Original Article

Comparison of the Performance of Existing Nutritional Screening Tools against Subjective Global Assessment in Cirrhotic Patients

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Background: Malnutrition in cirrhosis has a significant negative impact on morbidity and mortality. There is no agreed gold standard of the screening tool. Study comparing the diagnostic properties of nutritional assessment tools in cirrhotic patients is limited. The Subjective Global Assessment (SGA) is one of the global assessment tools. It is used to assess nutritional status in different patient populations.

Objective: To evaluate the diagnostic properties of different nutritional screening tools compared with SGA in cirrhotic patients.

Materials and Methods: A cross-sectional study was conducted at the HRH Princess Maha Chakri Sirindhorn Medical Center. All cirrhotic patients were enrolled. The nutritional status was evaluated by the SGA, the Royal Free Hospital Subjective Global Assessment (RFH-SGA), the Royal Free Hospital-Nutritional Prioritizing tool (RFH-NPT), the Liver Disease Undernutrition Screening Tool (LDUST), the Malnutrition Universal Screening Tool (MUST), the Prognostic Nutritional Index (PNI-O), the Nutritional Risk Index (NRI), the Spanish Society of Parenteral, the Enteral Nutrition (SENPE), and the Controlling Nutritional Status (CONUT). Sensitivity, specificity, positive predictive value, and negative predictive value were calculated to evaluate RFH-SGA, RFH-NPT, LDUST, MUST, PNI-O, NRI, SENPE, and CONUT compared with SGA.

Results: Ninety-four cirrhotic patients were included. The mean age was 60.82 (SD 10.11) years. Patients with cirrhosis Child Turcotte Pugh (CTP) A, B, and C were 62, 21, and 11, respectively. Twenty-five patients (28.7%) were malnourished according to SGA, five with CTP A cirrhosis, twelve with CTP B cirrhosis, and ten with CTP C cirrhosis. The present study also showed that NRI had the highest sensitivity (100%) and LDUST had the highest specificity (94%).

Conclusion: NRI is an effective tool with high sensitivity for identifying malnutrition in early stage of cirrhosis.

Keywords: Nutritional screening; Cirrhosis; Subjective Global Assessment; SGA; Nutritional Risk Index; NRI

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Malnutrition is common in cirrhosis. Prevalence is reported between 5% and 99%, depending on the method of assessment[1]. Malnourished cirrhotic patients are associated with higher mortality, higher rate of complications, longer hospitalization, higher cost, and poor quality of life[2-5]. Malnutrition increases with the severity of cirrhosis[3,6]. However, nutritional status is not included in various prognostic models. Although there are many widely used nutritional assessment tools, there is no universally accepted screening tool for malnutrition in cirrhotic patients. Nutritional assessment in cirrhotic patients comprises anthropometry, body composition assessment, functional assessment, dietary assessment, and global assessment tools. Global assessment tools consist of the Subjective Global Assessment (SGA), the Royal Free Hospital Subjective Global Assessment (RFH-SGA), the Royal Free Hospital-Nutritional Prioritizing tool (RFH-NPT), the Liver Disease Undernutrition Screening Tool (LDUST), the Malnutrition Universal Screening Tool (MUST), the Prognostic Nutritional Index or Index Onodera (PNI-O), the Nutritional Risk Index (NRI), the Spanish Society of Parenteral and Enteral Nutrition (SENPE), and the Controlling Nutritional Status (CONUT). Most nutritional assessment tools are complex and time-consuming. Some tools require expertise and special equipment. The SGA is a simple and standard method used to diagnose malnutrition and identify those who would benefit from nutritional care. It has been validated in

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a variety of patient populations including cirrhotic patients[7-9]. The SGA predicted in hospital mortality and short-term survival of cirrhotic patients[9,10]. The EASL guideline recommended SGA as a nutritional assessment tool in cirrhotic patients[11]. Therefore, SGA was chosen as the reference criterion in the present study. The aim of the present cross-sectional study was to evaluate the diagnostic properties of different nutritional screening tools compared with SGA in cirrhotic patients.

