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Artigo Original

Clinical and nutritional evaluation indicators of patients on waiting list for liver transplantation

Indicadores de avaliação clínica e nutricional de pacientes em lista de espera para transplante hepático

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Keywords

Nutritional assessment
Anthropometry
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Objective: Comparing different methods of clinical and anthropometric assessment of pre-liver transplant patients. **Methods**: This was a cross-sectional study with quantitative approach. We analyzed data from the medical records of pre-transplant patients older than 18 who received care at a Nutrition outpatient clinic of a Liver Transplant Center in Fortaleza-CE. We collected data regarding patient identification, clinical diagnosis, nutritional assessment and diagnosis. This study was approved by the Ethics Committee in Research of Walter Cantídio University Hospital of the Federal University of Ceará. Data were analyzed in the statistical program SPSSTM version 17.0 **Results**: The sample consisted of 71 patients, with 46 men (64.8%) and 25 women (35.2%), with a mean age of 53.7 years. The average BMI was 27.2 kg/m2; most women were healthy (60.0%) and most men were with excess of body weight (69.0%). As for the nutritional diagnosis according to the percentage of adequacy of the mid-upper arm circumference, we noted that 52.4% and 43.6% of female and male patients, respectively, showed some level of protein-calorie malnutrition. For the triceps skin fold, we noticed that most male patients (54.5%) were diagnosed as being overweight or obese. When assessing the percentage of adequacy of the mid-upper arm muscle area, most patients of both sexes had some level of malnutrition (62.3%). No significant correlation was observed between the MELD and Child-Pugh severity score (indices that encompass biochemical and clinical parameters for the prognostic evaluation of end-stage liver disease) and anthropometric variables. **Conclusion**: The severity indicators of the disease were not related to the anthropometric indices, but most patients who are eligible for a liver transplant were overweight according to BMI, although suffer from muscle mass depletion according to mid-upper arm muscle are, which shows the necessity of the combined use of several nutritional assessment methods in order to achieve a diagnosis of their body composition and, consequently, a faithful nutritional diagnosis.

Palavras-Chave

Avaliação nutricional
Antropometria
Transplante de fígado

***Objetivo**: Comparar diferentes métodos de avaliação clínica e antropométrica de pacientes pré-transplante hepático. **Métodos**: O estudo foi do tipo transversal com abordagem quantitativa. Foram analisados dados dos prontuários dos pacientes no pré-transplante maiores de 18 anos atendidos no ambulatório de Nutrição de um centro de transplante de fígado em Fortaleza-CE. Foram coletados dados relativos à identificação, diagnóstico clínico de gravidade da doença, avaliação e diagnóstico nutricional. O estudo foi aprovado pelo Comitê de Ética do Hospital Universitário Walter Cantídio da Universidade Federal do Ceará. Os dados foram analisados no programa estatístico SPSS® versão 17.0. **Resultados**: A amostra foi composta por 71 pacientes, sendo 46 homens (64,8%) e 25 mulheres (35,2%) com idade média de 53,7 anos. O IMC médio foi de 27,2Kg/m2, tendo a*

maioria das mulheres se apresentado eutrófica (60,0%) e a maior parte dos homens com excesso de peso (69,0%). Quanto ao diagnóstico nutricional segundo o percentual de adequação da circunferência braquial, observou-se que 52,4% e 43,6% dos pacientes do sexo feminino e masculino, respectivamente, apresentaram algum grau de desnutrição proteico-calórica. Para a dobra cutânea tricipital, pôde-se verificar que 54,5% dos homens apresentou diagnóstico de sobrepeso ou obesidade. Na avaliação do percentual de adequação da área muscular do braço, a maioria dos pacientes de ambos os sexos demonstrou algum grau de desnutrição (62,3%). Não foi observada correlação significativa entre os índices de gravidade MELD e Child-Pugh (índices que englobam parâmetros bioquímicos e clínicos para avaliação prognóstica da doença hepática em estágio final) e as variáveis antropométricas. ***Conclusão****: Os indicadores de gravidade da doença não tiveram relação com os índices antropométricos, entretanto a maioria dos pacientes candidatos a transplante hepático encontrava-se com excesso de peso pelo IMC, porém com depleção de massa muscular pela área muscular do braço, o que mostra a necessidade da utilização combinada de vários métodos de avaliação nutricional para que se obtenha um diagnóstico da composição corporal e, consequentemente, um diagnóstico nutricional fidedigno.*

INTRODUCTION

A liver transplant is recommended for patients who have chronic liver failure of multivariate etiology, such as: chronic hepatocellular diseases, metabolic liver diseases, chronic cholestatic liver diseases, vascular live diseases and primary liver tumors[1, 2, 3].

