UNIVERSITY OF LJUBLJANA | ZF Faculty of Health Sciences

Lymphoedema after Breast Cancer Surgery: Anatomical Background and Physiotherapy Interventions

Juvančič Eva[1], Kodrnja Natalija[1], Šuc Tjaša[1], Tomasino Kaja[1], Boc Anja[2]
Faculty of Health Sciences & Faculty of Medicine, University of Ljubljana
Contact: Anja Boc: anja.boc@mf.uni-lj.si

ABSTRACT

Breast cancer-related lymphoedema (BCRL) is a common long-term complication following breast cancer treatment, resulting from impaired lymphatic transport due to surgical and radiotherapeutic damage. It leads to accumulation of protein-rich interstitial fluid, causing swelling, functional impairment, and reduced quality of life.

Physiotherapy represents the cornerstone of conservative management, particularly through complex decongestive therapy (CDT), which integrates compression therapy, manual lymphatic drainage, therapeutic exercise, skin care, and patient

METHODS

A narrative literature review was conducted to examine the anatomical background, pathophysiology, and physiotherapy management of BCRL. Scientific articles published from 2001 onwards were identified using PubMed and ResearchGate databases.

Peer-reviewed studies, systematic reviews, and meta-analyses were included to provide an overview of current evidence and clinical practice trends (1).

CONCLUSION

BCRL is a chronic and progressive condition associated with disruption of lymphatic pathways following breast cancer treatment.

Physiotherapy, particularly CDT, represents the cornerstone of management. Early detection, individualized treatment, and interdisciplinary care are essential for optimal long-term outcomes.

RESULTS

Pathophysiology

Breast cancer-related lymphoedema (BCRL) develops as a consequence of impaired lymphatic transport capacity following surgical and radiotherapy-induced damage to lymphatic vessels and nodes (1,2). Disruption of lymphatic pathways leads to the accumulation of protein-rich interstitial fluid, which initiates a chronic inflammatory response within the affected tissues (1,2).

This inflammatory process promotes infiltration of immune cells and the release of pro-inflammatory mediators, resulting in progressive fibrosis and adipose tissue deposition (2,3). Over time, these structural changes reduce lymphatic vessel compliance and further impair lymph transport, contributing to the chronic and progressive nature of the condition (1,2,3).

Importantly, BCRL is no longer considered a purely mechanical disorder but rather a complex chronic inflammatory disease, where lymphatic injury triggers long-term pathological changes that may become irreversible if not managed early (1, 2).

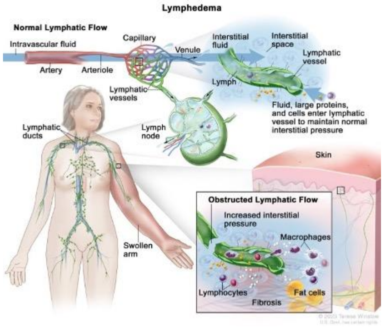

Figure 1. Figure 1: Pathophysiology of lymphoedema: comparison of normal and obstructed lymphatic flow. Adapted from the National Cancer Institute (NCI) Lymphedema (PDQ®)–Health Professional Version. Illustration © Terese Winslow, U.S. Government.

Risk Factors

The development of BCRL is multifactorial and influenced by both treatment-related and patient-related factors (4). The most significant risk factor is axillary lymph node dissection, which causes extensive disruption of lymphatic drainage pathways (4). Although sentinel lymph node biopsy is less invasive, it still carries a measurable risk, particularly when combined with adjuvant therapies such as radiotherapy (1, 4).

Radiotherapy further contributes to lymphatic damage by inducing fibrosis of soft tissues and reducing lymphatic vessel function (1,4). Patient-related factors such as high body mass index and postoperative weight gain have been consistently identified as independent predictors of lymphoedema development (4, 5).

In addition, postoperative complications, including infection and seroma formation, may further increase the risk by exacerbating inflammatory processes and delaying lymphatic recovery (1,4). These findings highlight the importance of early risk identification and long-term monitoring in breast cancer survivors.

Clinical Presentation

Clinical presentation is variable and often develops gradually. Early symptoms include heaviness, tightness, and discomfort in the affected limb, while later stages are characterized by visible swelling and functional limitations (6).

Patients frequently experience reduced range of motion, decreased strength, and difficulties in daily activities, which significantly affect quality of life (6).