Materials and Methods

Study design

The present cross-sectional study was conducted at the HRH Princess Maha Chakri Sirindhorn Medical Center, Tertiary care academic referral center, Thailand, between July 2019 and November 2020. The present study was approved by the Ethics Committee of Srinakharinwirot University, Thailand (SWUEC-367/2561). Written informed consents were obtained from all patients.

Study populations

All consecutive adult patients aged 18 years or older diagnosed cirrhosis were enrolled. The diagnosis of cirrhosis was based on a liver biopsy or a combination of clinical, laboratory, and imaging data. Patients having one or more of the following criteria were excluded, critical illness, history of acute decompensation causing increased levels of serum bilirubin or declined in serum albumin, grade 3 and 4 hepatic encephalopathy, acute or chronic liver failure, hepatocellular carcinoma, Human immunodeficiency virus (HIV) infection, active cardiac or pulmonary disease, cerebrovascular disease, malabsorption, chronic pancreatitis, active malignancy, psychiatric disease, pregnancy, or lactation.

Data collection

The authors collected demographic data, comorbidities, cause and severity of cirrhosis, and laboratory data. Severity of cirrhosis was classified by the Child Turcotte Pugh (CTP) and the Model of End-stage Liver Disease (MELD) score. Body mass index was calculated by using scale weight minus ascites weight with mild at 5%, moderate at 10%, and severe at 15% with an additional 5% if bilateral pedal edema. All the enrolled patients underwent nutritional assessment by the authors.

Nutritional assessment

The SGA comprises of five clinical parameters, which are weight change, dietary intake change, gastrointestinal symptoms, functional capacity, disease, and its relation to nutritional requirements, and three physical examinations for loss of subcutaneous fat, muscle wasting, and edema or ascites[12]. Patients were subjectively rated as well-nourished (A), moderately malnourished (B), or severely malnourished (C). In the present study, patients with SGA rating B and C were considered malnutrition.

The RFH-SGA combines subjective assessment of nutritional status with body mass index (BMI), mid-arm muscle circumference (MAMC), and dietary intake[13]. Patients are classified as well-nourished, mild, or moderately malnourished, and severely malnourished. Patients with mild or moderately, and severely malnourished were considered as having malnutrition.

The RFH-NPT classifies nutritional risk score as low (0 point), moderate (1 point), or high (2 to 7 points)[1]. First, the presence of acute alcoholic hepatitis or tube feeding is evaluated, conditions which classified the patients as high risk. The second step assesses fluid overload and its impact on food intake and weight loss. Finally, patients without fluid overload are assessed for nutritional status with BMI, unplanned weight loss, and daily dietary intake. The authors considered patients with scores above or equal to 1 as malnutrition.

The LDUST comprises six questions, nutrient intake, weight loss, loss of subcutaneous fat, loss of muscle mass, swelling or fluid in abdomen or legs, and functional status[14]. Each question has three answers in columns A, B, or C. Malnutrition is diagnosed when there are two or more answers in columns B or C.

The PNI-O is calculated by the formula 10 × albumin (g/L) + 0.005 × lymphocyte count/μL[15]. The patient was classified as malnutrition when the score was less than 40.

The SENPE assesses the participants base on three criteria, (A) weight loss more than 5% in one month or 10% in six months or BMI less than 18 kg/m², (B) albumin less than 3.5 g/dL, and (C) total lymphocyte less than 1,600 c/mm³, and cholesterol less than 180 mg/dL[16]. The patient was classified as malnutrition when meeting two of three criteria.

The CONUT is derived from the values of serum albumin, cholesterol, and lymphocyte counts. A score of 2 or more is defined as malnutrition[17].

The NRI is calculated by the formula 1.519 × serum albumin (g/L) + 41.7 × (current weight over usual weight)[18]. Malnutrition was defined when the patient had a score below 100.

