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PhD THESIS SUMMARY

NUTRITION IN PATIENTS WITH LIVER CIRRHOSIS - CLINICAL AND PARACLINICAL ASPECTS

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INTRODUCTION

Chronic liver diseases pose significant challenges to global public health, with epidemiological research indicating a continual rise in both their occurrence and prevalence.

The realm of Hepatology, a vast and extensively studied field, has piqued my interest due to the intricate nature of the pathologies that impact various systems within the human body, some of which operate via mechanisms that are not fully understood.

Current medical practice predominantly emphasizes the prevention and management of complications associated with chronic liver diseases to enhance patient survival rates. Nevertheless, there is a tendency to overlook other potential conditions that may manifest throughout the progression of the illness such as malnutrition and sarcopenia which are frequently underdiagnosed due to the absence of standardized protocols for management.

Based on this fundamental assumption, the subsequent **working hypothesis** was posited: the existence of diseases that manifest in clinical, subclinical, and latent forms, intricately linked to chronic liver conditions, with potentially adverse effects on individuals from the outset. This impact is further exacerbated by the presence of risk factors, concurrent health issues, and complications associated with liver disorders.

Consequently, we formed the doctoral thesis "*NUTRITION IN PATIENTS WITH LIVER CIRRHOSIS—CLINIC AND PARACLINICAL ASPECTS."* by establishing the following **main objectives of the research**: to pinpoint the most sensitive, cost-effective, and easily replicable method for identifying malnourished/sarcopenic patients. Additionally, I endeavored to evaluate the adequacy of dietary intake among patients with liver cirrhosis, explore the impact of an insufficient oral diet on their nutritional status, assess the prevalence of sarcopenia in cirrhosis patients, and investigate the correlation between sarcopenia and the occurrence of complications, as well as overall survival.

The thesis includes a general, theoretical part and a special part, with personal contributions.

The general part consists of four chapters that analyze the existing understanding, encompassing a thorough examination of the literature within this particular field.

Chapter 1 presents information concerning the epidemiology, etiology, clinical manifestations and complications of liver cirrhosis.

Chapter 2 is dedicated to the presentation of malnutrition and sarcopenia: definition, pathophysiology, prevalence, and prognosis.

Chapter 3 presents methods to assess malnutrition and sarcopenia in Liver Cirrhosis.

Chapter 4 provides data about therapeutical management of malnutrition and sarcopenia.

The part concerning individual contributions is structured across chapters 1-6, with chapter 6 outlining the research findings, personal contributions, and future outlook. Citations are included towards the conclusion of the thesis within a distinct section.

GENERAL PART

Liver cirrhosis is the final step of chronic liver diseases. It is characterized by fibrosis and nodule formation that disrupt the liver's structure and function, leading to various complications. It is the 14th leading cause of death globally, 4th in Europe, and 9th in the United States, causing about 1.48 million deaths annually. It results from hepatocyte degeneration, necrosis, and fibrosis, leading to portal hypertension and liver dysfunction. Major causes include alcohol consumption (45% of cases), hepatitis C (41%), and nonalcoholic fatty liver disease (NAFLD) (26%), with NAFLD being the leading cause of new cases.

Liver cirrhosis can lead to several complications that are often overlooked, such as malnutrition, frailty, and sarcopenia, all of which are interconnected. Malnutrition refers to an imbalance in nutrient intake, while sarcopenia involves the losing muscle mass and function, and frailty indicates reduced physiological reserves. Additionally, overweight patients may experience sarcopenic obesity, characterized by reduced muscle mass and expanded fat mass.

Malnutrition results from decreased intake, malabsorption, inactivity, hyperammonemia, hypermetabolism, altered metabolism, and gut microbiome changes. Sarcopenia arises from abnormal energy use, hormonal imbalances, and inflammation. Factors like vitamin D deficiency, hormonal imbalances, and insulin resistance also exacerbate muscle wasting.

Malnutrition affects 26.1% to 72.2% of cirrhosis patients, depending on disease severity and screening methods, while sarcopenia prevalence is about 33%, varying with disease severity: 31.2% in Child-Pugh class A, 58.3% in class B, and 93.5% in class C. Sarcopenia predicts poor prognosis, higher mortality, readmission rates, hepatic decompensation, and infection risk.

