

Effect of lower limb exercise on orthostatic hypotension in patients with Parkinson's disease

Yasuko Mori, R.N.^{#1}, Kaori Nagao, R.N.^{#1}, Daisaku Kondo, R.N.^{#1}

#1. Department of Nursing department, Tokushima National Hospital, National Hospital Organization, 1354 Shikiji, Kamojima, Yoshinogawa, Tokushima 776-8585 Japan

Abstract

Patients with Parkinson's disease are prone to orthostatic hypotension because the blood vessels of the lower limbs are unable to contract well. They are at increased risk of unconsciousness and falling. We considered whether vasoconstrictive promotion by exercise could improve orthostatic hypotension. Five inpatients with Parkinson's disease that had orthostatic hypotension, and ADL became independent. The patients stood on tiptoe and conducted exercise for three weeks. The evaluation went to resemble on admission four weeks after hospitalization later. The evaluation study involved a Shellong test, interview, thermography and a CS - 30 test. Average blood pressure was increased in all the subjects by the intervention. Orthostatic hypotension was improved in four patients but not in one patient. In conclusion, the lower limb exercise was thought to be effective for improvement of orthostatic hypotension.

Keywords: Parkinson's disease, orthostatic hypotension, lower limb exercise

Introduction

Parkinson's disease (PD) is the most common neurodegenerative disease, characterized by motor symptoms including resting tremor, rigidity and akinesia [1, 2]. Progressive loss of dopaminergic neurons in the substantia nigra and Lewy body formation are the main pathologies in PD. However, the pathology of PD is not just limited to the substantia nigra; in addition, many parts of the central nervous system are affected. Therefore, various non-motor symptoms can be seen in PD and some of these symptoms are due to autonomic neuropathy[3]. Non-motor symptoms contribute to the severity of PD and adversely affect the quality of life [4, 5]. Cardiovascular autonomic nervous system disorders are part of the autonomic neuropathy of PD. Both sympathetic and parasympathetic parts of the cardiovascular autonomic nervous system are affected in PD [6-8]. Orthostatic hypotension (OH), postprandial hypotension, non-dipping and supine hypertension are the clinical consequences of cardiovascular autonomic

dysfunction in PD [9-11].

In patients with Parkinson's disease hospitalized in Tokushima National Hospital, there are many who are troubled with orthostatic hypotension. They often suffer unconsciousness, and this causes physical injury if they fall down. We teach patients with orthostatic hypotension to wear elastic stockings and slowly stand up. In the preliminary research, the effect of the tiptoeing exercise on orthostatic hypotension of autonomic nervous system disorders and anemia has been reported. By increasing the quantity of muscle in the leg and the blood flow, an improvement of orthostatic hypotension was shown. We studied whether lower limb exercise improved orthostatic hypotension in patients with Parkinson's disease.

Subjects and methods

The subjects were five patients with Parkinson's disease hospitalized for rehabilitation. They met the following criteria. 1) Orthostatic hypotension had been

diagnosed. 2) ADL becomes independent. 2) They did not take medicine associated with blood pressure.

The study period was from August 2015 to February 2017.

Intervention method

The patients worked on a tiptoeing training method following the advice of the physical therapist. The training was conducted after hospitalization every day for three weeks. They raised their heels for 2-3 seconds then lowered them for 2-3 seconds more. The exercise was repeated 10 times. After a short rest, a similar exercise was repeated another ten times. The exercise was performed at the bedside. The patients held onto the bed fence during the exercise for safety. We put a chair behind the patient. The end-point was decubitus and standing blood pressure. We interviewed patients about symptoms such as dizziness or drift. We measured change of the skin temperature before and after the exercise by thermography. We evaluated the lower limbs' muscular strength with a CS-30 test. On admission and four weeks later after hospitalization, we performed a Schellong test. We conducted thermography and a CS-30 test at the beginning and end of the exercise. We analyze it by comparing the results of each item.