Table 1. Baseline characteristic classified by SGA

Variables	No malnutrition (n=67); mean±SD	Malnutrition (n=27); mean±SD	Total (n=94); mean±SD
Age (years)	60.2±10.3	62.3±9.6	60.8±10.1
Sex: male; n (%)	42 (62.7)	12 (44.4)	54 (57.4)
BMI (kg/m^2)	25.4±4.6	20.2±4.0	23.9±5.0
Comorbidities; n			
Diabetes mellitus	26	13	39
Hypertension	28	12	40
Dyslipidemia	28	14	42
Cerebrovascular disease	3	3	6
Chronic kidney disease	2	1	3
Cause of cirrhosis; n			
Alcohol	11	8	19
HBV	30	5	35
HCV	10	7	17
NASH	4	1	5
Autoimmune	2	1	3
Cryptogenic	1	2	3
Mixed	9	3	12
Child-Pugh class (A/B/C); n	57/9/1	5/12/10	62/21/11
MELD score	9.0±2.6	20±4.4	10.8±5.0
Previous complication; n	17	24	41
Bilirubin (mg/dL)	1.0±0.8	1.8±1.2	1.2±1.0
AST (U/L)	42.0±28.7	60.1±38.3	47.5±32.6
ALT (U/L)	33.3±18.8	32.1±23.0	33.1±19.9
Albumin (g/L)	4.1±0.6	2.9±0.5	3.8±0.8
Prothrombin time (INR)	1.1±0.1	1.4±0.3	1.2±0.2
Creatinine (mg/dL)	1.0±0.8	1.5±1.3	1.2±1.0
Hemoglobin (g/dL)	13.4±1.8	10.0±1.8	12.4±2.3
Platelet count (×10^{-3})	159.6±85.7	153.4±122.3	157.8±97.0
Cholesterol (mg/dlL)	174.2±46.0	139.3±46.0	164.2±48.4

SGA=Subjective Global Assessment; SD=standard deviation; BMI=body mass index; HBV=hepatitis B virus; HCV=hepatitis C virus; NASH=non-alcoholic steatohepatitis; MELD=Model for End-stage Liver Disease; AST=aspartate aminotransferase; ALT=alanine transaminase; INR=international normalized ratio

The MUST assessed three categories, BMI, unintentional weight loss, and the presence of any acute disease that could compromise nutritional intake for more than five days. Patients were stratified as being no risk if they had a score of 0, moderate risk if they had a score of 1, and high risk if they had a score of 2 or more. For statistical purposes, nutritional status was categorized into two groups, no malnutrition and malnutrition when they had moderate and high risk.

Statistical analysis

All data were recorded in a database system on a personal computer, and all statistical analyses were performed using IBM SPSS Statistics software, version 23.0 (IBM Corp., Armonk, NY, USA). Categorical variables were reported as frequencies and percentages. Continuous variables were presented as mean ± standard variations, including median and interquartile ranges. Using SGA as the gold standard, the diagnostic properties of the nutritional assessment in cirrhotic patients were described in terms of sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV).

Results

During the present study period, 98 patients were initially recruited, and four patients had one or more exclusion criteria. Finally, the study consisted of 94

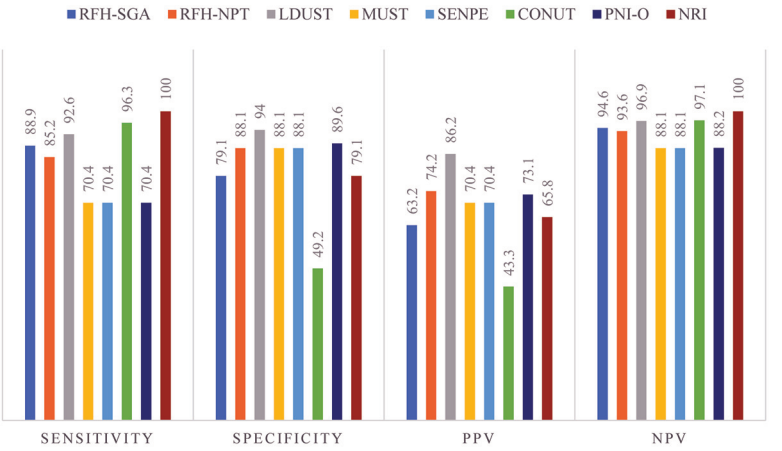

Figure 1. Diagnostic properties of nutritional assessment tools using SGA as the gold standard.

