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Communication

Liphedema Rehabilitation after Breast Cancer Surgery Using Combined Physiotherapy Techniques

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Abstract: Mastectomy-associated lymphoedema is a complication of the complex breast cancer therapy that affects patients' quality of life. Manual lymphatic drainage massage results in combating pressure sensation in the upper limb joints and lymphatic edema. The study is based on the hypothesis that the application of complete decongestive therapy will reduce lymphatic edema of the operated upper limb. Twenty-five patients with radical mastectomy and lymphoedema of the operated upper limb were evaluated. Circumferences of the upper limbs were measured with a tape measure at the following levels: metacarpophalangeal joint; distal radioulnar joint; forearm 10 cm distal to the elbow joint; arm 5 cm respectively 10 cm proximal to the elbow joint. Patients were given multi-layer compression bandaging, 2 sessions per week of manual lymph drainage massage, and twice weekly muscle stimulation exercises of the affected upper limbs. The results of the measurements showed significant decreases in the perimeters of the forearm and joints: metacarpophalangeal and distal radiocarpal. Patients with lymphedema secondary to mastectomy are recommended complete decongestive therapy in the early stage of the condition to improve quality of life.

Keywords: breast cancer; lymphedema management; manual lymph drainage; liphedema rehabilitation after mastectomy

1. Introduction

Lymphedema is the accumulation of lymph fluid in the tissue with hypervolemia of the affected area. The subject has the following symptoms: pain, decreased mobility of the scapulohumeral joint, and a sensation of pressure in all the joints of the upper limb. After chemotherapy, patients experience the development of lymphoedema in the upper limbs and also in the chest [1].

The design of post-mastectomy adjuvant treatment is intended to minimize the risk of neoplasm recurrence or metastasis. Although the administration of chemotherapy and local radiotherapy reduces mortality, these treatments have negative effects on the body, like, cardiotoxicity, respiratory disorders, decreased shoulder mobility (especially in the case of local radiotherapy), premature infertility, peripheral neuropathy, lymphatic edema, insomnia, anxiety, nausea, vomiting (when chemotherapy is administered). [2–5].

According to the US National Cancer Institute, a diagnostic criterion for lymphedema has not been validated. A difference of 2 cm, however, between measurements of the healthy upper limb and those of the affected limb indicates lymphatic edema.

Norman et al. identify 3 stages of lymphoedema progression: mild, moderate, or severe [6]. Tretbar et al. present 4 stages of progression of lymphatic edema as follows: stage 0 (reversible), stage

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1 (appropriately treated returns to the original form), stage 2 (tissue fibrosis, eczema, lymphatic fistulas, and erysipelas may occur), and stage 3 (elephantiasis, is an irreversible form) [7]:

Harris et al., Kayiran et al., and Torgbenu et al. provide indications and recommendations on the management and treatment of lymphedema secondary to mastectomy. All these data provide physiotherapists and patients with an early diagnosis of certainty, correct assessment of edema, and implementation of full decongestive therapy.

Lymphoedema management includes all physiotherapy tools that can be used in the treatment of lymphoedema secondary to mastectomy. The most commonly used therapy is complete decongestive therapy and consists of manual lymphatic drainage, multi-layer compression bandaging, and upper limb muscle stimulation exercises on the side of surgery [8–10].

The removal of lymph nodes in the axillary and pectoral region with mastectomy results in the obstruction of lymph circulation [11]. In conclusion, the application of lymphatic drainage massage increases the effectiveness of the physiotherapy protocol [12]. According to current studies, lymphatic drainage massage contributes to pain relief for patients who develop post-mastectomy edema [13].

Manual lymphatic drainage therapy also facilitates the prophylaxis of lymphatic edema. Massage techniques include stationary circular maneuvers (applied to the lymph nodes as well as to the arm and forearm with the fingertips and palmar facets of fingers 2-5 or with the help of the thumb), pumping techniques (performed with the palmar face of the fingers to create gentle upward pressure), arm pressures (performed by applying interdigital space between the thumb and index finger; upward pressure is applied with proximal to distal application direction).

Foldi and Strossenreuther also recommend the use of effleurage at the beginning of the massage and vibration at the end to stimulate the deep lymphatic vessels [14]. Specialists opt for a treatment initiated by a series of 10 consecutive sessions and followed by sessions performed at 2 per week. In addition, self-massage plays an important role in the daily management of lymphatic edema, which is why patients will learn self-massage techniques.

Complete decongestive therapy applied in the early stages of lymphoedema and secondary to breast cancer has long-term beneficial effects. It contributes to a considerable decrease in the volume of lymphoedema but also improves the range of motion of the affected upper limb [15–17].

