Are hot tubs safe for people with treated hypertension?

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Abstract

Background: People with hypertension are commonly warned to check with a physician before using a hot tub, but there is little literature on which to base this advice. We compared symptoms, heart rate, and systolic and diastolic blood pressure in response to 10 minutes of hot-tub immersion in a group of patients with treated hypertension and in a control group normotensive subjects.

Methods: We recruited 21 patients (18 men and 3 women aged 43–76 years) with stable, treated hypertension and 23 control subjects (14 men and 9 women aged 19–83 years) without hypertension. They were studied, in mid-afternoon, at a public facility. Systolic and diastolic blood pressure and heart rate were measured at baseline, during immersion in a hot tub at 40°C and for 10 minutes after immersion. We asked each subject to report any symptoms.

Results: None of the subjects reported dizziness, chest pain or palpitations. During immersion, systolic blood pressure fell in both groups, from a mean (and standard deviation [SD]) of 144 (17) mm Hg to 122 (18) mm Hg in the hypertensive group ($p < 0.05$) and from 130 (14) mm Hg to 110 (17) mm Hg in the control group ($p < 0.05$). It returned toward baseline within 10 minutes after the subjects left the hot tub. Diastolic blood pressure also fell, whereas heart rate was increased in both groups. The hypertensive group showed a slightly lower maximal increase in heart rate than the normotensive group (5 [SD 5] v. 13 [SD 10] beats/minute, $p < 0.05$).

Interpretation: Immersion in a hot tub for 10 minutes lowers blood pressure in subjects with treated hypertension, but no more than in normotensive control subjects. Spending 10 minutes in a hot tub should be safe for most treated hypertensive patients.

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Hot tubs, commonly called jacuzzis, are very popular in Canada and other temperate countries. Most public facilities with hot tubs post a sign stating that people with high blood pressure (or other medical conditions) should consult a physician before using them. In a MEDLINE search of articles published from 1966 to 2002, we found only one paper on the dangers of "hot tubbing."[1] This report, from Australia, published in 1980 and picturesquely subtitled "suicide soup," described near syncope in 3 healthy men immersed in a 41°C hot tub for 3 periods of 20 minutes each. In 2 of the 3 men the diastolic blood pressure became "unrecordable." To our knowledge, there is no other report confirming this observation, testing the effect of shorter exposures or extending it to treated hypertensive subjects. It seemed possible that people with treated hypertension may be less able than those without hypertension to maintain blood pressure in the face of a vasodilator stress, owing either to a deficient baroreflex[2] or to drug therapy.[3]

We therefore tested the hypothesis that hemodynamic responses to hot-water immersion would be greater in treated hypertensive subjects than in normotensive subjects. We chose a 10-minute exposure as a reasonable, likely safe, period.

Methods

We recruited 21 patients (18 men and 3 women aged 43 to 76 years) receiving drug treatment for hypertension at the Cardiovascular Risk Factor Reduction Unit of the University of Saskatchewan, Saskatoon, and 23 control subjects (14 men and 9 women aged 19 to 83 years) with normal blood pressure. The hypertensive subjects were considered to have their hypertension under good control in the clinic. None had had a stroke, transient ischemic attack, myocardial infarction or unstable angina within the 6 months before the study. Two had diabetes mellitus, controlled with oral medical therapy. None complained of postural dizziness. Antihypertensive drug therapy included thiazide-type diuretics ($n = 14$), angiotensin-converting-enzyme inhibitors ($n = 12$), calcium-channel antagonists ($n = 9$), angiotensin-receptor blockers ($n = 4$) and β-blockers ($n = 2$). The control subjects included family members of the authors and other volunteers. They had no personal or family history of hypertension, and none was taking drugs known to affect blood pressure.

All subjects gave written informed consent, and the University of Saskatchewan Committee on Ethics in Human Experimentation (Biomedical) approved the protocol.

The subjects wore only bathing attire and were studied at a public swimming facility (Harry Bailey Aquatic Centre, Saskatoon) in mid-afternoon. The air temperature was 27°C–29°C, and the hot tub water temperature was 40°C. A jet system agitating the water was engaged.