SGA=Subjective Global Assessment; RFH-SGA=Royal Free Hospital Subjective Global Assessment; RFH-NPT=Royal Free Hospital-Nutritional Prioritizing tool; LDUST=Liver Disease Undernutrition Screening Tool; MUST=Malnutrition Universal Screening Tool; SENPE=Spanish Society of Parenteral Enteral Nutrition; CONUT=Controlling Nutritional Status; PNI-O=Prognostic Nutritional Index; NRI=Nutritional Risk Index; PPV=Positive predictive value; NPV=Negative predictive value

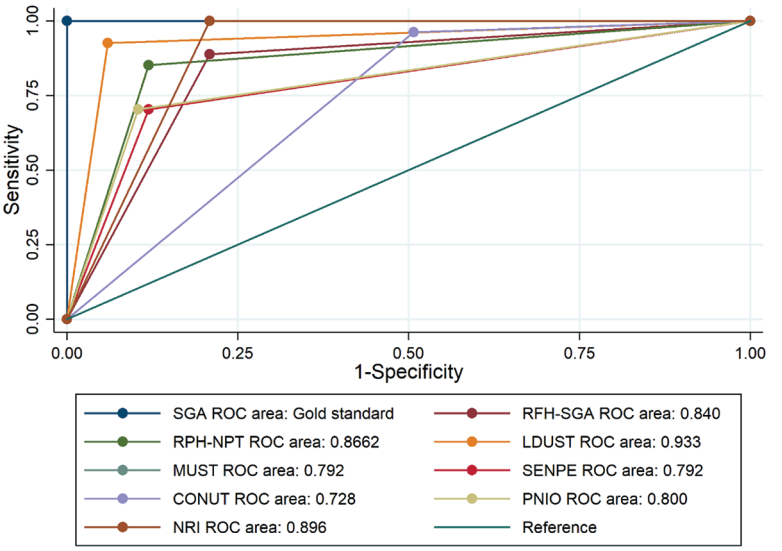

Figure 2. Receiver-Operating-Characteristic (ROC) curve of nutritional screening tools.

patients. The mean age was 60.8 years in overall patients, and more than half were men. Sixty-two of the patients were Child-Pugh class A. The mean MELD score was 10.8. The main etiology of cirrhosis was hepatitis B. Forty-one patients had previous complications. Detail data of the patients are shown in Table 1.

Based on the SGA results, 27 of 94 patients of cirrhosis were classified as malnourished. Cirrhotic patients with malnutrition had lower BMI than patients without malnutrition. Causes of cirrhosis in malnourished patients were alcohol (8/27) and hepatitis C (7/27). Most malnourished patients were Child-Pugh class B and C. In addition, malnourished patients had more previous complication than patients without malnutrition. Details about MELD score and laboratory markers of malnutrition are demonstrated in Table 1.

Using SGA as the gold standard, the present results revealed that NRI had high sensitivity and high NPV (Figure 1). Meanwhile, the LDUST had high specificity and high PPV, which was better than other tools. LDUST had the highest area under the ROC curve (Figure 2). As demonstrated in Table 2,