2. Materials and Methods

A total of 25 subjects, who underwent surgery for breast cancer and who presented with upper limb lymphatic edema on the side of the surgery, were included in this study. The patients were evaluated by the medical doctor and treated by the physiotherapist at the Medical Rehabilitation Centre of the National University of Physical Education and Sport in Bucharest. The study was conducted following the principles of scientific research set out in the Declaration of Helsinki. The study was approved by the Ethics and Deontology Commission of the National University of Physical Education and Sport in Bucharest, with the number 19/27.09.2022.

Inclusion criteria: patients with lymphoedema after unilateral radical mastectomy surgery, who are surgically healed, do not present fever, and have no altered values of inflammatory blood markers.

Exclusion criteria: patients with integumentary lesions and altered tumor markers. Subjects who did not properly follow the physiotherapy protocol were excluded.

Circumference of the upper limb was assessed with metric tape at the metacarpophalangeal joint, distal radioulnar joint, at the forearm - 10 cm distal to the elbow joint, at the arm - 5, 10 cm proximal to the elbow joint, respectively.

A complete decongestive therapy program was performed twice a week, consisting of special massage to facilitate lymphatic stimulation, multi-layer compressive bandaging, and exercises to stimulate the muscles of the upper limb to reduce muscle hypotonia.

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Hypothesis

Terapia decongestică complete diminuează edemul limfatic la nivelul membrului superior de partea intervenției chirurgicale de mastectomie.

3. Results

Perimetry - metacarpophalangeal joints

At the metacarpophalangeal joint level, there was a decrease in the mean values obtained at the initial assessment compared to the final assessment, the difference being 0.7 cm (3.8%) from 19.0 to 18.3. The mean circumference value of the unaffected upper limb at this level is 18.5, 0.2 cm less than that of the affected upper limb.

The values obtained in the 2 assessments are homogeneously dispersed, as the coefficient of variation is constant, i.e. 5.6%. As for the minimum value, a decrease was observed from the initial assessment (17.0 cm) to the final assessment (16.5). A statistically significant difference was found between the two means (initial and final assessment), as expressed by the two-tailed t-test, where the value of the statistical significance threshold $p<0.001<0.05$ and the t-value is 7.86. The effect size (1.57) highlights the decrease in circumference at this level (Table 1).

Table 1. Statistical indicators – metacarpophalangeal joints' perimetry.

Evaluation	Statistical indicators					T-test for dependent means			
	Mean ± standard deviation	Minimum	Maximum	Amplitude	Variation coefficient	t	df	P	Effect size
Initial	19.0 ± 1.1	17.0	21.0	4.0	5.6%	7.86	24	<0.001	1.57
Final	18.3 ± 1.0	16.5	20.0	3.5	5.6%				

Perimetry - distal radio-ulnar joint

The mean circumference measured at the distal radio-ulnar joint shows a difference of 1.5 cm (7.9%) between the initial (18.5 cm) and final (17.0 cm) assessment. At this level, the mean value identified in the unaffected upper limb (16.7 cm) is lower compared to the affected upper limb by 0.3 cm.

Following statistical processing of the data, the values obtained indicate a homogeneous dispersion, as evidenced by the coefficient of variance, which at the initial assessment is 11.1% and at the final assessment 8.2%. Both minimum and maximum values decreased from 15.0 to 14.0 and from 24 to 19.5 respectively.

We also noted the existence of a statistically significant difference between the mean values, which was underlined in the two-tailed t-test by the significance threshold $p<0.001<0.05$, the t-value being 5.19. The effectiveness of the applied protocol is also evidenced by the effect size, which is 1.04 (Table 2).

Table 2. Statistical indicators – distal radio-ulnar joint perimetry.

Evaluation	Statistical indicators					T-test for dependent means			
	Mean ± standard deviation	Minimum	Maximum	Amplitude	Variation coefficient	t	df	P	Effect size
Initial	18.5 ± 2.0	15.0	24.0	9.0	11.1%	5.19	24	<0.001	1.04
Final	17.0 ± 1.4	14.0	19.5	5.5	8.2%				

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Forearm - 10 cm distal to the elbow joint

Statistical processing of the data revealed a difference between the initial (25.8 cm) and final (23.2 cm) assessment of 2.6 cm in the circumference assessment of the affected upper limb. The mean value of the unaffected upper limb is 22.4 cm, which is 0.8 cm less than the mean value obtained in the final assessment of the affected limb.

There is a statistically significant difference, given that the bilateral dependent t-test found a significance threshold of p<0.001<0.05 and a t-value of 6.55. The coefficient of variation shows that the data are homogeneously dispersed, both at baseline (11.6%) and at final assessment (9.7%). The yield of the physiotherapy protocol is evidenced by the effect size (1.31) (Table 3).

Table 3. Statistical indicators – 10 cm distal to the lateral elbow joint.