The European Association for the Study of the Liver (EASL) recommends screening all chronic liver disease patients for malnutrition using BMI and Child-Pugh classification. A BMI below 18.5 kg/m² and Child-Pugh class C indicate higher malnutrition risk. For BMIs of 18.5 to 29.9 kg/m² and Child-Pugh

class A or B, tools like RFH-NPT or LDUST are advised, but High-risk patients can also be assessed for malnutrition using tools like NRS 2002, SGA, PG-SGA, and SARC-F.

Detailed dietary assessments identify nutrient deficiencies and barriers to eating using methods like Food Records, 24-hour Recall, and Food Frequency Questionnaire. Accurate dietary assessment helps tailor nutritional interventions and improve patient outcomes.

When it comes to the assessment of sarcopenia, various tools are available. To assess muscle strength, Hand Grip Strength (HGS) and Chair Stand Test are recommended by the recent guidelines. To assess muscle mass, anthropometry, CT and MRI (Gold standards for measuring muscle mass, correlating with mortality and post-transplant outcomes), Dual-energy X-ray Absorptiometry (DXA) and Bioelectric Impedance Analysis (BIA) can be used.

Accurate evaluation of malnutrition and sarcopenia in individuals with liver cirrhosis is essential for implementing customized nutritional strategies and enhancing patient prognoses.

Management of sarcopenia, malnutrition, and frailty in liver cirrhosis is crucial for improving prognosis. This involves addressing the underlying causes of chronic liver disease, ensuring adequate nutrient intake, and improving physical activity. Recommendations include specific caloric intake (30-40 kcal/kg/day), protein intake (1.2-1.5 g/kg/day), and avoiding prolonged fasting by scheduling late dinners and early breakfasts. Branched-chain amino acids supplementation may help recover from protein-energy malnutrition. Addressing deficiencies in carnitine, zinc, and vitamin D is recommended, as well as promoting gradual weight loss in obese patients. Encouraging physical activity can enhance muscle mass, cardiopulmonary function, and overall quality of life.

SPECIAL PART

Chapter 1. General objectives.

Our investigation has been meticulously organized into three interconnected sections, with the expectation that it will help us generate more comprehensive and meaningful insights.

The main objectives of this research are the following:

Firstly, we aim to assess and compare the effectiveness of different nutritional assessment methods in identifying malnourished cirrhotic patients, in order to enhance the accuracy and efficiency of nutritional screening for this vulnerable group.

In the second phase of our research, we strived to analyze the dietary intake of individuals with liver cirrhosis in order to pinpoint areas where dietary adjustments could enhance the overall health and well-being of these patients.

Lastly, our focus shifted to examining the prevalence of sarcopenia in liver cirrhosis patients and exploring the potential link between sarcopenia and a higher incidence of complications.

Chapter 2. General research methodology

The current research project is a prospective, observational, and multidisciplinary study involving 201 participants ranging in age from 19 to 80 years, with a median age of 61.6 ± 9.4. Of the participants, 127 (63%) were male and 74 (36%) were female. The study took place from January 2018 to December 2020, adhering to the ethical standards outlined in the Helsinki Declaration of 1975 (revised in 2008) and with the approval of the ethics committee of the Victor Babeș University of Medicine and Pharmacy Timișoara. Furthermore, the study was conducted in collaboration with the Clinical Emergency County Hospital "Pius Brînzeu" Timişoara, and all participants provided informed consent.

The **inclusion criteria** included: adults aged ≥ 18 years, conscious, cooperative, who provided verbal and written consent for inclusion in the study; liver cirrhosis previously diagnosed; the availability of a diagnostic reference standard method, namely Contrast-enhanced Computer Tomography.

The **exclusion criteria** varied slightly across the three studies. In the first and second studies, patients with hepatic encephalopathy, tuberculosis, hepatorenal syndrome, pancreatic insufficiency, coexisting human immunodeficiency virus, chronic renal failure, inflammatory bowel disease, septicemia, enteral tube feeding, and malignancies were excluded. In the third study, patients with factors independently influencing sarcopenia, such as Human Immunodeficiency Virus, congestive heart failure, tuberculosis, chronic renal failure, obstructive pulmonary disease, inflammatory bowel disease, neuromuscular disorders, and malignancies other than hepatocellular carcinoma, were excluded.

All participants in the studies underwent a thorough dietary assessment using the 24-hour diet recall method conducted by an experienced nutrition expert. We used various measures and nutrition screening tools such as Subjective Global Assessment, Royal Free Hospital-Nutritional Prioritizing Tool, as well as anthropometric measurements including skinfold thickness, mid-upper arm circumference, mid-upper arm muscle circumference, handgrip strength, and body mass index to evaluate the nutritional status of the patients. Additionally, skeletal muscle index was assessed using CT scans for all patients.

