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Exercise Prescription in Breast Cancer–Related Lymphedema: Safety, Functional Outcomes, and Practical Rehabilitation Strategies

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Abstract

Background: Breast cancer-related lymphedema (BCRL) is a chronic complication of breast cancer treatment that may affect limb volume, symptoms, upper-limb function, activity and quality of life. Although limb avoidance was historically recommended, current evidence supports structured exercise in rehabilitation and survivorship care.

Aim: This narrative review synthesized evidence on exercise prescription in BCRL, focusing on safety, resistance training, functional outcomes, compression, assessment and practical strategies.

Material and methods: The review included randomized trials, prospective and acute exercise studies, systematic reviews, meta-analyses, guidelines, consensus statements and clinical frameworks. Searches were conducted in PubMed/MEDLINE, Google Scholar, Cochrane Library, Scopus, Web of Science and EBSCO, where accessible. Evidence was interpreted separately for established BCRL, at-risk populations, mixed samples and acute exercise studies.

Results: The strongest evidence concerns progressive resistance training. In selected patients with stable BCRL, gradual resistance training does not appear to worsen lymphedema outcomes with monitoring and precautions. In at-risk populations, resistance or multimodal exercise does not appear to increase BCRL risk, although prevention evidence remains mixed. Aerobic and mixed exercise may support fitness, fatigue, function and quality of life, but BCRL-specific dosing is less defined. Compression use varies across studies, supporting individualized decisions. Assessment should combine limb measures, symptoms, function, stage and patient-reported outcomes.

Conclusions: Exercise should not be automatically contraindicated in patients with BCRL or women at risk. Prescription should consider baseline assessment, BCRL status, symptom stability, progressive loading, compression needs and monitoring. Future research should standardize definitions, compression protocols, exercise dosing, outcomes and event reporting.

Keywords: *breast cancer-related lymphedema; exercise prescription; resistance training; rehabilitation; compression therapy; physical activity.*

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1. Introduction

Breast cancer survivorship has become an increasingly important area of clinical care as advances in screening, systemic therapy, surgery and radiotherapy have improved long-term outcomes. However, many breast cancer survivors experience persistent treatment-related complications that affect physical function, daily activity and quality of life. One of the most clinically relevant long-term complications is breast cancer-related lymphedema (BCRL), which may develop after lymph node surgery, radiotherapy and other oncologic treatments affecting lymphatic drainage.

BCRL is a form of secondary lymphedema characterized by impaired lymphatic transport and accumulation of lymphatic fluid and tissue changes in the affected upper limb. Clinically, it should not be understood only as increased limb volume. Patients may experience swelling, heaviness, tightness, pain, skin and soft-tissue changes, reduced shoulder range of motion, decreased strength, functional limitations and psychological distress. Patient-reported outcome measures (PROMs), such as the LYMPH-Q Upper Extremity Module, further emphasize that the burden of arm lymphedema includes symptoms, function, appearance, psychological impact, information needs and concerns related to arm-sleeve use.

Historically, women after breast cancer treatment were often advised to avoid strenuous activity, heavy lifting or repetitive use of the affected limb because of concerns that exercise could trigger or worsen lymphedema. Although such recommendations were intended to reduce risk, excessive restriction may contribute to fear of movement, physical deconditioning, reduced muscle strength and lower participation in daily and recreational activities. This creates an important clinical problem: patients with BCRL require protection from avoidable harm, but they also need effective strategies to maintain physical function and quality of life.

During the last two decades, this avoidance-based approach has been increasingly challenged by clinical trials and exercise oncology guidelines. Evidence from randomized controlled trials suggests that progressive resistance training, when introduced gradually and monitored appropriately, does not necessarily worsen BCRL outcomes in women with stable established BCRL or in women at risk of developing BCRL [4-6]. Later studies and evidence syntheses further support the safety and functional value of supervised or carefully progressed resistance exercise in selected patients, including protocols using low-load and high-load resistance training.

The central clinical question has therefore shifted from whether patients with BCRL should exercise at all to how exercise should be prescribed safely and effectively. This requires attention to baseline risk factors, BCRL stage, symptom stability, limb-volume or fluid assessment, shoulder function, patient-reported symptoms, compression use and access to supervised rehabilitation. It is also necessary to distinguish between different populations and study designs. Evidence from patients with established BCRL should not be merged without caution with evidence from women at risk of BCRL. Similarly, acute exercise studies should not be interpreted as proof of long-term safety, and general cancer survivorship guidelines should not be treated as BCRL-specific recommendations unless they include BCRL-relevant outcomes.

Compression during exercise remains a particularly important and clinically nuanced issue. Some trials required compression garments during resistance training, while others used compression as part of complex decongestive therapy, allowed optional use, introduced compression after symptom or bioimpedance spectroscopy (BIS) triggers, or reported compression protocols incompletely. As a result, current evidence does not support a simple universal rule that compression should always or never be used during exercise. Instead, compression decisions should be guided by clinical stage, symptoms, previous specialist recommendations, patient preference and response to exercise.

Because the evidence base includes randomized trials, acute exercise studies, systematic reviews, clinical practice guidelines, consensus statements and practical oncology-exercise frameworks, a narrative synthesis may be useful for clinicians and rehabilitation specialists. Such a synthesis can integrate trial-level safety data with practical recommendations concerning assessment, monitoring, progression, compression and referral. This review therefore focuses on exercise prescription in BCRL from a rehabilitation perspective, with emphasis on safety, resistance training, functional outcomes and practical clinical strategies.

2. Research Objective

The objective of this narrative review was to synthesize current evidence on exercise prescription in breast cancer-related lymphedema, with particular emphasis on safety, functional outcomes, assessment, compression considerations and practical rehabilitation strategies.

3. Research Problems

1. Is exercise safe in patients with established BCRL and in patients at risk of developing BCRL?
2. What is the role of resistance training in BCRL rehabilitation?
3. What evidence exists for aerobic exercise and mixed exercise interventions in BCRL or at-risk breast cancer survivors?
4. How should compression during exercise be interpreted in clinical practice?
5. Which assessment and monitoring strategies are relevant for safe exercise prescription in BCRL?
6. What practical rehabilitation implications can be derived from current evidence?

4. Research Hypotheses / Review Assumptions

As this article is a narrative review, no formal statistical hypotheses were tested. The review was guided by the assumption that exercise in BCRL should not be treated as an automatic contraindication, but rather planned according to BCRL status, symptom stability, functional capacity, compression needs, clinical complexity and monitoring capacity.

