Nutrición Hospitalaria

Trabajo Original

Paciente crítico

One-year follow-up of the nutritional status of patients undergoing liver transplantation

Seguimiento a un año del estado nutricional de los pacientes sometidos a trasplante hepático

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Abstract

Background: Choosing the method of nutritional assessment is essential for proper follow-up of the nutritional status of patients undergoing liver transplantation.

Objectives: Evaluate and compare the nutritional status of cirrhotic patients before and after liver transplantation over a year by different methods of nutritional assessment.

Methods: Patients undergoing liver transplantation were assessed in five phases: pre-transplant, 1, 3, 6 and 12 months after transplantation at the hospital Santa Casa de Misericordia de Porto Alegre, RS, Brazil. The methods used for nutritional assessment were anthropometry, grip strength of the non-dominant hand (HGS) by dynamometry, thickness of the adductor pollicis muscle (APM) and phase angle (PA) by bioelectrical impedance analysis (BIA). In all evaluations, the same measurements were taken.

Results: Evaluations were performed in 22 patients. Methods that showed a higher prevalence of malnourished patients before transplantation were PA by BIA (25%), arm muscle circumference (AMC) (21.9%) and arm circumference (AC) (18.8%). When comparing the nutritional status of patients during follow-up, there was a significant difference only in the evaluation methods AC, triceps skinfold thickness and PA by BIA. At the end, the methods of nutritional assessment were compared again. They showed a significant statistical difference, with HGS being the best method for detecting malnutrition.

Conclusions: In conclusion, it is suggested that the method PA by BIA could be widely used with this population since the results are consistent with other findings in the literature and they are significant, reliable, and reproducible.

Key words:

Nutritional assessment. Cirrhosis. Bioimpedance. Liver transplantation.

Resumen

Introducción: la elección del método para la evaluación nutricional es fundamental para el correcto seguimiento del estado nutricional de los pacientes sometidos al trasplante de hígado.

Objetivos: evaluar y comparar el estado nutricional de los pacientes antes y después del trasplante de hígado por el tiempo de un año para los diferentes métodos de evaluación nutricional.

Métodos: se evaluaron los pacientes que se sometieron a un trasplante de hígado en diferentes momentos: pretrasplante, 1, 3, 6 y 12 meses después del procedimiento, en la Hermandad de la Santa Casa de Porto Alegre, Porto Alegre, RS, Brasil. Los métodos utilizados fueron la antropometría, la fuerza de apretón de manos por la fuerza de agarre no dominante (FAM), el espesor del músculo aductor del pulgar y el ángulo de fase (AF) por bioimpedancia eléctrica (BIA). En todas las evaluaciones se tomaron las mismas medidas.

Resultados: las evaluaciones se llevaron a cabo en 22 pacientes. Los métodos que mostraron mayor prevalencia de pacientes desnutridos antes del trasplante fueron la FA por BIA (25%), la circunferencia muscular del brazo (CMB) (21,9%) y la circunferencia del brazo (CB) (18,8%). Al comparar el estado nutricional de los pacientes durante el seguimiento, hubo diferencia significativa en los métodos de evaluación de CB, espesor del pliegue cutáneo tricipal y AF por la BIA. Al final del seguimiento, los métodos de evaluación nutricional fueron nuevamente comparados y mostraron de diferencias significativas, siendo la FAM el método de mayor detección de desnutrición.

Conclusiones: se sugiere que podría intensificarse el uso del método AF por la BIA en esta población, ya que los resultados están en consonancia con los encontrados en la literatura, siendo significativos, fiables y reproducibles.

Palabras clave:

Evaluación nutricional. Cirrosis. Bioimpedancia. Trasplante hepático.

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INTRODUCTION

Protein energy malnutrition (PEM) is frequently found in cirrhotic patients and it leads to severe effects on their overall condition, with direct impact on the prognosis, impairing liver function, adversely affecting the clinical evolution of cirrhotic patients (1-3), and reflecting on patient morbidity and mortality (4,5).

Patients in more advanced stages of chronic liver disease, submitted to liver transplantation, have a more compromised clinical status. In them, complications of cirrhosis, such as malnutrition, are more common since the PEM in patients with advanced liver failure is more prevalent (6).

