Safety and Efficacy of Repeated Sauna Bathing in Patients With Chronic Systolic Heart Failure: A Preliminary Report

HIROMITSU MIYAMOTO, MD,[1] HISASHI KAI, MD, PhD,[1,2] HIROYUKI NAKAURA, MD, PhD,[1] KATSUNORI OSADA, MD,[1] YOSHIHIKO MIZUTA, MD,[1] AKIRA MATSUMOTO, MD, PhD,[1] AND TSUTOMU IMAIZUMI, MD, PhD[1,2]

Kurume, Japan

ABSTRACT

Background: We sought to determine the safety and efficacy of repeated 60°C sauna bathing in patients with chronic systolic congestive heart failure (CHF).

Methods and Results: This study included 15 hospitalized CHF patients (New York Heart Association class = 2.8 ± 0.4) in stable clinical condition on conventional treatments. Sauna bathing was performed once per day for 4 weeks. Repeated sauna bathing was safely completed without any adverse effects in all patients. Symptoms improved in 13 of 15 patients after 4 weeks. Sauna bathing decreased systolic blood pressure without affecting heart rate, resulting in significant decrease in the rate-pressure product (6811 ± 1323 to 6292 ± 1093). Echocardiographic left ventricular ejection fraction was significantly increased from 30 ± 11 to 34 ± 11%. Sauna bathing significantly improved exercise tolerance manifested by prolonged 6-minute walking distance (388 ± 110 to 448 ± 118 m), increased peak respiratory oxygen uptake (13.3 ± 1.8 to 16.3 ± 2.1 mL/kg/min), and enhanced anaerobic threshold (9.4 ± 1.2 to 11.5 ± 1.9 mL/kg/min). Four-week bathing significantly reduced plasma epinephrine (40 ± 42 to 21 ± 23 pg/mL) and norepinephrine (633 ± 285 to 443 ± 292 pg/mL). Sauna bathing reduced the number of hospital admission for CHF (2.5 ± 1.3 to 0.6 ± 0.8 per year).

Conclusion: Repeated 60°C sauna bathing was safe and improved symptoms and exercise tolerance in chronic CHF patients. Sauna bathing may be an effective adjunctive therapy for chronic systolic CHF.

Key Words: Thermal therapy, exercise tolerance, echocardiography, catecholamines.

The primary therapeutic goals of chronic congestive heart failure (CHF) are improvement of prognosis and maintenance of quality of life. In this regard, great progress has been achieved by recent advances in pharmacologic treatment using angiotensin-converting enzyme inhibitors,[1,2] angiotensin II receptor blockers,[3,4] β-blockers,[5,6] and aldosterone antagonists.[7] However, many patients on conventional treatment still have impaired quality of life. Therefore, some other modalities of treatment are desirable.

Cardiovascular responses to ordinary hot (80°C) sauna include tachycardia, systolic hypertension, and increased cardiac workload, which are mediated by peripheral vasodilatation and stimulation of the sympathetic nerve system.[8–10] These changes are similar to the response to heat stress. Thus hot sauna bathing is considered to be inappropriate or harmful for CHF patients. However, Tei et al[11] have demonstrated that a single 60°C dry sauna bathing for 15 minutes was tolerable to CHF patients and produced beneficial acute hemodynamic effects, such as increase in cardiac output and decreases in systemic vascular resistance and pulmonary capillary wedge pressure via thermal peripheral vasodilatation. In addition, the same group showed that repeated 60°C sauna bathing for 2 weeks improved subjective well-being and the forearm endothelial function in CHF patients.[12] However, there were no reports on the effects of repeated sauna bathing on the exercise tolerance. Accordingly, the safety and efficacy of repeated 60°C sauna bathing for 4 weeks were investigated in patients with systolic chronic CHF on conventional treatment. For these purposes, we determined the effects of sauna bathing on clinical symptoms, exercise tolerance, neurohumoral factors, and echocardiographic left ventricular ejection fraction (LVEF).

From [1]The Third Department of Internal Medicine and [2]Cardiovascular Research Institute, Kurume University School of Medicine, Kurume, Japan

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Reprint requests: Hisashi Kai, MD, PhD, The Third Department of Internal Medicine and Cardiovascular Research Institute, Kurume University School of Medicine, 67 Asahimachi, Kurume 830-0011, Japan.

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Methods

This study included 15 (12 men and 3 women) patients with chronic CHF (Table 1); 6 with idiopathic dilated cardiomyopathy, 1 with dilated phase of hypertrophic cardiomyopathy, 7 with old myocardial infarction, and 1 with valvular heart disease. Age of the patients ranged from 34 to 75 (mean 62 ± 15) years. Of these patients, 3 and 12 were in New York Heart Association (NYHA) functional class II and III, respectively. This study excluded patients with (1) acute myocardial infarction or unstable angina; (2) uncontrollable tachycardic or bradycardic arrhythmia; (3) acute pulmonary edema; (4) cardiogenic shock; (5) uncontrollable hypertension; (6) systemic disorders such as severe hepatic, renal, hematologic, and malignant diseases; (7) diabetes mellitus under insufficient control; (8) active inflammation (serum C-reactive protein >2.0 mg/mL); (9) anemia (hemoglobin concentration <8.0 mg/mL); or (10) hypoxia (arterial oxygen saturation <70 %).