5. Research Materials and Methods

5.1 Research Material

This narrative review synthesized evidence from clinical trials, systematic reviews, meta-analyses, clinical practice guidelines, consensus statements and practical frameworks relevant to exercise prescription in breast cancer-related lymphedema. The review included studies with different populations: women with established BCRL, women at risk of developing BCRL after breast cancer treatment, mixed populations and acute exercise study participants. Studies were included if they evaluated exercise interventions, compression protocols, assessment methods or rehabilitation strategies in the context of BCRL or lymphedema risk after breast cancer treatment.

5.2 Search Strategy

Searches were conducted in PubMed/MEDLINE, Google Scholar, Cochrane Library, Scopus, Web of Science and EBSCO, where accessible. Search terms included combinations of: "breast cancer-related lymphedema," "exercise," "resistance training," "aerobic exercise," "physical activity," "compression," "rehabilitation," "exercise prescription," "lymphedema assessment," "bioimpedance spectroscopy," "patient-reported outcomes" and "exercise oncology." No language restriction was applied. Reference lists of included systematic reviews, guidelines and consensus documents were screened for additional relevant sources. The search was not limited by publication date, but priority was given to recent evidence and to landmark trials that shaped current clinical practice.

5.3 Inclusion and Exclusion Criteria

Studies were included if they evaluated exercise interventions in women with BCRL or at risk of BCRL, reported safety or efficacy outcomes relevant to exercise prescription, or provided clinical practice recommendations for exercise in BCRL. This included randomized controlled trials, prospective cohort studies, acute exercise studies, systematic reviews, meta-analyses, umbrella reviews, clinical practice guidelines, consensus statements and practical frameworks. Studies were excluded if they focused exclusively on non-exercise interventions without exercise-relevant outcomes, if they evaluated lymphedema in non-breast-cancer populations without BCRL-specific discussion, or if they were editorials, opinion pieces or conference abstracts without sufficient methodological detail.

5.4 Data Extraction

For each included study, the following information was extracted when available: study design, sample size, population characteristics, BCRL status, inclusion and exclusion criteria, type of exercise intervention, supervision, frequency, intensity, session duration, total duration, progression rules, comparator, compression use, outcome measures, key results, adverse events, adherence and limitations. BCRL status was categorized as established BCRL, at-risk for BCRL, mixed population or unclear. Acute exercise studies were interpreted separately from long-term intervention studies. Studies including general breast cancer survivors or general cancer survivors were not automatically treated as BCRL-specific evidence.

Compression protocols were extracted separately because compression use differed substantially across studies. The extraction distinguished between compression used as part of complex decongestive therapy, compression used during exercise, optional compression, symptom-triggered compression, compression after a bioimpedance spectroscopy trigger and unclear compression protocols.

For systematic reviews, meta-analyses, umbrella reviews, clinical practice guidelines and consensus documents, extracted information included document type, scope, population, key findings or recommendations, certainty or strength of evidence when available, practical relevance and major limitations.

Missing data were not inferred. If sample size, intervention details, compression protocol, follow-up duration, outcome values, p-values, adverse events or other details were not available in the source material, they were not treated as confirmed findings.

5.5 Data Synthesis

The extracted evidence was synthesized narratively. No pooled quantitative analysis was performed. Findings were grouped into clinically relevant thematic areas: clinical background of BCRL, assessment and monitoring, exercise safety, resistance training, aerobic exercise and general physical activity, mobility and shoulder function, quality of life, compression during exercise and practical rehabilitation strategies.

Particular attention was given to methodological distinctions that influence clinical interpretation. Evidence from patients with established BCRL was not merged with evidence from at-risk populations without explicit clarification. Acute exercise studies were not used as proof of long-term safety. General cancer exercise guidelines were interpreted as supportive frameworks rather than BCRL-specific evidence when appropriate. Exercise interventions embedded within complex decongestive therapy or compression-based rehabilitation were not interpreted as isolated exercise effects.

5.6 Statistical Analysis

No statistical analysis or meta-analysis was performed because this study is a narrative review. Quantitative results from included studies were reported descriptively when available in the original source material. Effect estimates, confidence intervals and p-values were included only when explicitly available from the reviewed sources.

6. Research Results

6.1 Clinical Background of Breast Cancer-Related Lymphedema

Breast cancer-related lymphedema is a secondary lymphedema that may occur after breast cancer treatment, particularly when lymphatic drainage of the upper limb is disrupted by axillary surgery, regional lymph node irradiation or treatment-related tissue changes. The condition is not limited to fluid accumulation alone. It may involve progressive changes in soft tissues, local inflammation, skin changes, heaviness, discomfort, reduced limb function and recurrent clinical exacerbations. In clinical practice, BCRL may therefore present as a spectrum ranging from subclinical lymphatic dysfunction to clinically evident, persistent and functionally limiting upper-limb swelling.

The pathophysiology of BCRL reflects a mismatch between lymphatic load and lymphatic transport capacity. Removal or damage of lymph nodes and lymphatic vessels may reduce lymphatic reserve, while radiotherapy, postoperative scarring, infection, inflammation and obesity may further compromise lymphatic flow. Over time, persistent lymph stasis may contribute not only to increased limb volume, but also to changes in tissue composition, skin texture, fibrosis and altered limb mechanics. These mechanisms are clinically relevant for exercise prescription because limb volume alone may not fully reflect tissue condition, symptom burden or functional limitations.

Risk stratification is an important component of BCRL management. The most consistently reported clinical risk factors include axillary lymph node dissection, higher number of removed lymph nodes, regional nodal irradiation, taxane-based chemotherapy, mastectomy, elevated body mass index or obesity and postoperative complications such as infection or fluid-related complications [10, 11]. These factors should not be interpreted as automatic contraindications to exercise. Rather, they identify patients who may require closer surveillance, more cautious progression, earlier referral or supervised rehabilitation.

The clinical presentation of BCRL is multidimensional. Patients may report swelling, heaviness, tightness, pain, fatigue of the affected limb, altered skin sensation, difficulty with clothing or jewelry, limited shoulder range of motion, reduced strength and impairment in activities of daily living. Functional limitations may include difficulty lifting, reaching, carrying, writing, dressing, performing household tasks or participating in occupational and recreational activities. Therefore, BCRL should be considered both a lymphatic and functional condition.

Patient-reported burden is particularly important because objective measurements of limb volume may not capture the full impact of BCRL on daily life. The LYMPH-Q Upper Extremity Module was developed to assess patient-reported outcomes in arm lymphedema after breast cancer treatment. Its domains include symptoms, function, appearance, psychological impact, information needs and arm-sleeve-related concerns. This supports a broader view of BCRL assessment in which limb measurements are combined with patient-reported symptoms, functional limitations and quality-of-life consequences.

