment.

**MLD and Prevention of LE**

Prevention of lymphedema after axillary node dissection has been poorly investigated. Devoogdt et al8 conducted the first RCT to date examining the preventative effect of MLD on the development of lymphedema. This study investigated the effect of a six-month treatment program consisting of guidelines, exercise therapy, and MLD compared with the same program without MLD on development of breast cancer-related lymphedema in 160 participants, of which two were men. The cumulative incidence rate for arm lymphedema was comparable between groups along with the time to develop arm lymphedema during the first year after surgery.

**Long-term Management of LE**

In a prospective cohort involving 537 patients, Vignes et al10 analyzed the respective role of each of the three components of CDT including manual lymph drainage, low stretch bandaging, and elastic sleeve use, on lymphedema volume during the one-year maintenance phase therapy. The results of this study correlated with the regular use of low-stretch bandages, requiring at least three bandages per week, and elastic sleeve compliance. Furthermore, non-compliance to MLD was not deemed a risk factor in this study.

Of the articles reviewed, the more sound studies included a RCT and a viable control group. McNeely et al6 and Devoogdt et al8 were the only studies designed to satisfy both variables. The design piloted by McNeely et al allowed for vigorous control of the intended intervention and optimal comparison between the group that received MLD in combination with CB and the group that received CB alone. Similarly, the design by Devoogdt et al allowed for standardized comparisons, thereby limiting the influence of extraneous variables. The Williams et al9 study was the only study among those reviewed that included multiple outcome measures in the results. Although many studies indicated inclusion of multiple outcomes in the methods, measurements of these outcomes were not followed throughout the study’s entirety.5,8 The Williams et al9 study is further strengthened by its RCT design but weakened by the absence of a true control group and a small sample size. Lack of a control group in this study and in the Koul et al study confounds the possibility that the reductions in limb volume may have occurred despite exposure to the intervention.7,9 Non-randomization of patients observed in articles by Koul et al, Leduc et al, and Vignes et al prevented the examiner from establishing the contribution of each component of CDT individually, therefore the independent effects of MLD and CB on lymphedema could not be determined.7,10,13 Of the RCT’s reviewed, only Devoogdt et al monitored the patient pool long-term to one-year follow up, the next longest time period studied was three-months shown in the article by Williams et al.8,9 As a general conclusion found in many studies reviewed, continued use of compression is usually required to maintain treatment results.5,6,9,10,13 However, as a result of dissimilar interventions comparing various treatment modalities, along with a lack of randomization among the studies, the direct comparison of data between studies was problematic.

**Limitations of the Evidence**

In the studies reviewed, there are several limitations that need to be acknowledged. The greatest being the failure of many studies to effectively measure the contribution of each individual component when evaluating CDT as a bundled intervention. 5,7,8,10,13 Secondly, there are inconsistencies between studies regarding application technique and frequency of MLD. For example, in the study by Vignes et al, MLD was applied according to Földi’s technique; whereas, Williams et al and Devoogdt et al used the Vodder method of MLD.8-10 The studies also differed in terms of frequency and duration of MLD application. McNeely incorporated forty-five minutes of MLD five times a week for four weeks; similarly Williams et al applied forty-five minutes of MLD five times a week for three weeks. Anderson et al designated one-hour of MLD therapy, to be applied in eight treatment sessions over a two-week period. Lack of standardization between methods used led to impaired generalizability of results. The McNeely article experienced high drop out rates, while Vignes et al encountered significant loss to follow up leading to incomplete results and was therefore a potential source of bias.6,10 Additionally, inconsistences in measurement protocols prevented equal comparison among studies. For example, Vignes et al, Williams et al, and Andersen et al, assessed lymphedema volume using a tape measure every 4-5 cm5,9,10, whereas the study by Luduc et al used tattooed reference markings placed on the skin localized 10 cm apart13, and McNeely et al utilized volumetry.6 Finally, a lack of blinding present in several of the studies included in this review may account for contradictions and ambiguous results between various studies.5,7,9,10

**Recommendations for Future Research**

Contradictory findings apparent in the studies reviewed may be in part due to differences in study protocols, which highlight the need for further balanced studies, consistent protocols, development of standard definitions and longer-term follow up. For instance, there continues to be no standard degree of enlargement that constitutes lymphedema. From a measurement prospective and as a result of the various degrees of lymphedema such as mild, moderate, or severe, early or late onset1, there is need for better-quality classifications across studies.

There is need for improved efforts to establish relevant and valid clinical outcomes for the assessment of patients with lymphedema. In order to establish a best practice guideline, future studies must include parameters such as the effects of lymphedema treatment on pain, function, and quality of life. Studies based on these outcomes are more likely to influence clinical practice.

**Application to Clinical Practice and Capstone Project**

The National Cancer Institute, a component of the National Institutes of Health, estimates that one in eight women will develop breast cancer at some time during her life.17 Those who elect to undergo surgical treatment of breast cancer often require postoperative physical therapy to increase function, mobility, and manage lymphedema. Lymphedema management is of particular importance for clinicians secondary to its relatively high frequency, which is estimated to occur in 8% to 56% of patients at 2 years post surgery.18 Because it commonly appears late in recovery, cancer related lymphedema is becoming more relevant in the outpatient setting and more people are seeking treatment options for this chronic, debilitating side effect. As research efforts continue to uncover more evidence about post mastectomy lymphedema dysfunction, there is an increased need to develop best practice strategies and implement effective interventions for its treatments.Furthermore, due to the cost, time, and training required to apply MLD, it is relevant to know how useful this technique is clinically as a component of CDT.

