



Review Article

Modern surgical management of breast cancer therapy related upper limb and breast lymphoedema



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ABSTRACT

Breast cancer is the commonest cancer in the UK. Advances in breast cancer treatment means that the sequelae of treatment are affecting more women and for a longer duration. Lymphoedema is one such sequela, with wide-ranging implications, from serious functional and psychological effects at the individual level to wider economic burdens to society.

Breast cancer-related lymphoedema is principally managed by conservative therapy comprising compression garments and manual decongestive massage. This approach is effective for early stages of lymphoedema, but it is not curative and the effectiveness depends on patient compliance. Early surgical approaches were ablative, gave significant morbidity and hence, reserved for the most severe cases of refractory lymphoedema. However, recent non-ablative reconstructive surgical approaches have seen a revival of interest in the prevention or surgical management of breast cancer-related lymphoedema.

This review examines the modern surgical techniques for the treatment of breast cancer-related lymphoedema. Liposuction reduces the volume and symptoms of lymphoedema, but requires continual compressive therapy to avoid recurrence. Lymphatic reconstruction or bypass techniques including lymph node transfer (inguinal nodes are transferred to the affected limb), lymphatico-lymphatic bypass (lymphatics bypass the axilla using a lymph vessel graft reconstructing lymphatic flow from arm to neck) and lymphaticovenous anastomoses (lymphatics in the arm are joined to the venous system aiding lymph drainage) show promise in reducing lymphoedema significantly. Further research is required, including into the role of primary lymphaticovenous anastomoses in the prevention of lymphoedema at the time of axillary dissection.

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Abbreviations: BCRL, breast cancer-related lymphoedema; LNT, lymph node transfer; LLB, lymphatico-lymphatic bypass; LVA, lymphaticovenous anastomoses.

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1. Introduction

Breast cancer is the commonest cancer in women [1]. In the UK, breast cancer is the commonest cancer overall, and accounts for 30% of all cancers in British women [2]. In 2011, the age-standardized incidence rate was 125 per 100,000 women per year, and 50,285 new cases of breast cancer were diagnosed in the UK [2]. The five-year survival rate for breast cancer in the UK is 85.1% [3] many of whom experience the complications of breast cancer treatment.

This paper reviews breast cancer-related lymphoedema (BCRL), a common complication of breast cancer treatment. The primary focus will be on the surgical management of this condition, which has undergone a renaissance in the last two decades. We performed a literature search and present the modern surgical approaches to prevention and management of BCRL, and provide recommendations for optimal management at different stages of disease. We also note the research needs of this surgical approach to BCRL.

1.1. Breast cancer-related lymphoedema

Lymphoedema is the accumulation of protein rich fluid in the subcutaneous tissue and skin secondary to dysfunction of the lymphatic system. It may be primary [4], or secondary to infection, surgical lymphadenectomy, or radiotherapy [5]. As the condition progresses, lymphatic stasis leads to inflammation, lipogenesis, fat deposition, and fibrosis [6]. These pathological processes produce clinical manifestations represented by the lymphoedema staging system from the International Society of Lymphology [7] (Table 1).

BCRL is caused by damage or destruction of the upper limb lymphatic drainage system by surgery, radiotherapy, chemotherapy, or combination treatment, or owing to the infiltration of lymphatics by the cancer itself [8]. BCRL occasionally emerges immediately after surgery, but it most often appears after a latent period [9].

The incidence of BCRL after radical mastectomy, total mastectomy with axillary radiation and total mastectomy have been observed to be 58.1%, 38.3% and 49.1%, respectively [10]. For breast conserving surgery, the incidence varies considerably with the aggressiveness of treatment, from as low as 13% in patients who undergo breast conservation with sentinel lymph node biopsy without chemotherapy to as high as 61% or 65% in patients undergoing breast conservation and chemotherapy with axillary lymph

node dissection or regional radiotherapy [11]. Obesity is known to increase the risk of BCRL independent of treatment modality [12].

BCRL results in significant physical and psychological morbidity [13,14]. It interferes with mobility of the affected limb, causes a feeling of heaviness and discomfort, causes recurrent attacks of infection and inflammation [15–17], and also affects patients' self-perception, acting as a constant reminder of the cancer and its treatment. Economically, compared to breast cancer patients without BCRL, those who developed BCRL incur considerably higher medical costs, ranging from 14,877 to 23,167 USD/year [18].

1.2. Management of breast cancer-related lymphoedema

BCRL is traditionally managed conservatively with complete decongestive physiotherapy, a fourfold approach of manual lymphatic drainage, compression, skin care and exercises [19]. While the effectiveness of this approach has been documented in a number of studies [20,21], the intense training required for it to be effective, along with the expectation that these measures must be continued for the rest of a patient's life, highlight considerable practical limitations.

Surgical management of BCRL has evolved significantly since Sistrunk [22] first applied the debulking principles of the Charles' [23] and Kondoleon's [24] operations to the upper limb. Modern techniques for treating or preventing lymphoedema after breast cancer treatment can be categorized as reductive and physiological.

The chief reductive approach is liposuction. This technique is often used as an adjunct to conservative management that should continue post-operatively. Physiological approaches comprise lymph node transfer (LNT), lymphaticovenous or lymphaticovenular anastomosis (LVA), and lymphatic-lymphatic bypass (LLB).

In LNT, several lymph nodes within a block of tissue are taken from the groin and transplanted to the axilla, antecubital fossa or wrist as a vascularized free flap. These nodes are then thought to stimulate lymphangiogenesis, improving lymphatic clearance from the arm. In LVA, lymphatics are anastomosed to veins providing a physiological bypass of the disrupted lymphatic system in the axilla, and returning the lymphatic fluid to the circulation peripherally rather than centrally. Lymphovenous indicates a deeper larger anastomosis whereas lymphovenular indicates subcutaneous lymphatics being anastomosed to subdermal venules. In LLB, a long segment of a healthy lymphatic channel is harvested from the medial thigh, and like an interposition vein graft is anastomosed from lymphatic channels in the arm to channels in the neck in order to bypass the obstructed lymphatics in the axilla.

Table 1
 International society of lymphology classification of lymphoedema [7].

Stage	Clinical features
0	Subclinical lymphoedema without oedema but evidence of impaired lymphatic function
1	Reversible pitting oedema. No palpable fibrosis. Negative or borderline Stemmer's sign
2a	Pitting oedema that is not reduced by elevation. Positive Stemmer's sign.
2b	Non-pitting oedema secondary to pronounced fibrosis. Presence of hyperkeratosis and lymphostatic warts. Positive Stemmer's sign.
3	Lymphostatic elephantiasis. Progressive fibrosis, acanthosis, hyperkeratosis and papillomatosis. Ulceration.

Stemmer's sign is the inability to pinch a fold of skin at the base of the second toe or in the upper limb the finger.

2. Methods

We searched Medline from inception to February 2014 using the following strategy:

- 1 *Lymphatic vessels/su [surgery] (102)
- 2 *Lymphedema/su [surgery] (662)
- 3 1 or 2 (713)
- 4 lymphedema.ab.ti. (4182)
- 5 lymphoedema.ab.ti. (1457)

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