ORIGINAL RESEARCH PAPER

Gastroenterology

SARCOPENIA ASSESSMENT BY DIFFERENT METHODS (MRI-L3 SMI INDEX, SUBJECTIVE GLOBAL ASSESSMENT AND HANDGRIP STRENGTH) AS PREDICTIVE FACTORS IN PATIENTS WITH LIVER CIRRHOSIS

KEY WORDS: Chronic Liver Disease, Sarcopenia, SGA, Hand grip, MRI-L3 SMI Index

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ABSTRACT

Introduction: Malnutrition is common in patients with chronic liver disease. We aimed to assess the value of malnutrition assessment tools (BMI, MAMC, SGA, HG and MRI L3-SMI Index) in predicting severity and survival of patients with liver cirrhosis

Material and Methods: Eligible patients were cirrhotics of all etiology and severity who were admitted at department of gastroenterology, NIMS medical college, Jaipur between August 2016 and July 2018. Anthropometric evaluation was performed at the time of referral, according with the ISAK manual of International Society forthe Advancement of Kinanthropometry. Nutritional assessment was performed in all patients using SGA score on the day of admission. We measured the handgrip strength a hydraulic dynamometer Jamar ® previously adjusted to the patient hand size was used. A transverse MRI image was taken from third lumbar vertebra (L3) in department of radiology at NIMS

Results: Patients were mainly men (81.7 %), with mean age of 44 ± 13.5 (Range 13-79 years). MAMC, HG and L3-SMI Index mean values were significantly lower with increasing cirrhosis severity as estimated by Child-Pugh class, MELD and MELD-Na scores. There is highest significant correlation between L3-SMI Index by MRI and severity of liver disease

Conclusion: Our study show that nutritional parameter such as MAMC, HG, SGA and L3 –SMI Index by MRI are fair predictors of disease severity in cirrhotic patients

INTRODUCTION:

Skeletal muscle wasting is a common feature of malnutrition in patients with liver cirrhosis [1].The majority of "malnourished" patients with cirrhosis experience skeletal muscle wasting or sarcopenia, a major predictor of adverse clinical outcomes [2-4]. Etiology and severity of the underlying liver disease, duration of illness, age and co-morbidities contribute to the severity of sarcopenia [5, 6, 7, 8, 9].The diagnosis of skeletal muscle loss requires analysis of the body composition using one or more of a number of available techniques (Table 1) as well as the normal values to define the appropriate cut-off values for sarcopenia [10, 11, 12].Body mass index (BMI) and subjective global assessment are both used for evaluation of malnutrition. BMI underestimate malnutrition in patients with ascites or peripheral edema. MAMC is calculated based on the anthropometric measurement of the triceps skinfold (TSF) and mid-arm circumference (MAC) on the nondominated arm[13, 14]. Nevertheless, SGA may underestimate malnutrition in decompensated cirrhosis, has poor interobserver agreement, and requires patient's cooperation (Impaired in overt hepatic encephalopathy)[15-17]. Handgrip strength (HG-a measure of muscle function) has been utilized in cirrhotic patients but when normalized for body mass index may not be accurate in cirrhosis due to fluctuations in body weight related to changes in body water. Muscle strength is estimated by measuring the HG of the arm by using a dynamometer. Quantifying muscle mass by measurements in a single anatomic area like the limb or abdominal muscles are believed to provide a reasonably accurate measure of whole body muscle mass [18]. Measurements of psoas and abdominal muscle mass on CT images at L3 or L4 vertebra are used due to their relative independence from the activity level. We aimed to assess the value of malnutrition assessment tools (BMI, MAMC, SGA, HG and MRI L3 SMI Index) in predicting severity and survival of patients with liver cirrhosis

METHODS:

One hundreds thirty one patients with liver cirrhosis prospectively enrolled in the study. Eligible patients were cirrhotics of all etiology and severity who were admitted at department of gastroenterology, NIMS medical college, Jaipur between August 2016 and July 2018. The variables were prospectively collected .Inclusion criteria were age between 18 to 80 years old and cirrhosis confirmed by either radiological imaging (ultrasound or cross- sectional imaging showing lobulated liver, irregular margins or dilated portal vein) or transient elastography (defined as liver stiffness ≥ 14 kPa) or complications of portal hypertension (ascites, varices or variceal bleeding or hepatic encephalopathy) . We evaluated severity of liver cirrhosis using the Child-Pugh, MELD and MELD-Na scores at admission in all patients [19]. We excluded patients with active malignancy or end stage renal disease. The study protocol was approved by the institutional review board prior to data collection.

