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Feasibility of the acute physical exercise following Cryotherapy protocol in Rheumatoid Arthritis: A Case report

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Abstract

Rheumatoid arthritis (RA) patients often present important cardiovascular mortality. An efficient strategy for the prevention of cardiovascular mortality is intermittent exercise (IE). Indeed, the use of cryotherapy can control pain and disease activity, which can be triggered by the IE. This project aimed to verify the protocol feasibility of the IE following local cryotherapy in patients with RA (PwRA). A 74-year-old woman PwRA was evaluated before and immediately after IE (30 minutes), after cryotherapy, and two consecutive days after performing the protocol. The disease activity (DAS 28 and echography), arterial stiffness (peripheral pulse wave velocity), hemodynamic parameters (blood pressure and heart rate), and tolerance (step test, Borg RPE and VAS) of the PwRA were measured. The PwRA did not show disease exacerbation or pain. The IE intensity was able to promote acute improvements in peripheral arterial stiffness, while it was tolerable by the PwRA that reported 11 points in Borg RPE. The step test showed a discrete decrease probably due to the learning effect with a decrease in movement fear (kinesiophobia). In conclusion, this protocol showed feasibility for the PwRA. It needs further studies with a larger number of people for confirmation of these findings.

INTRODUCTION

Rheumatoid arthritis (RA) is the most frequent chronic rheumatism and manifests by synovitis, deformity joint, and loss of functionality (1). Moreover, patients with RA often present higher cardiovascular mortality than the general population (2).

Physical exercises (PE), specifically Intermittent aerobic Exercise (IE) have been identified as one of the most efficient strategies for cardiovascular mortality (3). The IE consists in high and low-intensity alternation, which promotes constant cardiorespiratory, circulatory, and metabolic adjustments. Hence, IE is the most efficient PE for the improvement of the cardiovascular system (4). Although the evidences of the IE benefits, patients with RA (PwRA) still have a less physical activity level than the general population mainly by the fear of disease exacerbation and discomfort or pain caused by joint movements (5).

To ensure the PE benefits limiting RA exacerbation, the use of cold (cryotherapy) as a recovery modality may be associated to this practice. Recent systematic review showed that the analgesic and anti-inflammatory induced-effects in the rheumatic patients (6). The present study aimed to verify a feasibility of a protocol based on IE followed by cryotherapy in terms of the disease activity, arterial stiffness, hemodynamic parameters and tolerance of the patient with RA.

CASE REPORT

A woman PwRA (74 y) participated of this study (7). The study was realized in the Rheumatology Service at CHRU of Besançon, France (RCB number 2011-A01355-36). All procedures were performed in accordance with the Declaration of Helsinki.

The patient performed three consecutive sessions of the protocol once a day. She abstained from alcoholic and stimulant beverages (e.g., coffee, tea, and energizing drink), food 4 hours preceding exercises and strenuous physical activity 48 hours before her sessions. The disease activity level was measured before the first session (S1) and before last session (S3) of the protocol. All sessions began with a supine rest period of 15 minutes follow the arterial stiffness, hemodynamic and tolerance measures. The second session (S2) and S3 ended after these measures. The S1 continued with the realization of 32-min IE (initial 1-min for warm up and the last 1-min for return calm) on a cycle ergometer (Monark 839E Digital Ergometer Testing Bike - Sweden) conform previous protocol (4). The low intensity was performed set at 55% of the theoretical maximal HR (HRmax), while the high intensity was set at 85% of HRmax (4). After the end of the IE, hemodynamic and tolerance was evaluated.

The patient returned to supine position for a recovery period of 45 minutes, which 15-min of ice pack application in the legs, 15-min without and 15-min over again ice packs application. After the end of the recovery period, the arterial stiffness, hemodynamic and tolerance measures were realized (Figure 1).

The same operator realized all these measures, except the blood sample and echography measures made by the nurse and doctor, respectively.

Measures

Disease activity

The joint echography identified joints inflammations with an Esaote MyLab five aircraft on 32 joints of the hands, wrists and feet using a score synoptic B-mode and Doppler quoted each one from 0 to 32, with a total of 0 to 64. The Disease Activity Score (DAS28) test was calculated from the Protein C Reactive.

Arterial Stiffness

A validated and non-invasive measure of the Pulse Wave Velocity (PWV, m.s⁻¹) of the carotid-radial segment was realized by the Complior SP device (Artech Medical, France). The procedures were conducted according to the previous study (8).

Hemodynamic

The Systolic, Diastolic, Mean Blood Pressure (SBP, DBP, MBP, mmHg) and HR (bpm) were measured with an automatic monitor Omron model HEM-705CP, (ORMO Healthcare Company, Japan).

Tolerance

The step test consisted in up and down 15 times a stairs with two steps of hospital use as quickly as possible without hand support (9). The time in seconds was recorded. BORG and EVA evaluated the exertion perception and pain