Nutritional assessment is critical in the investigation of changes associated with liver disease, since it is through it that the correction conduct or maintenance of nutritional status will be based on (4,7).

However, to date, there is no "golden standard" method to accurately diagnose changes in the nutritional status of these patients. Liver transplantation has significant nutritional implications both in the pre-, peri- and post-surgical phases. Patients on waiting lists are often malnourished due to several factors associated with the disease, the treatment (8), and possibly due to iatrogenic conducts (9).

Choosing the method of nutritional assessment is essential for an accurate diagnosis, both in the pre- and post-operative period, to ensure adequate follow-up of the nutritional status of these patients (10). With an appropriate assessment of the nutritional status, intervention will or will not be necessary to ensure better survival of transplanted patients.

Therefore, the purpose of this study was to evaluate and compare the nutritional status of cirrhotic patients before and after liver transplantation over a year of follow-up by different methods of nutritional assessment.

METHODS

A prospective cohort study was conducted. The study included adult patients (over 18 years of age) in the transplant waiting list and submitted to liver transplantation at Hospital Dom Vicente Scherer of the Irmandade Santa Casa de Misericórdia de Porto Alegre, Rio Grande do Sul, Brazil. All patients agreed to participate in the study by reading and signing the free and informed consent form. The research project was approved by the Ethics Committee of the Federal University of Health Sciences of Porto Alegre (UFCSPA), protocol No. 733/08. Data were collected from June 2011 to December 2013.

Patients who did not have physical and psychological conditions, patients with neuromuscular disorders in the upper limbs, and patients undergoing double transplantation or retransplantation were excluded from the study.

The patients were interviewed and assessed on the day of the surgery or one day before, and after 1, 3, 6, and 12 months following surgery. The pre-transplant evaluation was performed

as soon as the patient checked in for the procedure. Subsequent evaluations were performed in bed, when the patient was hospitalized, or during appointment previously scheduled at the Gastroenterology Outpatient Clinic at the Hospital Santa Clara of the Irmandade Santa Casa de Misericórdia of Porto Alegre.

The same measurements were obtained during all evaluations, according to a protocol and performed by previously trained people. The assessment of nutritional status was performed by applying diagnostic procedures in sequence: anthropometry, grip strength of the non-dominant hand (HGS), adductor pollicis muscle (APM), and phase angle (PA) by bioelectrical impedance analysis (BIA).

Classic anthropometry was performed using weight, height, triceps skinfold (TSF), arm circumference (AC), arm muscle circumference (AMC), and body mass index (BMI), the last two obtained by mathematical formulas. To measure height, a fixed wall stadiometer was used. To measure weight, a scale with a 100-g range (Filizola®) was used. To determine a skinfold measurements and circumferences, a scientific skinfold caliper (Cescorf®) and an inelastic tape, respectively, were used. BMI calculation (weight divided by height squared) allowed classification of the nutritional status according to the recommendations of the World Health Organization (11). The results obtained for the remaining indicators were related to the default values shown in Frisancho's percentiles tables, 1990 (12) and classified according to Blackburn and Thorton, 1979 (13).

HGS was measured by dynamometry (7), using a mechanical dynamometer (Baseline®, Smedley Spring model). The results obtained were classified according to Budziareck et al., 2008 (14). To measure the thickness of the adductor pollicis muscle, a Cescorf® scientific caliper was used. The results obtained were classified according to Lameu et al. (15).

The PA for classifying the nutritional status was measured by bioelectrical impedance with a Biodynamic model 450 device (Seattle, WA, USA). The patient remained in supine position, with hands and feet parallel to the body. A pair of electrodes was placed on the dorsal side of the hand near the middle finger and another at the wrist joint, both on the right side of the body. Another pair of electrodes was placed on the dorsal side of the foot, at the middle toe and the ankle, always on the right side of the body. The electric current used was 80A A and 50 kHz, which allowed measuring the resistance and reactance, thus obtaining the value of the phase angle. The PA is derived from two segments of body composition, calculated by using following formula: $PA = arctangent (Xc/R) \times 180/3.1416$, as proposed by Barbosa-Silva et al. (16). The results allow classifying the patients according to their nutritional status. The patients were classified according to the cutoff points established (5.44) in a study previously conducted with a similar population (17).