Nutritional assessment was performed in all patients using SGA score on the day of admission[20]. Based on history and physical examination of the patient, patients were subjectively rated as well nourished (A), moderately malnourished (B), or severely malnourished (C).The examiner asked every patient about his/her involuntary weight loss and change in dietary intake in the past 6 months and 2 weeks, the presence of gastrointestinal symptoms for more than 2 weeks (nausea, vomiting, diarrhea, and anorexia), and his/her performance status. Physical examination assessed on a 4-point scale (0-3) the severity of subcutaneous fat loss, muscle wasting, ankle, and sacral edema as well as ascites. Anthropometric evaluation was performed at the time of referral, according with the ISAK manual of International Society forthe Advancement of Kinanthropometry [21]. The average of three consecutive measurements was then recorded on the patients file. Body Mass Index (BMI) was obtained using the equation weight/height^2.Mid Upper Arm Circumference (MUAC) was measured in centimeters, using a flexible measuring tape wrapped around the mid upper arm, halfway between the olecranon and the acromion process. Triceps Skinfold (TSF) was measured in millimeters, using a skin fold caliper on the mid-line of the posterior surface of the arm, halfway between the olecranon and the acromion process.Ideal mid-arm muscle circumference (MAMC) was calculated by using MUAC (cm) - 3.14x TSF (mm)

The anthropometric values of each patient were compared with the NHANES (National Health and Nutrition Examination Survey) reference values on Frisancho tables, and the nutritional status was classified according with the criteria described by Blackburn & Thornton [22,23].

We measured the handgrip strength a hydraulic dynamometer Jamar ® previously adjusted to the patient hand size was used. Three measurements were performed using the non-dominant hand, always encouraging the patient to exert his greatest strength. The best value obtained was recorded. The results were further categorized in percentiles according with gender, age and height [24].

Assessment of muscle mass by MRI scans:

MRI done in patients who are admitted in department of gastroenterology at National Institute of Medical Sciences (NIMS) .A transverse MRI image was taken from third lumbar vertebra (L3) in department of radiology at NIMS .Muscles in the L3 region encompass psoas, erector spinae, quadrantus lumborum, transverses abdominis, external and internal obliques and rectus abdominis .A commercially available clinical 3.0 Tesla MR imaging system (Ingenia 3.0 T; Philips Healthcare, Best, Netherlands) or a 1.5 Tesla MR imaging system (Ingenia 1.5 T; Philips Healthcare, Best, Netherlands) was used. The different magnetic field strengths (3.0 or 1.5 T) did not impact the results, since both are equally effective in depicting the anatomy and thus muscle fat distribution. Agreement on classification of sarcopenic and non-sarcopenic patients was 1.000 ($p<0.001$).

Consequently and due to the known fact that main visceral arteries are largely immobile and rarely show inter-individual differences, the radix of the superior mesenteric artery was chosen as landmark for the measurement of the erector spinae muscle .We measured both sides to avoid confounders due to individual local inflammatory or degenerative processes or differences between both sides resulting from dominant use of one side, postural fitness and preferences Sarcopenia was defined according to following cut offs: L3 Skeletal muscle index (L3- SMI) ≤38.5 cm^2/m^2– Women, ≤52.4 cm^2/m^2– Men in all patients Patient's medical records were reviewed at 6 months to check for complications, death, or liver transplantation. If there were no new data at 6 months, patients were contacted by telephone.

Quantities variables were presented as mean ± standard deviation (SD). Categorical variables were presented as absolute values and percentages. Comparison between groups was done using Chi-square and Krukal –Wallis test, while correlation between quantitative variables were done using Pearson r test. SPSS 16.0 was used for statistical analysis. A 2 tailed p value less than 0.05 was considered statistically significant

RESULTS:

Patients were mainly men (81.7 %), with mean age of 44 ± 13.5 (Range 13-79 years). The origin of liver disease were alcohol (69.5%), HBV related (16.2%), HCV (1.5%), cryptogenic (9.9%) and autoimmune (4.6%). Patients with sarcopenia had more advanced liver disease as compare to no sarcopenia Mean Child-Pugh Score 9.7 ± 1.7 vs. 6.0 ± 1.1 and MELD score 19.8 ± 6.1 vs.11.1 ± 3.4.

Comparisons between distribution of SGA scores and mean values of BMI, MAMC, HG and L3-SMI index (MRI) among Child-Pugh groups are shown in Table 1.

