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Differential Composition of CT-derived Visceral and Subcutaneous Fat in Sarcopenic Chronic Kidney Disease Patients

Seok-hyung Kim, Jong-Woo Yoon, Gwangho Choi, Jin-eop Kim, Gwang-Eon Shim, Hyunsuk Kim
Department of Internal Medicine-Nephrology, Chuncheon Sacred Heart Hospital, Korea, Republic of

Objectives : Sarcopenia and body fat composition are important factors to consider in both general population and chronic kidney disease (CKD) patients. In this study, we aimed to investigate the relationship between muscle mass and fat mass, including subcutaneous and visceral fat, in CKD patients. We conducted a comprehensive analysis of body composition using bioelectrical impedance analysis (BIA) and computed tomography (CT) imaging in a CKD cohort and compared the results with those observed in the general population.
Methods : To quantify muscle mass, we calculated the appendicular skeletal muscle (ASM) by the summing skeletal muscle mass (SMM) of both the lower limbs and arms. The SMM measurements were obtained through BIA. We utilized synapse volumetry to measure the subcutaneous and visceral fat volume in CT cross-sectional images.
Results : Among the 189 participants included in the analysis, the mean age was 58.6 ± 17.7 years. The mean eGFR was 47.6 ± 35.6 mL/min/1.73 m^2. Notably, CKD patients were found to be significantly older than those without CKD. Additionally, CKD patients exhibited a lower mean BMI compared to those without CKD. It's worth noting that participants with CKD had lower subcutaneous fat and higher visceral fat compared to those without CKD. Within the non-CKD group, participants with higher muscle mass exhibited statistically significant increases in both BMI and waist circumference compared to those with lower muscle. Additionally, both subcutaneous and visceral fat showed statistically significant elevations in the higher muscle mass group. However, in the CKD group, it was observed that subcutaneous fat was lower in sarcopenic patients, but there was no statistically significant difference in visceral muscle mass between the higher muscle mass group and sarcopenic patients, even after adjusting for relevant variables.
Conclusions : In the CKD group, sarcopenic patients, lower skeletal muscle mass and relatively higher visceral mass were observed compared to the non-CKD group.

FIGURE 1&2.jpg

Table 1. Comparison of clinical characteristics of participant without CKD by muscle mass

Clinical variables	Higher muscle mass (n=31)	Lower muscle mass (n=37)	*p*-value
Age (years)	48.0 ± 14.7	53.7 ± 16.7	0.168
BMI (kg/m²)	26.9 ± 6.3	20.9 ± 5.0	<0.001
Waist circumference (cm)	94.8 ± 9.4	83.0 ± 7.7	<0.001
eGFR (mL/min/1.73 m²)	92.5 ± 18.1	87.1 ± 18.2	0.271
Subcutaneous fat (cm²)	199.0 ± 84.1	130.7 ± 60.6	0.002
Visceral fat (cm²)	115.8 ± 57.4	78.7 ± 51.7	0.005
Skeletal muscle index	7.97 ± 0.97	6.49 ± 0.94	<0.001

Data are presented as mean ± standard deviation or number (percentage) of subjects. BMI, body mass index; eGFR, estimated glomerular filtration rate

Table 2. Comparison of clinical characteristics of participant with CKD by muscle mass

Clinical variables	Higher muscle mass (n=58)	Lower muscle mass (n=63)	*p*-value
Age (years)	60.9 ± 14.5	68.7 ± 12.1	<0.001
BMI (kg/m²)	21.8 ± 7.0	20.1 ± 5.4	0.228
Waist circumference (cm)	93.9 ± 9.3	87.2 ± 8.9	<0.001
eGFR (mL/min/1.73 m²)	26.0 ± 18.3	25.1 ± 18.3	0.602
Subcutaneous fat (cm²)	158.0 ± 98.5	122.5 ± 68.7	0.040
Visceral fat (cm²)	114.1 ± 76.1	110.1 ± 61.9	0.996
Skeletal muscle index	8.11 ± 1.34	6.63 ± 0.94	<0.001

Data are presented as mean ± standard deviation or number (percentage) of subjects. BMI, body mass index; eGFR, estimated glomerular filtration rate

FIGURE 1&2.jpg

Table 3. Multivariate logistic regression analysis for muscle mass according to kidney function

	All participants		Participants without CKD		Participants with CKD	
Variables	OR (95% CI)	*P*- value	OR (95% CI)	*P*- value	OR (95% CI)	*P* -value
Waist circumference	0.880 (0.841-0.920)	<0.001	0.831 (0.753-0.917)	<0.001	0.903 (0.857-0.952)	<0.001
Subcutaneous fat	0.927 (0.890-0.966)	<0.001	0.869 (0.800-0.945)	0.001	0.941 (0.891-0.991)	0.020
Visceral fat	0.924 (0.876-0.974)	0.004	0.847 (0.752-0.954)	0.006	0.943 (0.884-1.005)-	0.071

Adjusted by age, sex, presence of diabetes, SBP and BMI