Vascular physiotherapy in treatment of chronic venous disease

Fisioterapia vascular no tratamento da doença venosa crônica

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Abstract

Background: In chronic venous disease (CVD), vascular physiotherapy in the form of therapeutic exercises and manual lymph drainage (MLD) contributes to reducing vascular disorders, with improved venous return, reduced venous stasis and improved clinical status. **Objective:** To investigate the efficacy of vascular physiotherapy in treatment of CVD. **Methods:** A prospective, longitudinal pilot study that assessed ten patients with CVD, with CEAP classifications from 1 to 5. Patients were administered the SF-36 and AVVQ quality of life questionnaires and underwent water plethysmography and goniometry of the lower limbs. After initial assessments they were given ten 60-minute sessions of vascular physiotherapy consisting of therapeutic exercises and MLD. After treatment they were once more assessed using the same questionnaires and methods for volumetric measurement and assessment of joint movement amplitude (JMA). **Results:** The patients were all female, with a mean age of 43.1 years. Their predominant positions during practical activities of life was prolonged and orthostatic. The majority of the patients had a CEAP classification of C_3 and just 10% were C_2. When questioned about their principal complaints, they reported feelings of heaviness and tiredness in their limbs, pain in their legs, itching and swelling. After the vascular physiotherapy sessions all patients were free from complaints. Both JMA and quality of life improved significantly after the intervention with vascular physiotherapy. **Conclusions:** Vascular physiotherapy contributed to controlling the clinical manifestations of CVD, improving edema and JMA, and promoting improved quality of life for patients.

Keywords: venous insufficiency; physiotherapy methods; lymphatic system.

Resumo

Contexto: A aplicação da fisioterapia vascular através dos exercícios terapêuticos e da drenagem linfática manual (DLM) na Doença Venosa Crônica (DVC) contribui para a minimização das alterações vasculares, com melhora do retorno venoso, diminuindo a estase sanguínea e contribuindo para a melhora do quadro clínico. **Objetivo:** Verificar a eficácia da fisioterapia vascular no tratamento da DVC. **Métodos:** Estudo-piloto prospectivo longitudinal, que avaliou dez pacientes com DVC, com classificação CEAP (1-5), que responderam aos questionários de qualidade de vida (QV) SF-36 e AVVQ, sendo submetidos a pletismografia a água e goniometria dos membros inferiores. Finalizada a avaliação inicial, receberam tratamento fisioterapêutico vascular, com exercícios terapêuticos e DLM, em dez sessões de 60 minutos. Após tratamento, foram novamente avaliadas pela aplicação dos questionários iniciais e realização dos métodos de mensuração volumétrica e de amplitude de movimento articular (ADM). **Resultados:** Pacientes do gênero feminino, com idade média de 43,1 anos. Nas atividades de vida prática (AVPs), a posição predominante foi ortostatismo prolongado. Na classificação CEAP, a maioria das pacientes apresentou C_3 e apenas 10% delas eram C_2. Nos questionamentos sobre suas principais queixas, relataram sensação de peso e cansaço nos membros, dor nas pernas, prurido e edema. Após as sessões de fisioterapia vascular, todas as pacientes encontravam-se sem queixas. A ADM e a QV apresentaram melhora significativa após intervenção da fisioterapia vascular. **Conclusão:** A fisioterapia vascular contribui para o controle do quadro clínico da DVC, melhorando edema e ADM, e favorecendo a melhora da QV dos acometidos pela doença.

Palavras-chave: insuficiência venosa; modalidades de fisioterapia; sistema linfático.

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INTRODUCTION

The importance of Vascular Physiotherapy for management of chronic venous disease (CVD) is founded on the facts that this treatment prevents exacerbation, promotes and recuperates health, is an aid in treatment of this vascular condition and improves circulatory function and condition, preventing people from losing function and minimizing the clinical consequences of the disease.[1,2]

Therapeutic exercises are an effective treatment method for CVD. With regard to neuromuscular exercises, there is evidence that training the musculature of the calf is an activity that is capable of reducing reflux of blood and improving competence of the veins, reducing the discomfort and harm caused by this dysfunction.[3]

Vascular physiotherapy treatment programs for CVD, known as vascular kinesiotherapy, should comprise three phases: warm-up, training and relaxation.[4] The objectives of the first phase (warm-up) are to increase blood flow in the muscles and baseline oxygen consumption and also to achieve psychological effects, which are primarily manifest as a feeling of preparation.[5,6]

The training phase can be performed using resistance exercises, offering improvements in ejection of the venous volume and increased resistance of the calf muscles and also a consequent improvement in performance of activities of daily living. These can also be combined with aerobic exercises to make even greater use of the calf, facilitating venous return and promoting greater range of movement in the metatarsophalangeal and talocrural joints.[4,7,8]