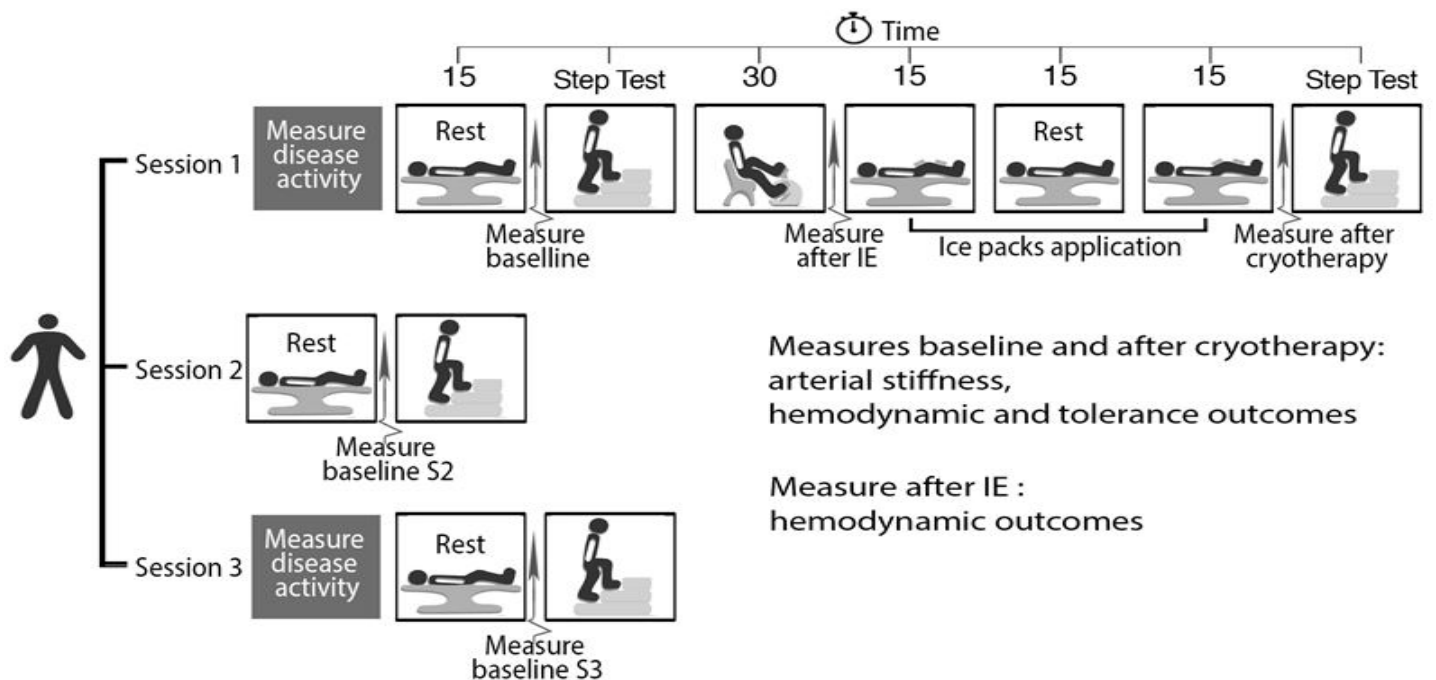


Figure 1: Scheme of the intervention, measures and duration of the protocol.

Table 1: The values raw of the parameters measured during the protocol.

	Session 1 (S1)			Session 2 (S2)	Session 3 (S3)	Changes S3 from baseline (%)	
	Baseline	After IE	After cryotherapy				
Disease Activity							
DAS28 (points)	3.48	-	-	-	1.88		(46%)
Protein C Reactive (mg/dl)	< 2.9	-	-	-	< 2.9		(0%)
Echography (points)	5	-	-	-	5		(0%)
Arterial Stiffness							
Pulse Wave Velocity - radial (m.s ⁻¹)	8.1	-	7.3	-	7.0		(13.6%)
Hemodynamic							
Systolic Blood Pressure (mmHg)	150	161	165	136	147		(2%)
Diastolic Blood Pressure (mmHg)	95	107	88	77	90		(5.3%)
Mean Blood Pressure (mmHg)	113.3	125	113.7	96.7	109		(3.8%)
Heart Rate (bpm)	72	71	65	67	69		(4.2%)
Tolerance							
Step Test (seconds)	80	-	68	72	68		(- 15%)
Borg RPE (points)	-	11	-	-	-	-	
VAS (mm)	-	0	-	-	-	-	

respectively.

DISCUSSION

According to a systematic review, there is no study about the effects of a protocol of PE followed by cryotherapy on disease activity and cardiovascular outcomes of the patients with RA (PwRA) (10). Consequently, this case report tested a protocol with these combined interventions for a PwRA.

The patient showed echography and PCR level unchanged and a decrease in the disease activity by DAS28 of 1.6 points S3 from baseline suggesting the disease activity control by the ice packs after high intensity IE (6). The high intensities PE tend to exacerbate the disease, but the low intensities often not are able of to improve the cardiovascular outcomes and, for this, not interesting as a cardiovascular rehabilitation for the PwRA (11).

Therefore, concerning the arterial stiffness, the results showed an acute decreasing in the PWV of 1.1 m/s in radial segment S3 from baseline. Hence, it is possible to verify that the protocol is effective for promote the acute improvement in arterial stiffness. In addition, the hemodynamic outcomes showed expect alterations after the IE from baseline, with return of the baseline values in S3. This type of exercise is widely used in the rehabilitation of patients, showing safe (12) and positive results in improving arterial stiffness (13) and hemodynamic parameters (14). However, we needed to know the tolerance of PwRA patients to perform an exercise with such intensity.

Relating to the tolerance, the PwRA attributed 11 points in Borg RPE after IE. Thus, the equivalent intensity (85–95% of HR) used in this protocol was associated with Borg RPE around 16–17 (hard to very hard) according previous study (15). The tolerance measured by the step test showed a

discrete decrease. However, this result cannot be explained only by an IE bout. The absence of pain by VAS results even after IE probably is linked to this decrease in the step test time, but the learning effect (9) and a decrease in movement fear (kinesiophobia) can be else considerate. (5,16).

This case report is a preliminary study presenting limitations that to require consideration. First, the evaluators were not blinded. Second, the blinding of the patient through control groups for monitoring of the placebo effects can be envisaged.

The results of this preliminary case report study highlight the protocol feasibility for the PwRA. It is necessary to conduct further studies on a larger number of people with RA for confirmation of these results.

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