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Letter to the Editor

Reversible lateral trunk flexion treated with a rehabilitation program in a patient with Parkinson's disease

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Sustained lateral trunk flexion (LTF) often affects motor function in Parkinson's disease (PD). We describe a PD patient with reversible LTF persisting for more than 1 year that was treated by rehabilitation alone.

In 1994, a 62-year-old, right-handed woman with a history of surgery for left breast cancer at 37 years of age and an ovarian cyst at 46 years noticed right-finger tremor. In 2005, right-hand tremor and slowness of movement developed. She had bradykinesia, right-side-dominant rigidity, and resting tremor. The patient received cabergoline and these features improved. By 2010, She had wearing-off but her parkinsonian signs and symptoms were well controlled by modifying anti-parkinsonian medications. She was given levodopa (200 mg/day), trihexyphenidyl (4 mg/day), amantadine (200 mg/day), and ropinirole (1.5 mg/day). In 2011, LTF and short-stepped gait developed. First, the doses of levodopa and subsequently ropinirole were increased. Next, we discontinued amantadine, followed by trihexyphenidyl. LTF did not respond. Since tremor developed, trihexyphenidyl was restarted. In 2012, LTF with gait difficulty progressed further, and the patient frequently fell, leading to admission to our hospital. On admission, she was receiving levodopa (300 mg/day), trihexyphenidyl (4 mg/day), and ropinirole (6 mg/day). She showed features of mild parkinsonism, including retropulsion, bradykinesia, and cogwheel rigidity in all four limbs. Cranial nerve, sensory, and cerebellar functions were intact. The scores on the Mini-Mental Status Examination (MMSE) (27/30) and Frontal Assessment Battery (17/18) were normal. The scores on parts I, II, III, and IV of the unified Parkinson's disease rating scale were 2, 13, 9, and 0, respectively. The results of cranial magnetic resonance imaging were normal. The heart-mediastinum 123I-metaiodobenzylguanidine uptake ratio was significantly decreased. The results of SPECT imaging with technetium-99m-ethyl cysteinate dimer was normal.

The patient showed marked LTF (Fig. 1A). LTF increased in parallel to bilateral abdominal pain when she continued to walk and abated when recumbent. The pain was accompanied by palpable contractions of the abdominal external oblique muscles (AEOM). The severity of pain decreased when she was supine, but increased on sitting or walking. Both lumbar paraspinal muscles showed palpable contractions without pain. The Manual Muscle Test (MMT) scores based on a 0- to 5-point scale were 3, 4, and 4 in the gluteus maximus, gluteus medius, and gluteus minimus, respectively. The serum creatine kinase concentration (114 U/l) was normal. Surface electromyography (EMG) of both AEOM and the rectus abdominis showed no constant hypertonic activity, but motor unit action potentials were evident in the AEOM in supine position. Needle EMG in supine position showed non-myopathic polyphasic action potentials or abnormal tonic hyperactivity in the paraspinal muscles at the levels of the L3 and L4 vertebrae and the AEOM, but the number of motor unit action potentials of the right AEOM was greater than that of the left AEOM. Computed tomographic (CT) scanning from the C4 to S5 vertebrae showed that AEOM and paraspinal muscles from the Th12 to L4 vertebrae were thicker on the right side than the left (Fig. 1).

Physical rehabilitation was performed for 2 weeks (5 days per week, 1 h/day), without modifying the dosage of anti-parkinsonian medications. Physical therapy included "bridge" exercises and straight leg raising in supine position, as well as stretching exercises of both hip, knee, and ankle joints, and the trunk muscles. The following balance exercises were also performed: 1) foot-step exercises using wall bars or while sitting, 2) simultaneously lifting one upper limb and the contralateral lower limb while crawling on hands and knees, 3) shifting from kneeling on both knees to raising one knee, and 4) riding on a big balance ball. Resistance-training exercises comprised 1) the "hip-up" exercise in supine position, 2) pushing her back on the floor for pelvic adjustment, 3) having the patient look at her navel to strengthen the abdominal muscles, 4) squatting, 5) stepping on stairs, and 6) calf raising while standing.

The angle of LTF decreased from 27° to 4° (Fig. 1A). The score on the timed "up and go" test improved from 19.8 to 13 s, and

