

Effects of Repeated Sauna Treatment on Ventricular Arrhythmias in Patients With Chronic Heart Failure

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Background The aim of the present study was to determine whether repeated 60°C sauna treatment improves cardiac arrhythmias in chronic heart failure (CHF) patients, because ventricular arrhythmias are an important therapeutic target in CHF.

Methods and Results Thirty patients (59±3 years) with New York Heart Association functional class II or III CHF and at least 200 premature ventricular contractions (PVCs)/24 h assessed by 24-h Holter recordings were studied. They were randomized into sauna-treated (n=20) or non-treated (n=10) groups. The sauna-treated group underwent a 2-week program of a daily 60°C far infrared-ray dry sauna for 15 min, followed by 30 min bed rest with blankets, for 5 days per week. Patients in the non-treated group had bed rest in a temperature-controlled room (24°C) for 45 min. The total numbers of PVCs/24 h in the sauna-treated group decreased compared with the non-treated group [848±415 vs 3,097±1,033/24 h, p<0.01]. Heart rate variability (SDNN, standard deviation of normal-to-normal beat interval) increased [142±10 (n=16) vs 112±11 ms (n=8), p<0.05] and plasma brain natriuretic peptide concentrations decreased [229±54 vs 419±110 pg/ml, p<0.05] in the sauna-treated group compared with the non-treated group.

Conclusion Repeated sauna treatment improves ventricular arrhythmias in patients with CHF. (Circ J 2004; 68: 1146–1151)

Key Words: Heart failure; Heart rate variability; Premature ventricular contractions; Sauna

Patients with chronic heart failure (CHF) have a high prevalence of potentially serious arrhythmias and consequently, a high incidence of sudden cardiac death^{1–4}. The presence of ventricular arrhythmias defines a higher-risk patient group with either ischemic or non-ischemic cardiomyopathy^{5–9}. Antiarrhythmic medications, such as class I drugs, have been tested in myocardial infarction survivors with depressed ventricular function and in atrial fibrillation patients with a history of congestive heart failure, and most were found not to be helpful and may even increase the occurrence of arrhythmias and cardiac mortality^{10–12}. Some studies have shown that amiodarone improves ventricular arrhythmias and sudden cardiac death mortality in patients with CHF, yet the improvement in total mortality remains controversial^{13–15}. Previous studies have demonstrated that vasodilators, such as angiotensin-converting enzyme inhibitors and angiotensin receptor blockers, improve the prognosis and ventricular arrhythmias in patients with CHF^{16–18} therefore arrhythmia is an important target for therapy in patients with CHF.

We have used thermal therapy with a 60°C dry sauna in patients with CHF, and found that it improves hemodynamic parameters, endothelial function, and clinical symptoms

in many patients^{19–21}. Furthermore, we have demonstrated that repeated sauna treatment improves the prognosis in hamsters with CHF²². It is well recognized that alterations in the neural control of the heart, characterized by decreased vagal activity and relative sympathetic predominance, play a key role in the occurrence of cardiac arrhythmias in patients with CHF²³. Several studies have shown that reduced heart rate variability (HRV), determined from 24-h ambulatory electrocardiographic (ECG) recordings, is associated with a greater risk for ventricular fibrillation and poor prognosis in patients with CHF^{24–27}. Therefore, we prospectively investigated the effects of thermal therapy on cardiac arrhythmias and HRV in patients with CHF.

Methods

Study Population

We studied 30 patients with CHF, aged 28–80 years (mean age: 59±3 years): 24 patients (16 men, 8 women) had idiopathic dilated cardiomyopathy and 6 (5 men, 1 woman) had ischemic cardiomyopathy. Inclusion criteria included the presence of symptomatic CHF, left ventricular ejection fraction (LVEF) <50% by echocardiography, New York Heart Association (NYHA) functional class II–III, and >200 premature ventricular contractions (PVCs) per day on 24-h Holter monitoring. Seven patients were in NYHA functional class II, and the other 23 were in class III. They were randomized into a sauna-treated group (n=20) or a non-treated group (n=10). The mean number of PVCs/24 h was 3,123±819; the mean cardiothoracic ratio (CTR) on chest radiography was 58.5±1.0% (range: 49–75%); and the mean LVEF on echocardiography was 29±2% (range:

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10–48%). All patients were receiving maintenance doses of medications for heart failure and arrhythmias, including angiotensin-converting enzyme inhibitors, diuretics,

were replaced by a linear interpolation algorithm. The standard deviation (SD) of all normal beat intervals and the mean length of the NN intervals (SDNN) were used for time-domain measures from the entire recording period. We analyzed 24 patients; 6 patients with atrial fibrillation were excluded.

Study Protocol

Sauna treatment was performed daily for 5 days each week, for a total of 2 weeks. All examinations were performed before the first treatment and on the day after the last treatment.

Statistical Analysis

All data are expressed as the mean \pm SEM. Differences in baseline characteristics were evaluated by the chi-square test and unpaired t-test. Within-group changes between baseline and after 2 weeks were evaluated by paired t-test or Wilcoxon signed rank test for variables that were not normally distributed. Between-group comparisons were evaluated by Mann-Whitney's U test using differences between baseline and after 2 weeks. A value of $p < 0.05$ was considered statistically significant.

Results

Baseline Clinical Characteristics and Assessment of Clinical Symptoms

Baseline clinical characteristics are summarized in Table 1. There were no differences in age, gender, NYHA functional class, mean heart rate, blood pressure or use of drugs, such as digoxin, angiotensin-converting enzyme

inhibitor,

nificantly greater in the sauna-treated group compared with the non-treated group (Table 2).

Neuro-Hormonal Factors

At baseline, there were no differences in the plasma concentrations of ANP, BNP, or catecholamine between the 2 groups. After 2 weeks, there were no differences in the plasma concentrations of ANP or catecholamine between the 2 groups, but the plasma concentration of BNP in the sauna-treated group was significantly lower than in the non-treated group (229 ± 54 pg/ml vs 419 ± 110 pg/ml, $p<0.05$; Table 3).

NYHA Functional Class, Chest Radiography, Echocardiography and Laboratory Parameters

At baseline, there were no differences in NYHA functional class, CTR or LVEDD between the 2 groups, but after 2 weeks, there was a significant difference in NYHA functional class, body weight, and CTR in the sauna-treated group; LVEDD did not change between the 2 groups. Laboratory parameters, including liver function tests (aspartate aminotransferase, alanine aminotransferase, lactate dehydrogenase,

ventricular arrhythmias at 2 weeks, but further studies of the long-term effects and benefit in CHF patients with NYHA functional class IV are needed.

In conclusion, repeated 60°C sauna treatment decreased ventricular arrhythmias in CHF patients with NYHA functional class II or III.

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