# 7 - A HYDROCINSIOTHERAPEUTIC PROPOSAL TO 3rd PHASE POST-AMF CARDIAC REHABILITATING PATIENTS - A STUDY OF CASE - 6' WT AND HEARTBEAT ANALYSES

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**Introduction**

The Acute Myocardium Failure (AMF) assaults about 1.5 million people every year in the world, however this number has been progressively decreasing in the last 20 years. (1)

The myocardium failure or myocardium cells death occurs by a prolonged heart attack which is resulting from a complete occlusion of a coronary wall or a strong occlusion (usually by a atherosclerothic process), combined with the vasemotor tonus increase (2). This way the inappropriate perfusion of the cardiac tissue results a necrosis focus called acute myocardium failure (3). Cardiac Insuficiency (CI) is an alteration which may come from an AMF and provokes a stronger ventricular deterioration even indicating a worse clinical prognostication (4).

The Cardiac Rehabilitation (CR) restores cardiopathological patients' physiological, social and laborative conditions; prevents the progression or reverses the atherosclerotic process in coronarianpath patients; reduces the cardiovascular morbimortality and improves the chest symptomlogical angina, that is, it increases the duration and quality of life in relation to the convenient cost/effectiveness (5). The post heart failure is divided into four phases which are variable according to each patient clinical situation (5.6)

Physical exercises conduct to an increase of VO2max, of O2 offers to the myocardium and the arterial-venose O2 difference due to the increase of the capilar density which proportions an improvement of O2 transportation - consequently a better extraction of O2 by the muscle, which increases the cardiac functional capacity. Another benefits are a higher tolerance to efforts and lower O2 consume by the myocardium which are directly dependent to the heartbeat analysis and the atherosclerothic process - which are reduced. The reduction of heartbeats also proportions an increase of the coronarian flux due to the higher diastole time which conducts to a lower MVO2 (7).

The water physical properties establish the hydrotherapy because they provoke physiological alterations in many body systems and help to the improvement and restoration of organic functions. The physiological effects of immersion physical exercises are related to the aerobic and anaerobic energetic mechanism, to the maximum O2 captation, the blood flow system, the ventilation, the temperature regulation, and the endocryn system answers (8).

The objective of this study was to evaluate the effects of the long -term aquatic 3rd phase Cardiac Rehabilitation in post-AMF patients through hydrocinesiotherapy in warming pools.

**Methodology**

The research consisted of a descriptive and experimental study of case, with quantitative approach, preceded by bibliographical revision (9). The protocol was evaluated and approved by the Project Office and the Ethics in Research Committee of the National University of Santa Maria, previously to the beginning of study. The volunteers were told the proceedings and the Clarified and Free Term of Permission according to the 196/96 resolution by the Health Ministery.

The volunteers were selected from HUSM patients which were conducted to the Cardiology ambulatory. All of them are participants of Revicardio project - Secondary Rehabilitation in Cardiovascular Diseases Project - 3rd phase. The sample was constituted by coronarian-pathological patients, 2 of them, men, age of 59 and 68, which attended the criteria of inclusion. The selected patients were submitted to the treatment protocol for 7 weeks, twice a week, each session lasting the average of one hour and a half.

The study occurred in the Physical Education Center warming pool of the National University of Santa Maria. The dimensions of the pool are 25m vs. 12.5m and the water temperature alternated from 29?C to 33?C.

The instruments used in the study included anamnesis, physical exam, postural evaluation, goniometry, muscular strength test, flexibility test, coordination and balance test, 6' walk test (6' WT), aquatic abilities evaluation, Borg escale, and double product (DP).

After the eavaluation, the patients started the Aquatic Rehabilitaion protocol. This program was divided into 6 (six) steps, according to chart 1.

| warming up | breathing | aerobics | Diswarming | strengthing | relaxing |
|---|---|---|---|---|---|
| walk stretching | threshold | deep-water crawl long stride | back long stride | mmss/mmii abdominal | scretching skidding in s |
| 15’ | 5’ | 15’ | 5’ | 25’ | 10’ |

The vital signs were checked in the beginning of the session in pre-determined intervals between the modalities of exercises and at the end of the session.

It was used the simple descriptive analysis of the averages to the interpretation of the data. The data were demonstrated by graphs which were discussed quantitatively in comparison to the revised literature.

