DECOMPRESSION TREATMENT OF ARM LYMPHEDEMA IN PATIENTS WITH BREAST CANCER DEPENDING ON THE DOMINANCE OF THE AFFECTED ARM

LILIANA-ANTOANETA VIȘU[1], MIHAI POPESCU[2], VALENTIN TITUS GRIGOREAN[3], OANA ILONA DAVID[4], ALEXANDRU BLIDARU[5]

[1,3,5]"Carol Davila" University of Medicine and Pharmacy Bucharest,
[2]University of Pitești, [4]"Bagdasar-Arseni" Emergency Clinical Hospital, Bucharest

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Abstract: *Arm lymphedema affects a significant part of patients treated for breast cancer and is an important factor in reducing the quality of life of these patients. Early symptoms for lymphedema are subtle, they can be limited to fatigue sensation of the upper limb, slight sensations of tingling or pain, sporadically swelling and de-swelling of the affected limb or segments of it. Along with the progress of the lymphedema, other symptoms may appear, such as: decreased mobility and functionality, severe pain of the affected arm and important increase in the volume of the affected arm. The non-surgical treatment (decompression) of lymphedema contributes to decrease in volume and increase in mobility and functionality of the affected limb, in order to allow the patient to perform daily activities as close to normal as possible.*

INTRODUCTION

Over the last few years, survival rate for the people suffering from breast cancer is continually increasing both due more efficient treatment and to the possibility to detect the disease in a less advanced state, the detection being an important factor in increasing the 5-year survival rate.(1) The association of factors like extended axillary lymphadenectomy, axillary radiotherapy, obesity, infections of the affected superior limb may increase the risk of arm lymphedema in patients with breast cancer. Therefore, it is mandatory to reduce the influence of these risk factors in order to decrease the incidence of lymphedema, and, in the case of occurrence, to use the right treatment, capable of reducing the negative impact of arm lymphedema on the patient's quality of life. The early symptoms in case of lymphedema are subtle, they can be limited to fatigue sensation of the upper limb, slight sensations of tingling or pain, intermittent swelling of the affected limb or segments of it ("*fleeting lymphedema"*). Often, patients in this stage of disease, ignore these signs and symptoms, being able to continue with cvasi-normal daily activity. With the progress of lymphedema, other symptoms may appear, such as: decrease in arm mobility and functionality, intense pain, frustration, fury, depression (2), swelling of the hand without remission. If not treated in this stage, the lymphedema may lead to important increase in volume of the affected limb, severe pain, chronic infection, lymphorrhea and even lymphoangiosarcoma. Currently, the non-surgical standard treatment of arm lymphedema, secondary to breast cancer treatment consists in *combined physical therapy* (*CPT*) including, at first, *manual lymphatic drainage* (*MLD),* compression bandage, therapeutic exercise and skin care (3). The purpose of the second stage is optimizing the results obtained in the first stage and consists in continuing skin care and physical exercise as well as using decompression gloves.(4) Several studies show a significant decrease of lymphedema after decompression treatment.(5,6) Over the last few years, during massage therapy, *pneumatic compression devices (PCDs)* have beentried on. Studies show encouraging results, especially in using intermittent pneumatic compression devices.(7,8,9,10)

PURPOSE

The objective of the current study consists in evaluating whether the efficiency of the decompression treatment (with pneumatic compression devices), in case of arm lymphedema secondary to breast cancer treatment, depends on which hand is affected (dominant or non-dominant).

METHODS

Selection of the patients. The study included 54 female subjects (patients), who underwent one or more treatment series, from which a series is dedicated to treating the arm affected by lymphedema. Only one patient had bilateral lymphedema; this particular situation being registered as two separate cases in our study. Also, three cases were eliminated, the treatment for these patients being interrupted after a reduced number of sessions, thus resulting a total of 55 cases.

The patients excluded from the study were those with contraindication for pneumatic compression (deep vein thrombosis certified by Doppler imaging, infection of the affected limb, renal or heart failure, intense pain, pleurisy, history of pulmonary thromboembolism, skin grafts, disease in evolution).

