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The impact of skeletal muscle mass on BMD in ESRD patients initiating hemodialysis

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Objectives : Osteoporosis and sarcopenia are highly prevalent in CKD and ESRD patients. However, there are few studies to address the association of muscle and bone in dialysis patients. In addition, BIA and DXA as measurement tools for assessing skeletal muscle mass have a limitation that hydration status in dialysis patients results in having low accuracy and reproducibility. Thus, the purpose of this study is to examine the association between skeletal muscle mass measured by abdominal CT and BMD for ESRD patients initiating hemodialysis.
Methods : This observational study recruited patients who underwent abdominal CT and BMD within 3 months after initial HD date at Daejeon St. Mary's hospital between January 2018 and September 2021. A total of 87 patients were included in this study. Using the open-source software program which was developed by Samsung Medical center of Korea in 2018, the skeletal muscle mass was quantified with a single abdominal CT image exported at the upper endplate of L3 transverse section. The BMD was measured at the Lumbar spine and Proximal femur using DXA.
Results : Patients were divided into two groups according to the average value of skeletal muscle mass (122.92 ± 29.06). The T-score of lumbar spine BMD was significantly greater in high SMM group (-0.71 ± 1.27) than in low SMM group (-1.83 ± 1.53). The T-score of proximal femur BMD between two groups was greater in high SMM group (-1.31 ± 2.02, -2.27 ± 2.16, respectively). The skeletal muscle mass was positively correlated with lumbar spine BMD and proximal femur BMD in Pearson's correlation analysis ($r = 0.426$, $r = 0.514$, $p < 0.001$). The only variable that significantly associated with each BMD was the SMM in multivariate regression analysis ($p < 0.001$).
Conclusions : Skeletal muscle mass was independently associated with the BMD of lumbar spine and proximal femur in hemodialysis patients.

Table1.png

Characteristics	Total (N= 87)	Low SMM group (N=44)	High SMM group (N=43)	*p*-value
Sex Male, n(%)	46(52.9)	12(27.3)	34(79.1)	< 0.001
Age(years)	65.37 ± 13.76	67.66 ± 12.93	63.02 ± 14.33	0.117
BMI(kg/m^2)	24.15 ± 4.17	22.24 ± 3.41	26.02 ± 4.03	< 0.001
Past medical history, n(%)				
DM	63(72.4)	28(63.6)	35(81.4)	0.064
HTN	62(71.3)	25(56.8)	37(86.0)	0.003
GN	7(8.0)	4(9.1)	3(7.0)	0.717
Laboratory findings				
Skeletal muscle mass(cm^2)	122.92 ± 29.06	99.99 ± 14.90	146.38 ± 19.70	< 0.001
Hb(g/dℓ)	9.35 ± 1.52	9.23 ± 1.55	9.49 ± 1.50	0.456
BUN(mg/dℓ)	87.38 ± 30.68	86.58 ± 31.35	88.19 ± 30.32	0.808
Cr(mg/dℓ)	8.26 ± 3.26	8.04 ± 3.31	8.48 ± 3.23	0.528
eGFR(MDRD)	7.21 ± 3.22	6.88 ± 3.22	7.58 ± 3.22	0.326
Albumin(g/dℓ)	3.57 ± 0.63	3.57 ± 0.62	3.57 ± 0.65	0.963
C-reactive protein(mg/dℓ)	2.12 ± 5.34	2.90 ± 6.72	1.31 ± 3.23	0.170
Total cholesterol(mg/dℓ)	149.86 ± 63.48	155.98 ± 53.01	143.60 ± 72.83	0.384
Triglyceride(mg/dℓ)	137.23 ± 81.48	121.62 ± 68.02	152.85 ± 91.24	0.091
LDL-cholesterol(mg/dℓ)	82.79 ± 43.24	93.89 ± 50.98	75.23 ± 36.40	0.202
HDL-cholesterol(mg/dℓ)	42.28 ± 15.60	46.48 ± 12.64	37.98 ± 17.26	0.015
Corrected Ca(mg/dℓ)	8.35 ± 0.92	8.57 ± 0.80	8.12 ± 0.98	0.019
Phosphate(mg/dℓ)	5.68 ± 1.85	5.64 ± 1.96	5.71 ± 1.75	0.855
Intact PTH(pg/mℓ)	212.56 ± 201.21	233.92 ± 262.26	189.86 ± 113.09	0.299
ALP(IU/L)	85.54 ± 42.45	82.55 ± 41.82	88.76 ± 43.40	0.504
Vitamin D Total(ng/mℓ)	10.79 ± 8.02	12.36 ± 8.86	9.12 ± 6.77	0.101
Uric acid(mg/dℓ)	7.07 ± 2.49	6.73 ± 2.71	7.41 ± 2.23	0.208
Subcutaneous fat area(cm^2)	128.08 ± 58.47	114.80 ± 49.60	141.66 ± 64.09	0.031
Visceral fat area(cm^2)	143.53 ± 93.96	118.78 ± 80.23	168.84 ± 100.95	0.012
Lumbar spine BMD(g/ cm^2)	-1.29 ± 1.51	-1.83 ± 1.53	-0.71 ± 1.27	0.001
Proximal femur BMD(g/cm^2)	-1.80 ± 2.13	-2.27 ± 2.16	-1.31 ± 2.02	0.036

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