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Review Article

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Rehabilitation for Cancer-Related Lymphedema: An Evidence-Based Review of Current Interventions and Clinical Outcomes

Jagmohan L. Meena*, Navin Khattry, Vikram Gota, Sudhir Nair, Anbarasan Sekar, Geeta S. Nath, Akanksha Sharma and Prakash Kumar

Associate Professor & SA 'D' Department of Occupational Therapy ACTREC -Tata Memorial Centre, India

***Corresponding Author**
Jagmohan L. Meena, In Charge, Associate Professor & SA 'D', Department of Occupational Therapy, ACTREC - Tata Memorial Centre, India.

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Abstract

Background: *Cancer Related Lymphedema (CRL) is one of the most common long-term complications following cancer treatment, particularly among survivors of breast, gynaecological, genitourinary, head and neck, melanoma, sarcoma, and lymphoma cancers. It negatively affects limb volume, physical function, pain, quality of life, and psychosocial well-being.*

Objective: *To review the effectiveness of rehabilitation interventions for cancer-related lymphedema and provide evidence-based recommendations for clinical practice.*

Methods: *A narrative review of studies published between 2015 to 2026 was conducted using major databases including PubMed, Scopus, Web of Science and Cochrane Library.*

Results: *Current evidence supports Complete Decongestive Therapy as the first-line conservative intervention. Emerging evidence supports additional benefits from progressive resistance exercise, therapeutic activities, kinesiotaping, lympha press, low-level laser therapy, aquatic therapy, and bioimpedance-guided surveillance.*

Conclusion: *Modern Rehabilitation for cancer-related lymphedema should extend beyond edema reduction. Early lymphedema diagnosis with multidisciplinary rehabilitation significantly improves limb volume, and quality of life.*

Keywords: Cancer-Related Lymphedema, Rehabilitation, Occupational Therapy, Physiotherapy, Complete Decongestive Therapy, Manual Lymphatic Drainage, Breast Cancer Related Lymphedema, Head and Neck Lymphedema, Lower Limb Lymphedema, Genital Lymphedema, Lymphedema Therapy

1. Introduction

Lymphedema is a chronic, inflammatory, and progressive condition resulting from abnormalities or damage to the lymphatic system. It is characterised by the accumulation of protein-rich fluid in the interstitial spaces, resulting from a disruption in the lymphatic transport system. Lymphedema is classified as either primary or secondary. Primary lymphedema is caused by developmental abnormalities of the lymphatic system. Symptoms may develop at birth or later in life. Secondary lymphedema is caused by an acquired condition causing damage to the lymph system. The most common causes are infection, injury, and removal of lymph nodes in the underarm, groin, pelvis, or neck for treatment of cancer and radiation [1].

Cancer-related lymphedema (CRL) is one of the potential survivorship treatment-related effects that can occur within weeks, months, or years after treatment completion. Treatments for breast, gynaecologic, prostate, and head-and-neck cancers, and for melanoma, are most frequently associated with CRL. Surgical removal of lymph nodes for cancer treatment is the most common

cause for CRL. The risk of CRL increases with the number of lymph nodes affected. There is less risk with the removal of only the sentinel lymph node [2].

Breast cancer-related lymphedema (BCRL) is one of the most frequently reported complications after breast cancer-related treatments. BCRL is defined as a chronic progressive swelling caused by accumulation of protein-rich lymph fluid in the interstitial spaces due to the breast cancer-related surgery, radiotherapy, or chemotherapy, which can disrupt the lymphatic system [1,2]. Head and neck lymphedema (HNL) is a common complication of head and neck cancer (HNC) treatment. Head and neck lymphedema (HNL) can be classified into 3 types: internal, external, and mixed. External HNL refers to fluid accumulation in the subcutaneous tissue that manifests as visible swelling and skin changes. Internal HNL refers to edema involving the mucosal and submucosal tissues of the upper aero-digestive tract, including the oral cavity, pharynx, and larynx. External HNL can often result in noticeable cosmetic deformities that contribute to body image disturbance, psychological distress, and subsequent social withdrawal, whereas internal HNL can cause dysphagia, voice changes, and airway-related symptoms [3]. Lower extremity lymphedema (LEL) is a common complication following surgical staging of endometrial cancer. LEL is a chronic condition associated with significant impact on patient morbidity and quality of life (QoL) [4]. Genital lymphedema is the accumulation of lymph fluid in any of the genital tissues. affects the penis, the foreskin and the scrotum in men and vulva and labia in women. It often leads to pain, thickened skin, and a higher risk of recurrent skin infections [5].

