Clinical Practice Guideline: **Lymphedema**

Date of Implementation: **October 18, 2012**

Product: **Specialty**

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GUIDELINES

Medically Necessary

American Specialty Health – Specialty (ASH) considers complex lymphedema therapy (complete decongestive therapy) medically necessary for the treatment of intractable lymphedema when **ALL of the following** are met:

- Documented failure of a reasonable course of conservative medical management that includes home exercises, limb elevation, and compression garments.
- The lymphedema is directly responsible for impaired functioning in the affected limb.
- The complex lymphedema therapy is prescribed by or under the supervision of an appropriate healthcare provider.

Not Medically Necessary

Vasopneumatic compression device use as part of complex lymphedema therapy is considered not medically necessary.

Considered Medically Necessary when criteria in the applicable policy statements listed above are met:

CPT® Codes and Descriptions

CPT ® Code	CPT® Code Description
97140	Manual therapy techniques (e.g., mobilization/manipulation, manual lymphatic drainage, manual traction), 1 or more regions, each 15 minutes
97535	Self-care/home management training (e.g., activities of daily living (ADL) and compensatory training, meal preparation, safety procedures, and instructions in use of assistive technology devices/adaptive equipment) direct one-on-one contact, each 15 minutes
29581	Application of multi-layer compression system; leg (below knee), including ankle and foot
25984	Application of multi-layer compression system; upper arm, forearm, hand, and fingers

HCPCS Codes and Descriptions

HCPCS Code	HCPCS Code Description
S8430	Padding for compression bandage, roll
S8431	Compression bandage, roll
S8950	Complex lymphedema therapy, each 15 minutes

Multi-layered, sustained, graduated, high compression bandage systems (CPT® code 29581- Application of multi-layer compression system; leg (below knee), including ankle and foot and CPT® code 29584 - Application of multi-layer compression system; upper arm, forearm, hand, and fingers) are used primarily to treat lymphedema and venous or stasis ulcers. A number of graduated, high-compression bandage systems products have been developed, including Profore®, Dyna-Flex®, Surepress®, Setopress®, and other similar product systems.

Providers should note that the treatment of lymphedema with the application of high compression bandage systems continues to be non-covered by Medicare. However, a brief period (i.e., three or fewer sessions if no new specific issues are identified) of patient and/or caregiver education for home management of lymphedema with compression wrap applications may be medically necessary and reimbursable. Medical necessity for the

education must be clearly indicated in the patient's record and must meet the code descriptor requirements for CPT® 97535, supporting home management training. S8430 – padding for compression bandage, roll and S8431 – compression bandage, roll may be appropriate and allowable per health plan benefit.

DESCRIPTION

Complex lymphedema therapy (CLT) is a non-invasive treatment for lymphedema with the aim to reduce and control the amount of swelling in the affected limb and restore function. CLT is a noninvasive treatment that is a considered a standard of care for lymphedema. This method has also been referred to as complete decongestive physiotherapy (CDP), and complex decongestive therapy (CDT). The treatment aim is to reduce and control the amount of swelling in the affected limb and restore function. The objective of the technique is to redirect and enhance the flow of lymph through intact cutaneous lymphatics. Programs are generally provided on an outpatient basis in the office setting or in a lymphedema rehabilitation center or clinic (Lasinski and Boris, 2002; MacDonald et al., 2003). The typical CLT program consists of two phases of treatment: a treatment phase and a maintenance phase. Phase I, the treatment phase, usually last 2 to 4 weeks. This phase consists of four components (Lawenda et al., 2009):

- Skin and nail care: The purpose is to inspect skin, provide moisture and prevent infection.
- Manual lymph drainage (MLD): This is a light, massage-like technique that is performed for 30-60 minutes and is used to stimulate residual lymphatic vessels to carry excess fluid from the affected extremity.
- Compression bandaging: This involves wrapping multi-layered bandages around affected limb.
- Therapeutic exercise: This includes movement of the limb through a range of motion with bandaging in place.

Most patients will be able to progress to a home-based, self-managed program after an initial in-office program of 1–2 weeks. Instruction in self-management should begin in the first week of therapy. Both patients and family are taught bandaging and exercise techniques, as well as the essentials of skin and nail care. After the initial one- to two-week program, patients should be re-evaluated to determine whether continued in-office therapy is necessary or if treatment can be provided in the home.

Phase II, the maintenance phase, consists of life-long self-care to maintain the size of the limb. In this phase, the patient maintains and optimizes the results by applying the techniques learned in the treatment phase including skin and nail care, wearing an elastic sleeve during the day, bandaging the affected limb overnight and exercises (Petrek, 2000).

Duration and Frequency

A program of complex lymphedema therapy provided 2–5 times per week for two weeks is generally considered medically necessary for the treatment of primary or secondary lymphedema, in the absence of any contraindications. Programs that go beyond a four-week period are generally considered not medically necessary.

Contraindications

Absolute contraindications to lymphedema therapy include:

- Acute infections of the affected limb
- Venous or arterial obstruction (deep vein thrombosis)
- Active malignancy confirmed or suspected local disease
- Unwillingness or inability of the member to participate in the treatment

Relative contraindications to lymphedema therapy include:

- Suspicion of deep vein thrombosis prior to starting treatment
- Congestive heart failure
- When the local massage is performed in area of irradiated soft tissue

(Note: Placing an acupuncture needle in a limb at risk of, or exhibiting lymphedema is absolutely contraindicated. For more information, see the *Acupuncture Services Medical Policy/Guideline (CPG 264 – S)* clinical practice guideline.)

GENERAL BACKGROUND

Lymphedema is defined as the excessive and persistent accumulation of protein rich fluid that collects in the interstitial spaces, due to an inefficiency of the lymphatic system (Szuba et al., 2002; Leal et al., 2009). Lymphedema occurs primarily as a result of malformation, underdevelopment, or acquired disruption of the lymphatic circulation (Szuba et al., 2002). Primary lymphedema is due to congenital defects of the lymphatic system, which can affect from one to as many as four limbs or other parts of the body and is considered rare (National Lymphedema Network, 2011). Secondary lymphedema is acquired and is due to an obstruction or interruption in the lymphatic circulation. Secondary lymphedema can develop as a result of surgery, radiation, infection or trauma. It is a common treatment-related side effect experienced by cancer patients. Patients that undergo surgery for breast cancer that includes node dissection or axillary radiation therapy are at high risk of developing lymphedema.

Historically, lymphedema has been classified into 3 stages based on its severity and on observation of the patient's condition. Currently, the International Society of Lymphedema is recognizing a Stage 0 in patients, which refers to a latent or sub-clinical condition where swelling is not evident despite impaired lymph circulation. Patients often report a feeling of heaviness in the limb; however, many patients are asymptomatic in the latency stage. Stage 0 may be present for months or years prior to a patient exhibiting signs

and symptoms of edema. Stage I lymphedema is referred to as spontaneously reversible lymphedema (Lawenda et al., 2009; Bicego et al., 2006) and typically involves pitting edema, an increase in limb girth (usually upper extremity), and heaviness. Stage II is also known as spontaneously irreversible lymphedema and it is marked by spongy consistency of the tissue and non-pitting edema (Bicego et al., 2006). Tissue fibrosis marks the beginning of hardening of the limbs and increased girth of extremity and is often found in Stage II (Bicego et al., 2006). Stage III is the most advanced stage and is often referred to as lymphostatic elephantiasis. During Stage III the swelling is irreversible with tissue being fibrotic and unresponsive including patients who present with very large limb(s) size. It is associated with a significant increase in the severity of the fibrotic response, tissue volume, and other skin changes such as papillomas, cysts, fistulas, and hyperkeratosis (Lawenda et al., 2009; Zuther, 2005). With regards to Stage 0, the literature is insufficient to conclude that the use of CDT is either clinically effective or ineffective in the treatment of subclinical or latent stage of breast cancer related lymphedema.

The best practice or gold standard for lymphedema treatment is considered CDT, also known as complex lymphedema therapy (CLT). CDT is a noninvasive treatment and consists of four basic components as follows: skin and nail care, manual lymph drainage (MLD), followed by bandaging/compression, education, and exercise. The goal of CDT is to reduce and control the amount of swelling in the affected limb and restore function. A treatment option that may be used to manage secondary lymphedema is intermittent pneumatic compressions (IPC) (vasopneumatic compression) which is often added to CDT. However, evidence does not support the addition of IPC to CDT or within any treatment plan. Low-level laser therapy (LLLT) is another treatment option that has been studied as a treatment when used in conjunction with other standard lymphedema treatments. However, low-level laser is currently considered experimental, investigational and/or unproven. Exercise demonstrates improvements in function and quality of life (QoL), but not in limb reduction. The goal of all conservative treatment is to reduce and control the amount of swelling in the affected limb and restore function.

