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Relationship Between MRI and postoperative gait improvement in patients with cervical spondylotic myelopathy

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Background

❖ Cervical spondylotic myelopathy (CSM) is a condition that results from compression of the spinal cord in the neck due to degenerative changes in the cervical spine.
❖ Several studies have suggested that the signal changes observed on MRI are related to possible clinical outcomes as well as the postoperative prognosis, but there is still controversy.
❖ Gait analysis is considered the gold standard for assessing human walking patterns because it provides a comprehensive evaluation of multiple factors that contribute to gait abnormalities.

OBJECTIVE

❖ This study aimed to determine relationships between increased signal intensity (ISI) on T2-weighted cervical spine magnetic resonance imaging (MRI) and change of gait parameters in patients with CSM.

METHODS

❖ **Study Design**
- Retrospective study
- 129 patients with CSM
- Between January 2016 to December 2019.
- Underwent decompression surgery by a single surgeon.

❖ **Demographics**
- Age, BMI,
- Type of surgery
- Japanese Orthopedic Association (JOA) score
- Neck disability index
- NCV/EMG study, Electrophysiology study

❖ **Gait analysis**
- Performed before surgery and at 6 months after surgery.
- Flat-ground, 20-m track using a computerized three-dimensional gait analysis system consisting of six infrared cameras (Motion Analysis®, Santa Rosa, CA, USA).

❖ **Magnetic Resonance Imaging**
- The patients were divided into two groups
- Group A (no ISI or faintly ISI, 68 patients)
- Group B (intensely ISI, 61 patients).

RESULTS

Table 1. Baseline characteristics of study population (N=129))

Variables	ISI group A (N=68)	ISI group B (N=61)
Age	62.53 ± 12.40	57.69 ± 11.23
BMI(Kg/m2)	25.42 ± 3.37	25.33 ± 3.53
JOA scale		
Pre-operative	12.39 ± 2.46	12.69 ± 2.84
Post-operative (6mo)	13.22 ± 2.41	12.52 ± 2.76
Difference	1.04 ± 2.38	0.22 ± 2.22
Neck disability index		
Pre-operative	13.29 ± 9.30	13.73 ± 9.46
Post-operative (6mo)	11.83 ± 8.99	12.27 ± 8.10
Difference	-3.96 ± 10.62	-0.92 ± 7.94
Operation		
Anterior	55	46
Posterior	13	15
NCV/EMG study		
Normal	23	24
Abnormal	42	30
Uncheckable	3	7
Electrophysiology study		
Normal	9	8
Abnormal	48	46
Uncheckable	11	7

NCV/EMG study, nerve conduction velocity/Electromyogram study;

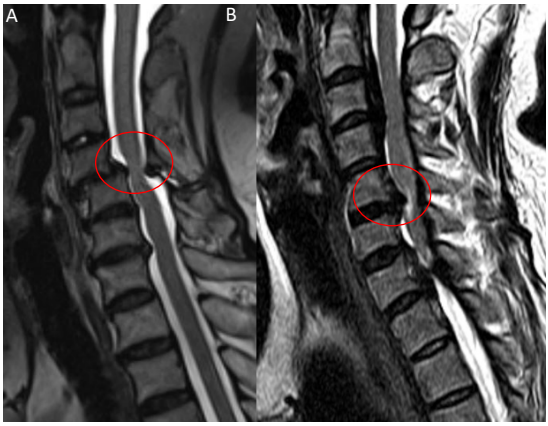

Figure 1. Division of subjects into two groups based on signal intensity on T2-weighted cervical MRI

Table 2. Parameter changes before and after surgery (paired t-test)

Variables	Mean ±SD	p-value
Standing phase (% of gait cycle)	-2.12 ± 2.59	0.00*
Double limb support (% of gait cycle)	-4.02 ± 4.72	0.00*
Single limb support (% of gait cycle)	1.9 ± 2.7	0.00*
Step width	-0.23 ± 3.43	0.47
Step length	6.2 ± 13.69	0.00*
Velocity	8.63 ± 18.2	0.00*
Cadence	4.12 ± 12.1	0.00*

Table 3. Comparison between groups based on signal intensity

Difference	ISI group A (N=68)	ISI group B (N=61)	p-value
Δ Standing phase (% of gait cycle)	-2.51 ± 2.42	-1.13 ± 4.05	0.03*
Δ Double limb support (% of gait cycle)	-4.81 ± 4.55	-3.54 ± 4.14	0.05*
Δ Single limb support (% of gait cycle)	2.52 ± 2.43	1.51 ± 2.59	0.03*
Δ Step width	-0.59 ± 3.15	-0.09 ± 3.69	0.28
Δ Step length	8.52 ± 15.44	4.19 ± 11.31	0.04*
Δ Velocity	10.06 ± 20.22	7.62 ± 15.83	0.46
Δ Cadence	3.74 ± 12.82	4.89 ± 11.29	0.60
Postoperative	**ISI group A (N=68)**	**ISI group B (N=61)**	**p-value**
Standing phase (% of gait cycle)	63.27 ± 3.29	64.25 ± 3.14	0.11
Double limb support (% of gait cycle)	25.79 ± 5.52	28.62 ± 6.06	0.07
Single limb support (% of gait cycle)	37.47 ± 3.11	35.62 ± 3.31	0.05*
Step width	14.09 ± 3.87	13.66 ± 3.54	0.52
Step length	102.03 ± 20.75	96.4 ± 20.36	0.13
Velocity	88.67 ± 24.22	85.14 ± 23.03	0.22
Cadence	108.99 ± 13.84	105.3 ± 12.44	0.04*

❖ When comparing changes in gait parameters between two groups at 6 months after the surgery, the improvements in single limb support and step length were significantly greater in group A than in group B.
❖ In postoperative assessment, single limb support and cadence were significantly higher in group A.

CONCLUSION

❖ In the gait analysis, both groups showed improvement in spatiotemporal parameters after surgery.
❖ However, at the 6 months follow-up after surgery, the group with high signal intensity on MRI had significantly less improvement compared to the low signal intensity group.