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Low skeletal muscle mass and spasticity in male patients with spinal cord injury

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Introduction
It is well-known that spasticity and loss of skeletal muscle mass occur after spinal cord injury. Both spasticity and muscle atrophy restrict activities of daily living and impairs quality of life, but there are few studies about their relationship. Therefore, the Objective of this study is to investigate the association between skeletal muscle mass and spasticity in Korean patients with spinal cord injury.

Methods
Fifty six male patients with spinal cord injury were included. Spasticity was assessed using spasticity sum score and Penn spasm frequency test. Low skeletal muscle mass was defined by appendicular skeletal muscle mass divided by height squares. Laboratory tests including hemoglobin, albumin, creatinine, fasting glucose, and cholesterol were performed.

Results
Mean age was 42.3 years and 37 patients (66.1%) were complete injury (ASIA A). Forty seven patients (83.9%) showed low skeletal muscle mass. They showed significantly lower body mass index (BMI), waist circumference, serum creatinine level, and spasticity than patients with normal skeletal muscle mass. Low skeletal muscle mass was significantly correlated with decreased spasticity score. BMI was the only significant variable in logistic regression analysis for low skeletal muscle mass.

Conclusions
Low skeletal muscle mass is prevalent in patients with spinal cord injury. Low skeletal muscle mass was significantly correlated with decreased spasticity.

Key words
spinal cord injury; sarcopenia; spasticity; muscle atrophy

Table 1. Demographics

	Spinal cord injury patients (n = 56)
Age	42.3 ± 3.0
Tetraplegia	39 (69.6%)
Complete injury (ASIA A)	37 (66.1%)
Body mass index	22.06 ± 0.92
Waist circumference	86.6 ± 3.0
Body fat percentage	31.3 ± 2.4
Appendicular skeletal muscle mass	5.47 ± 0.26

Table 2. Characteristics of spinal cord injury patients with low skeletal muscle mass

	Low skeletal muscle mass (n = 47)	Others (n = 9)	p-value
Age	43.0	39.0	0.346
Tetraplegia	32 (68.1%)	7 (77.8%)	0.562
Complete injury (ASIA A)	33 (70.2%)	4 (44.4%)	0.135
BMI	21.2	26.4	0.000*
Waist circumference	84.3	98.7	0.000*
Body fat percentage	30.8	34.1	0.117
Spasticity sum score	1.28	2.44	0.001*
Penn spasm frequency test	1.11	2.56	0.001*
Laboratory test			
Hemoglobin	14.4	15.1	0.279
Albumin	4.15	4.24	0.474
Creatinine	0.56	0.73	0.001*
Fasting glucose	92.8	104.1	0.271
HbA1c	5.22	5.46	0.254
Total cholesterol	172.9	178.8	0.640
HDL	40.0	38.3	0.544
LDL	106.0	115.4	0.345
ApoB	98.7	100.9	0.794
hsCRP	0.70	0.30	0.330

Table 3. Spearman's correlation between skeletal muscle mass and spasticity

	Skeletal muscle mass	Spasticity sum score	Penn spasm frequency test
Skeletal muscle mass			
Spasticity sum score	$r = 0.430$ $p = 0.001$		
Penn spasm frequency test	$r = 0.487$ $p = 0.000$	$r = 0.874$ $p = 0.000$	

Table 4. Logistic regression for low skeletal muscle mass

	B	OR	95% CI	p-value
Body mass index	-0.767	0.464	0.289 – 0.745	0.001
Constant	20.134			