Original Research Article

Handgrip strength is a better tool for assessing early malnutrition than subjective global assessment in liver cirrhosis

Devapriya Rejeev[1], Nagaraja BS[2], Kiran S[3*], Chaitra KR[4]

[1]Senior resident, Department of Internal medicine, Bangalore Medical College and Research Institute, Karnataka, India

[2]Professor, Department of Internal medicine, Bangalore Medical College and Research Institute, Karnataka, India

[3]Assistant Professor, Department of Medical Gastroenterology, Bangalore Medical College and Research Institute, Karnataka, India

[4]Senior resident, Department of Internal medicine, Bangalore Medical College and Research Institute, Karnataka, India

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Abstract

Introduction: Malnutrition occurs in majority of patients with liver cirrhosis and progresses as liver function deteriorates. Also, malnutrition is the single reversible prognostic marker that accelerates deteriorating liver function. Aim of our study was to assess the nutritional status using various nutrition assessment parameters including anthropometry and its correlation with severity of liver disease in patients with liver cirrhosis.
Methods: This was a prospective, observational study conducted over a period of 2 years, included consecutive patients diagnosed with cirrhosis of liver based on clinical or radiological evidence. Nutritional status was assessed using biochemical parameters, anthropometry: Body mass index (BMI), mid arm circumference(MAC), mid arm muscle circumference(MAMC), triceps skin fold thickness(TSFT), subjective global assessment (SGA) and handgrip(HG) strength. Severity of liver disease was assessed using Child Pugh Score (CTP). **Results:** Ninety one consecutive patients with liver cirrhosis were included – 79 (86.8%) male, mean age was 47±13.6 yrs, 77 (84.6%) had alcohol related liver cirrhosis. Cirrhosis was classified Child Pugh A, B or C in 30, 30 and 31 patients respectively.The prevalence of malnutrition as per SGA was 62.63%.In our study, about 86.8% of the patients had weak handgrip strength .Of the biochemical parameters serum albumin, serum bilirubin (total/direct), total leukocyte count and international normalized ratio were significantly deranged in Child Pugh class C versus Child Pugh class A.BMI, MAC, MAMC and TSFT did not correlate well with severity of the liver disease. Handgrip strength and SGA showed significant difference between the three Child Pugh Classes.Of the 21 patients in SGA C (severely malnourished) group, all of them had weak handgrip strength whereas 73.5% of patients in SGA A (well nourished) group also had weak handgrip strength.**Conclusion:** There was evidence of malnutrition even in patients with early liver cirrhosis when assessed using SGA and handgrip strength over traditional anthropometric methods and biochemical parameters.Patients who were not malnourished according to SGA were found to have weak handgrip strength.This signifies that handgrip strength is a better tool for assessing early malnutrition than SGA.

Keywords: Handgrip strength, subjective global assessment, anthropometry, malnutrition, liver cirrhosis.

Introduction

Cirrhosis is a diffuse process characterized by fibrosis and regenerating nodules[1]. About 20% of patients with compensated cirrhosis and 60% of patients with decompensated cirrhosis have malnutrition. It is seen in both alcoholic cirrhosis and non alcoholic cirrhosis and has been shown to adversely affect the outcome.

Prevalence of malnutrition in cirrhosis ranges from 27% to 87%. Prevalence increases as the severity of liver disease progresses[2-6].Patients with end stage liver disease not only have muscle wasting but also decreased fat stores and overt cachexia. Cirrhotic will have fat soluble vitamin deficiency, anemia from iron,folate , and pyridoxine deficiency[7,8].

**Correspondence*
Dr. Kiran S
Assistant Professor, Department of Medical Gastroenterology, Bangalore Medical College and Research Institute, Karnataka, India
E-mail: drvjkirans@yahoo.co.in.

Given that malnutrition is associated with worst prognosis;all patients with cirrhosis of liver are advised to undergo a nutritional screen. The traditional nutritional assessment techniques used for most patients and healthy subjects do not translate well to cirrhotics[9].Conventional parameters of nutritional status, such as body mass index, anthropometry and biochemical parameter does not estimate the exact nutritional status in patients with cirrhosis of liver. Subjective global assessment uses clinical criteria to determine the nutritional status. Based on history and examination patients are classified as SGA A, B or C which denotes well nourished, mild/moderate under nutrition and severe under nutrition respectively. Muscle wasting in cirrhotic is an indirect evidence of malnutrition. Hand grip strength can be used to measure the functional loss of muscle mass.