We placed chairs near the hot tub. After the subjects had had 10 minutes of seated rest, we recorded 3 consecutive blood pressure and heart rate readings (at 1, 5 and 10 minutes) with an Omron HEM-711IC oscillometric self-inflating and self-deflating device (Omron Healthcare, Inc., Vernon Hills, Ill.). The average of the 3 readings was taken as the baseline value. All subjects completed a 10-item questionnaire enquiring about symptoms (headache, lightheadedness, chest pain, palpitations or other discomfort).

The subjects then immersed themselves in the hot tub to mid chest level, with the blood pressure cuff in place. Further blood

pressure and heart rate readings were obtained 1, 5 and 10 minutes after the subjects entered the hot tub. Care was taken to position the arm at heart level during the recordings. The questionnaire was again administered between the 5- and 10-minute recordings. After 10 minutes the subjects left the hot tub and resumed sitting. Heart rate and blood pressure were monitored for 10 further minutes, and the questionnaire was again administered (between 5 and 10 minutes).

We calculated sample size requirements based on a fall in systolic blood pressure in the control group of 15 (standard deviation [SD] 10) mm Hg and a "clinically significant" difference in the reduction in systolic blood pressure in the hypertensive subjects of 25 (SD 10) mm Hg. For this, we required 18 subjects per group at $\alpha = 0.05$ and $1 - \beta = 0.90$. We compared the baseline characteristics of the groups using one-way analysis of variance. We compared changes in blood pressure and heart rate within each group using analysis of variance with repeated measures, and compared dichotomous variables using the χ^2 test.

Results

The baseline characteristics of the subjects are shown in Table 1. The hypertensive subjects were more likely than the normotensive subjects to be older, female and obese. However, the age range in the 2 groups overlapped considerably (43–76 years and 19–83 respectively). Systolic and diastolic blood pressure and heart rate were higher in the hypertensive subjects than in the normotensive subjects ($p < 0.05$).

We recorded no severe adverse effects before, during or after immersion the hot tub. No subject reported more than very mild headache or dizziness. None complained of palpitations or chest discomfort.

The changes in systolic and diastolic blood pressure and heart rate are shown in Fig. 1. Both groups showed a substantial fall in blood pressure and an increase in heart rate in the early phase of immersion; the values returned toward baseline 5–10 minutes after the subjects left the tub. The mean maximal change in systolic blood pressure in the hypertensive group was –26.3 (SD 12.5) mm Hg, compared with –21.8 (SD 10.4) mm Hg in the normotensive group, a nonsignificant difference. Diastolic blood pressure also fell in both groups, the mean maximal changes being –25.3 (SD 6.4) mm Hg and –24.4 (SD 12.1) mm Hg respectively, also a nonsignificant difference. There was no difference between the groups in these maximal changes as a percent of baseline.

The mean increase in heart rate was significantly lower in the hypertensive group than in the normotensive group (5.2 [SD 5.2] v. 12.9 [SD 9.5] beats/minute, $p < 0.05$). This difference persisted after the data for the 2 hypertensive subjects using β-blockers were removed from the analysis.

Fig. 2 depicts the frequency distribution of maximal changes in systolic blood pressure; there was no difference between the 2 groups. The frequency distribution of maximal heart rate changes was shifted downward in the hypertensive group (data not shown).

There was no correlation between age and the change in blood pressure or heart rate in either group or in the subjects as a whole. Also, we found no effect of female or male sex on these changes.

Interpretation

In this group of treated hypertensive subjects, immersion in a hot tub caused substantial falls in systolic and diastolic blood pressure accompanied by an increase in heart rate. However, none of the subjects became symptomatic, and the changes in blood pressure, both in absolute and in percentage terms, were not different from those in the normotensive control subjects. Although the heart rate response was reduced in the hypertensive subjects, blood pressure in this group returned to baseline values almost as rapidly as in the normotensive group.

