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Review Article

Assessment Techniques of Sarcopenia in Chronic Liver Disease

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Abstract

Sarcopenia is a state outlined by loss of muscle strength, muscle quantity, or function. Sarcopenia is usually seen in the elderly population, persons following a sedentary lifestyle, and individuals with inappropriate nutritional intake or absorption; hence sarcopenia was interchangeably used with frailty syndrome. It is quite often seen in chronic ailments, such as chronic liver disease, accompanying with a greater possibility of unpleasant clinical outcomes. Nutritional assessment plays a pivotal role in treatment planning, more so in patients suffering from chronic ailments. The traditional methods of nutritional assessment and sarcopenia have been widely subjective, while the objective measurement techniques, especially using computed tomography (CT scan) has been in vogue lately. Imaging of lean body mass (LBM), skeletal muscle index, anthropometric measurements such as "mid upper arm circumference (MUAC), and muscle strength" measurements together mark the gold standard for assessing sarcopenia.

Keywords: Chronic liver disease; Frailty syndrome; Nutritional assessment; Sarcopenia; Skeletal muscle mass

Introduction

Nutrition plays a significant role in health maintenance in all disease conditions. Liver has a key pivotal function in all metabolic processes in preserving and regulating the levels of lipid, glucose as well as energy metabolism. Nutritional assessment plays a pivotal role in treatment planning, more so in patients suffering from chronic ailments. As per the initial reports, the term sarcopenia signifies an age-associated depletion in muscle mass [1] probably due to the occurrence in older individuals with reduced physical activity; hence sarcopenia was interchangeably used with frailty syndrome. Recent consensus has revised the definition, very specifically to address causes other than aging such as the chronic inflammatory disease process [2, 3]. I.H Rosenberg created the term sarcopenia obtained from "Greek word, sarx means flesh and penia means loss" and is applied in clinical setting for muscle mass loss.

Sarcopenia represents a significant reduction of skeletal muscle volume and muscle function. Sarcopenia is linked with unfavorable outcomes in chronic liver disease (CLD) patients like increased risk of falls, functional impairment, increased hospital stays and readmission rates, thereby escalating morbidity and mortality [4-7]. In patients with End stage liver disease (ESLD), the imbalance between protein turnover and breakdown is red-flagged, from the beginning of treatment. In patients wait listed for liver transplantation (LT), measurement of sarcopenia serves as a tool to prevent complications in the pre-transplant period and sarcopenia predict the outcomes following LT [8-14]. Malnourishment and sarcopenia among cirrhotics are correlated with greater complications [15].

Sarcopenia is defined when the patient has less muscle mass and decreased HGS. Patients presented with less HGS only were grouped in s- pre-sarcopenic category and with loss of muscle volume were put into v- pre-sarcopenic category [16]. Measurement of HGS and psoas muscle index (PMI) based on CT scan results were pondered as an easy and appropriate way for determining sarcopenia and pre-sarcopenia among CLD patients.

Sarcopenia Assessment Techniques

The most usual imaging techniques to assess lean muscle mass include "magnetic resonance imaging (MRI), computed tomography abdomen (CT), bioimpedance analysis (BIA), and dual-energy X-ray absorptiometry (DEXA)" [17-20]. These techniques along with physical performance test to determine muscle strength are mentioned in Table-1.

S. No.	*Techniques*	*Cut off/ Remarks*	*References*
1.	Imaging techniques		
	○ CT Scan	Cut off values usually vary.	[21, 22]
	○ MRI Scan	Cut off values usually vary.	
	○ BIA	Measures total body mass and the cut off values also vary widely. "(Men: <10.75 kg/m^2, Women:- < 6.75 kg/m^2)"	[2]
	○ DEXA	The cut off values are "Men: < 7.26 kg/m^2/ Women:- < 5.5 kg/m^2"	[2]
2.	Muscle strength assessment		
	○ Hand grip strength (HGS)	- Measure with digital hand dynamometer - Mean HGS value less than 28 kg and 27 kg respectively were considered to be having low muscle strength.	[23, 24]
3.	Frailty Index		
	○ Chair stand test	It is used for assessing muscle strength and endurance in legs.	
	○ Gait speed/ Walking speed	- Six-minute walk test distance, a test of walking endurance. - Reflect skeletal muscle function. Cut off is 0.8m/s.	[23, 24]
	○ Unipedal stance time	It is a test of static balance.	
4.	Anthropometry measurements		
	○ MUAC	The MUAC was measured on the non-dominant in centimetres, halfway between the tip of the acromion and olecranon process, using a standard measuring tape. The cut off was <22.5cm	[23]
	○ TST	A skinfold caliper is used to measure the TST at the left arm to the nearest millimetre. It varies according to gender and as age advances.	[23]

Table 1: Assessment techniques for Sarcopenia.

