Multi-Regional CT for Sarcopenia Assessment Using Deep Learning

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Purpose

Sarcopenia, characterized by the progressive decline in skeletal muscle mass and function, is a major health concern, particularly among older populations. While single-level computed tomography (CT) imaging at the third lumbar vertebra (L3) has been widely used for sarcopenia assessment, its limitations in capturing heterogeneous muscle loss patterns have been reported. This study aims to evaluate the diagnostic accuracy of multi-regional CT imaging combined with deep learning-based segmentation in assessing sarcopenia.

Material and Methods

- *Study design and setting* : retrospective study, August 2023 ~ July 2024, 83 patients, in single tertiary institute
- *Sarcopenia diagnosis & evaluation* : based on the Asian Working Group for Sarcopenia (AWGS) criteria
  1) 5-time chair stand test
  2) Handgrip strength
  3) Calf circumference
  4) SARC-F
  5) Skeletal muscle index(SMI)
- *CT protocol* : multi-regional(T4, L3, ASIS, Femoral head, Mid-thigh, Proximal calf), without contrast enhancement
- *Outcome measures* :
  Quantification of skeletal muscle volume using AI-driven deep learning algorithm
  Comparison of predictive power of different muscle volumes
  Assessment of their associations with clinical parameters

Results
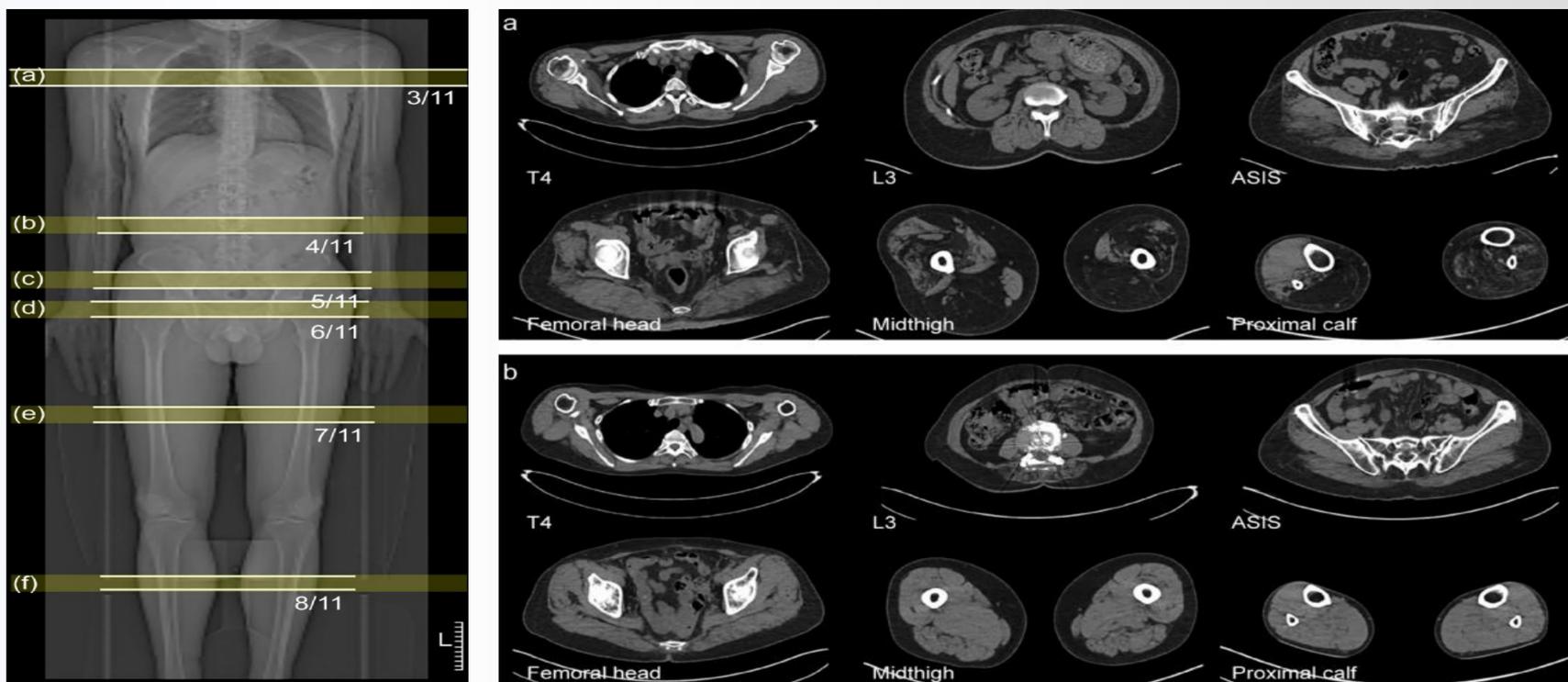
Figure 1. Multi-regions on CT image

Table 1. Demographic Characteristics

	Total (N=83)	Non-sarcopenia (N=57)	Sarcopenia (N=26)
Sex			
Female	70 (84.3%)	49 (86.0%)	21 (80.8%)
Male	13 (15.7%)	8 (14.0%)	5 (19.2%)
Age (yr)	68.53±13.46	65.56±14.48	75.04±7.77
BMI (kg/m²)	23.02±3.44	23.86±3.27	21.17±3.12
5-time chair stand (sec)	13.38±8.07	11.40±4.96	18.09±11.65
Handgrip strength (kg)	18.63±7.86	20.50±8.36	14.55±4.57
Calf circumference (cm)	33.87±3.89	34.92±3.70	31.43±3.22
SARC-F score	4.73±2.81	4.25±2.91	5.87±2.20
SMI (kg/m²)	6.05±0.94	6.38±0.83	5.33±0.74

N = number of participants; BMI = body mass index; SARC-F = screening tool for sarcopenia, assessing Strength, Assistance in walking, Rising from a chair, Climbing stairs, and Falls; SMI = skeletal muscle index

Table 2. Comparisons of Muscle Volume

	Total	Non-sarcopenia	Sarcopenia	*p*-value
Muscle_Total (cm³)	76.89±15.82	79.19±16.57	71.83±12.93	**0.032**
Muscle_T4	25.94±7.05	25.74±7.43	26.37±6.27	0.695
Muscle_L3	15.25±4.38	15.51±4.82	14.68±3.21	0.358
Muscle_ASIS	22.77±4.58	22.68±4.47	22.96±4.89	0.805
Muscle_Femoral head	23.78±4.32	24.13±4.34	23.02±4.26	0.282
Muscle_Mid-thigh	24.39±5.95	25.50±6.02	21.96±5.10	**0.008**
Muscle_Proximal calf	13.46±3.84	14.06±3.92	12.17±3.40	**0.029**

*Artificial Intelligence(AI)-driven software solution for body composition analysis (DeepCatch version 1.1.3.4586; MEDICALIP Co., Ltd.) is used on each CT image.

Muscle_Total = total muscle volume; ASIS = anterior superior iliac spine

Conclusion

Multi-regional CT imaging can improve the diagnostic accuracy in sarcopenia assessment compared to single-level CT imaging.
Muscle volume at the level of mid-thigh and proximal calf may serve as better markers for the evaluation of sarcopenia.
Deep learning-based segmentation on CT scan can lead efficient quantification of muscle volume.