

## LETTER TO THE EDITOR

## HYDROTHERAPY IN HEART FAILURE: A CASE REPORT

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## BACKGROUND

Heart failure is considered to be the last stage of heart disease and a significant cause of morbidity and mortality worldwide.<sup>1,2,3</sup> It is characterized by the persistent activation of the neurohormonal system,<sup>4</sup> endothelial dysfunction,<sup>5</sup> exercise intolerance,<sup>6,7,8,9</sup> high mortality<sup>10</sup> and a poor quality of life.<sup>11</sup>

Exercise training has been strongly recommended as a safe and important tool for the non-pharmacological treatment of heart failure. Exercise training improves exercise capacity,<sup>12,13</sup> quality of life,<sup>14</sup> endothelial dysfunction,<sup>15</sup> skeletal muscle oxidative capacity,<sup>16</sup> the catecholamine plasma level<sup>17</sup> and the autonomic and ventilatory responses.<sup>18</sup> In heart failure patients, designing an appropriate aerobic exercise routine is crucial for obtaining both an increase in exercise capacity and the reasonable control of exercise-related risks.<sup>1,6</sup>

Hydrotherapy (i.e., exercise in warm water) had been considered potentially dangerous in heart failure patients due to the increased venous return caused by the hydrostatic pressure. However, it is now known that cardiac function actually improves during water immersion due to the increase in early diastolic filling and decrease in heart rate, resulting in improvements in stroke volume and ejection fraction.<sup>19</sup> Studies with sauna therapy (i.e., warming) have demonstrated important improvements in neurohormonal attenuation and exercise status in heart failure patients. These data suggest that hydrotherapy is a good potential treatment for heart failure patients. However, few studies are available,

and none have compared conventional rehabilitation to hydrotherapy.<sup>20</sup>

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## CASE REPORT

A 51-year-old male heart failure patient (ischemic etiology with 40% left ventricular ejection fraction) was recruited from a cardiology hospital to this rehabilitation program (Table 1). This patient underwent 24 exercise sessions in a 22–24°C temperature-controlled gym (conventional exercises) between May and July 2007. After the exercise training program, this patient was invited to continue in our rehabilitation program but opted out. After 6 months, the patient returned to our program to continue the exercise program, and we assigned him to hydrotherapy. Between January and March 2008, he had 24 more exercise sessions in a 30–31°C temperature-controlled swimming pool (hydrotherapy). The exercise training protocol was almost the same for both methods: 5 minutes of warm up exercises (stretching), 30 minutes of aerobic exercise training (90% of ventilatory threshold), 25 minutes of strength exercises (lower and upper limbs) and 5 minutes of cool down exercises (stretching). A treadmill (Max 1; Marquette Electronics; Milwaukee, WI, USA) cardiopulmonary exercise test (Vmax 229 model, SensorMedics, Yorba Linda, CA, USA), 24-hour ambulatory blood pressure measurement (Space Labs Redmond, Wash, USA), New York Heart Association functional classification and a Minnesota Living With Heart Failure Questionnaire were performed before and after the exercise training protocols (the cardiopulmonary exercise test was performed 2 days prior to the other evaluations). The medications were not changed during the protocols (150 mg/day Carvedilol, 100 mg/day Losartan, 40 mg/day Furosemide, 25 mg/day

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**Table 1** - Patient data before and after exercise training

	<i>Conventional (pre-training)</i>	<i>Conventional (post-training)</i>	<i>Hydrotherapy (pre-training)</i>	<i>Hydrotherapy (post-training)</i>
BMI (kg/m <sup>2</sup> )	36.7	37.1	38.8	37.5
Waist (cm)	120	119	123	121
Hip (cm)	110	110	121	117
Peak VO <sub>2</sub> (mLO <sub>2</sub> .kg <sup>-1</sup> .min <sup>-1</sup> )	21.5	28.7	16.5	26.9
VO <sub>2</sub> AT (mLO <sub>2</sub> .kg <sup>-1</sup> .min <sup>-1</sup> )	12.8	13.3	9.0	12.5
VO <sub>2</sub> VT (mLO <sub>2</sub> .kg <sup>-1</sup> .min <sup>-1</sup> )	17.3	21.7	16.1	20.5
VE/VCO <sub>2</sub> slope	28.7	27.5	33.3	24.5
RER	1.05	1.04	1.04	1.07
Time (exercise test)	17	19	14	16
NYHA	2	1	3	1
MLHFQ	51	49	68	26
SBP 24 hours (mmHg)	118	117	130	125
DBP 24 hours (mmHg)	63	67	70	66
HR 24 hours (bpm)	69	76	91	69
SBP daytime (mmHg)	124	117	137	127
DBP daytime (mmHg)	67	67	74	69
HR daytime (bpm)	69	78	94	67
SBP nighttime (mmHg)	108	118	116	122
DBP nighttime (mmHg)	55	68	62	61
HR nighttime (bpm)	69	72	85	73

