Editorial Commentary

Sarcopenic obesity: recent consensus and clinical implications in patients with chronic liver disease

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Sarcopenia and obesity are two major public health concerns, particularly in the elderly population. These conditions have a significant impact on both the individual's health and quality of life. Sarcopenia is defined as a loss of muscle mass, strength, and function physiologically present with aging, while obesity is an excessive accumulation of body fat. While these conditions are often considered separately, there is growing recognition that they frequently coexist, may synergistically enhance one another, leading to an increased risk of various chronic diseases and mortality. Sarcopenic obesity (SO) is the term utilized to define the simultaneous occurrence of sarcopenia and obesity (1). Since recently, the lack of common diagnostic criteria for SO has made it difficult to diagnose and manage this condition effectively.

In February 2022, the European Society for Clinical Nutrition and Metabolism (ESPEN) and the European Association for the Study of Obesity (EASO) published a consensus statement on the definition and diagnostic criteria for sarcopenic obesity (2).

The consensus was aimed at overcoming various definitions and diagnostic approaches that have been utilized in clinical practice and in research studies (3). These definitions were primarily based on measures of muscle mass and evaluation of obesity through body mass index (BMI). Indeed, in spite of the comprehensive definition of sarcopenia, the majority of previous studies were mainly focused on a reduction of muscle mass, frequently disregarding muscle performance. Muscle function is an important component of sarcopenia, and loss of muscle strength can have a significant impact on physical function and mobility (4). As far as BMI, this is a simple and widely used measure of body composition, but it is not always an accurate indicator of the amount of body fat. In fact, individuals with high levels of muscle mass may have a high BMI, even if their body fat percentage is low. On the other hand, obesity may cause a relative reduction of muscle which is, however, normal in absolute amount. Obesity-related complications are also dependent on distribution of fat i.e., subcutaneous or visceral fat, that may exert a different effect on cardiovascular risk (5). All these different approaches and limitations could prevent to obtain a reliable diagnosis and to fully capture the complexity of SO or its impact on overall health.

The experts in the Consensus attempted for the first time to standardize the diagnosis of SO across different healthcare settings. For this purpose, they acknowledge the need to deploy a practical approach which requires less time, is cost efficient, and easily available with the best accuracy, sensitivity, and specificity.

The assessment of SO is divided in a three-step procedure starting with screening criteria, moving to a

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more specific diagnostic approach and concluding with a global staging (2).

The screening criteria for SO includes an elevated BMI or waist circumference with ethnicity specific cut-off points and the coexistence of indicators of sarcopenia (e.g., chronic diseases, recent acute diseases, recent rapid weight loss, risk factors, etc.) or a SARC-F positive questionnaire. These criteria are utilized to provide a clear and concise first approach to sarcopenic obesity, which will facilitate further diagnosis and management.

The diagnosis to confirm SO is proposed as a two-step assessment. Firstly, an assessment of skeletal muscle functional parameters should be performed by hand-grip strength, knee extensor strength, or chair stand test. If these tests suggest a low functional parameter, further assessment of body composition should be done using dual-energy-X-ray absorptiometry (DXA) or bio-electrical impedance analysis (BIA), and when possible, a computed tomography (CT) assessment. Additionally, the statement emphasizes the importance of assessing physical function in individuals with SO, using measures such as gait speed and a physical performance battery test. The consensus statement also provides guidance on the interpretation of these measures and recommends the use of validated assessment tools.

Once the diagnosis of SO is confirmed, the authors suggest that subjects are to be divided into two groups based on the severity of SO: those with clinical complications (for example- presence of metabolic diseases, cardiovascular disorders, etc.) associated with this condition and those without clinical complications.

However, the proposal and the complete criteria of SO diagnosis needs to be confirmed by further studies. We don't know if these criteria will be suitable for every disease or if there should be disease-specific cut-offs. Nonetheless, this should promote studies to have a proper definition and to link the condition to the clinical outcomes.

Sarcopenia has been reported to be associated with advanced liver disease (6,7). The obesity epidemic and the increasing number of patients with metabolic disorders associated with liver disease are likely to increase the number of those with SO. The reported prevalence of SO is 2–42% in patients with liver cirrhosis (*Table 1*). It is associated with higher mortality and adversely impacts metabolic profile and physical function than either condition alone (16). Studies showed that cirrhotic patients with SO had worse prognosis and lower median survival time (12,15). Pre-liver transplant (LT) SO has been linked to higher mortality at short- and long-term follow-up post LT (17).

Early diagnosis of SO in patients with liver disease may allow timely implementation of appropriate management strategies (i.e., proper nutrition and physical activity) to tackle this condition. Further, identifying at-risk patients at an early stage might aid into the prevention of SO and associated co-morbidities and improving the clinical outcomes. However, studies are required to assess if the new consensus definition and diagnostic criteria can be suitable also for patients with advanced chronic liver disease.