From the perspective of rehabilitation, BCRL should be interpreted according to both disease status and clinical complexity. A patient at risk of BCRL after breast cancer treatment differs from a patient with stable established BCRL, and both differ from a patient with advanced, unstable or complicated lymphedema. This distinction is essential when interpreting exercise studies. Evidence from women at risk of BCRL cannot be automatically applied to women with established lymphedema, and evidence from stable, supervised clinical trial populations cannot be directly generalized to all patients with uncontrolled symptoms or recurrent complications.

6.2 Assessment and Monitoring in BCRL

Safe exercise prescription in BCRL requires baseline assessment before progression of physical activity or resistance training. The assessment should include treatment history, risk factors, current BCRL status, limb volume or fluid measurements, clinical stage, skin and tissue condition, symptoms, shoulder mobility, strength, functional limitations and patient-reported outcomes. This multidimensional approach is necessary because exercise tolerance depends not only on the presence or absence of swelling, but also on symptom stability, tissue condition, comorbidities and the patient's ability to monitor and report changes.

Objective assessment of limb size remains a central component of BCRL evaluation. Methods used in clinical studies include water displacement volumetry, circumferential measurements with truncated-cone volume estimation, perometry and other limb-volume assessment techniques. Water displacement was used in major resistance-training trials to assess interlimb volume differences and swelling-related outcomes [5, 6]. Circumference-based methods were used in several rehabilitation studies because they are inexpensive and clinically feasible, although they are operator-dependent and cannot distinguish fluid accumulation from changes in muscle, adipose tissue or fibrosis.

Bioimpedance spectroscopy and the L-Dex score provide additional information about extracellular fluid changes and may be useful for prospective surveillance, particularly in high-risk patients. Current BIS-based clinical guidance emphasizes the value of pre-treatment baseline measurement when possible, followed by serial monitoring after breast cancer treatment. In this model, an L-Dex increase greater than 6.5 over baseline may be used as a trigger for early intervention, such as short-term compression and repeat measurement, with referral for complex decongestive therapy or specialist management if abnormal findings persist [10]. This threshold should be interpreted as a surveillance trigger rather than as a standalone diagnostic criterion for established clinical lymphedema.

Clinical staging and physical examination remain essential. Assessment should include inspection and palpation of the affected limb, evaluation of pitting, skin quality, soft-tissue texture, tissue firmness, anatomical contour, signs of infection and functional impact. Staging systems and clinical practice guidelines support a stage-based approach, distinguishing subclinical or early fluid accumulation from clinically evident and more advanced lymphedema [1, 2]. Such staging is particularly important when determining whether a patient can begin with home-based or community exercise, requires supervised rehabilitation, or should be referred for specialist lymphedema management.

Symptom monitoring is a key safety mechanism during exercise prescription. Relevant symptoms include swelling, heaviness, tightness, pain, pitting, skin changes, reduced limb mobility, difficulty with writing or daily tasks, and subjective changes after exercise. In the Physical Activity and Lymphedema (PAL) trials, participants were monitored for symptom changes, and changes persisting for at least one week or objective increases in limb measures triggered further lymphedema evaluation [5, 6]. This principle is clinically important: exercise progression should not be based only on planned training parameters, but also on the patient's symptom response.

Functional assessment should include shoulder range of motion, upper-limb strength, grip strength when relevant, pain and disability measures. Tools such as DASH or QuickDASH may help capture activity limitations, while goniometry or functional movement assessment can identify mobility restrictions that are not reflected by limb volume alone. In intervention studies, functional and quality-of-life outcomes were often secondary but clinically meaningful, especially when exercise was integrated with complex decongestive physiotherapy (CDP) or broader rehabilitation programs.

Patient-reported outcome measures complement objective assessment. Generic quality-of-life tools, such as SF-36 or EORTC questionnaires, may capture broader health-related outcomes, but they may not fully reflect the specific burden of arm lymphedema. The LYMPH-Q Upper Extremity Module is more specific to arm lymphedema and includes domains directly relevant to BCRL, such as symptoms, function, appearance, psychological impact, information and arm-sleeve concerns. In its validation work, the module demonstrated strong psychometric properties, including high internal consistency and test-retest reliability [3]. However, it should be used as an assessment and patient-reported burden tool rather than as a substitute for objective limb-volume or fluid assessment.

Monitoring during rehabilitation should therefore combine patient-reported symptoms with objective and functional assessments. A practical monitoring set may include limb volume or circumference, BIS/L-Dex when available, clinical stage, skin status, pain, heaviness, tightness, shoulder range of motion, strength, functional capacity and PROMs. The intensity of monitoring should be adapted to risk and clinical complexity. Patients with stable mild symptoms may require periodic reassessment, while those with recent changes, higher-risk treatment history, established BCRL or complex comorbidities may require closer follow-up or specialist referral.

Certain findings should prompt program modification or referral before further progression. These include rapid swelling increase, persistent worsening of heaviness or tightness, increasing pain, erythema, warmth, fever, suspected cellulitis, skin breakdown, suspected vascular complications, new unexplained mass or suspicion of cancer recurrence, and unstable comorbid disease. In these situations, exercise should not necessarily be abandoned permanently, but progression should be paused until appropriate clinical evaluation has been completed.

6.3 Exercise Safety in BCRL

The available evidence does not support the concept that exercise should be automatically contraindicated in patients with breast cancer-related lymphedema or in women at risk of developing it. The strongest safety data concern progressive resistance training, particularly when exercise is introduced gradually, monitored systematically and adapted to symptom response. However, the interpretation of safety must remain conditional. Most trials included selected patients, used supervised initiation, applied conservative progression rules, monitored symptoms or limb volume, and in several cases included compression garments or complex decongestive therapy as part of the intervention.

One of the most important trials in patients with established BCRL is the randomized controlled trial by Schmitz et al. [5], which included women with stable arm lymphedema after breast cancer treatment. In this study, a slowly progressive weight-lifting program performed twice weekly for one year did not increase limb swelling compared with control. The proportion of women with a clinically relevant increase in swelling was similar between groups, while lymphedema exacerbations were less frequent in the weight-lifting group. The intervention also improved muscle strength and symptom severity. Importantly, this study should be interpreted as evidence for the safety of progressive weight lifting in stable BCRL under specific conditions: participants used compression garments during weight lifting, received education, were monitored for symptoms, and underwent periodic limb measurements. It should not be cited as evidence that unsupervised upper-limb resistance exercise without compression or monitoring is universally safe.

