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BACKGROUND

- Sarcopenia and atherosclerosis is age-related disorders and its prevalence is common in individuals with type 2 diabetes.
- Several epidemiologic studies proposed that sarcopenia was associated with central obesity, insulin resistance, and type 2 diabetes. However, there was only few studies for investigating associations between sarcopenia and atherosclerosis.
- In this study we examined relationships of sarcopenia with carotid intima-media thickness (CIMT) in Korean male patients with type 2 diabetes.

METHODS

- A total of 262 male subjects with type 2 diabetes were enrolled.
- B-mode ultrasound was used for measuring CIMT. High IMT was defined as ≥ 75 percentiles of maximum CIMT in common carotid artery.
- Appendicular skeletal muscle mass (ASM) was assessed using dual energy X-ray absorptiometry (DEXA). We defined sarcopenia as follows: ASM (kg)/body mass index (BMI: kg/m2) <0.789.

RESULTS

Table 1. Characteristics of total subjects according to sarcopenia

	Sarcopenia		P
	No (n=191)	Yes (n=71)	
Age (years)	59.7±9.1	63.4±8.8	0.004
BMI (kg/m²)	24.7±2.8	26.7±3.6	<0.001
Waist circumference (cm)	88.3±7.6	93.2±8.1	<0.001
Systolic BP (mmHg)	126.0±12.9	127.9±12.6	0.3
Diastolic BP (mmHg)	72.5±8.7	72.4±9.9	0.9
DM duration (years)	10.4±7.5	10.2±7.6	0.9
Hypertension, n (%)	108 (56.3)	51 (72.9)	0.02
Current smokers, n (%)	60 (31.3)	20 (28.6)	0.8
Total cholesterol (mg/dl)	149.8±32.1	145.9±26.7	0.4
Triglyceride (mg/dl)	140.8±86.9	166.9±99.9	0.04
HDL cholesterol (mg/dl)	49.5±14.5	45.1±12.0	0.02
LDL cholesterol (mg/dl)	79.4±29.3	78.5±25.0	0.8
Fasting blood glucose (mg/dl)	139.1±41.9	147.0±42.1	0.2
HOMA-IR	2.91±2.93	3.41±3.01	0.2
HbA1C (%)	7.3±1.2	7.4±1.2	0.4
Serum creatinine (mg/dl)	1.01±0.43	1.06±0.36	0.3
eGFR (ml/min per 1.73 m²)	86.3±19.1	80.3±22.3	0.03
hsCRP (mg/l)	1.5±2.2	1.7±2.0	0.4
25[OH]D (ng/ml)	19.2±8.1	17.5±7.0	0.1
PWV (cm/sec)	1615.5±302.2	1719.6±333.2	0.002
meanCIMT (mm)	0.681±0.125	0.737±0.143	0.002
maxCIMT (mm)	0.875±0.194	0.978±0.212	<0.001
High CIMT, n (%)	35 (18.3)	28 (40.3)	<0.001
ASM/BMI (kg per kg/m²)	0.904±0.076	0.731±0.044	<0.001

Categorical variables are present as n (%) and continuous variables as means ± SD.
High CIMT was defined as ≥ 75 percentiles of maximum IMT

Table 3. Correlations between baPWV and metabolic parameters

Sarcopenia	ORs (95% CI)	
	No (n=191)	Yes (n=71)
Model 1	1	2.286 (1.228-4.252) [†]
Model 2	1	2.207 (1.121-4.344) [*]

Model 1: adjusted for age.
Model 2: further adjusted for BMI, WC, hypertension, TG, HDL cholesterol, and eGFR.
^{*}: P value<0.05, [†]: P value < 0.01.

Table 2. The Pearson correlation of maximum CIMT with metabolic parameters

	r	P
Age, years	0.392	<0.001
BMI, kg/m²	0.148	0.008
Waist circ., cm	0.22	<0.001
Systolic BP, mmHg	0.06	0.2
Diastolic BP, mmHg	-0.09	0.1
#DM duration, y	0.02	0.4
#TG, mg/dl	-0.02	0.4
HDL, mg/dl	-0.129	0.02
LDL, mg/dl	-0.001	0.5
#HOMA-IR	0.07	0.1
eGFR (ml/min per 1.73 m²)	-0.13	0.02
#hCRP, mg/l	0.06	0.2
ASM/BMI	-0.272	<0.001

r: Pearson correlation coefficient, #: Log transformed data before analysis.

Figure 1. Correlations between max CIMT and appendicular skeletal muscle mass (ASM)

- Patients with sarcopenia were more likely to be elderly and hypertensive, have higher values of BMI, waist circumference (WC), triglycerides (TG), mean CIMT, and maximum CIMT, and have lower values of HDL cholesterol and estimated glomerular filtration rate (eGFR) compared to those without sarcopenia.
- High CIMT was more common in subjects with sarcopenia than those without sarcopenia (Non-sarcopenic vs. Sarcopenic = 18.3% vs. 40.3%, p<0.001).

- Maximum CIMT was positively correlated with age, WC, and BMI, but showed negative correlations with HDL and eGFR. ASM/BMI was significantly associated with maximum CIMT (r²=0.074, p<0.001).
- The odds ratio (OR) of sarcopenia for high CIMT after adjusted for age was 2.286 (95% CI = 1.228-4.252, p<0.01). The OR remained significant after further adjustments for BMI, WC, hypertension, TG, HDL cholesterol, and eGFR (p<0.05).

CONCLUSIONS

- We showed that sarcopenia was significantly associated with CIMT in Korean male patients with type 2 diabetes independent of age, WC, BMI, hypertension, TG, HDL cholesterol, and eGFR. To explore causal relationships between sarcopenia and atherosclerosis, further studies are needed.