Improving best practices for diagnosing lymphedema

A proposal to assess limbs according to segment

Assessing limb segments can change the rate of diagnosis for lymphedema

Introduction

Breast cancer treatment is the most common cause of secondary lymphedema (Armer, 2005). Cancer treatment results in secondary lymphedema for approximately 12-60% of breast cancer patients (ILF Best Practice for the Management of Lymphoedema—2nd edition). For most patients, lymphedema develops in the first few years following treatment; for some, it manifests clinically up to 15 or 20 years later (Pillar et al., 2009). Quinlan et al. (2014) found that the rate at which lymphedema changes over time is not influenced by the extent to which there is lymphedema shortly after surgery.

There is no cure for lymphedema and sufferers often go without adequate information about the condition. Groups such as the International Lymphoedema Framework (ILF) are working to raise public awareness of lymphedema, to encourage constituents in health care systems to prioritize diagnosis and treatment of the condition, and to improve the scientific base for its professional care. The International Society for Lymphology's (ISL) classification ranks lymphedema as mild if there is less than 20% difference in the affected and non-affected limbs, moderate if there is a 20-40% difference, and severe if the difference is greater than 40%.

There is no fail-safe method of predicting onset or risk of lymphedema in breast cancer patients (Pillar et al., 2009). But, there is some evidence that using lower thresholds in the objective measures improves prediction of future lymphedema: for instance, Mansel (2006) found that using a 4-5% threshold at 3-6 months post-surgery, over 50% of the breast cancer survivors are predicted to subsequently develop lymphedema and a 6% threshold predicted 60% will develop lymphedema at 18 months post-surgery.

Measuring arm volume is one method to determine the severity of lymphedema in breast cancer survivors, and is used to help determine treatment plans. The volume of the affected arm is compared to the unaffected arm and the difference is expressed in milliliters or as a percentage. The ILF's Best Practice document (2006), considers edema to be present if the volume of the affected limb is 10% greater than the unaffected contralateral limb. Existing diagnostic guidelines consider the whole limb (Lymphoedema Framework, 2006). Based on data from a multi-site Canadian study of breast cancer survivors, this paper argues to change these guidelines. We advocate assessing severity by considering the upper and lower arm separately. Our study's results further indicate that diagnosing lymphedema can be improved by considering arm dominance. The paper first outlines the data and methods of the study, followed by the results and then our specific recommendations to be considered in future guideline changes.

Data and method

This study uses data collected in the context of a larger parent study concerning arm morbidity in breast cancer survivors. The parent study is currently being carried out by an interdisciplinary research team with members representing oncology, family medicine, psychology, physiotherapy and sociology and has over 30 collaborators with clinical/research experience in arm morbidity.

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Beginning in 2005, data for the parent study was collected on 740 women from four Canadian locations, Vancouver, Winnipeg, Montreal, and Fredericton. Within a window of 6 to 12 months following surgery, patients were recruited into the study through the study's clinicians at each of the four sites, according to the following inclusion criteria: 1) Women 18 years of age and older; 2) English or French speaking; 3) Able to provide informed consent; 4) Unilateral breast cancer (women with bilateral breast disease were excluded because they are few in number and comparative assessment of the contralateral and ipsilateral arms is precluded); and 5) Diagnosis of Stage I-III breast cancer.

While the parent study collects data from five annual clinical assessments, this study uses data from only the last three assessments because the data from the first two assessments are inadequate for a comparison of upper lower, and total arm volumes. In each of the last three clinical assessments, seven circumferential arm measurements are taken on both arms of each subject: metacarpophalangeal joints (MCP), thumb base, wrist crease, and wrist crease +10, 20, 30, and 40 cm. Many clinicians use the elbow crease as a landmark to differentiate upper from lower arm. However, our circumferential measures are taken at prescribed distances up the arm from the wrist. The lower arm volume calculations use the circumferential measures from the MCP joints, thumb base, wrist crease, and wrist crease +10 cm. The upper arm volume calculations are based on measurements taken at 20 cm, 30 cm, and 40 cm from the wrist.

Results

The results that follow are presented in two parts. In the first part, arm dominance is not considered in the determination of lymphedema, whereas in the second part, arm dominance is taken into account. In each of the two parts, the average volume differences are plotted over the 3 clinical assessments, followed by a table with the percent and number of women in the sample with lymphedema.

