P 3-66

Magnetic stimulation of paravertebral muscles for strengthening in kyphotic subacute stroke patients

Joonhyun Park[1*], Jong Ouk Kim[1], Jong Moon Kim[1,2], MinYoung Kim[1,2†]

CHA Bundang Medical Center, CHA University School of Medicine, Department of Rehabilitation Medicine[1], CHA University, Rehabilitation and Regeneration Research Center[2]

Introduction
Weakened core muscles in hemiplegic stroke patients lead to a decrease in trunk stability and poor sitting balance, which limit the rehabilitation outcomes both in terms of hand function and locomotive ability. For this reason, stimulating the paravertebral muscle using had been tried using neuromuscular electrical stimulation device. Recently, instead of electrical stimulation, magnetic stimulation is used to improve motor function, which can induce painless deep muscle contraction without direct skin contact. In this pilot study, we investigated whether repetitive peripheral magnetic stimulation (rPMS) can improve the core strength and balance of stroke patients.

Subjects and Methods
This retrospective review was based on chart review of patients hospitalized between January 2019 and May 2019. Inclusion criteria were as follows: 1) subacute stage within 6 months after the onset of the stroke, and 2) who were treated with rPMS in lower paravertebral muscles for at least two weeks. Among these patients, we studied patients who had both initial and follow up back muscle strength measure using pressure biofeedback unit (PBU), as explained below. A total of five patients were included. Medical history including low back pain severity by numeric rating scale (NRS), gender, age, cause of the stroke, duration from the onset, previous history associated with lumbar spine (Table 1). In order to evaluate low back muscle strength, in a prone position on a hard surface while placing their belly on the PBU (Stabilizer, Chattanooga Group Inc., Hixson, USA), patients contracted their back muscle under examiner's verbal command. To minimize effect of intrathoracic pressure, full exhalation before back extension was ordered. At end-expiratory cuff pressure was set to 70mmHg, maximal increase of cuff pressure was recorded ($\triangle P$ = maximum cuff pressure – 70 (mmHg)). During each trial, patient was told the cuff pressure, so encouraged to maximize the result by real-time bio-feedback manner. In lumbar paravertebral muscle rPMS protocol, rPMS coil center was focused at the L3 spinous process. 20-min rPMS session was conducted on a daily basis using electromagnetic stimulation device (Salus Talent Pro, Remed Co., Korea) in biphasic

pulse mode of 3-15Hz using pulse duration of 250 μsec. Pain-free maximum intensity stimulation was used.

Results
In all five patients, the mean pressure difference was increased from 24.2 to 25.0 mmHg (p =0.043, by Wilcoxon-signed rank test) and the mean NRS score for low back pain was decreased from 3.8 to 2.2 (p=0.039, Table 2). In addition, no side effect was observed associated with the treatment.

Conclusion
This pilots study suggests that rPMS could be used for core muscle strengthening and pain relief safely. Further research is needed for confirm this finding.

Table 1. Baseline characteristics of the patients

	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5
Age (years)	88	87	71	68	72
Sex	F	F	F	F	F
Diagnosis	Ischemic stroke	Ischemic stroke	Hemorrhagic stroke	Tumor	Hemorrhagic stroke
Main lesion	Right MCA territory	Right MCA territory	Right MCA M2 aneurysm rupture	Right prepontine chordoma	Left anterior choroidal artery aneurysm rupture
Onset (days)	23	24	111	81 (from tumor removal surgery)	46
Past history (related to low back pain)	Diagnosed as spinal stenosis 15 years ago	-	Sacroiliac joint arthritis, diagnosed recently	L1 vertebroplasty due to compression fracture	Posterolateral interbody fixation (L4-5) surgery due to spinal stenosis 12 years ago

MCA, middle cerebral artery

Table 2. Outcomes after repetitive peripheral magnetic stimulation therapy in subacute stroke patients

| | PBU pressure difference, △P (mmHg) | | | Back pain (NRS) | | Functional assessment‡ | | | |
| | Pre† | Post | Post –Pre | Pre | Post | BBS | | TIS | |
						Pre	Post	Pre	Post
Patient 1	23.3	24.2	0.8	4	3	0	4	0	2
Patient 2	28.3	30.2	1.8	3	2	28	41	15	18
Patient 3	19.2	19.3	0.1	5	3	5	21	4	8
Patient 4	23.3	24.8	1.5	4	1	3	10	6	18
Patient 5	26.7	27.3	0.6	3	2	33	54	15	21

†Pre and post PBU pressure measures were conducted on the first and last day of treatment.

‡Pre and post scores of functional assessment are from admission and discharge evaluation each. PBU, Pressure Biofeedback Unit; NRS, Numeric Rating Scale; BBS, Berg Balance Scale; TIS, Trunk Impairment Scale