We found no studies with which to compare ours. In the 1980 Australian study[1] the subjects were immersed for 3 consecutive 20-minute periods separated by either standing or light exercise. A report in which healthy animals (3 dogs and 2 monkeys) were immersed in 40°C–45°C water for 60 minutes documented a shocklike, apparently hypovolemic state following the exposure.[4] Our protocol was much less demanding, and we did not observe symptomatic hypotension, arrhythmias or other symptoms.

The effects of high-temperature sauna bathing on hemo-

Table 1: Baseline characteristics of hypertensive subjects and normotensive control subjects immersed in a hot tub for 10 minutes

Characteristic	Hypertensive subjects *n = 21*	Normotensive subjects *n = 23*	*p* value
Mean age (and SD), yr	60.6 (10.1)	43.0 (17.3)	< 0.02
Sex (male/female), no. of subjects	18/3	14/9	0.03
Mean body mass index (and SD)	25.9 (3.9)	23.0 (3.4)	NS
No. of antihypertensive drugs used	1–3	0	
Mean systolic blood pressure (and SD), mm Hg	144.8 (17.3)	130.0 (14.2)	< 0.05
Mean diastolic blood pressure (and SD), mm Hg	92.7 (8.9)	83.1 (9.1)	< 0.05
Mean heart rate (and SD), beats/min	83.3 (14.8)	74.7 (12.9)	< 0.05

Note: SD = standard deviation; NS = not significant.

dynamics[5,6] and on other physiologic functions have been investigated. In general, few adverse effects have been reported, either in normotensive subjects or in patients with hypertension or coronary artery disease. Indeed, Luurila[7] reported that only 1.7% of all sudden deaths in Finland occurred within 24 hours after exposure to a sauna. In healthy people a 30-minute sauna increases the heart rate but does not affect blood pressure.[8] Presumably the increase in cardiac output compensates for the vasodilation-induced fall in peripheral resistance. Likewise, systolic blood pressure did not change during a 14- to 20-minute sauna in 11 young hypertensive subjects treated with either placebo or diltiazem.[9] Systolic blood pressure did fall by 12 mm Hg when these subjects were treated with atenolol. This reduction seems less than the reduction of 26 mm Hg observed in our subjects. The question arises as to whether the hot tub truly induces a greater fall in blood pressure than the sauna. It is plausible that the lower body positive pressure due to the water initially increases venous return, leading to the production of cardiac natriuretic peptides.[10] These potent vasodilators may further decrease peripheral resistance.