**Report of case**

**Individual A** - A.M.C., 68 years old, male, Caucasian, retired, from Santa Maria, previous AMF (2003) and 2 stents (2003/2004), hypertension, coronarianpathology in family's story. He takes medicine to cardiovascular control (monocordil 25mg-2x/day, atenolol 25mg-2x/day, sinvastatine 40mg-1x/day, AAS 100mg-1x/day, losortan 25mg-1x/day). Previous surgery of traumatic amputation of the 2nd and the 5th fingers of his left hand.

He was evaluated and allowed to participate by the REVICARDIO physicians after the Walk Test, but it was detected a weak cardiorespiratory aptitude (according to AHA) and was fit to the secong functional group (NYHA).

| Measure | Evaluation | Prevision |
|---|---|---|
| FCmax bpm | 112 | 153 |
| DC l/min | 12.78 | 15.11 |
| DPmax bpm mmHg | 17920 | 32381 |
| METmax | 6.27 | 8 |

In order to begin the treatment, the patient was evaluated according to this study requisites.

In the physical exam, the patient was asymptomatic, with FC 57 bpm, FR 15 cpm, PA 110/70 mmHg under rest. He weighed 74kg, 1.67m tall, and his BMI was 26.53.

In the 6' Walk Test it was traversed 525m which corresponds to 8.5% more than the prevision according to his height, age and weight (483.59m). He presented as pre-test resting values: PA 110/70 mmHg, FR 15 com, FC 58 bpm e Sat02 95%; and in the post-test: PA 110/70, FR = 19 cpm, FC 62 bpm e Sat02 92%. The maximum reached FC was 96 bpm at 3' of waking, keeping this index up to 6'.

On the first training day in the pool, he was evaluated referring to his aquatic abilities and he was a little afraid of water, with some difficulty to float, but able to keep in orthotatism. He reported a brief respiratory discomfort inside the pool, which was softened up to the moment it was not noticed by him. Besides that, the auxiliary equipments to therapy (vests, floatings) were adapted according to the individual's capacities.

On the second day, the real training phase started without interruptions. On the forth day the patient was oriented how to make the crawl long stride, with triple flexion of hips, knees and ankle what made him achieve the higher FC up to then.

From the forth to the seventh day the patient had gotten a labyrinthits (according to SIC information), which provoked him a brief discomfort to change from a laying position to an up position not interfering although in the FC variation. On the sixth day he had gotten a cold and was taking some medicine. On the seventh day the patient was tense and nervous due to familiar stress. This condition continued up to the end of the training. After the end of the training, the patient was re-evaluated.

**Individual B** - J.A.P.B., 59 years old, male, Caucasian, real estate broker, from Pelotas but living in Santa Maria, previous AMF (Jan 1, 1985) and catheterism (Aug 10, 2006), taking cardiovascular medication (Sustrate 10mg-3x/day, Sinvastatina 40mg-1x/day, AAS 100mg-2cp 1x/day, Captopril 25mg-1/2cp in 12/12h). Personal risk factors: ex-smoker, everyday ethylist (a glass of wine), sedentarism, obesity, dislipidemy and stress; and familiar risk factor: coronarianpathology.

A REVICARDIO participant, he was evaluated and allowed to participate by the project physicians after the Walk Test which presented regular cardiorespiratory aptitude (according to AHA) and was included in the first class of the functional group (according to NYHA).

| Measure | Evaluation | Prevision |
|---|---|---|
| FCmax bpm | 145 | 162 |
| DC l/min | 16.75 | 16.64 |
| DPmax bpm mmHg | 23200 | 32867 |
| METmax | 8.26 | 9.14 |

Chart 3. Results from the Walk Test

In order to start the training, the participant was evaluated according to this study requesites.

In the physical exam the patient was asymptomatic, with FC 93 bpm, FR 16 cpm, PA 100/60 mmHg under rest. He weighed 86 kg, 1.62m tall, and BMI 32.8.

In relation to the 6' WT, the participant traversed 530m, that is, 12% more than the prevision (469.8m). He presented as pre-test resting numbers: PA 100/70 mmHg, FC 88 bpm, FR 16 cpm and SatO2 96%, and the maximum FC was 117 at 6' of walk.