DOCUMENTATION GUIDELINES

Documentation should support a diagnosis of lymphedema and not tissue edema due to other etiologies (chronic venous insufficiency, congestive heart failure, acute infection(s), etc.). Recent changes in the patient's condition as well as prior unsuccessful therapies (elevation, bandaging, diuresis, etc.) should be reported to justify the need for skilled services.

EVIDENCE REVIEW

Lymphedema is a common sequela of cancer or its treatment that affects the lymphatic transport system that results in failure of lymph node drainage. Secondary lymphedema is often a debilitating, chronic, progressive condition that commonly occurs after treatment of breast cancer. A number of health professional and patient instigated conservative

therapies have been developed to help treat this condition. A systematic review conducted by Moseley et al. (2007) reviewed the common conservative therapies used for management of secondary arm lymphedema as follows: complex physical therapy, manual lymphatic drainage, pneumatic pumps, oral pharmaceuticals, low level laser therapy, compression bandaging and garments, limb exercises and limb elevation. This study found that the more intensive and health care professional driven therapies, such as complex physical therapy (skin and nail care, manual lymphatic drainage, a multilayer compression bandage and therapeutic exercises), manual lymphatic drainage, pneumatic pump and laser level light therapy generally yielded the greater volume reductions, compared to self-instigated therapies such as compression garment wear, exercises and limb elevation. These self-care methods showed reductions, however in lesser volumes. All conservative therapies reviewed in this study produced improvements in subjective arm symptoms and QoL issues, where these were measured.

Stout et al. (2008) completed a study on Stage 0 lymphedema. They used infrared optoelectronic technology to identify those at risk for edema based on volume measurements. This technology allows for changes to be noted before they are actually visible to the eye. When these changes are noted, treatment initiated immediately may prevent the development of further stages of lymphedema. However, there is no standard for the treatment of early-stage, subclinical lymphedema. When the diagnosis of breast cancer related lymphedema is delayed, therapeutic management requires intensive decongestive therapy and life-long maintenance. This study suggested that an early intervention protocol with 20- to 30-mm Hg compression garments, significantly reduced the affected limb volume to near baseline measures and prevented progression to a more advanced stage of lymphedema for at least the first year postoperatively. Further research is warranted to confirm the long-term clinical and cost effectiveness of this early intervention model compared with a traditional model in treating breast cancer related lymphedema.

Complete Decongestive Therapy (CDT), Manual Lymphatic Drainage (MLD), and Compression Methods

A prospective trial of complete decongestive therapy for upper extremity lymphedema after breast cancer was reviewed by Mondry et al. (2004). Patients completed 2-4 weeks (median, 2 weeks) of treatment; including skin and nail care, manual lymphatic drainage, a multilayer compression bandage and therapeutic exercises. Edema of the affected limb was reassessed on a weekly basis. Authors concluded that decreasing girth correlated significantly with decreasing visual analogue scale scores for pain, but not with increasing QoL. Data gathered showed median girth reduced 1.5 cm and median volume reduced 138mL. This study concluded that compliance with the treatment regimen at home decreased with duration of the program and girth reductions contributed to less pain. Increased frequency of treatment sessions provides marked improvement in girth, volume, and weight but resulted in poorer compliance. Longer latency more

successfully reduces girth, volume, and pain and increases QoL. Pain and QoL are improved by treatment and continue to improve after treatment has ended. A randomized controlled trial conducted by McNeely et al. (2004) looked at the addition of manual lymph drainage to compression therapy for managing breast cancer-related lymphedema. The authors of this study compared the reduction in arm lymphedema volume achieved from manual lymph drainage massage in combination with multi-layered compression bandaging to that achieved by compression bandaging alone. Treatment group one received manual lymph drainage (MLD)/compress ion bandaging (CB). This group received 45 minutes of daily MLD and CB, Monday-Friday for 4 weeks. The second treatment group received short stretch bandaging, Monday-Friday for 4 weeks. Authors concluded that a significant reduction in lymphedema volume was found over the 4 week period for both the manual lymph drainage/compression bandaging and compression bandaging alone groups. No significant differences existed between groups (McNeely et al., 2004).

Koul et al. (2007) assessed the results of combined decongestive therapy and manual lymphatic drainage in patients with breast cancer-related lymphedema over a two-year period. This study was a non-randomized clinical trial that reviewed data from 250 patients with a final analysis reviewed from 138 patients. The pre- and post-treatment volumetric measurements were compared and correlated with age, body mass index, and type of surgery, chemotherapy, and radiotherapy. One group was treated with all 4 parts of combined decongestive therapy for 1 hour daily for up to several weeks, depending on the severity and response. Combined decongestive therapy consisted of manual lymphatic drainage, compression, exercises for the arm and shoulder, and deep breathing to help promote venous and lymphatic flow. Patients were also fitted with custom-made garments to be worn daily while awake and removed at bedtime. Self-lymph drainage at least once daily was also recommended. A second treatment group received MLD alone. They were also fitted for custom compression garments. Self-lymph drainage was also recommended. A third treatment group received one hour of home instruction and counseling, including simple self-drainage techniques, skin care, and exercise. They also received custom compression garments. Results noted a significant reduction in arm volumes at 1 year after the beginning of treatment with some or all components of combined decongestive therapy in patients with lymphedema after breast cancer treatment.

Patients with moderate to severe lymphedema had a maximal response after combined decongestive therapy, and patients enrolled in the home program had mild lymphedema and less dramatic responses to treatment. Authors concluded that combined decongestive therapy and manual lymphatic drainage with exercises were associated with a significant reduction in the lymphedema volume in all groups assessed. Long-term management of breast cancer-related lymphedema after intensive decongestive therapy was studied by Vignes et al. (2007). The authors' aim was to describe the effect of the maintenance therapy on lymphedema volume reduction and to analyze the impact of the

different components of treatment in women with upper limb lymphedema after breast cancer treatment. The treatment consisted of an intensive phase of CDT, including manual lymph drainage (30 minutes, 5 times a week), low stretch compression bandaging (24 hours daily), exercises after bandages were applied to enhance lymphatic flow from peripheral to central compartments and skin care. Maintenance therapy consisted of education (3 bandages per week). Authors concluded that bandaging and elastic sleeves are a key component to maintenance therapy after intensive CDT.

A systematic review was conducted by Karki et al. (2009) on the effects and harms of physiotherapy methods of lymphedema therapy in breast cancer patients. Fourteen randomized controlled studies were included, two of which had moderate risk of bias and the remainder had high risk. There was moderate evidence that compression bandages alone decreased lymphedema, and that pneumatic pumps had no effect on lymphedema compared to no treatment. With the remainder of the studies that had high risk of bias, the interventions and comparisons varied across all trials. This review found moderate evidence to support that compression bandages decreased lymphedema. There was no evidence regarding volume reduction outcomes in any other body part except the upper limb. Evidence on other physiotherapy methods and combinations is limited due to poor quality of the studies. Devoogdt et al. (2010) conducted a systematic review of combined physical therapy, intermittent compression, and arm elevation for treatment of lymphedema secondary to axillary dissection for breast cancer. The review included ten randomized controlled trials and non–randomized, experimental trials. The review found that combined physical therapy can be considered as an effective treatment modality for treatment of lymphedema; however, the effectiveness of its different components remains uncertain. Szolnoky et al. (2009) compared manual lymphatic drainage with manual lymphatic drainage plus intermittent pneumatic compression for treatment of unilateral arm lymphedema in 27 women previously treated for breast cancer. One treatment group received complex decongestive physiotherapy (CDP), which included manual lymph drainage (MLD) using the Vodder technique. Treatment sessions were for 60 minutes per day for 10 consecutive business days by a specific physiotherapist, followed by skin care, bandaging, and exercise. MLD was performed on the neck, breast, and abdomen. The second treatment group received complex decongestive physiotherapy plus intermittent pneumatic compression (CDP+IPC). This included the same MLD using the Vodder technique for 30 minutes per day for 10 days, followed by 30 minutes of IPC with a Lympha Mat device at a pressure of 50 mmHg. Patient also received skin care, bandaging, and exercise. Each treatment method was effective in reducing limb size, but the combination treatment of CDP+IPC showed statistically significant greater reductions in limb size when compared to CDP alone, with no negative side effects noted. No other statistically significant changes were noted in the patients' subjective reports with either treatment method at any time.

