Original Article

Application value of two-dimensional ultrasound and shear-wave elastography parameters in evaluating sarcopenia with essential hypertension

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Background: Patients with essential hypertension have a high risk of muscle mass and strength decline. Ultrasound is a promising method for assessing sarcopenia. This study aimed to analyze the correlation between ultrasound and shear-wave elastography (SWE) features, and muscle mass, muscle strength, and physical performance, and to assess the clinical applicability of ultrasound in the diagnosis of sarcopenia in patients with essential hypertension.

Methods: In total, 134 patients with essential hypertension were enrolled in this cross-sectional study. The appendicular skeletal muscle mass index (ASMI), handgrip strength, and 6-meter walking speed of all the patients were measured. The patients were classified into the sarcopenia group and the non-sarcopenia group. The ultrasound-derived muscle thickness (MT), cross-sectional area (CSA), and SWE of the rectus femoris muscle (RFM) were measured in both the relaxed and contracted states. In addition, ultrasound features, such as the muscle fascicle length (Fl), pennation angle (PA), MT, and SWE of the gastrocnemius medialis muscle (GMM), were measured in the relaxed state. Correlations between the clinical indicators, and the ultrasound and SWE features were analyzed. The clinical indicators, and the ultrasound and SWE features were then compared between the sarcopenia and non-sarcopenia groups to determine the independent predictors. Based on these predictors, diagnostic models were established by logistic regression analysis.

Results: Both the ASMI and grip strength were positively correlated with the ultrasound-derived MT and CSA of the RFM in the relaxed and contracted states, and positively correlated with the MT, Fl, PA, and SWE of the GMM in the relaxed state (all $P<0.05$). The 6-meter walking speed was positively correlated with the ultrasound-derived MT and CSA of the RFM in the relaxed and contracted states, and positively correlated with the Fl and SWE of the GMM in the relaxed state (all $P<0.05$). Compared with the non-sarcopenia patients, the sarcopenia patients had a decrease in the ultrasound-derived MT and CSA of the RFM in the relaxed and contracted states, and the MT, Fl and SWE of the GMM in the relaxed state (all $P<0.05$). Based on these results, the cut-off value of the prediction model was 0.443, and it had a diagnostic sensitivity of 84.5% and a specificity of 90.8%.

Conclusions: Two-dimensional ultrasound combined with the SWE model can be used to diagnose sarcopenia in patients with essential hypertension. The model has high sensitivity and specificity, and can more accurately detect sarcopenia in patients with essential hypertension.

Keywords: Sarcopenia; essential hypertension; two-dimensional ultrasound; shear-wave elastography (SWE)

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Introduction

Sarcopenia is a geriatric syndrome referring to a progressive, generalized decrease in skeletal muscle mass, strength, and function (1). In 2010, the European Working Group on Sarcopenia in Older People (EWGSOP) provided a consensus definition of sarcopenia as an age-related syndrome characterized by decreased muscle mass, reduced muscle strength, and/or a decline in physical function (2). Subsequently, the Asian Working Group for Sarcopenia (AWGS) published its own definition of sarcopenia for Asians (3). Sarcopenia is associated with physical disabilities, a decreased quality of life, and an increased risk of mortality (4). According to the EWGSOP standards, the prevalence of sarcopenia ranges from 8% to 36% in individuals under 60 years old, and from 10% to 27% in those aged 60 years and above (5). Sarcopenia can be classified as primary or secondary. Primary sarcopenia refers to an age-related process without any evident secondary cause, while secondary sarcopenia is caused by systemic diseases, and is prevalent in individuals with cardiovascular disease (31%), diabetes (31%), respiratory disease (27%), and dementia (26%) (6).

