REDUCED MUSCLE STRENGTH ASSOCIATES WITH HIGHER RISK OF MORTALITY COMPARED WITH REDUCED MUSCLE MASS IN ASIAN SARCOPENIC HEMODIALYSIS PATIENTS

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Introduction and aim

Sarcopenia is a reliable marker of frailty and poor prognosis among elderly individuals. We evaluated the association of reduced muscle mass [assessed by bio-electrical impedance analysis, BIA], reduced muscle strength [assessed by handgrip] and combined presence of the two (sarcopenia) with mortality in hemodialysis (HD) patients.

Materials and Methods

One hundred eight HD patients (60 men, mean age of 66.1 ± 11.9 years and vintage of 47 (7-204 months) underwent assessment of sarcopenia, and were followed prospectively for up to 5 years. Low muscle mass (by BIA-appendicular muscle mass index, ASMI) and low muscle strength were defined according to criteria postulated by the Asian Working Group for Sarcopenia (AWGS) in Older People. ASMI cutoffs for low muscle mass and handgrip cutoffs for low muscle strength were defined as values two standard deviations (SD) below sex-specific means in a young reference population (7.0 kg/m^2 in men and 5.7 kg/m^2 in women, 26 kg in men and 18kg in women, respectively). During 5 years follow-up, 35 (32%) HD patients died. Associations of reduced muscle mass, reduced muscle strength or combined (sarcopenia) with mortality over a mean follow-up period of 65 months were assessed with adjustments for clinical, laboratory and body composition parameters.

Results: Results are shown in **Figures 1., 2.** and **Tables 1-3**.

Fig.1 Classification in hemodialysis patients (n=108)

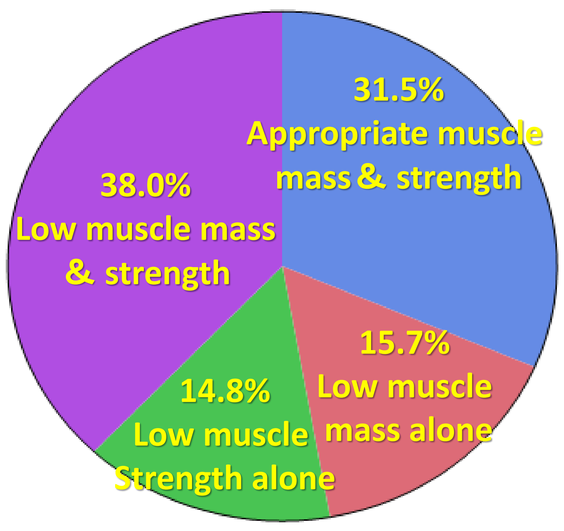

Table 1.
Clinical characteristics of HD patients according to the presence of appropriate or low muscle mass (MM) together with appropriate or low muscle strength (MS).

	Appropriate MM 50 (46 %)		Low MM 58 (54 %)		
	Appropriate MS	Low MS	Appropriate MS	Low MS	MANOVA
Patients, n (%)	34 (32)	16 (15)	17 (16)	41 (37)	
Age, years	62 (43-71)	**67 (59-78)**	66 (46-78)	**75 (61-85)**	***MS, MM&MS***
Sex (% man)	23 (68)	7 (44)	12 (71)	18 (44)	**0.08[A]**
DM (%)	10 (29)	4 (25)	3 (18)	18 (44)	**NS[A]**
CVD (%)	5 (14)	5 (31)	2 (12)	6 (15)	**NS[A]**
GNRI	97 (92-101)	94 (76-103)	94 (87-100)	**91 (79-100)**	***MM&MS***
Vintage (Months)	55 (12-159)	40 (2-293)	72 (15-248)	41 (3-234	NS
GFR, mL/min/1.73 m^2	5.3 (3.9-6.8)	5.8 (4.2-8.0)	5.0 (4.1-7.4)	6.0 (4.2-8.4)	NS
BMI (kg/m^2)	23 (20-28)	**21 (18-26)**	20 (16-25)	**21 (15-24)**	***MS, MM&MS***
s-albumin (g/L)	3.7 (3.5-4.1)	3.7 (2.5-4.4)	3.8 (3.4-4.2)	3.6 (3.0-4.0)	NS
Hemoglobin (g/L)	11.8 (9.3-11.4)	10.1 (7.4-12)	10.2 (8.5-11.9)	9.9 (8.9-12.1)	NS
s-creatinine (mg/dl)	9.1 (6.5-11.4)	8.0 (5.2-9.0)	**8.3 (6.7-10.3)**	**6.8 (4.5-10.0)**	***MM, MM&MS***
CRP (mg/dL)	0.1 (0-1.0)	0.1 (0-4.8)	0.1 (0-0.8)	0.4 (0-2.3)	NS
Intact-PTH (pg/dl)	153 (59-283)	126 (31-686)	146 (54-402)	130 (44-207)	NS

Categorical data are shown as number of patients and percentage; continuous data as median and 10th-90th percentiles; MANOVA, multivariate analysis of variance: ***MS*** denotes a significant effect (P<0.05) attributed to the component of low muscle strength; ***MM*** denotes a significant (P<0.05) effect attributed to the component of low muscle mass; ***MM&MS*** denotes a significant (P<0.05) effect attributed to the component of both low muscle mass and low muscle strength; NS=not significant; A=Comparisons performed by Chi-square test. DM, diabetes mellitus; CVD, cardiovascular disease; GNRI, geriatric nutritional risk index; BMI, body mass index; CRP, C-reactive protein; PTH, parathyroid hormone.