Further support for resistance training in established BCRL comes from the randomized trial by Cormie et al. [7], which compared high-load resistance exercise, low-load resistance exercise and usual care in women with clinical BCRL. The intervention lasted three months and was supervised. Both high-load and low-load resistance training were tolerated without worsening lymphedema-related outcomes, and no lymphedema exacerbations or other adverse events were reported in the extracted full text. This finding challenges the assumption that higher external loads are inherently harmful in BCRL. Nevertheless, its findings should not be generalized without caution. The trial was relatively short, included selected participants, and compression use was optional rather than standardized.

Evidence in at-risk populations also supports the safety of progressive resistance training, although it should not be interpreted as definitive prevention evidence. In the randomized equivalence trial by Schmitz et al. [6], women at risk of BCRL performed a one-year slowly progressive weight-lifting program. The intervention did not increase the incidence of BCRL compared with a no-exercise control group. Strength outcomes improved, and in the subgroup of women with a higher number of lymph nodes removed, swelling-defined onset was lower in the weight-lifting group. However, the authors emphasized that the primary aim was safety, not superiority or definitive prevention. Therefore, this study should be used to support the safety of carefully progressed resistance training in at-risk women, not as proof that resistance training prevents BCRL in all high-risk patients.

Ammitzbøll et al. [14] further evaluated progressive resistance training in women at risk of arm lymphedema after axillary lymph node dissection. The intervention did not significantly prevent arm lymphedema during the first year after breast cancer surgery, but it also did not worsen key lymphedema outcomes and did not lead to harm-related interruption or withdrawal. This distinction matters for interpretation: a negative prevention result does not equal a safety concern. Rather, it suggests that progressive resistance training may be incorporated into rehabilitation after axillary surgery when monitoring and appropriate progression are used, while its preventive effect remains uncertain.

In women receiving adjuvant chemotherapy, Bloomquist et al. [15] assessed a supervised multimodal exercise program that included heavy-load resistance exercise. The study population was mixed, as most participants were at risk for lymphedema, while individuals with existing lymphedema were not fully excluded. The intervention did not worsen L-Dex or most BCRL-related symptoms compared with a walking-based comparator, and no adverse events requiring medical attention were reported. However, the program included more than resistance training alone; therefore, the findings should not be presented as isolated evidence for heavy-load resistance exercise.

Acute exercise studies add useful but limited information. Cormie et al. [16] found that acute bouts of low-, moderate- and high-load upper-body resistance exercise did not produce adverse short-term changes in inflammatory markers, lymphedema-related measures or symptoms in women with BCRL. Similarly, acute resistance-exercise data from Cormie et al. [17] and remedial-exercise data from Gülören et al. [18] suggest that short exercise exposure does not necessarily provoke immediate BCRL worsening in selected patients. These findings are valuable for understanding short-term tolerance, but they cannot be used as proof of long-term safety. Acute exercise studies should therefore be interpreted separately from long-term intervention trials.

Overall, exercise safety in BCRL should be framed as a monitored and individualized process rather than as a simple yes-or-no decision. The most consistent safety pattern across studies is not "unrestricted exercise," but rather gradual progression, symptom surveillance, appropriate regression when symptoms worsen, and clinical referral when red flags occur. Patients with stable or early BCRL may often be able to exercise safely, while those with unstable swelling, recurrent infections, rapid symptom progression, skin breakdown or significant comorbidities require more cautious evaluation and specialist input.

6.4 Resistance Training

Resistance training is the best-studied exercise modality in the context of BCRL. This is clinically relevant because many patients after breast cancer treatment experience reduced upper-limb strength, fear of loading the affected limb, shoulder dysfunction and limitations in daily activities. Resistance training may address these problems by improving muscle strength, functional capacity and confidence in limb use, provided that progression is gradual and monitored.

The earliest randomized evidence came from Ahmed et al. [4], who evaluated weight training in breast cancer survivors after axillary dissection. Although the study population was mixed and included women with and without prevalent lymphedema, the intervention did not worsen arm circumference or self-reported lymphedema outcomes. This study contributed to the early shift away from strict activity restriction. Its limitations should be recognized: it was not a pure established-BCRL treatment trial, compression was not standardized as an intervention, and key outcomes such as BIS, DASH, quality of life and detailed adverse events were not available in the extracted full text.

The strongest established-BCRL evidence is provided by Schmitz et al. [5]. Their one-year program used slowly progressive whole-body weight lifting, with upper-body exercises introduced cautiously and progressed according to symptom stability. Participants trained twice weekly, began with low or minimal resistance, and increased load only after tolerating previous sessions without symptom worsening. This approach provides a model of resistance training as a structured rehabilitation intervention rather than as uncontrolled heavy loading.

The trial by Cormie et al. [7] expanded this evidence by directly comparing high-load and low-load resistance exercise in established BCRL. High-load training was prescribed at approximately 75–85% of one-repetition maximum, while low-load training used approximately 55–65% of one-repetition maximum. Both programs were supervised and progressed carefully. Neither condition worsened BCRL outcomes compared with usual care, and strength and endurance outcomes improved in the exercise groups. Together, these findings suggest that load alone is not the only determinant of safety; patient selection, supervision, progression and symptom monitoring are equally important.

Low-load resistance exercise has also been studied in the context of complex decongestive physiotherapy. Kim et al. [12] evaluated active resistive exercise added to complex decongestive physiotherapy in women with diagnosed BCRL. The protocol used very low loads, short daily sessions and compression during exercise. The intervention was associated with greater proximal arm volume reduction and selected quality-of-life improvements compared with complex decongestive physiotherapy without active resistive exercise. This study supports the inclusion of low-load resistance exercise as an adjunct to decongestive rehabilitation, but it should not be generalized to high-load training or to exercise without compression.

Omar et al. [19] investigated low-intensity resistance training with or without compression garment use in established unilateral BCRL. Both exercise conditions improved limb volume, symptoms, shoulder range of motion and upper-limb disability measures, while the additional benefit of compression garment use during exercise was not clearly established. This study is particularly relevant to the compression debate, but it has important limitations, including inconsistent sample-size reporting, lack of a no-exercise control group and incomplete compression details. It should therefore be interpreted as evidence that low-intensity resistance exercise may be useful in BCRL management, not as definitive proof for or against compression garments during exercise.