Hypertension is one of the most common cardiovascular diseases, affecting more than 1 billion people worldwide (7). The prevalence of sarcopenia among patients with hypertension ranges from 20.2% to 25.8%, which is significantly higher compared to that of the general population (8,9). This suggests that essential hypertension contributes to the onset and progression of sarcopenia. The mechanism underlying this association could be linked to structural changes caused by essential hypertension in skeletal muscle capillaries (10), along with aberrant muscle mitochondrial turnover and augmented oxidative damage in muscles (11). These factors collectively affect the delivery of oxygen and nutrients, ultimately resulting in a decrease in both muscle mass and strength. Sarcopenia has emerged as a frequent complication in individuals, and reduced muscle mass independently contributes to the risk of mortality (12), which in turn significantly affects both the quality of life and prognosis of these patients (13,14). Therefore, accurately assessing and intervening in muscle wasting is becoming increasingly important in the clinical diagnosis and treatment of patients with essential hypertension.

The most widely used diagnostic criteria for sarcopenia are the EWGSOP criteria, which were revised in 2019 (15). The EWGSOP criteria define sarcopenia as the presence of low muscle mass accompanied by poor muscle strength or physical performance. A variety of techniques can be used to estimate muscle mass. Computed tomography (CT) and magnetic resonance imaging are considered the gold standards for the non-invasive measurement of muscle mass. Dual-energy X-ray absorptiometry (DXA) and bioelectrical impedance analysis (BIA) are preferred alternative methods for research and clinical use due to their wide availability in clinical settings, and the availability of reference data. Ultrasound has also been used as an alternative or new test to assess muscle mass. Muscle strength can be evaluated by grip strength, and physical performance can be assessed by gait speed. DXA can be used to measure the appendicular skeletal muscle mass (ASM), which can then be converted using a formula to calculate the appendicular skeletal muscle mass index (ASMI). Ultrasound can assess muscle condition by measuring parameters such as muscle thickness (MT), the cross-sectional area (CSA), muscle volume, fascicle length (Fl), the pennation angle (PA), echogenicity, and muscle hardness (16). Among them, quadriceps muscle imaging has been shown to be a reliable predictor of overall skeletal muscle quality (17). Previous studies have confirmed the diagnostic value of ultrasound quadriceps muscle imaging for secondary sarcopenia in diseases such as chronic obstructive pulmonary disease, Parkinson's disease, liver cirrhosis, and stroke (18-21).

In this prospective study, we aimed to evaluate sarcopenia in patients with essential hypertension by quantifying skeletal muscle mass and muscle stiffness by ultrasound combined with shear-wave elastography (SWE). We present this article in accordance with the STROBE reporting checklist (available at https://qims.amegroups.com/article/view/10.21037/qims-24-1718/rc).

Methods

Study design and patients

A total of 160 patients with essential hypertension from the First Hospital of China Medical University (Shenyang, China) were recruited for this prospective observational study between June 2023 and June 2024. Clinical feature data, including age, sex, height, and weight, were obtained from the patients' medical records. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the Research Ethics Committee of The First Hospital of China Medical University (No. 2023-415-2), and all patients provided written informed consent. To be eligible for inclusion in this study, the patients had to meet the following inclusion criteria: (I) have signed the informed consent form; (II) have been diagnosed with essential hypertension; and (III) be aged ≥55 years. Patients were excluded from the study if they met any of the following exclusion criteria: (I) had severe cardiopulmonary disease, severe hepatic or kidney insufficiency, or cancer; (II) had a physical disability; (III) had a concomitant disease affecting the musculoskeletal system, such as hyperthyroidism, rheumatism, severe acute infectious disease, or metabolic disease; (IV) had received long-term systemic steroid therapy; and/or (V) had a pacemaker implant. In total, 26 patients were excluded from our study due to the presence of diabetes (n=13), a cardiac pacemaker (n=7), orthopedic disease (n=2), and not consenting to the study procedure (n=4). Ultimately, the cohort comprised 134 patients. Based on the AWGS consensus criteria, the patients were divided into sarcopenia (n=58) and non-sarcopenia (n=76) groups.

