Science Press

Journal homepage:
www.jcimjournal.com/jim
www.elsevier.com/locate/issn/20954964
Available also online at www.sciencedirect.com.

• Short Report

Effects of ice massage of the head and spine on heart rate variability in healthy volunteers

A. Mooventhan[1], L. Nivethitha[2]

1. Sri Dharmasthala Manjunatheshwara College of Naturopathy and Yogic Sciences and Hospital, Ujire-574240, Karnataka, India
2. Swami Vivekananda Yoga Anusandhana Samsthana University, Bengaluru-560019, Karnataka, India

ABSTRACT

OBJECTIVE: Ice massage (IM) is one of the treatment procedures used in hydrotherapy. Though its various physiological/therapeutic effects have been reported, effects of IM of the head and spine on heart rate variability (HRV) have not been studied. Thus, this study evaluated the effects of IM of the head and spine on HRV in healthy volunteers.

METHODS: Thirty subjects were randomly divided into 3 sessions: (1) IM, (2) tap water massage (TWM) and (3) prone rest (PR). Heart rate (HR) and HRV were assessed before and after each intervention session.

RESULTS: A significant increase in the mean of the intervals between adjacent QRS complexes or the instantaneous HR (RRI), square root of mean of sum of squares of differences between adjacent normal to normal (NN) intervals (RMSSD), number of interval differences of successive NN intervals greater than 50 milliseconds (NN50), proportion derived by dividing NN50 by total number of NN intervals along with significant reduction in HR after IM session; significant increase in RRI along with significant reduction in HR after TWM, and a significant increase only in RMSSD after PR were observed. However, there was no significant difference between the sessions.

CONCLUSION: Results of this study suggest that 20 min of IM of the head and spine is effective in reducing HR and improving HRV through vagal dominance in healthy volunteers.

Keywords: heart rate variability; hydrotherapy; massage therapy

Citation: Mooventhan A, Nivethitha L. Effects of ice massage of the head and spine on heart rate variability in healthy volunteers. *J Integr Med.* 2016; 14(4): 306–310.

1 Introduction

Naturopathy is a drugless system that aims to bring harmony in the physical, mental, moral and spiritual planes of living[1]. It is a distinct type of primary care medicine that blends age-old healing traditions with scientific advances and current research[2]. It consists of hydrotherapy, diet therapy, fasting therapy, mud therapy, helio therapy and air therapy[1]. Hydrotherapy is the external/internal use of water in any of its forms (ice, water and steam) at various temperatures, pressures, durations and locations on the body for the promotion of health or the treatment of various diseases. It was used widely in ancient cultures including India, Egypt and China[3].

Cardiovascular functions are controlled by neural factors, hormones and temperature[4]. Ice is a therapeutic agent used in medicine as an integral part of injury treatment and rehabilitation[5]. The application of ice has been shown to produce physiologic changes[6], such as reduction in pain, edema, nerve conduction velocities,

http://dx.doi.org/10.1016/S2095-4964(16)60266-2
Received April 21, 2016; **accepted** May 29, 2016.
Correspondence: A. Mooventhan, MD; E-mail: dr.mooventhan@gmail.com

cellular metabolism and local blood flow. It also has been shown to induce local anesthesia around treatment area[5,7,8], attenuate ischemic tissue damage and reduce microcirculatory impairment[8].

Ice massage (IM) of the head and spine is one of the naturopathic treatments used to reduce blood pressure[9]. Though it is widely used, the precise physiological responses have not been fully explored and, to the best of our knowledge, no study has reported the effect of IM of the head and spine on heart rate variability (HRV). Thus, the present study evaluates the effect of IM of the head and spine on HRV in healthy volunteers.

2 Materials and methods

2.1 Subjects

A total of 30 healthy male volunteers between 18 and 25 years of age were recruited from a residential college in south India based on the inclusion criteria.

2.1.1 Inclusion criteria

The criteria for inclusion of patients in the present study were: aged 18 years and above, male, and willing to participate in the study.

2.1.2 Exclusion criteria

Subjects were excluded if they had a history of any systemic and/or mental illness, regular use of any medications, regular smoking and/or regular alcohol consumption.

The study protocol was approved by the institutional ethics committee of Sri Dharmasthala Manjunatheshwara College of Naturopathy and Yogic Sciences and a written informed consent was obtained from each subject.

2.2 Study design

A cross over design was used, in which each participant was assessed in three different intervention sessions: (1) IM, (2) tap water massage (TWM) and (3) prone rest (PR). Subjects were assigned to treatment order randomly by drawing from an envelope with the description of the three different orders (n=10)[10]. The sessions were performed on days 1, 2 and 3 respectively in orders: IM, TWM, PR (the first order); TWM, PR, IM (the second order); or PR, IM, TWM (the third order). Assessments of heart rate (HR) and HRV were measured before or after 20 min of each intervention session. The trial profile is shown in Figure 1.

2.3 Intervention

Each subject received 3 intervention sessions in any one of the 3 different orders as described in the above. The duration of each intervention session was about 20 min[5,11–13]. Duration of the intervention was chosen based on a previous study[14].

2.3.1 IM session

Subjects were asked to lie prone on the massage table. Then, IM was given to the head and spine by continuous longitudinal displacements[7] by means of a rubber bag filled with ice[15] (1–2 °C) for the duration of 20 min[5,11–13]. The use of an ice bag was mainly to avoid overuse injuries among the patients[6].

2.3.2 TWM session

TWM was given as an active control for IM. Subjects were asked to lie prone on a massage table. Then TWM was given to the head and spine by continuous longitudinal displacements by means of a rubber bag filled with tap water (24–25 °C) for the duration of 20 min.

2.3.3 PR session

PR was given as a passive control, in which subjects did not receive any hydrotherapic intervention, but similar to IM and TWM, all subjects were asked to lie in the prone position for 20 min. The prone rest was given to avoid postural variation.

2.4 Assessments

2.4.1 Anthropometrics

Height (cm) was measured using a standard measuring tape[4]. Weight (kg) and body mass index (BMI, kg/m^2) were measured using Body Composition Analyzer (TANITA SC-330, Japan), which calculates body composition from bio-electric impedance, and measured by the unit[16]. The measurement was done by asking the subjects to stand erect with bare feet on the footplate of the analyzer.

2.4.2 HR and HRV

HR and HRV were assessed using a four-channel polygraph (MP 36, Biopac Student Lab, BIOPAC System Inc, USA). The Ag/AgCl pre-gelled electrodes were placed according to the standard limb lead II configuration for recording electrocardiogram. Data were acquired at the sampling rate of 1 024 Hz.

2.4.3 Data extraction

Frequency domain and time domain analysis of the HRV data were carried out for baseline and post-intervention (5 min recordings for each) for each of the three intervention sessions. The data recorded were visually inspected off-line and only noise-free data were included for the analysis[17].

The data were analyzed with an HRV analysis program developed by the Biomedical Signal Analysis Group (University of Kuopio, Finland)[18]. The energy in the HRV series in the following specific frequency bands was studied: low frequency (LF) band (0.05–0.15 Hz), and high frequency (HF) band (0.15–0.5 Hz). LF/HF ratio was also calculated. The LF and HF band values were expressed as normalized units. The following components of the time domain HRV were analyzed: (1) the mean of the intervals between adjacent QRS complexes or the instantaneous HR (RRI), (2) HR, (3) the square root of the mean of the sum of the squares of differences between adjacent normal to