Table 2. Comparison of screening tools based on CTP

Tool	CTP	Sensitivity (95% CI)	Specificity (95% CI)	PPV (95% CI)	NPV (95% CI)	Prevalence
RFH-SGA	A	100 (100)	82.5 (73.0 to 91.9)	33.3 (21.6 to 45.1)	100 (100)	8.1
	B	83.3 (67.4 to 99.3)	66.7 (46.5 to 86.8)	76.9 (58.9 to 94.9)	75.0 (56.5 to 93.5)	57.1
	C	90.0 (72.3 to 100)	0* (0)	90.0 (72.3 to 100)	0* (0)	90.9
RFH-NPT	A	80.0 (70.0 to 90.0)	93.0 (86.6 to 99.3)	50.0 (37.6 to 62.4)	98.1 (94.8 to 100)	8.1
	B	83.3 (67.4 to 99.3)	55.6 (34.3 to 76.8)	71.4 (52.1 to 90.8)	71.4 (52.1 to 90.8)	57.1
	C	90.0 (72.3 to 100)	100 (100)	100 (100)	50.0 (20.5 to 79.6)	90.9
LDUST	A	100 (100)	96.5 (91.9 to 100)	71.4 (60.2 to 82.7)	100 (100)	8.1
	B	83.3 (65.3 to 98.3)	88.9 (77.2 to 100)	90.9 (77.2 to 100)	80.0 (65.3 to 98.3)	57.1
	C	NA	NA	NA	NA	
MUST	A	80 (70.0 to 90.0)	91.2 (84.2 to 98.3)	44.4 (32.1 to 56.8)	98.1 (94.7 to 100)	8.1
	B	75.0 (56.5 to 93.5)	66.7 (46.5 to 86.8)	75 (56.5 to 93.5)	66.7 (46.5 to 86.8)	57.1
	C	60.0 (31.0 to 89.0)	100 (100)	100 (100)	20.0 (–3.6 to 43.6)†	90.9
SENPE	A	40 (27.8 to 52.2)	96.5 (91.9 to 100)	50 (37.6 to 62.4)	94.8 (89.3 to 100)	8.1
	B	75.0 (56.5 to 93.5)	44.4 (23.2 to 65.7)	64.3 (43.8 to 84.8)	57.1 (36.0 to 78.3)	57.1
	C	80.0 (56.4 to 100)	0* (0)	88.9 (70.3 to 100)	0* (0)	90.9
CONUT	A	80.0 (70.0 to 90.0)	57.9 (45.6 to 70.2)	14.3 (5.6 to 23)	97.1 (92.8 to 100)	8.1
	B	NA	NA	NA	NA	
	C	NA	NA	NA	NA	
PNI-O	A	20.0 (10.0 to 30.0)	100 (100)	100 (100)	93.4 (87.3 to 99.6)	8.1
	B	75.0 (56.5 to 93.5)	33.3 (13.2 to 53.5)	60.0 (39.0 to 81.0)	50.0 (28.6 to 71.4)	57.1
	C	90.0 (72.3 to 100)	0* (0)	90.0 (72.3 to 100)	0* (0)	90.9
NRI	A	100 (100)	93.0 (86.6 to 99.3)	55.5 (43.2 to 67.9)	100 (100)	8.1
	B	NA	NA	NA	NA	
	C	NA	NA	NA	NA	

CTP=Child Turcotte Pugh score; PPV=positive predictive value; NPV=negative predictive value; CI=confidence interval; RFH-SGA=Royal Free Hospital Subjective Global Assessment; RFH-NPT=Royal Free Hospital-Nutritional Prioritizing tool; LDUST=Liver Disease Undernutrition Screening Tool; MUST=Malnutrition Universal Screening Tool; SENPE=Spanish Society of Parenteral, the Enteral Nutrition; CONUT=Controlling Nutritional Status; PNI-O=Prognostic Nutritional Index; NRI=Nutritional Risk Index; NA=not available

NA of sensitivity, specificity, PPV, NPV were not evaluated due to malnutrition 100% in the group

* Specificity is zero due to no patients classified as well-nourished based on the test and SGA, † 95% CI less than zero due to NPV less than (1.96×SE)

the diagnostic properties of nutritional tools were compared including sensitivity, specificity, PPV, and NPV based on the CTP score. The results showed that RFH-SGA, LDUST, and NRI had the highest sensitivity in CTP A, whereas RFH-SGA, RFH-NPT, and LDUST had the highest sensitivity in CTP B. In addition, the present study also revealed that NRI showed the highest sensitivity in patients with MELD scores less than 15. Meanwhile, LDUST showed the highest sensitivity in patients with MELD scores above or equal to 15 (Table 3).