Statistical analyses of the data were performed using the SPSS (Statistical Package for Social Sciences) software version 17.0 and a significance level of 5% ($p \leq 0.05$). The quantitative variables were described by mean and standard deviation, while the qualitative variables were described by absolute and relative frequencies. To associate categorical variables, Fischer's exact test

was applied. To compare the methods of nutritional assessment, the Cohran test was applied and with regard to statistical significance, the McNemar's test was used.

RESULTS

Initially, 38 patients were assessed, but six patients were excluded from the study because they did not undergo transplantation right after the initial assessment. Thus, the sample initially consisted of 32 patients who underwent liver transplantation, with a mean age of 57.3 ± 7.9 years, of whom 23 (71.9%) were male. As for severity of the liver cirrhosis, 19 (59.4%) patients were classified as Child Pugh B, 10 (31.3%) Child Pugh A, and only three (9.4%) as Child Pugh C. The pre transplantation MELD (Model for End-Stage Liver Disease) had an average score of 24.9 ± 4.6. The sample characterization is shown in table I.

Out of the 32 patients who underwent liver transplantation, only 22 completed the study up to this date. Therefore, the final sample consisted of 22 patients (68.8%). The losses were due to death (n = 2), withdrawal from the study (n = 4), and an incomplete year of post-transplantation follow-up (n = 4), which will occur in February 2014. Of these 10 losses, all patients were male.

For statistical purposes, it is important to note that the same crosschecking was made with the four patients who have not yet completed the study (and who were assessed for only six months) and no result differing from the current result was found. Therefore, we decided to continue the analyses without them and to include them in the study only after completing the follow-up.

According to the nutritional assessment methods used, BMI and APM did not diagnose any patient as malnourished during the pre-transplant period. The methods that diagnosed the highest number of malnourished patients were PA by BIA (25%), AMC (21.9%), and AC (18.8%). There was a significant difference between the nutritional assessment methods (p = 0.014). The anthropometric characteristics are shown in table II.

When comparing the nutritional status of patients during follow-up, there was only a significant difference in the evaluation methods of AC (p = 0.009), TSF (p = 0.044), and PA by BIA (p = 0.008). The malnutrition behaviors by the methods AC and PA by BIA were very similar, with the percentage of malnourished patients being significantly higher after one month of transplantation when compared to the percentage after six months, and one year after transplantation. Regarding TSF, the decrease in the percentage of malnourished patients occurred between the pre-transplant period and after sixth month from transplantation. However, the same result could not be observed after only one month from surgery, as observed in the other methods. These results are shown in table III.

At the end of follow-up, the methods of nutritional assessment were again compared. They showed a significant statistical difference (p = 0.049), with HGS being the method that better detected malnutrition when compared to APM, which, in its turn, did not identified any malnourished patient, as shown in figure 1.

A new variable was created to determine the association between pre-transplant nutritional assessment and one-year post-transplantation nutritional assessment by different methods. Patients were considered malnourished at the end of follow-up if this characteristic was identified by at least one of the methods. Thus, 10 malnourished patients (45.5%) were found by at least one of the methods of nutritional assessment at the end of follow up. When comparing this variable with pre-transplant malnutrition identified by the methods, there was an association with PA by BIA (p = 0.010) and HGS (p = 0.029). All patients identified by HGS and PA as malnourished during the pre-transplant period presented malnutrition after one year of post-transplant follow-up by at least one of the methods. On the other hand, of all patients identified as well-nourished by PA and HGS during the pre-transplant

Table I. Sample characterization

Characteristics	Initial sample (n = 32)	Final sample (n = 22)
Age – mean ± SD	57.3 ± 7.9	57.1 ± 8.2
Males – n (%)	23 (71.9)	13 (59.1)
Child Pugh – n (%)		
A	10 (31.3)	6 (27.3)
B	19 (59.4)	14 (63.6)
C	3 (9.4)	2 (9.1)
MELD – mean ± SD	24.9 ± 4.6	23.5 ± 3.8

SD: Standard deviation; MELD: Model for End Stage Liver Disease.