Assessment of sarcopenia

This study adopted the following definition of sarcopenia provided in the 2019 AWGS consensus criteria: low muscle strength or physical performance accompanied by low skeletal muscle mass.

Muscle mass

BIA (InBody770; InBody, Seoul, Korea) was used to estimate muscle mass based on whole-body electrical conductivity. First, each patient was guided to remove any metal jewelry and then lay on a bed. Second, electrodes were attached to the patient's wrists and ankles, and the patient was told to remain still. After 1 min, BIA showed the ASM. The ASM was divided by height squared, and expressed as the ASMI. Based on the BIA diagnostic criterion, low muscle mass was defined as an ASMI ≤7.0 kg/m^2 for males and ≤5.7 kg/m^2 for females.

Muscle strength

Handgrip strength was used as an indicator of muscle strength, and was assessed by a Camry electronic grip strength meter (EH101; Camry Scale). The patients used their dominant hand for the measurement with their elbows extended. The patients were asked to contract with full strength three times. The highest value was taken. Low muscle strength was defined as handgrip strength <28 kg for males and <18 kg for females.

Physical performance

According to the AWGS criteria, the patients were directed to move ahead at usual speed down a straight, closed, and long 6-m indoor corridor, and stop at the finish line. The time taken to perform the 6-m walk was measured using a stopwatch, and the gait speed was calculated as m/s. The patients completed the test twice, and the faster speed was taken. The cut-off value of poor physical performance was a 6-m walking speed of <1.0 m/s for both sexes.

Ultrasound and SWE biomarkers of the RFM

All ultrasound and SWE measurements were performed by a single ultra sonographer, who had received formal training. SWE was performed using an Aixplorer ultrasound system (Supersonic Imagine, France) with ShearWave™ Elastography coupled with a 4–15 MHz linear transducer with pre-set musculoskeletal parameters. The following parameters were used to acquire the ultrasound images: mode: B; depth: 3–5 cm; and gain: 42%. The patients were placed in the supine position with the hip in extension. Ultrasound and SWE assessments were conducted twice with the patients' knees straight, and at 90 degrees of flexion. Ultrasonography of the dominant quadriceps was performed. The linear probe was placed in the mid-point of the rectus femoris muscle (RFM), which was the half distance between the lower edge of the patella and the anterior superior iliac spine. First, the probe was placed perpendicular to the long axis of the thigh. The CSA and thickness of the RFM were measured. Next, the SWE region of interest (ROI) size (diameter =3 mm) was set in a

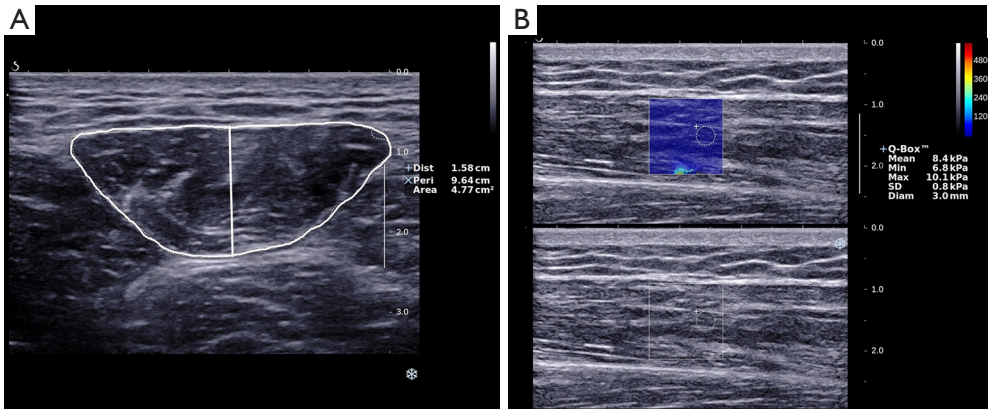

Figure 1 Ultrasound and SWE images of the RFM. (A) Two-dimensional ultrasound image of the RFM. The CSA and MT of the RFM were measured. (B) The SWE values of the RFM were measured (region of interest =3 mm, depth: 1.5 cm). CSA, cross-sectional area; MT, muscle thickness; RFM, rectus femoris muscle; SWE, shear-wave elastography.