Instruments and method. A treatment session contained lymphatic massage with a pump (1 session of 27 minutes twice a week), compression bandaging at the end of each massage session, therapeutic physical exercise. During massage a *pneumatic compression devices with intermittent sequential compression* was used. This pump is composed of an air compressor, an inflatable glove with multiple chambers that inflate-deflate along the arm, and intermittently along established regions, following a program pre-set by the manufacturer. Lymph propulsion from the extravascular space towards the lymphatic collecting ducts and finally, through the axilla towards the body's main lymph collectors is performed. Measurements of the affected limb were performed, using

[1]Corresponding author: Liliana Antoaneta Vișu, B-dul Ion C. Brătianu, Nr. 1, Sector 3, București, România, E-mail: lilianavisu@gmail.com, Phone: +4021 3874258
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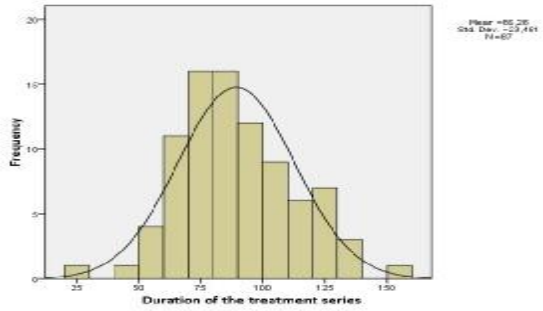
centimetre tape, before and after massage therapy using the pump. The first measurement of the circumference was performed at the radiocarpal joint and then every four centimetres. Patients were divided into two groups, depending on the presence of lymphedema on the dominant or non-dominant hand. Measurements at level 0 (radiocarpaljoint), at 8, 16, 24, 32 and 40 centimetres were studied. The data obtained was introduced in a SPSS database (v. 16) and analysed afterwards using this statistic package.

RESULTS AND DISCUSSIONS

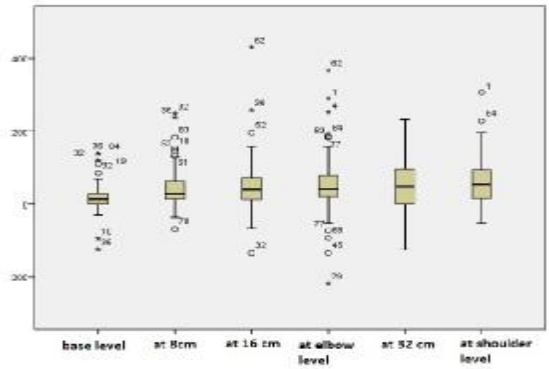
The patients mean age was 57.3 years (standard deviation=11.2 years), at the studies start point. The patients underwent a total of 87 series of treatment sessions. The treatment series duration is distributed as seen in figure no. 1.

Figure no. 1. The distribution of the treatment series duration



For the comparative evaluation of effects an efficiency indicator was assembled, which takes into account the evolution of the section of the arm treated in six measuring positions. Figure no. 2 presents, in comparisons, the sections evolution box-plots in all six measurement positions. The fact that the effects are different is obvious.

Figure no. 2. Comparison between the evolution of sections of the treated arm, between the initiation and the ending of the treatment series, in all six measuring positions (Vertically the measurement unit is square centimetre, negative values corresponding to unfavourable evolutions)



Interpretation. The fact that both the mean and median of the efficiency indicator are positive shows that the treatment is effective. More precisely, we can calculate the statistical significance attached to the statement: "as a result of treatment the efficiency indicators value is over 35 cm^2". The statistical significance is 0.025, under the value 0.05 (as seen in table no. 1), which means that the previous statement is statistically significant.

Objective: Is the effect of treatment different for the dominant and non-dominant arm? It is possible that the efficiency of treatment is different for dominant or non-dominant arm. By "dominant arm" we understand the hand frequently used by patient during daily activities. The main descriptive statistical indicators, for the value of the indicator of treatment efficiency, for the two situations, are showed in table no. 2:

Table no. 1. Result of paired t-test for evaluating statistical significance

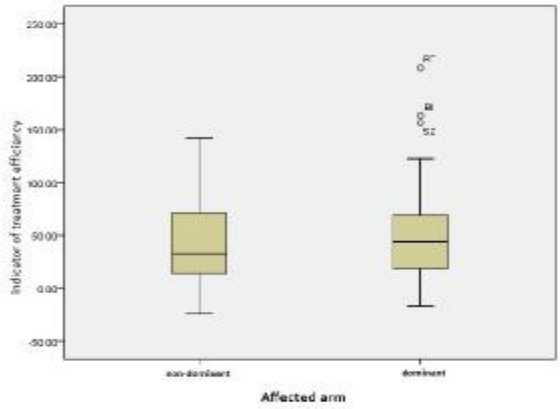
	Paired Differences				
	Mean	Std. Deviation	95% Conf. Interval of the Difference		Sig. (2-tailed)
			Lower	Upper	
Indicator of treatment efficiency-35	11.13	44.641	**1.442**	**20.818**	**0.025**