The training program should end with relaxation, with a gradual deceleration in exercise intensity, with a reduction in sympathetic nerve stimuli and increase in parasympathetic stimuli, leading to peripheral vasoconstriction, for which manual lymph drainage (MLD) can be used.[6,9] This, in turn, is a noninvasive technique that provides therapeutic benefits by relaxing the patient, reducing venous stasis and promoting venous return,[9-11] leading to detoxification of interstitial tissues and improving oxygenation and cell nutrition,[12] reducing patients' clinical manifestations, with a positive influence on their quality of life (QoL).

Chronic venous disease is caused by malfunction of certain valves, which may or may not be associated with obstruction of venous flow and can affect both superficial and deep venous systems, the underlying condition of which is venous hypertension.[4]

In view of the growing incidence of CVD and the scarcity of studies investigating the use of vascular physiotherapy in this disease and the great benefits offered by physiotherapy, it is opportune to verify the efficacy of vascular physiotherapy for treatment of chronic venous disease.

MATERIALS AND METHODS

This study was approved by the Research Ethics Committee at the Universidade Estadual de Ciências da Saúde de Alagoas (UNCISAL) under CAAE No. 13991713.9.0000.5011/2013, in accordance with the Ministry of Health's National Health Council resolution 196/96, which regulates research involving human beings.[13] It was conducted in the city of Maceió, AL, Brazil, from October to November of 2013 and is a prospective, longitudinal pilot study.

Sampling was non-probabilistic, and the study sample comprised ten patients from the Delza Gitaí teaching clinic, who underwent vascular physiotherapy with therapeutic exercises and manual lymph drainage.

The sample comprised female patients, with CVD classified as clinical 1-5 according to the CEAP system (Clinical Manifestations, Etiologic Factors, Anatomic Distribution of Disease, Pathophysiologic Findings).

The CEAP classification is a system that categorizes CVD according to clinical manifestations, etiologic factors, anatomic distribution and pathophysiology. The clinical signs of CVD are classified as follows: C_0 - no visible or palpable signs of venous disease; C_1 - telangiectasies or reticular veins; C_2 - varicose veins; C_3 - edema; C_4 - changes to the skin and subcutaneous tissues caused by venous disease; C_5 - skin changes with healed ulcer, and C_6 - skin changes with active ulcer.[14-17]

Patients with the following characteristics did not take part in the study: age less than 18 years; concurrent arterial and lymphatic abnormalities; diabetes; hypertension; neuropathies; erysipelas; lymphangitis; acute deep vein thrombosis; non-venous ulcers; use of elastic compression stockings/bindings; psychiatric disorders and/or dementia (physician-diagnosed); clinical instability; or age greater than or equal to 60 years plus cognitive abnormalities, according to the Mini Mental State Examination (MMSE).

The MMSE is a scale for assessing specific cognitive functions by screening for cognitive dysfunctions with origins in organic brain disorders (spatial and temporal orientation, attention, reading, writing, memory and visual constructive capacity). It can have a score of 0 to 30 points and takes 5 to 10 minutes to administer.

People who met the research inclusion criteria were invited to take part and, if they accepted, signed a free and informed consent form providing all information relating to the study.

After signature of the free and informed consent form, data were collected using a form designed by the researchers covering name, age, sex, height, weight, body mass index (BMI), profession, educational level, personal history, principal and secondary complaints and CEAP classification.

Two QoL questionnaires were administered: the Short Form-36 (SF-36) and the Brazilian version of the Aberdeen Varicose Veins Questionnaire (AVVQ-Brazil). Participants also underwent water plethysmography (volumetric measurement) of the lower limbs (LL) and goniometry (measurement of the amplitude of movement) of the ankles.

The SF-36 is a multidimensional QoL questionnaire comprising 36 items distributed across eight domains (functional capacity, role physical, pain, general health status, vitality, role social, role emotional and mental health) that has been validated for Brazil. The total score ranges from zero to 100, with zero indicating the worst general health status and 100 the best health status.[18]

The AVVQ-Brazil questionnaire comprises 13 questions that relate to quality of life with CVD in the lower limbs and also cover disease severity, distributed across four domains: pain and dysfunction, esthetic appearance, extent of varicosity and complications, with scores ranging from zero to 100, where zero represents the best score (no evidence of the disease) and 100 the worst (greatest disease severity).[19,20]

Volumetric measurement of limbs was conducted using a hand-built glass plethysmograph with the following dimensions: 40 cm high × 25 cm in wide × 32 cm deep, with a 3.5 cm gap between the top of the vessel and the overflow drain. All measurements were performed by the same examiner, using a basin with two drains (one for adjusting the water level and the other for the water displaced during measurement), at room temperature and for both LL of all patients. Measurements were conducted in duplicate for each limb and the mean calculated.