The liver is the largest metabolic organ in the human body and it takes part in several complex biochemical processes: metabolism of carbohydrates, proteins and lipids, storage of vitamins and activation, detoxification and excretion of endogenous and exogenous products. Protein-calorie malnutrition (PCM) can be observed during liver failure, and it is highly prevalent and predictive of morbidity and mortality[4, 5].

A patient's pre-operative nutritional status influences their prognosis. Hypermetabolic and malnourished patients have greater risk of mortality when submitting to a transplant. Such patients require the implementation of strategies whose aim is to improve their nutritional status[6].

Simple methods, such as the Subjective Global Assessment (SGA) or anthropometry measurements, are regarded as adequate to identify patients at nutritional risk. Other methods, such a physical examination, muscular strength and bioelectrical impedance can also be part of the nutritional assessment. One must be aware of patients who show fluid retention (edema and ascites), and in such cases measuring subcutaneous fat using skin folds and lean mass using area measurements is recommended (Mid-Upper Arm Muscle Area)[6, 7, 8].

The goals of nutritional therapy for liver disease patients who suffer from liver failure are to improve quality of life through liver functional improvements; maintaining or recovering adequate weight; controlling muscular and visceral protein catabolism; maintaining nitrogen balance, acute-phase protein synthesis and liver regeneration without increasing the risk of hepatic encephalopathy[7, 8].

Therefore, diagnosing patient's pre-transplant nutritional status is crucial in order to establish adequate diet options aiming to achieve an adequate nutritional status and improve the patient's prognosis.

The goal of this study was to compare different clinical indicators and nutritional status assessment methods for patients in the period which precedes a liver transplant.

METHODS

This was a cross-sectional study with a quantitative approach. We analyzed data from the Nutritional Medical Records of patients older than 18 who received care at the Nutrition outpatient clinic at a Liver Transplant Center in Fortaleza-CE, from January 2011 to June 2012 and from August 2013 to November 2013. We considered data from the latest appointment recorded in the medical records.

We collected data regarding patient identification such as name, date of birth, age, clinical diagnosis, model for end-stage liver disease (MELD) and Child-Pugh scores and nutritional assessment and diagnosis.

The MELD and Child-Pugh scores are prognostic models for end-stage liver disease[9]. The former encompasses objective variables such as serum creatinine, total bilirubin and international normalized ratio (INR) in a formula with a result ranging from 6 (less severe status) to 40 (more severe status)[10]. The latter uses the objective variables serum albumin, serum bilirubin and prothrombin time, and the subjective variables ascites and hepatic encephalopathy, classifying the patient into three levels of disease severity (A, B or C, in ascending order of scoring for severity) according to the sum of the points assigned to these parameters [9].

For nutritional assessment and diagnosis, we recorded, based on the clinic's standardized Nutritional

Medical Records, weight, height, mid-upper arm circumference (MUAC) and triceps skin fold (TSF) measurements. We also collected data such as patients' usual weight. We also collected indices such as the body mass index (BMI), percentage of weight loss and percentage of adequacy of MUAC, TSF and mid-upper arm muscle area (MUAMA). In order to classify the BMI, we used the World Health Organization (WHO) criteria[11, 12]. The assessment of the adequacy of current weight in relation to habitual weight was conducted using the criteria proposed by Blackburn and Harvey[13]. In order to classify individuals according to the percentage of adequacy of the MUAC, of the TSF, and of the MUAMA, we also used the cut-off points proposed by Blackburn and Harvey[13]. In order to calculate patients' current weight, we discounted the water weight estimated according to the intensity of ascites and/or of peripheral edema, according to James[14].

