

# MEDICAL EDUCATION: A DEFICIENCY OR A DISGRACE

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Students and clinicians should be able to establish a diagnosis of lymphoedema along with differential diagnoses, and be aware of effective therapeutic interventions. However, it is commonly misdiagnosed. This paper summarises published knowledge on lymphoedema and lymphatic system teaching in medical courses. The lack of results suggests that despite an exponential increase in understanding and research in lymphatics, this has not yet translated into the realms of medical education. Until this undergraduate educational gap is addressed, there will continue to be a lack of awareness and resulting poor management of patients with these afflictions.

## Key words

Lymphoedema education  
Lymphology  
Medical curricula

With respect to those who are educated about the lymphatic system and the consequences and sequelae of its dysfunction and damage, there are few clinicians, specialists and scientists across the world and even fewer of these in teaching roles in medical and allied health professional schools. The Flinders School of Medicine is fortunate to have this range of knowledge, access to staff in the lymphatics and micro-circulatory area and a specialist elective in lymphoedema and lymphatics. Sadly, in the authors' opinion, this is not the case in many other Schools in Australia and across the world.

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A high, but variable proportion of breast, genitourinary, gynaecological, or melanoma survivors in Australia (specifically) and around the world (National Breast and Ovarian Cancer Centre [NBOCC], 2008; Gordon and Mortimer, 2007) will experience swelling consistent with lymphoedema. However, despite this, there appears to be a lack of awareness and knowledge of the condition and, in the authors' opinion, general practitioners and other clinicians often attribute symptoms to other common causes such as venous oedema associated with generalised or local venous failure, or systemic arterial issues. With the potential for significant improvements in patient morbidity and quality of life (QoL) if recognised early (Armer et al, 2010; Franks et al, 2006), it is important that there is a greater awareness of lymphoedema as a clinical condition (NBOCC, 2008).

It has been argued by Rockson et al (2004) that there needs to be a greater level of lymphology teaching and thus lymphoedema awareness in medical courses. The application of such knowledge could lead to earlier and more accurate diagnosis, thus reducing the incidence/prevalence and severity of lymphoedema, which, in turn, would reduce costs of treatment and the physical and psychological impact. This article reviews the published literature pertaining to

lymphoedema in medical curriculae, specifically focusing on Australia.

## Definitions and underlying theory

### Lymphoedema

Primary lymphoedema occurs when the lymphatic system is underdeveloped, usually from birth, but may not appear until a later age (Foeldi et al, 2003). Secondary lymphoedema can occur after treatment for cancer following surgery or radiation therapy, or other medical conditions, severe injury or burns (Foeldi et al, 2003). *Table 1* lists the major causes of lymphoedema.

### Prevalence

There are an estimated 140–250 million cases of lymphoedema worldwide, with filariasis causing the majority of cases both internationally and in developing countries (Marty, 2009). In the authors' opinion, there is uncertainty about the incidence and prevalence of secondary lymphoedemas in Australia and internationally, but in Australia it is estimated that approximately 300,000 people may have some degree of primary or secondary lymphoedema (Lymphoedema Association of Victoria Inc [LAVI n. d.], 2010). It does seem clear, however, that the incidence of secondary lymphoedema following cancer treatment is likely to be underestimated. Conservatively, while the estimates are variable and

Table 1

## Causes of lymphoedema (Creager and Dzau, 2005)

Primary	Secondary
» Congenital (includes Milroy's disease)	» Recurrent lymphangitis
» Lymphoedema praecox (includes Meige's disease)	» Filariasis
» Lymphoedema tarda	» Tuberculosis
	» Neoplasm
	» Surgery
	» Radiation therapy

dependent on the nature of the intervention and diagnostic criteria, at least 20% of breast, genitourinary, gynaecological, or melanoma survivors will experience secondary lymphoedema (Rockson, 2008; Norman et al, 2009; Cormier et al, 2010). This is consistent with approximately 8000 new Australian cases per year (NBOCC, 2008), highlighting the potential health and economic burden of disease associated with secondary lymphoedema in Australia and internationally.