2. Methodology

A narrative review of studies published between 2015 to 2026 was conducted using major databases including PubMed, Scopus, Web of Science and Cochrane Library using the following Mesh terms: “Lymphedema”, “Cancer Related Lymphedema”, ”Breast Cancer Related Lymphedema”, ”Head and Neck Lymphedema”, ”Lower Limb Lymphedema”, ”Lower Extremity Lymphedema”, ”Occupational Therapy”, “Physical Therapy”, “Rehabilitation”, “Rehabilitation Interventions”, “Complete Decongestive Therapy”, “Exercise”, “Manual lymphatic drainage”, “Progressive Resistive Exercise”.

3. Risk Factors, Incidence, & Pathophysiology

Cancer-related lymphedema can develop as a result of obstruction of lymphatic channels or nodes by tumour compression, tumour cell infiltration of the lymphatic vessels, lymph node dissection or removal, lymphatic channel destruction from radiotherapy, or chemotherapy agents such as taxanes. Other noncancer-related risk factors also increase the risk of developing lymphedema, including trauma, overweight or obesity, chronic venous insufficiency, deep vein thrombosis (DVT), cellulitis, advanced age. Additional contributors include postoperative seroma or infection, and delayed initiation of rehabilitation. The strongest risk factors include extensive lymph node dissection, and regional lymph node irradiation. For breast cancer survivors, axillary lymph dissection (ALND) carries a substantially greater risk than sentinel node biopsy (SLNB). Similar risks are observed in other cancers [1,2,5].

The incidence of CRL varies according to cancer type, site and treatment modalities, with estimates ranging from 5% to 83% in various cancers. Approximately 20% patients treated for breast cancer go on to develop lymphedema, increasing to 20 -40% following ALND and 5-10% after SLNB [1,2,5]. The reported prevalence of HNL ranges widely from 12 to 90%, depending on the study population, treatment modality, timing of assessment, and diagnostic criteria used. External head and neck lymphedema affects approximately 35-75% of survivors, while internal lymphedema occurs in more than 50% of patients following multimodal treatment. Mixed HNL (external + internal) has been reported in 50-90% of head & neck cancer survivors [6,7]. Lymphedema develops in approximately 20-40% of women following treatment for gynaecological cancers and 10-30% of patients with genitourinary malignancies undergoing pelvic lymph node dissection [4,8]. The prevalence of lymphedema in the lower limbs and genital regions after prostate cancer range from 0–14% and 0–1% after surgery, and 0–9% and 0–8% after pelvic radiation respectively, with a much higher prevalence in patients who underwent Pelvic Lymph Node Dissection followed by pelvic radiotherapy (18–29% and 2–22%) [9]. Genital Lymphedema occurs in 0% to 1% of patients after pelvic surgery, rising to 2% to 22% when radiation therapy is added [1,5]. Gynaecological and prostate cancers carry the highest risk, because treatments in these areas often damage the pelvic lymph nodes [4]. Moreover, cancer-related lymphedema occurs in approximately 1 in 6 patients with a history of melanoma, gynaecologic, and genitourinary cancers following cancer treatment [2]. Most cases develop lymphedema within the first 2-3 years after treatment, although the risk persists lifelong [1].

Cancer Related Lymphedema results from impaired lymphatic transport following damage to the lymphatic system, leading to accumulation of protein-rich fluid in the interstitial tissue. This protein-rich fluid accumulation triggers a cascade of inflammation, macrophage activation, adipose tissue deposition, and tissue fibrosis. Persistence lymph stasis also promotes chronic inflammation, oxidative stress, tissue hypoxia, progressive fibrosis, and immune dysfunction, increasing susceptibility to recurrent cellulitis and which further reinforces lymphatic injury. If untreated, the disease progresses from soft, pitting edema to irreversible fibrotic swelling, with progressive skin thickening and functional impairment [1,2].

4. Clinical Assessment

Onset of lymphedema is usually insidious in nature. Early signs and symptoms of CRL include reports of clothes or jewellery feeling constrictive / tighter on the affected limb (for example, tightness of finger rings, wristwatches, clothing sleeves, or footwear). Other symptoms include heaviness or fullness of the affected limb or region. Swelling in head & neck cancer is often reported as worse upon awakening, with gradual improvement throughout the day with standing and activity. Mild swelling and minimal or no soft-tissue fibrosis are the most common findings of early-stage

lymphedema on physical examination. Early identification of CRL is key, because it provides an opportunity for prompt intervention when the condition is at an early and potentially reversible stage. Management of CRL in early-stage is more conservative and may reduce the psychosocial, physical, and financial burdens associated with this chronic condition [1,2,5].

Diagnosis of lymphedema requires a detailed medical history and physical examination. Assessment of localized, regional or limb swelling typically involves a general medical assessment to rule out other causes of swelling, followed by a focused lymphedema assessment [1,2,5].