On the first training day in the pool, he was evaluated in relation to his aquatic abilities and was adapted to water - he could float, swim, keep in orthotatism and denied hydrophobia. Besides that, the auxiliary equipments to the therapy (vests, floatings) were adapted according to the individual capacities. On the second day the real training phase started without interruptions.

On the second and third weeks, the participant had gotten a cold and was taking medicines. On the forth day the patient was uncomfortable, anxious and tense. He reported he was under emotional stress. On the fifth and sixth days, the Crawl long stride was interrupted more or less after 3 minutes because the participant was feeling cramps in MID.

On the seventh and eighth days, the participant complained of pain in the paravertebral region. Musculature relaxing exercises were made, but he kept himself tense and under intense heartbeating. On the thirteenth day the patient complained of some discomfort in the paravertebral region once more which was intensified during the crawl long stride exercise and kept him tense until the end of the session. The patient was re-evaluated at eh end of the training.

**Results and Discussion**

Based on the analyses of the pre and post-training data, chart 4 presents the numbers of the traversed distance and FCmax (heartbeat) in A's and B's 6' WT.

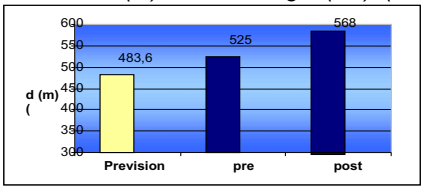
| | Individual A | | Individual B | |
|---|---|---|---|---|
| Parameter | Pre | Post | Pre | Post |
| Traversed Distance | 525 | 568 | 530 | 563 |
| FCmax (heartbeat) | 96 | 98 | 117 | 117 |

Chart 4. Values of 6' WT pre vs. post-training

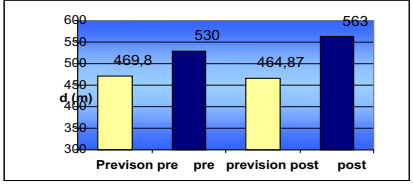
According to chart 4, individual A traversed a distance of 525m in the pre-training and of 568m in the post one and achieved the maximum FC (heartbeat) of 96 and 98 bpm respectively. Individual B increased the traversed distance from 530 to 563m but kept the maximum FC (heartbeat) in 117 bpm.

Graphs 1 and 2 show the traversed distance values and the pre and post-training prevision values according to a formula:

$$D\ TC6\ (m) = 7.57 \times height\ (cm) - (5.02 \times age) - 1.76 \times weight\ (kg)\ 309m \quad (10)$$




Graph 1. Inividual A distances




Graph 2. Individual B distances

We can observe in graph 1 that individual A surpassed 41.4m (8.5%) of the predicted distance (483.6m) in the pre-training while in the post-training the distance increased 94.4m (17.4%). This shows a variation of the pre and post traversed

distance of 43m. Individual B, according to graph 2, achieved 33.2m (12%) above from the predicted distance (469.8) in the pre-training. In the post-training there was a decrease of the predicted distance into 464.87m, once he had a small gain of weight of 2.8kg, surpassing in 98.1m (21%) that distance. The variation between pre and post-training was 33m.

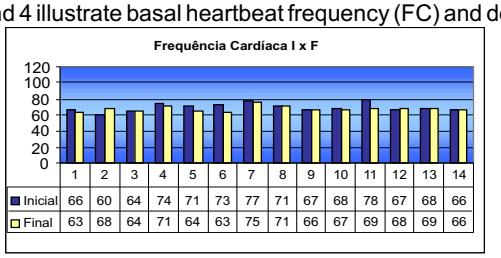
Both of the individuals achieved distances above of the predicted ones according to his particularities. The literature points that 6' WT traversed distances which are superior to 450m are a good prognostic to cardiopaths (11). It is possible to consider that the numbers above are satisfactory then.

Pires et al (12) analyzed the 6' WT traversed distances in groups of different age and BMI. They tested 122 healthy and sedentary adults and obtained an average traversed distance of 457.39 +- 64.10m to individuals in their 60's; and 492.93+-73.18m to those who BMI›25‹35. The sample of this study inserts in that context once individual A is 68 years old and has BMI 26.53 and individual B is 59 years old and BMI that varied fom 32.8 in the first evaluation to 33.9 in the last one. Both of them reached the superior distances mentioned by Pires et al.