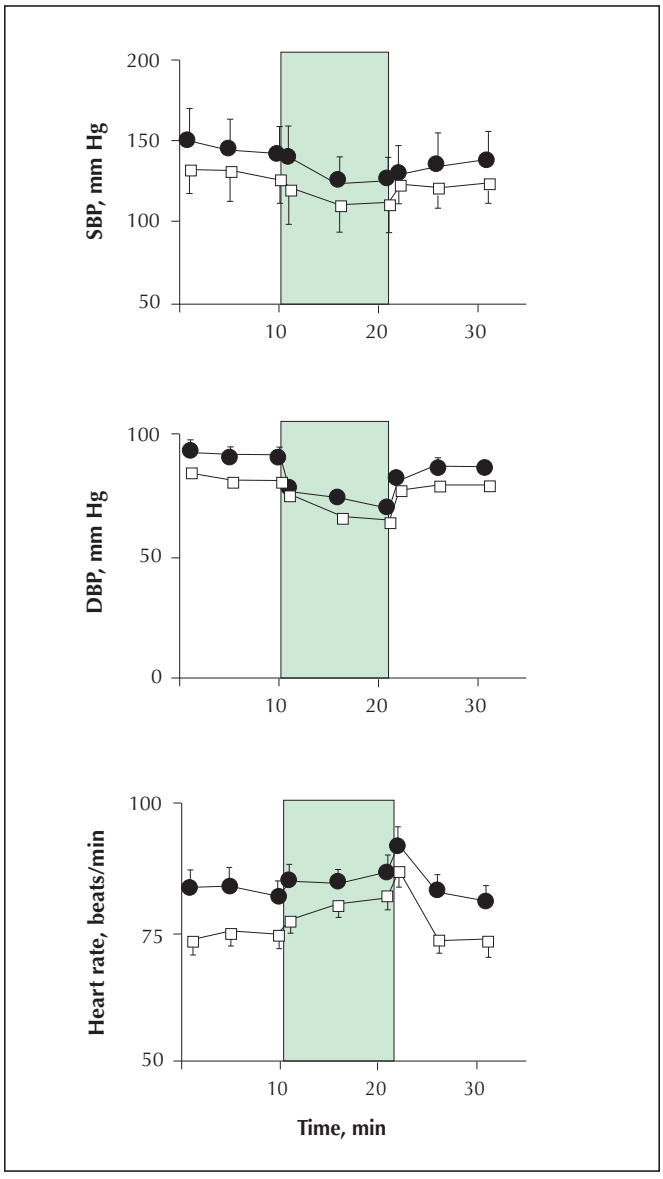

Fig. 1: Systolic blood pressure (SBP), diastolic blood pressure (DBP) and heart rate in hypertensive subjects (*n* = 21) (black circles) and normotensive subjects (*n* = 23) (white squares) before, during and after 10-minute immersion in a hot tub at 40°C. Error bars are standard error of the mean. Grey areas represent time spent in the hot tub.

How much can blood pressure be reduced acutely without causing symptoms? Studies done several decades ago in which normotensive subjects and subjects with treated and untreated hypertension were given sympathoplegic agents to acutely reduce blood pressure showed that cerebral blood flow was unchanged when mean arterial pressure was reduced by 25% (equivalent to a reduction of 35% in systolic blood pressure).[11,12] Furthermore, no symptoms were reported until systolic blood pressure was reduced by 50%. Accordingly, a reduction of 20%–25% in mean arterial pressure within "minutes to hours" is recommended for hypertensive emergencies.[13] We observed reductions in mean arterial pressure of 26% (from 99 to 73 mm Hg) in the normotensive group and of 23% (from 110 to 85 mm Hg) in the hypertensive group. Only 3 normotensive subjects and 1 hypertensive subject showed reductions greater than 30%, and none showed reductions greater than 35%; none complained of hypotensive symptoms.

It should be noted that we measured blood pressure with the subject seated rather than supine or standing. It is possible that greater changes would have been observed in standing subjects. Caution should be exercised in extrapolating our findings to patients with other disorders. For example, seizures have been provoked in people with epilepsy by hot-water immersion.[14] Similarly, children may be more susceptible to symptomatic, heat-induced hypotension.[15] Finally, none of our subjects was taking long-acting nitrates

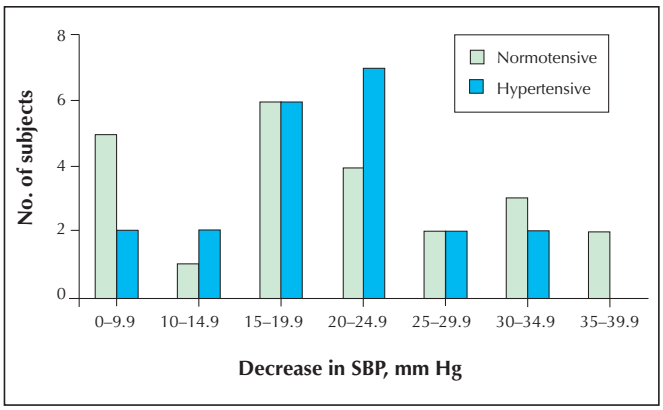

Fig. 2: Frequency distribution of maximal changes in systolic blood pressure (SBP) during hot-tub immersion in the normotensive and hypertensive groups.

or wearing nitroglycerine patches. It is uncertain whether these potent vasodilators would aggravate hypotension from hot-tub use; this warrants investigation.

In summary, we have shown that a 10-minute immersion in a hot tub is likely safe for most people with hypertension controlled with drug treatment. Physicians can reassure their patients.

This article has been peer-reviewed.

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Competing interests: None declared.

Contributors: All of the authors contributed to the conception, design and execution of the study. Drs. Shin and Wilson contributed to the data analysis. Dr. Wilson wrote the initial draft of the manuscript. All of the authors reviewed and revised the draft manuscript.

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