The statistical analysis was conducted utilizing the MedCalc software designed for Windows operating system (version 19.3.1, developed in Ostend, Belgium).

Chapter 3. Results

- **A comparative analysis of different nutritional assessment tools to detect malnutrition and sarcopenia among patients with cirrhosis.**

Our first study involved 156 patients with liver cirrhosis, with average age 61.8 ± 8.7 years, with 61.5% being male. The causes of liver cirrhosis were as follows: alcoholic cirrhosis (57.1%), hepatitis C virus (HCV) cirrhosis (25.6%), hepatitis B virus (HBV) cirrhosis (11.5%), and other types of cirrhosis (5.8%). Based on the Child-Pugh Classification, 21.8% of the patients were in class A, 39.1% were in class B, and 39.1% were in class C.

In our study, we found that 60.2% of the overall cohort had malnutrition/sarcopenia, with a higher prevalence in the decompensated group at 70.4%. Sarcopenic obesity was found in 31.7% of the cohort. We aimed to assess various nutritional assessment methods to effectively identify malnutrition. Our findings showed that all methods examined were linked to malnutrition, with RFH-NPT, HGS, MUAC, MUMC, and SGA showing the strongest correlation. When comparing these methods against our reference method (SMI evaluated by CT combined with HGS), RFH-NPT, MUAC, and MUMC were the most effective, with AUROCs of 0.86, 0.81, and 0.79, respectively. Combining RFH-NPT with either MUAC or MUMC resulted in a highly accurate diagnostic tool. We also found strong agreement between SMI + HGS and RFH-NPT (kappa value of 0.62) and between SMI + HGS and HGS alone (kappa value of 0.55).

- **Correlation between dietary habits and sarcopenia in patients diagnosed with liver cirrhosis.**

Our second study analyzed data from 201 patients with an average age of 61.6 years. Patients were classified based on the Child-Pugh system: 20.4% in class A, 40.7% in class B, and 38.9% in class C. The majority had alcoholic cirrhosis (55.2%), followed by hepatitis C virus (HCV) cirrhosis (27.3%), hepatitis B virus (HBV) cirrhosis (12.9%), and other etiologies (4.6%). 57.2% of patients had a grade 3 ALBI score.

According to EWGSOP2 criteria, 57.2% of our group had sarcopenia, with 97% in the decompensated group and 3% in the compensated group. Additionally, 47.8% had a BMI > 25, but only 25.4% had sarcopenic obesity.

We categorized the population into non-sarcopenic, sarcopenic, and sarcopenic obesity groups. It revealed that the non-sarcopenic group had a higher dairy intake, while the sarcopenic groups had lower consumption of meat and fish. The three groups consistently consumed 2-3 portions of fruit per day, but the group with sarcopenic obesity had a lower intake of vegetables. Sweets consumption was highest in the obese sarcopenic group, showing a significant difference from the other groups ($p < 0.001$).

Data regarding patients' dietary patterns, physical activity, and alcohol intake was gathered. It was observed that the non-sarcopenic group exhibited a higher frequency of late-night snacking and a 30.4% regular exercise rate, in contrast to the 2-6% range seen in the sarcopenic groups. Moreover, alcohol consumption was notably prevalent among the sarcopenic groups, with 60-70% of individuals admitting to partaking in it.

In our research, we discovered that minimal dairy intake is linked to a 20-fold rise in the likelihood of developing sarcopenia. Likewise, alcohol consumption is associated with a tenfold increase in risk, whereas insufficient vegetable consumption shows a threefold increase. On the other hand, consuming high amounts of meat seems to have a protective effect, with an odds ratio of 0.22.

Furthermore, in the sarcopenic obesity group, we found that low intake of dairy products increased the risk of developing sarcopenia by 7.8 times. Alcohol consumption, low vegetable intake, and high consumption of sweets also raised the risk. However, high consumption of meat had a protective effect.

We analyzed patient mortality rates based on nutritional status at 6 and 12 months. Sarcopenic patients had higher mortality rates than those with sarcopenic obesity. At 6 months, sarcopenia had a 26.31% mortality rate, while sarcopenic obesity had 7.46%. At 12 months, sarcopenia had a 46.26% mortality rate, while sarcopenic obesity had 19.9%. Patients with cirrhosis and sarcopenia were 11.5 times more likely to die at 6 months and 9.8 times more likely at 12 months compared to non-sarcopenic patients.