CT Scan

In order to best assess muscle mass in CLD patients is by CT abdomen and its findings are treated as a predictor of patient's clinical outcome [21]. Computed tomography (CT) can distinguish muscle from other body compositions, and this modality is relatively cheap, quick, readily available and highly accurate. Furthermore, the cross-sectional imaging of skeletal muscle on CT is not hindered by overweight or fluid retention, usually occurs in advanced cirrhosis, thus may confer this to a potential tool for diagnosing sarcopenia [18]. Recently, "skeletal muscle index (SMI)" has been pondered to be of more accuracy in defining sarcopenia and is endorsed as the way of assessment.

Bioelectrical impedance (BIA)

Bioelectrical impedance analysis (BIA) is used as an easy method for the estimating the body mass. It is a useful bedside technique to assess malnutrition in cirrhotic patients with and without ascites. "BIA is an exact technique for defining sarcopenia in adult patients suffering from cancer prior to treatment modalities and is a best substitute to CT, DEXA, MRI in oncology clinical practice"[25].

MRI

Magnetic resonance imaging (MRI) is another accurate method that can easily make a distinction of body structures and help for exact estimation of body composition [26, 27]. Cut off values usually vary between ethnicity.

DEXA

Dual-energy x-ray absorptiometry (DEXA) scans are usually linked with bone density analysis but also provide exact assessments of lean body mass [28]. But, DEXA does not measure skeletal muscle mass.

Bioelectrical impedance analysis is an exclusively appealing way for assessing sarcopenia patients in clinical routine because it is an affordable, non-invasive test that can be completed within a few minutes. It does not require highly skilled personnel, and get results within short time [25].

Hand grip strength (HGS) assessment

Handgrip strength (HGS) assessment with the aid of a dynamometer may be used as a quick reliable, and smooth technique to identify undernutrition among CLD patients and is mentioned in kilograms (Kg). Few studies reported measuring of HGS on both hands to measure the muscle strength [29]. An average of 3 measurements can be taken for assessment. The EWGSOP definition is based on specific parameters [2, 22]. The presence of low muscle mass and function along with gait speed and grip strength using handheld dynamometry were used to define Sarcopenia. According to AWGS 2019 and EWGSOP2 2019 consensus for HGS [21, 22] depicted that mean HGS value less than 28 kg and 27 kg respectively were considered to be having low muscle strength in males.

Chair stand and balance testing

Timed chair stands -The number of seconds the patient takes to complete five chair stands with the patient's arms folded and kept across the chest will be measured for timed chair stands [30].

Balance testing - The duration of seconds in which the patient can balance in 3 positions (feet placed side-to-side, semi tandem, and tandem) for a maximum duration of 10 seconds in each position will be calculated for assessing balance testing [30].

Based on the 3 performance-based assessment of physical function such as HGS, chair stands and balance testing, the liver frailty index (LFI) can be calculated. Frailty score need to be assessed and high frailty in cirrhotics are linked with poor prognosis [31].

Anthropometry measurements

The MUAC can be measured on the non-dominant in centimetres, halfway between the tip of the acromion and olecranon process, using a standard measuring tape. A skinfold caliper can be used to measure the TST at the left arm to the nearest millimetre. An average of three measurements can be taken for the MUAC and TST. Mid arm muscle circumference (MAMC) can be calculated with the formula {MAMC = MUAC - (3.145x TST)}.

Diagnostic criteria for sarcopenia peculiar to CLD patients are still not demarcated. Moreover, factors like ascites and body mass index (BMI) should be taken into account while doing sarcopenic assessment among cirrhotics [32, 33]. Significant muscle loss among patients with cirrhosis affects the clinical outcome and survival and moreover, sarcopenia and under nutrition can escalate the chance of developing hepatic encephalopathy [23, 34].

Conclusion

Sarcopenia has great impact on activities of daily living, quality of life and functional abilities among older populations and in patients with liver diseases. Hence monitoring and assessment of level of nutrition and sarcopenia among cirrhosis patients is of utmost importance and special care has to be given to measure muscle mass and muscle strength. Asian countries researchers of sarcopenia had framed the Asian Working Group for Sarcopenia (AWGS) and formulated policies for checking and monitoring of sarcopenia.

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