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ASSESSMENT OF SARCOPENIA IN CIRRHOSIS BY COMPUTED TOMOGRAPHY USING PSOAS MUSCLE THICKNESS AND CORRELATE IT WITH DISEASE SEVERITY

Radio-Diagnosis

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ABSTRACT

Background: The skeletal muscle index is the most often used technique for sarcopenia diagnosis (SMI). According to a number of research, psoas muscle thickness per height (PMTH) can also be used to identify sarcopenia and forecast prognosis in cirrhosis patients. **Aim:** to determine the best PMTH cutoff values for sarcopenia detection in patients with cirrhosis. **Methods:** The study encompassed all cirrhotic patients who had abdominal computed tomography (CT) scans, with L3 and umbilical levels measured for transverse psoas muscle thickness and SMI, respectively. There were two definitions of sarcopenia employed. sex-specific SMI cutoffs for sarcopenia are ≤52.4 cm2/m2 in men and ≤38.5 cm2/m2 in women. Men's and women's best PMTH cutoff values for predicting SMI-sarcopenia were 17.3 mm/m and 10.4 mm/m, respectively. **Conclusions:** In individuals with cirrhosis, PMTH and SMI had a strong correlation. Compared to SnPMTH-sarcopenia, SsPMTH-sarcopenia was a more accurate predictor of mortality and an independent predictor of death in these individuals.

KEYWORDS

Sarcopenia; Cirrhosis; Prognosis; Psoas muscle

BACKGROUND:

Liver cirrhosis is a major global public health concern. Malnutrition is a common occurrence in patients with liver cirrhosis and is a strong predictive factor. Ascites, decreased protein synthesis, and water retention make it still challenging to objectively assess nutritional status in cirrhotic patients.

Thus, there is ongoing discussion over the relationship between low nutritional status and higher mortality in patients with cirrhosis, regardless of the Model for End Stage Liver Disease (MELD) score, with differing findings based on various variables. (1).

Sarcopenia is a disease that is defined by a gradual and widespread loss of strength and skeletal muscle mass. Studies have revealed that persons with cancer and frequent chronic comorbidities such liver cirrhosis are more likely to develop sarcopenia. Sarcopenia in these patients is indicative of protein-energy deficiency and is useful as a quantitative, objective, and straightforward approach to evaluate the patient's nutritional status. (2).

The European Association for the Study of the Liver (EASL)(3) states that abdominal computed tomography (CT) should be used to evaluate sarcopenia in cirrhotic patients.

A recent study found that the cross sectional area of many muscles, including the psoas, on computed tomography (CT) or magnetic resonance imaging (MRI) at the L3 spinal level is an independent predictor of death in transplant candidates. (1).

According to recent research, sarcopenia was identified in persons with cirrhosis when their skeletal muscle index at the third lumbar vertebra (L3 SMI) was less than 50 cm2/m2 in men and less than 39 cm2/m2 in women (4).

Psoas muscle thickness per height (PMTH) and skeletal muscle index (SMI) exhibited a strong positive connection in cirrhosis patients. In these patients, sex specific (Ss)PMTH-sarcopenia was a more reliable independent predictor of death than sex non specific (Sn)PMTH-sarcopenia. The optimal PMTH cutoff values for sarcopenia in men and women were 17.3 mm/m and 10.4 mm/m, respectively.

MATERIALS AND METHODS

Study population:

The study has been carried out after institutional committee acceptance and ethical clearance and data was collected. Conducted a prospective study on 80 patients with liver cirrhosis was diagnosed histologically or clinically from october 2023 to February 2024.

The study is primarily based on investigations as radiology itself is a tool of investigation. Informed consent has been obtained before any procedure from competent voluntary patient. Consent has been taken after explaining the procedure and receiving their approval to be included in the study.

Inclusion criteria for study group:

1. Patients aged above 18 years and diagnosed with cirrhosis of any etiology based on clinical and/or radiological findings.

Exclusion criteria for study group:

1. Patients with chronic infections.
2. Patients who had organ transplantation.
3. Patients with malignancies.

Data Collection:

Patients diagnosed with cirrhosis in D. Y. Patil Hospital and Research Institute, Kadamwadi, Kolhapur will be selected for study.