- **The effects of sarcopenia on the survival and clinical outcomes of patients with liver cirrhosis.**

In the last study we analyzed 201 patients with an average age of 61.65 ± 9.49 years. Most were male (63.2%). The majority had alcoholic cirrhosis (55.2%), followed by hepatitis C virus (HCV)

cirrhosis (24.8%), hepatitis B virus (HBV) cirrhosis (8.9%), and other etiologies (10.9%). Using the Child-Pugh Classification, 20.4% were classified as A class, 40.8% as B class, and 38.81% as C class.

Following EWGSOP2 criteria, overall sarcopenia prevalence was 57.2% in the entire cohort, with a significant p-value of <0.0001. In the decompensated group, 67.5% had sarcopenia, compared to 17.07% in the compensated group. Sarcopenia prevalence did not significantly differ between genders, with 76 males and 39 females affected.

The study compared clinical outcomes and survival rates between non-sarcopenic and sarcopenic groups. Significant differences were found in factors such as albumin level, MELD score, Child-Pugh score, and others. Sarcopenic patients had higher percentages of upper gastrointestinal bleeding and pulmonary infections.

Lower albumin or sodium levels were associated with an increased risk of sarcopenia ($p<0.0001$), along with higher MELD score, Child-Pugh Score, INR level, and length of hospitalization days.

The factors associated with sarcopenia include hepatic encephalopathy, ascites, hepatocellular carcinoma, urinary tract infection, and spontaneous peritonitis. Sarcopenia increases the risk for ascites by 3.78 times, hepatocellular carcinoma by 9.23 times, urinary tract infection by 4.83 times, and spontaneous peritonitis by 2.49 times.

Chapter 4. Discussions.

- **A comparative analysis of different nutritional assessment tools to detect malnutrition and sarcopenia among patients with cirrhosis.**

In our cohort, 60.2% of patients were diagnosed with sarcopenia using EASL proposed cut-offs and EWGSOP 2 criteria. This emphasizes the importance of screening for these conditions. Our findings align with those of Bunchorntavakul C et al., who reported a similar prevalence.

We compared the effectiveness of two nutritional screening tools, SGA and RFH-NPT, to a reference method. Our research found that SGA had a sensitivity rate of 81.9% but a low specificity of 61.2%. There was moderate agreement between the identification of sarcopenia using SMI + HGS and SGA. Several studies have shown that SGA may underestimate the occurrence of sarcopenia compared to other nutritional evaluation methods.

In research involving 315 cirrhosis patients, sarcopenia was evaluated through the skeletal muscle index and the Subjective Global Assessment. The findings revealed a lack of consensus between the two evaluations, particularly in the case of overweight or obese patients. Sarcopenia demonstrated a correlation with mortality, whereas the Subjective Global Assessment did not.

The RFH-NPT screening tool, tailored for patients with advanced liver disease, demonstrated substantial concordance with the reference method. It yielded a k-value of 0.62 and a p-value of below 0.0001, along with superior diagnostic performance (AUROC of 0.86 and p-value of below 0.0001). These findings substantiate its endorsement as a dependable screening tool for malnutrition in cirrhosis. Its promptness and capability to individually assess patients with volume overload further enhance its utility. In a study of 148 patients, RFH-NPT was identified as an independent predictor of clinical deterioration and transplant-free survival. Another study by Georgiou et al. found that RFH-NPT and LDUST were the only reliable screening tools for detecting malnutrition in patients with cirrhosis.

Secondly, we evaluated the effectiveness of anthropometrical measurements with the reference method.

Our research shows that BMI and dry BMI are not effective in accurately identifying malnourished patients. Only 2.5% were found malnourished using BMI and 8.3% using dry BMI, significantly lower than the actual rate of 60.2%. Similar results were obtained in a more recent study by Nunes et al., who reported that 8% were malnourished according to BMI. Despite this, BMI can still be a valuable tool in malnutrition screening, as the EASL algorithm recommends.

We also used MUAC and MUMC to assess malnutrition in patients. 48% were malnourished by MUAC, and 34.6% by MUMC. Both methods had strong predictive value compared to SMI + HGS. Tandon et al. also obtained similar results.

Our study found that TSF had lower prognostic power than MUMC for mortality among cirrhotic patients. Compared to SMI + HGS, TSF had a low diagnostic performance with an AUROC of 0.63 and weak agreement $k = 0.20$, $p < 0.0001$. According to Alberino F et al., TSF can be helpful in predicting the mortality rate among cirrhotic patients, although its prognostic power is relatively lower than that of MUMC.