### Cost

It is currently unknown in Australia what the financial burden of lymphoedema is on the patient and healthcare system. However, a study done in the US (Shih et al, 2009) estimates the total cost of lymphoedema treatment per post-operative breast cancer patient to be between \$31,000 to \$46,000 USD over two years. Costs were attributed to physical therapies, treatment for complications of lymphoedema, and outpatient visits including mental health services (Shih et al, 2009). On average, patients accrued between 56 to 73 consultations and treatment visits over the two-year study period (Shih et al, 2009). Currently, under chronic care guidelines in the USA, patients are eligible for up to five treatment sessions which are covered by Medicare if referred by a GP (House of Representatives, 2010). All other costs outside these sessions

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are to be borne by the patient. These figures reiterate the potential significant cost of lymphoedema management to the health system and the patient.

### Clinical significance

Lymphoedema usually presents as an unexplained, slow and generally painless swelling that may 'pit' on pressure (indentation) (International Society of Lymphology [ISL] consensus, 2009). As it progresses, discomfort can contribute to loss of mobility resulting in possible episodes of infection (cellulitis). Further progression may result in a painful, hard and resistant limb (fibrosis), together with altered limb appearance. Significant swelling compromises a patient's mobility and comfort, and has a significant effect on quality of life, including areas such as emotional, physical, social, and functional wellbeing (Beaulac et al, 2002; Cormier et al, 2010). Psychologically, 'disfigurement' may result in social isolation and other emotional problems, while having a heavy or uncomfortable limb may reduce physical activity and affect productivity (Cooke et al, 2007).

Although lymphoedema remains difficult to heal completely, there are treatments to improve symptoms and quality of life such as those presented in editions of this and other lymphoedema-related journals. Early detection may improve the chance of a good outcome since early or pre-clinical stages primarily involve fluid accumulation (International Society of Lymphology [ISL] consensus, 2009). The mainstay of treatment is to improve lymphatic flow within existing or collateral drainage routes through stimulating interventions (Gordon and Mortimer, 2007). These treatments may include physical therapy, external compression by pneumatic pumps, multilayer bandaging or elastic garments, gentle exercises such as swimming, skin care and massage techniques including manual lymphatic drainage (MLD) and simple lymphatic drainage (SLD) (Lymphoedema Framework, 2006; NBOCC, 2008). Many of the treatments mentioned above can be combined to manage different clinical features. Early detection and treatment may help reduce the costs and other comorbidities associated with lymphoedema (Shih et al, 2009).

### Lack of physician awareness

In the authors' opinion, while lymphoedema is known to be a common complication following treatment for cancer, it is often misdiagnosed in this patient subgroup. At worst, there is no diagnosis and a complete lack of acknowledgement of it as a medical condition (Moffatt et al, 2003). Accordingly, in the authors' clinical experience, swelling is often attributed to another common cause such as local or systemic venous-related oedema. Another under-recognised and misdiagnosed disorder is lipoedema, which is commonly diagnosed as lymphoedema or may even be dismissed as obesity (Lymphoedema Framework, 2006; Gordon and Mortimer, 2007).

### Lymphology and lymphoedema in undergraduate medical education in Australia

According to the criteria set by

the Australian Medical Council, which assess and accredit medical programmes in Australia, there is no set national curriculum in place. This allows individual medical schools the flexibility to set their own curriculum provided that core objectives are met. In relation to medical curriculum content, core objectives stated by the Australian Medical Council (2009) must include a comprehensive coverage of:

- ▶ Basic biomedical sciences, sufficient to underpin clinical studies
- ▶ Scientific method, inquiry skills, critical appraisal and evidence-based medicine
- ▶ Clinical sciences relevant to the care of adults and children
- ▶ The pathological basis of disease
- ▶ Clinical skills (medical history construction, physical and mental state examination, diagnostic reasoning skills, problem formulation and construction of patient management plans).

