Effects of regional heat stimulation by moxibustion on cardiovascular responses

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Abstract Background: Moxibustion is an alternative medicine performed by burning moxa at a specific part of the body. However, there has been no quantitative analysis of whether moxibustion induces physiological responses in previous studies. In this study, we investigated the thermal effects of moxibustion on cardiovascular responses. Methods: Twenty healthy volunteers participated in this study. Moxibustion treatment was applied to the lower leg (Zusanli acupoint). Heart rate (HR), blood pressure (BP) and skin temperature (ST) were measured continuously for 2 min at rest and 6 min at moxibustion. Results: HR significantly decreased (64.3±7.5 to 62.3±1.3bpm, p=0.005) when ST reached a maximum (45.0±10.1℃) by moxibustion. There was no significant change in BP, and the bradycardic effect was also observed when ST was continuously maintained with a 38℃ heat stimulator at specific sites in the body. Conclusion: Regional heat stimulation by moxibustion provides fundamental evidence for effective bradycardia response.

Keywords Heart rate, Blood pressure, Skin temperature, Moxibustion, Heat stimulation

1. Introduction

Moxibustion is an alternative medicine performed by burning moxa at a specific part of the body. Previous studies reports indicated that moxibustion was also promoted as a treatment for pain relief and gastrointestinal problems such as irritable bowel syndrome [1,2]. In clinical practice, on the other hand, it has been used to treat cardiovascular disease including hypertension, but its use is not backed by research evidence in previous studies.

Local thermotherapy such as neck and chest packs have been reported to induce cardiovascular responses [3,4]. These findings suggest that regional heat stimulation affected cardiovascular responses through the modulation of autonomic nervous system activities. In addition, the transient receptor potential cation channel family, especially the vanilloid 1 (TRPV) is known as heat-sensitive channels [5,6]. A previous animal study also demonstrated that TRPV1 activation in peripheral sensory nerves induced by thermal stimulation at acupoint in lower leg decreased sympathoexcitatory cardiovascular reflex responses [7]. However, to the best of our knowledge, subsequent studies have not examined the effect of heat stimulation by moxibustion on cardiovascular responses in humans in more detail.

Therefore, the aim of the study was to quantify heart rate and blood pressure responses to heat stimulation generated by moxibustion.

2. Methods

Subjects

Twenty-one volunteers participated in the present study. All protocols were reviewed and approved by the

Ethics Committee of Morinomiya University of Medical Sciences (No. 2019-057). Written informed consent in accordance with the Declaration of Helsinki was obtained from all subjects after they were given full explanations of the objectives, methods, and potential risks of the study.

Protocol 1(n=20)

The subjects had mean (±SD) 20.8±0.5 age. The experiment was designed to investigate the effect of moxibustion on heart rate and blood pressure responses Subjects were requested to remain calm in a rest supine position for approximately 5min. Then, disposable electrocardiogram (ECG) electrodes, blood pressure measurement device, and skin thermometer were attached. Cardiovascular responses were recorded for 2 min of the resting period and 6 min at moxibustion. Each subject received heat stimulation induced by moxibustion to the Zusanli acupoint (WHO; ST36) of the right side.

Protocol 2 (n=1)

A subject had 21 age. The experiment was designed to observe the effect of heat stimulator (CQ5000, Murata, Kyoto, Japan), which provide a constant heat stimulation, on heart rate response. The subject was attached disposable ECG electrodes and requested to remain calm in a rest supine position for 3 min. Then subjects were received heat stimulation with a heat stimulator, which is maintained by 43 ℃ of temperataure, for 3 min.

Figure 1. Heat stimulator

Data analysis

In protocol 1, cardiovascular measurements and skin temperature were averaged as follows: 2min of resting period, each 1 min segment during heat stimulation period. In protocol 2, heart rate response and skin temperature were averaged as follows: 3 min of resting period, 3min of heat stimulation period.

3. Results

Protocol 1

Figure 2A shows representative traces of heart rate response and skin temperature recorded in one subject. Heart rate decreased as skin temperature increased.

