

The changing landscape of lymphoedema: lessons from the past, directions for the future

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Celebrating 20 years of the *Journal of Lymphoedema* has prompted me to reflect on my own professional journey over the past two decades in the lymphoedema field, and more recently, in the broader area of chronic oedema. My career as a lymphoedema physiotherapist began in 1991 in Victoria, Australia, at a time when awareness of lymphoedema was limited and specialised services were rare. I was fortunate to establish a dedicated lymphoedema service — primarily for individuals with secondary lymphoedema following cancer treatment — across both public and private healthcare settings.

Over the past 20 years, global advancements in lymphatic science and lymphoedema management have significantly shaped my clinical practice. These include improvements in assessment techniques, therapeutic approaches and the range of available management products. However, I write this article not only as a lymphoedema physiotherapist but also as a clinical researcher, reflecting on how research has driven key developments in the understanding and management of lymphoedema. These advances can be grouped into four key domains:

1. Understanding of the lymphatic system, fluid balance and dysfunction
2. Global prevalence of lymphoedema, chronic oedema and risk factors
3. Advances in cancer-related lymphoedema management and their application to other populations
4. Research progression and future directions.

This article examines these developments, their influence on clinical practice and the

persistent gaps — particularly in addressing the needs of an ageing population, which increasingly represents a substantial proportion of individuals living with chronic oedema beyond those affected by cancer-related lymphoedema.

Advances in understanding the lymphatic system, fluid balance and dysfunction

Over the past two decades, significant progress has been made in understanding the lymphatic system and its role in fluid balance and dysfunction. Assessment advances, such as indocyanine green (ICG) lymphography, have allowed healthcare professionals to visualise superficial lymphatic pathways and identify flow abnormalities (Narushima et al, 2016). These insights have informed the direction of manual lymphatic drainage pathways and enhanced decision-making in clinical management (Suami et al, 2019; Koelmeyer et al, 2021).

One of the most transformative developments has been the revised understanding of the Starling principle, particularly the role of the endothelial glycocalyx — a gel-like layer lining blood vessels (Levick, 2004). Research has shown that nearly all interstitial fluid returns via the lymphatic system rather than venous capillaries (Levick, 2004; Mortimer and Levick, 2004). This paradigm shift highlights the lymphatic system as central to both oedema formation and resolution, irrespective of the underlying cause — be it venous insufficiency, immobility, systemic disease, surgery, cancer treatment or inflammation (Mortimer and Levick, 2004). Clinically, lymphoedema practitioners should assess all forms of chronic oedema across the full spectrum of contributing factors. For lymphoedema practitioners, this new knowledge needs to be considered when managing

lymphoedema in individuals with comorbid conditions that also contribute to oedema, such as chronic heart failure (Urbanek et al, 2020) and venous disease (Mortimer and Levick, 2004), to ensure more comprehensive and effective care.

Emerging research further reveals that sustained lymphatic overload induces structural and functional changes in lymphatic vessels. In secondary lymphoedema, chronic fluid accumulation leads to vessel dilation, followed by smooth muscle hyperplasia and collagen deposition, which may eventually occlude the vessel lumen (Weber et al, 2022). These changes contribute to chronic inflammation and impaired immune function, key features of lymphoedema progression (Bowman and Rockson, 2024). These findings underscore the importance of early intervention to reduce oedema and lymphatic load.

Sustained lymphatic overload can potentially be caused by systemic disorders, such as chronic heart failure which results in peripheral oedema (Clark and Cleland, 2013; Atkin and Byrom, 2022). Taking into consideration the findings of Weber and colleagues, that chronic fluid accumulation results in lymphatic vessel changes, which may eventually occlude the lymphatic vessel lumen (Weber et al, 2022), it would be reasonable to infer that fluid overload from systemic disorders could also possibly lead to secondary lymphatic structural changes. Therefore, managing chronic oedema in people with chronic heart failure is essential to prevent secondary known complications, such as wounds (Burian et al, 2022) and cellulitis (Webb et al, 2020). Clinically, a growing body of evidence supports the use of low-grade compression in cases where oedema persists despite medical management, such as in stable chronic heart failure (Urbanek et al, 2020; Atkin and Byrom, 2022; Wounds UK, 2023; Nasu et al, 2024). Lymphoedema

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practitioners, with their expertise in compression therapy, are well positioned to support this patient group.