Descriptive analysis was performed to show simple frequency, percentage and standard deviation. In order to analyze the linear correlation between the MELD severity score and the studied anthropometric variables we used Pearson's "r" test. For the Child-Pugh score we used the Kruskal-Wallis statistical test. Statistical significance was considered when $p < 0.05$. Analyses were performed using SPSS™ 17.0 software (Chicago, IL, USA).

This study follows the Regulatory Guidelines for Research involving Human Beings – Resolution Nº 466 of the National Health Council [15] and was approved by the Ethics Committee in Research of Walter Cantídio University Hospital of the Federal University of Ceará under number 740.569.

RESULTS

We reviewed the medical records of 71 patients, 46 male (64.8%) and 25 female (35.2%). Patients were aged 18 to 68 years old, and the mean age was 53.7 years (± 9.6 years). The average MELD was 15.8 (± 4.0), while the average among male patients was 15.4 (± 4.3) and among female patients was 16.5 (± 3.6). As for the Child-Pugh classification, we noticed a greater prevalence of Child-Pugh B patients (60.9%), followed by Child-Pugh C (21.9%) and Child-Pugh A (17.2%).

Table 1 shows the distribution of patients in absolute figures and in percentages according to diagnosis through different anthropometric measurement methods.

When analyzing weight and height data according to BMI categorization, the average BMI was 27.2 kg/m^2 (± 4.6). We observed that most female patients were healthy and most male patients were overweight according to this parameter.

Table 1: Nutritional diagnosis according to different nutritional parameters in pre-liver transplant patients. Fortaleza-CE, 2014.

Anthropometric Variables	Male		Female		Total	
	n	%	n	%	n	%
BMI						
Malnutrition	2	4.4%	0	0%	2	2.9%
Healthy	12	26.7%	15	60.0%	27	35.6%
Overweight	21	46.7%	6	24.0%	27	35.6%
Obesity 1	7	15.6%	3	12.0%	10	14.3%
Obesity 2	3	6.7%	1	4.0%	4	5.7%
MUAC						
Severe PCM	2	5.1%	0	0%	2	3.3%
Moderate PCM	7	18.0%	8	38.1%	15	25.0%
Mild PCM	8	20.5%	3	14.3%	11	18.3%
Healthy	18	46.2%	7	33.3%	25	41.7%
Overweight	3	7.7%	0	0%	3	5.0%
Obesity	1	2.6%	3	14.3%	4	6.7%
TSF						
Severe PCM	5	15.2%	7	35.0%	12	22.6%
Moderate PCM	3	9.1%	0	0%	3	5.6%
Mild PCM	4	12.1%	3	15.0%	7	13.2%
Healthy	3	9.1%	6	30.0%	9	17.0%
Overweight	2	6.1%	2	10.0%	4	7.6%
Obesity	16	48.5%	2	10.0%	18	34.0%
MUAMA						
Severe PCM	1	3.0%	0	0%	1	1,9%
Moderate PCM	5	15.2%	4	20.0%	9	17.0%
Mild PCM	17	51.5%	6	30.0%	23	43.4%
Healthy	10	30.3%	10	50.0%	20	37.7%

BMI: body mass index; MUAC: mid-upper arm circumference; TSF: triceps skin fold; MUAMA: mid-upper arm muscle area.

Regarding the MUAC, male and female patients had an average MUAC of 28.7 cm (± 4.7 cm) and 27.5 cm (± 5.7 cm), respectively. As for the nutritional diagnosis according to the percentage of adequacy of that measurement, we noted that 52.4% of female patients showed some level of PCM, with many of the patients being diagnosed with moderate PCM. With respect to male patients, 43.6% also showed some level of PCM.

In the analysis of TSF results, we observed an average TSF of 15.0 mm (± 7.2) for male patients and of 18.0 mm (± 6.2) for female patients. The average percentage of adequacy for male patients was 127.4% and 88.4% for female patients. Regarding the nutritional diagnosis according to that measurement's percentage of adequacy, we observed that most male patients (54.5%) were diagnosed as being overweight or obese according to this parameter. Most female patients (35.0%) were diagnosed with severe PCM.