Table no. 2. The values of the indicator of treatment efficiency in case of dominant and non-dominant arm

Arm affected	N	Minimum	Median	Mean	Std. Dev.	Maximum
Non-dominant	34	-24.29	32.79	**41.50**	43.05	142.18
Dominant	50	-16.73	43.72	**49.28**	45.86	208.50
Total	84	-24.29	39.94	46.13	44.64	208.50

and, for clarity, the data for the two possible situations is presented in the following box-plot (as seen in figure no. 3):

Figure no. 3. The indicator of treatment efficiency in the dominant arm/non-dominant arm



As observed in the box-plot (and in table no. 2) the values of the indicator of treatment efficiency are better in case of treatment of the dominant hand: median 43.72 and mean 49.28 in case of the dominant hand, as opposed to 32.79, respectively 41.50 in case of the non-dominant hand.

The histograms for the values of the indicator of treatment efficiency for the two groups, overlapped by the optimal normal distribution curves, are presented in figure no. 4.

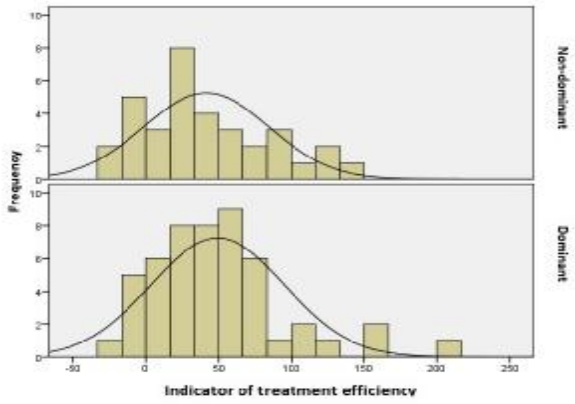
Apparently, the deviations from normal values are not drastic, which justifies using t-test (unpaired, unilateral). The result of this test is the significance (P value) attached to the statement: "the values of the efficiency indicator are higher in case of treatment for the dominant hand". More specific, using the t-test implemented in SPSS leads to the following results, as shown in table no. 3

Since the Levene's test for equality of group variations ("those who were treated for the involvement of the dominant hand" versus "those who were treated for the involvement of the non-dominant hand") reaches the significance value 0.947, which is very close to 1, we can accept the equality. Thus the expected result can be read on line 1-a.

Table no 3. T test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Indicator of treatment efficiency	Equal variances assumed	0.004	0.947	0.782	82	0.436	7.78	9.95	-12.01	27.578
	Equal variances not assumed			~~0.792~~	~~73.93~~	~~0.431~~	~~7.78~~	~~9.83~~	~~-11.80~~	~~27.36~~

Figure no. 4. Histograms of the indicator of treatment efficiency in the dominant /non-dominant hand



The difference between group means is 7.781cm^2 (=49.28-41.50), favouring those who were treated for dominant hand lymphedema. Still, the confidence interval is 95% for this difference (-12.02, +27.57), therefore it contains 0, thus the difference of efficiency is not statistically significant. (In fact, the statistical significance is 0.218, very week, way above 0.05).

So, we cannot state that the effect of the treatment would depend on the treated hands dominance.

If we are unwilling to accept the normality of the data in the groups – see histograms from figure no. 4, which reveals important deviations from the normal optimal curves – then we have no theoretical justification for applying t-test. However the Mann-Whitney non-parametric test, which evaluates the statistical significance of the statement depending on the rank of the value, does not depend on the normal distribution of data. This test compares mean rank, the group with the higher mean rank being "better" (see table no. 4).

Table no. 4. Non-parametrical Mann-Whitney test

	Affected arm	N	Mean Rank	Sum of Ranks
Indicator of treatment efficiency	Non-dominant	34	**41.41**	1408.00
	Dominant	53	**45.66**	2420.00
	Total	87		

Table no. 5. Mann-Whitney test for the "affected arm" variable

	The indicator of treatment efficiency
Mann-Whitney U	813.000
Asymp. Sig. (2-tailed)	0.444

A discrepancy between the mean ranks is observed, favouring the group in which the treatment was conducted for the dominant hand. The statistical significance of this discrepancy is evaluated based upon the U statistic (Mann-Whitney); the value is 0.222 (as seen in table no. 5). Irrespective of the test we use to study the data, parametric or not, no difference of efficiency is confirmed between the two groups, therefore it is unimportant if the treated hand is dominant or not.

CONCLUSIONS

For the group of the patients included in the present study there are no statistically significant differences between the treatment efficiency for dominant and non-dominant arm.

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