

## Nutritional Assessment and Tools Used in Chronic Liver Disease Patients Awaiting Liver Transplant

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### Abstract

Patients waiting for liver transplant are faced with a variety of nutritional deficiencies and as liver disease advances, they might present with severe malnutrition, which enhances morbidity, prolonged hospital stay, increased infectious complications and decreased clinical outcome. Due to various metabolic alterations occurs in patients with chronic liver disease (CLD), it is a challenge to manage and maintain nutritional requirements to improve their outcome and survival as they are prone for micronutrient deficiencies along with protein calorie deficiency. Hence, it is vital to do nutritional assessment during their visit to hepatology clinic and plan diet plan accordingly. In this review, we are addressing about the nutritional issues frequently observed among cirrhotics and the usual nutritional assessment tools.

**Keywords:** Chronic liver disease; Cirrhosis; Nutritional assessment; Sarcopenia; Malnutrition

### 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 [1]. The most common complication observed in 'end stage liver disease' (ESLD) patients are protein calorie malnutrition (PCM) irrespective of liver disease etiology [2, 3]. Decline in level of nutrition as disease advances in ESLD patients has been significantly correlated with poor clinical outcome [3].

Global Burden of Disease (GBD) Project framed by WHO for estimating mortality and morbidity in relation to demographic and geographical factors [4]. The estimated global death among cirrhotics was significantly higher during 2001 and was considered as the major cause of mortality [5]. By 2020, mortality due to cirrhosis might be the 12th leading cause [6]. Liver transplant (LT) has transformed the management of chronic liver disease [7] and has been widely accepted in India.

Nutritional status assessment and diet therapy is an essential aspect in pre transplant care. Though many nutritional assessment tools are available, still it is a challenge to address undernutrition among cirrhotics due to fluid retention and changes in metabolic patterns [8-10]. Hence, nutritional status to be maintained in order to reduce PCM and subsequent morbidity and mortality among patients in pre transplant period. This review focuses on the usual metabolic changes, malnutrition assessment techniques, with prompt nutritional therapy along with fast track programmes (ERAS protocol) and advanced nutritional interventions in patients awaiting LT.

### Metabolic alterations in ESLD

The main role of liver is the nutrient metabolism and the hepatic metabolic changes in cirrhotics leads to insulin resistance and sensitivity to hepatic tissues [11] results in muscle depletion and loss of subcutaneous fat and can be manifested before the development of obvious malnutrition [12]. In the early stages of cirrhosis, protein catabolism will be higher and protein deficiency will be at peak as diseases advances, leads to sarcopenia and low muscle strength [13]. Muscle mass depletion is quiet common in CLD patients awaiting LT [14]. Decreased level of polyunsaturated fatty acids (PUFA) in ESLD patients have been linked with advanced stage of malnutrition [15].

The important metabolic alterations are listed in table 1.

<b>Nutrient metabolism in ESLD</b>	<b>Usual alterations</b>
Carbohydrates	1. Glucose intolerance.
	2. Insulin resistance in peripheral tissue & decreased insulin like growth factor.
	3. Increased gluconeogenesis.
	4. Fasting leads to decreased glycogen stores [16].
	5. Decreased hepatic and muscle glycogen stores.
	6. Increased catabolism.
Proteins	1. Diminished skeletal muscle synthesis.
	2. Increased total muscle protein breakdown leads to reduced muscle mass [17].
	3. Decreased plasma levels of branched chain amino acids (BCAA).
	4. Increased levels of aromatic amino acids (AAA).
Lipids	1. Increased level of free fatty acids, glycerol and ketone body.
	2. Increased lipolysis and mobilisation of lipids.
	3. Decrease in essential and polyunsaturated fatty acids [18].
	4. Deficiency of long chain polyunsaturated fatty acids.

**Table 1:** Metabolic changes in ESLD patients.

### Nutritional status assessment

Nutritional Assessment in the pre- LT phase aids to plan better diet plan for them [19]. The suitable assessment of patients with cirrhosis might be very robust, and expertise in dietary status will assist to fight inappropriate nutritional losses and stabilise the patient's nutritional status [20]. The principal aims of nutritional management in the pre-LT period are to avoid extra muscle depletion and loss of nutrients and to rectify any nutrient deficiencies including vitamins and minerals to curtail the risk of infectious complications and diseases.