At present, the current framework of medical curriculum in Australia is moving to a structure based around units or blocks focused on a particular system of the body, e.g. haematology and immunology, cardiovascular, respiratory (Flinders University, 2010; University of Sydney, 2010). Anecdotally, most medical curriculum in Australia incorporate a basic overview of the lymphatic system in biomedical subjects, covering this within the teaching of cardiovascular or vascular systems. Lymphology is also offered as a six-month optional elective for second year students in at least one postgraduate medical school in Australia (Flinders, Adelaide). In 2010, 7% of students undertook this elective and in 2011, 20% of the graduate medical entry programme students selected it, thus the situation may be changing. However, the level of lymphoedema teaching in medical curriculum within the general curriculum framework is currently unknown, but does seem deficient.

In the authors' opinion, incorporating even a basic overview of lymphatic biology and disease in

undergraduate medical education may raise the awareness of lymphoedema among clinicians and help to improve clinical detection and prevention. This literature review aims to summarise current published knowledge on lymphoedema and lymphatic system teaching in medical courses.

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**Method**

The literature review involved searching Ovid MEDLINE, Expanded Academic ASAP and Psycinfo for all publications relating to lymphology, lymphatics or lymphoedema in undergraduate medical education. The primary search terms were education, medical, undergraduate or curriculum in MAJR (main subject heading) combined (AND) with lymphatics, lymphatic system, lymphatic diseases, lymphatic abnormalities, lymphology, lymphoedema, lymphedema, lymph in MeSH (subject heading).

Eighty-eight publications met the above search criteria. All publications were sorted manually following the search. The authors considered 82 articles irrelevant, the majority because they were not concerned with undergraduate medical education or because of their obvious irrelevance (not concerned with lymphology, the lymphatic system or lymphoedema, or with undergraduate medical education). Examples of obviously irrelevant articles included a historical article about the origins of the Kondoleon procedure (Dimakakos and Arkadopoulos, 2000), a surgical procedure for lymphoedema, and an article on the effect of lymphatic filariasis on school children (Ramaiah and Vijay Kumar, 2000). Articles not published in English were excluded,

including one potentially useful article in German, 'a lymphology report with special reference to student education' (Berens von Rautenfeld and Cornelsen, 1994). There were two articles that discussed lymphatic education in postgraduate medical education for general practitioners and surgeons respectively. These were excluded because they did not focus on undergraduate medical curriculum. Two other articles which discussed teaching lymphology to medical students were excluded because they were published before 1980 and were not considered to be current enough. Exclusion criteria included:

- ▶ Articles focusing on postgraduate rather than undergraduate medical education
- ▶ Articles published in a language other than English
- ▶ Articles published before 1980.

After exclusion, only two articles were left.

**Results**

Unexpectedly, the search revealed only two results which fulfilled all inclusion criteria. It is difficult to draw conclusions about medical education based upon two articles. The lack of results suggests that despite an exponential increase in understanding and research in the area of lymphatics, this has not yet translated into the realms of medical education.

In the first article, Rockson (2004) writes an editorial about the need for a greater presence of lymphatic biology, function and pathology in formal undergraduate and postgraduate medical curriculum. He discusses the global scale of the problem which is compounded by medical ignorance, '... millions of individuals with forms of primary and secondary lymphatic diseases most often encounter responses from medical caregivers that encompass ignorance, disbelief, and frustration' (Rockson, 2004). He also highlighted the current imbalances in lymphatic education, stating that despite research advances in lymphatics, 'this vital biological system still receives little attention in the formal undergraduate

and postgraduate medical curriculum' (Rockson, 2004).

In the only other article (Granger et al, 2004), the authors discuss in detail the current issues with the lack of teaching in lymphatics in undergraduate and postgraduate medical education, as well as the continuing lack of physician awareness of the clinical problem of lymphoedema. This discussion takes the form of a written summary and discussion of a workshop presented by the authors at the Annual Meeting of the Association of American Medical Colleges, the peak undergraduate medical education conference in America, attended by more than 3100 medical educators. The Workshop, titled 'Lymphatic Biology and Disease: Is It Being Taught? Who Is Listening?', was presented as a case study to highlight the very real inequity of teaching of lymphatic biology and disease within medical schools compared to other 'traditional' biological systems. The broader themes and objectives of the workshop were to provide 'extended, focused, interactive, and skill-oriented learning experiences' to highlight and nurture greater awareness among medical educators (Rockson, 2004).