Table 1: Nutritional assessment values in different Child-Pugh classes

Parameters	Child-Pugh A	Child-Pugh B	Child-Pugh C	P value
Patients	22	53	56	
Age, years	38.77±3.19	45.71±1.76	45.30±1.76	0.059
BMI (Kg/m2)	19.72±0.73	21.28±0.50	21.78±0.42	0.000
MAC (cm)	28.00±0.50	24.39±0.41	23.01±0.45	0.005
TSF (mm)	13.63±0.58	12.88±0.29	11.67±0.38	0.000
MAMC (cm)	23.66±0.45	20.39±0.35	19.31±0.39	0.000
SGA –A/B/C	22/0/0	23/27/3	0/32/24	
CFS	3.27±0.27	5.01± 0.17	6.92±0.17	0.000
HG (kg)	43.31±0.63	30.18±0.96	26.16±0.79	0.000
MRI-L3 SMI Index	44.09±0.66	31.52±0.97	26.28±0.84	0.000

MAMC, HG and L3-SMI Index mean values were significantly lower with increasing cirrhosis severity as estimated by Child-Pugh class, MELD and MELD-Na scores (Fig-1)

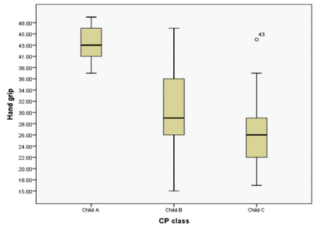

Table 2: Comparisons between mean CP score, MELD score and MELD-Na scores among SGA classes:

	CP score		MELD		MELD-Na	
	Mean±SD	P value	Mean±SD	P value	Mean±SD	P value
SGA						
A	6.91±0.21		13.70±0.68		14.37±0.74	
B	9.96±0.20	{P=0.000}	18.98±0.70	{P=0.000}	19.35±0.72	{P=0.000}
C	10.92±0.27		24.44±1.30		24.74±1.21	

Correlations between liver disease severity (CP scores, MELD and MELD-Na) and nutritional assessment parameters (BMI, MAMC, HG and L3 –SMI index) are shown in Table 3.

Table-3: Correlation between CP score, MELD, MELD-Na and BMI, MAMC, HG, L3- SMI Index:

Parameters	CP Scores Pearson r coefficient, P value	MELD Pearson r coefficient, P value	MELD-Na Pearson r coefficient, P value
BMI	0.254, 0.003	0.166 , 0.600	0.175, 0.045
MAMC	0.36, 0.000	-0.260, 0.003	-0.222 ,0.011
HG	-0.587 ,0.000	-0.437 , 0.000	-0.396 , 0.000
L3-SMI Index	-0.678, 0.000	-0.571 , 0.000	-0.487 ,0.000

There is highest significant correlation between L3-SMI Index by MRI and severity of liver disease

DISCUSSIONS:

We included hospitalized patients with liver cirrhosis. Most patients were males (81.7%). Had alcohol abuse as etiological factor (69.5%) and had decompensated liver disease (Child B or C, 81.9%).Mean BMI values didn't predicts cirrhosis severity (Child-Pugh class, MELD and MELD-Na).The mean BMI values were identical in Child-Pugh A and C classes, most probably in relation to fluid overload with ascites and edema in decompensated cirrhosis. This confirms what has been decribed in other previous studies [25,26]

MAMC have significant correlation with severity of the liver disease (CP score, MELD and MELD-Na= Pearson correlation coefficients and P values respectively, - 0.36, 0.000, -0.260, 0.003 and -0.222, 0.011) . Our results are similar with previous study found a correlation between TSF, MAC and severity of liver disease [27]

65.6% of our patients were malnourished (SGA B or C), higher than the reported 28% in another similar studies[28] The difference may be partly explained by the fact that we included patients with more severe disease (our study- 16% Child-Pugh A, 40% Child-Pugh B 43% Child-Pugh C and their study 88% Child-Pugh A, 12% Child-Pugh B, and no patients Child-Pugh C) studies In our study population, SGA significantly correlated with prognosis scores (Child- Pugh, MELD and MELD-Na). Two studies on more than 150 patients with liver cirrhosis also found a significant correlation between SGA and Child-Pugh scores ($p<0.05$) [27,29] In a recent study by Gaikwad et al.[30] , 80 patients with alcoholic liver disease with a mean MELD score of 10.50±2.67 were followed for 3 months, a significant correlation was noted between handgrip

and Child-Pugh score (r=-0.606, p≤0.0012) and MELD score (r=-0.394, p≤0.001). We have shown similar results, with significant lower handgrip in patients who have severe liver disease. Our study also shown there is highest significant correlation between L3-SMI Index by MRI and severity of liver disease In conclusion our study show that nutritional parameter such as MAMC, HG, SGA and L3 –SMI Index by MRI are fair predictors of disease severity in cirrhotic patients

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