A technology assessment requested by Centers for Medicare and Medicaid Services (CMS) was conducted by McMaster University Evidence-based Practice Center for the Agency for Healthcare Research and Quality (AHRQ) (Oremus et al., 2010) diagnosis and treatment of secondary lymphedema. The review included randomized controlled trials or observation studies with comparison groups (e.g., cohort, case control). The assessment concluded the following:

- CDT has been observed to have a significant effect on edema reduction and is recognized internationally as a successful treatment for lymphedema.
- There is no single treatment that is considered usual care for lymphedema. At this time, CDT, which is a combination of therapies, is suggested as the main method of conservative care for lymphedema. CDT includes manual lymphatic drainage (MLD), application of compression low stretch bandages, exercise, and skin care.

A randomized controlled-group study conducted by Kim et al. (2010) investigated the differences between the effects of complex decongestive physiotherapy with and without active resistive exercise for the treatment of patients with breast cancer-related lymphedema. Treatment group one received CDT (manual lymphatic drainage, compression therapy, and exercise, including resistance training) 5 times a week for 2 weeks followed by self-administered treatment for another 6 weeks. The control group received the CDT without the resistance training added to the exercise program. Authors concluded that active resistive exercise with CDT did not create additional swelling and assisted with reduction of arm volume. QoL was also improved for this group. The National Lymphedema Network (NLN) published a position statement regarding treatment of lymphedema (2011). Included in the document were the following statements regarding CDT:

- CDT is the main treatment for lymphedema. Experts who treat lymphedema consider CDT the "gold standard" of treatment. The treatment has been shown to be safe and effective. CDT is the current international standard of care for managing lymphedema.
- CDT has been shown to be effective in large numbers of case studies demonstrating limb volume reductions of 50–70% or more, improved appearance of the limb, reduced symptoms, improved quality of life, and fewer infections after treatment. Even people with progressive lymphedema for 30 years or more before starting CDT have been shown to respond.
- Patient adherence during Phase II CDT is critical for preserving volume reduction.
- It is recommended that CDT adaptations or other lymphedema treatments be used on a case-by-case basis under the supervision of a healthcare provider (e.g., physician, nurse, physician assistant, therapist) with demonstrated expertise in lymphedema management.

In 2020, the International Society of Lymphology (ISL) published an updated consensus document regarding the diagnosis and treatment of peripheral lymphedema. The document

makes the following notes regarding lymphedema treatment that was consistent with their 2013 consensus statements:

- CDT is included in the statement as a standard treatment for lymphedema that is backed by longstanding experience. The first phase includes skin care, light manual massage, range of motion exercise and compression with multilayered bandage-wrapping. The second phase aims to conserve and optimize results obtained in Phase 1.
- An assessment should be made of limb volume before, during and after treatment. Treatment outcomes should be reported in a standardized manner in order to assess effectiveness of treatment protocols.

Hwang et al. (2013) completed a systematic review and meta-analysis on the effects of MLD on breast cancer-related lymphedema. They investigated whether manual lymphatic drainage (MLD) could prevent or manage limb edema in women after breast-cancer surgery. In total, 10 RCTs with 566 patients were identified. Authors concluded that the current evidence from RCTs does not support the use of MLD in preventing or treating lymphedema. However, clinical and statistical inconsistencies between the various studies confounded our evaluation of the effect of MLD on breast-cancer-related lymphedema. Lasinski (2013) summarized the evidence on the management of lymphedema and provided recommendations. CDT is effective in reducing lymphedema, although the contribution of each individual complete decongestive therapy component has not been determined. In general, levels of evidence for complete decongestive therapy are moderate. Fu et al. (2014) aimed to provide healthcare professionals with evidence-based clinical practice guidelines for lymphedema treatment and management through a systematic review. Findings of the systematic review support complete decongestive therapy, compression bandages, and compression garments with highest evidence for best clinical practice. Weight management, full-body exercise, education, prevention, and early intervention protocols are likely to be effective for clinical practice.

Shao et al. (2014) sought to determine whether the use of an intermittent pneumatic pump (IPC) could manage lymphedema effectively. Seven randomized controlled trials, with 287 patients, were included. Results showed that the use of the IPC could alleviate lymphedema, but no significant difference between routine management of lymphedema with or without pneumatic pump existed. Authors concluded that current trials fail to show the effectiveness of the addition of an IPC to the routine management of BCRL. Leung et al. (2015) evaluated the available evidence for the treatment of secondary lower limb lymphedema in patients with malignancies. Authors concluded that few studies have evaluated the clinical effectiveness and potential side effects of treatments for lower limb lymphedema. Moreover, symptoms and quality-of-life assessments were inconsistently reported. All included studies report lower limb volume reduction after treatment, which includes complex decongestion therapy, graded compression stockings and lymphovenous microsurgical shunts. Adequately powered randomized controlled trials of these

interventions are recommended. Ezzo et al. (2015) assessed the efficacy and safety of MLD in treating BCRL. Six trials were included. Authors concluded that MLD is safe and may offer additional benefit to compression bandaging for swelling reduction. Compared to individuals with moderate-to-severe BCRL, those with mild-to-moderate BCRL may be the ones who benefit from adding MLD to an intensive course of treatment with compression bandaging. This finding, however, needs to be confirmed by randomized data. In trials where MLD and sleeve were compared with a non-MLD treatment and sleeve, volumetric outcomes were inconsistent within the same trial. Findings were contradictory for function (range of motion), and inconclusive for quality of life. For symptoms such as pain and heaviness, 60% to 80% of participants reported feeling better regardless of which treatment they received. One-year follow-up suggests that once swelling had been reduced, participants were likely to keep their swelling down if they continued to use a custom-made sleeve. Finnane et al. (2015) sought to summarize efficacy findings of reviews on lymphedema treatment. Overall, there was wide variation in review methods. The quality of studies included in reviews, in study design and reporting overall, has been poor. Reviews consistently concluded that complex physical therapy is effective at reducing limb volume. Volume reductions were also reported after the use of compression garments, pumps, and manual lymphatic drainage. However, greatest improvements were reported when these treatments formed a combined treatment program. Large, well-designed, evaluated, and reported randomized, controlled trials are needed to evaluate and compare treatments.

Elastic therapeutic taping (e.g., Kinesio taping) has been proposed as a treatment intervention for lymphedema, given its properties and hypothesized mechanism to lift the skin away from the adjacent muscle and allow intercellular fluid to flow more freely. For example, lymph will move more easily out of lymph channels and into larger lymph ducts for uptake. Bialoszewski et al. (2009) studied the effects of KT in reducing edema of lower limbs in patients subjected to limb lengthening. Twenty-four patients developed post-surgical lymphedema. They were randomized into 2 groups. One group received taping and the other received standard physiotherapy (lymphatic drainage). Both methods reduced edema significantly pre- and post-treatment (after 10 days); however, the application of the KT produced a significantly faster reduction of edema compared to standard lymphatic drainage methods. A study by Tsai et al. (2009) hypothesized whether KT could replace the bandage in decongestive lymphatic therapy (DLT) for breast-cancer-related lymphedema. The pilot study looked at standard DLT combined with pneumatic compression (PC) or modified DLT using KT combined with PC; both types of treatments resulted in reduced girth measurements of the upper extremity and other outcomes in 41 patients with breast-cancer-related lymphedema. Results demonstrated no significant differences between the two types of treatments. Thus, use of KT could replace the bandage typically used in DLT. Morris et al. (2013) reported on a systematic review with the purpose of this study was to investigate the effect of Kinesio Tex tape (KTT) from randomized controlled trials (RCTs) in the management of clinical conditions. The review

included 8 RCTs: 6 included patients with musculoskeletal conditions; 1 with breast-cancer-related lymphedema; and 1 included stroke patients with muscle spasticity. Six studies included a sham or usual care tape/bandage group. The review found limited to moderate evidence that KTT is no more clinically effective than sham or usual care tape/bandage. The authors concluded that there currently exists insufficient evidence to support the use of KTT over other modalities in clinical practice. Kalron and Bar-Sela (2013) reported on a systematic review that assessed the effects of therapeutic Kinesio Taping (KT) on pain and disability in participants suffering from musculoskeletal, neurological, and lymphatic pathologies. Twelve met inclusion criteria. The final 12 articles were subdivided according to the basic pathological disorders: musculoskeletal (*N*=9) (4 randomized, controlled trials (RCT), 3 single-blinded RCT, 1 cross-over trial and one case-control study); neurological (*N*=1) (RCT); and lymphatic (*N*=2) (RCT). Regarding lymphatic disorders, inconclusive evidence was reported. The authors concluded that although KT has been shown to be effective in aiding short-term pain, there is no firm evidence-based conclusion of the effectiveness of this application on the majority of movement disorders within a wide range of pathologic disabilities. Gatt et al. (2017) aimed to determine the effectiveness and safety of kinesiotaping (KT) in the management of cancer-related lymphedema (CRL) compared to compression bandaging or hosiery. Five studies were included in the meta-analysis of the primary outcome limb volume (n = 203, KT n = 91, compression n = 112). No significant difference existed between the interventions. An increased risk of skin complications with KT was reported in five studies affecting between 10% and 21% of patients. Where lymphedema-related symptoms were reported KT was found to be superior to compression. Paradoxically, patients receiving bandaging reported a higher QoL. Thus, authors concluded that KT was not found to be more comfortable than bandaging and should only be used with caution where bandaging cannot be used.

