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The Body Compositional Change of Obese Tetraplegic Patients after Short-term Rehabilitation

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Introduction
Spinal cord injury (SCI) patients are vulnerable to obesity, due to concurrent development of sarcopenia, decreased metabolic rate, limited mobility, and diminished levels of activity. In relation to decreased physical activities, the risk of adiposity, disorders of carbohydrate metabolism and coronary artery disease are also increased. The prevalence of obesity among SCI individuals has been reported to be very high as 40-66% across studies. Therefore , this study aims to reveal the change of body composition in the obese tetraplegic patients following short-term rehabilitation treatment.

Methods
The medical charts of SCI patients who were admitted to tertiary university hospital for rehabilitation treatment from 2016 to 2017 were reviewed. Only the patients with A and B by ASIA Impairment Scale and with available records of initial and follow-up body weight and body composition analysis by bioelectrical impedance were included. In our institution, short-term rehabilitation consists of appropriate nutritional support, physical therapy including passive or active exercise, respiratory muscle training, and neuromuscular electrical stimulation lasting 6-8 weeks. Obesity was defined as body mass index (BMI) ≥ 22kg/m2 or body fat mass > 25% for male and > 35% for female. The prevalence of obesity and body compositional change in obese SCI patients after short-term rehabilitation were analyzed.

Results
Total 36 tetraplegia patients were included. The average age was 44.0 years old, the majority of participants were male (97.2%) and ASIA A (68.4%). Twenty-three patients (63.9%) were classified as obese in accordance with aforementioned definition of obesity (Table 1). After short-term rehabilitation, absolute fat mass (kg), fat percentage and fat

mass index (kg/m2) were significantly reduced (p<0.05). On the other hand, body weight and BMI tended to decrease. Absolute skeletal muscle mass (kg) and skeletal muscle percentage tended to increase (Table 2).

Conclusions

The percentage of obesity was consistently high in tetraplegic patients. Through short-term rehabilitation, obesity can be managed effectively without any loss of skeletal muscle mass, even in the tetraplegic patient with ASAI A and B, who have severe disability in their motor function. These results imply that modifiable obesity in SCI patients need to be identified depending on their metabolic demand in relation to physical condition and intensity of rehabilitation therapy for proper management. Further studies with more patients with various features of SCI (level, severity and chronicity) are necessary in order to establish effective management of obesity in SCI patients.

Table 1. Patients characteristics

Characteristics (%)	ASIA A, B (n=36)
Age (year, range)	44.0 ± 17.8 (15-79)
Male/Female	35/1 (97.2/2.8)
ASIA A/B	25/11 (68.4/30.6)
Disease duration (d, range)	73.9 ± 62.9 (16-244)
Subacute/Chronic	18/18 (50/50)
Obesity	
BMI >25kg/m^2	3 (8.3)
BMI >22kg/m^2	17 (47.2)
Fat (M >25%; F >35%)	15 (41.7)
BMI (>22) & Fat% (M>25; F>35)	**23 (63.9)**

Values are mean±standard deviation.

BMI, body mass index; M, male; F, female

Table 2. Change of body weight and composition after short-term rehabilitation

Characteristics (%)	ASIA A, B (N=23)	
	Initial	Follow up
Body Wt. (kg)	68.3 ± 1.8	67.6 ± 1.9
BMI (kg/m^2)	23.1 ± 2.3	22.8 ± 2.4
Fat (kg)	**18.2 ± 4.5**	**14.5 ± 4.7***
Fat (%)	**27.3 ± 6.0**	**22.8 ± 6.9***
FMI (kg/m^2)	**6.2 ± 1.6**	**4.9 ± 1.8***
Skeletal muscle (kg)	26.7 ± 4.8	26.7 ± 3.9
Skeletal muscle (%)	38.9 ± 3.5	39.9 ± 6.7
SMMI (kg/m^2)	9.0 ± 1.3	9.0 ± 1.2

Values are mean±standard deviation.

*$P<0.05$ compared to initial results by Wilcoxon signed-rank test

BMI, body mass index; FMI, Fat mass index; SMMI, skeletal muscle mass index