4.1. General Medical Assessment

Oncologist should screen and assess for potential causes of swelling other than CRL. Swelling secondary to CRL can coexist with swelling from other comorbid conditions. Causes of unilateral limb swelling include deep vein thrombosis, post-thrombotic syndrome, arthritis, orthopedic or trauma surgeries, and—most importantly—active cancer or recurrence. Causes of bilateral lower limb swelling include obesity, chronic venous insufficiency, major organ insufficiency or failure (such as congestive heart failure and renal or liver dysfunction), and medication-related edema (e.g. corticosteroids, nonsteroidal anti-inflammatory drugs, and calcium channel blockers). Once non-CRL causes have been assessed and appropriately addressed, referral to a qualified lymphedema professional for targeted assessment and management should not be delayed [1,2,5].

4.2. Focused CRL Assessment

Assessment of CRL is typically performed by a certified lymphedema professional. A history focuses on the type and extent of potential lymphatic damage secondary to cancer treatments (surgery, radiation, chemotherapy), previous trauma (fractures, musculoskeletal injuries, previous surgeries), and past history of infections (cellulitis) and thrombotic events. Current medications, psychosocial screening, and determination of functional status are also core elements of the assessment [1,2,5].

Targeted physical examination of patients with cancer related lymphedema (CRL) should include measurement of body weight or body mass index (BMI) and examination of the affected limb or area, including for the presence or absence of pitting and skin changes. Limb size should be quantified using standardized circumference measurements obtained at predetermined anatomic landmarks on both the affected and the unaffected limbs, with limb volume subsequently estimated using validated calculation methods. In patients with HNL, objective assessment may also be include standardized facial and neck circumference measurements using defined anatomical landmarks to quantify external swelling and monitor disease progression or response to treatment [1,5]. Severity of lymphedema of limb / extremity is determined based on the International Society of Lymphology classification (Table 1) & Severity in external Head and Neck Lymphedema is commonly assessed using MD Anderson Cancer Center Head and Neck Lymphedema Rating Scale (Table 2). The CRL measurements are repeated at follow-up visits to evaluate management response and evolution of the condition [1,10].

Lymphedema Stages	Description
0	A latent or subclinical condition in which swelling is not evident despite impaired lymph transport. It can be transitory and may exist months or years before overt edema occurs
I	Early-onset lymphedema, in which there is accumulation of tissue fluid that subsides with limb elevation. The edema may be pitting at this stage.
II	Limb elevation alone rarely reduces the tissue swelling, and pitting is manifest.
Late Stage II	The limb may not pit as excess subcutaneous fat and fibrosis develop.
III	The tissue is hard (fibrotic), and pitting can be absent. Skin changes such as thickening/acanthosis, hyperpigmentation, increased skin folds, fat deposits, and warty overgrowths are present. Lymphostatic elephantiasis present in this stage.

Table 1: Lymphedema Staging According to the 2023 Consensus Document of the International Society of Lymphology (ISL) [1].

Stage	Description
0	No visible oedema but patient reports heaviness.
1a	Soft visible oedema, no pitting and reversible.
1b	Soft pitting oedema and reversible
2	Firm pitting oedema, not reversible, no tissue changes
3	Irreversible Tissue Changes

Table 2: MD Anderson Cancer Center Head and Neck Lymphedema Staging [11].

Assessment of both affected and nonaffected limbs or areas should systematically include a series of examinations.

4.3. Dermatologic Examination

It is performed to evaluate skin integrity and identify characteristics cutaneous changes associated with lymphedema, such as dryness, erythema, pachydermia, and hyperkeratosis. Clinicians should also

assess for lymphorrhea, superficial fungal or bacterial infections, and skin breakdown or open wounds, especially in individuals with diabetes or other conditions that impair wound healing, as these factors may influence treatment planning and infection risk [1,5].

4.2.1.1. Pitting test

This test is performed by Applying firm pressure to the oedematous tissue for approximately 30 seconds. Persistence of an indentation after release indicates pitting edema, reflecting the presence of interstitial fluid accumulation. Pitting is more prominent in any early stages. In advanced stages, pitting becomes less evident or may be absent due to progressive fibrosis, adipose tissue deposition, pachydermia, resulting in firmer, non-pitting tissue consistency [1,5].

4.2.1.2 Stemmer's sign

The Stemmer sign is assessed by attempting to pinch and lift a fold of skin at the base of the second toe or finger of affected limb. Inability or difficulty in lifting the skin fold indicates a positive Stemmer sign and is suggestive of lymphedema. It may be present across different stages of lymphedema but more commonly observed in advanced lymphedema [1,5].

4.2.2 Limb volume

Limb volume difference should be determined by measuring the circumference of both affected and unaffected limbs at standardized anatomical landmarks or by using the water displacement method [1].

4.3 Diagnostic tools

4.3.1 Tape measure

Circumferential tape measurement is one of the most widely used methods for assessing limb volume in patients with lymphedema. Limb circumferences are measured at standardized anatomical intervals (commonly every 4 cm), and total limb volume is estimated using the truncated cone formula. This method is inexpensive, readily available, and feasible in routine clinical practice. However, it is relatively time-consuming and dependent on the individual examiner's technique, which can lead to variability in measurements [1].