Each patient's information will be gathered, including their age, sex, height, underlying liver disorders, and the outcomes of their initial laboratory tests. International normalised ratio (INR), bilirubin, albumin, creatinine (Cr)levels made up the initial set of laboratory tests.

Within a week of the CT imaging used to measure TPMT, the clinical and laboratory data utilised for the analysis will be gathered. MELD score will be evaluated with the gathered clinical and laboratorical values.

Patient will undergo CT evaluation by 128 slice MDCT machine. L3 PMTH will be measured by below methodology and sarcopenia will be assessed in each patient. Proportion of sarcopenia in cirrhotic patients will be evaluated. Following this, any correlation between sarcopenia prevalence and disease severity will be assessed.

Measurement of PMTH:

An abdominal CT scan was performed utilising a 128-slice multidetector CT scanner to produce slices that were 5 mm thick in order to calculate the TPMT.

TPMT is quantified by measuring the transverse thickness of the right psoas muscle on a cross-sectional CT image taken at the level of L3.

The maximum diameter of the psoas muscle on an axial view will be used to define axial psoas muscle thickness (Fig. 1). The diameter of the psoas muscle perpendicular to the axial diameter was used to define transversal psoas muscle thickness.

The PMTH will be created by standardising the PMT for height of patient: PMTH (mm/m) = PMT (mm)/height (m) Men's and women's best SsPMTH cutoff values for predicting sarcopenia were 17.3 mm/m and 10.4 mm/m, respectively.

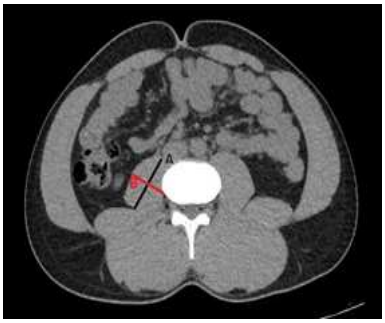
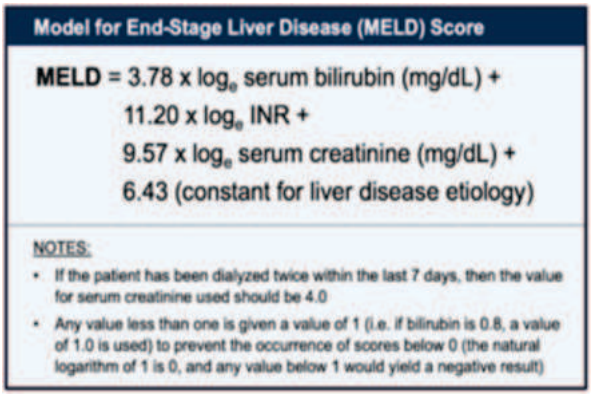


Figure 1 shows a computed tomography (CT) scan image with the right psoas muscle thickness measured at the L3 level. Psoas muscle thickness is equal to the transverse psoas muscle's diameter (red line,B) which is perpendicular to the axial diameter (black line,A)



Score > 15 - Compensated chronic liver diseaseScore ≤ 15 - Decompensated chronic liver disease

Statistical analysis:
Statistical analysis will be performed using SPSS 24.0 at 95% confidence level. Categorical variables will be present in terms of frequency and percentage. Continuous variables will be presented as Mean±SD. Association between sarcopenia and Child pugh score and association between sarcopenia and MELD score will be found using chi square test. A P value of less than 0.05 will be considered as statistically significant.

RESULTS:
Table 1. Baseline characteristics of all included patients with liver cirrhosis

	ALL PATIENTS (80)
Age (years)	51.4 ± 11.1
Male (n, %)	53 (66.2%)
Female (n, %)	27 (21.6%)
BMI (kg/m2) 23.6±3.8	23.4 ±4.1
PMTH (mm/m) 17.4 ± 4.0	17.6 ± 4.2
Underlying liver disease (n, %)	Viral 29 (72.5%) Alcohol 8 (20%) Others 3 (1.2%)
Platelet count (×109 /L)	113.6±60.5
INR	1.3±0.3
AST (IU/L)	78.8±157.8
ALT (IU/L)	61.0±77.5
Bilirubin (mg/dL) 2.5±3.8	2.4±3.8
Albumin (g/dL)	3.4±0.8
Creatinine (mg/dL)	0.9±0.4
Sodium (mEq/L)	141.6±4.0
MELD score	11.5±4.7

Values are presented as mean±SD or n (%). BMI, body mass index; PMTH, psoas muscle thickness/height; INR, international normalized ratio; AST, aspartate aminotransferase; ALT, alanine amino transferase; MELD, model for end stage liver disease.