Araújo et al (13) compared 30 individuals, between 65 and 87 years old, divided into 2 groups, according to previous AMF or no. Post-AMF patients traversed an average distance of 413.57+-84.36m. The sample of this study, similar to those ones, overcame them.

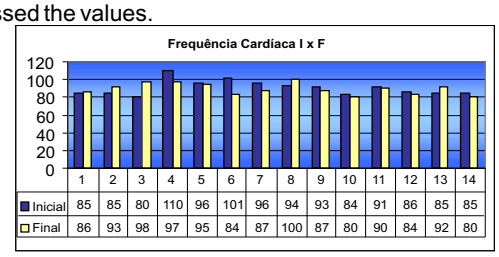
Municinó et al (14) applied a protocol of hydrocinesiotherapy in 18 cardiopath patients twice a day, 6 days a week for 3 weeks. He obtained an increase in the 6' WC of +- 120m what was justified by the improvement of the cardiovascular conditions promoted by the exercise in immersion. This study differs from the achieved values by individuals A and B in this study because, although the training exercises were similar, Municinó focused on more intense exercises. So he achieved more significant results in relation to the distance traversed pre and post-training.

Graphs 3 and 4 illustrate basal heartbeat frequency (FC) and demonstrate the initial and final variation in each session.




Graph 3. Initial and final Heartbeat Frequency of the Individual A.

According to graph 3, in 8 of the14 attends, individual A presented final FC lower than the initial FC, decreasing the average of 4.5 bpm. FC kept linear during the training period - between 60 and 74 bpm, occurring two elevations in the final FC days 7 and 11, which surpassed the values.




Graph 4. Initial and final Heartbeat Frequency of the Individual B.

According to graph 4, in 9 of the 14 attends, individual B presented a final FC inferior to the initial FC, decreasing an average of 6.45 bpm. From the 1st to the 2nd, and from the 10th to the 14th days, FC kept between 80 and 93 bpm. On the other days, there was oscillations up to 110 bpm.

Individual A basal FC, in comparison to individual B, shows inferior values (an average of 21.5 bpm), because individual A takes a Betablocker, which blocks the beta-adrenergic receptors and reduces FC, DC and controls pressure levels (15).

According to graphs 3 and 4, final FC returned to values next to initial FC. This links it to Ricardo et al (16) study, which analyzed the cardiac variability to aerobic exercises in 544 individuals, 115 of them were cardiopaths, and found in them the recuperation of final FC in similar values to the initial ones.

Almeida (17) suggests that the FC under rest suffers a higher influence from the Parasympathic Nervous System, by vagal stimuli, and the additional variation depends on the sympathic stimuli. Ricardo et al (16) proposes that in FC recuperation, at the end of the exercise, occur both sympahic (decrease) and parasympathic (return). Then the post-effort FC tends to achieve values next to the rest ones, higher or lower depending on the answer to this double stimulation. Individuals A and B final FC achieved values next to the initial ones. This study is according to the literature mentioned above then.

Municinó (14) did not find alterations in the pre and post-training basal FC after 3 weeks of hydrotherapy protocol application. In this present study, basal FC numbers do not alter either, keeping the same ones from the beginning to the end of the training. It may be due to the short time of training although there are evidences that the long-term physical trainings induce to the reduction of basal FC in cardiopaths. Silva et al (19) made a controlled dtudy in 24 patients with cronic stable cardiac insufficiency, average age of 52 +- 16 years old, for 3 months, and they obtained as result the basal FC decrease.

During the trainings the individuals showed peacks of initial FC elevation related to emotional stress. It may affect the cardiovascular system through neuro-humor influences, especially through the sympathic hyperactivity what increases the heartbeat frequency, the cardiac debt and blood pressure (20).

**Conclusion**

Physical exercises in an aquatic environment have determined many cardiorespiratory and hemodynamic alterations in coronarianpathological patients. The increase of the traversed distance in the post-training 6' WT showed in both the individuals that the protocol used was efficient as a way to propose better physical capacity. However, in relation to FC, it is not possible to affirm that there was increase in the physical condition. Then it is necessary to research even more focusing on the use of hydrocinesiotherapy benefits with groups under control and with a higher number of samples. This way it will be possible to check the benefits of water physical exercises to 3rd phase coronarianpathological patients.