Table II. Pre-transplant nutritional status of patients by the different methods (n = 32)

Characteristics	Well-nourished n (%)	Malnourished n (%)
BMI	32 (100)	0 (0.0)[a]
AC	26 (81.3)	6 (18.8)[b]
TSF	28 (87.5)	4 (12.5)[ab]
AMC	25 (78.1)	7 (21.9)[b]
HGS	27 (84.4)	5 (15.6)[ab]
APM	32 (100)	0 (0.0)[a]
PA-BIA	24 (75.0)	8 (25.0)[b]

[a,b]*Same letters do not differ by McNemar's test at 5% significance. BMI: Body mass index; AC: Arm circumference; TSF: Triceps skinfold; AMC: Arm muscle circumference; HGS: Non-dominant hand grip strength; APM: Abductor pollicis muscle; PA-BIA: Bioelectrical impedance analysis by phase angle.*

assessment, 29.4% and 33.3%, respectively, were considered malnourished at the end of one year by any one of the nutritional assessment methods, as shown in figure 2.

DISCUSSION

The results provide a prospective description of the nutritional status in the first year after transplantation. The methods used are non-invasive, inexpensive, easily reproducible and they are thus tools that can be used in routine evaluations of these patients. These methods have been widely used with patients with chronic liver disease and are recommended by recent guidelines (18). The main finding of this study is that the nutritional status significantly improved in malnourished cirrhotic patients during the first 12 months after transplantation, as shown by three methods. These patients showed a significant improvement during follow-up.

Table III. Malnutrition assessment before, at 1, 3, 6 months, and 1 year after transplantation (n = 22)

Methods n (%)	Pre-tx	1 month post-tx	3 months post-tx	6 months post-tx	1 year post-tx	p*
BMI	0 (0.0)	1 (4.5)	1 (4.5)	1 (4.5)	1 (4.5)	0,856
AC	4 (18.2)[ab]	8 (36.4)[b]	5 (22.7)[ab]	1 (4.5)[a]	2 (9.1)[a]	0.009
TSF	4 (18.2)[b]	2 (9.1)[ab]	2 (9.1)[ab]	0 (0.0)[a]	1 (4.5)[ab]	0.044
AMC	4 (18.2)	6 (27.3)	4 (18.2)	1 (4.5)	2 (9.1)	0.193
HGS	4 (18.2)	6 (27.3)	2 (9.1)	3 (13.6)	6 (27.3)	0.171
APM	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	-
PA-BIA	5 (22.7)[ab]	9 (40.9)[b]	5 (22.7)[ab]	2 (9.1)[a]	3 (13.6)[a]	0,008

Cochran's test.

[a,b] *Same letters do not differ by McNemar's test at 5% significance.*

BMI: Body mass index; AC: Arm circumference; TSF: Triceps skinfold; AMC: Arm muscle circumference; HGS: Non-dominant hand grip strength; APM: Abductor pollicis muscle; PA-BIA: Bioelectrical impedance analysis by phase angle.
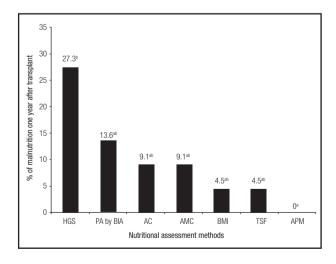

Figure 1.

Comparison of nutritional assessment methods after one year of follow-up (n = 22) ([a,b]Same letters do not differ by McNemar's test at 5% significance. HGS: non-dominant hand grip strength; PA by BIA: phase angle by bioelectrical impedance analysis; AC: arm circumference; AMC: arm muscle circumference; BMI: body mass index; TSF: triceps skinfold; APM: abductor pollicis muscle).
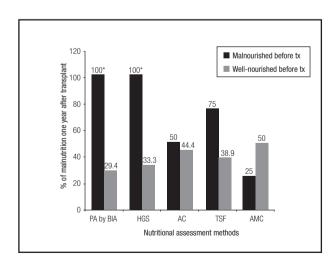

Figure 2.

Association between nutritional assessment by different methods in the pre-transplant period and one year after transplantation (n = 22) (*p < 0.05 Fischer's exact test) (PA by BIA: Phase angle by bioelectrical impedance analysis; HGS: Non-dominant hand grip strength; AC: Arm circumference; TSF: Triceps skinfold; AMC: Arm muscle circumference).