The MUAMA allows us to assess an individual's protein reserve. Regarding the MUAMA, measurements for male and female patients were 23.9 cm (± 3.3 cm) and 21.8 cm (± 4.3 cm), respectively. With respect to that measurement's percentage of adequacy, the average for male patients was

88.3% and 96.5% for female patients. Regarding the nutritional diagnosis obtained through the percentage of adequacy of that measurement, we can observe that 69.7% of male patients showed some level of PCM, while most (51.5%) have a mild PCM.

Figure 1 allows us to make a comparative analysis of the distribution of individuals by percentage according to their nutritional diagnosis by different methods used in this study. We can see a large variation in the results obtained.

Figure 1: Comparison of the percentage distribution of studied patients according to different methods of nutritional diagnosis analyzed. Fortaleza-CE, 2014. BMI: body mass index; MUAC: mid-upper arm circumference; TSF: triceps skin fold; MUAMA: mid-upper arm muscle area.

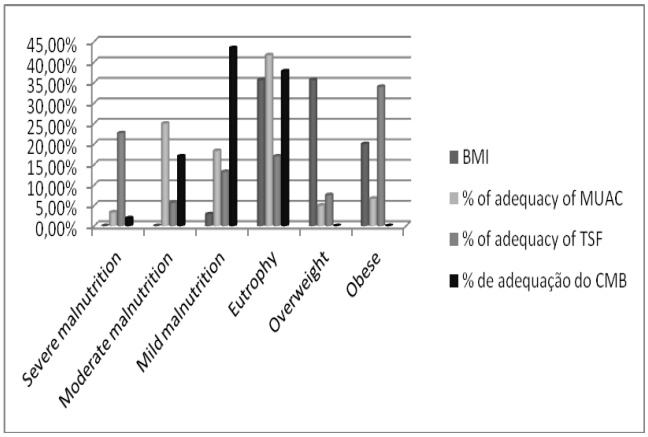

Table 2 shows the results from the linear correlation analysis through Pearson's "r" test of the MELD severity score with the studied anthropometric variables. There was no statistically significant correlation. In the analysis of averages using the Kruskal-Wallis test, we observed no statistically significant difference between averages within the sub-classification of the Child-Pugh severity score (Table 2).

Table 2: Analysis of the linear correlation between MELD and Child-Pugh and the studied anthropometric variables using Pearson's "r" test and Kruskal-Wallis' test. Fortaleza-CE, 2014.

Anthropometric Variables	Pearson's "r" Test		Kruskal-Wallis' Test	
	r	p	χ^2	p
BMI				
Males	-0.06	0.68	0.19	0.91
Females	-0.17	0.42	1.01	0.60
MUAC				
Males	-0.06	0.75	0.78	0.68
Females	-0.00	0.99	3.53	0.17
TSF				
Males	-0.10	0.57	1.01	0.61
Females	0.03	0.89	1.61	0.45

Table 2 (continued)

Anthropometric Variables	Pearson's "r" Test		Kruskal-Wallis' Test	
	r	p	χ^2	p
MUAMA				
Males	-0.04	0.85	0.85	0.65
Females	0.02	0.95	3.36	0.18

BMI: body mass index; MUAC: mid-upper arm circumference; TSF: triceps skin fold; MUAMA: mid-upper arm muscle area.

DISCUSSION

A nutritional assessment and early malnutrition diagnosis in this group of patients is extremely relevant, because the pre-transplant nutritional status influences the patients' post-transplant prognosis[6].

In a study conducted by Anastácio et al.[16] with 163 patients and which aimed at assessing weight loss and its risk factors during the course of liver disease until the first consultation after the transplant, researchers observed that patients lost 7.70 ± 12.40 kg, on average, while they were sick, regardless of age, sex, education and income. However, the cause of liver disease was related to weight loss, while patients who were diagnosed with alcoholic cirrhosis lost significantly more weight. Other variables independently associated with weight loss were being an ex-smoker, having a higher body mass index and being overweight before the liver disease.