Figure 2B depicts representative traces of blood pressure response and skin temperature recorded in one subject. Blood pressure did not change with increased skin temperature.

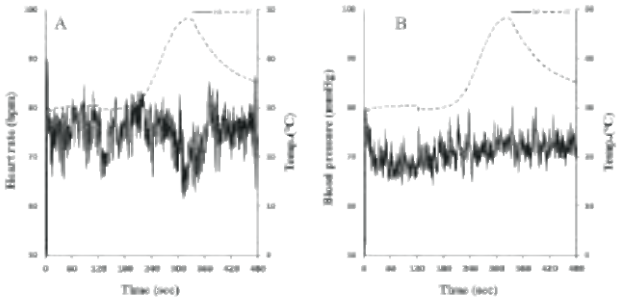

Figure 2. Representative traces of heart rate (A) and blood pressure (B) responses to heat stimulation obtained with protocol 1. The solid line represents heart rate or blood pressure, and the dotted line represents skin temperature.

Figure 3 indicates heart rates averaged for all subjects during the rest period and the heat simulation period when reached the average skin temperature to the maximum level for 1 min. Heart rate decreased significantly during the heat stimulation period compared to the rest period. Skin temperature increased significantly from 30.0 ± 13.1 ℃ at rest to 45.0± 10.1℃ at maximum level. On the other hand, there was no significant difference in blood pressure between the rest and the heat stimulation periods.

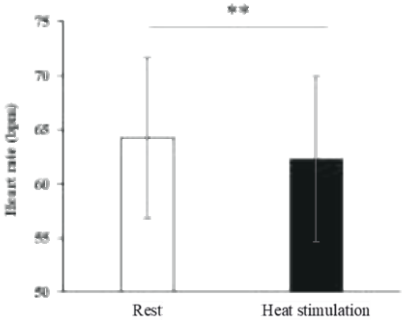

Figure 3. Heart rate averaged during rest period and heat stimulation when the skin temperature reached the maximum level for 1 min.
**p<0.01 by paired *t* test.

Protocol 2

Figure 4 depicts traces of heart rate response and skin temperature recorded in one subject both resting and heat stimulation periods. Heart rate decreased during heat stimulation compared to rest (68.2 bpm to 65.5bpm).

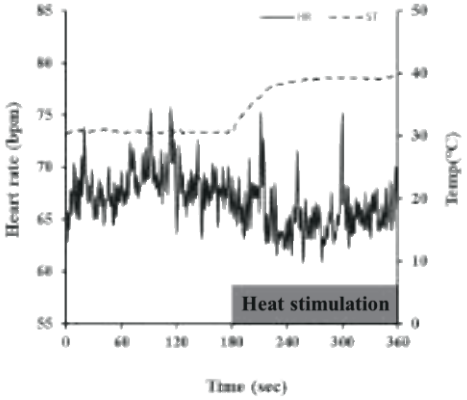

Figure 4. Representative traces of heart rate (HR) and skin temperature (ST) recorded with protocol 2. Gray bars denotes the duration of the heat stimulation .

4. Discussion

The present study demonstrated that the effects of regional heat stimulation by moxibustion on heart rate response, such that significant bradycardic response was observed during the heat stimulation. Furthermore, the bradycardic response became more pronounced with increases in skin temperature. The bradycardic effect was also observed when skin temperature was continuously maintained with a 38°C using heat stimulator.

Local heat stimulation causes cardiovascular responses. Yasui et al. [3] indicated that increasing parasympathetic nervous activity and decreasing sympathetic nervous activity were observed by applying a heat- and steam-generating sheet on the neck. Manjuladevi et al. [4] also reported that a significant decrease in systolic blood pressure was observed during the hot chest pack. These findings support our results.

In addition, our study observed that the bradycardic effect became more pronounced as the skin temperature increased. The result suggests that there is temperature-dependence of heart rate response for heat stimulation.

5. Conclusion

Regional heat stimulation by moxibustion provides fundamental evidence for effective bradycardia response.

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