While the presence of chronic liver disease (particularly NASH and liver cirrhosis) is included among the suspicion factors for the screening of sarcopenic obesity (2), there are some limitations that should be acknowledged.

Firstly, the screening criteria for SO proposed in the consensus statement are based on BMI, which has limitations as a measure of obesity in patients with fluid retention and ascites. This limitation highlights the need for the development of a more accurate and reliable measure of obesity that takes into account body composition. Secondly, among the diagnostic criteria for sarcopenic obesity, DXA and BIA are supported as methods for the assessment of body composition. However, as also discussed by the authors, fat mass % when normalized for body weight, may be underestimated when total body water is increased. Furthermore, the equations utilized by DXA and BIA to evaluate skeletal muscle mass are based on the assumption of constant hydration which is unlikely in patients with chronic liver diseases. Finally, the primary assessment of muscle function still needs to be explored as an accurate method for the assessment of sarcopenia in patients with advanced liver disease. Possible confounding factors in these patients are direct muscle alcohol toxicity in post-alcoholic cirrhosis, hyperammonemia and hepatic encephalopathy, and the frailty syndrome evidenced by a progressive decline in muscle function and rapid exhaustion. The consensus group analyzed and discussed many other critical issues that could serve as a foundation for planning future research.

In conclusion, the ESPEN and EASO consensus statement on the definition and diagnostic criteria for sarcopenic obesity is a significant contribution to the field of sarcopenia and obesity research. The consensus statement proposes for the first time a standardized screening and diagnostic criteria, and recommended assessment tools for SO. The implementation of the diagnostic criteria proposed in the consensus statement has the potential to identify sarcopenic obesity early, enabling healthcare professionals to implement timely appropriate management strategies.

Table 1 Sarcopenic obesity in liver disease

Study	Sample size, N (% males)	Adiposity		Muscularity		Prevalence of SO
		Diagnostic method	Cut-off	Diagnostic method	Cut-off	
Kamo *et al.* [2019] (8)	n=277 (48.4%)	VFA or BMI	VFA ≥100 cm^2 BMI ≥25 kg/m^2	SMI	SMI = SMA/ht (cm^2/m^2) <40.31: M <30.88: F	SMI and VFA =3% SMI and BMI =2%
Kroh *et al.* [2019] (9)	n=70	Body fat percentage	Top 2 quintiles	SMI	SMI = SMA/ht (cm^2/m^2) <43 if BMI <25; <53 if BMI >25: M <41: F	23%
Kobayashi *et al.* [2017] (10)	n=465 (78.9%)	VAT area (at level of umbilicus)	VAT ≥100 cm^2 in M and F	SMM (L3)	SMI = SMA/ht (cm^2/m^2) <40.21: M <30.88: F	6.7%
Hammad *et al.* [2017] (11)	n=200 (47.5%)	BMI	≥25 kg/m^2	PMA	PMI= PMA/ht (cm^2/m^2) <6.39: M <3.92: F	5%
Montano-Loza *et al.* [2016] (12)	n=457 (67%)	BMI	≥25 kg/m^2	SMM (L3)	SMI = SMA/ht (cm^2/m^2) <53: M <43: F	20%
Carias *et al.* [2016] (13)	n=207 (68%)	BMI	≥30 kg/m^2	SMM (L3-L4)	SMI = SMA/ht (cm^2/m^2) <52.4: M <38.5: F	41.7%
Kaibori *et al.* [2015] (14)	n=141 (75.9%)	IMAC	IMAC −0.44; IMAC −0.31 (HU density)	SMM (L3-L4)	SMI = SMA/ht (cm^2/m^2) <44: M <38: F	Not reported
Hara *et al.* [2016] (15)	n=161 (58.4%)	VFA	VFA >100 cm^2 in M and F	ULM	ULMI = ULM/ht (kg/m^2) <1.7: M <1.2: F	9.3%

VFA, visceral fat area; BMI, body mass index; VAT, visceral adipose tissue; IMAC, intramuscular adipose tissue content; SMI, skeletal muscle index; SMM, skeletal muscle mass; PMA, psoas muscle area; ULM, upper limb skeletal muscle mass; SMA, skeletal muscle area; PMI, psoas muscle index; ULMI, upper limb skeletal muscle mass index; SO, sarcopenic obesity.

While there are limitations to the universal adoption of the proposed diagnostic procedure for the assessment of SO, this consensus may stimulate further investigations in specific categories of patients, such as those with advanced liver diseases. How to take care of confounding factors such as fluid retention, neuromuscular alterations, and frailty in these patients may implement further research to find specific cut-offs to improve the diagnosis of SO in liver diseases and ultimately improve the management and outcomes of those affected by this condition.

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