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**A HYDROCINSIOTHERAPEUTIC PROPOSAL TO 3rd PHASE POST-AMF CARDIAC REHABILITATING PATIENTS - A STUDY OF CASE - 6' WT AND HEARTBEAT ANALYSES**

**ABSTRACT:**

INTRODUCTION: The Cardiac Rehabilitation is an interdisciplinary program which aims at improving physical, mental and social conditions in cardiopathological patients. The hydrocinesiotherapy is a different and pleasant way to achieve those gains, since it provokes many physiological alterations. OBJECTIVE: Evaluating the short-term aquatic 3rd phase cardiac rehabilitation in post Acute Myocardium Failure (AMF) patients through hydrocinesiotherapy in warming pools. METHODOLOGY: A descriptive study of case with quantitative approach. The sample was constituted of 2 people, average age 63.5 years-old, on the 3rd phase post-AMF, REVICARDIO Project participants. The evaluation was consisted of anamnesis, physical exam, 6-minute walk test and aquatic abilities. The training was divided into 6 steps, all of them monitored through a POLAR FS1 heartbeat measure by checking people's arterial pressure and breath frequency in the beginning and end of each session. The training protocol consisted of exercises of lengthening, warming-up, breath frequency, aerobics, diswarming and relaxing, twice a week, for 7 weeks, average 90-minute lasting. RESULTS: In the 6' WT test, the anticipated traversed distance inceased 17.4% in A, and 21% in B. The final heartbeat test was 57.1% inferior to the initial one in A sessions, and 64.3% in B. CONCLUSION: The water exercise was pleasant, however it is necessary a long-term physical preparation with an intensive observation by the interdisciplinary staff. Then there is the necessity of more sample long-term studies. KEY-WORDS: cardiac rehabilitation, hydrocinesiotherapy, physical exercise

**PROPOSITION HIDROKINÉSITHÉRAPEUTIQUE POUR LA RÉHABILITATION CARDIAQUE PHASE III PARMI LES PATIENTS POST-IAM - ÉTUDE DE CAS - ANALISE DU TM 6' E DE LA FC**

**RESUME:**

INTRODUCTION: La Réhabilitation Cardiaque est um programme interdisciplinaire que vise améliorer les conditions phisiques, mentales et sociaux des patients cardiopathes. L'hidrokinésithérapie est un moyen differencié et agréable de proportionner ces gains par éveiller des variées modifications physiologiques.OBJECTIS:Évaluer les effets de la Réhabilitation Cardiaque phase III aquatique á court terme parmi les patients post-Infarctus Aigu du Myocarde (IAM) travers l'hidrokinésithérapie dans une piscine réchaufée.MÉTHODOLOGIE: ètude de cãs de genre descriptif, avec une abordage quantitative. L'échantillon a eté constitué par 2 individus, ages em moyenne de 63,5 ans, quisont à la phase III post- anamnese, IAM et qui participent au projet REVICARDIO . L'évaluation a eté composée de:examén physique, Test de la Marche des 6 minutes (TM 6') et lê Test des Habilites Aquatiques. L'entraînement a eté divise em 6 étapes qui ont eté monitorées travers lê frequencimètre cardiaque POLAR FS1, em mésurant la tension artérielle et la fréquence respiratoire au début et à la fin de chaque session. Le protocole d'entraînement a eté composé d'exercices d'allongement, réchauffement; exercices aérobiques, refroidissement et rêlachement, realisés 2 fois par semaine, pendant 7 semaines, ayant une durée d'environ 90 minutes.RÉSULTATS: Au TM 6', l'éloignement parcouru prevu a eté augmenté 17,4% à l'individu A et 21% à l'individu B. La FC (frequence cardiaque) finale a eté inférieure á FC initiale en 57,1% aux sessions de l'individu A, et en 64,3% à l'individu B. CONCLUSION: L'exercice au millieu aquatique a eté agréable, néanmoins il y a besoin d'um conditionnement à long terme, avec le monitorat intensif de l'équipe interdisciplinaire.Donc,il faut faire des études à long terme en utilisant un échantillon plus nombreux. MOTS CLÉS: réadaptation cardiaque, hydrocinesiotherapy et exercice

physique

**PROPUESTA HIDROCINESIOTERAPEUTICA DE REABILITACIÓN CARDÍACA FASE III EN PACIENTES PÓS-IAM - ESTUDIO DE CASO - ANÁLISIS DEL TC 6' Y DE LA FC**