In a study of 69 cirrhosis patients, researchers found that Mid-Arm Muscle Circumference (MAMC) and handgrip strength were the most reliable predictors of Body Cell Mass (BCM) depletion. A MAMC below 23 centimeters and handgrip strength under 30 kilograms showed high sensitivity and

negative predictive value. Other indicators like Subjective Global Assessment and biochemical factors showed poor correlation with BCM, similar to our findings.

The contractile function of skeletal muscle was assessed using Hand Grip Strength (HGS), with 62.8% of patients identified as malnourished based on HGS. HGS showed good results with a k value of 0.55, $p < 0.0001$, and a predictive value with an AUROC of 0.78, $p < 0.0001$. Additionally, studies by Tapper et al. and others, also found strong correlations between HGS and skeletal muscle measurements.

According to a recent meta-analysis [153], the measurements of Mid-Arm Muscle Circumference (MAMC) and Triceps Skinfold Thickness (TSF) effectively predict pre-transplant mortality. However, their effectiveness in predicting non-mortality endpoints and post-transplant outcomes is limited. It has also been observed that relying solely on BMI to predict outcomes in cirrhosis patients may not be reliable, as it fails to differentiate between muscle and fat compartments and does not factor in fluid retention.

We improved sarcopenia detection by using the RFH-NPT model with MUAC or MUMC, producing precise results with an AUROC of 0.89 and p-value < 0.0001. Using RFH-NPT and MUAC is faster and more convenient for patient follow-up than relying on MUMC, which requires measuring both MUAC and TSF.

The study compared different methods and found several factors associated with malnutrition/sarcopenia, including age, Child-Pugh score (especially class C), low albumin values, vitamin D deficiency, male gender, and alcoholic etiology. Previous research indicates that individuals with alcoholic liver disease are more likely to have insufficient nutritional intake compared to those with other causes of cirrhosis. Additionally, patients with Child-Pugh class B or C are at higher risk of developing malnutrition/sarcopenia. In our study, most patients were classified as Child-Pugh B and C, and alcohol abuse was the most common cause of cirrhosis in our cohort (57%), which may explain the high prevalence of malnutrition/sarcopenia.

Male patients with cirrhosis showed a higher prevalence of sarcopenia, consistent with a previous study by Fozouni L. et al., where the ratio of male to female patients with sarcopenia was 2:1, similar to our findings.

The increasing prevalence of nonalcoholic steatohepatitis-related cirrhosis has led to a rise in obesity among cirrhotic patients. Additionally, sarcopenic obesity was found to have a high prevalence of 31.7% in our study, consistent with the range of 20% to 35% reported in a review by Eslamparast T. et al.

The study had limitations such as a lack of long-term follow-up, a single-center cohort, and cohort homogeneity. Nonetheless, it made a notable contribution to understanding malnutrition and sarcopenia in cirrhotic patients, providing valuable information for nutritional assessment, especially in Romania.

- **Correlation between dietary habits and sarcopenia in patients diagnosed with liver cirrhosis.**

In our study, we evaluated the energy and protein intake of patients with cirrhosis. We found that the average energy intake of patients diagnosed with sarcopenia was lower than the recommended amount. Additionally, protein intake was notably low in the sarcopenic and sarcopenic obesity samples compared to the guidelines. These findings are consistent with the Kirrhos study, which also discovered that patients with cirrhosis did not meet the suggested levels of energy and protein intake.

All three groups had moderate carbohydrate intake, comprising 48-57% of their energy consumption. Their sugar intake was high, exceeding 22% of their total energy intake, especially in the sarcopenic obesity group. The sarcopenic obesity group had the highest average lipid intake of 43.43 ± 8.03%, which, combined with the high consumption of simple carbohydrates, may contribute to high body fat and low muscle mass. Our results align with the Buscail et al. study, which reported an average carbohydrate intake of 44-47% of total energy intake and a sugar intake of over 20% of total energy consumption.

We found that patients with sarcopenia had low consumption of non-refined cereals, legumes, fruits, and vegetables, poultry, and fish but consumed high levels of red meat and sugars, consistent with the Kirrhos study.