Torres-Lacomba et al. (2020) compared the effects of four types of bandages and kinesio-tape and determine which one is the most effective in women with unilateral breast cancer-related lymphedema. A total of 150 women presenting breast-cancer-related lymphedema were randomized into five groups (n = 30). All women received an intensive phase of complex decongestive physiotherapy including manual lymphatic drainage, pneumatic compression therapy, therapeutic education, active therapeutic exercise, and bandaging. The only difference between the groups was the bandage or tape applied (multilayer; simplified multilayer; cohesive; adhesive; kinesio-tape). The main outcome was percentage excess volume change. Other outcomes measured were heaviness and tightness symptoms, and bandage or tape perceived comfort. Data were collected at baseline and finishing interventions. This study showed significant differences between the bandage groups in absolute value of excess volume. The five groups exhibited a significant decrease in symptoms after interventions, with no differences between groups. In addition, kinesio-tape was perceived as the most comfortable by women and multilayer as the most uncomfortable ($P < 0.001$). The most effective were the simplified multilayer and the

cohesive bandages. The bandages/tape with the least difference were kinesio- and adhesive bandage.

Zasadzka et al. (2018) compared the effectiveness of multi-layer compression bandaging (MCB) and CDT for treating lymphedema in elderly patients. One hundred three patients (85 women and 18 men) aged ≥60 years, with unilateral lower limb lymphedema. The subjects were divided into two groups: 50 treated with CDT and 53 with MCB. Pre- and post-treatment BMI, and average and maximum circumference of the edematous extremities were analyzed. Results noted a reduction in swelling in both groups was achieved after 15 interventions. Both therapies demonstrated similar efficacy in reducing limb volume and circumference, but MCB showed greater efficacy in reducing the maximum circumference. Authors concluded that compression bandaging is a vital component of CDT. Maximum lymphedema reduction during therapy and maintaining its effect cannot be achieved without it. Sezgin Ozcan et al. (2018) evaluated the effects of CDT on upper extremity functions, the severity of pain, and quality of life. A total of 37 women with breast cancer-related lymphedema (BCRL) [age, 53.6 ± 11.2 (28-72)] were included in this study. All patients underwent CDT-phase 1 program, including meticulous skin care, manual lymphatic drainage, remedial exercises, and compression bandages. The mean of the posttreatment volume of the affected limb was lower compared to pretreatment volume. A statistically significant reduction in pain and heaviness VAS scores and improvement of shoulder mobility among upper extremities with lymphedema ($p < 0.001$) was noted after CDT. The mean of posttreatment DASH score was lower, and all subgroups of the SF-36 parameters were increased after the CDT application. Also, being under 65 years old, having a body mass index above 30 and short duration of lymphedema were found to be related to greater improvement in upper extremity functions. Authors concluded that CDT provides enhancement of upper extremity functions and quality of life in patients with BCRL.

Michopoulos et al. (2020) evaluated the effectiveness and safety of CDT of phase I in the Greek population with lymphedema. CDT was implemented in all patients for 20 sessions in a 4-week treatment period. The edema's (excess volume (EV) and percent of excess volume (PEV)) measurements were carried out four times in the treatment period, whereas the percent reduction of excess volume (PREV) was calculated at the end of phase I. Every infection, trauma of skin, and pain of limb during the treatment was also recorded. One-hundred five patients with lymphedema were enrolled, of whom 31.4% had upper limb lymphedema and 68.6% had lower limb lymphedema. A significant reduction between the pre-treatment and post-treatment values of EV and PEV was found for both upper and lower limb lymphedema. For patients with upper limb lymphedema, the average PREV was 66.5%, whereas for patients with lower limb lymphedema, a 71.5% median value was measured. No side effects from the treatment were recorded during CDT. Authors

concluded that the proper treatment of the CDT phase I ensures safety and a great reduction in edema in patients with lymphedema that predispose the success of phase II of CDT.

Watanabe et al. (2020) authored an article on the development and themes of diagnostic and treatment procedures for secondary leg lymphedema in patients with gynecologic cancers. They note that for the treatment of lymphedema, complex decongestive physiotherapy (CDP) including manual lymphatic drainage (MLD), compression therapy, exercise, and skin care, are generally performed. In recent years, CDP has often required effective multi-layer lymph edema bandaging (MLLB) or advanced pneumatic compression devices (APCDs). If CDP is not effective, microsurgical procedures can be performed. They conclude that the most important concern is the prevention of secondary lymphedema, which is achieved through approaches such as skin care, weight control, gentle limb exercises, avoiding sun and heat, and elevation of the affected leg.

In accordance with the most recent Consensus Document of the International Society of Lymphology (2020), CDT should include two phases: 1. Phase I: characterized by skincare, manual lymphatic drainage (MLD), with or without deeper techniques including muscle pumping exercises or hydraulic pressotherapy, followed by multilayer compression bandage, aiming at improving lymphedema volume; 2. Phase II: characterized by skincare and compression garments wearing, including lowstretch elastic stocking or sleeve, aiming at avoiding complications and conserving the results obtained in Phase I.

Thompson et al. (2021) evaluated the effectiveness of MLD for those at-risk of or living with lymphedema. Seventeen studies with a total of 867 female and two male participants were included. Only studies examining breast cancer-related lymphedema were identified. Some studies reported positive effects of MLD on volume reduction, quality of life and symptom-related outcomes compared with other treatments, while other studies reported no additional benefit of MLD as a component of complex decongestive therapy. In patients at-risk, MLD was reported to reduce incidence of lymphedema in some studies, while others reported no such benefits. Authors concluded that reviewed articles reported conflicting findings and were often limited by methodological issues. They suggest the need for further experimental studies on the effectiveness of MLD in lymphedema. There is some evidence that MLD in early stages following breast cancer surgery may help prevent progression to clinical lymphedema. MLD may also provide additional benefits in volume reduction for mild lymphedema. However, in moderate to severe lymphedema, MLD may not provide additional benefit when combined with complex decongestive therapy.

Kalemikerakis et al. (2021) authored an article on the diagnosis and management of cancer-related lymphedema. They note that early diagnosis and treatment of lymphedema is related with better therapeutic outcomes. Women with breast cancer confront more problems with lymphedema than with mastectomy. Its effect on patients' quality of life is

relevant to changes in body image, self-esteem, feelings of weakness, fear and anxiety about disease progression, financial costs, and reduced limb function. Relative to conservative management, authors summarize that CDT remains the treatment of choice and in combination with exercise, weight control programs and self-care training seems to significantly improve patients' quality of life. Forner-Cordero et al. (2021) assessed whether treatment with intermittent pneumatic compression plus multilayer bandages is not inferior to classical trimodal therapy with manual lymphatic drainage in the decongestive lymphedema treatment. 194 lymphedema patients, stage II-III with excess volume > 10% were stratified within upper and lower limb and then randomized to one of the three treatment groups. Baseline characteristics were comparable between the groups. For interventions all patients were prescribed 20 sessions of the following regimens: Group A (control group): manual lymphatic drainage + Intermittent Pneumatic Compression + Bandages; Group B: pneumatic lymphatic drainage + Intermittent Pneumatic Compression + Bandages; and Group C: only Intermittent Pneumatic Compression + Bandages. The outcome was the percentage reduction in excess volume (PREV). Results demonstrated that all patients improved after treatment. Global mean of PREV was 63.9%, without significant differences between the groups. Most frequent adverse events were discomfort and lymphangitis, without differences between groups. A greater baseline edema, an upper-limb lymphedema and a history of dermatolymphangitis were independent predictive factors of worse response in the multivariate analysis. Authors concluded that decongestive lymphatic therapy performed only with intermittent pneumatic compression plus bandages is not inferior to the traditional trimodal therapy with manual lymphatic drainage. This approach did not increase adverse events.