Figure 1 (right) charts the excess volume in the affected arm, compared to the unaffected arm. The three lines pertain to the total, the upper, and the lower arm over the three clinical assessments. The excess volume values, expressed in milliliters, are averaged over the sample. Evident from the figure is that the majority of the excess volume in the total arm is in the upper arm. The excess volume in the lower arm contributes very little to the excess volume in the total arm.

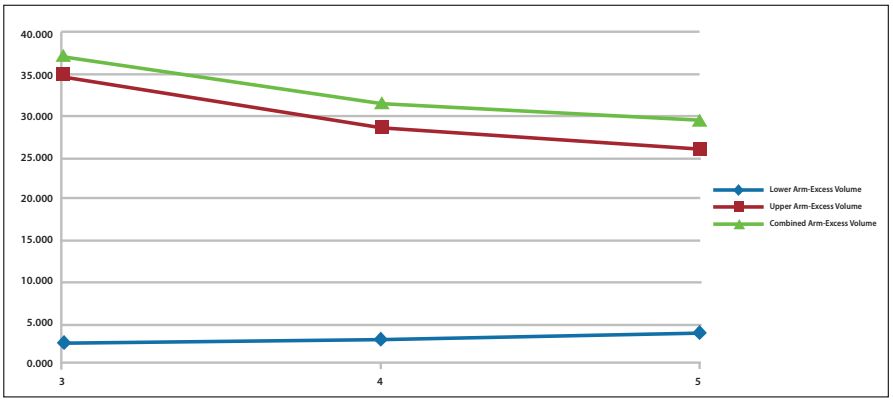

Figure 1: Excess volume in mL, affected versus unaffected, unadjusted for dominance.

Table 1 (below) provides the percentage of women in the sample (with absolute numbers in brackets) with lymphedema for each of the three clinical assessments. Lymphedema is defined as having a greater-than-10% difference between affected and non-affected arms. The three columns pertain to the percent and number of women who would be considered lymphedemic if the total arms, the upper arms, and the lower arms are compared, respectively. The comparisons of affected and non-affected arms, used for the results in Table 1, do not take into consideration arm dominance. The percentages are based on a differing number of participants, depending on the extent of missing data for each of the comparisons between affected and non-affected segments.

From Table 1, we find that for all three clinical assessments, a larger percentage of the women in the sample are considered lymphedemic by measuring and comparing arm segments rather than the measuring and comparing the entire arm. Table 1 confirms that a greater percentage of women will be diagnosed with lymphedema by considering upper arm rather than total arm.

Arm dominance

Determination of the severity of lymphedema rarely incorporates a consideration of dominance (Pillar, 2010) and few research studies incorporate analysis of dominance (see Armer, 2005; McLaughlin et al., 2008; Quinlan et al., 2014 for exceptions). The extent of clinicians' consideration of dominance in diagnosing lymphedema is yet to be studied. However, as Pillar et al. (2009) argues, it is likely that without taking dominance into consideration, patients whose affected arm is their dominant arm can be subjected to unnecessary treatment.

For the purposes of demonstrating the effect of accounting for dominance, the following results, derived by re-doing the above analysis adjusting for dominance, are discussed. In the revised calculation of differences between affected and non-affected segments, we allow a 5% difference for arm dominance, in accordance with the practice of the study's clinicians. Two examples illustrate the algorithm. Example 1: Left-sided breast cancer, woman with right dominant arm, left arm volume 10% greater than right (either whole arm, or just upper or just lower—whichever is the higher). However because she is right dominant we would subtract 5% from the right arm as dominancy allowance so her left arm is in fact 15% greater and the excess volume is more significant than was apparent before taking dominancy into consideration. Example 2: Left-sided breast cancer, woman with left dominant arm. Left arm volume 10% bigger than left. Subtracting 5% for the left dominancy effect, we get net excess volume of 5%, which we would consider borderline lymphedema and treat more conservatively. A confounding element of the procedure is that the dominant arm is identified based on handedness, not the strength or muscular dominance.

Table 2 (below) provides the percentage of women in the sample (with absolute numbers in brackets) with lymphedema for each of the three clinical assessments. Once again, lymphedema is defined as having a greater-than-10% difference between affected and non-affected arms. The three columns pertain to the percent and number of women who would be considered lymphedemic if the total arms, the upper arms, and the lower arms are compared, respectively. In Table 2, arm dominance is taken into account in the comparison of affected and non-affected sides, as described above.

