

# Hyperreflexia in outpatients with Parkinson's disease and coexisting cervical spinal stenosis: A retrospective cohort study

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## ABSTRACT

**Background.** Degenerative cervical myelopathy (DCM) is poorly recognized and infrequently diagnosed.

**Objectives.** To identify symptoms and signs in the lower extremities physically and radiologically in outpatients with idiopathic Parkinson's disease (PD) and coexisting DCM.

**Methods.** In 2023, a retrospective cohort study was performed to review the medical records from 2016 to 2020 at the outpatient clinic of the Department of Internal Medicine. As a result, 8 women with PD were diagnosed based on the presence of cardinal features, asymmetry, and a good response to levodopa. Brain and cervical magnetic resonance imaging (MRI) was conducted in 4 patients (group A): 3 with hyperreflexia of the patellar tendon, and 1 with Babinski's sign.

**Results.** The motor subtype of the 8 patients aged 69 to 90 was a tremor-dominant type of PD. The Hoehn and Yahr (H&Y) stages were II (1) and III (3) in group A, and III (3) and IV (1) in those without hyperreflexia of the patellar tendon. Hyperreflexia and Babinski's sign were predominant on the tremor-dominant side in group A. Radiologically, their anteroposterior diameters at the most stenotic level (C5-6) were 6.0, 7.1, 7.1, and 10.4 mm. They developed muscular rigidity and spasticity involving the lower extremities. The gait and balance performance were particularly affected compared with the upper extremity function.

**Conclusion.** Hyperreflexia of the patellar tendon and imbalance of gait performance due to coexisting DCM were the important factors affecting gait in older women with tremor-dominant PD.

**Keywords:** tremor-dominant Parkinson's disease, degenerative cervical myelopathy, hyperreflexia, Hoehn and Yahr stage, older women

## INTRODUCTION

Bone mineralization disorders, such as osteoporosis and bone fracture, are common in postmenopausal women. The chief clinical manifestations are vertebral and hip joint disorders. Especially in older women, degenerative cervical myelopathy (DCM) is infrequently diagnosed [1,3]. Hyperreflexia is one of the most important neurological findings in those with DCM [2,3].

Peripheral neuropathy is well-recognized in patients with Parkinson's disease (PD), and influences gait and balance parameters [4]. These patients generally show normo or hyporeflexia.

When gait impairment develops in patients with PD, coexisting DCM must be considered. However, it is difficult to distinguish the causes of weakness and gait impairment due to PD and DCM. In this study, hyperreflexia of the patellar tendon was physically and radiologically examined in patients with PD and coexisting DCM.

## METHODS

In 2023, a retrospective cohort study was performed to review the medical records from 2016 to 2020 at the outpatient clinic of the Department of Internal Medicine. As a result, 8 female patients aged 69

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to 90 were diagnosed with PD based on the presence of cardinal features (resting tremor, rigidity, bradykinesia, and gait impairment), asymmetry, and a good response to levodopa. The personal and family medical histories were reviewed, and laboratory screening tests were carried out. Also, brain and cervical magnetic resonance imaging (MRI) was conducted in 4 patients (group A): 3 with hyperreflexia of the patellar tendon, and 1 with Babinski's sign.

### Ethics approval statement

This retrospective cohort study was approved by the Ethics Committee of Kanazawa Seirei Hospital (Number: 5-1/2023). The requirement to obtain informed consent was waived.

### RESULTS

The motor subtype in the 8 patients was tremor-dominant type of PD [5]. The Hoehn and Yahr (H&Y) stages were II (1), III (6), and IV(1). Group A consisted of 3 patients aged 69, 72, and 77 with bi or unilateral hyperreflexia of the triceps tendon and bilateral hyperreflexia of the patellar tendon, and 1 patient aged 83 with unilateral hyperreflexia of the triceps tendon and bilateral Babinski's sign. The hyperreflexia and Babinski's sign were predominant on the tremor-dominant side. Four patients aged 74, 80, 83, and 90 showed normo or hyporeflexia of the patellar tendon (group B). Two of them exhibited bi or unilateral hyperreflexia of the triceps tendon. The H&Y stages were II (1) and III (3) in group A, and III (3) and IV (1) in group B.

Radiologically, group A showed cervical spinal stenosis. The vertebral levels of stenosis were C3-6 (2) and C4-6 (2). The most stenotic level was C5-6 (4) [6]. Their anteroposterior diameters at the most stenotic levels were 6.0, 7.1, 7.1, and 10.4 mm. The H&Y stage was II in the patient aged 69 with a diameter of 10.4 mm, and III in the other three.