Table 2. presence of sarcopenia based on the SMI and sex-nonspecific and sex-specific PMTH definitions

	Sarcopenia by SMI definition		Sarcopenia by sex-nonspecific PMTH definition		Sarcopenia by sex-specific PMTH definition	
	Pts with sarcopenia	Pts without sarcopenia	Pts with sarco penia	Pts without sarco penia	Pts with sarcopenia	Pts without sarco penia
PMTH (mm/m)	15.8±3.6	18.4±4.0	13.8±2.3	20.4±2.4	14.1±2.5	19.3±3.5
MELD score	12.0±5.3	11.1±4.4	11.8±4.9	11.1±4.7	11.9±5.0	11.2±4.7

Men had considerably greater levels of PMTH (18.1±3.8 mm/m vs. 15.2±3.9 mm/m, P<0.001) than women did. A strong association was observed between PMTH and SMI (Pearson's correlation coefficient: 0.526; P<0.001). Men's 17.3 mm/m (sensitivity: 65.3%; specificity: 76.3%) and women's 10.4 mm/m (sensitivity: 31.2%; specificity: 90.6%) were the best cutoff values for predicting SMI-sarcopenia. Using these cutoff values, sarcopenia was diagnosed in 72.5% of patients and they were defined as SsPMTHsarcopenia.

This study found a strong correlation between PMTH and SMI. Additionally, PMTH's AUROC for predicting sarcopenia, as defined by SMI, was quite high in both men and women, indicating that PMTH is a more straightforward, impartial, and easily accessible way to measure skeletal muscle mass. SMI-based sarcopenia was predictive of death, independent of other potential confounders, as was the case with earlier research. It's interesting to note that, in contrast to sex-nonspecific PMTH-based sarcopenia, sex-specific PMTH-based sarcopenia was discovered to be strongly linked with mortality. More women were classified as sarcopenic when sarcopenia was identified with the SnPMTH-sarcopenia. Patients with SnPMTH-sarcopenia had considerably reduced BMI, serum albumin, and creatinine levels, but significantly higher levels of blood bilirubin. There was no difference in the MELD scores of the two groups (11.8±4.9 vs. 11.1±4.7, P=0.083)

Mortality:
The presence of sarcopenia considerably affected the cumulative survival rate (Fig. 4). According to the SMI definition of sarcopenia, survival rates for patients without sarcopenia were 97.7%, 93.3%, and 88.3% at 1, 2, and 3 years, respectively, but those for patients with sarcopenia were 86.2%, 81.0%, and 78.8%, respectively (P<0.001). The survival rates at 1, 2, and 3 years were 95.3%, 91.5%, and 88.4%, respectively, for patients without sarcopenia, and 91.4%, 85.6%, and 80.6%, respectively, for patients with sarcopenia, using the sex-nonspecific cutoff of PMTH as the criterion of sarcopenia (P=0.024). When sarcopenia was defined as having a sex-specific cutoff of PMTH, the survival rates for patients without sarcopenia were 90.2%, 92.4%, and 89.7%, respectively, at 1, 2, and 3 years, in patients with sarcopenia (P=0.002)

The results of this study indicate that PMTH is a more straightforward, objective, and accessible way to measure skeletal muscle mass. Specifically, PMTH and SMI showed a strong correlation, and PMTH's AUROC for predicting sarcopenia as defined by SMI was quite high in both men and women. Consistent with earlier research, death was predicted by SMI-based sarcopenia, regardless of potential confounding variables. It's interesting to note that, in contrast to sex-nonspecific PMTH-based sarcopenia, sex-specific PMTH-based sarcopenia was substantially linked to mortality.

CONCLUSION
Sarcopenia is a frequent side effect of cirrhosis that has a negative impact on life expectancy, quality of life, and reaction to stressors including infection and surgery. Sarcopenia is a strong indicator of morbidity and the advancement of chronic illnesses.

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