The characteristic of the sample of adult cirrhotic patients was in line with the literature, since most patients were male (19). In addition, the ten initial losses of the sample were male and, despite such losses, the male gender prevailed.

The PEM is highly prevalent in patients with chronic liver disease, leading to severe consequences on the general state of the individual. It has an impact on the prognosis of cirrhotic patients, it impairs liver function and affects the clinical outcome (2,20,21), with reflexes on the morbidity and mortality of these patients (3). Thus, the nutritional assessment of these patients is extremely important, since it will allow to determine the nutritional status of the patient, consequently supporting the correction conduct or maintenance of this state (4,7).

In the present study, we assessed the nutritional status of patients by different methods and during previously established periods. During the initial nutritional assessment –prior to transplantation–, it was observed that BMI and APM did not identify any malnourished patient. In a recent study with a similar population, Gottschall et al. (22) did not find any malnourished patients by BMI and, with the same method, they found many overweight patients, indicating that there might be a strong correlation with the clinical condition of the patient due to water retention and ascites. The APM did not diagnose any malnourished patient in any of the periods of assessment, showing that this is a low-sensitivity method.

PA by BIA, HGS and AC were the methods that diagnosed the highest number of malnourished patients, with PA by BIA diagnosing 25% of the patients as malnourished. In a recent study of cirrhotic population, 34.1% of malnourished patients were identified by the same method (17).

Throughout the post-transplant follow-up, it was observed that in the first month the nutritional status of the patients tended to worsen, a result that is consistent with the literature, where the nutritional status of the patients tends to worsen in the first post-transplant month (23). This finding is probably related to the duration of hospitalization and potential complications during this initial period. Another similar study that also monitored the nutritional status over one year after transplantation decided to conduct the first post-transplant evaluation three months after the procedure, so that this initial period did not interfere with results (24).

When comparing the nutritional status of patients during the study, there is a significant difference in the evaluation methods by AC, TSF, and PA by BIA. Studies with a similar design also showed a significant improvement in the value of TSF during the one-year follow-up after transplantation (24,25). Another recent study similarly found a significant improvement in AC and PA by BIA after one year from transplantation (23). Wagner et al. evaluated three groups of patients after liver transplantation, at five, 10 and 15 years after the procedure, with PA tending to increase over time, although this result was not statistically significant (26).

At the end of follow-up, the HGS was the method of nutritional assessment that diagnosed the highest number of malnourished patients. This result is in line with findings by Ferreira et al. (23) and Plank et al. (27), who found a significant improvement over the first year with this method.

The HGS decrease in these patients is possibly associated with the fact that during the first year post-transplant studies have shown that patients are sedentary or not very active (23). Merli et al. (24) found that during this period patients had gained more fat tissue than lean mass, corroborating this assumption.

All patients ranked as malnourished by PA and HGS during the pre-transplant phase, showed malnutrition by at least one of the methods in the post-transplant period. This suggests that these methods should be included in the nutritional assessment protocol of patients under nutritional counseling during the liver pre- and post-transplant phases. On the other hand, not showing any variation during the assessment periods, the APM method could be excluded from this protocol.

The results suggest that, although malnourished cirrhotic patients are at higher risk of morbidity and mortality after liver transplantation, as shown by the literature, they might also get the highest benefit on nutritional status in the first year after transplantation. Although consensus has it that there is no "golden-standard" for assessing the nutritional status of cirrhotic patients, studies have shown that the method PA by BIA has a low error rate when compared to other methods (17,28-30). Studies that followed patients before and after transplantation showed significant results for PA (23) or a tendency of improving their values over the post-transplant years (26).

The number of patients evaluated is considered a limitation of this study. We believe that a larger sample the results could improve validity. Therefore, the researchers' goal is to continue the present study.

Thus, based on the results presented and discussed, we believe that the method PA by BIA can be increasingly employed with this population, since the results are in line with the literature and show to be significant, reliable, and reproducible. However, we recommend further studies to evaluate and follow-up the nutritional status of cirrhotic patients submitted to liver transplantation.

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