Evidence syntheses support the general safety and functional value of resistance exercise. Hasenoehrl et al. [8] concluded that resistance exercise does not appear harmful for breast cancer-related lymphedema and may improve strength outcomes. However, the authors also noted heterogeneity in study populations, measurement methods and intervention protocols. Similarly, Wang et al. [9] synthesized guidelines, consensus statements and systematic reviews to provide practical recommendations for resistance exercise in BCRL. A broader systematic review with meta-analysis by Hayes et al. [20] also informs the prevention and treatment context of cancer-related lymphedema, although its scope is not limited to BCRL. Their recommendations emphasize baseline and periodic lymphedema assessment, gradual progression, monitoring during and after exercise, and reduction or cessation of exercise when symptoms worsen.

From a practical perspective, resistance training in BCRL should start below the patient's current symptom threshold and progress slowly. A reasonable framework, derived from evidence-based recommendations, includes two to three sessions per week, two to three sets, 8–15 repetitions, rest intervals of approximately two to three minutes, and gradual load progression of about 5–10% when symptoms remain stable [9, 22]. These parameters should not be treated as a rigid protocol for all patients. Intensity, volume and progression should be adapted to BCRL stage, baseline fitness, comorbidities, symptom response, treatment history, compression needs and access to supervision.

Resistance training should also include clear regression rules. If swelling, heaviness, tightness, pain or soreness lasting more than 48 hours increases after training, progression should be paused and the program should be modified. After missed sessions, illness or treatment interruptions, patients should restart with lower loads and rebuild gradually. This strategy is consistent with the progression principles used in the PAL trials and with practical recommendations from evidence-based guidelines.

In summary, resistance training should be considered a core component of exercise prescription in BCRL rehabilitation. The evidence supports its safety and functional benefits when it is introduced gradually and monitored appropriately. However, it should not be presented as a universal, unsupervised or compression-independent intervention. The safest clinical interpretation is that resistance training is appropriate for many patients with or at risk of BCRL when prescribed according to clinical stage, symptom stability, functional capacity and monitoring capacity.

6.5 Aerobic Exercise and General Physical Activity

Although resistance training has the strongest and most direct evidence base in BCRL-specific exercise literature, aerobic exercise and general physical activity remain important components of breast cancer survivorship care. Aerobic activity may support cardiorespiratory fitness, fatigue management, metabolic health, weight control and overall quality of life. These effects are clinically relevant because obesity, deconditioning and reduced physical activity may contribute to poorer functional outcomes and may also interact with lymphedema risk and symptom severity.

General exercise oncology guidelines [22] emphasize that cancer survivors should avoid inactivity and gradually progress toward regular physical activity when clinically appropriate. However, BCRL-specific aerobic exercise prescription is less precisely defined than resistance-training prescription. In contrast to resistance training, where several studies provide more detailed progression models and safety data, aerobic exercise recommendations for patients with BCRL are often extrapolated from broader cancer survivorship evidence. Therefore, aerobic exercise should be prescribed according to baseline fitness, comorbidities, cancer treatment status, symptom response and patient preference.

In practical rehabilitation, aerobic activity may include walking, cycling, low-impact endurance exercise or other forms of moderate-intensity activity adapted to the patient's tolerance. For patients with BCRL or at risk of BCRL, the safest approach is to start from the current activity level and increase duration or intensity gradually. Monitoring should include not only general fatigue and cardiorespiratory tolerance, but also limb-specific symptoms such as heaviness, tightness, swelling, pain or prolonged soreness.

Mixed-mode programs may better reflect real-world rehabilitation than single-modality exercise. In the trial by Bloomquist et al. [15], the supervised intervention included heavy-load resistance training as part of a broader exercise program during adjuvant chemotherapy. The program did not worsen L-Dex or most BCRL-related symptoms compared with a walking-based comparator, but because the intervention was multimodal, its effects cannot be attributed to resistance training alone. Similarly, Ramírez-Parada et al. [21] evaluated a prospective surveillance model combined with the STRONG-B exercise program in high-risk women. This approach improved arm-volume difference and functional outcomes, but it should be interpreted as a surveillance-plus-exercise strategy in an at-risk population rather than as treatment of established BCRL.

In practice, aerobic and mixed exercise can be integrated into comprehensive rehabilitation and survivorship care. Their role is not limited to lymphedema volume control. They may support general fitness, walking capacity, weight management, fatigue reduction and functional confidence. However, because BCRL-specific aerobic dosing remains less standardized, aerobic activity should be individualized and integrated with resistance training, mobility work and monitoring rather than prescribed as an isolated universal intervention.

6.6 Mobility, Shoulder Function and Quality of Life

Upper-limb rehabilitation in BCRL should not focus exclusively on limb volume. Breast cancer treatment and BCRL may be associated with shoulder stiffness, pain, reduced range of motion, impaired strength, fear of movement and limitations in activities of daily living. These functional impairments may persist even when limb-volume changes are mild or stable. Therefore, mobility and functional assessment are central components of BCRL rehabilitation.

Shoulder range of motion is particularly important after breast cancer surgery, radiotherapy and lymph node treatment. Limited flexion, abduction or external rotation may impair dressing, reaching, lifting, personal care and occupational activities. Exercise programs that include stretching, active mobility, scapular control and functional reaching tasks may help restore upper-limb use. In patients with BCRL, these interventions should be introduced with attention to symptoms, skin status, compression needs and overall clinical complexity.

Basha et al. [13] compared two exercise modes embedded within complex decongestive physiotherapy: an Xbox Kinect-based exercise program and a resistance exercise program. Both groups received complex decongestive physiotherapy, including compression-related management, which means that the isolated effects of exercise mode cannot be separated from the broader rehabilitation context. Nevertheless, the study suggests that different exercise modalities may preferentially influence different outcomes. The virtual-reality-based program appeared more favorable for pain, upper-limb disability and shoulder range of motion, whereas resistance exercise was more favorable for shoulder and grip strength. Taken pragmatically, exercise modality can be selected according to the dominant rehabilitation goal.

Quality-of-life outcomes are also clinically relevant. Kim et al. [12] reported selected improvements in SF-36 domains when low-load active resistive exercise was added to complex decongestive physiotherapy. Basha et al. [13] also assessed quality of life and functional outcomes in the context of combined exercise and decongestive treatment. However, quality-of-life findings across studies should be interpreted cautiously because tools, populations, interventions and comparators differ substantially. Moreover, generic quality-of-life tools may not capture the full BCRL-specific burden.