4.3.2 Perometry

It is a fast, accurate method that uses infrared light to scan a limb and create a 3D model. It provides automated limb volume assessment with greater reproducibility and less operator dependence than circumferential tape measurement. It enables precise longitudinal monitoring of limb volume and localization of regional swelling, making it a valuable tool for clinical research and the early detection of lymphedema. However, its routine use for lymphedema surveillance is limited by its cost and limited availability [1,12].

4.3.3 Bioimpedance spectroscopy (BIS

It is a non-invasive technique that objectively measures extracellular fluid changes and can detect subclinical lymphedema before clinically apparent increases in limb volume occur. BIS generates an L-Dex Score, which quantifies extracellular fluid changes in the affected limb relative to a pre-treatment baseline or the contralateral limb. An increase in the L-Dex score of ≥6.5 units from baseline has been recommended as an indicator of subclinical unilateral breast cancer-related lymphedema, facilitating early intervention. The technique is rapid, repeatable, and well-suited for longitudinal surveillance in at-risk patients. However, its diagnostic accuracy may be reduced when baseline measurements are unavailable or in patients with bilateral limb lymphedema, where comparison with the contralateral limb is not feasible [1,12,13].

4.3.4. Tissue dielectric constant (TDC)

It provides a rapid, non-invasive assessment of localized tissue water content and can detect regional extracellular fluid changes that may not be captured by limb-based measurements. Studies have demonstrated good reliability and moderate to strong correlations with established clinical measures of lymphedema. However, standardized diagnostic thresholds have not been established, and availability of TDC device remains limited in routine clinical practice. Therefore, TDC should be considered as adjunctive assessment tool rather than a standalone diagnostic test, as current evidence is insufficient to supporting its independent diagnostic accuracy [1,5,14].

4.3.5. Volumeter

The volumeter, or water displacement method, is a direct technique for measuring limb volume and has traditionally been regarded as the reference standard for volumetric assessment in patients with lymphedema. The method involves immersing the affected limb in a calibrated water-filled container and measuring the volume of displaced water, which corresponds to the volume of the submerged limb segment. A relative volume difference of ≥ 10% between affected and unaffected limbs is commonly used as a diagnostic threshold for lymphedema. Although this method is accurate, inexpensive, and conceptually simple, it requires full limb immersion and is therefore unsuitable for patients with limited mobility, active skin infections, and open wound. In addition, the procedure is time-consuming, cumbersome, and susceptible to measurement error during water collection and volume determination, limiting its routine use in clinical practice. Consequently, circumferential tape measurement and water displacement remain the most commonly used methods for limb volume assessment in clinical practice [1,5].

5. Rehabilitation Interventions

The Rehabilitation intervention for Cancer Related Lymphedema involves following:

5.1. Complete Decongestive Therapy (CDT)

Complex Decongestive Therapy, also referred to as Complete Decongestive Therapy (CDT), is a two-phase treatment approach and is considered as the standard of care for lymphedema. Phase 1 (Intensive Phase) aims to reduce lymphedema and typically includes meticulous skin care, manual lymphatic drainage (MLD), compression therapy using multi-layer low-stretch bandaging, and

therapeutic exercises that promote the muscle pump. Intensive CDT is generally recommended for patients with clinically evident lymphedema. Phase 2 (Maintenance Phase) begins after maximal edema reduction has been achieved and is aimed at preserving and optimizing the results obtained in the first phase. Phase 2 includes skin care, continued exercise, compression garments, and MLD as needed. Compression therapy, particularly with appropriately fitted compression garments (low-stretch elastic stocking or sleeve), is considered the cornerstone of long-term lymphedema management [1,5].

Complex Decongestive Therapy comprises five key components: manual lymphatic drainage (MLD), compression therapy, therapeutic exercise, skin care, and patient education with self-management strategies [1,5].

Manual Lymph Drainage (MLD) is a gentle, specialized manual technique that uses slow, rhythmic skin-stretching techniques to stimulate superficial lymphatic vessels and facilitate the movement of protein-rich interstitial fluid from congested areas toward functioning lymphatic pathways and regional lymph nodes. It is delivered as one component of Complex Decongestive Therapy (CDT), in combination with compression therapy, exercise, skin care, and patient education. [1,5].

A systematic review by Ezzo et al. (2015) evaluated the efficacy and safety of manual lymphatic drainage (MLD) for breast cancer-related lymphedema (BCRL) and found that MLD may provide additional benefits, particularly in patients with mild-to-moderate BCRL. When combined with intensive compression bandaging as part of CDT, MLD achieved an additional 7.11% reduction in limb swelling. However, this reduction was more pronounced in individuals with mild-to-moderate lymphedema than in those with moderate-to-severe lymphedema [15].