In the Schellong test, we measured 1) Blood pressure in the decubitus position, 2) Blood pressure just after standing, 3) Blood pressure one minute after adopting the standing position, 4) Blood pressure three minutes after adopting the standing position, 5) Blood pressure five minutes after adopting the standing position. For the thermography examination, we measured the temperature of the skin of the foot in a room at 25 degrees

Celsius. The CS-30 test was assessed by counting the maximum number of times the patient could rise from a chair during 30 s.

Ethical consideration

We obtained approval from the Ethical Review Board of Tokushima National Hospital.

We explained the following contents to the patients who became study patients obtained the agreement signature in a document. 1) Protection of personal information. 2) Benefits and disadvantages of participating in the study. 3) The right to refuse to participate in the entry.

Results

The subjects consisted of five patients: three men (patients 1-3) and two women (patients 4, 5). The age was 66 years old ± 7.17 (mean \pm SD). Patients 1, 4 and 5 had been hospitalized in Tokushima National Hospital one year previously. We show the Schellong test results on admission and at discharge in Figure 1. Hypotension at rising had disappeared on discharge in Patient 3. Hypotension was improved in Patients 1 and 5. Mean of the rising study blood pressure at on admission, discharge. For all the subjects, the mean blood pressure at discharge increased compared to on admission. The symptoms of Patients 2 and 3 improved. Change of skin temperature did not show a constant tendency according to the thermography examination (Figure 2). The lower limbs' muscular strength was improved in three patients according to the CS-30 test.

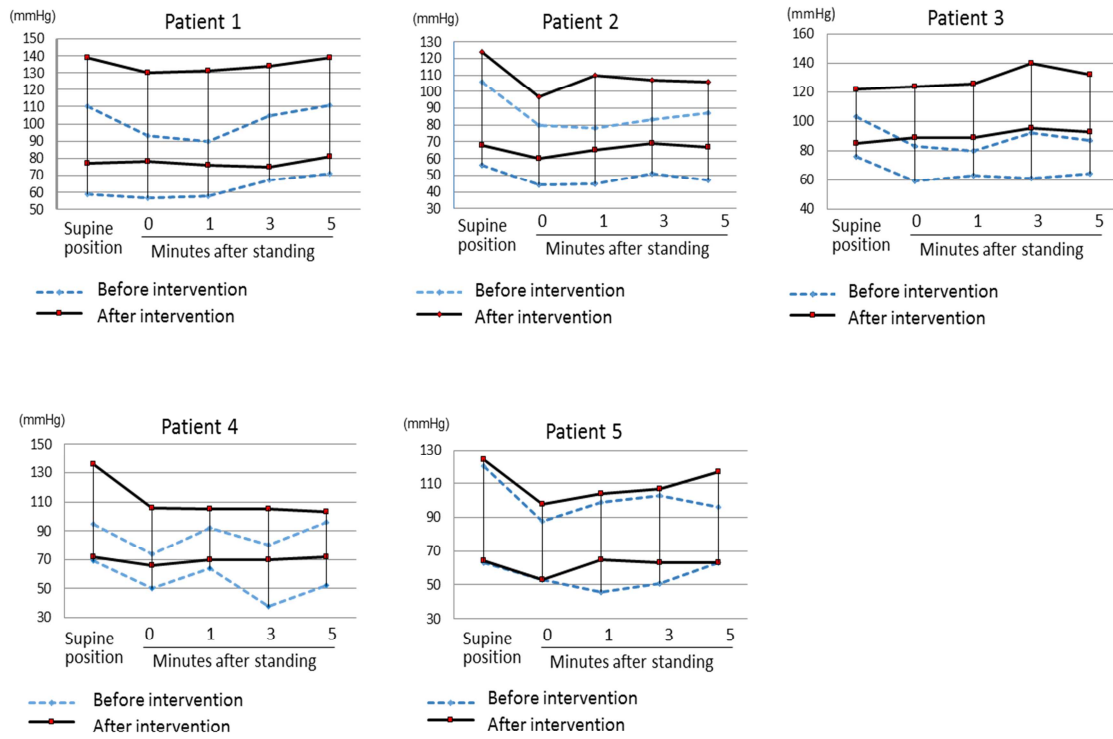


Figure 1. Results of Schellong test before and after intervention in Patients 1-5

