Cardiovascular Responses Associated with the Moving Beans Task: Influence of Psychological Characteristics

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Background and Objective: High blood pressure (BP) after stroke is associated with a poor outcome. However, exercise training or speech therapy for patients with stroke can raise the BP. The aim of this study was to examine cardiovascular responses during the moving beans task (MBT) used in occupational therapy and to study the influence of psychological characteristics on cardiovascular responses during this task in healthy subjects. *Materials and Methods:* In 34 healthy volunteers, the BP and the heart rate (HR) were continuously measured during the baseline period, the 5-minute MBT, and the 1-minute cold pressor test (CPT). All subjects completed self-reported questionnaires, including the Center for Epidemiologic Studies Depression Scale (CES-D), the State Trait Anxiety Inventory Y-2, and the Japanese version of the 20-item Toronto Alexithymia Scale (TAS-20). *Results:* The systolic blood pressure (SBP), the diastolic blood pressure (DBP), and the mean blood pressure (MBP) significantly increased during the MBT and the CPT compared with the baseline values. SBP, DBP, and MBP responses during the MBT significantly correlated with the TAS-20 scores. Moreover, DBP response during the MBT correlated with the CES-D scores. *Conclusions:* The MBT significantly raised BP without increasing the HR. BP responses during this task were influenced by the psychological characteristics of depression and alexithymia.
Key Words: Blood pressure—depression—alexithymia—occupational therapy.

Introduction

A poor outcome after stroke is independently associated with an elevation in the blood pressure (BP) during the acute phase.[1] BP is the most consistent and powerful predictor of stroke.[2] BP reduction lowers vascular risk after stroke.[3] Conventionally, patients with stroke participate in an exercise program for their rehabilitation. However, exercise seems to be linked to transient increases in BP[4]; therefore, BP should be carefully monitored before and during rehabilitation.

Previous studies have examined the effects of physical therapy on BP and heart rate (HR) during exercise training for patients with stroke. Functional walk tests such as the 6-minute walk test increased systolic blood pressure (SBP) by approximately 16 mm Hg, diastolic blood pressure (DBP) by approximately 2 mm Hg, and HR by approximately 29 bpm compared with the rest

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in patients with stroke.[5] The bicycle ergometer exercise at 4 metabolic equivalents significantly increased SBP by 79 mm Hg in patients with stroke.[6] Furthermore, during active movements of patients with subacute stroke, such as sitting, standing, and walking, both SBP and DBP variabilities were significantly higher compared with those in the movements of healthy volunteers.[7] On the other hand, in speech therapy, the therapist-directed approach substantially increased both SBP and DBP in patients with stroke with disturbances in speech,[8] the so-called white coat effect.[9] Similar to these cases, increased BP during occupational therapy for patients with stroke was also predicted. However, few studies have reported about cardiovascular responses in occupational therapy. In healthy participants, moving beans with chopsticks using the nondominant hand for 5 minutes increased the SBP and the DBP.[10] The moving beans with chopsticks task training has been used in rehabilitation, particularly in occupational therapy, for dominant hand disorders in patients with stroke.[11] BP changes during the moving beans task (MBT) may be due to both physical and psychological effects.[10] However, little is known about the effects of the MBT on cardiovascular response.

Cardiovascular responses to stress are influenced by psychological characteristics.[12] The psychological characteristics, such as depression, anxiety, and alexithymia, are associated with a significant increase in BP during stress stimuli.[13-15] One third of all patients with stroke experience significantly depressive symptoms after the onset of stroke.[16] Alexithymia seems to be a common feature of neurological diseases, with most evidence available for patients with traumatic brain injury, stroke, and epilepsy.[17] Therefore, BP should be carefully monitored during rehabilitation in patients with stroke.

The aims of the present study were to examine the cardiovascular responses during the MBT using the nondominant hand in healthy subjects and to further study whether psychological characteristics could influence the cardiovascular responses during the MBT.

Materials and Methods

Subjects

Thirty-four healthy volunteers (16 men and 18 women; mean age, 20.3 years [standard deviation {SD}, 2.8]) were enrolled in the study; no subject reported any physical or mental diseases. The subjects were instructed to abstain from food, alcohol, caffeine, and cigarettes for 2 hours before the task.[18] All subjects gave their written informed consent to participate. Each subject was provided an opportunity to refuse inclusion in the research. The study protocol was reviewed and approved by the Ethics Committee of Tohoku Fukushi University (RS0903173).

Experimental Procedure

Two types of tasks, the MBT[10] and the cold pressor test (CPT),[19] were performed by all subjects. Both tasks were performed in a quiet room with a temperature of approximately 22°C.[20] The subjects had to complete both tasks on the same day with 5-minute rest periods before, between, and after the tasks. The tasks were given in random order. The subject sat in a normal chair, with relaxed arms resting on the table. The BP and the HR were recorded continuously and noninvasively using a photoplethysmographic device[21] (Finometer; Finapres Medical Systems, Amsterdam, The Netherlands) from the middle phalanx of the third finger of the dominant hand. The validity, reliability, and clinical application of the Finometer device have been confirmed previously.[22] The dominant hand was positioned on the table at the level of the heart. The BP and the HR were continuously measured during the 5-minute rest periods, the 5-minute MBT, and the 1-min CPT.

Experimental Tasks

MBT

The subjects used chopsticks with the nondominant hand to transfer as many beans as possible from 1 dish to another within 5 minutes.[10] The dishes were 20 cm apart.

CPT

The BP and the HR were recorded during CPT, which is considered to be an acute physical stress, to compare with the BP and the HR during the MBT.[19] The nondominant hand was immersed up to the wrist for 1 minute in a bucket of ice water at 4°C with the subject sitting on a chair.

Psychological Characteristics

All subjects also completed self-report questionnaires to investigate their psychological characteristics. Questionnaires included the Center for Epidemiologic Studies Depression Scale (CES-D),[23] the State Trait Anxiety Inventory (STAI)[24] Y-2, and the Japanese version of the 20-item Toronto Alexithymia Scale (TAS-20).[25] CES-D is a well known and widely used self-rating scale for the screening of depression.[26] CES-D consists of 20 items measured on a 4-point (0-3) frequency scale, with potential scores ranging from 0 to 60. Higher scores indicate greater levels of depressive symptoms. The CES-D has been validated in community settings to detect depressive symptoms.[26] The STAI consists of 20 items to measure how they generally feel anxiety as a personality characteristic on a 4-point (1-4) Likert scale, with potential scores ranging from 20 to 80.[24] The STAI Y-2 assessment measures trait anxiety, which refers to a relatively stable characteristic of personality.[27] Higher scores indicate greater levels of trait