can be used to visualize the position of any electrophysiologic catheter. This may have implications for the regular use of such a system.

Radiation exposure during catheter ablation of supraventricular tachycardias depends on the operator and the fluoroscopic system used.[12,13] To minimize the effect of these confounding variables, patients were matched by operator in the present study, and all procedures were performed in the same year by the same electrophysiologic team, using an identical fluoroscopic system. Furthermore, patient groups were almost identical for nonmatched variables such as body mass index. Because this study was part of the initial European Safety Trial of LocaLisa, we used continuous fluoroscopy during all radiofrequency current applications in this study to minimize potential risks related to the use of LocaLisa. The growing experience with the system and technical improvements of LocaLisa may further reduce radiation exposure.

The routine use of a new nonfluoroscopic catheter visualization system reduces procedure-related exposure to ionizing radiation by 35% during ablation of supraventricular tachycardias after a short training phase. These results encourage the use of LocaLisa for catheter ablation procedures and may warrant further evaluation of the system in randomized trials.

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Effect of Repeated Sauna Therapy on Survival in TO-2 Cardiomyopathic Hamsters With Heart Failure

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Several clinical and experimental studies have shown that vascular endothelial function is impaired in chronic congestive heart failure (CHF), leading to vasoconstriction and clinical symptoms.[1] We have recently reported that repeated sauna therapy using 60°C sauna, a new nonpharmacologic thermal vasodilation therapy, induces vasodilation of the systemic and pulmonary arteries and veins, reduces cardiac preload and afterload, and improves hemodynamics and clinical symptoms in patients with CHF,[2,3] probably due to improvement in vascular endothelial dysfunction[3–5] and abnormality of neurohormonal systems.[2,3] Therefore, we sought to determine whether repeated sauna therapy improves prognosis in CHF. Because it is difficult to evaluate the precise clinical effect of single treatment on survival in patients with CHF, we investigated whether repeated sauna therapy improves survival in CHF using cardiomyopathic hamsters.

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The TO-2 cardiomyopathic hamsters (Bio Breeders, Fitchburg, Massachusetts) that were used in this study, an animal model of idiopathic dilated cardiomyopathy, reproducibly develop CHF (general edema,

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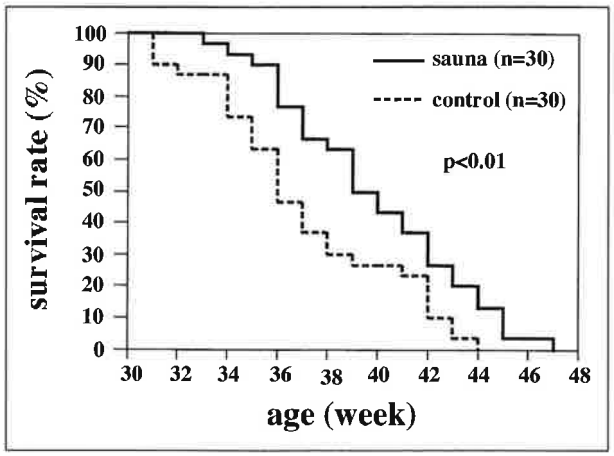

FIGURE 1. Kaplan-Meier curves of survival in sauna-treated and control hamsters. *Solid line,* sauna-treated hamsters (n = 30); *broken line,* control hamsters (n = 30). The survival rate was significantly improved by sauna treatment (p <0.01).

pleural effusion, and so forth) around 30 weeks old and die within a year.[6,7] All hamsters were allowed food and water ad libitum and maintained under controlled environmental conditions (24°C, 12-hour light/dark cycles). This study was performed in accordance with the Guide for Animal Experimentation of the Faculty of Medicine at Kagoshima University.

Sixty male 30-week-old TO-2 hamsters were divided into 2 groups (sauna, n = 30 and controls, n = 30). There was no difference in body weight at 30 weeks of age between the 2 groups (sauna 122.3 ± 7.6 g, control: 121.2 ± 7.8 g, p = NS); no hamster was excluded during the study.

Sauna therapy was performed as previously described.[5] In brief, the 30 TO-2 hamsters in the sauna group underwent sauna therapy in an experimental far infrared ray dry sauna system at 39°C for 15 minutes followed by 30°C for 20 minutes, in which their core temperatures were elevated about 1°C. This temperature was maintained for about 20 minutes as shown in the clinical setting,[2,3] once daily, 5 times/week. We have confirmed that the proper sauna temperature (60°C for 15 minutes) to clinically treat CHF is one that increases core temperatures by about 1°C.[2,3] Under this condition, the sympathetic nervous system is not stimulated, the increase in oxygen consumption is only 0.3 METs, and patients do not feel uncomfortable.[2] Therefore, we determined that the proper condition is 39°C for 15 minutes, which induces an increase of 1°C in core temperature in hamsters.[5] In contrast, 30 TO-2 hamsters in the control group were placed in the same sauna system switched off for 35 minutes (24°C) once daily, 5 times/week.

Survival curves were plotted by use of the Kaplan-Meier method and analyzed by the log-rank test. Statistical significance was set at p <0.05.

During sauna treatment, the hamsters were calm, not excited or suffering, and their behavior was quite similar to that of the controls. No hamster died during or right after sauna treatment throughout the study. As shown in Figure 1, the survival rate in the sauna group was significantly higher than that in the control group, as analyzed with Kaplan-Meier method (log-rank test p <0.01).

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In this study, we clarified that repeated sauna therapy improves survival in cardiomyopathic hamsters with CHF. We have already reported that sauna therapy induces thermal vasodilation of the systemic and pulmonary arteries and veins, reduces cardiac preload and afterload, and improves hemodynamics and clinical symptoms in patients with CHF.[2] Repeated sauna therapy, therefore, may improve the prognosis as well as the quality of life in patients with CHF.

We have already demonstrated that repeated sauna therapy improves impaired vascular endothelial function, and decreases the brain natriuretic peptide concentrations in patients with CHF, and that there is a significant correlation between the degree of improvement of endothelial dysfunction and the percent improvement in the brain natriuretic peptide concentrations.[3] These data suggest that repeated sauna therapy improves the peripheral vascular endothelial dysfunction and then reduces cardiac afterload, resulting in an improvement in cardiac dysfunction, clinical symptoms, and prognosis in CHF. Furthermore, we have already found that repeated sauna therapy upregulates arterial endothelial nitric oxide synthase mRNA and protein expression in hamsters.[5] We believe that this is one of the mechanisms by which repeated sauna therapy improves vascular endothelial dysfunction. Because we have also found that increased cardiac afterload induces myocardial injury in dystrophin-deficient mice,[8] long-term sauna therapy may ameliorate myocardial injury due to the reduction of cardiac afterload.

The beneficial effect of repeated sauna therapy on the prognosis of cardiomyopathic hamsters was significant but modest in this study. We treated TO-2 hamsters with CHF only by sauna to estimate the precise effect of sauna therapy on prognosis in CHF. It is likely that a combination of pharmacologic and sauna therapy may bring a further improvement in mortality in CHF.

In conclusion, repeated sauna therapy improved survival in TO-2 cardiomyopathic hamsters with CHF, suggesting a new potential nonpharmacologic therapy for CHF.

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