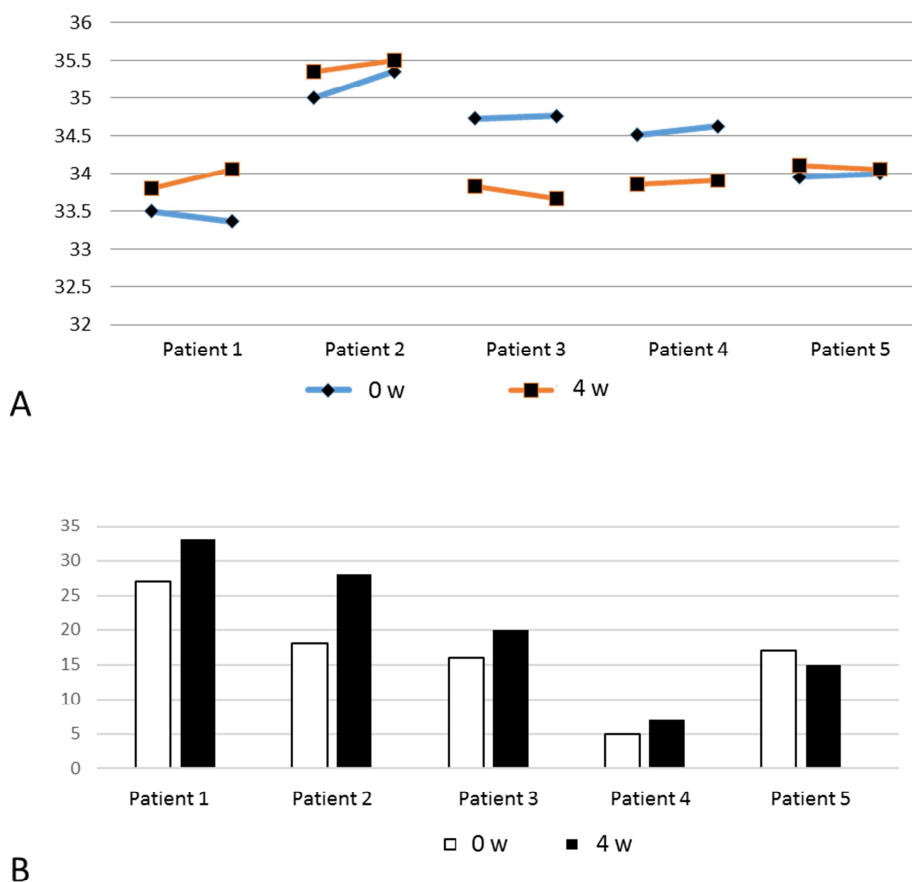


Figure 2. Changes of skin temperature (A) and CS-30 scores (B) in Patients 1-5

Discussion

The tiptoeing exercise that we conducted in this study has momentum of approximately 2 - 3 Mets degree. The number of starts of the CS-30 test increased in three men. In the CS-30 test, two women showed no improvement. It was suggested that there were individual differences in the effect of the everyday tiptoeing exercise. Men may experience a greater effect than women. We showed results of the Schellong test one year

before in three patients (Patients 1, 4 and 5). In Patients 1 and 5, orthostatic hypotension had improved clearly from one year ago. In Patient 4, the reduced blood pressure at rising also decreased compared to one year ago. The present exercise seemed to be effective for improvement of orthostatic hypotension. In the present study, there were few patients enrolled. We intend to repeat the study with a larger number of patients in the future.