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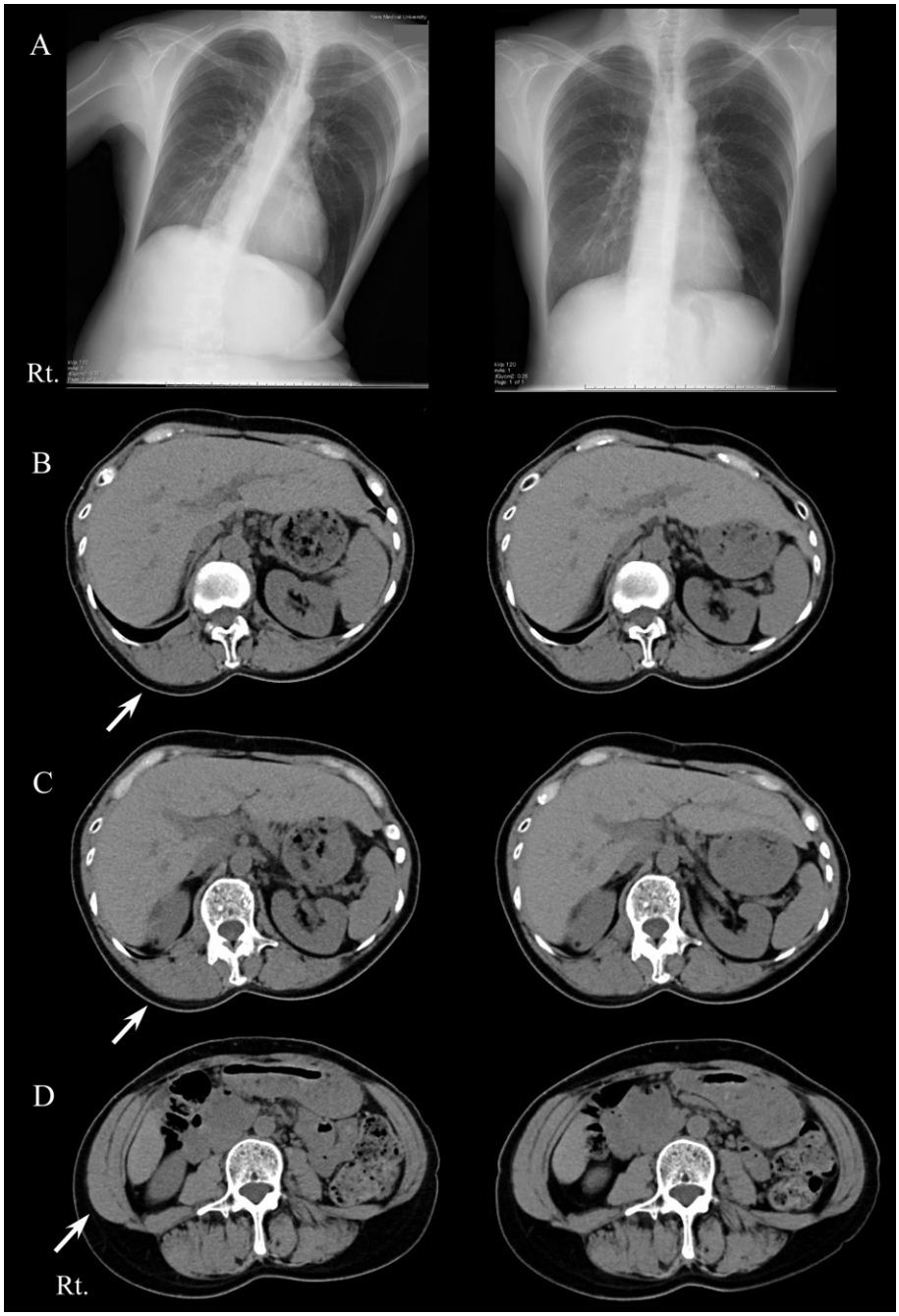

Fig. 1. Lateral trunk flexion before (left panel) and after (right panel) rehabilitation program. Panel A: Lateral trunk flexion markedly decreased after the rehabilitation program. Panels B and C: Paraspinal muscles at the level of the L1 (panel B) to L2 vertebrae (panel C) on computed tomography showed that the muscle thickness or area of the paraspinal muscles was greater on the right side than on the left (white arrow). Asymmetry of the paraspinal muscles at the level of the L1 to L2 vertebrae decreased after the rehabilitation program. Panel D: The abdominal external oblique muscles (white arrow) did not show asymmetry of thickness or area after the rehabilitation program.

pain intensity on a visual analog pain decreased from 77 to 8 mm. She had placed a hand on her thigh or waist when walking 50 m previously, but after rehabilitation she could walk 300 m without such assistance. Gait time (13.6 s) and step number (24) improved to 9.23 s and 19, respectively. Asymmetric muscle thickness of the paraspinal muscles on CT decreased at the levels of the L1 (Fig. 1B) and L2 vertebrae (Fig. 1C), but that of the AEOM (Fig. 1D) and other paraspinal muscles remained unchanged. A region-of-interest analysis of the area of the right and left paraspinal muscles at the level of the L1 (Fig. 1B) and L2 vertebrae (Fig. 1C) showed that the muscle margin on the right side decreased from 1691.47 and 2058.12 mm^2 to 1410.18 and 1776.13 mm^2, respectively. The difference in the right and left muscle areas at each level also decreased from 138.21 and 564.64 mm^2 to 18.21 and 252.39 mm^2, respectively.

In our patient, LTF resolved after 2 weeks of rehabilitation, while continuing stable doses of anti-parkinsonian drugs. Drug therapy, including the use of botulinum toxin, and deep brain stimulation has also been used to treat individual patients, but clear-cut evidence of efficacy is lacking. Reversible LTF in response