predefined square sampling box. The ROI did not contain any vessels, myotendinous, or myofascial structures. Later, the mean elastic modulus (kPa) was automatically reported (*Figure 1*). All RFM measurements were repeated three times, and the mean values were taken for the statistical analysis.

Ultrasound and SWE biomarkers of gastrocnemius medialis muscle (GMM)

All patients were put in the prone position with their feet outside the examination bed. The examiner parallelly and lightly placed the probe on the GMM in the maximum part of the below-knee circumference. The examiner scanned the image of the subcutaneous adipose tissue and GMM. The MT, PA, and Fl of the GMM were measured when the patients were in the relaxed state. MT (mm) was defined as the distance between the subcutaneous fascia and the deep fascia. PA (°) was defined as the acute angle between the fascicle orientation and deep aponeurosis orientation. Fl (mm) was defined as the length of a linear fascicle path between the superficial aponeurotic junction and the deep aponeurotic junction, which was measured when the fascicles were fully visible in the field of view. Next, the probe was positioned such that a fixed-size ROI delimiting the elastography field of view (SWE box: size 10 mm × 10 mm), ROI (3-mm diameter) was placed in a given square SWE color map at a depth of 1.5 cm (*Figure 2*). The results were accepted as the averages of three consecutive measurements.

Statistical analysis

The statistical analyses were performed using IBM SPSS 26.0 (IBM SPSS Inc., Chicago, IL, USA). The Shapiro-Wilk test was used to evaluate normality. The normally distributed continuous variables are expressed as the mean ± standard deviation, and were analyzed using an independent *t*-test. The continuous variables with skewed distributions are expressed as the median and interquartile range (25th–75th percentiles), and were analyzed using the Mann-Whitney *U* test. The categorical variables are expressed as the percentage, and were compared using the chi-squared test. Spearman's product-moment correlation was used to explore the correlations between the clinical indicators and ultrasound features. Binary logistic regression analysis was performed to identify the statistically significant clinical characteristics and ultrasound features for screening for sarcopenia. A prediction model was built using the logistic equation. To assess the diagnostic performance of the model, a receiver operating characteristic (ROC) curve analysis was performed, which was expressed as the area under the curve (AUC). The Youden index was used to determine the best cut-off value, and was calculated as the maximum (sensitivity + specificity – 1). The statistical significance level was set to $P<0.05$ in all analyses.