Earlier in my career, I encountered patients with swollen limbs that were soft, non-pitting and free of fibrosis — presentations I struggled to interpret at the time. It is now understood that lymphoedema is a progressive condition: initial fluid accumulation eventually transitions to tissue fibrosis and adipose proliferation due to chronic inflammation (Brown et al, 2023). This progression from a fluid to a fatty state reduces the effectiveness of conservative treatments, highlighting the need for timely intervention to avoid irreversible tissue changes. In later stages, surgical options may need to be considered.

While my career has mainly focused on primary and secondary lymphoedema, recent research has expanded our understanding of ageing-related lymphatic decline. Ageing is associated with reduced lymphatic contractility and impaired drainage (González-Loyola and Petrova, 2021; Lei et al, 2023), and is often compounded by comorbidities such as venous insufficiency, immobility and cardiovascular disease. These factors increase susceptibility to chronic oedema and necessitate age-specific strategies for screening, assessment and management.

Global prevalence of lymphoedema, chronic oedema, risk factors and impact

Understanding the prevalence and risk factors for chronic oedema, which includes lymphoedema, is essential for lymphoedema practitioners. This knowledge supports client education, enables early identification and monitoring of at-risk individuals, and informs advocacy efforts with policymakers and funding bodies — who often first ask: “How widespread is the problem?”

Prevalence data for lymphoedema following cancer treatment are well-established, particularly in breast cancer populations. Meta-analyses show a lower incidence of lymphoedema with sentinel lymph node biopsy (SLNB; 5–7%) compared to axillary lymph node dissection (ALND; 20–30%) (DiSipio et al, 2013). Clinically, this allows practitioners to provide more accurate risk information and tailor follow-up. Additional risk factors — such as radiotherapy, advanced disease

stage, high body weight and taxane-based chemotherapy — further refine individual risk profiles (Kilbreath et al, 2016; Martínez-Jaimez et al, 2022). This evidence has helped inform screening programmes, guide early intervention and incorporate tools, such as bioimpedance spectroscopy to detect early changes before visible swelling appears (Seward et al, 2016; Forte et al, 2021; Shah et al, 2024).

Beyond cancer-related lymphoedema, emerging data from international epidemiological studies, led by the International Lymphoedema Framework (LIMPRINT studies) (Dai et al, 2019; Borman et al, 2019; Gordon et al, 2019; Keeley et al, 2019; Keast et al, 2019; Norregaard et al, 2019; Colgan et al, 2021) have revealed chronic oedema as a common and under-recognised global condition. Prevalence rates vary widely across healthcare settings — for example, 5.0% to 66.1% depending on facility type (Dai et al, 2019), 52.1% among bariatric patients (Newman et al, 2021) and 39% of inpatients (Norregaard et al, 2019). These studies also identified poor oedema control, reduced quality of life and increased hospitalisation due to infections as common consequences of chronic oedema.

In aged care settings, chronic lower-limb oedema appears to be prevalent. Prevalence rates of oedema in community-dwelling older adults have been reported ranging from 20% in the United States of America (Besharat et al, 2021) to 60% in the United Kingdom (Moffatt et al, 2019). An Australian study found that nearly 40% of the 459 individuals screened by non-health professionals at an aged care provider had chronic lower-limb oedema (O'Connor et al, 2025). It is estimated in residential aged care homes the prevalence is likely higher, at approximately 52% (Moffatt et al, 2019) but this was based on studies with small sample sizes, where access to residents was difficult due to consent. Further research is required in this vulnerable population where the prevalence may be high.

Key risk factors for chronic lower-limb oedema include advanced age (Besharat et al, 2021), obesity, immobility (Moffatt et al, 2019), diabetes (Besharat et al, 2021), and heart failure (Moffatt et al, 2019). Chronic lower-limb oedema is associated with reduced quality of life (Mercier et al, 2019) and complications such as wounds (Burian et al, 2022) and cellulitis (Burian

et al, 2021) which can significantly impact older adults' health (Gethin et al, 2012). The economic burden is also considerable, with high costs linked to managing wounds (Barnsbee et al, 2019; Burian et al, 2022) and cellulitis (Burian et al, 2021; St. John et al, 2018; Webb, 2023).