The water displacement technique was used for feet and legs. This method is known as water plethysmography and it is assumed that the immersed volume of the extremity is equivalent to the volume of water that is displaced into a recipient in which the excess volume is measured in absolute numbers.[21-23]

In order to obtain precise values, after filling the plethysmograph, the tap was opened until no further water poured out, to set the level of the surface of the water and then the tap was closed again and the water that had drained out during this process discarded.

The patient was requested to assume an orthostatic position, back to the wall, and then immerse one lower limb at a time into the plethysmograph. An empty recipient was placed below the tap and then the tap was opened for a standard interval of 1 minute. The volume of water displaced during this interval of time was weighed in a high-precision balance and then the results converted from grams (g) into milliliters (mL).

Ankle mobility was assessed by goniometry, which is a method for measuring joint movement amplitude (JMA), using a universal goniometer (Carci® brand), and is easy to administrate, noninvasive and inexpensive.[24,25] After the movements to be performed during the test had been demonstrated to patients, they were requested to conduct the following movements to the maximum amplitude: plantar flexion, dorsiflexion, adduction and abduction of the ankle. Three JMA measurements were taken for each movement and the means were calculated.

In all cases these measurements were conducted by two examiners. One of them stabilized the goniometer while the other took the readings. For plantar flexion and dorsiflexion, JMAs were measured with patients in decubitus dorsal, with feet in a neutral position and beyond the bench. The goniometer's pivot was positioned over the ankle joint, at the lateral malleolus, the fixed arm was aligned with the lateral midline of the fibula and the movable arm was aligned parallel to the lateral surface of the fifth metatarsal.

During measurement of the JMAs for adduction and abduction, patients were positioned sitting down with the knees at 90° and the feet in plantar flexion. The examiner instructed them not to rotate the knees or hips during the test. In this case the pivot of the goniometer was positioned at the tibiotalar joint with the fixed arm aligned parallel to the anterior border of the tibia and the movable arm over the dorsal surface of the second metatarsal.

After the initial assessment, patients followed a physiotherapy treatment protocol comprising 10 sessions with an average duration of 60 minutes, three times a week, with emphasis on the lower limbs. They were assessed again at the end of the treatment sessions, with administration of the same questionnaires and measurements of limb volumes and JMA. The physiotherapy protocol consisted of three stages:

Warm-up: starting with stretching of the hamstrings and triceps surae, conducted in a static position maintained for 20 seconds and repeated four times, as described

by Lima et al.[4] During the same stage, metabolic ankle exercises were also conducted, combining exercise of the ankle with subtalar movements, as described by Meyer et al.[26] Each exercise was initially conducted in two series of 10 repetitions, later progressing to three series, in decubitus dorsal with the LL elevated on a foam support with a height of 20 cm, and with the joints free.

Training: consisting of vascular kinesiotherapy using resistance exercises for the calf,[4] initially conducted in two series of 10 repetitions, later progressing to three series. Aerobic exercises in the form of a 10-minute walk on a treadmill were also included.

Relaxation: MLD massage,[9] with surface stroking and pumping (Vodder technique), for 30 minutes, starting with emptying of the lymph nodes and with patients in decubitus dorsal with the LL raised.

Primary variables were the domains of the SF-36 and AVVQ questionnaires, water plethysmography results and goniometry measurements of the ankles. Secondary variables were age, sex, BMI, educational level and CEAP.

Statistical analysis was performed using the Wilcoxon test for plethysmography and goniometry results and the domains of the SF-36 and the AVVQ. A significance level of $p<0.05$ was adopted for these tests,. Analysis of data was conducted with the aid of SPSS version 17.0.

RESULTS

The sample comprised ten female patients aged from 24 to 54 years, with a mean age of 43.1 (±9.4). The majority had not completed primary education (80%).

The patients' predominant position during practical activities of life was prolonged standing, accounting for nine (90%) of the participants, followed by prolonged sitting, in one case (10%).

It was observed that eight (80%) patients had not previously undergone surgery for varicose veins, while two (20%) of them had. With regard to CEAP clinical classification, nine (90%) patients were C_3 and one (10%) was C_2.

Body Mass Index (BMI) results demonstrated that eight (80%) patients were overweight (BMI= 25-30), whereas two (20%) were classified as healthy (BMI= 18.5-25).