Malnutrition in cirrhosis is associated with increased mortality and morbidity[10].Therefore early recognition of malnutrition is important in patients with cirrhosis of liver as nutritional

supplementation improves the treatment outcome. In this study we intended to find out the best nutritional assessment tool in cirrhotic.

Materials and Methods

This was a prospective, observational study conducted between October 2017 and September 2019,in hospitals attached to Bangalore Medical College and Research Institute (BMCRI), Bangalore, Karnataka. Patients with cirrhosis of liver diagnosed based on clinical or radiological evidence and aged between 18-60 years were included in the study. Patients with chronic co-morbidities like chronic kidney disease, cardiac disease, neoplasm, acquired immunodeficiency syndrome, etc were excluded.

Ethical clearance and approval was taken from the Institutional Ethics Committee of BMCRI and a written consent was taken from all patients satisfying the inclusion and exclusion criteria. Detailed history, clinical examination and routine base line investigations like complete blood count, liver function test, prothrombin time – international normalized ratio, ultrasound abdomen and other relevant investigations were done. All patients in the study were categorized to Child Pugh A, B, C class. Nutritional assessment was performed in all patients using traditional anthropometric measures like BMI, triceps skin fold thickness, mid arm circumference, mid arm muscle circumference. Patients were also assessed using Subjective global assessment forms (available online at nutrition care in canada.ca). Muscle strength was assessed using a handgrip Dynamometer.

a) BMI = kg/m^2 where kg is a person's weight in kilograms and m^2 is their height in metres squared. Since weight prior to fluid retention was not available in almost all patients with ascites, dry weight was estimated by subtracting the percentage of weight based upon severity of ascites (mild, 5%; moderate, 10%; severe, 15%), with an additional 5% subtracted if bilateral pedal edema is present.
b) A skinfold calliper was used to measure thetriceps skin fold thickness at the right arm to the nearest millimetre.
c) Mid arm circumference was measured with inch tape at a midpoint between acromion process and olecranon in the relaxed non dominant arm.
d) Mid arm muscle circumference was calculated by using the formula:MAMC (cm) = MAC − [3.14 × TSFT (cm)].
e) SGA was done according to the suggestion of Detsky et al[11]. A detailed history was recorded with appetite, caloric intake and change in body weight. Based on this evaluation, patients were classified into three groups: well nourished, mild/ moderately malnourished and severely malnourished.
f) Hand grip strength was assessed with Camry digital hand grip dynamometer in the dominant hand, three measurements were taken and the highest was considered.The final value was expressed in Kg.
g) Values of MAC, MAMC, TSFT and HG below the 5th percentile or less than 60% of healthy controls were considered as abnormal and patients were diagnosed to have malnutrition.

Statistical Analysis:Statistical analysis was performed using R Statistical software version 3.6.1. Statistical measures obtained included descriptive, proportions, mean and standard deviations, chi square test, ANOVA and t-test. P value <0.05 is considered statistically significant for all analysis.

Results

Our study included 91 patients. The mean age of patients was found to be 47.0±13.6 years. Among 91 patients, 12(13.2%) were female and 79 (86.8%) were male. Among 91 patients, 14(15.4%) were non alcoholic and 77(84.6%) were alcoholic. Among 14 (15.4%) non alcoholic patients, 11(78.6%)) were female and 3(21.4%) were male patients. Out of 77(84.6%) alcoholic patients, 1(1.3%)) was female and 76(98.7%) were male patients.

Severity of liver disease was assessed based on the Child Pugh score. Seven (50.0%), 4(28.6%) and 3(21.4%) non alcoholic patients, and 23(29.9%), 26(33.8%) and 28(36.4%) alcoholic patients were categorized as Child Pugh A, Child Pugh B and Child Pugh C respectively. Alcoholic and non alcoholic patient's categorization based on severity of liver disease did not show any significant difference (p-value - 0.3121).

Comparison of biochemical parameters among patients under Child Pugh A, Child Pugh B and Child Pugh C was carried out (Table 1). Among all the parameters studied, values of Total bilirubin (TB), Direct bilirubin (DB), Total leukocyte count (TLC), Albumin and Prothrombin time – international normalized ratio (PT-INR) among Child Pugh A, Child Pugh B and Child Pugh C patients were found to be statistically significant at 99% confidence interval (P- value is <0.05).

