DIAGNOSING BREAST CANCER-RELATED LYMPHOEDEMA IN THE ARM

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Abstract

Background: Lymphoedema of the arm may complicate breast cancer treatment, including sentinel lymph node biopsy, but when it is mild it is difficult to detect. This study considers the difficulties of diagnosing mild breast cancer-related lymphoedema particularly in relation to the natural differences between right and left arm volume. *Methods:* Arm volume was measured opto-electronically in 33 women treated for unilateral breast cancer and in 37 age-matched healthy women. The ipsilateral arms of the breast cancer group were also examined closely for clinical signs of lymphoedema. *Results:* On the basis of clinical examination, seven of the breast cancer group were found to have (previously undiagnosed) mild lymphoedema. The difference between ipsilateral and contralateral arm volume in three of these women was within the range of dominant minus non-dominant arm volume differences in the control group (and within 2 standard deviation [SD] of the mean difference). In the other four women, arm volume differences were outside the normal range (1–2 SD in one, greater than 2 SD in three). *Conclusions:* Measurement of arm volume may not detect mild lymphoedema and close inspection of the arm is necessary. Early diagnosis and treatment are essential, as are detection and reporting for healthcare prioritisation. *Conflict of interest:* None.

Key words

Breast cancer
Secondary lymphoedema
Arm volume
Arm dominance
Diagnosis (of lymphoedema)

Lymphoedema of the arm is acknowledged as a serious complication of breast cancer treatment. With the introduction of treatments that conserve the axilla such as axillary sampling and particularly sentinel lymph node biopsy (SLNB), there is a view that breast cancer-related lymphoedema (BCRL) is now much less of a problem. It has even been suggested that dedicated lymphoedema clinics are a waste of time (Rampaul et al, 2003). Several reports conclude that SLNB poses less of a risk of BCRL than lymph node dissection or clearance (Blanchard et al, 2003; Mansel et al, 2006). The disparity in the reported incidence of BCRL following SLNB in these studies has several possible explanations, including differing times since axillary surgery when the patient is assessed, inaccurate reporting in questionnaires, use of different anatomical sites at which to measure circumference (with often only two sites being measured), and use of different circumference or volume thresholds.

Circumference measurement using a tape measure remains the gold standard for routine diagnosis and monitoring of arm swelling. Arm volume can be calculated fairly accurately from circumferences measured every 4 cm, or measured opto-electronically using a perometer (Stanton et al, 2003). Other methods for the assessment of lymphoedema include calipers for the measurement of posterior axillary skinfold thickness, ultrasound, tonometry, and bioimpedance measurement (Stanton et al, 2000; Burnand et al, 2003; Mellor et al, 2004).

The aim of this study was to examine the effectiveness of measuring arm volume in order to diagnose mild lymphoedema. This was done by examining the difference between the volume of the right and left arm in a group of healthy women, in comparison with a group of women who had recently undergone treatment for breast cancer. The women were also examined for other signs of lymphoedema.

Methods

The study was approved by Wandsworth Local Research Ethics Committee and was conducted in accordance with the Helsinki Declaration. Thirty-four right-handed and three left-handed healthy women with a mean age of 55 years (standard deviation [SD] = ±8 years; range = 39–68 years) were recruited from staff and visitors at St George's Hospital, London. A careful history was taken to exclude any conditions that could affect arm volume (such as previous surgery, breast cancer or lymphoedema). The right and left arms were carefully inspected and forearm plus upper volumes were measured in

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the horizontal position using a perometer model 350 S (Pero-System, Wuppertal, Germany). We then examined the arms of 33 women aged 61 years (SD = ± 9 years; range = 41–75 years), recruited from the breast clinics at St George's Hospital, London, and the Royal Marsden Hospital, Surrey, who had recently completed breast cancer treatment and had no record of BCRL. All had been treated by axillary dissection seven months previously (SD = ±3 months). We examined the ipsilateral arm for:

- Decreased visibility of subcutaneous veins on the ventral forearm and dorsal hand. This was because skin is thickened in patients with lymphoedema and is therefore more opaque
- Smoothing or fullness of the medial elbow and distal upper-arm contours, where swelling often predominates
- Increased skin and subcutis thickness if the tissues are pinched between finger and thumb
- Pitting oedema upon application of digital pressure applied for 60 seconds.

Arm volumes were then measured using the same technique as the healthy group. Comparison of arm volumes was performed using the paired t test.

Results

Healthy group

Differences in the prominence of veins between the right and left forearms were sometimes evident on inspection of the healthy arms, but were not accompanied by other signs of lymphoedema. Arm volumes for both groups are shown in *Table 1*. In the healthy right-handed group, the mean right arm volume was 1.7% (SD = ±3.7%; range = -4.5–8.5%) greater than left arm volume (n = 34, P = 0.05). Thirteen women (38%) had a larger non-dominant arm. In the three women who were left-handed, the left arm was -2.8%, -1.6% and 1.3% (mean = -1%) larger than the right arm.

Breast cancer group

In the group of women who had been treated for breast cancer, seven (21%) were found to have mildly oedematous ipsilateral arms. Only one woman had noticed any swelling. She and one other reported that their watch-strap caused indentation at the wrist. Clinical signs of oedema were evident on examination in all seven. The ipsilateral arm appeared larger than the contralateral arm in three women, and in one there was swelling of the thumb. There was decreased visibility of veins in four women; greater fullness of the medial elbow region in three; greater thickness of the skin and subcutis in two; and pitting oedema in two.