All patients were in stable clinical condition before this study in our hospital on maintenance doses of conventional medications for chronic CHF, including renin-angiotensin system inhibitor (angiotensin-converting enzyme inhibitors or angiotensin II receptor blockers), β-blocker, diuretics, and digitalis.[13] Of the 15 patients, all had a renin-angiotensin system inhibitor and furosemide, 9 had spironolactone, and 11 had digitalis (Table 1). Although 5 patients had a β-blocker, β-blockers were not used in the remaining 10 patients because of intolerable bradycardia or hypotension. Their medications were not changed during the study. This study complied with the Declaration of Helsinki. The study protocol was approved by the Ethics Committee of Kurume University, and written informed consent was obtained from each patient before participation.

Sauna Bathing

A far infrared-ray sauna system (Olympia Co, Miyazaki, Japan) was used. Patients were placed in the sitting position in a 60°C dry sauna for 15–20 minutes, and then rested on a reclining chair with sufficient warmth provided by blankets in a temperature-controlled room at 25°C for 30 minutes.[11] Patients were weighed before and after sauna bathing, and oral hydration with water (100–200 mL) was supplied to compensate for water loss.

Study Protocol

Patients underwent 60°C sauna bathing once per day, 5 days per week, for 4 weeks. Exercise tolerance, plasma levels of neurohumoral factors, echocardiogram, and chest roentgenogram were evaluated just before and immediately after 4-week bathing. Fasting blood samples were drawn from the antecubital vein early in the morning. Plasma epinephrine, norepinephrine and brain natriuretic peptide (BNP) were measured at a commercial available laboratory (SRL, Fukuoka, Japan). The left ventricular (LV) and left atrial dimensions were measured on the M-mode echocardiograms, and LVEF was calculated by the modified Simpson's method.[14]

Assessment of Clinical Symptoms

Clinical symptoms (shortness of breath, fatigue, appetite loss, insomnia, and constipation) were evaluated by a self-assessment quality-of-life questionnaire.[12] After 4 weeks of sauna bathing, questionnaire sheets were given to patients and they were asked to choose 1 from 4 grades: "remarkably improved," "improved," "no change," or "worsened," as compared with the baseline, for each symptom. Based on the results, patients were categorized to the following 3 groups: improved patients with "remarkable improvement" or "improvement" of more than 2 items, worsened patients with "worsening" of at least more than 1 item, and the others.

Exercise Tolerance Tests

In all patients, a 6-minute walk testing was carried out and the total walking distance was determined. For further quantitative evaluation for exercise tolerance, in the last 5 consecutive patients (Patients 11–15), cardiopulmonary exercise testing was performed

Table 1. Patient Profile

Patient Number	Age (y)	Gender	Diagnosis	NYHA Class	Diabetes Mellitus	HC	Medication				
							ACEI or ARB	β-Blocker	Furosemide	Spironolacton	Digitalls
1	61	Male	DCM	III	−	−	+	−	+	−	+
2	63	Female	dHCM	III	+	−	+	−	+	−	+
3	34	Male	DCM	III	+	−	+	+	+	+	+
4	53	Male	OMI	III	+	+	+	−	+	+	+
5	38	Male	DCM	III	−	−	+	−	+	+	+
6	74	Male	OMI	III	−	−	+	−	+	+	+
7	74	Female	DCM	III	−	−	+	+	+	−	+
8	70	Female	OMI	III	+	+	+	−	+	+	+
9	47	Male	OMI	II	−	+	+	+	+	+	+
10	71	Male	VHD	II	−	−	+	−	+	−	+
11	68	Male	OMI	III	+	+	+	−	+	+	−
12	77	Male	OMI	III	+	−	+	−	+	+	+
13	72	Male	DCM	III	−	−	+	−	+	−	−
14	62	Male	OMI	II	+	+	+	+	+	+	−
15	75	Male	DCM	III	−	−	+	+	+	−	−

DCM, dilated cardiomyopathy; dHCM, dilated phase of hypertrophic cardiomyopathy; OMI, old myocardial infarction; VHD, valvular heart disease; ACEI: angiotensin-converting enzyme inhibitor; ARB, angiotensin II receptor blocker.

Diabetes mellitus was defined as hemoglobin A1c greater than 5.8%.

Hypercholesterolemia (HC) was defined as total cholesterol greater than 220 mg/mL.