Blood 142 (2023) 3652–3654

The 65th ASH Annual Meeting Abstracts

POSTER ABSTRACTS

803.EMERGING TOOLS, TECHNIQUES AND ARTIFICIAL INTELLIGENCE IN HEMATOLOGY

Development of a Novel Artificial Intelligence Tool to Measure Psoas Volumes in Patients with Diffuse Large B Cell Lymphoma

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Introduction

Sarcopenia is associated with poor outcomes in cancer patients. However, it is poorly defined, and its clinical assessment can be tedious. Studies have shown psoas muscle volume (PV), measured on computed tomography (CT) scans, correlate with validated measures of frailty and clinical outcomes (Yamada Y., et al. 2023), with better predictive value than another frequently used radiological surrogate - the psoas muscle area measured on a single axial cut at the L3 vertebral level. The labor-intensive nature of PV measurement, lack of validated reference ranges, and inter-observer variability has limited its adoption as a marker of sarcopenia. We hence aim to investigate if an artificial intelligence (AI) model can be developed and trained to automate the measurement of PV in patients with diffuse large B cell lymphoma (DLBCL).

Methods

This was a retrospective cohort study. Consecutive patients with DLBCL treated at our center from 2010 to 2018 were included. For inclusion, patients had to have at least one contrast-enhanced CT scan performed after diagnosis. Patients who only had positron electron tomography (PET) scans were excluded. The CT scan temporally closest to diagnosis was selected for segmentation.

Manual full PV segmentation (Figure 1) was performed on axial CT images using a cloud-based annotation tool (https://darwin.v7labs.com/) by two radiologists, encompassing the entire muscle from origin to insertion. The segmentation data from the first 10 patients (650 images) were then used to train an AI model (Ultralytics YOLOv8) to automatically segment the psoas muscles (Figure 1). Segmented psoas muscles on CT imaging were converted to volume measurements using a code. This was calculated for every patient using the metadata of pixel area and slice thickness contained within each unique CT image. Muscle volumes for the entire patient cohort were generated using this machine learning model and correlated with patient age, height, weight, body mass index (BMI), lean body weight (LBW) (Janmahasatian S., et al. 2005) and body surface area (BSA) determined by the Mosteller formula. Correlation was determined using Pearson's correlation coefficient.

Results

Data from 123 patients were available for analysis. The median age was 62 years (IQR 53.0 - 70.0), with 89 (72.4%) males. 83 (67.5%) patients were Chinese and 27 (22.0%) were Malay. 111 (90.2%) patients had an Eastern Cooperative Oncology Group (ECOG) performance status of $\leq$1, and 9 (7.3%) patients had a body mass index (BMI) <18kg/m ^{2}. The median weight was 62.6kg (IQR 54.1 - 72.8), median BMI 23.5kg/m ^{2} (IQR 20.8 - 26.1), median LBW 48.5kg (IQR 40.2 - 54.3) and median BSA 1.69m ^{2} (IQR 1.53 - 1.83). 7 (7.4%), 18 (19.1%), 8 (8.5%) and 61 (64.9%) patients were stages 1, 2, 3 and 4 at diagnosis, respectively. 56 (45.6%) of patients had an International Prognostic Index (IPI) of $\geq$3.

Psoas volumes for our population were successfully generated using our deep learning model. The model was able to accurately identify the psoas muscle and distinguish it from other intra-abdominal and intra-pelvic tissue, across a range of body and psoas muscle sizes. It was also able to distinguish the psoas from the iliacus within the pelvis. The median PV was 158.27ml

(IQR 105.10 -190.71). There were positive correlations between PV and all physical measures analyzed including height ($r = 0.60$, $p < 0.001$), weight ($r = 0.47$, $p < 0.001$), BMI ($r = 0.28$, p 0.002), LBW ($r = 0.66$, $p < 0.001$), and BSA ($r = 0.55$, $p = <0.001$), and a negative correlation between PV and age ($r = -0.22$, $p = 0.015$).

Conclusion

We have developed a novel AI tool that can identify and distinguish the psoas muscle from other tissue on CT scans. The volumes measured by our AI correlate, as expected, positively with all physical indices analyzed, and negatively with age. Further work is required to determine the accuracy and quantify the efficiency of the AI model compared with trained radiologists, as well as to assess if AI-measured PV changes temporally or predicts clinical outcome.

Disclosures De Mel: *Pfizer:* Other: advisory board.

https://doi.org/10.1182/blood-2023-178239

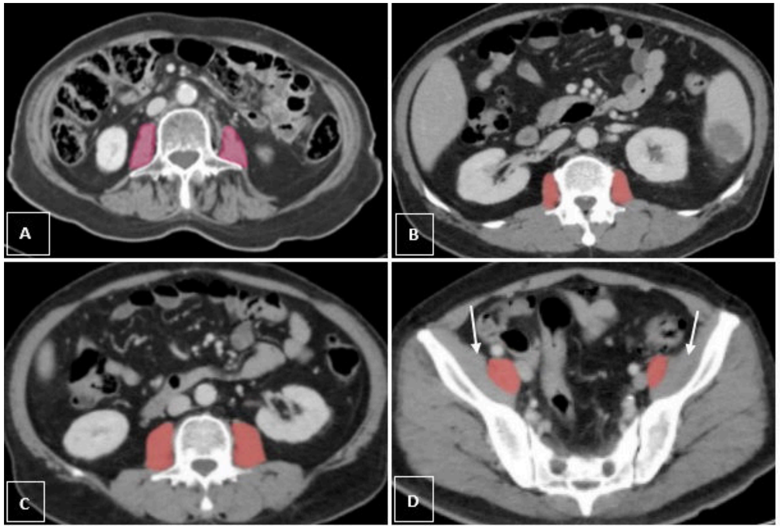

Figure 1: Manual segmentation of the psoas muscle compared with deep learning segmentation by our artificial intelligence (AI) model

This figure demonstrates psoas muscle segmentation done on various axial cuts of contrast-enhanced computed tomography (CT) scans. A shows the psoas muscles at the L3 vertebral level that have been manually segmented by a radiologist. B-D show automated psoas muscle segmentation performed by our AI model on a contrast-enhanced CT scan of a single patient at various axial cuts (B at the L2 vertebra, C at the L3 vertebra, and D within the pelvis). Note the ability of the model to distinguish the psoas from the iliacus (white arrows) within the pelvis (D).

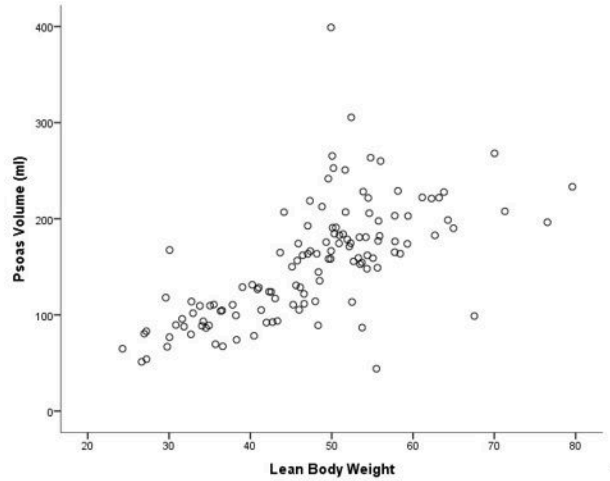

Figure 2: Scatterplot demonstrating positive correlation between psoas volume and lean body weight (r = 0.66, p < 0.001)

Figure 1