EDITORIAL

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Psoas as a sentinel muscle for sarcopenia: a flawed premise

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Loss of mass and functional capacity of skeletal muscle is a major cause of morbidity in older individuals as well as in patients affected by a host of acute and chronic conditions including infectious disease, endocrine and metabolic disorders, organ dysfunction, immunological disease, vascular diseases, haematological disorders, and malignancies. Quantitative approaches are required to diagnose and study this muscle loss, and these are represented in the literature predominantly by dual energy X-ray (DXA), computed tomography (CT), and magnetic resonance imaging.[1] Total appendicular skeletal muscle by DXA has been considered the standard quantitative measure[1] and appears in nearly 500 publications. The application of CT has recently been popularized in patients who had an indication for CT scan as part of their standard medical care.

The methods cited above are subject to the limitation that they are not typically amenable to the quantification of whole body muscle mass, for different reasons. DXA is limited to muscle in the limbs, and clinical CT scans are rarely of the whole body. Within these restrictions, effort is taken to measure as much, if not all of the muscle, to fully represent this organ system. Literature on sarcopenia does not focus on specific individual muscles, rather the systemic loss of muscle, and its impact on overall function[2,3] is highlighted. While the CT approach is not yet set to internationally accepted standards, the majority of researchers adopted quantification of total lumbar muscle cross-sectional area (CSA) because this region is the object of diagnostic imaging in multiple illnesses and this area of the body includes a diverse representation of muscles (*psoas*, *erector spinae*, *quadratus lumborum*, *transverse abdominis*, external and internal obliques, and *rectus abdominus*). Lumbar muscle area is also reasonably well correlated with whole body muscle mass.[4,5]

A single-muscle approach to the diagnosis of clinically important depletion of skeletal muscle is a recent trend in the literature on CT-defined muscle quantification. The single muscle is most often the *psoas major* and occasionally *adductor pollicis*, *pectoralis*, or *masseter*. Single muscle studies represent a minority (~6%) of quantitative studies of muscle mass, and the vast majority of scholarly works on sarcopenia does not contain any suggestion that a single muscle would serve as a sentinel. The premise that *psoas* should be selected over all other individual muscles, muscle groups, and total muscle mass has not been discussed in the literature nor has any validation been conducted. The choice of *psoas* is merely stated to be 'simple and convenient'[6] to measure.

The article by Rutten *et al*. in this edition of JCSM[7] provides a quantitative comparison of total lumbar muscle area with the *psoas* area. Data are from patients with ovarian cancer, but the findings may have broader implication. The weaknesses that these authors observe for the *psoas*-only approach include its very low proportion of total trunk muscles (<10%), high measurement error, and weak correlation of *psoas* area with total lumbar muscle area. *Psoas* area change over time showed a large variance and was unrelated to the clinical outcome of overall survival. A method of imputation of *psoas* area from measures of its length and width was particularly disastrous in terms of its poor correlation with *psoas* area and the high inconsistency of measures between observers. This muscle is not symmetrical in shape, and such methods would seem unlikely to be reliable. By a variety of quantitative indices, *psoas* failed all tests of technical and clinical merits for the assessment of systemic muscle wasting in this patient population.

A rabble of disparate measurements and reporting is found in the publications concerning *psoas* muscle sarcopenia. *Psoas* is represented variously by its unidimensional thickness, its CSA in unadjusted cm^2, CSA normalized to patient height^2, CSA normalized to body surface area, or CSA normalized to the area of the adjacent vertebral body; occasionally, the volume of the entire muscle has been reported. *Psoas* area is often measured at a standard lumbar vertebral landmark (L3 or L4), but sometimes, unreliable soft tissue landmarks such as the

umbilicus have been used. The literature contains no justification (or reconciliation) of these disparate approaches. The resulting data cannot be aggregated, nor can it be compared with the larger literature in which the accepted basis for normalization of muscle mass is by the individual subject's height[2]. Quantitative data on *psoas* have been related to a variety of clinical outcomes, with the overall concept that some threshold for low *psoas* amount would predict morbidity or mortality; however, because such threshold values are reported in disparate units of measure, no general conclusions can be reached.

Muscles have specific functions. *Psoas* is the main flexor of the hip and also provides postural support of the lumbar spine, sacroiliac, and hip joints. The fibre type is mixed (40% type I, 50% type IIa, and 10% type IIx) with the 60:40 predominance of fast fibres providing for *psoas* dynamic and postural functions.[8,9] However, as Rutter *et al*.[7] point out, a large theme in literature concerning the *psoas* relates to spinal pathology. Localized *psoas* atrophy occurs with spinal injury, spinal deformity, spinal degeneration, specific diseases of the spine, and low back pain of known and unknown aetiologies. These conditions are extremely common in older adults that researchers are typically studying using CT. e.g. Low back pain is the fifth most common reason for all physician visits in the USA.[10] The worldwide lifetime prevalence of low back pain is 84%.[11] Osteoarthritis of the hip, another prevalent condition in older adults, associates with atrophy and fatty degeneration of the *psoas.*[12] These demographics suggest a high likelihood of localized *psoas* atrophy, independent of the behaviour of other muscles and muscle groups, and undermine the idea of its utility as a sentinel muscle.

In the end, it is not surprising that the notion of a single sentinel muscle for the diagnosis of sarcopenia is not proposed by any expert group,[1,2] as it would be difficult to claim that any one muscle is representative. While it is hoped that the quantification of human skeletal muscle mass might be made more accessible and rapid, this aim may be more realistically be achieved by automation of the total muscle segmentation in CT images.[13]

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Conflict of interest

None declared.

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