The workshop involved three stages. Firstly, the authors examined the level of lymphatic teaching in undergraduate medicine by relating it to the United States Medical Licensing Exam (USMLE) Step One examination (standardised American medical licensing exam). Secondly, they looked at the learning objectives set out by the Associations of Chairs of Departments of Physiology for an indication of what might be a suitable level of lymphatic teaching. Thirdly, they examined a survey of the Heads of Physiology at all medical schools.

#### **United States Medical Licensing Exam (USMLE) Step One Examination**

The USMLE Step One examination is administered to American medical students at the completion of the second of two preclinical years. Medical schools in the United States

base their curriculum on the expected content to appear in this examination and are guided by the course book prepared by the USMLE. Granger et al (2004) discuss the sparse appearance of lymphatic physiology in the USMLE course guide; '... listed under the cardiovascular system, where it is grouped with material related to the microcirculation and microcirculatory function' and suggest this as a reason for its lack in medical curricula.

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#### **Learning objectives for medical physiology teaching departments**

The medical physiology component of medical curriculum is produced by the American Physiological Society, in collaboration with the Physiology Department Chairs. Learning objectives for this curriculum are listed in a document circulated to physiology departments. Granger et al (2004) highlight that, once again, lymphatics is not listed as a distinct system but as a sub-topic under the cardiovascular system in association with the blood microcirculation. They highlight five of the 125 objectives outlined for the cardiovascular system as being relevant to the lymphatic system, predominantly in its function to prevent accumulation of interstitial fluid or the formation of oedema. Granger et al (2004) rationalise that this translates to 4% of cardiovascular teaching (five out of 125), which may equate to approximately 50 minutes of teaching time in a typical 20-hour block of cardiovascular teaching.

#### **Survey of physiology chairs about lymphatic teaching**

The article next reflects on a survey

conducted to the Chairs of Physiology at medical schools around the United States about the level of lymphatic teaching at their respective schools. The Chairs are asked the following questions:

1. How much time do you devote to teaching lymphatic function in your medical curriculum during the preclinical years?
2. Is the time that is allotted sufficient?
3. Are lymphatics addressed as a distinct system or as part of another system?
4. Is the coverage accompanied by a clinical correlation?

#### **Time allocated to lymphatic teaching**

The response rate was 33% (50 out of 150 Chairs), and results revealed that about half of the respondents devoted 30 minutes or less to teaching lymphatic function in the first two years of medical school at their respective institutions. It is reported that nearly 40% of participants responded that 1–3 hours of time was devoted to the lymphatic system, while about 25%, indicating 15 minutes or less, was spent on it.

#### **Sufficiency of lymphatic teaching time**

Sixty-two percent of these respondents felt that this time was sufficient, 27% said no, and 11% 'didn't know'. Out of those who felt that the time was sufficient, it was commonly rationalised that there was not sufficient time to expand the allotment to lymphatic biology, even if this were desirable. Another common response was to state that the coverage of the topic was consistent with what appears on the standardised examinations. Others stated that the lack of time devoted to this system was consistent with the coverage of lymphatics in most major medical textbooks.

#### **Taught as a lymphatic subject or as a subtopic of another system**

Only 6% reported that lymphatics was covered under its own system. For 94%, the subject was taught as a sub-topic under another system, with



100% of respondents replying that it was covered in the cardiovascular system block. Twelve percent also incorporated some aspects of the lymphatic system during the gastrointestinal tract teaching block, and 8% felt that the system was covered in other systems such as pathology, immunology and the respiratory system.