Physiotherapy Management

Physiotherapy represents a central component of conservative BCRL management, aiming to reduce oedema, improve upper limb function, and support long-term self-management (7). A multimodal and individualized approach is recommended to address the complex pathophysiology of the condition (7).

Complex decongestive therapy (CDT) is considered the gold standard treatment and consists of manual lymphatic drainage, compression therapy, therapeutic exercise, skin care, and patient education (7,8). Evidence shows that CDT leads to clinically meaningful reductions in limb volume and improvements in functional outcomes when applied consistently and over a sufficient duration (7,8).

Manual lymphatic drainage is used to stimulate lymph flow and redirect fluid toward functioning lymphatic pathways, while compression therapy plays a key role in maintaining volume reduction and preventing fluid reaccumulation (7). Skin care is essential for preventing infections, which may worsen lymphoedema and further impair lymphatic function (1,7).

Figure 2. Figure 2: Compression bandaging of the upper limb in BCRL (Yaman et al., 2021).

Therapeutic exercise is an important active component of physiotherapy. Current evidence demonstrates that progressive resistance training does not exacerbate lymphoedema and is safe for breast cancer survivors (8). On the contrary, it contributes to improvements in muscle strength, functional capacity, and overall quality of life when properly prescribed and supervised (7,8). In addition to CDT, several adjunct interventions have been investigated. Kinesiotaping may improve functional outcomes and perceived quality of life, although its effect on limb volume reduction remains inconsistent (9).

Hydrotherapy has been shown to provide short-term benefits in pain reduction and range of motion, particularly due to the hydrostatic pressure of water (8,9).

Photobiomodulation therapy has also demonstrated potential benefits; however, current evidence remains limited and heterogeneous (9). Patient education represents a crucial component of long-term management. It focuses on self-monitoring, appropriate use of compression garments, maintenance of physical activity, and early recognition of symptoms (7). Active patient participation is essential for maintaining treatment outcomes and preventing disease progression (7,8).

REFERENCES

1.Pappalardo, M., Starnoni, M., Franceschini, G., Baccarani, A., & De Santis, G. (2021). Breast Cancer-Related Lymphedema: Recent Updates on Diagnosis, Severity and Available Treatments. Journal of Personalized Medicine, 11(5), 402. https://doi.org/10.3390/jpm11050402
2. International Society of Lymphology. (2020). The diagnosis and treatment of peripheral lymphedema: 2020 Consensus Document of the International Society of Lymphology. Lymphology, 53(1), 3–19.
3. Kataru, R. P., Wiser, I., Baik, J. E., Park, H. J., Rehal, S., Shin, J. Y., & Mehrara, B. J. (2019). Fibrosis and secondary lymphedema: chicken or egg? Translational Research, 209, 68–76. https://doi.org/10.1016/j.trsl.2019.04.001
4. Shen, A., Lu, Q., Fu, X., Wei, X., Zhang, L., Bian, J., Qiang, W., & Pang, D. (2022). Risk factors of unilateral breast cancer-related lymphedema: an updated systematic review and meta-analysis of 84 cohort studies. Supportive Care in Cancer, 31(1). https://doi.org/10.1007/s00520-022-07508-2
5. Hing, J. J. X., et al. (2024). Defining breast cancer-related lymphedema (BCRL) prevalence and risk factors. Annals of the Academy of Medicine Singapore, 53(2), 80–89. https://doi.org/10.47102/annals-acadmedsg.2023264
6. Gursen, C., et al. (2021). Self-reported signs and symptoms of secondary upper limb lymphoedema. European Journal of Cancer Care, 30(5). https://doi.org/10.1111/ecc.13440
7. Shamoun, S., & Ahmad, M. (2023). Complete decongestive therapy for BCRL. Asian Pacific Journal of Cancer Prevention, 24(7), 2225–2238. https://doi.org/10.31557/APJCP.2023.24.7.2225
8. Hasenoehrl, T., et al. (2020). Resistance exercise and BCRL. Supportive Care in Cancer, 28(8), 3593–3603. https://doi.org/10.1007/s00520-020-05521-x
9. Marotta, N., et al. (2023). Kinesio taping in BCRL. European Journal of Physical and Rehabilitation Medicine, 59(2), 237–247. https://doi.org/10.23736/S1973-9087.23.07752-3