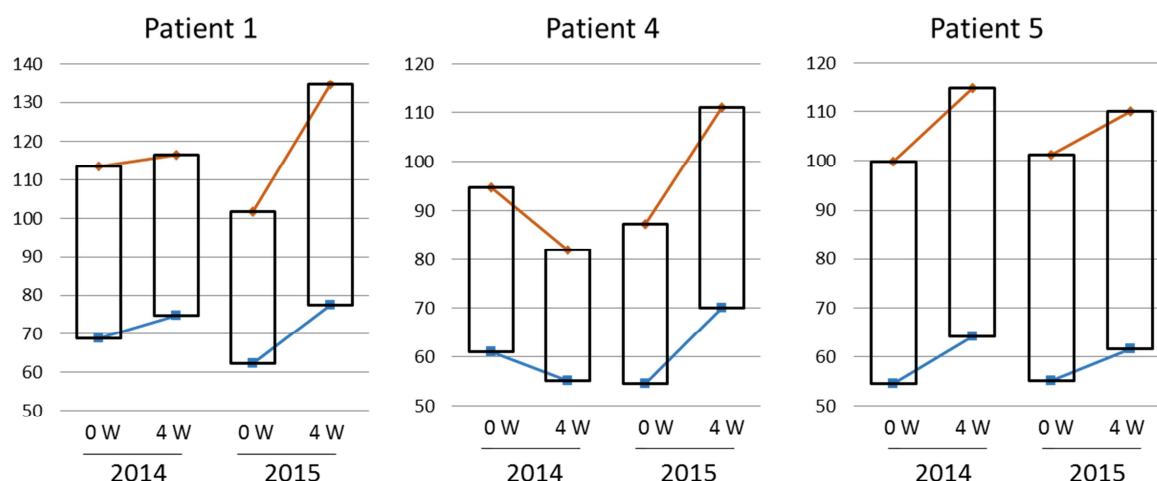


Figure 3. Present results of Schellong test in Patients 1, 4, and 5, compared with those a year ago

References

- Alves G, Forsaa EB, Pedersen KF, Dreetz Gjerstad M, Larsen JP (2008). Epidemiology of Parkinson's disease. *J Neurol*, 255 Suppl 5: 18-32
- Reichmann H (2010). Clinical criteria for the diagnosis of Parkinson's disease. *Neurodegener Dis*, 7: 284-290
- Breen DP, Barker RA (2010). Parkinson's disease and 2009: recent advances. *J Neurol*, 257: 1224-1228
- Chaudhuri KR, Yates L, Martinez-Martin P (2005). The non-motor symptom complex of Parkinson's disease: a comprehensive assessment is essential. *Curr Neurol Neurosci Rep*, 5: 275-283
- Antonini A, Barone P, Marconi R, Morgante L, Zappulla S, Pontieri FE, et al. (2012). The progression of non-motor symptoms in Parkinson's disease and their contribution to motor disability and quality of life. *J Neurol*, 259: 2621-2631
- Kallio M, Haapaniemi T, Turkka J, Suominen K, Tolonen U, Sotaniemi K, et al. (2000). Heart rate variability in patients with untreated Parkinson's disease. *Eur J Neurol*, 7: 667-672
- van Dijk JG, Haan J, Zwinderman K, Kremer B, van Hilten BJ, Roos RA (1993). Autonomic nervous system dysfunction in Parkinson's disease: relationships with age, medication, duration, and severity. *J Neurol Neurosurg Psychiatry*, 56: 1090-1095
- Goldstein DS, Holmes C, Li ST, Bruce S, Metman LV, Cannon RO 3rd, (2000). Cardiac sympathetic denervation in Parkinson disease. *Ann Intern Med*, 133: 338-347
- Plaschke M, Trenkwalder P, Dahlheim H, Lechner C, Trenkwalder C (1998). Twenty-four-hour blood pressure profile and blood pressure responses to head-up tilt tests in Parkinson's disease and multiple system atrophy. *J Hypertens*, 16: 1433-1441
- Ejaz AA, Sekhon IS, Munjal S (2006). Characteristic findings on 24-h ambulatory blood pressure monitoring in a series of patients with Parkinson's disease. *Eur J Intern Med*, 17: 417-420
- Schmidt C, Berg D, Herting, Prieur S, Junghanns S, Schweitzer K, et al. (2009). Loss of nocturnal blood pressure fall in various extrapyramidal syndromes. *Mov Disord*, 24: 2136-2142