In our curriculum we have yet to discuss this prevalent and growing impairment, it is my goal to increase awareness in regards to the management of lymphedema and describe our role in treating its effects. I strongly believe there is a need to increase the awareness of treatment options for this dysfunction within our profession and prepare entry-level students to properly recognize the signs and symptoms of this condition and provide them with effective treatment strategies in the clinic.

**Conclusion**

The research investigating the role of manual lymphatic drainage in lymphedema management remains divided, with some studies concluding that MLD is an unnecessary component of breast cancer-related lymphedema treatment in the short-term5,6,8 and one study determining that MLD does play a role in improved outcomes in this population9. It appears compression bandaging is an effective method for reducing lymphedema when used with or without MLD, at least in the short-term.6 Further studies are needed to isolate the different components of treatment to better determine if MLD is beneficial and truly necessary.

**References:**

1. Lasinski, B. B., Thrift, K. M., Squire, D., Austin, M. K., Smith, K. M., Wanchai, A., et al. (2012). A systematic review of the evidence for complete decongestive therapy in the treatment of lymphedema from 2004 to 2011. *PM&R, 4*(8), 580-601. doi:10.1016/j.pmrj.2012.05.003
2. Warren AG, Brorson H, Borud LJ, Slavin SA. Lymphedema: A comprehensive review. *Ann Plast Surg*. 2007;59(4):464-472. doi: 10.1097/01.sap.0000257149.42922.7e.
3. Martin, M. L., Hernandez, M. A., Avendano, C., Rodriguez, F., & Martinez, H. (2011). Manual lymphatic drainage therapy in patients with breast cancer related lymphoedema. *BMC Cancer, 11*, 94. doi:10.1186/1471-2407-11-94
4. Quirion, E. (2010). Recognizing and treating upper extremity lymphedema in post mastectomy/lumpectomy patients: A guide for primary care providers. Journal of the American Academy of Nurse Practioners, 22, 450-459.
5. Andersen, L., Hojris, I., Erlandsen, M., & Andersen, J. (2000). Treatment of breast-cancer-related lymphedema with or without manual lymphatic drainage--a randomized study. *Acta Oncologica (Stockholm, Sweden), 39*(3), 399-405.
6. McNeely, M. L., Magee, D. J., Lees, A. W., Bagnall, K. M., Haykowsky, M., & Hanson, J. (2004). The addition of manual lymph drainage to compression therapy for breast cancer related lymphedema: A randomized controlled trial. *Breast Cancer Research and Treatment, 86*(2), 95-106. doi:10.1023/B:BREA.0000032978.67677.9f
7. Koul, R., Dufan, T., Russell, C., Guenther, W., Nugent, Z., Sun, X., et al. (2007). Efficacy of complete decongestive therapy and manual lymphatic drainage on treatment-related lymphedema in breast cancer. *International Journal of Radiation Oncology\*Biology\*Physics, 67*(3), 841-846. doi:10.1016/j.ijrobp.2006.09.024
8. Devoogdt, N., Christiaens, M. R., Geraerts, I., Truijen, S., Smeets, A., Leunen, K., et al. (2011). Effect of manual lymph drainage in addition to guidelines and exercise therapy on arm lymphoedema related to breast cancer: Randomised controlled trial. *BMJ (Clinical Research Ed.), 343*, d5326. doi:10.1136/bmj.d5326
9. Williams, A. F., Vadgama, A., Franks, P. J., & Mortimer, P. S. (2002). A randomized controlled crossover study of manual lymphatic drainage therapy in women with breast cancer-related lymphoedema. *European Journal of Cancer Care, 11*(4), 254-261.
10. Vignes S, Porcher R, Arrault M, Dupuy A. Long-term management of breast cancer-related lymphedema after intensive decongestive physiotherapy. Breast Cancer Res Treat. 2007;101(3):285-90
11. Mayrovitz HN. The standard of care for lymphedema: current concepts and physiological considerations. Lymphat Res Biol. 2009;7(2):101-8.
12. Ko, D. (1998). Effective treatment of lymphedema of the extremities. Arch Surg, 133, 452-458.
13. Leduc O, Leduc A, Bourgeois P, Belgrado JP. The physical treatment of upper limb edema. Cancer. 1998;83(12 Suppl American):2835-9.
14. Kligman L, Wong RK, Johnston M, Laetsch NS. The treatment of lymphedema related to breast cancer: a systematic review and evidence summary. Support Care Cancer. 2004;12(6):421-31.
15. Hafner J, Botonakis I, Burg G. A comparison of multilayer bandage systems during rest, exercise, and over 2 days of wear time. *Arch Dermatol*. 2000;136(7):857-863.
16. Petrek JA, Pressman PI, Smith RA. Lymphedema: current issues in research and management. CA Cancer J Clin. 50(5):292-307.
17. Altekruse SF, Kosary CL, Krapcho M, et al. *SEER Cancer Statistics Review, 1975–2007*. Bethesda, MD: National Cancer Institute, 2010.
18. Paskett ED, Naughton MJ, Mccoy TP, Case LD, Abbott JM. The epidemiology of arm and hand swelling in premenopausal breast cancer survivors. Cancer Epidemiol Biomarkers Prev. 2007;16(4):775-82.