Patient-reported outcomes can complement objective measures. The LYMPH-Q Upper Extremity Module is particularly relevant because it was developed for arm lymphedema after breast cancer treatment and includes domains such as symptoms, function, appearance, psychological impact, information needs and arm-sleeve concerns. These domains highlight that the impact of BCRL extends beyond measurable limb volume. In rehabilitation practice, such patient-reported information may help identify concerns that are not visible during physical examination, including fear of using the limb, dissatisfaction with appearance, sleeve-related burden and functional avoidance.

Mobility, function and quality of life should therefore be treated as core rehabilitation outcomes, not secondary issues. A patient may have stable limb volume but still experience pain, shoulder restriction, reduced strength, avoidance behavior or reduced participation in daily activities. Conversely, a rehabilitation program may improve strength or function without producing large changes in limb volume. This distinction should guide both interpretation of exercise studies and goal-setting with patients.

6.7 Compression During Exercise

Compression is an established component of lymphedema management, but its role during exercise is more complex than a simple universal recommendation. In BCRL rehabilitation, compression may appear in several different contexts: as part of complex decongestive therapy, as a long-term garment prescribed by a lymphedema specialist, as an early intervention after a surveillance trigger, as compression worn during exercise, or as optional support based on patient preference and symptoms. These contexts should not be merged without caution.

The exercise trials included in this review used compression in different ways. In Schmitz et al. [5], women with stable established BCRL were provided custom-fitted compression garments and were required to wear them during weight lifting. Therefore, the trial supports progressive resistance training in stable BCRL under a protocol that included compression and monitoring. It should not be interpreted as evidence for resistance training without compression.

In Schmitz et al. [6], the population consisted of women at risk of BCRL without clinical lymphedema at baseline. Compression garments were provided to participants who developed lymphedema, and these participants were required to wear the garment during weight lifting. This is different from routine prophylactic compression for all at-risk participants. Therefore, the compression context in the at-risk trial should not be transferred directly to all women exercising after breast cancer surgery.

Other studies used compression differently. In Cormie et al. [7], compression garment use during resistance exercise was optional and not standardized. In Kim et al. [12], compression was part of complex decongestive physiotherapy, and active resistive exercise was performed with a compression stocking or multilayer bandage. In Basha et al. [13], both exercise groups received complex decongestive physiotherapy and multilayer bandaging during exercise. In Omar et al. [19], low-intensity resistance training was compared with or without compression garment use, but compression details and sample reporting limitations reduce the certainty of interpretation. Gülören et al. [18] provides acute data comparing remedial exercise with and without compression, but this should not be used as long-term evidence for compression strategy.

Guidelines and consensus documents also favor case-by-case decision-making rather than a universal rule. The ISL consensus [1] emphasizes that compression during exercise should be individualized, while Wang et al. [9] similarly supports patient-centered decisions based on symptoms, preferences and clinical assessment. Shah et al. [10] describes short-term compression after a BIS/L-Dex surveillance trigger, but this is an early-intervention pathway rather than a rule for exercise compression.

In practical terms, compression during exercise is a case-by-case decision based on BCRL stage, symptom burden, tissue condition, current specialist prescription, comfort, patient preference and response to activity. Patients already prescribed compression should generally follow specialist instructions. Patients with stable established BCRL performing upper-limb resistance training may benefit from exercising with appropriate compression, particularly if this is part of their current management plan. In contrast, there is insufficient evidence to recommend routine compression during all exercise sessions for every at-risk patient without clinical or subclinical lymphedema.

6.8 Practical Rehabilitation Strategies

The practical rehabilitation approach to BCRL should move away from avoidance-based advice and toward structured, individualized exercise prescription. A stepwise clinical model is most consistent with the reviewed evidence: safety screening, baseline assessment, risk and stage classification, exercise prescription, gradual progression, monitoring, program modification and referral when needed. This model can be applied in text-based clinical practice without requiring a separate graphical algorithm.

The first step is safety screening. Before progressing exercise, clinicians should assess for red flags such as suspected cellulitis or acute infection, fever, erythema, warmth, rapidly increasing swelling, skin breakdown, suspected vascular complications, unexplained new mass or suspected recurrence, severe pain and unstable comorbid disease [1, 2, 23, 24]. If these features are present, exercise progression should be paused and the patient should be referred for medical or lymphedema specialist assessment. This does not mean that exercise is permanently contraindicated, but that the clinical problem must be clarified before progression.

The second step is baseline classification. Patients should be categorized as at risk of BCRL, subclinical or Stage 0, early/stable BCRL, established stable BCRL, or advanced/unstable BCRL. This classification should be combined with risk factors, symptoms, objective limb assessment, shoulder function, strength, comorbidities and access to supervision. Low-complexity patients may be suitable for education and home- or community-based activity with periodic monitoring. Moderate-complexity patients may benefit from supervised exercise or physiotherapy. High-complexity patients, especially those with advanced or unstable lymphedema, recurrent infections, marked symptoms or complex comorbidities, should be managed with specialist lymphedema input and may require complex decongestive therapy.

Exercise prescription should include resistance training, aerobic activity, mobility exercises and functional training when clinically appropriate. Resistance training should begin with low loads or low perceived difficulty and should progress slowly. Aerobic exercise should begin at the patient's current fitness level and progress gradually. Mobility and shoulder rehabilitation should address range of motion, scapular control, stretching, reaching and functional lifting tasks. In all cases, the program should be adapted to symptoms rather than based only on predefined training parameters.

Progression should follow conservative rules. Only one training variable should be increased at a time, such as load, repetitions, sets, frequency or session duration. Load increases of approximately 5–10% may be reasonable in selected patients when symptoms remain stable, but this should not be treated as a mandatory rule. After illness, missed sessions or treatment interruptions, resistance should be reduced and rebuilt gradually. If heaviness, tightness, pain, swelling or soreness lasting more than 48 hours increases, progression should be paused and the program modified.

Monitoring is essential throughout the program. Patients should be asked about swelling, heaviness, tightness, pain, fatigue, skin changes, prolonged soreness and functional changes. Periodic objective assessment may include limb volume, circumference or BIS/L-Dex when available. Functional monitoring may include shoulder range of motion, strength, grip strength, activity limitation and patient-reported outcomes. Monitoring intensity should be higher in patients with established BCRL, recent symptom changes, high-risk treatment history or low confidence in self-monitoring.

Education is another key element. Patients should be informed that BCRL is not an automatic reason to avoid exercise, but exercise should be introduced progressively and monitored. Education should include symptom self-monitoring, skin care, infection warning signs, safe progression, when to reduce load, and when to contact a clinician. This may reduce fear of movement and improve adherence.

In summary, practical rehabilitation strategies should balance safety with functional restoration. The goal is not unrestricted exercise, but structured exercise prescription that supports strength, mobility, fitness and quality of life while minimizing risk through assessment, individualized progression, compression decision-making and monitoring.