McNeely et al. (2022) examined the efficacy of nighttime compression as a self-management strategy for women with chronic breast cancer-related lymphedema. Authors conducted a parallel 3-arm, multicenter, randomized trial. Women were recruited from 3 centers in Canada and randomized to group 1 (daytime compression garment alone [standard care]), group 2 (daytime compression garment plus nighttime compression bandaging), or group 3 (daytime compression garment plus the use of a nighttime compression system garment). The primary outcome was the change in excess arm volume from the baseline to 12 weeks. Participants from all groups used a nighttime compression system garment from weeks 13 to 24. One hundred twenty women were enrolled, 118 completed the randomized trial, and 114 completed the 24-week follow-up. The rates of adherence to nighttime compression were 95% ± 15% and 96% ± 11% in the compression bandaging and nighttime compression system groups, respectively. After the intervention, the addition of nighttime compression was found to be superior to standard care for both absolute milliliter reductions (P = .006) and percentage reductions (P = .002) in excess arm lymphedema volume. Significant within-group changes were seen for quality of life across all groups; however, no between-group differences were found (P > .05). Authors concluded that this study demonstrated a significant improvement in arm lymphedema

volume from the addition of nighttime compression whether through the application of compression bandaging or through the use of a nighttime compression system garment.

De Vrieze et al. (2022) investigated the effect of fluoroscopy-guided manual lymphatic drainage (MLD) versus traditional MLD or placebo MLD for the treatment of breast cancer-related lymphedema (BCRL) when added to decongestive lymphatic therapy (DLT). All participants received standard DLT (education, skin care, compression therapy and exercises). Participants were randomized to also receive fluoroscopy guided MLD ($n = 65$), traditional MLD ($n = 64$) or placebo MLD ($n = 65$). Participants received 14 sessions of physiotherapy during the 3-week intensive phase and 17 sessions during the 6-month maintenance phase. Participants performed self-management on the other days. All outcomes were measured: at baseline; after the intensive phase; after 1, 3 and 6 months of maintenance phase; and after 6 months of follow-up. The primary outcomes were reduction in excess volume of the arm/hand and accumulation of excess volume at the shoulder/trunk, with the end of the intensive phase as the primary endpoint. Excess lymphedema volume decreased after 3 weeks of intensive treatment in each group. The effect of fluoroscopy guided MLD was very similar to traditional MLD and placebo MLD. Authors concluded that in patients with chronic BCRL, MLD did not provide clinically important additional benefit when added to other components of DLT.

Borman et al. (2022) evaluated the effects of CDT in patients with breast cancer-related lymphedema (BCRL), in regard to volume reduction, functional status and QoL. Fifty patients with unilateral BCRL were included. All patients received combined phase 1 CDT including skincare, manual lymphatic drainage, multilayer bandaging, and supervised exercises, 5 times a week for 3 weeks, as a total of 15 sessions. Patients were assessed by limb volumes and excess volumes. The functional disability was evaluated by quick disability of arm, shoulder, and hand questionnaire (Q-DASH). QoL was assessed by the European Organization for Research and Treatment of Cancer Core Cancer Quality of Life Questionnaire (EORTC QLQ-C30) and its breast-cancer-module (EORTC QLQ-BR23). Fifty females with mean age of 53.22 ± 11.2 years were included. The median duration of lymphedema was 12 months. There were 22 patients in stage1, 26 in stage2 and 2 patients in stage3. The mean baseline limb and excess volumes were significantly decreased at the end of therapies. The Q-DASH and EORTC QLQ-C30 and BR23 scores were also decreased significantly. The improvements in volumes were related negatively with the duration of lymphedema, and the stage of lymphedema. Authors concluded that CDT in a combined manner performed daily for 3 weeks, greatly reduces the volumes as well as improves the disability and QoL, especially when performed earlier.

de Sire et al. (2022) completed a review to characterize the comprehensive management of lymphedema, providing a broad overview of the potential therapy available in the current literature. They conclude that a multidisciplinary treatment should be truly integrated for lymphedema patients, and rehabilitation should be considered the cornerstone of the

multidisciplinary treatment not only for patients not suitable for surgical interventions but also before and after surgical procedures. Rehabilitation should include (CDT), which includes manual lymph drainage (MLD), skin care, specialized exercises, compression garments and self-education. Rangon et al. (2022) investigated the immediate, short-term, and long-term effects of complex physical therapy and multimodal approaches on lymphedema secondary to breast cancer. Fourteen studies were identified for the systematic review and 11 studies for the meta-analysis. The common outcomes involved total volume, pain, and physical function of the upper limb. Complex physical therapy has shown a favorable tendency to control outcomes in the short- and long-term. The meta-analysis indicated a small effect for volume reduction and a moderate effect for short-term pain reduction. Authors concluded that high-quality evidence suggests a more significant effect of complex physical therapy on multimodal approaches to the control of the upper limb total volume, substantiating the absence of changes in the current clinical practice in the management of lymphedema secondary to breast cancer. Future research should aim to identify concrete effect of therapeutic modalities in the immediate-, short-, and long-term.

Lin et al. (2022) analyzed the effectiveness of manual lymphatic drainage (MLD) in breast cancer-related lymphedema (BCRL) patients in a systematic review and meta-analysis. In total, 11 RCTs involving 1,564 patients were included, in which 10 trials were deemed viable for inclusion in the meta-analysis. Due to the effects of MLD for BCRL, statistically significant improvements were found on the incidence of lymphedema and pain intensity. Besides, the meta-analysis carried out implied that the effects that MLD had on volumetric changes of lymphedema and quality of life, were not statistically significant. The current evidence based on the RCTs shows that pain of BCRL patients undergoing MLD is significantly improved, while our findings do not support the use of MLD in improving volumetric of lymphedema and quality of life. Torgbenu et al. (2023) aimed to describe and compare international guidelines on lymphedema diagnosis, assessment, and management. This systematic review of 1,564 articles and 159 web pages yielded 14 guidelines. All guidelines were from high-income countries. Ten focused exclusively on lymphedema, and four on cancer. Most (n = 13) guidelines recommended an integrated medical, psychological assessment, and physical examination, with a limb volume measurement of >10% in the affected limb compared, confirming a lymphedema diagnosis. Recommended management involved Complex Decongestive Therapy (CDT) followed by self-management using skincare, self-lymphatic drainage massage, exercise, and compression.

Qiao et al. (2023) analyzed the efficacy of MLD for BCRL. A total of 457 patients were included in the analysis. There was no significant difference in the amount of upper extremity edema between the MLD treatment and control or no MLD groups. However, when the treatment course was ≥20 sessions, there was a significant reduction in the upper extremity volume. There was also a significant reduction in the upper extremity volume when treatment duration was >2 weeks. Authors concluded that manual lymphatic drainage

treatment statistically did not reduce the upper extremity limb volume of BCRL, but upper extremity volume was reduced at statistically significant levels when treatment number were ≥20 sessions or the duration of treatment was >2 weeks.

Donahue et al. (2023) summarized current BCRL prevention and treatment strategies. They report that complete decongestive therapy (CDT) remains the standard of care for patients with BCRL. Intermittent pneumatic compression, nonpneumatic active compression devices, and low-level laser therapy appear promising in lymphedema management. Currently, no pharmacological approaches have proven successful. Senger et al. (2023) summarized current concepts in primary lymphedema. Primary lymphedema is a heterogeneous group of conditions encompassing all lymphatic anomalies that result in lymphatic swelling. Primary lymphedema can be difficult to diagnose, and diagnosis is often delayed. As opposed to secondary lymphedema, primary lymphedema has an unpredictable disease course, often progressing more slowly. Primary lymphedema can be associated with various genetic syndromes or can be idiopathic. Diagnosis is often clinical, although imaging can be a helpful adjunct. The literature on treating primary lymphedema is limited, and treatment algorithms are largely based on practice patterns for secondary lymphedema. The mainstay of treatment focuses on complete decongestive therapy, including manual lymphatic drainage and compression therapy. For those who fail conservative treatment, surgical treatment can be an option. Microsurgical techniques have shown promise in primary lymphedema, with both lymphovenous bypass and vascularized lymph node transfers demonstrating improved clinical outcomes in a few studies.