**RESUMEN:**

INTRODUCIÓN: La Rehabilitación Cardiaca es un programa interdisciplinario que tiene como objetivo mejorar las condiciones físicas, mentales y sociales en pacientes cardiópatas. La hidrocinesioterapia es un recurso diferenciado y agradable para proporcionar las mejoras mencionadas anteriormente, por promover diversas alteraciones fisiológicas. OBJETIVO: Evaluar los efectos de la Rehabilitación Cardiaca fase III acuática a corto plazo en pacientes pos Infarto Agudo del Miocardio (IAM) por medio de la hidrocinesioterapia en piscina termica. METODOLOGIA: Estudio de caso de tipo descriptivo, con abordaje cuantitativa. La muestra fue constituida por 2 individuos, con edad media de 63.5 años, en la fase III pos-IAM, participantes del Proyecto REVICARDIO. La evaluación consistió de: anamnese, examen físico, Prueba de Caminata de 6 minutos (TC 6') y de las Habilidades Acuáticas. El entrenamiento se dividió en 6 etapas, controladas a través del frecuencimetro cardíaco marca POLAR FS1, midiéndose la presión arterial y la frecuencia respiratoria en el comienzo y al final de cada sesión. El protocolo de entrenamiento consistió de ejercicios de estiramiento, calentamiento, respiratorios, aeróbicos descalentamiento y relajamiento, realizados 2 veces por semana, durante 7 semanas, con tiempo medio de 90 minutos. RESULTADOS: En el TC 6' la distancia prevista discurrida se elevo 17,4% en el individuo A, y 21% en el individuo B. La FC final fue inferior a FC inicial en 57,1% en las sesiones del individuo A, y en 64,3% en el individuo B. CONCLUSIÓN: El ejercicio en el agua fue placentero, pero hay necesidad de un condicionamiento a largo plazo, con acompañamiento intensivo de un equipo interdisciplinario. Luego, surge la necesidad de estudios de largo plazo con una muestra mas grande. PALABRAS CLAVES: rehabilitación cardiaca, hydrocinesiotherapy , ejercicio físico

**PROPOSTA HIDROCINESIOTERAPÊUTICA DE REABILITAÇÃO CARDÍACA FASE III EM PACIENTES PÓS-IAM - ESTUDO DE CASO - ANÁLISE DO TC 6' E DA FC**

**RESUMO:**

INTRODUÇÃO: A Reabilitação Cardíaca é um programa interdisciplinar que visa melhorar as condições físicas, mentais e sociais em pacientes cardiopatas.A hidrocinesioterapia é um meio diferenciado e agradável para proporcionar tais ganhos, por provocar diversas alterações fisiológicas. OBJETIVO: Avaliar os efeitos da Reabilitação Cardíaca fase III aquática a curto prazo em pacientes pós Infarto Agudo do Miocárdio (IAM) através da hidrocinesioterapia em piscina aquecida. METODOLOGIA: Estudo de caso do tipo descritivo, com abordagem quantitativa. A amostra foi constituída por 2 indivíduos, com idade media de 63,5 anos , na fase III pós-IAM, participantes do Projeto REVICARDIO. A avaliação constou de: anamnese, exame físico, Teste da Caminhada dos 6 minutos (TC 6') e das Habilidades Aquáticas. O treinamento dividiu-se em 6 etapas, monitoradas através de freqüencímetro cardíaco marca POLAR FS1, aferindo-se a pressão arterial e a freqüência respiratória no início e ao final de cada sessão. O protocolo de treinamento constou de exercícios de alongamento, aquecimento, respiratórios, aeróbicos, desaquecimento e relaxamento, realizados 2 vezes por semana, durante 7 semanas, com tempo médio de 90 minutos. RESULTADOS: No TC 6' a distância prevista percorrida aumentou 17,4% no indivíduo A, e 21% no indivíduo B. A FC final foi inferior a FC inicial em 57,1% nas sessões do indivíduo A, e em 64,3% no indivíduo B. CONCLUSÃO: O exercício na água foi prazeroso, porém há necessidade de um condicionamento a longo prazo, com acompanhamento intensivo da equipe interdisciplinar. Portanto, surge a necessidade de estudos a longo prazo com maior amostra.

PALAVRAS-CHAVES: reabilitação cardíaca, hidrocinesioterapia, exercício físico.