Figure 2.
Survival rate of HD patients stratified according to the presence of appropriate muscle mass and strength, low muscle mass alone, low muscle strength alone, or both.

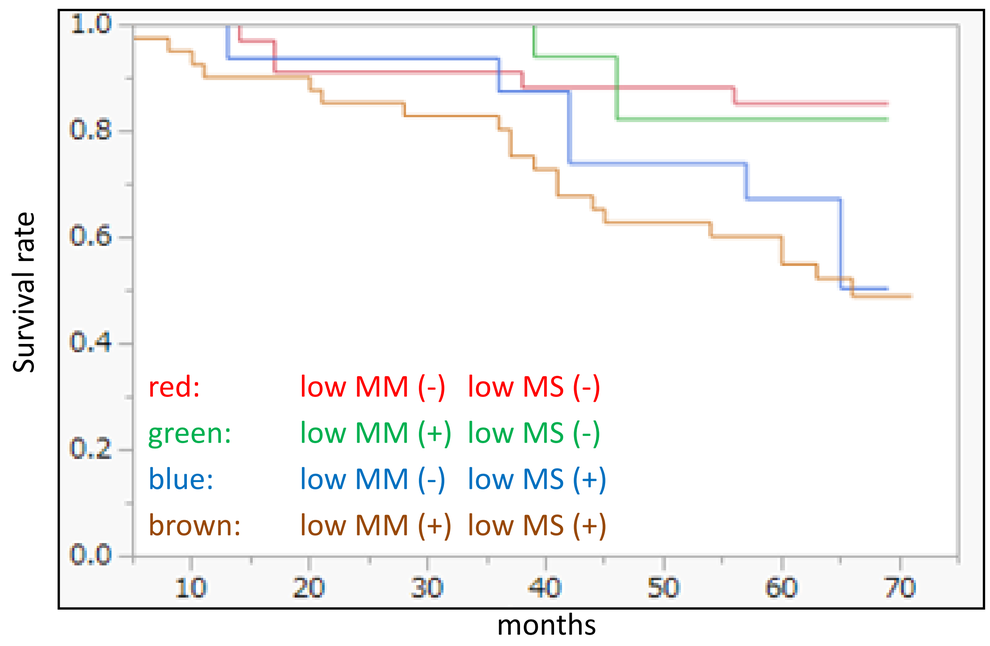

Table 2.
Hazard ratios (HR) and 95% confidence intervals (CI) after categorization regarding the presence of low muscle mass alone, low muscle strength alone or both in HD patients.

	Model 1		Model 2		Model 3	
	HR (95% CI)	P	HR (95% CI)	P	HR (95% CI)	P
Appropriate MM & MS (n=34)	1		1		1	
Low MS alone (n=16)	4.0 (2.2-7.2)	<0.0001	2.8 (1.5-5.2)	0.001	**2.0 (1.0-3.9)**	**0.04**
Low MM alone (n=17)	1.7 (0.8-3.2)	0.14	1.4 (0.7-2.7)	0.39	1.2 (0.6-2.6)	0.61
Low MM & MS (n=41)	4.2 (2.4-7.4)	<0.0001	3.0 (1.7-5.3)	<0.0001	2.0 (1.1-3.8)	**0.03**

SD, standard deviation; Model 1 denotes crude, Model 2 includes minimal adjustment for age and sex; Model 3 includes adjustment for age, sex, diabetes, cardiovascular disease, eGFR, and CRP.

Table 3.
Uni- and Multivariate logistic models examining predictors of death in HD patients.

	univiriate			multivariate		
	odds ratio	95% CI	p value	odds ratio	95% CI	p value
presence of low MM	2.08	0.91 – 4.90	0.08			
presence of low MS	**4.84**	**2.00 – 12.8**	**0.0003**	**3.79**	**1.50 – 10.3**	**0.0045**
Age (>65)	**3.14**	**1.33 – 7.94**	**0.0085**	2.25	0.88 – 6.00	0.09
Gender (male)	2.24	0.98 - 5.39	0.06			
presence of low DM	**2.4**	**1.03 – 5.60**	**0.04**	2.07	0.83 – 5.18	0.12
BMI (>21.4)	1.16	0.50 – 2.60	0.73			
Hb (<10)	1.05	0.50 – 2.40	0.91			
CRP (>0.1)	1.70	0.25 - 1.35	0.21			
GNRI (< 92)	1.13	0.48 – 2.60	0.77			

Pseudo r^2= 0.14

According to analysis by the receiver operating characteristics (ROC) curve, the cut off value of BMI, Hb, CRP and GNRI as predictor of all-cause mortality was respectively determined.

Summary and conclusions

HD patients with sarcopenia, i.e. low muscle strength (handgrip strength) plus low muscle mass (BIA), were over two times more likely to die during a follow-up period of 5 years relative to patients with appropriate muscle mass and strength, regardless of age, gender and other confounding factors. The increased mortality risk was mainly accounted for by low muscle strength suggesting that assessments, and preventive and therapeutic interventions, targeting muscle strength deserve more attention in dialysis patients.

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