Before the interventions, when asked about their most important complaints (primary symptomology) in the LL, five (50%) reported feelings of heaviness and tiredness; three (30%) of leg pain; one (10%) of itching, and one (10%) of edema. When asked about secondary symptomology, two (20%) complained of tiredness; four (40%), of leg pain, and four (40%) of edema, as can be observed in Figure 1.

At the end of the ten vascular physiotherapy sessions, patients were reassessed and 100% of them were free from primary and secondary complaints.

The results of volumetric measurements revealed that the mean volume of water varied from one side to the other. The initial assessments of right lower limbs (RLL) resulted in a mean volume of 1,430.9 mL (±234.2), which reduced to 1,287.3 mL (±217.3) after vascular physiotherapy, which is a difference of 143.6 mL. For the left lower limb (LLL), means were 1,388.6 mL (±224.9) before and 1,274.8 mL (±239.4) after treatment, which is a difference of 113.8 mL, as shown in Table 1.

The goniometry assessments demonstrated significant gains in JMA for all movement variables after vascular physiotherapy. Results for degrees of ankle movement are expressed as means with standard deviation and are shown in Table 2 together with their *p* values.

All of the mean scores for the AVVQ-Brazil domains reduced from their initial values after the vascular physiotherapy sessions, indicating improvement in the patients' disease-specific QoL, as can observed in Table 3.

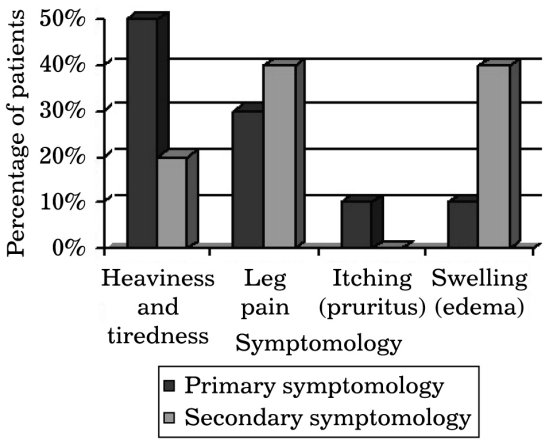

Figure 1. Distribution of patients by primary and secondary symptoms.

Table 1. Means, standard deviations and *p* values for volumetric measurement of lower limbs, before and after treatment.

Volumetric measurements	Before		After		p*
	M	SD	M	SD	
RLL	1430.9 mL	234.2 mL	1287.3 mL	217.3 mL	0.008
LLL	1388.6 mL	224.9 mL	1274.8 mL	239.4 mL	0.008

*Statistical significance ($p<0.05$). Wilcoxon's nonparametric test; M: Mean; SD: Standard deviation; RLL: Right lower limb; LLL: Left lower limb.

Table 2. Reference values for normal JMA, and means, standard deviations and *p* values for goniometry of ankles, before and after treatment.

Goniometry	JMA	Before		After		p*
		M	SD	M	SD	
Dorsiflexion RLL	20°	14.9°	3.8°	19.8°	0.6°	0.010
Plantar flexion RLL	45°	37.6°	6.2°	43.0°	2.9°	0.017
Adduction RLL	20°	10.8°	3.0°	16.6°	4.2°	0.011
Adduction RLL	40°	26.1°	6.9°	33.4°	8.3°	0.007
Dorsiflexion LLL	20°	15.5°	4.4°	19.1°	1.7°	0.018
Plantar flexion LLL	45°	37.8°	3.9°	43.0°	3.6°	0.008
Adduction LLL	20°	12.5°	4.2°	16.8°	3.9°	0.007
Adduction LLL	40°	25.8°	8.4°	32.8°	8.5°	0.012

*Statistical significance (p<0.05). Wilcoxon test; JMA: Amplitude of movement; M: Mean; SD: Standard deviation; RLL: Right lower limb; LLL: Left lower limb.

Table 3. Mean total score and domain scores for AVVQ-Brazil before and after treatment with *p* values.

AVVQ-Brazil	Before	After	p*
Domain	M	M	
Total score	26.4	14.2	0.005
Pain and dysfunction	38.5	4.7	0.008
Aesthetic appearance	77.4	55.8	0.018
Extent of varicosity	22.8	17.6	0.005
Complications	12.4	4.7	0.017

*Statistical significance (p<0.05). Wilcoxon test; M: Mean score. AVVQ: Aberdeen Varicose Veins Questionnaire.

Table 4. Mean scores for SF-36 domains before and after treatment and *p* values.