In a recent study, Chmelová and Nováčková (2022) evaluated the effectiveness of manual lymphatic drainage (MLD) during the maintenance phase of breast cancer-related lymphedema in 30 patients following breast cancer surgery. The mean time from surgery to study enrolment was 32.5 months, and the mean duration of lymphedema at baseline was 19.8 months. After 10 MLD sessions over 8 weeks, the affected limb volume decreased by a mean of 3.0%, representing a 57% reduction in excess lymphedema volume compared with baseline. These findings suggest that MLD may be effective in maintaining and reducing lymphedema volume during the maintenance phase of breast cancer-related lymphedema [16].

Compression therapy is a cornerstone of Complete Decongestive Therapy (CDT) and involves the use of compression bandages (CB) or compression garments (CG) to apply gradient pressure, with the highest pressure distally and progressively lower pressure proximally. This pressure gradient facilitates lymphatic and venous return, reduces capillary filtration, enhances the muscle pump, prevent reaccumulation of interstitial fluid and promotes the movement of lymph toward central lymphatic pathways. In complete decongestive therapy (CDT), multilayer compression bandaging is primarily used in intensive phase (phase I), whereas compression garments are prescribed during the maintenance phase of therapy (phase II) to maintain limb volume reduction [1,2]. Systematic reviews and international guidelines consistently recommend compression therapy for reducing limb volume and maintaining long-term treatment outcomes, although its effectiveness is greatest when combined with other CDT components such as manual lymphatic drainage, exercise, and skin care [17].

Targeted exercise therapy is an essential component of lymphedema management, as it enhances the skeletal muscle pump, promotes lymphatic and venous return, and improves physical function without increasing the risk of lymphedema progression. Exercise programs should be individualized according to the patient's clinical condition, functional capacity, and treatment goals, and ideally be prescribed and supervised by a certified lymphedema therapist [1,18].

Yin et al. (2025) reported that a home exercise intervention effectively reduced the incidence of lymphedema, improved upper limb function, and enhanced quality of life in patients with breast cancer.Wittenkamp et al. (2025) conducted a randomized crossover trial to evaluate the safety of high-intensity interval training (HIIT) with and without compression garments in patients with cancer-related lower limb lymphedema (LLL). The study found that stationary bicycle-based HIIT was well tolerated and appeared to be safe regardless of the use of compression garments [20].

Meticulous skin care is a fundamental component of lymphedema management, as it helps maintain skin integrity and reduces the risk of infections associated with impaired lymphatic function. Patients should be advised to keep the skin clean and well moisturized, avoid skin trauma, and regularly inspect the affected limb for signs of infection or skin breakdown to enable early intervention [1,2].

5.2. Pneumatic Compression Therapy (PCT) / Lympha Press

Intermittent pneumatic compression therapy involves the use of an inflatable sleeve or garment that applies sequential, graduated external pressure to the affected limb. The cyclic compression enhances lymphatic and venous return, reduces interstitial fluid accumulation, and augments the muscle pump mechanism, thereby promoting lymphatic drainage and reducing limb oedema. Evidence from Cochrane reviews, randomized controlled trials, and international guidelines supports the use of IPC as an adjunct to Complete Decongestive Therapy (CDT) for reducing limb volume and improving symptoms in patients with cancer-related lymphedema, although it is not recommended as a replacement for standard CDT. However, a recognized limitation of PCT is the potential for proximal fluid congestion. [1,2,15].

A systematic review and meta-analysis by Uzkeser et al. (2015) demonstrated that intermittent pneumatic compression (IPC) effectively reduced limb volume and improved symptoms in patients with breast cancer-related lymphedema. Furthermore,

Mosti and Cavezzi (2019) reported that IPC delivered at low pressures (40–60 mmHg) may be more effective than higher compression pressures [21,22].

5.3. Kinesiotaping

Kinesiology Taping (KT) has emerged as an adjunctive intervention in cancer rehabilitation for management of cancer-related lymphedema. KT is applied using a specialized technique designed to create skin convolutions to increase the space between the skin and muscles. This skin space is proposed to facilitate blood and lymphatic flow, thereby promoting lymphatic drainage [1,23].

A 2024 systematic review and meta-analysis by Yang et al. reported that kinesiology taping (KT) did not significantly reduce the severity of breast cancer-related lymphedema but was associated with improvements in upper limb function, quality of life, and patient comfort. Similarly, a 2025 systematic review by Skwiot et al. found that KT improved upper limb circumference, pain, range of motion, and functional status in post-mastectomy patients with lymphedema. However, both reviews concluded that the current evidence remains limited and emphasized the need for larger, high-quality randomized controlled trials with long-term follow-up to establish the clinical effectiveness of KT [24,25].