Results

Patient characteristics

The basic clinical characteristics of the patients are

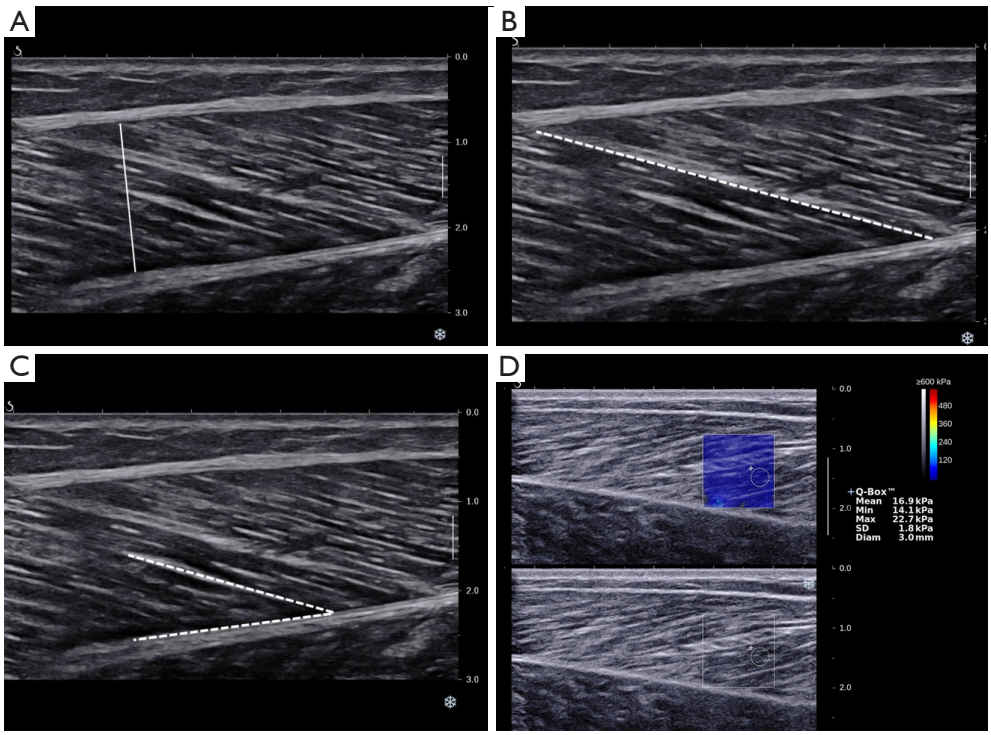

Figure 2 Ultrasound and SWE images of the GMM. (A) Two-dimensional ultrasound image of the MT of the GMM. (B) Two-dimensional ultrasound image of the Fl of the GMM. (C) Two-dimensional ultrasound image of PA of the GMM. (D) The SWE values of the GMM were measured (region of interest =3 mm, depth: 1.5 cm). GMM, gastrocnemius medialis muscle; MT, muscle thickness; Fl, fascicle length; PA, pennation angle; SWE, shear-wave elastography.

summarized in *Table 1*. In total, 58 patients (43.3%) were found to have sarcopenia. The patients in the sarcopenia group were older than those in the non-sarcopenia group (P<0.05).

Ultrasound and SWE biomarkers of patients

The ultrasound biomarkers of the patients are summarized in *Table 2*. The ultrasound-derived MT and CSA of the RFM in the relaxed and contracted states, and the MT, Fl, and SWE of the GMM in the relaxed state were lower in the patients with sarcopenia than the patients without sarcopenia (all P<0.05).

Correlations between clinical indicators and ultrasound features

The Spearman's product-moment correlation analysis showed that the two-dimensional ultrasound and SWE features were positively correlated with the ASMI, handgrip strength, and 6-meter walking speed (*Table 3*).

Validity of ultrasound and SWE biomarkers screening for sarcopenia

The patients' basic characteristics (sex, age, and weight) and ultrasound features (MT and CSA of the RFM in the relaxed and contracted states, and the MT, Fl, and SWE of the GMM in the relaxed state) were selected for inclusion in the binary regression analysis. *Table 4* shows the independent predictors for sarcopenia. A logistic regression equation was established based on the significant predictors as follows: p = 1/1 + Exp – [23.99 – 3.30 × sex + 0.18 × age – 1.60 × CSA (RFM, relaxed) – 5.18 × MT (RFM, contracted) – 1.52 × Fl – 0.87 × SWE]. The cut-off value of the prediction model was 0.443, and it had a diagnostic sensitivity of 84.5%, a specificity of 90.8%, and an AUC of 0.949. The ROC curve, AUC, sensitivity, and specificity of the prediction model are shown in *Figure 3*.