As global populations age, the need for comprehensive chronic oedema screening and management is becoming more urgent. By 2030, one in six people worldwide will be over 60, and the number of individuals aged 80 or older is expected to triple between 2020 and 2050 (World Health Organization, 2024). Given the current prevalence rates of chronic oedema in the ageing population and its association with complications such as wounds and cellulitis, the potential cost to health systems worldwide is substantial if not appropriately identified and managed.

Lymphoedema practitioners must continue to advocate for early identification and management of chronic oedema, especially in ageing populations. Aged care organisations should prioritise screening and staff education to address this under-recognised condition. Governments and funding bodies must invest in research, workforce training and access to evidence-based interventions. Without targeted action, the growing burden of chronic oedema will place increasing strain on individuals, healthcare systems and aged care services worldwide.

Advances in cancer-related lymphoedema management and translating to other populations

Advances in screening, surveillance and early intervention have enhanced the early detection and management of cancer-related lymphoedema (Ridner et al, 2021; Rafn et al, 2022). In breast cancer populations, early identification enables timely implementation of risk-reduction strategies, alleviating symptoms and prevent progression to irreversible lymphoedema (Rafn et al, 2022). Exercise, particularly when combined with compression therapy, is a key component of management. Both aerobic and resistance training are safe and effective, and no evidence of exacerbating lymphoedema has been found (McNeely, 2006; Kwan et al, 2011; Singh et al, 2016).

It is reasonable to propose that the principles of early detection and intervention used in cancer-related

lymphoedema may also benefit other causes of chronic oedema, such as individuals with chronic lower-limb oedema, particularly among older adults. However, further research is required to tailor these strategies to the specific needs and functional limitations of this population, with careful consideration of common comorbidities, to develop effective, age-appropriate interventions.

Accelerating progress in lymphatic research

Recent bibliometric analyses have highlighted significant growth in lymphedema-related research over the past two decades (Zhang et al, 2022). Similarly, a steady rise in breast cancer-related lymphedema publications has been noted from 2003–2022, while there has been “explosive growth” in lymphoedema insights and approaches, particularly in genetics, imaging and surgery (Rockson, 2021). The field has seen advancements in various aspects, including pathophysiology, diagnostics and management strategies (Barnhart et al, 2024; Zhang et al, 2022). Key research areas include preventive strategies, complex decongestive therapy, and reconstructive interventions (Huang et al, 2024).

Despite this progress, substantial gaps remain, especially in translating these advances to older populations and non-oncological chronic oedema. Future research must prioritise age-specific studies that address comorbidities, frailty and care setting complexities. Expanding research beyond oncology to encompass the broader spectrum of chronic oedema will be critical to informing tailored, evidence-based approaches for a rapidly ageing global population.

Conclusion

Reflecting on the past 20 years in the lymphoedema field reveals remarkable progress in our understanding, assessment and management of lymphatic dysfunction. Advances in lymphatic science, redefined concepts of fluid regulation, and improved clinical strategies — particularly in cancer-related lymphoedema — have shaped contemporary practice. However, looking toward the next 20 years, it is clear that the focus must broaden.

Chronic oedema, especially in older adults, remains under-recognised despite

its high prevalence and substantial clinical and economic impact. The principles underpinning successful cancer-related lymphoedema care — early identification, risk stratification, exercise and compression — must be adapted for ageing populations with complex comorbidities. This translation requires rigorous research and context-specific implementation strategies.

Lymphoedema practitioners and researchers must drive clinical innovation, build the evidence base, and advocate for systemic change. Aged care organisations must embed screening and staff education into routine practice. Governments and funding bodies must invest in scalable, evidence-based programmes that ensure equitable access to care. Without coordinated and sustained action, the growing burden of chronic oedema will place increasing strain on individuals, caregivers and healthcare systems worldwide.

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