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Repeated Sauna Treatment Improves Vascular Endothelial and Cardiac Function in Patients With Chronic Heart Failure

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Rationale and Design

This group previously showed that thermal therapy by dry sauna improved clinical variables and cardiac output in congestive heart failure (CHF) patients. In the current study, the investigators sought to determine the mechanisms of this improvement and the effects of thermal therapy on endothelial function.

Twenty patients with CHF class ll or lll and mean age 62 ± 15 years were studied. The mean ejection fraction was 38 ± 14%. The patients were placed supine in a 60 degree C infrared-ray dry sauna for 15 minutes and then removed and kept at bed rest with a blanket for an additional 30 minutes. Sauna therapy was performed once a day 5 days a week for 2 weeks.

Symptoms were evaluated with a self-administered questionnaire, and patients were divided based on their responses of *improved* or *no change*. Fasting blood was obtained to evaluate neurohumeral factors, atrial natriuretic peptide (ANP), brain natriuretic peptide (BNP), and tumor necrosis factor (TNF). Endothelial function was evaluated using a noninvasive ultrasound method to determine hyperemic response in the right arm and response to sublingual nitroglycerin.

Results

All enrolled patients completed the study. Clinical symptoms improved in 17 of 20 patients and were unchanged in 3. Two-week sauna therapy significantly increased the %FMD (flow-mediated dilation) in the improved group but not in the unchanged group. BNP concentrations were lower after 2 weeks of therapy but ANP and catecholamine levels were unchanged. The left ventricular end-diastolic dimension decreased significantly compared with baseline. There was a significant correlation between the change in %FMD and the improvement in BNP ($P<.0005$).

Editor's Comment

It is known that CHF patients have impaired endothelial-dependent vasodilatation and the proposed mechanism for this is decreased peripheral vascular production of endothelium-derived nitric oxide. Endothelial function in CHF can be improved with ACE inhibitors, physical training, and vitamin C. This study showed that 2 weeks of sauna therapy also improved endothelial function and decreased the BNP. BNP levels are an important marker of cardiac status and prognosis in heart failure, as highlighted by several recent studies. The sauna therapy also reduced systolic blood pressure. The precise mechanism by which sauna therapy improves CHF is not clear from this study, but the authors hypothesize that sauna therapy acutely causes vasodilatation, which leads to upregulation of eNOS protein in the endothelium. Clinically, it is worth commenting that sauna therapy may be widely applicable to CHF patients and could also be used in patients incapable of exercise.