Marotta et al. (2023) aimed to assess the role of KT among the CDT to treat BCRL. Rehabilitation has a key role in the comprehensive management of this condition with several studies reporting positive results after performing complex decongestive therapies (CDT) in women. Kinesio taping (KT) is a rather recent therapeutic approach to treat BCRL, however, evidence in literature regarding its effectiveness is far from being fully characterized. Out of the documents identified, 123 were eligible for data screening, and only 7 RCTs satisfied the eligibility criteria and were included. Authors found that KT might have a positive effect on limb volume reduction in patients with BCRL, studies are of low quality. Authors concluded that this systematic review showed that KT did not significantly reduce the upper limb volume in BCRL women, though it seemed to increase the flow rate during the passive exercise. Further high-quality-studies are needed to improve the knowledge to include KT into a multidisciplinary rehabilitative approach for the management of BC survivors affected by lymphedema.

Cheng et al. (2023) identified and appraised the current evidence for rehabilitation interventions in HNCaL. Of 1642 citations identified, 23 studies (1.4%; n = 2147 patients) were eligible for inclusion. Six studies (26.1%) were randomized clinical trials (RCTs) and 17 (73.9%) were observational studies. Five of the 6 RCTs were published during 2020 to 2022. Most studies had fewer than 50 participants (5 of 6 RCTs; 13 of 17 observational

studies). Studies were categorized by intervention type, including standard lymphedema therapy (11 studies [47.8%]) and adjunct therapy (12 studies [52.2%]). Lymphedema therapy interventions included standard complete decongestive therapy (CDT) (2 RCTs, 5 observational studies), modified CDT (3 observational studies), therapy setting (1 RCT, 2 observational studies), adherence (2 observational studies), early manual lymphatic drainage (1 RCT), and inclusion of focused exercise (1 RCT). Adjunct therapy interventions included advanced pneumatic compression devices (APCDs) (1 RCT, 5 observational studies), Kinesio Taping® (1 RCT), photobiomodulation (1 observational study), acupuncture/moxibustion (1 observational study), and sodium selenite (1 RCT, 2 observational studies). Serious adverse events were either not found (9 [39.1%]) or not reported (14 [60.9%]). Low-quality evidence suggested the benefit of standard lymphedema therapy, particularly in the outpatient setting and with at least partial adherence. High-quality evidence was found for adjunct therapy with Kinesio Taping®. Low-quality evidence also suggested that APCDs may be beneficial.

Other Treatments

Low Level Laser Therapy (LLLT)

Carati et al. (2003) performed a double blind, placebo controlled randomized, single crossover trial use of low-level laser therapy (LLLT) for a treatment option for patients with post mastectomy lymphedema (PML). Participants received either one cycle or two cycles of LLLT to the axillary region of their affected arm. The authors monitored for reduction in affected limb volume, upper body extracellular tissue fluid distribution, dermal tonometry and range of motion. The result yielded two cycles of LLLT improved lymphedema; however, limb volume reduction was not immediate and was reported 2-3 months post-treatment (Carati et al., 2003). A study conducted by Dirican et al. (2011) reviewed the authors' short-term experience with low-level laser therapy in the treatment of breast-cancer related lymphedema. Treatment consisted of laser therapy using 300mJ for one minute to 17 different points on the surgical scar tissue of the axilla. Patients were also treated with compression garments or bandaging. Two of the patients in the study also had sessions using an intermittent compression device. Authors concluded that patients with breast cancer gain additional benefits in the form of volume reduction from low level laser therapy when used in conjunction with other standard treatments (Dirican et al., 2011). Further studies are needed to confirm these findings. Smoot et al. (2015) examined the literature on effectiveness of LLLT in reducing limb volume and pain in adults with breast cancer related lymphedema (BCRL). They concluded that moderate strength evidence supports LLLT in the management of BCRL. The overall review of literature investigated conservative therapies for secondary arm lymphedema that can be divided into intensive treatments administered by trained healthcare professionals and limb maintenance that are carried out by the patient. Treatments that are predominantly administered by healthcare professionals, such as CDT, MLD, and pneumatic pump therapy generally yielded the larger reduction in limb volume. LLLT may be a potential treatment option, but more well-designed studies are needed. Maintenance therapies

generally carried out by the patient in a self-care program (e.g., wearing compression garments, performing limb exercises, limb elevation, and self-massage) yielded smaller limb reduction.

Kozanoglu et al. (2022) investigated the long-term effectiveness of combined intermittent pneumatic compression (IPC) plus low-level laser therapy (LLLT) versus IPC therapy alone in patients with postmastectomy upper limb lymphedema (PML). The patients were allocated into two groups in this single-blinded, controlled clinical trial. Group I received combined treatment with IPC plus LLLT (n = 21) and group II received only IPC (n = 21). IPC treatment was given 5 sessions per week for 4 weeks (20 sessions). LLLT was also performed 5 sessions per week for 4 weeks (20 sessions). Clinical evaluations were performed before and after the treatment at the 3, 6, and 12-month follow-up visits. According to within-group analysis, statistically significant improvements in the circumference difference and grip strength were observed in both groups. Visual analog scale values for arm pain and shoulder pain during motion were decreased only in group I. Authors concluded that interventions have positive effects on lymphedema, grip strength, and pain. Long-term effects of combined therapy, especially on pain, are slightly superior to the pneumatic compression alone.

Wang et al. (2022) analyzed the evidence from existing systematic reviews investigating the effectiveness and safety of low-level laser therapy (LLLT) in patients with breast cancer-related lymphedema (BCRL). Conflicting results regarding the effectiveness of LLLT were presented by the overview of systematic reviews. The AMSTAR 2 showed that the methodological quality of included systematic reviews was low or critically low quality due to one or more critical weaknesses. The GRADE and GRADE-CERQual showed that the evidence quality was low to very low for most outcomes. The updated systematic review showed that LLLT may offer additional benefits as compared to compression therapies (pneumatic compression or compression bandage), placebo laser, or no treatment for patients with BCRL. However, when compared to other types of active interventions, LLLT did not improve outcomes significantly. None of the treatment-related adverse event was reported. Many trials had a high or unclear risk of bias for two or more items, and this updated systematic review showed low quality of evidence per outcome using GRADE approach. Due to insufficient data and poor quality of evidence, there is uncertain evidence to reach these conclusions that LLLT is superior to another active or negative intervention and is safe. More RCTs of high methodological quality, with large sample sizes and long-term follow-up, are needed to inform clinical guidelines and routine practice.

Chiu et a. (2023) aimed to organize existing research and determine the optimal combination of LLLT parameters for BCRL treatment in a meta-analysis. Although low-level laser therapy (LLLT) has been explored as a treatment option for BCRL, they could not find a regimen that is more effective than others, which prompted their study. Authors focused on the aspects of the treatment area, treatment regimen, and total treatment sessions

across the included studies. The comparisons between LLLT and non-LLLT were performed through a meta-analysis. Post-treatment QOL was significantly better in the axillary group. The group treated "three times/week with a laser density of 1.5-2 J/cm2" had significantly better outcomes in terms of swelling reduction, both immediately post-treatment and at 1-3 months follow-ups. The group with > 15 treatment sessions had significantly better post-treatment outcomes regarding reduced swelling and improved grip strength. According to these results, LLLT can relieve the symptoms of BCRL by reducing limb swelling and improving QOL. Further exploration found that a treatment approach targeting the axilla, combined with an increased treatment frequency, appropriate laser density, and extended treatment course, yielded better outcomes. However, further rigorous, large-scale studies, including long-term follow-up, are needed to substantiate this regimen.

Exercise

Kwan et al. (2011) conducted a systematic review of the contemporary literature to distill the weight of the evidence and provide recommendations for exercise and lymphedema care in breast cancer survivors. Seven studies were identified addressing resistance exercise, seven studies on aerobic and resistance exercise, and five studies on other exercise modalities. Studies concluded that slowly progressive exercise of varying modalities is not associated with the development or exacerbation of breast cancer-related lymphedema and can be safely pursued with proper supervision. Combined aerobic and resistance exercise appear safe, but confirmation requires larger and more rigorous studies. Authors concluded that strong evidence is now available on the safety of resistance exercise without an increase in risk of lymphedema for breast cancer patients. Buchan et al. (2016) compared the effect of progressive resistance- or aerobic-based exercise on breast cancer-related lymphedema extent and severity, as well as participants' muscular strength and endurance, aerobic fitness, body composition, upper-body function and QoL. Authors concluded that participating in resistance- or aerobic-based exercise did not change lymphedema status but led to clinically relevant improvements in function and QoL, with findings suggesting that neither mode is superior with respect to lymphedema impact. As such, personal preferences, survivorship concerns and functional needs are important and relevant considerations when prescribing exercise mode to those with secondary lymphedema.

