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ORIGINAL ARTICLE

MUSCULOSKELETAL PAIN ASSESSMENT IN PARTICIPANTS OF A CARDIOPULMONARY AND METABOLIC REHABILITATION PROGRAM

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Background: Patients with cardiovascular diseases associated with musculoskeletal disorders may have pain when participating in Cardiopulmonary and Metabolic Rehabilitation (CPMR). **Objective:** To determine the presence, quantity, intensity and locations of musculoskeletal pain at rest and during physical exercise before and after CPMR. **Methods:** The subjects were evaluated by the Locomotor System Assessment Inventory before and after three months of CPMR. **Results:** 57% of the 37 patients (61 ± 10 years) reported pain at baseline. There was no reduction in the amount of rest pain after three months, but a reduction in the amount of pain during physical exercise (p=0.03). There was no change in pain intensity at rest after CPMR and it worsened from exercise. The most frequently reported local pain at all times was in the lumbar spine and knees. **Conclusion:** The CPMR program helped reduce the amount of pain during exercise, however, without modifying its intensity.

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INTRODUCTON

Cardiovascular diseases (CVD) are the leading cause of death worldwide[1,2]. Among the diseases associated with CVD are those of musculoskeletal origin in which the main symptom is pain[3-5], representing an important reason for disability[6-7].

Pain can be a limiting factor for both activities of daily living and for physical exercise[8]. However, clinical studies have shown that physical activity reduces the pain intensity reported by patients with musculoskeletal pain[9-12].

Cardiopulmonary and Metabolic Rehabilitation (CPMR) with emphasis on exercise has been employed as an effective treatment for patients with CVD[13]. Some studies have evaluated the prevalence of pain in patients with cardiovascular diseases or participants in CPMR programs[14,15,16,17], however, the literature is scarce regarding the impact of pain on physical activity[4,8], and especially in relation to the effect of CPMR programs on pain.

Given the above, the objective of this study was to determine the presence, quantity, location/site and intensity of musculoskeletal pain at rest and during physical exercise, before and after three months of participation in a CPMR program.

MATERIALS AND METHODS

This is an observational longitudinal study. The project was approved by the Ethics Committee of Research on Human Beings (Opinion 149/2011). All participants were informed about the research and signed the Clear and Informed Consent Form.

Subjects who voluntarily sought the CPMR program participated in the study. Inclusion criteria were patients allocated in Phases II and III of the CPMR program who were not doing performing any sort of systematized exercise in the last three months and being over the age of 18. Individuals with peripheral arterial obstructive disease, neuropathies or subject to continuous use of analgesics were excluded from the study.

The subjects participated in a physical exercise program already established by the institution, and held three times a week for 12 weeks. The sessions were composed of a five minute warm up period, thirty minutes of aerobic exercise on a treadmill with an intensity between 70 and 85% of their maximum attained heart rate in the stress test, followed by twenty minutes of resistance exercises for the major muscle groups, and concluding with five minutes stretching[18], totaling an hour for each session.

Data were collected before and after three months of participation in the CPMR program. Characterization of the participants was performed by information contained in the medical records. The reference values suggested by the World Health Organization[19] and Pan American Health Organization[20], respectively, were adopted for classification of nutritional status up to 60 years and above.

To assess pain at rest and during exercise, which in this study was referred to as "pain worsened by exercise" according to the chosen instrument, the second part of the Locomotor System Assessment Inventory (LSAI) by Carvalho et al. (2010)[21] was used. This instrument verifies the location, the amount of local pain and pain intensity through a body diagram, visual analogue scale, and verbal descriptor scale with five levels: mild (1), moderate (2), strong (3), quite strong (4) and unbearable pain (5).

To ensure that the reported pain had musculoskeletal origin, we use the information that is described in the instrument: "Do you feel/have felt bone, muscle or joint (articular) pain?" Regarding the amount of pain, this variable was obtained by the body diagram that is also part of the instrument. In this case, each respondent marked one or more sites of pain or pains on the diagram. At the end of the interview, the number of pain sites was added, which we described as amount of pain or pain complaints. Intensity was set at the levels as described above. With regard to pain during exercise according to the LSAI, we asked: "Do you feel pain worsening by exercise?" Worsening pain was considered as pain that occurs or increases in intensity during exercise.

The patients answered questions relating to the presence of musculoskeletal pain at rest and during exercise, prior to the beginning and after the end of 12 weeks of the CPMR program, referring to the last 30 days. The interviews were conducted individually in an environment without external interference, and by an evaluator without prior knowledge regarding the study objectives.

The data were tabulated and analyzed using the *Statistical Package for the Social Sciences (SPSS for Windows)* computer program version 20.0. Descriptive statistics

(mean, standard deviation and frequency distribution) and inferential statistics were performed using the Mann-Whitney U test for comparison of two independent groups (with and without pain), Wilcoxon test for comparison of paired samples (before and after), chi-square or Fisher's Exact test for the association between categorical variables as needed, and McNemar's test for the association of paired samples. MedCalc software was used to compare proportions. A significance level of 5% was adopted[22].