### DISCUSSION

Bone mineralization disorders, such as osteoporosis and bone fracture, are associated with older women. Especially in those with PD, these disorders are often present [7-10]. However, coexisting DCM is poorly recognized and infrequently diagnosed [1,3]. Hyperreflexia is one of the most important neurological findings leading to suspected DCM [2,3]. A dynamic study identified a diameter smaller than 12 mm at the responsible segment in 7 young male Japanese patients with degenerative cervical spondylotic myelopathy [11]. In group A, the anteroposterior diameters at the most stenotic levels were 6.0, 7.1, 7.1, and 10.4 mm.

In group A, the hyperreflexia and Babinski's sign were predominant on the tremor-dominant side. This asymmetry was an important clinical manifestation. The severity of hyperreflexia was associated with that of tremor. Group A developed muscular rigidity and spasticity involving the lower extremities. The gait and balance performance were particularly affected. However, daily activities, such as visual acuity function [12], speaking, swallowing, and upper extremity function, were spared compared with the lower extremity function. The progression of H&Y stages was mainly determined by the lower extremity functional performance. An etiological study determined that lower leg rigidity was differentially associated with frequent falls compared with upper limb, neck, and total rigidity [13].

The tremor-dominant type is a common motor subtype in women with PD [5]. All patients in groups A and B exhibited this subtype. In group A patient aged 77, tremor involved the head, which is not a common symptom [14]. She also showed cardinal features of PD, asymmetry, and a good response to levodopa. Levodopa was effective for the head tremor. Physical therapy and social medical support contributed to reduce symptoms and signs in the lower extremities. This patient also showed a minimum diameter of 6.0 mm at the most stenotic level. Head tremor may promote vertebral and intervertebral disk degeneration. Both bone mineralization disorders and involuntary movement around the neck may be important factors affecting gait in patients with PD and coexisting DCM.

When gait impairment develops, hyperreflexia of the patellar tendon and imbalance of gait performance [15] due to cervical spinal stenosis must be considered, especially in older women with PD. These are the contributing factors for H&Y stage progression, especially in patients with tremor-dominant PD [16]. However, it is difficult to distinguish the causes of weakness and gait impairment due to PD and DCM [17,18]. In general, patients' voluntary neck movements are restricted by rigidity and bradykinesia. A resting tremor is a continuous rhythmic movement. One study performing motion analysis with phase-contrast MR imaging data reported an association of a restless spinal cord with periodic, cardiac-related movement [19]. The tremor may affect the anterior cervical spinal cord at the most stenotic vertebral site. Raynaud's phenomenon is one of the important systemic vibration injuries. One etiological factor may be the ischemic changes at this site due to repetitive vibratory rhythmic movement. Also, orthostatic hypotension in patients with PD may exacerbate the ischemia. A case study after surgical treatment reported a possible risk of anterior spinal cord ischemia due to cervical disk herniation at C5-6 in a woman 72-year-old [20]. Further studies in larger groups including

other motor subtypes of PD [21] are required to clarify gait impairment due to coexisting DCM.

## CONCLUSIONS

Hyperreflexia of the patellar tendon and imbalance of gait performance due to coexisting DCM were

important factors affecting gait in older women with tremor-dominant PD. These were the contributing factors for H&Y stage progression. Involuntary movements around the neck due to resting tremor may affect the anterior cervical spinal cord at the most stenotic vertebral site.