5.4. Low-level Laser Therapy (LLLT)

It is non-invasive intervention that uses low-intensity laser light to gently stimulate cellular activity without causing thermal tissue damage. The absorbed light energy enhances mitochondrial function, increases adenosine triphosphate (ATP) production, and modulates inflammatory and reparative processes, thereby promoting lymphatic function and tissue healing. Evidence from systematic reviews and randomized controlled trials suggests that LLLT may reduce limb volume, improve tissue fibrosis, relieve pain, and enhance upper limb mobility in patients with cancer-related lymphedema [1,26].

In a 2025 systematic review and meta-analysis by Hisham et al. found that LLLT showed limited effectiveness in improving overall lymphedema outcomes. However, significant benefits were observed in terms of pain reduction and improved shoulder mobility, suggesting it can be used as an adjunctive therapy with Complete Decongestive Therapy [27].

5.5. Progressive Resistance Exercise / Training

Resistance exercise improves muscle strength and doesn't increase the risk of lymphedema, with moderate-high-intensity exercise demonstrating greater benefits than low intensity exercise. Adverse events are minimal [28,1].

Wu et al. (2026) conducted a meta-analysis and concluded that progressive resistance training is a safe and effective intervention for breast cancer-related lymphedema. The analysis demonstrated that the resistance training significantly reduces the risk & severity of BCRL while improving limb volume, lymphatic function, and shoulder mobility. The authors recommended integrating progressive, short-duration, high-frequency resistance training into multimodal rehabilitation protocols to maximize therapeutic outcomes [29].

5.6 Therapeutic Activities

Therapeutic activities are an important adjunct in the rehabilitation of individuals with lymphedema, focusing on improving functional performance, independence, in activities of daily living, and participation in meaningful occupations. These activities are tailored to each patient‘s impairments. Evidence indicates that incorporating therapeutic activities alongside CDT enhances functional outcomes, and quality of life without increasing the risk of lymphedema progression when performed appropriately. However, therapeutic activities are considered as an adjunct intervention for management of cancer related lymphedema [30].

5.7 Aquatic Therapy

Aquatic therapy is a beneficial adjunct intervention for individuals with lymphedema. The natural compression provided by water may help reduce edema and improve comfort. Current evidence suggests that supervised aquatic exercise is safe and can improve limb function and quality of life without exacerbating lymphedema [30].

6. Clinical Outcomes

Cancer related lymphedema significantly affects physical function, psychosocial well-being, and overall quality of life, making the assessment of clinical outcomes essential for evaluating treatment effectiveness [1,2]. Contemporary evidence recommends that outcome assessment should extend beyond volume reduction to include patient-reported symptoms, functional status, and quality of life. Validated patient-reported outcome measures, such as LYMQOL, Lymph-ICF, and the EORTC QLQ-C30, are widely used to evaluate the impact of lymphedema and monitor treatment outcomes following multidisciplinary lymphedema management, particularly complete decongestive therapy (CDT) [1,2,15]. Emerging technologies, particularly bio impedance spectroscopy (BIS), have improved the early detection of subclinical cancer related lymphedema and provide an objective method for monitoring treatment response [1, 12]. Systematic reviews and international clinical practice guidelines consistently demonstrate that comprehensive lymphedema management not only reduces oedema but also improves functional capacity, decreases recurrent cellulitis, and enhances health-related quality of life, supporting the use of multidimensional clinical outcome measures in both routine practice and research [1,2].

Clinical outcomes may vary across patients and treatment protocols. The figure below summarizes the current evidence on the effectiveness of Complete Decongestive Therapy (CDT) and rehabilitation in improving clinical outcomes in patients with cancer-related lymphedema.

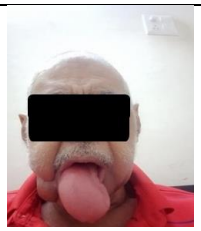
Case	Pre Intervention	Post Intervention
Lower Extremity Lymphedema		
Head & Neck Lymphedema		
Breast Cancer Related Lymphedema		
Upper Extremity Lymphedema		

Figure: Clinical Outcomes Following Complete Decongestive Therapy & Rehabilitation in Patients with Cancer Related Lymphedema

7. Clinical Practice Recommendation

Current international guidelines recommend that management of cancer related lymphedema should begin before the development of clinically apparent swelling through evidence-based risk reduction and prospective surveillance strategies. Preventive measures include patient education, optimization of body weight, meticulous skin care & positioning, regular physical activity, and early post-operative rehabilitation. Prospective surveillance models incorporating baseline pre-treatment assessment and periodic follow-up using limb volume measurements or bio

impedance spectroscopy (BIS) facilitate the early detection of subclinical lymphedema and enable timely intervention before irreversible tissue changes occur. Randomized controlled trials have demonstrated that early intervention initiated at the subclinical stage significantly reduces progression to chronic lymphedema and improves long-term functional outcomes. Furthermore, prophylactic compression garments in high-risk patients, particularly following axillary lymph node dissection, have been shown to decrease the incidence and severity of breast cancer-related lymphedema without compromising quality of life. Consequently, contemporary guidelines advocate a multidisciplinary, risk-stratified approach that integrates surveillance, early intervention, and rehabilitation to optimize long-term clinical outcomes [1,2].