**Was this teaching accompanied by clinical correlation**

Approximately one third of respondents stated that lymphatic teaching was accompanied by a clinical correlation, most commonly a form of oedema. The other two-thirds of respondents replied that their courses did not incorporate a clinical correlation with the teaching.

**Education needs for future consideration**

The rest of the paper by Granger et al (2004) summarises the other parts of the workshop, which involved highlighting areas of awareness to address current clinician perceptions of lymphatic disease. These areas can be broadly summarised in the following headings.

**Lack of awareness of lymphoedema as a clinical condition**

Despite significant advances in the understanding of the lymphatic system, many clinicians are unable to diagnose, or are unaware of the condition. The authors argue that it should be a relatively straightforward educational intervention to teach students and clinicians the differential diagnoses of lymphoedema, how to perform a simple and directed physical examination to diagnose lymphoedema, and simple diagnostic imaging modalities to support a diagnosis

**Dismissing lymphoedema as unimportant**

Several clinicians dismiss lymphoedema as a condition that is not critical or serious. However, Granger et al (2004) emphasise that it often can and does significantly affect patient quality of life with considerable psychological impact. They state that it has been objectively studied that

lymphoedema can have implications on patient self-esteem, body image, functionality, and disease-associated anxiety. The patients most likely to be adversely affected psychologically by lymphoedema are those with upper

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extremity involvement, concurrent pain, and those with poor social support mechanisms.

**Lymphoedema is a rare disease**

The authors summarise that with a greater surgical approach towards breast cancer, as many as 15–25% of the treatment survivors will have some form of breast cancer-associated lymphoedema. With up to 3.5 million survivors of breast cancer in the US alone, this number is expected to increase by another million by the year 2020 (Mariotto et al, 2011). Therefore, the perception that lymphoedema is a rare disease is inaccurate, although widespread.

**No treatment for lymphoedema**

Granger et al (2004) are critical of the clinician who assumes that there are no treatment options available for lymphoedema. It is clarified that as such, there is no definitive cure for lymphoedema — but several effective treatments are available including a range of non-operative interventions such as combined physical and compression therapy, and operative treatments that include microsurgery, liposuction and resection (Consensus Document of the International Society of Lymphology, 2009).

**Key points**

- » There are still many uncertainties regarding the prevalence of lymphoedema.
- » Lymphoedema remains a poorly or misdiagnosed condition.
- » Most medical and healthcare professional courses have little or no content about lymphatics and lymphoedema.
- » Additional focused lymphological content is urgently needed.
- » Better outcomes for patients could be gained through improved education of healthcare professionals.

**Conclusions and future directions**

The sparsity of relevant articles from this literature search is indicative of the need for further urgent action in this area. With improvements in the research and understanding of lymphatic biology and disease over recent years, combined with the growing prevalence of primary and secondary lymphoedema, it would be reasonable to assume that this should be translated into a greater role in medical education.

However as it stands, lymphatic function and dysfunction is primarily addressed as a subtopic of the cardiovascular components of preclinical medical curriculum in American schools, and the time devoted to this subject is usually less than 30 minutes. The level of teaching time committed is viewed by medical educators as consistent with and guided by its appearance on standardised exams, such as the American USMLE, within major textbooks, and in the context of

nationally recommended learning objectives.

With respect to clinical medical education, students and clinicians should be expected to establish a diagnosis of lymphoedema and be aware of effective therapeutic interventions, as well as being able to differentially diagnose lymphoedema from other forms of swelling such as oedema, lipoedema, myxoedema, etc. In the authors' opinion, until this undergraduate educational gap is addressed (preclinical and clinical), there will continue to be a lack of awareness and resulting poor management of patients with these afflictions.

Undergraduate medical curriculum frameworks need to be dynamic and flexible to reflect the continuous advancement of medical research. Lymphatic disease is one area where this has not been the case, resulting in graduating junior doctors with little or no awareness of lymphoedema as a clinical problem. Future directions for research include an evaluation of current Australian medical curriculum objectives, and further published research on the current level of teaching of lymphatic biology and disease among undergraduate medical schools. JL

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