Discussion

The measurement of muscle mass is required to diagnose

Table 1 The basic clinical characteristics of the study population

Characteristics	Non-sarcopenia (n=76)	Sarcopenia (n=58)	P value
Sex			0.177
Male	41 (51.9)	38 (48.1)	
Female	35 (63.6)	20 (36.4)	
Age (years)	67.22±4.69	69.83±5.13	0.003*
Height (cm)	170.00 (164.25–172.00)	170.00 (161.50–173.00)	0.647
Weight (kg)	73.15±9.72	69.89±10.22	0.062
BMI (kg/m^2)	25.62 (23.27–27.04)	24.28 (22.19–27.40)	0.146
ASMI (kg/m^2)	7.42 (6.07–8.39)	6.11 (4.85–6.70)	<0.001*
Handgrip strength (kg)	32.75 (25.23–37.80)	20.10 (15.48–28.00)	<0.001*
6-meter walking speed (m/s)	0.94±0.23	0.79±0.15	<0.001*

Data are presented as mean ± standard deviation, median (interquartile range), and number (%). *, a statistically significant difference. BMI, body mass index; ASMI, appendicular skeletal muscle mass index.

Table 2 The ultrasound biomarkers of the study population

Characteristics	Non-sarcopenia (n=76)	Sarcopenia (n=58)	P value
MT of the RFM in the relaxed state (cm)	1.30 (1.04–1.48)	1.00 (0.85–1.20)	<0.001*
CSA of the RFM in the relaxed state (cm^2)	3.83 (3.05–4.51)	2.47 (2.09–3.00)	<0.001*
SWE of the RFM in the relaxed state (kPa)	13.05 (11.10–16.50)	12.65 (11.10–15.43)	0.762
MT of the RFM in the contracted state (cm)	1.56 (1.40–1.76)	1.22 (1.11–1.46)	<0.001*
CSA of the RFM in the contracted state (cm^2)	2.63 (2.08–3.04)	2.03 (1.72–2.45)	<0.001*
SWE of the RFM in the contracted state (kPa)	12.80 (10.23–17.48)	13.30 (11.18–15.35)	0.982
MT of the GMM (cm)	1.66 (1.40–1.81)	1.48 (1.33–1.69)	0.003*
FI of the GMM (cm)	4.19±0.54	3.94±0.58	0.012*
PA of the GMM (°)	21.54 (17.88–24.75)	20.00 (17.84–23.15)	0.209
SWE of the GMM (kPa)	18.79 (18.00–19.57)	17.58 (17.31–18.00)	<0.001*

The data are presented as the mean ± standard deviation, and median (interquartile range). *, a statistically significant difference. CSA, cross-sectional area; GMM, gastrocnemius medialis muscle; RFM, rectus femoris muscle; MT, muscle thickness; PA, pennation angle; FI, fascicle length; SWE, shear-wave elastography.

sarcopenia under both the EWGSOP and AWGS criteria. EWGSOP2 currently recommends DXA or BIA as the method for evaluating muscle mass in clinical practice. However, it should be noted that DXA measurements are affected by fluid status, and thus are less accurate in such cases (22). In addition, the currently available BIA prediction models have poor accuracy, and their measurement methods are easily influenced by factors such as body water content and electrolyte imbalances (23,24). BIA is also influenced by obesity, and BIA often overestimates muscle mass in obese patients (25). In addition, BIA cannot be used on individuals with pacemakers, as it employs a weak electrical current (26). Muscle strength and physical performance are assessed by handgrip strength, and the 6-m walking speed test or 5-time chair stand test, respectively. However, these procedures are cumbersome and difficult to implement for patients with limited mobility. SWE is an emerging ultrasound-based imaging method that has been widely used in studies of musculoskeletal disorders (27). This study aimed to find a more accurate and widely available method for the diagnosis

Table 3 Correlation matrix between the clinical indicators and ultrasound features