SF-36	Before	After	p*
Domain	M	M	
Functional capacity	39.0	80.0	0.005
Role physical	15.0	90.0	0.005
Pain	70.0	93.8	0.005
General health status	42.0	86.8	0.005
Vitality	37.0	77.5	0.005
Role social	45.0	88.8	0.005
Role emotional	30.0	90.0	0.014
Mental health	51.6	73.2	0.005

*Statistical significance (p<0.05). Wilcoxon test; M: Mean score. SF-36: Short Form-36.

Mean scores for all of the domains of the SF-36 questionnaire increased after vascular physiotherapy treatment, indicating improvements in general QoL for all aspects assessed, as shown in Table 4.

DISCUSSION

All of the ten patients studied were female. There are statistical data showing that CVD patients are predominantly women,[17,27,28] due to hormonal factors and also aesthetic reasons that mean that women seek treatment three times more often than men.[29]

Comparison of the characteristics of the sample assessed in this study with the results of certain prevalence studies shows that both the risk factors for CVD and the age range are in line with the literature. The average age was 43.1 years, and it has been observed that the prevalence of CVD increases progressively with age from the third decade of life onwards and, according to Evans et al.,[30] there is a progressive increase in the frequency of varicose veins from puberty onwards.

There is no consensus in the literature on predominant physical posture as a risk factor for CVD. Activities that require people to remain standing or sitting for long periods have a significant link to development and maintenance of the disease and also to the emergence of ulcers and to whether they become chronic.[31] This study found that the majority of patients remained standing for prolonged periods, which can provoke muscle fatigue and deterioration of the capillaries, compromising blood and lymphatic circulation and making the emergence of circulation disorders more likely.

Studies demonstrate a predominance of CVD among people with low educational levels, correlating this factor with their working conditions, understanding of how to care for their health and a lack of economic planning, interfering with access to treatments and making it more likely that the condition will become chronic.[32] This was borne out in the present study, in which the majority of patients had not completed primary education.

None of the patients in this study were classified as obese, but 80% of them had high BMI and were classified as overweight. It is probable that both obese and overweight people have increased compression of abdominal veins caused by increased abdominal volume and also have sedentary lifestyle habits, which can be correlated with worsening of varicose veins in the LL, since the calf muscle pump is compromised.[2,29]

The CEAP classification results in this study showed that there was a predominance of patients with C_3, and edema is present in classes from C_3 onwards. It is worth pointing out that, according Timi et al.,[33] this can contribute to reducing the amplitude of ankle joint movement, which in turn reduces in proportion to disease progression.

Volumetric measurements of the LL were conducted using the water displacement technique, which demonstrated a significant difference in volume after physiotherapy treatment. This is considered, by many authors, to be 100% reliable for precise measurement of the volume of the limb and for estimating variations in volume in relation to other specific factors.[21]

The results of this study demonstrate the reliability of goniometry measurements, since by using them it proved possible to verify improvements in the amplitude of all movements of the ankle after the intervention with vascular physiotherapy. This is in agreement with Nolasco et al.[34] who state that goniometers are reliable and easy-to-use instruments that can be used to monitor the progress of patients and, primarily, verify the efficacy of procedures employed to improve the JMA of the ankle.

The SF-36 and AVVQ-Brazil were used as instruments to assess the QoL of patients with CVD. Some authors state that these assessment methods are capable of monitoring patient progress and response to treatment, assessing the quality of healthcare,[35] which was the case in the present study, in which these instruments demonstrated improvements in the QoL of the patients in all of the aspects assessed.

This study demonstrated that the patients' clinical status improved significantly after vascular physiotherapy, eliminating their complaints of tiredness and pain, reducing swelling and increasing amplitude of ankle movements and, consequently, improving their QoL. According to some studies, physical exercises increase blood flow and muscle strength and resistance, in addition to improving venous hemodynamics and joint mobility, which improves the symptoms listed above, thereby improving the QoL of people with CVD[4,26,36].

In addition to the physical exercises, MLD is another physiotherapy resource that can be used for treatment of CVD, since it can ameliorate the changes caused by the disease through a global approach to the patient, resulting in improved mobility and reduced edema and pain, and better performance in functional activities,[26] in confirmation of the results demonstrated in this study.

As such, this study provides evidence, in clinical practice, of significant improvement in the clinical status of patients after intervention with vascular physiotherapy, and these improvements are proven by the very satisfactory statistical results.

It is therefore suggested that further research into the subject be conducted with larger numbers of participants in order to obtain additional information on the benefits of physiotherapy treatment for CVD.

CONCLUSIONS

Vascular physiotherapy is capable of modifying clinical status in CVD, promoting a positive change to the health status of patients and, consequently, a real improvement to their quality of life.

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