RESULTS

Thirty-seven patients with a mean age of 61 ± 10 years were evaluated. Men accounted for 59.5% of all individuals. Prior to participation in the CPMR program, 57% (n=21) reported some musculoskeletal pain. Tables 1 and 2 show the characterization of subjects with and without pain at rest and during exercise, before and after three months of exercise.

Age, body mass index (BMI) and abdominal circumference (AC) showed no differences between individuals with and without pain at the beginning and end of the CPMR program. No association was found between gender and the presence of pain at any time. Also, association between cardiovascular risk factors and heart disease or cardiac event and the presence of pain at rest and then worsened by exercise was not verified.

Table 1. Characteristics of participants and data on pain at rest before and after three months of CPMR.

	BEFORE			AFTER		
Variable (M ± SD)	**With pain (n=21)**	**Without pain (n=16)**	***p* value**	**With pain (n=19)**	**Without pain (n=18)**	***p* value**
Age (years)	59.7 ± 11	62.1 ± 8	0.57	61.8 ± 11	60.9 ± 8	0.92
BMI (kg/m	30.2 ± 6	30.7 ± 5	0.84	31.7 ± 6	29.1 ± 5	0.20
AC (cm)	100.6 ± 15	105.2 ± 16	0.32	104.6 ± 15	100.3 ± 15	0.67
Gender n (**%)**						
Men	10 (47.6)	12 (75)	0.17	9 (47.4)	13 (72.2)	0.12
Women	11 (52.4)	4 (25)		10 (52.6)	5 (27.8)	0.41
Clinical diagnosis n (%)						
SAH	16 (76.2)	11 (68.8)	0.76	16 (84.2)	11 (61.1)	0.15
DM	8 (38.1)	7 (43.8)	0.73	8 (42.1)	7 (38.9)	0.84
DLP	9 (42.9)	4 (25)	0.31	9 (47.4)	4 (22.2)	0.17
CAD	16 (76.2)	14 (87.5)	0.67	14 (73.7)	16 (88.9)	0.24
MI	7 (33.3)	7 (43.8)	0.51	7 (36.8)	7 (38.9)	0.89
HF	5 (23.8)	3 (18.8)	1.00	3 (15.8)	5 (27.8)	0.44

BMI: body mass index; AC: abdominal circumference; SAH: systemic arterial hypertension; DM: diabetes mellitus; DLP: dyslipidemia; CAD: coronary artery disease; MI: myocardial infarction; HF: heart failure; M: mean; SD: standard deviation; p: significance value.

Table 2. Characteristics of participants and data on the pain worsened by exercise before and after three months of CPMR.

	BEFORE			AFTER		
Variable (M ± SD)	**With pain (n=10)**	**Without pain (n=27)**	***p* value**	**With pain (n=6)**	**Without pain (n=31)**	***p* value**
Age (years)	61.3 ± 14	60.4 ± 9	0.75	59.5 ± 15	61.0 ± 9	0.90
BMI (kg/m	32.8 ± 6	29.6 ± 5	0.23	32.4 ± 6	30.0 ± 5	0.41
AC (cm)	110.1 ± 16	100.2 ± 14	0.16	110.4 ± 14	101.4 ± 15	0.32
Gender n (%)						
Male	6 (60)	16 (59)	1.00	3 (50)	19 (61.3)	0.67
Female	4 (40)	11 (41)		3 (50)	12 (38.7)	0.50
Clinical diagnosis n (%)						
SAH	9 (90)	18 (66.7)	0.23	5 (83.3)	22 (71)	1.00
DM	4 (40)	11 (40.7)	1.00	4 (66.7)	11 (35.5)	0.19
DLP	6 (60)	7 (25.9)	0.12	2 (33.3)	11 (35.5)	1.00
CAD	8 (80)	22 (81.5)	1.00	4 (66.7)	26 (83.9)	0.31
MI	1 (10)	13 (48.1)	0.05	2 (33.3)	12 (38.7)	1.00
HF	-	8 (29.6)	0.08	-	8 (25.8)	0.30

BMI: body mass index; AC: abdominal circumference; SAH: systemic arterial hypertension; DM: diabetes mellitus; DLP: dyslipidemia; CAD: coronary artery disease; MI: myocardial infarction; HF: heart failure; M: mean; SD: standard deviation; p: significance value.

In comparing the intensity and amount of pain at rest and then worsened by exercise before and after the intervention, it was observed that there was a reduction in the amount of pain worsened by exercise after three months in the group with pain before CPMR (p=0.03) (Table 3), and that there was no onset of pain in patients without pain before CPMR. Mean pain intensity at rest was quite strong both before and after intervention (p=0.25). The mean intensity of pain worsened by exercise was initially quite strong, and evolving to strong at the end of three months of exercise (p=0.31); however, with no statistical difference.

Table 3. Comparison of intensity and amount of pain according to the Locomotor System Assessment Inventory (LSAI) before and after CPMR.