Evaluation	Statistical indicators					T-test for dependent means			
	Mean ± standard deviation	Minimum	Maximum	Amplitude	Variation coefficient	t	df	P	Effect size
Initial	25.8 ± 3.0	21.0	32.5	11.5	11.6%	6.55	24	<0.001	1.31
Final	23.2 ± 2.3	19.0	28.0	9.0	9.7%				

Arm perimetry - 5 cm proximal to the elbow joint

The data collected from the initial and final assessments were statistically and mathematically processed, and at 5 cm proximal to the elbow joint, as shown in Table 4, there is a difference of 2.5 cm (8%) between the mean values of the two assessments (31.6 - initial, 29.0 - final). The assessment was performed bilaterally for comparison. We also identified a difference of 0.9 cm between the circumference at this level of the unaffected upper limb (28.1 cm) and that of the contralateral upper limb (29 cm). The mid-and maximum values decreased from 27 to 24 and 41 to 35.5, respectively.

The data are also homogeneously dispersed, as shown by the coefficient of variance value of 11.5% at baseline and 10.1% at an endpoint. A statistically significant difference can be observed between the two mean values, which is evident when the two-tailed dependent t-test is applied, where the statistical significance threshold p-value is less than 0.001<0.05. The magnitude of the effect (1.41) suggests that the treatment applied is effective (Table 4).

Table 4. Statistical indicators – 5 cm proximal to the elbow joint.

Evaluation	Statistical indicators					T-test for dependent means			
	Mean ± standard deviation	Minimum	Maximum	Amplitude	Variation coefficient	t	df	P	Effect size
Initial	31.5 ± 3.6	27.0	41.0	14.0	11.5%	7.04	24	<0.001	1.41
Final	29.0 ± 2.9	24.0	35.5	11.5	10.1%				

Arm perimetry - 10 cm proximal to the elbow joint

Mathematical processing of the data obtained for arm circumference measured at 10 cm proximal to the elbow joint revealed a difference in mean values of 1.8 cm (5.1%) between the initial test (34.5 cm) and the final test (32.7 cm). The arm circumference of the unaffected upper limb, measured at the same level, showed a difference in mean values of 0.4 cm between it (32.3 cm) and the contralateral upper limb (32.7 cm).

Statistically, the difference between the mean values is significant, which is identified in the two-tailed dependent t-test, where the significance threshold p-value is less than 0.001<0.05. According to the coefficient of variation, the data are dispersed homogeneously, both in the initial (12%) and final (13.7%) assessments (table 5).

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Table 5. Statistical indicators of arm perimetry - 10 cm proximal to elbow joint.

Evaluation	Statistical indicators					T-test for dependent means			
	Mean ± standard deviation	Minimum	Maximum	Amplitude	Variation coefficient	t	df	P	Effect size
Initial	34.5 ± 4.2	27.0	46.0	19.0	12.0%	6.61	24	<0.001	1.32
Final	32.7 ± 4.5	25.5	46.0	20.5	13.7%				

4. Discussions

According to Ha et al., the combination of lymphatic denudation massage and neuro-proprioceptive facilitation techniques is a potential therapeutic strategy applied to patients with breast neoplasm, considering the synergistic effects they have on edema volume, pain, range of motion in the scapula-humeral joint, and quality of life. Therefore, the incorporation of proprioceptive facilitation techniques may facilitate the physiotherapy protocol [18].

Patient management of lymphedema is a decisive factor in the prophylaxis and treatment of lymphatic edema [19]. Therefore, we consider that patients should be taught different techniques of self-massage, low-intensity exercise, dry brushing, hydration, and an edema-specific diet.

At first, this type of massage was applied to treat sinusitis as well as for cosmetic purposes. Nowadays, this type of therapy is applied post-mastectomy. It consists of the rhythmic and slow application of gentle and gentle maneuvers, taking into account the directions in which lymph fluid moves toward the lymph nodes [20].

5. Conclusions

Decreased range of motion in the upper limb joints on the side of the mastectomy procedure is caused by keloid scarring, which occurs after surgery. The pain experienced by patients could be caused by ligament and muscle damage following surgery.

Chemotherapy and radiotherapy are also the main factors involved in the chronicity of pain and its possible exacerbation. This chronic, persistent pain can be a disabling factor considering the peripheral neuropathy and phantom pain experienced following surgery.

We believe that post-mastectomy, patients with edema should be offered full decongestive therapy in the early stages of lymphatic edema.

Regarding perimetry at the metacarpophalangeal joints, the bilateral dependent t-test indicates a statistically significant result. The effect size indicates a decrease in edema at this level.

The perimetry performed at the distal radioulnar joint shows a homogeneous dispersion of the data collected during the two tests: initial and final.

For forearm circumference measured at 10 cm distal to the elbow joint, the effect size (1.31) shows a quantitative difference between the mean values obtained in the assessment of the subjects. At the same time, at the arm level, both at 5 cm and 10 cm proximal to the elbow joint, respectively, the bilateral dependent t-test revealed a statistically significant difference between the two mean values.

Thus, we can affirm that the applied physiotherapy protocol is effective and the hypothesis of the study is confirmed.

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