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## REFERENCES

- Grodzinski B, Stubbs DJ, Davies BM. Most degenerative cervical myelopathy remains undiagnosed, particularly amongst the elderly: modelling the prevalence of degenerative cervical myelopathy in the United Kingdom. *J Neurol*. 2023 Jan;270(1):311-319. doi: 10.1007/s00415-022-11349-8. Epub 2022 Sep 2.
- Trager RJ, Smith GA, Labak CM, Battaglia PJ, Dusek JA. Identification of degenerative cervical myelopathy in the chiropractic office: Case report and a review of the literature. *Cureus*. 2022 Oct 20;14(10):e30508. doi: 10.7759/cureus.30508.
- Doi T. Infrequently diagnosed common gait disorder in outpatients with cervical spinal stenosis: A retrospective cohort study. *Ro J Neurol*. 2023;22(4):304-307. doi: 10.37897/RJN.2023.4.11.
- Corrà MF, Vila-Chã N, Sardoeira A, Hansen C, Sousa AP, Reis I, et al. Peripheral neuropathy in Parkinson's disease: prevalence and functional impact on gait and balance. *Brain*. 2023 Jan 5;146(1):225-236. doi: 10.1093/brain/awac026.
- Haaxma CA, Bloem BR, Borm GF, Oyen WJG, Leenders KL, Eshuis S, et al. Gender differences in Parkinson's disease. *J Neurol Neurosurg Psychiatry*. 2007 Aug;78(8):819-24. doi: 10.1136/jnnp.2006.103788. Epub 2006 Nov 10.
- Waheed H, Khan MS, Muneeb A, Jahanzeb S, Ahmad MN. Radiologic assessment of cervical canal stenosis using Kang MRI grading system: Do clinical symptoms correlate with imaging findings? *Cureus*. 2019 Jul 3;11(7):e5073. doi: 10.7759/cureus.5073.
- Shribman S, Torsney KM, Noyce AJ, Giovannoni G, Fearnley J, Dobson R. A service development study of the assessment and management of fracture risk in Parkinson's disease. *J Neurol*. 2014 Jun;261(6):1153-9. doi: 10.1007/s00415-014-7333-8. Epub 2014 Apr 10.
- Torsney KM, Noyce AJ, Doherty KM, Bestwick JP, Dobson R, Lees AJ. Bone health in Parkinson's disease: a systematic review and meta-analysis. *J Neurol Neurosurg Psychiatry*. 2014 Oct;85(10):1159-66. doi: 10.1136/jnnp-2013-307307. Epub 2014 Mar 11.
- Rabin ML, Earnhardt MC, Patel A, Ganihong I, Kurlan R. Postural, bone, and joint disorders in Parkinson's disease. *Mov Disord Clin Pract*. 2016 Jul 18;3(6):538-547. doi: 10.1002/mdc3.12386. eCollection 2016 Nov-Dec.
- Camacho-Soto A, Gross A, Nielsen SS, Miller AN, Warden MN, Salter A et al. Fractures in the prodromal period of Parkinson disease. *Neurology*. 2020 Jun 9;94(23):e2448-e2456. doi: 10.1212/WNL.0000000000009452. Epub 2020 Apr 28.
- Terashima Y, Yurube T, Sumi M, Kanemura A, Uno K, Kakutani K. Clinical and radiological characteristics of cervical spondylotic myelopathy in young adults: A retrospective case series of patients under age 30. *Medicina (Kaunas)*. 2023 Mar 10;59(3):539. doi: 10.3390/medicina59030539.
- Weil RS, Schrag AE, Warren JD, Crutch SJ, Lees AJ, Morris HR. Visual dysfunction in Parkinson's disease. *Brain*. 2016 Nov 1;139(11):2827-2843. doi: 10.1093/brain/aww175.
- McKay JL, Hackney ME, Factor SA, Ting LH. Lower limb rigidity is associated with frequent falls in Parkinson's disease. *Mov Disord Clin Pract*. 2019 Jun 6;6(6):446-451. doi: 10.1002/mdc3.12784. eCollection 2019 Jul.
- Roze E, Coêlho-Braga MC, Gayraud D, Legrand AP, Trocetto JM, Fénelon G, et al. Head tremor in Parkinson's disease. *Mov Disord*. 2006 Aug;21(8):1245-8. doi: 10.1002/mds.20918.
- Malone A, Meldrum D, Bolger C. Gait impairment in cervical spondylotic myelopathy: comparison with age- and gender-matched healthy controls. *Eur Spine J*. 2012 Dec;21(24):2456-66. doi: 10.1007/s00586-012-2433-6. Epub 2012 Jul 24.
- Hely MA, Morris JG, Traficante R, Reid WG, O'Sullivan DJ, Williamson PM. The sydney multicentre study of Parkinson's disease: progression and mortality at 10 years. *J Neurol Neurosurg Psychiatry*. 1999 Sep;67(3):300-7. doi: 10.1136/jnnp.67.3.300.
- Xiao R, Miller JA, Lubelski D, Alberts JL, Mroz TE, Benzel EC et al. Quality of life outcomes following cervical decompression for coexisting Parkinson's disease and cervical spondylotic myelopathy. *Spine J*. 2016 Nov;16(11):1358-1366. doi: 10.1016/j.spinee.2016.07.530. Epub 2016 Aug 2.
- Xiao R, Miller JA, Lubelski D, Mroz TE, Benzel EC, Krishnaney AA et al. Clinical outcomes following surgical management of coexisting Parkinson disease and cervical spondylotic myelopathy. *Neurosurgery*. 2017 Aug 1;81(2):350-356. doi: 10.1093/neuros/nyw043.
- Hupp M, Pfender N, Vallotton K, Rosner J, Friedl S, Zipser CM et al. The restless spinal cord in degenerative cervical myelopathy. *AJNR Am J Neuroradiol*. 2021 Mar;42(3):597-609. doi: 10.3174/ajnr.A6958. Epub 2021 Feb 4.
- Acker G, Schneider UC, Grozdanovic Z, Vajkoczy p, Woitzik j. Cervical disc herniation as a trigger for temporary cervical cord ischemia. *J Spine Surg*. 2016 Jun;2(2):135-8. doi: 10.21037/jss.2016.06.04.
- Eisinger RS, Hess CW, Martinez-Ramirez D, Almeida L, Foote KD, Okun MS et al. Motor subtype changes in early Parkinson's disease. *Parkinsonism Relat Disord*. 2017 Oct;43:67-72. doi: 10.1016/j.parkreldis.2017.07.018.