The dietary intake during meals and snacks was similar across all three groups, but the number of reported eating episodes did not meet the recommended range of 4-6 meals/snacks per day as suggested by ESPEN. Late-night snacking was not common, with only 6.96% and 11.8% of sarcopenic and sarcopenic obesity patients, respectively, reporting having one. This finding aligns with a study on patients with cirrhosis awaiting liver transplants. However, a 2019 meta-analysis by C-J Chen indicated that having a late-night snack can improve liver function reserve for patients with liver cirrhosis.

Our group showed a high rate of sedentary behavior and a significant incidence of alcohol consumption among sarcopenic patients.

In patients with sarcopenia and found that low dairy consumption increases the risk by twenty times. Alcohol consumption increases the risk by ten times, and low vegetable consumption increases the risk by three times. High meat consumption has a protective effect.

In patients with sarcopenic obesity, low dairy consumption increases the risk by 7.8 times, alcohol consumption by 3.8 times, low vegetable consumption by 5.2 times, and high consumption of sweets by 7.5 times. High meat consumption has a protective effect.

A recent study showed also a connection between lower prevalence of sarcopenia and higher consumption of meat, fish, eggs, vegetables, and overall food intake.

We observed that cirrhotic patients with sarcopenia have a worse prognosis than non-sarcopenic patients, regardless of their overall body weight or BMI. This was confirmed in studies showing higher mortality rates in patients with sarcopenia or sarcopenic obesity compared to nonsarcopenic patients.

The 24-hour recall method in this study may have limitations in accurately recalling food details from the previous day. We addressed this by excluding patients with hepatic encephalopathy and having a professional dietician conduct interviews. Additionally, the absence of measuring resting energy expenditure presents challenges in evaluating daily energy requirements.

- **The effects of sarcopenia on the survival and clinical outcomes of patients with liver cirrhosis.**

In 57.2% of the patients in our group, sarcopenia was identified using the EWGSOP2 criteria and EASL/AASLD cutoffs. Due to the majority of our patients being Child Pugh B and C, and the most common cause being alcohol abuse (55.2%), the elevated prevalence of sarcopenia in our group can be justified. Similar findings were reported in the literature.

Our study found no statistically significant difference in the occurrence of sarcopenia between male and female individuals with cirrhosis. However, patients with sarcopenic cirrhosis had higher mortality rates at six months and one year compared to non-sarcopenic cirrhotic patients. Additionally, sarcopenic patients had a longer hospital stay and higher 30-day readmission rates.

The presence of esophageal varices, ascites, hepatic encephalopathy, and hepatorenal syndrome are strongly correlated with sarcopenia, according to our study. Sarcopenia increases the risk of ascites

and hepatocellular carcinoma in patients with cirrhosis. It also raises the risk of urinary tract infections and spontaneous bacterial peritonitis. These findings are consistent with previous research.

Our study has limitations. It was conducted at a single center, so a larger multicenter study is needed. The cut-off values for sarcopenia were derived from a different population sample, and the lack of cohort homogeneity could also be considered a limitation.

Personal contributions and research perspectives

The study contributes to interdisciplinary research in hepatology, internal medicine, and metabolic diseases, providing new perspectives and innovative methods. It also sheds light on dietary habits among cirrhosis patients, highlighting the prevalence of malnutrition and sarcopenia. The research identifies sarcopenia as a crucial factor in predicting negative outcomes and suggests the need for standardized assessments for malnutrition and sarcopenia in cirrhosis patients. Future research proposals include expanding the patient group, regular follow-up evaluations, and developing treatments and strategies targeting frailty, malnutrition, and sarcopenia. The study acknowledges contextual limitations and emphasizes the strong conclusions drawn from empirical evidence.

Conclusions

- Malnutrition and sarcopenia are prevalent in liver cirrhosis patients, leading to worse clinical outcomes.

- Sarcopenia is linked to various cirrhosis complications and a significant correlation with HCC.

- Regular assessment and early intervention for malnutrition are crucial for cirrhosis patients.

- A proposed algorithm can aid in the early detection and management of sarcopenia/malnutrition.

- While CT imaging is the most accurate diagnostic method, a simpler alternative model using RFH-NPT and MUAC has shown excellent accuracy.

- Proper nutrition significantly influences the development of sarcopenia.

- Dietary habits significantly differ based on sarcopenia status, with lower energy and protein intake in affected patients.

- Patients with alcoholic liver cirrhosis are more prone to inadequate nutrition.

- The incidence of malnutrition and sarcopenia tends to rise in advanced liver disease stages.

- Overweight and obesity are notably prevalent among cirrhotic patients.