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ORIGINAL RESEARCH

Manual Lymphatic Drainage and Active Exercise Effects on Lymphatic Function Do Not Translate Into Morbidities in Women Who Underwent Breast Cancer Surgery

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Abstract

Objective: To evaluate manual lymphatic drainage (MLD) and active exercise effects on lymphatic alterations of the upper limb (UL), range of motion (ROM) of shoulder, and scar complications after breast cancer surgery.

Design: Clinical trial.

Setting: Health care center.

Participants: Women (N = 105) undergoing radical breast cancer surgery who were matched for staging, age, and body mass index.

Interventions: Women (n = 52) were submitted to MLD and 53 to active exercises for UL for 1 month and followed up.

Main Outcome Measures: Shoulder ROM, surgical wound inspection and palpation, UL circumference measurements, and lymphoscintigraphy were performed in preoperative and postoperative periods.

Results: There was no significant difference between groups with regard to wound healing complications, ROM, and UL circumferences. After surgery, 25 (48.1%) of the MLD group and 19 (35.8%) of the active exercise group showed worsening in radiopharmaceutical uptake velocity, whereas 9 (17.3%) of the MLD group and 11 (20.8%) of the active exercise group showed improved velocity ($P = .445$). With regard to uptake intensity, 27 (51.9%) of the MLD group and 21 (39.6%) of the active exercise group showed worsening whereas 7 (13.5%) of the MLD group and 7 (13.2%) of the active exercise group showed some improvement ($P = .391$). The presence of collateral circulation was similar in both groups at both time points evaluated. The active exercise group had a significant increase in postoperative liver absorption ($P = .005$), and the MLD group had a significant increase in postoperative dermal backflow ($P = .024$).

Conclusions: MLD and active exercise effects are equivalent with regard to morbidity. Minor changes in lymphatic function associated with either MLD or active exercises were not related to patients' symptoms or signs.

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Advances in early diagnosis and breast cancer (BC) treatment in the past decades have resulted in prolonged survival (17.5y), drawing the attention not only to physical complications associated with BC treatment[1] but also to the need of performing

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preventive and rehabilitation techniques for an adequate physical and mental quality of life.[2]

Secondary lymphedema related to BC treatment is one of the most common physical complications, causing considerable functional and psychological disturbance.[2,3] Lymphedema incidence ranges from 24% to 49%[4] and may occur with minimal or no damage to axillary lymph nodes,[5] happening more commonly during the first 18 months after surgery. However, it may be developed during the immediate postoperative period or years after treatment.[5] Some of the risk factors for its development are axillary node dissection and axillary radiation therapy,[6,7] level of dissected lymph nodes, number of compromised lymph nodes,[8,9] surgical extension,[4,10,11] advanced age,[8-10] obesity, weight gain,[10] and infection.[3,10,11]

The benefits of exercises to shoulder rehabilitation after BC surgery are extensively described in the literature[2,12-15] and have become a standard practice in referral services.[12,15] However, the effects of early-stage exercises on collateral lymphatic vessel formation and lymphatic flow to promote lymphedema prevention are not fully known.[16] Although manual lymphatic drainage (MLD) is widely performed in women with lymphedema,[17] its preventive effect has been addressed in only a few randomized controlled studies.[18,19]

Studies addressing lymphedema evaluation and treatment have significant methodological variability. Similarly, tests commonly used to evaluate lymphedema (perimetry, volumetry) do not provide information on changes in the lymphatic system physiology,[20] making it more difficult to draw a comparison between incidence and results related to prevention and treatment. Therefore, effects of physical rehabilitation after BC surgery on potential short- and long-term lymphatic compensations and physical complications are still to be fully established.

Lymphoscintigraphy is the main imaging diagnostic method for peripheral lymphatic system[8,16] because it indicates and quantifies the morphological and functional characteristics of lymphatic drainage[21,22] with a specificity of 100% and sensitivity between 92% and 97%.[23,24] When performed before and after axillary dissection, it can provide some important information,[16] such as lymphatic drainage pattern alterations and lymphovenous anastomosis signs, which may be seen as early as 60 days after surgery.[6]

Thus, the aim of this study was to evaluate the effects of a treatment program based on educational strategies associated with MLD or supervised active exercises applied to patients undergoing breast cancer surgery concerning physical complications and lymphatic compensations.

Methods

Design overview and participants

A clinical trial involving women undergoing radical mastectomy because of invasive breast carcinoma was conducted at the Prof. Dr. José Aristodemo Pinotti's Women's Hospital—Women's Integrated Healthcare Center (CAISM/UNICAMP), Brazil. Women undergoing immediate breast reconstruction were excluded. Also excluded were patients who: (1) before surgery had a difference in upper limb (UL) circumference greater than 2 cm; (2) had motor deficit or infection in the UL ipsilateral to surgery; (3) had undergone radiation therapy; or (4) were unable to understand the exercises proposed.

Women meeting the inclusion criteria were invited to participate in the study. Those who agreed to participate were assigned to either the MLD or the active exercise group. Matching criteria included clinical staging, age (±10y), and body mass index (low body weight, $<18.5 kg/m^2$; normal body weight, ≥ 18.5 and $\leq 24.9 kg/m^2$; overweight, ≥ 25 and $\leq 29.9 kg/m^2$; obesity, $\geq 30 kg/m^2$). One week before surgery, patients underwent an evaluation at the physical therapy outpatient clinic, during which personal and clinical data were collected, UL circumference measurements and goniometry were performed, and the lymphoscintigraphy schedule was set. Sixty days after surgery, those women were reevaluated.

From October 16, 2006, to December 15, 2013, 115 women were included in the study (57 integrated in the MLD group and 58 in the active exercise group), enabling a 90% chance of finding substantial effects between the different physical therapy techniques used in the study.

Five women of the active exercise group and 5 of the MLD group dropped out from the study between the first and second lymphoscintigraphy procedures (fig 1).

List of abbreviations:

BC	breast cancer
MLD	manual lymphatic drainage
ROM	range of motion
UL	upper limb

Tests and examinations

UL circumference measurement

Measurements were obtained in centimeters by the principal investigator by using a flexible metric measure tape.[a] Four predetermined points were measured: (1) 7.5cm above and (2) below the elbow crease; (3) at the metacarpophalangeal joint; and (4) at the ulnar styloid process. To record natural differences between limbs, circumferences of the arms were obtained bilaterally before surgery. For lymphedema diagnosis, a difference of >2cm between arm circumferences at any point compared with the contralateral limb was considered to be of clinical significance.[25]

Inspection and palpation of surgical wound

Wound inspection was performed in each session. *Wound dehiscence* was defined as the separation of surgical wound edges. Surgical site infection was evaluated by inspection to confirm the presence of transudate, redness, and swelling and by palpation to verify hyperthermia and swelling. The presence of seroma was evaluated by palpation. Also, patients were asked if they had been submitted to needle aspiration after drain removal and provided information on the use of antibiotic therapy.

Shoulder range of motion

It was evaluated by goniometry by using a universal goniometer graded in degrees. The maximum range of motion (ROM) was considered to be 180° for flexion and abduction movements. Flexion was observed by placing a woman in the supine position and in the lateral abduction position.

Lymphoscintigraphy

It was performed at the nuclear medicine service 1 week before surgery and 60 days after surgery. The mean times were 9.25±6.20 days on preoperative examination and 68±8.3 days on postoperative examination. One millicurie (37MBq) of ^{99m}Tc dextran was administered by intradermal injection in the dorsum