Table 1: Comparison of biochemical parameters in patients belonging to different Child Pugh class

Biochemical Parameters	Child Pugh A (n=30)	Child Pugh B (n=30)	Child Pugh C (n=31)	P-value
Hb (%)	10±3.2	10.1±2.7	9±2.1	0.292
MCV (fl)	85.7±16	90.6±10.1	92.6±11.4	0.101
TLC (c/mm^3)	7930.7±4506.1	8805.5±5703.9	13158.4±7628.8	0.002
TB (mg/dl)	1.5±1	2.5±2.5	13.3±10.7	<0.001
DB(mg/dl)	0.5±0.4	1.3±1.6	7.7±7.2	<0.001
TP (g/dl)	6.3±1.0	6.1±1.1	6±1.2	0.561
Albumin(g/dl)	3.4±0.5	2.7±0.8	2.3±0.8	<0.001
INR (ratio)	1.3±0.3	1.4±0.3	2.5±2.4	0.002
PT (sec)	14.5±3.3	15.6±3.5	26.4±27.6	0.009

All patients in the study were subjected to anthropometric assessment; included height, weight and BMI. The mean BMI in each Child Pugh class showed no significant difference.Comparative assessment of malnutrition between Child Pugh A, Child Pugh B and Child Pugh C patients showed significant difference in subjective global assessment and handgrip strength (Table 2). MAC, MAMC and TSFT did not show significant difference between the three Child Pugh classes.Nineteen (63.3%), 22(73.3%) and 22(73.3%) Child Pugh class A, B and C patients respectively had weak handgrip strength whereas 11(36.7%), 8(26.7%) and 1(3.2%) patient in Child Pugh class A, B and C respectively had normal handgrip strength (Table 2). Distribution of patients based on the handgrip strength (weak or normal), among the three Child Pugh classes was significantly different from each group (p-value - 0.0052)**.**The hand grip strength had significant correlation with the severity of liver disease with mean hand grip strength in Child Pugh class A being 23±6 kg and in Child Pugh class C being 15±5.3 kg. However 63.3% of patients in Child Pugh class A, 73.3% patients in child Pugh class B and 96.8% in child Pugh class C had weak handgrip strength when compared to normal Indian Population based on Indian studies.Using subjective global assessment, 17(56.7%), 6(20%) and 7(23.3%) of Child Pugh class A; 10(33.3%), 14(46.7%) and 6(20%) of Child Pugh class B and 1(3.2%), 12(38.7%) and 18(58.1%) of Child Pugh class C patients were categorized into SGA A (well nourished) group, SGA B (mildly/moderately malnourished) group and SGA C(severely malnourished) group respectively.

Table 2: Comparison of nutritional parameters in patients belonging to different Child Pugh class

Parameters		Child Pugh A (n=30)	Child Pugh B (n=30)	Child Pugh C (n=31)	P-value
Hand Grip Strength(KG)(Mean ± SD)		23.3±6	21.3±8.4	15.4±5.3	<0.001
Hand Grip (n (%)	Weak	19(63.3%)	22(73.3%)	30(96.8%)	0.0052
	Normal	11(36.7%)	8(26.7%)	1(3.2%)	
Subjective GlobalAssesment(n (%)	SGA A	17(56.7%)	10(33.3%)	1(3.2%)	<0.001
	SGA B	6(20%)	14(46.7%)	12(38.7%)	
	SGA C	7(23.3%)	6(20%)	18(58.1%)	
MAC (CM) (Mean ± SD)		23.2±3.3	22.4±3.6	21.2±3.5	0.082
TSFT(MM) (Mean ± SD)		9.4±3.2	8.2±3.9	8.4±3.3	0.362
MAMC(MAC-3.14×TSFT) (Mean ± SD)		20±3.1	20±3.1	18.3±3.5	0.066