VO<sub>2</sub>, Oxygen consumption; RER, Respiratory exchange ratio; NYHA, New York Heart Association Functional Class; MLHFQ, Minnesota Living with Heart Failure Questionnaire; SBP, Systolic blood pressure; DBP, Diastolic blood pressure; HR, heart rate.

Spironolactone and 0.25 mg/day Digoxin). This protocol was approved by the ethical committee of our institution (number 1107/05).

## DISCUSSION

Exercise training is a well-established non-pharmacological treatment for patients with heart failure. Hydrotherapy is a new and well-tolerated method of exercise rehabilitation for heart failure patients. It is an alternative for elderly patients and patients with impaired mobility.<sup>21</sup> The patient in this case study did not have any orthopedic problems despite his high body mass index.

Studies with sauna baths have shown that they can lead to great improvements in heart failure by attenuating the neurohormonal system.<sup>21,22</sup> It is possible that hydrotherapy (i.e., exercise in a warm swimming pool) could provide the same beneficial effects of conventional exercise training and warming while also attenuating the neurohormonal system more significantly. Therefore, we expected the patient to improve more with hydrotherapy than with conventional exercise.

In this case, hydrotherapy was an effective method of cardiovascular rehabilitation and a safe alternative to conventional exercise. This is the first report in which a patient has performed both forms of exercise. The patient's peak and anaerobic threshold oxygen consumption, VE/VCO<sub>2</sub> slope, Minnesota living with heart failure quality of life score, body mass index, 24-hour ambulatory blood pressure and waist and hip circumference improved with both methods of exercise rehabilitation, but the improvements were more pronounced with hydrotherapy. The patient's peak and anaerobic threshold oxygen consumption showed an increase of 7.2 mLO<sub>2</sub>.kg<sup>-1</sup>.min<sup>-1</sup> during regular exercise training versus 10.4 mLO<sub>2</sub>.kg<sup>-1</sup>.min<sup>-1</sup> with hydrotherapy and an increase of 0.5 mLO<sub>2</sub>.kg<sup>-1</sup>.min<sup>-1</sup> with regular training versus 3.5 mLO<sub>2</sub>.kg<sup>-1</sup>.min<sup>-1</sup> with hydrotherapy, respectively. His VE/VCO<sub>2</sub> slope decreased by 1.2 with regular training, while it decreased to 8.8 with hydrotherapy. The Minnesota living with heart failure quality of life score decreased by 2 with regular training and by 42 with hydrotherapy. The patient's body mass index increased by 0.4 kg/m<sup>2</sup> with regular training, while it decreased by 1.3 kg/m<sup>2</sup> with hydrotherapy. His mean 24-hour systolic blood

pressure showed a 1 cm H<sub>2</sub>O decrease with regular training, while it decreased by 5 cm H<sub>2</sub>O with hydrotherapy. On the other hand, his mean diastolic blood pressure was unchanged by regular training while it decreased by 5 cm H<sub>2</sub>O with hydrotherapy. The patient's waist circumference showed a decrease of 1 cm with regular training and a decrease of 2 cm with hydrotherapy, while his hip circumference was unchanged by regular training but showed a 4 cm decrease with hydrotherapy.

Exercise intolerance (low peak oxygen consumption) and poor quality of life have been negatively correlated to neurohormonal activity in heart failure patients.<sup>23</sup> Some

clinical exams, such as the 24-hour ambulatory blood pressure, can detect the exacerbated neurohormonal activity seen in heart failure.<sup>24</sup> These clinical data reflect the stronger neurohormonal attenuation provided by hydrotherapy. Importantly, signs and symptoms of exercise intolerance were not observed during either exercise regimen.

## CONCLUSION

In this case report, we demonstrate that hydrotherapy is an effective method of cardiovascular rehabilitation and can be a safe alternative to conventional exercise.

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