Table 1

Arm volumes (in ml) of healthy control subjects and women treated for breast cancer (mean; ±SD)

Healthy controls	Right arm	Left arm	n	P*
Right-handed	1,982 (±545)	1,959 (±527)	34	0.05
Left-handed†	2,317	2,288	3	-
	Ipsilateral arm	**Contralateral arm**		
All breast cancer patients (non-BCRL)	1,875 (±357)	1,854 (±366)	26	0.3
Breast cancer patients (non-BCRL)				
Ipsilateral, dominant	1,893 (±340)	1,858 (±350)	17	0.04
Ipsilateral, non-dominant	1,842 (±407)	1,845 (±419)	9	0.8
Patients with incipient BCRL (all right-handed)	1,623 (±336)	1,532 (±328)	7	0.001

*Comparing right and left or ipsilateral and contralateral using a paired t test

†Arm volumes (right, left) for these 3 controls were 1,631 ml, 1,652 ml, 1,704 ml, 1,658 ml, 2,610 ml, 2,568 ml

Ipsilateral arm volume was 8.1% and 9.4% greater than the contralateral arm volume for the two right-sided ipsilateral arms, and had a mean percentage of 5.1% (SD = ±2.8%; range = 1.2–8.8%) greater for the five left-sided ipsilateral arms (n = 7; P = 0.001). All of the women were right-handed. The difference in arm volume for three of the seven women with mild oedema was within the normal range of differences expected due to handedness based on the arm volumes of the right-handed control group (one woman was within -1 SD of the mean difference and two were between ±1 and 2 SD). The arm volume difference for the other four was beyond the normal range (one was between -1 and -2 SD and three were greater than ±2 SD). The maximum difference in circumference between the ipsilateral and contralateral arms (at any point along the arm) of the seven women with mild swelling, obtained directly from the perometer images, was 1.4 (SD = ± 0.6 cm; range = 0.6–2.2 cm). Only one woman had a maximum difference in circumference of >2 cm. All seven were advised that they had mild lymphoedema and were referred accordingly.

Discussion

The principal findings are that mild or incipient BCRL was present in seven out of 33 women (21%) treated by axillary dissection for breast cancer seven months previously and with no previous record of BCRL. Most of these women were unaware that they had arm swelling. Clinical signs of swelling arising from thickening of the skin and subcutis (Mellor et al, 2004) were identifiable, even though the increase in volume of the ipsilateral arm (compared with the contralateral arm) was slight and within the normal range of differences between dominant and non-dominant arms for age-matched healthy women.

Mild BCRL was only detected by careful clinical assessment. Lymphoedema can involve any tissue within the lymphatic basin of the damaged nodal group, including the hand, breast, and adjacent trunk, so clinical assessment must also include these regions. Comparison of ipsilateral and contralateral arm volumes may yield differences of similar magnitude as found between the arms

of healthy individuals. The availability of a pre-surgery measurement of arm volume would increase the sensitivity of volume measurement in the detection of BCRL. A further limitation when comparing ipsilateral and contralateral arm volumes after unilateral breast surgery is that contralateral arm volume could change, perhaps through greater use after surgery. In other words, the relative dominance of the arms may change. A surprising finding was that the left arm is bigger than the right in one-third of the age-matched healthy group of women. This would make it difficult to take arm dominance into account when assessing the severity of BCRL.

Studies purporting to show the prevalence of lymphoedema after breast surgery will underestimate the condition if they are based solely on the difference between ipsilateral and contralateral arm size without close clinical examination. The diagnosis of swelling is often decided on the basis of whether the ipsilateral arm is at least 2 cm greater in circumference than the contralateral arm at two points (one in the forearm and one in the upper arm). This threshold for detection is unlikely to detect mild BCRL. A difference in circumference between the ipsilateral and contralateral arms of more than 2 cm was seen in only one of the seven cases of BCRL we detected. Measurement of circumference at only two sites could result in false-negative reporting even of moderate BCRL because of the uneven distribution of swelling along the arm (Modi et al, 2005). Although the BCRL seen in the present study was incipient and mild, early diagnosis of BCRL is vital. Treatment and patient education are likely to stabilise or improve the condition, whereas if ignored, the swelling will progress. Advice on cellulitis and preventive measures can be given, and measures to stimulate lymph transport commenced (Mortimer and Levick, 2004).

Conclusions

BCRL is still common, but probably less severe than in the past because of the introduction of more conservative surgery, including SLNB, and earlier diagnosis and treatment. It is important to note that the patient may be unaware of the swelling. Careful examination of the arms of patients with breast cancer is vital. Comparison of arm volumes (or circumferences) alone, will not detect early BCRL and will result in an underestimate of its prevalence in studies of the complications of axillary surgery. Accurate detection and reporting are essential to enable prioritisation of healthcare resources in the form of dedicated lymphoedema clinics. JL

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Key Points

- Mild breast cancer-related lymphoedema of the arm (BCRL) can be difficult to detect.
- Signs to look for when diagnosing lymphoedema include decreased visibility of veins; smoothing of contours in the medial elbow region; increased skin and subcutis thickness on palpation, and pitting oedema. The oedema can be limited to certain regions, e.g. hand and wrist only, or upper arm.
- Measurement of arm volume is of little value in diagnosing early, mild BCRL, and reliance on comparison of arm volumes or circumferences will cause an underestimation of the prevalence of BCRL.
- Accurate detection and reporting of BCRL are essential to enable prioritisation of healthcare resources in the form of dedicated lymphoedema clinics.

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