

Predisposing factors of hyperthyroidism related muscle weakness in Graves' disease patients

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Background/Aims: Graves' disease is the most common cause of hyperthyroidism and thyrotoxicosis. About 70% of patients with hyperthyroidism will develop muscle weakness, which is accompanied by myopathy. Pathogenesis and predisposing factors of hyperthyroidism related muscle weakness are still unknown. We investigated whether clinical factors such as laboratory tests, or imaging studies could be used as a predictive marker of muscle weakness in patients with Graves' disease.

Methods: We evaluated 46 patients diagnosed with Graves' disease. Thyroid function tests, such as T3, free T4, TSH, TBII, and Tc-99m thyroid scan were performed at the first visit to the hospital. At the same time, the Grip strength test, and the Chair stand test were conducted to evaluate the muscle strength of the patients. Patients were classified into two groups as decreased muscle strength and preserved muscle strength groups. Finally, we investigated clinical factors affecting muscle weakness in patients with Graves' disease.

Results: Preserved muscle strength was observed in 20 patients (43.5%). The analysis revealed significant differences in weight (decreased muscle strength group vs. preserved muscle strength group: 56.6 ± 10.9 vs. 64.9 ± 13.8 , $P = 0.028$) and BMI (21.8 ± 2.7 vs. 23.7 ± 3.2 , $P = 0.039$). Moreover, age showed strong statistically trend (36.0 ± 12.4 vs. 44.9 ± 15.4 , $P = 0.052$). In the subgroup analysis, more Tc-99m thyroid uptake predicted the decreased muscle function (15.9 ± 13.2 vs. 7.0 ± 4.7 , $P = 0.025$).

Conclusions: Age, weight, BMI, and value of Tc-99m thyroid uptake are important factors for predicting the preservation of muscle function in patients with Graves' disease.

Table 1. Patient characteristics

Parameter	No. (% or range)
Age (years)	39.9 ± 14.3 (18-73)
Sex	
Male	12 (26.1%)
Female	34 (73.9%)
Thyroid function tests	
T3 (ng/mL)	3.15 ± 1.68 (1.27-11.26)
FT4 (ng/dL)	3.50 ± 1.86 (1.02-10.46)
TSH (uIU/mL)	0.0045 ± 0.0232 (0.0001-0.1569)
TBII (IU/L)	30.25 ± 42.79 (0.26-201.05)
Height (cm)	162.5 ± 8.7 (148.2-181.9)
Weight (kg)	60.2 ± 12.8 (40.0-107.0)
BMI	22.61 ± 3.05 (16.64-32.34)
Thyroid disease	
Graves' disease	46 (100%)
Grip strength test	
Weak	26 (56.5%)
Normal	15 (32.5%)
Strong	5 (11.0%)
Chair stand test	
Below average	42 (91.3%)
Average	3 (6.5%)
Above average	1 (2.2%)

Table 2. Univariate analysis of clinical parameters for the prediction of muscle weakness (the Grip strength test only)

Parameters	Decreased muscle strength (n=26)	Preserved muscle strength (n=20)	P value
Age (years)	36.0 ± 12.4	44.9 ± 15.4	0.052
Sex			0.137
Male	9 (34.6%)	3 (15.0%)	
Female	17 (65.4%)	17 (85.0%)	
Thyroid function test			
T3 (ng/mL)	3.5 ± 2.0	2.7 ± 1.0	0.211
FT4 (ng/dL)	3.8 ± 1.9	3.1 ± 1.8	0.240
TSH (uIU/mL)	0.0012 ± 0.0032	0.0089 ± 0.0349	0.989
TBII (IU/L)	32.2 ± 49.8	27.6 ± 32.6	0.756
Height (cm)	160.5 ± 7.8	165.0 ± 9.5	0.088
Weight (kg)	56.6 ± 10.9	64.9 ± 13.8	0.028*
BMI	21.8 ± 2.7	23.7 ± 3.2	0.039*

* Statistically significant ($p < 0.05$)

Table 3. Subgroup analysis of clinical parameters for the prediction of muscle weakness (the Grip strength test only, with the value of Tc-99m thyroid uptake)

Parameters	Decreased muscle strength (n=19)	Preserved muscle strength (n=15)	P value
Age (years)	33.9 ± 11.2	47.7 ± 15.4	0.008*
VTU (%)†	15.9 ± 13.2	7.0 ± 4.7	0.025*
Weight (kg)	57.2 ± 11.6	65.6 ± 15.9	0.111
BMI	21.9 ± 2.6	23.8 ± 3.6	0.084

* Statistically significant ($p < 0.05$)

† VTU: the value of Tc-99m thyroid uptake