In his study which aimed at assessing the food intake of 25 patients with cirrhosis through a three-day food diary and use of a scale, establishing a correlation with nutritional status and the disease's staging, Nunes[17] found that 56.0% of the sample was malnourished according to the nutritional assessment conducted with MUAC measurements, strength of handshake of one's non-dominant hand (HS) and the phase angle by bioelectrical impedance analysis using the cutoff points of the Brazilian population. The average calories consumed were 26.4 ± 8.3 Kcal/kg, carbohydrates 56.4% ± 7.1 of the total energy value (TEV), proteins 1.05 ± 0.35 g/kg and lipids 29.3% of the TEV. Malnourished patients tended to consume less calories and proteins than those who were well nourished. In conclusion, the author verified that food consumption made no significant difference on the Child-Pugh scores and according to the nutritional status.

As in the present research, a study conducted by Mendes et al.[18] which assessed 85 outpatient clinic patients candidates for liver transplantation, 25.9% of patients were healthy, while over 70.0% were overweight or obese

according to the BMI, which may be attributed to fluid retention, which underestimates malnutrition diagnosis in these patients by BMI[7].

In their study which aimed at validating BMI cutoff points to detect malnutrition according to the level of ascites in hospitalized patients with cirrhosis, Campillo, Richardet and Bories[19] assessed 875 individuals, 327 of which did not have detectable ascites, 270 suffered from mild ascites and 278 had tense ascites. They recorded anthropometric measurements for weight, height, MUAC and TSF after admission or a short time later, when patients were suffering from encephalopathy. BMI cutoff points of 22.0 kg/m^2 for non-ascitic patients, 23.0 kg/m^2 for patients with mild ascites and 25.0 kg/m^2 for patients with tense ascites were validated and provided sensibility and specificity higher than 85.0% across the entire studied population. When we assess our patients according to this cutoff point proposal, we find that 18.8% of the sample is malnourished, while when using the cutoff points proposed by the WHO[11, 12] only 2.9% of the sample had the same diagnosis.

In their study with 49 patients with chronic liver diseases, do Nascimento, da Silva Pinto and Pereira da Silva[20] observed that malnutrition was found in 6.1% of patients through the BMI, 69.4%, 53.2%, and 89.1% through MUAC, TSF and MUAMA measurements, respectively, 8.2% through SGA and 73.5% through the HS. Such results confirm those in our study, which show a nutritional diagnosis through MUAC, TSF and MUAMA adequacy as the most sensitive for diagnosing malnutrition in this group of patients.

The work of Fernandes et al.[21] aimed at identifying a method that would offer a safe and efficient nutritional diagnosis for cirrhotic patients. The authors assessed 129 patients with cirrhosis using anthropometric measurements (weight, height, BMI, MUAC, TSF and mid-upper arm muscle circumference (MUAMC)), SGA, dynamometry and BIA. A comparison of those different methods of diagnosis showed conflicting results, with the percentage of malnourished patients ranging from 5.4% to 68.2%, diagnosed by BMI and dynamometry, respectively. The percentage of malnourished individuals according to MUAC, TSF and MUAMC measurements was 14.0%, 11.6% and 13.2%, respectively. In our study, the percentages of malnourished patients were higher than Fernandes et al. study, especially when assessed according to MUAMA measurements (62.3%), indicating that this parameter may be more sensitive to detect malnutrition in patients pre-transplantation.

Evaluating 300 patients treated for the first time at an outpatient clinic for liver diseases, Carvalho and Parise[22] found a high prevalence of PCM (75.3%), while 38.3% of them already had moderate and severe malnutrition, regardless of the cause. Patients with moderate and severe PCM had a worse intake of protein and energy. Due to the variables sex and cause, fat reserves, assessed by the TSF, were more depleted in cirrhotic women than in cirrhotic men (48.6% vs 26.6%). Muscle reserves, assessed according to the MUAC, were more depleted in cirrhotic men (43.4% x 13.4%), regardless of the cause of cirrhosis. Those results contradicted the results obtained in our study.