Characteristics	AMSI (kg/m^2)	Handgrip strength (kg)	6-m walking speed (m/s)
MT of the RFM in the relaxed state (cm)			
r	0.515	0.463	0.292
P value	<0.001*	<0.001*	0.001*
CSA of the RFM in the relaxed state (cm^2)			
r	0.596	0.466	0.262
P value	<0.001*	<0.001*	0.002*
SWE of the RFM in the relaxed state (kPa)			
r	0.107	0.082	0.109
P value	0.217	0.347	0.210
MT of the RFM in the contracted state (cm)			
r	0.530	0.353	0.332
P value	<0.001*	<0.001*	<0.001*
CSA of the RFM in the contracted state (cm^2)			
r	0.509	0.448	0.285
P value	<0.001*	<0.001*	0.001*
SWE of the RFM in the contracted state (kPa)			
r	−0.089	0.014	0.060
P value	0.306	0.869	0.494
MT of the GMM (cm)			
r	0.361	0.373	0.165
P value	<0.001*	<0.001*	0.056
FI of the GMM (cm)			
r	0.260	0.278	0.202
P value	0.002*	0.001*	0.019*
PA of the GMM (°)			
r	0.212	0.299	0.162
P value	0.014*	<0.001*	0.062
SWE of the GMM (kPa)			
r	0.550	0.467	0.317
P value	<0.001*	<0.001*	<0.001*

*, a statistically significant difference. ASMI, appendicular skeletal muscle mass index; CSA, cross-sectional area; GMM, gastrocnemius medialis muscle; RFM, rectus femoris muscle; MT, muscle thickness; PA, pennation angle; FI, fascicle length; SWE, shear-wave elastography.

of sarcopenia.

An ultrasound technique can be used to identify patients at higher risk of muscle mass loss with good discriminatory power (28). Pathophysiology changes in sarcopenic muscle include the transition of muscle fibers from type II to type I with age, leading to the loss of type II fibers and functional

Table 4 Prediction model for the diagnosis of sarcopenia

Characteristics	B	SE	OR	95% CI	P value
Sex	–3.298	0.820	0.037	0.007–0.184	<0.001*
Age (years)	0.180	0.076	1.197	1.032–1.388	0.017*
CSA of the RFM in the relaxed state (cm^2)	–1.595	0.557	0.203	0.068–0.605	0.004*
MT of the RFM in the contracted state (cm)	–5.180	1.764	0.006	0.017–0.179	0.003*
FI of the GMM (cm)	–1.521	0.735	0.218	0.052–0.922	0.038*
SWE of the GMM (kPa)	–0.866	0.434	0.420	0.180–0.984	0.046*
Constant	23.992	9.566	26,288,790,737.291	–	–

*, a statistically significant difference. CSA, cross-sectional area; GMM, gastrocnemius medialis muscle; RFM, rectus femoris muscle; MT, muscle thickness; FI, fascicle length; SWE, shear-wave elastography; OR, odds ratio; CI, confidence interval; SE, standard error; B, regression coefficient.

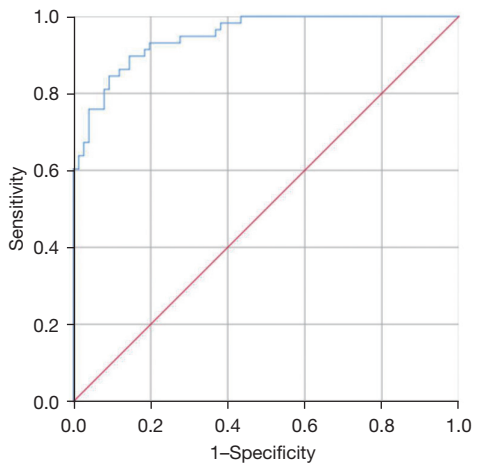

Figure 3 Receiver operating characteristic curve analysis for the prediction model (area under the curve: 0.949, P<0.001, cut-off value: 0.443, sensitivity: 84.5%, specificity: 90.8%).

