

Hand grip and leg muscle strength in hemodialysis patients and its determinants

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Background/Aims: Chronic inflammation and progressive loss of peripheral muscle strength and the ability to exercise associated with chronic kidney disease are more pronounced in patients on hemodialysis (HD). We evaluated the hand grip (HGS) and leg muscle strength (LMS) in patients receiving HD and tried to find factors associated with muscle strength.

Methods: We screened (January 2020) and followed up (June 2020) HGS (opposite the fistula side) and LMS (both sides) at single center (n=122) by using digital hand and leg dynamometer (T.K.K.5401 and 5710e/5715, Takei scientific instruments Co. Ltd., Niigata, Japan).

Results: Mean age was 63.1 years, and 72.1% of patients were men. Diabetes was the cause of kidney failure in 48% of patients and median HD vintage was 37 months. 65.7% of patients answered 'yes' to regular home-based exercise or regularly participated in the hospital-based resistance exercise through study period. HGS and LMS showed good correlation ($r = 0.701$, $p < 0.001$). HGS (21.7 vs. 14.8 kg) and LMS (34.5 vs. 21.6 kg) were better in men ($p < 0.001$ and $p < 0.001$, respectively). Older patients (≥ 60 years) showed decreased LMS than others in men and women ($p = 0.001$ and $p = 0.04$, respectively), but HGS was not different by age. Patients performed steady regular home- or hospital-based exercise showed higher HGS (21.3 vs. 16.4 kg, $p = 0.006$) but LMS did not show statistical significance (32.2 vs. 28.5 kg, $p = 0.65$). Female patients who did not exercise at all showed no improvement in HGS and LMS, although statistical significance was not valid ($p = 0.053$, $p = 0.24$). Serum albumin and creatinine positively correlated with HGS and LMS. Serum urea nitrogen and iron showed positive correlation with HGS, while Kt/V showed positive correlation with LMS. BMI positively correlated with LMS in men. Multiple linear regression analysis proved male sex, younger age, and steady participation in any type of exercises were factors associated with better HGS and LMS.

Conclusions: Sex, age, and exercise were the most important determinants of muscle strength in HD patients. We need to encourage patients to do regular home- or group-exercise and introduce new feasible form of exercise for HD patients.

Table. Multiple linear regression analysis of the factors related with hand grip and leg muscle strength

	Hand grip strength		Leg muscle strength	
	Standardized coefficient	p-value	Standardized coefficient	p-value
Constant	12.795	0.001	48.28	0.021
Sex (female)	-0.488	< 0.001	-0.466	< 0.001
Age (year)	-0.187	0.05	-0.376	< 0.001
ESRD cause (DM)	-0.244	0.012		
BMI (kg/m ²)			0.127	0.165
Exercise, home- or hospital-based (more)	0.264	0.004	0.153	0.072
Mean serum albumin (g/dl)	0.181	0.059	0.037	0.704
BUN (mg/dl)	-0.041	0.712		
Serum creatinine (mg/dl)	0.072	0.537	0.051	0.6
hs-CRP (mg/dl)	-0.037	0.683		
Kt/V			-0.116	0.249
Iron (mcg/dl)	0.199	0.039		
Mean intact PTH (pg/ml)	0.109	0.221		

BMI, body mass index; BUN, blood urea nitrogen; DM, diabetes mellitus; ESRD, end stage renal disease; hs-CRP, highly sensitive C-reactive protein; PTH, parathyroid hormone