In a study conducted by Reis and Cople[23] with 50 patients (47 men and 3 women) treated at a nutrition outpatient clinic and whose goal was to identify the impact of the alcoholic cirrhosis injury on a patient's nutritional state and the efficacy of diet therapy improving nutritional depletion, the percentage of patients who showed nutritional depletion according to the assessment of MUAC adequacy was much higher than in this study, with 16.0% of patients showing mild depletion, 22.0% moderate depletion and 58.0% severe depletion. With respect to TSF measurements, the results obtained by the same study also showed greater impairment of the nutritional status, with 12.0% of the sample showing mild depletion, 24.0% moderate depletion and 60.0% severe depletion. As for the assessment of the MUAMA, results followed the same trend, with mild depletion affecting 8.0% of patients, moderate depletion affecting 24.0% and severe depletion affecting 64.0%. Such results can be attributed to the constant caloric exchange made by alcoholics between alcohol and food intake. Therefore, patients suffering from chronic alcoholic liver disease have a severely compromised nutritional status.

Maio, Dichi and Burine[24] conducted a study which aimed at conducting a comparative investigation of nutritional indicators in patients with chronic liver disease and its relationship with the level of liver function impairment. Unlike the results obtained in our study, among the lean mass indicators (MUAC and MUAMA), the MUAC was the one which detected greater prevalence of deficit (61.0%). The prevalence of nutritional deficit through TSF measurements was 55.0%, a result that is higher than what we found in our study. Muscle mass deficiency was related to the severity of the liver disease. The use of anthropometric measurements as nutritional indicators is sensitive due to the chronic protein-energy deficit in those patients, with the exception of body weight and BMI. Those cirrhotic patients with moderate to severe disease are chronically malnourished patients who were diagnosed using simple and low-cost tools under a combination of two associated indicators: an adiposity indicator (TSF or subscapular skin fold) and a lean mass indicator (MUAC). The authors of that study reached the conclusion that PCM in cirrhosis is predominantly proteic, and it may be detected with more specificity by the MUAC.

As in other studies we already discussed[20, 21, 23, 24], in our study we observed greater prevalence of malnutrition when the diagnosis is made using the MUAC and/or MUAMA measurements as opposed to the BMI. This can be attributed to the fact that such malnutrition is predominately proteic and those measurements are more appropriate to detect the muscle mass reserve of that body compartment.

In a study conducted by Leitão et al.[8] 32 patients eligible for a liver transplant were assessed with respect to their nutritional status and physical capacity. The researchers observed high prevalence of physical incapacity and malnutrition regardless of the level of liver dysfunction assessed according to the Child-Pugh score. In this study, the nutritional status was assessed based on anthropometric (TSF, MUAC and MUAMA), hematological (hematocrit) and immunological (total lymphocyte count) parameters. The nutritional diagnosis was made from an analysis of parameters as a whole, according to Mendenhall's proposal and classified according to Blackburn[8].

As in our study, Gottsschal et al.[25] also found a high prevalence of healthy or overweight patients according to the BMI in their research of 34 adults suffering from cirrhosis caused by hepatitis C virus. According to their results, 13 (38.2%) patients were healthy and 21 (61.8%) were overweight. When assessed according to the Nutritional Subjective Global Assessment (NSGA), 22 (64.7%) of those patients were well nourished and 12 (35.3%) were mildly malnourished. As for TSF assessment, six (17.6%) patients had some level of malnutrition and for MUAMA assessment two (5.9%) were malnourished. Measurements of the HS using dynamometry showed that 27 patients (79.4%) were at nutritional risk and only seven patients were well nourished. In conclusion, the authors suggested that the HS seems to be the most sensitive method to make a nutritional diagnosis of those patients.

A review conducted by Johnson et al.[26], which aimed to discuss different nutritional assessment methods, as well as their limitations and/or uses in patients with advanced liver disease, showed that HS found to better predict complications of cirrhosis over the SGA, BMI, skin fold, MUAC, and BIA.

CONCLUSION

The disease severity according to MELD and Child-Pugh scores did not show any correlation with studied anthropometric variables. Nevertheless, most patients who are eligible for liver transplant suffer from muscle mass depletion according to MUAMA, although they were overweight according to BMI, and require the combined use of several nutritional assessment methods in order to achieve a diagnosis of their body composition and, consequently, a faithful nutritional diagnosis. BMI and TSF seem to be less specific in detecting malnutrition than MUAC and MUAMA. Muscle mass impairment and the presence of ascites lead to BMI to be limited as an isolated anthropometric measure in patients as end-stage liver disease.

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