motor units (29,30), which is collectively associated with the muscle contraction atrophy. Numerous studies have indicated that ultrasonographic evaluations of MT have a high correlation with DXA and CT-based measurements of muscle mass (31-33). Previous studies reported that RFM thickness and gastrocnemius thickness are associated with the skeletal muscle mass index (34-36). Ultrasound has been shown to be a promising method for screening sarcopenia in multiple clinical populations. For example, Sari *et al.* used a MT cut-off value of 1.47 cm (AUC =0.84) in the GMM to screen sarcopenia patients with systemic sclerosis (37). A previous study validated multi-modal ultrasound as a tool for diagnosing sarcopenia in hemodialysis patients by assessing muscle structure, stiffness, and perfusion (38). In addition, our results showed that ultrasonographic evaluations of the CSA of the RFM in the contracted state, the CSA of the RFM in the relaxed state, the MT of the RFM in the contracted state, and the MT of the RFM in the relaxed state were highly correlated with the ASMI, handgrip strength, and 6-m walking speed. Thus, these measured ultrasound parameters are associated with definitions of sarcopenia.

Fat infiltration of skeletal muscles, or myosteatosis, is one of the most prominent characteristics of the disease, contributing to muscle contraction atrophy (39-41). In addition, the biochemical changes of the skeletal muscle extracellular matrix that occur with aging are related to collagen fiber biosynthesis, the degradation rates of the different collagen types, and the formation of collagen cross-links (42,43). Therefore, a combination of muscle fiber atrophy, and lipid accumulation and alterations in the extracellular matrix may lead to alterations in muscle stiffness in patients with sarcopenia. SWE is an accessible and non-radiating imaging technique that can be used to directly quantify the elastic properties of tissue in real time (44). SWE can assess the stiffness of tissue by measuring the elasticity index based on the degree of distortion under the application of an external force (45).

The RFM and GMM were selected for SWE assessment in our study. Our results showed that the ultrasonographic evaluations of SWE of the GMM were highly correlated with the ASMI, handgrip strength, and 6-meter walking speed; thus, SWE of the GMM indirectly reflects muscle mass, muscle strength, and physical performance. Previous studies have found the SWE value of the RFM can be used

to diagnosis sarcopenia in patients with chronic obstructive pulmonary disease or renal transplants (18,46). However, in our study, the SWE of the RFM in the contracted state and the SWE of the RFM in the relaxed state had no statistical significance. This may be explained by the fact that most of the patients included in this study had thick subcutaneous fat, a phenomenon that was particularly pronounced in the anterior thigh. The SWE value of the RFM is affected by thicker subcutaneous fat and is less stable. Conversely, the subcutaneous fat of the lower leg is thinner and more suitable for SWE.

We selected the RFM and GMM for assessment for two primary reasons. First, it appears that geriatric muscle mass decrease does not occur in all anatomic places at the same pace, with lower limb muscles experiencing greater and earlier loss (47). Several studies have reported a positive correlation between ultrasound-derived RFM and gastrocnemius measurements and skeletal muscle mass (48,49). Second, RFM and GMM are superficial enough that they can be recognized by ultrasound easily.

Finally, our study established a predictive equation combining two-dimensional ultrasound and SWE indicators. The equation had an AUC of 0.949, a diagnostic sensitivity of 84.5%, and a specificity of 90.8%. This equation can be used for the early detection of sarcopenia with essential hypertension.

This study also had several limitations. First, we conducted this study only in a northern Chinese population, and the sample size was relatively small. Second, we used BIA as the reference method to measure muscle mass rather than gold-standard cross-sectional (CT) imaging modalities because of its low cost and lack of radiation; however, this might have led to less accurate muscle mass measurements. Therefore, future studies on this topic should include more samples.

Conclusions

In conclusion, ultrasound and SWE are promising potential tools for predicting sarcopenia in patients with essential hypertension.

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Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at https://qims.amegroups.com/article/view/10.21037/qims-24-1718/rc

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://qims.amegroups.com/article/view/10.21037/qims-24-1718/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the Research Ethics Committee of the First Hospital of China Medical University (No. 2023-415-2), and informed consent was obtained from all patients.

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