Table 1

Key intervention studies on exercise in breast cancer-related lymphedema and at-risk breast cancer survivors

Study	Population	Intervention	Compression context	Main outcomes	Key findings	Main caveat
Ahmed et al. [4]	Breast cancer survivors after axillary dissection; mixed population	Whole-body weight training for 6 months	Not standardized; compression according to specialist/self-care	Arm circumference, symptoms, strength	Weight training did not worsen arm circumference or lymphedema symptoms; strength improved	Not a pure established-BCRL treatment trial; compression and adverse events incompletely reported
Schmitz et al. [5]	Women with stable established BCRL	Slowly progressive weight lifting twice weekly for 12 months	Custom-fitted compression garment required during weight lifting	Limb volume, exacerbations, symptoms, strength	No increase in limb swelling; fewer exacerbations; improved strength and symptom severity	Applies to stable BCRL with compression and monitoring, not unrestricted exercise
Schmitz et al. [6]	Women at risk for BCRL without clinical lymphedema at baseline	Slowly progressive weight lifting for 12 months	Garment provided only to participants who developed lymphedema	Incident BCRL, symptoms, strength	Did not increase BCRL onset; strength improved	At-risk population only; not proof of definitive prevention
Cormie et al. [7]	Women with clinical BCRL	Supervised high-load or low-load resistance exercise for 3 months	Optional; not standardized or randomized	BIS/L-Dex, limb volume, symptoms, strength, ROM, QoL	High-load and low-load resistance training did not worsen BCRL outcomes; strength improved	Short follow-up; selected supervised population
Kim et al. [12]	Women with diagnosed BCRL	Low-load active resistive exercise added to complex decongestive physiotherapy	Compression therapy part of CDP; exercise performed with stocking or multilayer bandage	Circumference-derived volume, SF-36	Greater proximal volume reduction and selected QoL improvements	Small short-term study; cannot isolate exercise from CDP/compression
Omar et al. [19]	Women with unilateral established BCRL	Low-intensity resistance training with or without compression garment	Compression garment tested in one group; details incomplete	Limb volume, symptoms, ROM, DASH	Both groups improved; no clear added benefit of garment	No no-exercise control; sample-size inconsistencies; compression details limited
Ammitzbøll et al.	Women at risk after	Progressive resistance	Compression not part of	Interlimb volume difference,	Did not	Prevention study,

[14]	breast cancer surgery with ALND	training for 50 weeks	routine exercise intervention; symptom-triggered management	symptoms, clinical lymphedema, strength, ROM	prevent arm lymphedema but did not worsen key outcomes; no harm-related withdrawal	not established-BCRL treatment
Bloomquist et al. [15]	Physically inactive women during adjuvant chemotherapy; mostly at-risk/mixed	Supervised multimodal exercise including heavy-load resistance training	Compression not described as intervention	L-Dex, limb volume, symptoms, strength, QoL	No worsening of L-Dex or most BCRL symptoms; chest press strength improved; no AE requiring medical attention	Multimodal intervention; effects cannot be attributed to resistance training alone
Basha et al. [13]	Women with established BCRL	Xbox Kinect exercise + CDP vs resistance exercise + CDP	Both groups received CDP and multilayer bandaging during exercise	Limb volume, symptoms, DASH, ROM, strength, SF-36	Exercise mode influenced different functional outcomes; no lymphedema exacerbation recorded	No no-CDP or no-compression group
Ramírez-Parada et al. [21]	High-risk women without baseline arm-volume difference >200 mL	Prospective surveillance plus supervised multimodal STRONG-B exercise program	No compression protocol; not compression evidence	Perometer arm volume, grip strength, 6MWT, QoL, steps	Exercise plus surveillance improved arm-volume difference and functional outcomes	At-risk/high-risk prevention model; not established-BCRL treatment
Cormie et al. [16]	Women with unilateral established BCRL	Acute low-, moderate- and high-load upper-body resistance exercise sessions	Compression unclear; not randomized as a factor	Inflammatory markers, BIS/L-Dex, circumference, symptoms	No adverse acute response by load; no acute worsening reported	Acute study only; not long-term safety evidence
Gülören et al. [18]	Women with established BCRL	Acute remedial exercise with and without compression	Compression bandaging in compression condition	Circumference/fluid-related measures, symptoms	Exercise without compression did not acutely worsen outcomes; compression was associated with more favorable short-term measures	Acute study; not evidence for long-term compression strategy

Table 2

Practical implications for exercise prescription in breast cancer-related lymphedema

Domain	Practical implication	Evidence basis	Clinical caveat
Initial screening	Assess for infection, rapid swelling, skin changes, vascular symptoms, suspected recurrence and unstable comorbidities before exercise progression	[1, 2, 23, 24]	Red flags require clinical evaluation; they do not necessarily mean permanent exercise contraindication.
Baseline assessment	Evaluate BCRL status, limb volume or fluid, clinical stage, symptoms, shoulder ROM, strength, function and PROMs.	[2, 3, 10]	Limb volume alone does not capture patient burden.
Risk stratification	Separate at-risk, subclinical, stable established and unstable/advanced BCRL.	[2, 10, 11]	Risk factors guide monitoring intensity, not automatic restriction.
Resistance training	Start low, progress slowly and monitor symptoms; 2-3 sessions/week may be appropriate in selected patients.	[5-7, 9]	Evidence applies mainly to selected, stable or monitored patients.
Aerobic exercise	Encourage regular aerobic activity according to current fitness and tolerance.	[1, 22]	BCRL-specific aerobic FITT parameters are less precise than resistance-training parameters.
Mobility and shoulder rehabilitation	Include ROM, stretching, scapular control and functional upper-limb tasks.	[2, 13]	Mobility gains do not necessarily equal limb-volume improvement.
Compression during exercise	Individualize garment or bandage use according to stage, symptoms, current prescription and patient preference.	[1, 5, 9, 19]	No universal 'always' or 'never' rule.
Progression	Increase only one variable at a time and reduce load after breaks or symptom worsening.	[5, 6, 9]	Progression should be symptom-guided, not only protocol-driven.
Monitoring	Track swelling, heaviness, tightness, pain, skin changes, soreness >48h, ROM, strength and patient-reported burden.	[3, 5, 10]	Monitoring should combine subjective and objective measures when possible.
Referral	Refer to a lymphedema specialist or physician if symptoms persist, objective swelling increases, infection is suspected or function declines.	[1, 2, 23]	Referral thresholds may differ between clinical systems and available resources.
Patient education	Teach self-monitoring, skin care, infection warning signs, safe progression and when to seek help.	[2, 9, 22]	Education should reduce fear of movement without minimizing clinical risk.