### Global Leadership Initiative on Malnutrition (GLIM) with ESPEN

GLIM [21] in 2016 along with 'European Society of Clinical Nutrition and Metabolism' (ESPEN) recommended 'three phenotypic criteria' (non-volitional weight loss, low body mass index, and reduced muscle mass) and 'two etiologic criteria' (reduced food intake or assimilation, and inflammation or disease burden). The diagnostic criteria for malnutrition is the presence of 'at least one phenotypic' and 'one etiologic criterion.' 'Phenotypic criteria' is used for assessing malnutrition as 'stage 1 (moderate)' and 'stage 2 (severe)'. The etiologic criteria is intended for planning nutritional intervention and expected clinical outcomes [21].

### **Subjective Global Assessment (SGA)**

The SGA has shown the highest sensitivity and accuracy as a technique of assessing the status of nutrition among patients awaiting LT [22]. Hasse JM [23] projected SGA as a consistent and sensitive technique for assessing nourishment level in patients waiting LT. ESPEN [24] advocated the usage of SGA to assess the severity of malnutrition as it is a simple device in conjunction with simple anthropometric parameters. Nutritional assessment by SGA is based on medical history and clinical examination. The components of SGA assessment were (i) 'related to the medical history of the patients, such as recent changes in weight (in one month), food intake during one-month, gastrointestinal symptoms for the previous two weeks, alterations in functional capacity for one month, and metabolic demand; (ii) based on clinical examination, namely subcutaneous fat loss and muscle depletion, fluid retention results in oedema, and ascites' [25, 26]. Patients are classified as 'well-nourished', being grade A with a of score 7-14, 'moderately malnourished' as grade B, score of 15-28, and 'severely malnourished' as grade C, score of 29-35 as per SGA [27].

### **Royal Free Hospital-Nutritional Prioritizing Tool (RFH-NPT)**

Guidelines provided by ESPEN recommended to use the 'RFH-NPT' to detect risk of undernutrition among in patients with hepatic diseases. Wu Y et.al, suggested that using the RFH-NPT promotes the clinician's capacity to forecast malnutrition risk at an early stage among cirrhotics due to viral hepatitis [28]. Other nutritional screening tools such as 'Nutritional Risk Screening 2002' (NRS-2002), 'Malnutrition Universal Screening Tool' (MUST) and 'Liver Disease Undernutrition Screening Tool' (LDUST) are also available [28]. When compared with other screening tools, RFH-NPT and NRS-2002 tools showed increased sensitivity and specificity for assessing malnutrition risk among cirrhotics [28].

### **Hand grip strength (HGS)**

Hand grip strength (HGS) are used detect the loss of muscle strength by using a digital hand held dynamometer. The average of the 3 consecutive measurements will be taken on the dominant hand. Hand grip strength of less than 18 kg in women and 26 kg in men indicate loss of muscle strength as per AWGS 2019 consensus [29].

### **Skeletal mass index (SMI) and density**

Assessment of mean psoas muscle area ( $\text{mm}^2/\text{m}^2$ ) and psoas muscle density (Hu/kg) were identified by cross-sectional images using CT abdomen scan to diagnose the presence of sarcopenia. The mean muscle area was normalized to height to calculate muscle area index in  $\text{mm}^2/\text{m}^2$ , while the mean of muscle density was normalized to patient weight in kilograms to arrive at muscle density index expressed in Hounsfield unit / Kilogram (HU/kg) at both vertebral levels at L3 and L4. The cut-off values to define sarcopenia are less than  $50 \text{ cm}^2/\text{m}^2$  in men and  $39 \text{ cm}^2/\text{m}^2$  in women [30].

### **Frailty assessment tools**

Liver frailty index, 6 minute walk test and clinical frailty scale (CFS) can be used in an outpatient clinic for well-oriented patients with CLD to determine their clinical outcome.

Among all these assessment techniques subjective global assessment can be feasibly administered among CLD patients to assess nutritional status as it is quick and easy to interpret [31].

### **Conclusion**

Finding of an ideal technique of nutritional evaluation in cirrhotics is challenging due to several conventionally used parameters, including weight, body mass index (BMI), and mid upper arm circumference (MUAC), vary due to the liver disease severity irrespective of the level of nutrition. BMI might be the most widely used dietary evaluation method among the general population and is the best straightforward and easy method of determining malnutrition but is generally overestimated due to ascites and peripheral oedema.

Still SGA and RFH-NPT are easy to use in out patient liver clinic setting for nutritional assessment.

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