8. Conclusion

Cancer-related lymphedema is a common, chronic, and lifelong complication of cancer treatment that adversely affects physical function, psychosocial well-being, and health-related quality of life. A variety of diagnostic methods are available, each with specific strengths and limitations, and the choice of assessment should be guided by the clinical setting, stage of lymphedema, and available resources. Each method presents its own appropriateness for application in clinical practices. Current evidence supports a multidisciplinary rehabilitation approach, with Complete Decongestive Therapy serving as the cornerstone of management, complemented by exercise, compression therapy, manual lymphatic drainage, patient education, and prospective surveillance. Emerging approaches, including bioimpedance spectroscopy-guided surveillance, advanced compression technologies, and tele-rehabilitation, have further enhanced early detection and long-term management of cancer-related lymphedema. Individualized, evidence-based rehabilitation programs can effectively reduce symptom burden, improve limb function, and optimize patient-reported outcomes. Future research should prioritize high-quality multicenter randomized controlled trials, standardized outcome measures, and implementation strategies to strengthen the evidence base, refine clinical practice guidelines and improve equitable access to comprehensive lymphedema rehabilitation worldwide.

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References

1. ISL, I. (2013). The diagnosis and treatment of peripheral lymphedema: 2013 Consensus Document of the International Society of Lymphology. *Lymphology, 46*(1).
2. Rockson, S. G., Keeley, V., Kilbreath, S., Szuba, A., & Towers, A. (2019). Cancer-associated secondary lymphoedema. *Nature reviews Disease primers, 5*(1), 22.
3. Smith, B. G., Hutcheson, K. A., Little, L. G., Skoracki, R. J., Rosenthal, D. I., Lai, S. Y., & Lewin, J. S. (2015). Lymphedema outcomes in patients with head and neck cancer. *Otolaryngology–Head and Neck Surgery, 152*(2), 284-291.
4. Cucinella, G., Di Donna, M. C., Casarin, J., Schivardi, G., Multinu, F., Borsellino, L., ... & Chiantera, V. (2024). Lower limb lymphedema after surgical staging for endometrial cancer: Current insights and future directions. *Taiwanese Journal of Obstetrics and Gynecology, 63*(4), 500-505.
5. O'Donnell Jr, T. F., Allison, G. M., & Iafrati, M. D. (2020). A systematic review of guidelines for lymphedema and the need for contemporary intersocietal guidelines for the management of lymphedema. *Journal of Vascular Surgery: Venous and Lymphatic Disorders, 8*(4), 676-684.
6. Fadhil, M., Singh, R., Havas, T., & Jacobson, I. (2022). Systematic review of head and neck lymphedema assessment. *Head & Neck, 44*(10), 2301-2315.
7. Deng, J., Wulff-Burchfield, E. M., & Murphy, B. A. (2019). Late soft tissue complications of head and neck cancer therapy: lymphedema and fibrosis. *JNCI Monographs, 2019*(53), lgz005.
8. Decorte, T., Cerckel, M., Kheir, G. B., Monten, C., Vandecasteele, K., Vanden Bossche, L., ... & Randon, C. (2025). Risk factors for lower limb lymphedema after gynecological cancer treatment: a systematic review. *Frontiers in Oncology, 15*, 1561836.
9. Clinckaert, A., Callens, K., Cooreman, A., Bijnens, A., Moris, L., Van Calster, C., ... & Everaerts, W. (2022). The prevalence of lower limb and genital lymphedema after prostate cancer treatment: a systematic review. *Cancers, 14*(22), 5667.
10. Ridner, S. H., Dietrich, M. S., Niermann, K., Cmelak, A., Mannion, K., & Murphy, B. (2016). A prospective study of the lymphedema and fibrosis continuum in patients with head and neck cancer. *Lymphatic research and biology, 14*(4), 198-205.
11. Rajaram, R., Lee, J., Lok, E., Ng, S., & Yamamoto, T. (2025). The management of head and neck lymphoedema: a 2025 systematic review. *Head & Neck, 47*(10), 2897-2910.
12. Ridner, S. H., Dietrich, M. S., Cowher, M. S., Taback, B., McLaughlin, S., Ajkay, N., ... & Shah, C. (2019). A Randomized Trial Evaluating Bioimpedance Spectroscopy Versus Tape Measurement for the Prevention of Lymphedema Following Treatment for Breast Cancer: Interim Analysis: SH Ridner et al. *Annals of surgical oncology, 26*(10), 3250-3259.
13. Shah, C., Whitworth, P., Valente, S., Schwarz, G. S., Kruse, M., Kohli, M., ... & Vicini, F. A. (2023). Bioimpedance spectroscopy for breast cancer-related lymphedema assessment: clinical practice guidelines. *Breast Cancer Research and Treatment, 198*(1), 1-9.
14. Toro, C., Markarian, B., & Mayrovitz, H. N. (2024). Breast cancer-related lymphedema assessed via tissue dielectric constant measurements. *Cureus, 16*(4).
15. Ezzo, J., Manheimer, E., McNeely, M. L., Howell, D. M.,