7. Discussion

This narrative review summarizes current evidence on exercise prescription in breast cancer-related lymphedema, with particular focus on safety, resistance training, functional outcomes, compression and practical rehabilitation strategies. The main finding is that BCRL should not be treated as an automatic contraindication to exercise. Instead, exercise prescription should follow clinical assessment, staged progression, symptom surveillance and patient-specific decision-making. This interpretation is supported by randomized trials, systematic reviews, clinical practice guidelines and consensus statements, although the evidence base remains heterogeneous.

The strongest and most consistent evidence concerns resistance training. Earlier recommendations often promoted avoidance of heavy or repetitive upper-limb loading after breast cancer treatment because of concerns about lymphedema onset or worsening. However, randomized trials have challenged this approach. In women with stable established BCRL, slowly progressive weight lifting did not increase limb swelling and was associated with improved strength and fewer exacerbations when performed with compression garment use and regular monitoring [5]. In women at risk of BCRL, progressive weight lifting did not increase lymphedema onset compared with no exercise [6]. These findings support the transition from avoidance-based advice to structured exercise prescription.

Nevertheless, the safety of resistance training should not be overgeneralized. Many studies included selected patients, supervised initiation, gradual progression and systematic symptom monitoring. In Schmitz et al. [5], the intervention was not unrestricted gym training; it included compression garment use during lifting, education and repeated assessment. Similarly, in Cormie et al. [7], both high-load and low-load resistance training were supervised and performed in selected women with BCRL. Therefore, the appropriate conclusion is not that any resistance exercise is safe in any patient, but that progressive resistance training can be safe when carefully prescribed and monitored.

A key methodological issue is the distinction between established BCRL and at-risk populations. Several important trials evaluated women without clinical BCRL at baseline. These studies provide evidence that progressive resistance training or multimodal exercise does not appear to increase lymphedema risk in monitored settings, but they should not be interpreted as treatment trials for established BCRL. Conversely, studies in women with established BCRL provide direct rehabilitation evidence, but often include stable or mild-to-moderate cases and may not apply to patients with unstable, advanced or complicated lymphedema. Maintaining this distinction is essential for accurate clinical interpretation.

Acute exercise studies also require careful interpretation. Short-term studies evaluating single bouts of resistance or remedial exercise suggest that selected patients with BCRL may tolerate acute exercise without immediate worsening of limb volume, bioimpedance measures, symptoms or inflammatory markers. However, acute tolerance is not equivalent to long-term safety. Such studies are useful for understanding immediate physiological responses but should not replace long-term trials when developing practical rehabilitation recommendations.

The role of compression during exercise remains one of the least standardized practical areas. Compression was used differently across studies: mandatory during weight lifting in some established BCRL protocols, optional in others, embedded within complex decongestive therapy in some rehabilitation trials, triggered by surveillance findings in BIS-based pathways, or incompletely described. As a result, the current evidence does not support a universal rule that compression should always or never be used during exercise. Instead, compression should be individualized according to BCRL stage, symptom response, current specialist prescription, patient comfort and clinical monitoring. This interpretation is consistent with contemporary guideline and consensus-based recommendations.

Assessment and monitoring are central to safe exercise prescription. Objective tools such as limb volume, circumference, water displacement, perometry and BIS/L-Dex can help identify changes in limb status, but they do not capture the entire clinical burden of BCRL. Symptoms, shoulder range of motion, strength, pain, function and patient-reported outcomes are also necessary. The LYMPH-Q Upper Extremity Module highlights that arm lymphedema affects symptoms, function, appearance, psychological well-being, information needs and sleeve-related concerns. Therefore, clinical decisions should not be based solely on limb volume. A patient may have stable volume but persistent functional impairment, pain or fear of movement; conversely, improved strength or mobility may occur without large changes in limb volume.

Functional outcomes deserve particular attention. Exercise interventions may improve upper-limb strength, shoulder function, range of motion, grip strength, walking capacity or quality of life even when limb-volume outcomes remain unchanged. This is clinically relevant because rehabilitation goals in BCRL should include restoration of activity and participation, not only reduction of swelling. Trials such as Kim et al. [12] and Basha et al. [13] suggest that exercise embedded within decongestive rehabilitation may improve selected functional or quality-of-life outcomes. However, these effects should be interpreted within their intervention context, because complex decongestive therapy, compression and exercise often occur together.

Aerobic exercise and general physical activity are important but less specifically defined in BCRL literature than resistance training. General cancer exercise guidelines support regular aerobic and resistance exercise for cancer survivors, but BCRL-specific aerobic dosing remains less precise. Therefore, aerobic activity should be prescribed according to current fitness, comorbidities, cancer treatment status and lymphedema symptom response.

8. Conclusions

Exercise should not be automatically contraindicated in patients with breast cancer-related lymphedema or in women at risk of developing it. Current evidence supports a shift from avoidance-based recommendations toward structured, individualized and monitored exercise prescription.

Progressive resistance training has the strongest evidence base among exercise modalities in BCRL. It appears safe in selected patients when introduced gradually, progressed according to symptom response and combined with appropriate monitoring. However, the available evidence should not be interpreted as support for unrestricted or unsupervised training in all patients.

Patients with established BCRL and patients at risk of BCRL should be considered separately. Evidence from prevention or at-risk populations cannot be automatically transferred to patients with established or advanced lymphedema. Similarly, acute exercise studies should not be used as proof of long-term safety.

Aerobic exercise, mobility training and functional rehabilitation should be considered part of comprehensive survivorship care. Their role extends beyond limb-volume control and includes improvement of physical fitness, shoulder function, strength, daily activity and quality of life.

Compression during exercise requires case-by-case clinical decisions. Current evidence does not support a universal 'always' or 'never' rule. Decisions should consider BCRL stage, symptom burden, current specialist recommendations, patient preference, comfort and clinical response.

Exercise prescription in BCRL should be based on baseline assessment, risk and stage classification, staged progression, symptom monitoring and clear referral criteria. Clinicians should monitor not only limb volume, but also heaviness, tightness, pain, skin changes, shoulder range of motion, strength, function and patient-reported outcomes.

Future studies should standardize BCRL definitions, compression protocols, exercise dosing, outcome measures and adverse event reporting. Longer follow-up is needed, particularly for high-load resistance training, compression during exercise and mixed-mode rehabilitation programs.

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