Discussion

Our study was undertaken to assess the nutritional status in patients with cirrhosis and to study the correlation between severity of liver disease and malnutrition. Severity of liver disease was assessed by Child Pugh Score. All patients included in the study were categorized into Child Pugh A, B or C. Nutritional assessment was done using biochemical parameters, traditional anthropometric method like height, weight and BMI; Subjective global assessment, mid arm circumference, mid arm muscle circumference, triceps skin folds thickness and handgrip strength.Total number of cases included in the study was 91, who had either clinical or radiological evidence of cirrhosis irrespective of the etiology.30 cases each in Child Pugh A, B and 31 cases in Child Pugh C were included in the study. There was clear gender bias as 86.6% of the patients were males. The most common cause of cirrhosis in our study was alcohol (72.8 %). In our study the age group distribution of subjects was 20 to 60 years, majority of them were within the age group of 40 to 60 years.In our study BMI did not correlate well with the severity of the liver disease. The mean BMI in each CTP class showed no significant difference .All three Child Pugh classes had normal BMI irrespective of the severity of liver disease. This can be attributed to presence of edema which affects the weight. This was similar to observations in other studies. Subjective global assessment was performed in all patients included in the study. There was significant correlation with the SGA rating and the severity of liver disease with 58.1% of patients in Child Pugh C having a SGA rating of C compared to 23% in Child Pugh A. Similar observation was made by Patricia M Vieira et al with 57.9% in Child Pugh C and 2.6% in Child Pugh A[12].There was malnutrition based on SGA rating even in Child Pugh A and B in our study, which emphasis that SGA is a tool to assess malnutrition even in early stages of liver disease. The prevalence of malnutrition as per Subjective Global Assessment was 62.63%, which was in agreement with other studies.Hand grip strength was assessed in all patients using a hand held handgrip dynamometer. There was significant correlation between hand grip strength and the severity of liver disease by child Pugh score. Similar observations were made by Maria Ciocirlanet al[13]. Mean handgrip strength in Child Pugh class A was 23.3±6 kg and in Child Pugh class C was 15.4±5.3 kg. In our study about 86.8% of the patients had weak handgrip strength. Mean value of Hand grip strength (kg) in our patients were significantly lower than those observed in other studies.Hand grip strength was significantly lower in SGA C, with mean of 13.4±4.7 kg. Of the 21 patients in SGA C (severely malnourished) group, all of them had weak handgrip strength and 73.5% of patients in SGA A (well nourished) group also had weak handgrip strength. This signifies that handgrip strength is a better tool for assessing early malnutrition than SGA. Patients who were not malnourished according to subjective global assessment tool were found to have weak hand grip strength.Our patients also showed significant malnourishment even in early stages of cirrhosis (Child Pugh class A). Hence cirrhosis per se even if not decompensated is a cause for nutritional deficit through other mechanism of hyper metabolism, bile acid deficiency for micelle formation and fat absorption, muscle proteolysis for sustaining glycogen synthesis and others. Hence the nutritional parameters like subjective global assessment score and handgrip strength are invaluable in detecting the undernourished even early in the course of the disease, and they are probably the most cost effective bed side tools that are available so far.Other anthropometric measures MAC, TSFT and MAMC were measured in all patients. MAMC had no significant correlation with severity of liver disease. The mean mid arm circumference was 22.2±5.4 cm with no difference between the three groups. Though TSFT was significantly low in all patients, it did not correlate with the severity of liver disease. Study done by Nunes et al demonstrated correlation with TSFT and severity of liver disease and it approached a statistical significance[14].. This was not observed in our study.Among the biochemical parameters there was significant correlation between the serum albumin levels and severity of liver disease. Serum albumin levels were demonstrated to be significantly lower in patients with Child Pugh class C compared to the other classes. Similar observation was made by Mei Ling S Tai et al[15].Alcoholic patients are more prone for protein energy malnutrition according to literature. The fact that majority of the patients in our study were alcoholics and majority of them had ascites, raised the prevalence of malnourishment in our study. Low socio economic background of all our patients could be an additional factor responsible for poor dietary intake. Alcohol and ascites both reduce the food intake. Salt restricted diet invariably not well tolerated by patients could also be contributing to the malnutrition. Some of the medications prescribed to these patients like lactulose, may cause increased gas, bloating and diarrhea. Also, the presence of hepatic encephalopathy may impair dietary intake. Nutrients may also bypass the liver altogether in patients with significant porto-systemic shunting.

Conclusion

BMI does not correlate well with severity of cirrhosis or malnutrition because of edema and ascites. SGA and handgrip strength are better tools in assessing the nutritional status in cirrhosis of liver. There was evidence of malnutrition even in patients with early liver cirrhosis when assessed using SGA and handgrip strength. Patients who were not malnourished according to SGA were found to have weak handgrip strength signifying that handgrip strength is a better tool for assessing early malnutrition than SGA.

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