Variable (M ± SD)	**Rest**			**Worsened by exercise**		
	Before (n=21)	**After (n=19)**	***p* value**	**Before (n=10)**	**After (n=06)**	***p* value**
Pain intensity	3.3 ± 1.2	2.8 ± 1.4	0.25	3.0 ± 2.0	4.0 ± 1.0	0.31
Amount of pain	1.0 ± 1.3	0.9 ± 1.5	0.22	0.5 ± 0.9	0.2 ± 0.4	0.03

M: mean; SD: standard deviation; p: significance value.

In analyzing the specific sites of pain (Table 4), as each patient could indicate one or more sites of pain, it was observed that the lumbar spine and knees were the main reported sites by participants. Concentration of pain in the lower limbs was observed at all times. Despite a reduction of approximately half of referred pain in the lumbar area at rest and knee pain worsening by exercise after the CPMR program, no variable showed a significant difference via comparing the proportions.

Table 4. Description of the participants at rest and worsened by exercise before and after CPMR.

Characteristic	**Frequency**					
	Rest			**Worsened by exercise**		
	Before	**After**	***p* value**	**Before**	**After**	***p* value**
Individuals who reported pain (n)	21	19	0.819	10	06	0.396
Total/amount of reported pains	39	32		17	06	
Pain site (n / %)*						
Lumbar spine	8 (38)	4 (21)	0.408	3 (30)	2 (17)	0.988
Knee	6 (28)	8 (42)	0.947	5 (50)	1 (33)	0.886
Lower limbs	5 (24)	2 (10)	0.453	3 (30)	1 (17)	0.988
Shoulder	5 (24)	3 (16)	0.813	-	1 (17)	0.771
Ankle and foot	5 (24)	4 (21)	0.979	4 (40)	-	0.233
Hip	3 (14)	4 (21)	0.868	1 (10)	1 (17)	0.711
Cervical	3 (14)	4 (21)	0.868	-	-	-
Wrist and hand	3 (14)	-	0.276	-	-	-
Upper limbs	1 (5)	2 (10)	0.998	1 (10)	-	0.789
Elbow	-	1 (5)	0.997	-	-	-

* number of patients who reported pain in a particular place and relative percentage to the total number of participants who reported pain.

DISCUSSION

In this study we observed that more than half of the participants had some musculoskeletal pain before the CPMR program. This number was reduced from 57% (n=21) to 51% (n=19) at rest by the end of the program, and 27% (n=10) to 16% (n=6) during exercise. Being as the study population has a mean age over 60 years, our data corroborates other authors who reported that musculoskeletal disorders affect an important part of the older adult population with a prevalence of 50 to 85%[5,23], being a frequent comorbidity in CVD patients[14].

In this study, we observed that the physical characteristics did not affect the presence of pain in the assessed times (at rest and during exercise), before or after the CPMR program. With regard to the amount of pain, only pain during exercise (p=0.03) was found to show a reduction after three months. This result may be due to practicing physical exercise, especially aerobic, as it interacts as a modulator in the unpleasantness of pain through the psychological motivational cortex and dopamine, in the autonomic nervous system, in the descending mechanisms and the spinal cord[9].

Regarding the specific pain sites, it was observed that there was a predominance of pain in the knee joints and lower back, and the concentration of pain in the lower limbs was evident at all times, thus corroborating the literature[5,24], including studies involving participants from cardiac rehabilitation[15,16]. Although evaluating patients' performance in the CPMR program was not the object of this study, it is noteworthy that a study conducted by Weiner et al (2003)[25] observed that individuals with knee and hip pain had lower functional performance when compared to individuals with pain only in the lumbar spine. However, there is convergence when it comes to identifying whether the amount or intensity of pain is what causes the greatest impact on functional aspects.

Also in relation to the quantity and sites of pain, it has been reported[26,27] that increasing the number of pain sites promotes a negative effect on the balance, gait speed, perceived mobility and quality of life, while pain location also affects the functionality and mobility directly hindering daily activities and physical exercise[7,25,26]. A study conducted by Goel et al. (2010)[17], observed that a significant portion of participants of a cardiac rehabilitation program with musculoskeletal pain showed limitations in activities of daily living. These aspects become relevant for participants of CPMR as they may reflect in difficulties in performing the proposed exercise protocol or they can influence adherence to CPMR programs[19].

The findings of this study (through the LSAI instrument) showed that exercise did not significantly worsen pain at rest or during exercise; however, a higher intensity (of pain) was reported during exercise at the end of three months of CPMR program (from level 3 - quite strong; to level 4 - strong).

This study suggests that participants in CPMR programs must undergo a specific assessment to verify the interference of musculoskeletal pain when practicing exercise[18], and the need to adapt the exercises to clinical and physiological conditions of patients in order to facilitate practicing exercise without exacerbation of pain symptoms.

At the end of this study we observed that more than half of the individuals who initiated the CPMR program reported musculoskeletal pain. In these subjects, there was a significant reduction in the amount of pain only during exercise after three months of participation in a CPMR program; however, the pain intensity was not altered at rest or during exercise. Lastly, the sites with the highest concentration of pain were the lumbar spine and lower limbs, regardless of the assessment time.

Potential Conflict of Interest

The authors declare no conflict of interest.

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