TABLE 1: Percent (Number) Of Women In Sample With Lymphedema*
Not Adjusting For Dominance, By Clinical Assessment

Clinical Assessment	Comparing total arm volumes	Comparing upper arm volumes	Comparing lower arm volumes
30–36 months post-surgery	6.9% (22)	8.8% (28)	4.4% (14)
42–48 months post-surgery	5.8% (26)	6.7% (30)	4.0% (18)
54–60 months post-surgery	7.0% (30)	8.6% (37)	3.9% (17)

*Lymphedema is defined as > 10% difference between affected and non-affected arms.

TABLE 2: Percent (Number) Of Women In Sample With Lymphedema*
Adjusting For Dominance, By Clinical Assessment

Clinical Assessment	Comparing total arm volumes	Comparing upper arm volumes	Comparing lower arm volumes
30–36 months post-surgery	10.3% (33)	12.8% (41)	7.2% (23)
42–48 months post-surgery	8.2% (37)	9.6% (43)	5.6% (25)
54–60 months post-surgery	8.4% (36)	10.7% (46)	5.8% (25)

*Lymphedema is defined as > 10% difference between affected and non-affected arms.

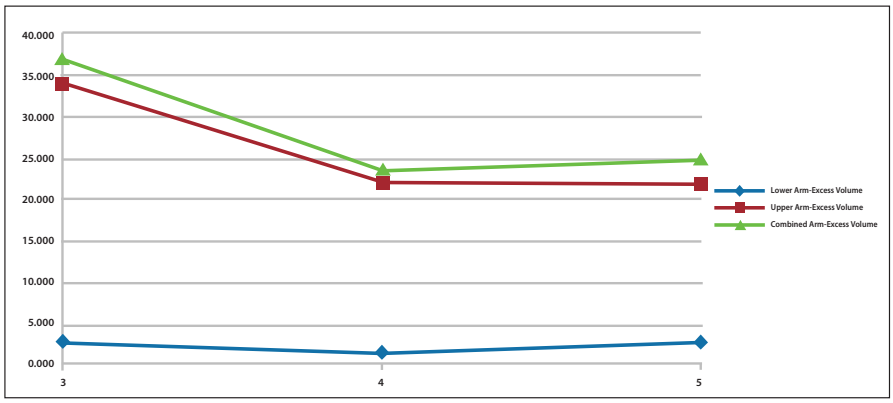

Figure 2: Excess volume in mL, affected versus unaffected, adjusted for dominance.

Figure 2 (above) charts the excess volume in the affected arm, compared to the unaffected arm. Similar to Figure 1, the three lines pertain to the total, the upper, and the lower arm over the three clinical assessments. However, Figure 2 depicts averaged volume values that are based on calculations that do account for arm dominance, as illustrated in the examples above. Like the unadjusted results, we find that the majority of the excess volume in the total arm is in the upper arm. The excess volume in the lower arm contributes very little to the excess volume in the total arm.

From Table 2, we find that for all three clinical assessments, a larger percentage of the women in the sample are considered lymphedemic by measuring and comparing arm segments rather than the measuring and comparing the entire arm. Table 2 confirms that a greater % of women will be diagnosed with lymphedema by considering upper arm rather than total arm, similar to our conclusions from Table 1.

Comparisons between Tables 1 and 2, cell by cell, reveal that adjusting for dominance yields greater percent and absolute number of women in the sample who would be considered lymphedemic. These results corroborate Quinlan et al. (2014) findings, which point to the importance of considering arm dominance when diagnosing lymphedema in breast cancer survivors.

Recommendations

The findings of our study have implications for clinicians diagnosing lymphedema. Considering differences in arm segments as well as arm dominance will lead to early detection of lymphedema, which in turn will improve management of the condition. We recommend that future international guide-

lines take this into consideration. We would suggest that if the total, upper, or lower segments are greater than 10% (in comparison to its opposite side), patients should be considered for bandaging treatment prior to being fitted for a compression garment. The bandaging should encompass the entire arm regardless of whether it is segment or the total arm found to be lymphedemic. LP

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Acknowledgement: The authors gratefully acknowledge the influence of Dorit Tidhar PT in alerting us to the importance of considering limb segments and dominancy in our clinical assessments.

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