Establishing Normative Cervical Paraspinal Muscle Indices in a Young Adult Population

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INTRODUCTION: Sarcopenia is associated with poorer outcomes after spine surgery; however, current gold-standard assessments, such as DEXA and hand dynamometer, are not always feasible in regular clinical practice. While lumbar imaging-based methods, such as the psoas:L4 vertebral index (PLVI), have been proposed as a surrogate for approximating muscle mass, cervical paraspinal musculature remains underutilized as an alternative assessment tool. Normative reference data for cervical muscle measurements are limited despite their potential for use when lumbar imaging is unavailable. This preliminary study aimed to establish normative cervical paraspinal muscle: vertebral indices (CPVI) in a healthy young adult population to support further studies on z-score-based sarcopenia assessment.

METHODS: We retrospectively reviewed 50 full-spine MRIs of patients aged 18 to 35 (mean age 26.5 years, 36.0% female) with no history of spinal surgery, fractures, malignancies, or infections. We additionally reviewed 110 MRIs of patients >35 years (mean age 61.4 years, 41.8% female). Cross-sectional area of the paraspinal muscles was measured bilaterally at cervical levels C5, C6, and C7, and psoas cross-sectional areas (CSA) at L4. All measurements were performed on PACS using the freehand region annotation tool and were normalized to the corresponding vertebral body CSA. Mean, standard deviation, and t-scores were calculated for each level to generate a normative dataset. This retrospective study was approved by our Institutional Review Board, with a waiver of informed consent.

RESULTS SECTION: Mean CPVI were as follows: C5 = 13.29 ± 3.40 cm^2, C6 = 12.61 ± 3.24 cm^2, C7 = 12.04 ± 3.37 cm^2. PLVI in this population was 2.67 ± 0.88 cm^2. T-scores followed a normal distribution. Strong interrater reliability was observed, particularly at C5 (ICC = 0.83). Among patients under 35 years old, we found strong correlations between PLVI and CPVI at every level (r = 0.53-0.64, $p < 0.001$). In patients over 35 years old, we found moderate correlations (r = 0.38-0.39, $p < 0.001$).

DISCUSSION: This study establishes normative CPVI in a healthy young cohort. Though retrospective design and limited sample size may restrict generalizability, the data may serve as a reference for future t-score-based studies and may be particularly useful for a t-score-based screening for sarcopenia. C5 demonstrated the highest reliability in measurement, which we will consider going forward in determining its potential for estimating global body sarcopenia.

SIGNIFICANCE/CLINICAL RELEVANCE: Establishing normative cervical paraspinal muscle indices provides a practical image-based alternative for assessing sarcopenia in our increasingly aging population. This improves accessibility for sarcopenia screening and preoperative risk stratification.

IMAGES AND TABLES:

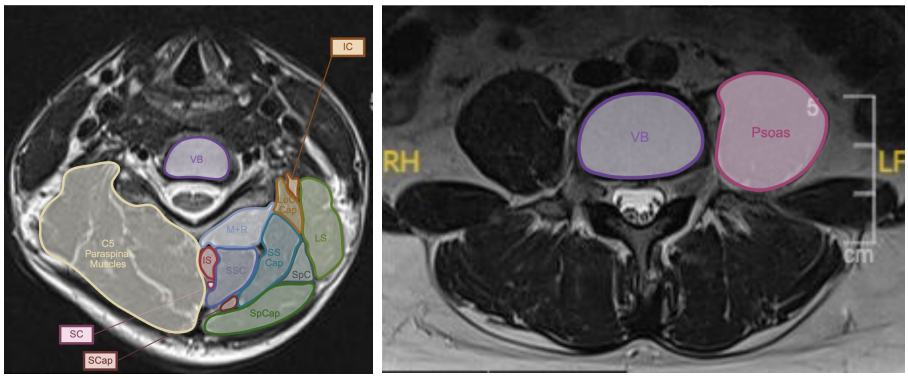

Figure 1 (Left). At the C5 level, CSA was measured for vertebral body (VB) and bilateral paraspinal muscles, which included multifidus and rotatores (M+R), longissimus cervicis and longissimus capitis (LoC/Cap), iliocostalis cervicis (IC), interspinales cervicis (IS), spinalis cervicis (SC), semispinalis cervicis (SSC), semispinalis capitis (SSCap), levator scapulae (LS), spinalis capitis (SCap), splenius cervicis (SpC), splenius capitis (SpCap). CPVI was calculated as the sum of left and right paraspinal muscle CSA divided by VB CSA. Figure 2 (Right). At the L4 level, CSA was measured for VB and bilateral psoas muscles. PLVI was calculated by the sum of left and right psoas CSA divided by VB CSA.

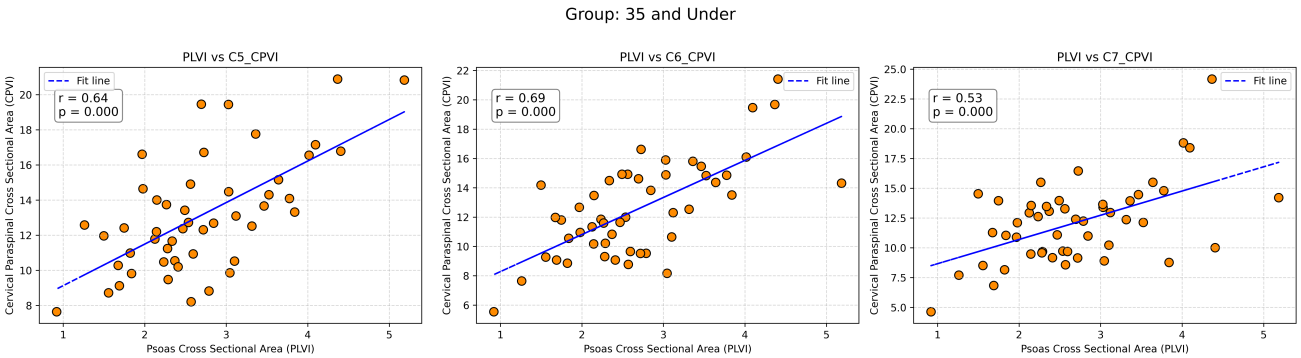

Figure 3. CPVI correlated well with PLVI at C5, C6, and C7 levels.