Overall, the consensus of managing lymphedema includes an appropriate diagnosis based on the patient’s history and physical examination and a determination that there is consistent evidence to indicate that lymphedema can be reliably measured using circumferential measures or volume displacement. Complex decongestive therapy is suggested as the main method of conservative care for lymphedema and is a combination of therapies that includes manual lymphatic drainage (MLD), application of compression low stretch bandages, skin care, education, and exercise. Johansson et al. (2015) reported on the evidence-based or traditional treatment of cancer-related

lymphedema. Authors concluded that with accumulating evidence and experience, it is time to consider if altering these treatment principles is needed. Based on accumulating evidence, authors suggest less emphasis on manual lymph drainage and more on early diagnosis, compression, weight control and exercise for improvement of strength and circulation. Bakar and Tuğral (2017) reviewed the current management strategies for lower extremity management of lymphedema after gynecologic cancer surgery. Studies indicated that the incidence of lower extremity lymphedema ranges between 2.4% and 41% after pelvic lymph node dissection in patients with gynecologic malignancies. Thus, management of lower extremity lymphedema in patients after gynecologic cancer surgery is an important issue. Complex decongestive therapy method is still the gold standard of lymphedema management.

Nelson (2017) summarizes the results of recent randomized controlled trials (RCTs) investigating the effect of resistance exercise in those with, or at risk for, BCRL. He also wanted to determine whether breast cancer survivors can perform RET at sufficient intensities to elicit gains in strength without causing BCRL flare-up or incidence. A total of 6 RCTs, involving 805 breast cancer survivors, met the inclusion criteria and corresponded to the aims of this review. The results of this review indicated that breast cancer survivors can perform RET at high-enough intensities to elicit strength gains without triggering changes to lymphedema status. There is strong evidence indicating that RET produces significant gains in muscular strength without provoking BCRL. Do et al. (2017) investigated the effects of a complex rehabilitation (CR) program and complex decongestive therapy (CDT) on edema status, physical function, and quality of life in patients with unilateral lower-limb lymphedema after gynecologic cancer surgery. CR comprised of stretching, strengthening, and aerobic exercises was performed for 40min, five times a week for 4weeks. Intensive CDT was administered by a physical therapist during weeks 0-2 and by the patients themselves during weeks 2-4. Results demonstrated that the edema status, fatigue, pain, and GCLQ-K scores were significantly improved in both groups after the 4-week intervention. Physical function and fatigue and the 30-s chair stand test and quadriceps muscle strength were significantly improved in the CRCDT group compared with the CDT alone group. Authors concluded that CR improves physical function, fatigue, and muscular strength without increasing edema status in patients with unilateral lower-limb lymphedema after gynecologic cancer surgery. Yeung et al. (2018) conducted a systematic review and meta-analysis on aquatic therapy compared to other lymphedema interventions. Four RCTs of moderate quality were included. There was moderate level evidence of no significant short-term differences in lymphedema status (relative volume) between patients receiving aquatic lymphatic therapy compared to land based standard care. There was low level evidence that no significant difference between aquatic lymphatic therapy and standard care for improving upper limb physical function. Authors conclude that current evidence indicates no significant benefit of aquatic lymphatic therapy over standard land-based care for treatment of lymphedema. Further research is needed to strengthen the evidence.

Baumann et al. (2018) assessed the effect of different types of exercise on breast cancer-related lymphedema (BCRL) in order to understand the role of exercise in this patient group. Eleven randomized controlled trials that included 458 women with breast cancer in aftercare were included. The different types of exercise consisted of aqua lymph training, swimming, resistance exercise, yoga, aerobic, and gravity-resistive exercise. Four of the studies measured a significant reduction in BCRL status based on arm volume and seven studies reported significant subjective improvements. No study showed adverse effects of exercise on BCRL. Authors concluded that the evidence indicates that exercise can improve subjective and objective parameters in BCRL patients, with dynamic, moderate, and high-frequency exercise appearing to provide the most positive effects. Hasenoehrl et al. (2020) performed a systematic review analyzing resistance exercise (RE) intervention trials in breast cancer survivors (BCS) regarding their effect on breast cancer-related lymphedema (BCRL) status. Authors concluded that RE seems to be a safe exercise intervention for BCS and not to be harmful concerning the risk of lymphedema. Lymphedema assessment methods that allow for a qualitative analysis of arm tissue composition should be favored. At the current time breast cancer related lymphedema is incurable but well manageable by a number of physical therapy modalities, especially complete decongestive therapy (CDT). One of the encouraging treatment methods is resistance exercise.

Kilbreath et al. (2020) investigated whether an exercise program reduced breast lymphedema symptoms compared to a non-exercise control group. This single-blinded randomized controlled trial was conducted in which women with stable breast lymphedema (n = 89) were randomized into an exercise (n = 41) or control (n = 47) group. The intervention comprised a 12-week combined aerobic and resistance training program, supervised weekly by an accredited exercise physiologist. All participants completed a weekly symptoms diary and were assessed monthly to ensure that there was no exacerbation of their lymphedema. Changes in the breast were captured physically with ultrasound and bioimpedance spectroscopy and changes in symptoms were captured using European Organization for Research and Treatment of Cancer (EORTC) Breast Cancer (BR23) and Lymphedema Symptom Intensity and Distress questionnaires. The exercise group reported a greater reduction in breast-related symptoms than the control group, assessed by the EORTC BR23 breast symptom questions. Measures of extracellular fluid, assessed with bioimpedance spectroscopy ratio, decreased in the exercise group compared to the control group. No significant difference was detected in dermal thickness in the breast, assessed by ultrasound. Session attendance in the exercise sessions was high, with two musculoskeletal adverse events reported, but no exacerbations of lymphedema observed. Authors concluded that combined resistance and aerobic exercise training is safe for women living with breast lymphedema. Preliminary data suggest exercise training can reduce breast lymphedema symptoms to a greater extent than usual care.

Saraswathi et al. (2021) systematically reviewed the effect of yoga therapy on managing lymphedema, increasing the range of motion (ROM), and quality of life (QoL) among breast cancer survivors. Studies which assessed the outcome variables such as QoL and management of lymphedema or related physical symptoms as effect of yoga intervention were considered for review. The different styles of yoga employed in the studies were Iyengar yoga (*n* = 2), Satyananda yoga (*n* = 2), Hatha yoga (*n* = 2), and Ashtanga yoga (*n* = 1). The length of intervention and post intervention analysis ranged from 8 weeks to 12 months. Authors concluded that yoga could be a safe and feasible exercise intervention for BCRL patients. Evidence generated from these studies was of moderate strength. Further long-term clinical trials with large sample size are essential for the development and standardization of yoga intervention guidelines for BCRL patients.

Bruce et al. (2021) evaluated whether a structured exercise program improved functional, and health related quality of life outcomes compared with usual care for women at high risk of upper limb disability after breast cancer surgery. Subjects included 392 women undergoing breast cancer surgery, at risk of postoperative upper limb morbidity, randomized (1:1) to usual care with structured exercise (*n*=196) or usual care alone (*n*=196). Usual care (information leaflets) only or usual care plus a physiotherapy led exercise program, incorporating stretching, strengthening, physical activity, and behavioral change techniques to support adherence to exercise, introduced at 7-10 days postoperatively, with two further appointments at one and three months. Main outcome measures included the Disability of Arm, Hand, and Shoulder (DASH) questionnaire at 12 months, analyzed by intention to treat. Secondary outcomes included DASH subscales, pain, complications, health related quality of life, and resource use, from a health and personal social services perspective. Upper limb function improved after exercise compared with usual care for exercise. Secondary outcomes favored exercise over usual care, with lower pain intensity at 12 months and fewer arm disability symptoms at 12 months. No increase in complications, lymphedema, or adverse events was noted in participants allocated to exercise. Exercise accrued lower costs per patient and was cost effective compared with usual care. Authors concluded that the PROSPER exercise program was clinically effective and cost effective and reduced upper limb disability one year after breast cancer treatment in patients at risk of treatment related postoperative complications.