Weiss, R., Johansson, K. I., ... & Karadibak, D. (2015). Manual lymphatic drainage for lymphedema following breast cancer treatment. *Cochrane Database of Systematic Reviews, (5).*

16. García-Chico, C., López-Ortiz, S., Lorenzo-Crespo, C., Pinto-Fraga, J., Santos-Lozano, A., & Domínguez-García, A. (2025). Wrapping up the evidence: bandaging in breast cancer-related lymphedema—a systematic review and meta-analysis. *Breast Cancer, 32*(4), 654-675.
17. Cormie, P., Atkinson, M., Bucci, L., Cust, A., Eakin, E., Hayes, S., ... & Adams, D. (2018). Clinical Oncology Society of Australia position statement on exercise in cancer care. *Medical journal of Australia, 209*(4), 184-187.
18. Yin, H., Wu, W., Zhang, Q., & Xie, F. (2025). Effect of home exercise on prevention and treatment of lymphedema in breast cancer patients. *Frontiers in Oncology, 15*, 1665012.
19. Wittenkamp, M. C., Juhl, C. B., Zerahn, B., & Vinther, A. (2025). Exercise and cancer-related lymphedema in the lower limbs—a randomized cross-over trial on high-intensity interval training (HIIT) with and without compression garments. *Supportive Care in Cancer, 33*(5), 391.
20. Hou, S., Li, Y., Lu, W., Zhang, X., Luo, H., Qiu, J., & Lu, Z. (2024). Efficacy of intermittent pneumatic compression on breast cancer-related upper limb lymphedema: a systematic review and meta-analysis in clinical studies. *Gland Surgery, 13*(8), 1358-1369.
21. Mosti, G., & Cavezzi, A. (2019). Compression therapy in lymphedema: Between past and recent scientific data. *Phlebology, 34*(8), 515-522.
22. Gatt, M., Willis, S., & Leuschner, S. (2017). A meta-analysis of the effectiveness and safety of kinesiology taping in the management of cancer-related lymphoedema. *European journal of cancer care, 26*(5), e12510.
23. Yang, F. A., Wu, P. J., Su, Y. T., Strong, P. C., Chu, Y. C., & Huang, C. C. (2024). Effect of Kinesiology taping on breast cancer-related lymphedema: a systematic review and meta-analysis of randomized controlled trials. *Clinical Breast Cancer, 24*(6), 541-551.
24. Skwiot, M. (2025). Effectiveness of Kinesio taping for lymphedema in the post-mastectomy patient: a systematic review of randomized controlled trials. *Journal of Clinical Medicine, 14*(5), 1700.
25. Smoot, B., Chiavola-Larson, L., Lee, J., Manibusan, H., & Allen, D. D. (2015). Effect of low-level laser therapy on pain and swelling in women with breast cancer-related lymphedema: a systematic review and meta-analysis. *Journal of Cancer Survivorship, 9*(2), 287-304.
26. Hussein, H. M., Gabr, A. M. M., Fadulelmulla, I. A., Aldemery, A. A., Ragab, M. M. M., Mohamed, A. R., ... & Ibrahim, A. A. (2024). Impact of low-level laser therapy on upper limb lymphoedema secondary to breast cancer: a systematic review and meta-analysis. *Archives of Medical Science: AMS, 21*(3), 889.
27. Campbell, K. L., Winters-Stone, K., Wiskemann, J., May, A. M., Schwartz, A. L., Courneya, K. S., ... & Schmitz, K. H. (2019). Exercise guidelines for cancer survivors: consensus statement from international multidisciplinary roundtable. *Medicine and science in sports and exercise, 51*(11), 2375.
28. Wu, S., Zhong, C., & Liu, Z. (2026). Effects of resistance training on breast cancer-related lymphedema: a meta-analysis. A*rchives of Rehabilitation Research and Clinical Translation, 100607.*
29. Bundred, N. J., Barrett, E., Todd, C., Morris, J., Watterson, D., Purushotham, A., ... & Investigators of BEA/PLACE studies. (2023). Prevention of lymphoedema after axillary clearance by external compression sleeves PLACE randomised trial results. Effects of high BMI. *Cancer Medicine, 12*(5), 5506-5516.