Corum et al. (2021) compared the effects of complex decongestive therapy (CDT) accompanied by resistance exercises on extremity circumference, lymphedema volume, grip strength, functional status, and quality of life in the treatment of breast cancer-related lymphedema (BCRL) in patients with and without pain. Fifty patients with unilateral BCRL were divided into groups: with pain (Group 1, *n* = 25) and without pain (Group 2, *n* = 25). Thirty minutes of manual lymphatic drainage and multilayered short-stretch bandaging were applied to all patients five times a week for 4 weeks. In addition, all patients were informed about skin care and given a supervised resistance exercise program

throughout the treatment. During the 1-month follow-up period, patients were asked to use low-tension elastic garments and to continue their home exercise program. Differences in upper extremity circumference and volume; grip strength; Quick Disabilities of the Arm, Shoulder, and Hand; and Functional Assessment of Cancer Therapy-Breast scores were evaluated at baseline, after treatment (week 4), and at 1-month follow-up. Moreover, the pain intensity of patients in Group 1 was measured using the visual analog scale (VAS). Patients in both Group 1 and Group 2 showed a statistical improvement in all outcome measures after treatment and at follow-up ($p < 0.05$); however, no significant difference was observed between the groups ($p > 0.05$). In Group 1, a statistically significant decrease was observed in the VAS score both at the end of treatment and at 1-month follow-up ($p < 0.05$). Authors concluded that combined CDT and resistance exercises appear to be effective in BCRL patients both with and without pain.

Hayes et al. (2022) evaluated the effects of exercise on (i) the prevention of cancer-related lymphedema (CRL), and (ii) the treatment of CRL, lymphedema-associated symptoms, and other health outcomes among individuals with CRL in a systematic review and meta-analysis. Twelve studies (n = 1,955; 75% moderate-high quality) and 36 studies (n = 1,741; 58% moderate-high quality) were included in the prevention and treatment aim, respectively. Relative risk of developing CRL for those in the exercise group compared with the non-exercise group was 0.90 overall, and 0.49 for those with 5 or more lymph nodes removed. Improvements post-intervention were observed for pain, upper-body function and strength, lower-body strength, fatigue and quality of life for those in the exercise group. Authors concluded that findings support the application of exercise guidelines for the wider cancer population to those with or at risk of CRL. This includes promotion of aerobic and resistance exercise, and not just resistance exercise alone, as well as unsupervised exercise guided by symptom response.

Maccarone et al. (2023) evaluated the effects of water-based exercise on pain, limb motor function, quality of life (QoL), and limb volume among patients affected by primary and secondary upper and lower limb lymphedema. The search produced a total of 88 studies. Eight randomized controlled trials and one clinical study of patients with primary or secondary lymphedema of upper or lower limbs who had undergone water-based treatment were included in the present study. Most trials had focused on breast cancer-related lymphedema. The shoulder range of flexion, external rotation, and abduction have been shown to improve after performing a water-based exercise protocol. Some evidence has also demonstrated that the lymphedematous limb strength can improve. Moreover, water-based exercise seemed to improve pain perception and QoL for patients with upper or lower limb lymphedema. In contrast, in the control groups, the QoL showed a tendency to worsen over time. Although some studies had not reported beneficial effects on the lymphedematous limb volume, most of the studies examined had reported a reduction in volume, especially in the short term. No adverse events were reported in the included studies. Authors concluded that these findings from the present review have shown the

potential for aquatic exercise in lymphedema management. However, at the same time, the findings underline the multiple limitations resulting from the heterogeneity in the study populations and related physical activity protocols. The role of aquatic exercise in the conservative treatment of lymphedema requires further investigation in the future to define specific protocols of application.

Lin et al. (2023) sought to determine the effective exercise methods for different complications of breast cancer patients after surgery in a systematic review and meta-analysis. Aerobic exercise reduced the intensity of the pain, improved shoulder flexion and internal rotation range, lessened upper limb dysfunction and improved muscle strength during flexion and abduction. Shoulder elbow movement improved the range of shoulder external rotation and reduced the incidence of arm lymphedema. Anti-resistance exercise also lessened upper limb dysfunction. Wang et al. (2023) This examined the existing best evidence on resistance exercise for BCRL to accurately describe the current status of the field and offer recommendations for clinicians in a systematic, evidence-based review. Twenty-two articles (7 guidelines, 4 consensus documents and 11 systematic reviews) were included. Six clinical topics involving 43 recommendations were identified. Recommendations were categorized by safety of resistance training, effectiveness of resistance training, evaluation prior to resistance exercise, resistance exercise prescription, resistance training outcome index and points for attention. Based on the available research, there is strong evidence evaluating the safety of resistance exercise. The findings support the assertion that breast cancer patients at risk of or with lymphedema should be encouraged to do resistance exercise. Resistance exercise could improve patients' muscle strength and quality of life. Authors also summarized the evidence of resistance exercise prescription which can be used to guide clinical practice. However, there are some inconsistent recommendations in the review, such as the effects of resistance exercise on preventing and relieving lymphedema. The main heterogeneity comes from different exercise prescriptions in terms of exercise type, frequency, intensity, etc. Future studies are needed to provide high-quality evidence for the specificity of exercise prescription, to identify the appropriate exercise volume for patients at different stages of lymphedema or at risk of lymphedema. In terms of whether or not to wear compression garments during exercise, future studies need to focus on patient comfort and compliance with these during exercise: clinicians should not simply take the effects of relieving lymphedema into consideration.

Measurement of Lymphedema

Hidding et al. (2016) attempted to provide best evidence of which measurement instruments are most appropriate in measuring lymphedema in its different stages. Authors concluded that measurement instruments with evidence for good reliability and validity are Bioelectrical Impedance Spectroscopy (BIS), water volumetry, tape measurement and perometry, where BIS can detect alterations in extracellular fluid in stage 1 lymphedema and the other measurement instruments alterations in volume starting from stage 2. In

research water volumetry is indicated as reference test for measuring lymphedema in upper extremities. Limitations included the following: no uniform definition of lymphedema was available and a gold standard as reference test was lacking. Items concerning risk of bias were study design, patient selection, description of lymphedema, blinding of test outcomes and number of included patients.

Şahinoğlu et al. (2024) evaluated the agreement between the American Physical Therapy Association (APTA) criteria, the criteria of Ramos et al., and the International Society of Lymphology (ISL) criteria in patients with upper and lower extremity lymphedema. Several classification systems are used to grade the severity of lymphedema. Their agreement with each other has not been reported. A total of 156 patients (63 and 93 patients with upper and lower extremity lymphedema, respectively) were included. The circumference measurements and limb volume were measured. The severity of lymphedema of the patients was classified as mild, moderate, and severe lymphedema using the APTA criteria, the criteria of Ramos et al., and the ISL criteria. An acceptable and poor agreement were found between the criteria in upper and lower extremity lymphedema, respectively. In pairwise comparisons, an acceptable agreement was found among each comparison in upper extremity lymphedema, and a poor agreement was found among each comparison in lower extremity lymphedema except between the APTA criteria and the criteria of Ramos et al. Authors concluded that patients with upper extremity lymphedema classified according to these criteria can be assumed to be samples of the same population; however, patients with lower extremity lymphedema graded according to the ISL criteria may be included in a different classification when they grade with the APTA criteria and the criteria of Ramos et al.

PRACTITIONER SCOPE AND TRAINING

Practitioners should practice only in the areas in which they are competent based on their education, training, and experience. Levels of education, experience, and proficiency may vary among individual practitioners. It is ethically and legally incumbent on a practitioner to determine where they have the knowledge and skills necessary to perform such services and whether the services are within their scope of practice.

It is best practice for the practitioner to appropriately render services to a member only if they are trained, equally skilled, and adequately competent to deliver a service compared to others trained to perform the same procedure. If the service would be most competently delivered by another health care practitioner who has more skill and training, it would be best practice to refer the member to the more expert practitioner.

Best practice can be defined as a clinical, scientific, or professional technique, method, or process that is typically evidence-based and consensus driven and is recognized by a majority of professionals in a particular field as more effective at delivering a particular

outcome than any other practice (Joint Commission International Accreditation Standards for Hospitals, 2020).

Depending on the practitioner's scope of practice, training, and experience, a member's condition and/or symptoms during examination or the course of treatment may indicate the need for referral to another practitioner or even emergency care. In such cases it is prudent for the practitioner to refer the member for appropriate co-management (e.g., to their primary care physician) or if immediate emergency care is warranted, to contact 911 as appropriate. See the *Managing Medical Emergencies (CPG 159 – S)* clinical practice guideline for information.

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