Discussion

Cirrhotic patients with malnutrition have been associated with the worse clinical outcomes. Nutritional assessment is an essential process to identify high-risk patients. Assessment of nutrition in cirrhotic patients are often overlooked. Some tools are not validated, and some tools have limitations in cirrhotic patients. Water retention in cirrhotic patients may affect the body weight and BMI. The present study showed that patients with malnutrition had a mean BMI in the normal range. Some cirrhotic patients with malnutrition had high BMI. BMI should not be the appropriate nutritional screening tool for every cirrhotic patient. The EASL guideline advised using Child-Pugh score, BMI, and RFH-NPT or LDUST as tools for screening nutritional status. SGA, RFH-SGA, and detailed dietary intake were used as detailed nutritional assessments and should be performed by expert dieticians[11]. The ESPEN recommended NRS-2002, MUST, and RFH-NPT

Table 3. Comparison of screening tools based on MELD

Tool	MELD	Sensitivity (95% CI)	Specificity (95% CI)	PPV (95% CI)	NPV (95% CI)	Prevalence
RFH-SGA	<15	86.7 (79.2 to 94.1)	81.2 (72.6 to 89.9)	52 (41.0 to 63.0)	96.3 (92.1 to 100)	19.0
	≥15	91.7 (77.7 to 100)	33.3 (9.5 to 57.2)	84.6 (66.4 to 100)	50.0 (24.7 to 75.3)	80.0
RFH-NPT	<15	80 (71.2 to 88.8)	89.1 (82.2 to 95.9)	63.2 (52.5 to 73.8)	95 (90.2 to 99.8)	19.0
	≥15	91.7 (77.7 to 100)	66.7 (42.8 to 90.5)	91.7 (77.7 to 100)	66.7 (42.8 to 90.5)	80.0
LDUST	<15	86.7 (79.2 to 94.2)	95.3 (90.6 to 100)	81.2 (72.6 to 89.9)	96.8 (93.0 to 100)	19.0
	≥15	100 (100)	66.7 (42.8 to 90.5)	92.3 (78.8 to 100)	100 (100)	80.0
MUST	<15	73.3 (63.6 to 83.1)	89.1 (82.2 to 95.9)	61.1 (50.4 to 71.9)	93.4 (88.0 to 98.9)	19.0
	≥15	66.7 (42.8 to 90.5)	66.7 (42.8 to 90.5)	88.9 (73.0 to 100)	33.3 (9.5 to 57.2)	80.0
SENPE	<15	60.0 (49.2 to 70.8)	89.0 (82.2 to 95.9)	56.2 (45.3 to 67.2)	90.5 (84.0 to 97.0)	19.0
	≥15	83.3 (64.5 to 100)	66.7 (42.8 to 90.5)	90.9 (76.4 to 100)	50 (24.7 to 75.3)	80.0
CONUT	<15	93.3 (87.8 to 98.8)	51.6 (40.5 to 62.6)	31.1 (20.9 to 41.3)	97.1 (93.3 to 100)	19.0
	≥15	NA	NA	NA	NA	
PNI-O	<15	53.3 (42.3 to 64.3)	92.2 (86.3 to 98.1)	61.5 (50.8 to 72.3)	89.4 (82.6 to 96.2)	19.0
	≥15	91.7 (77.7 to 100)	33.3 (9.5 to 57.2)	84.6 (66.4 to 100)	50.0 (24.7 to 75.3)	80.0
NRI	<15	100 (100)	82.8 (74.5 to 91.1)	57.7 (46.8 to 68.6)	100 (100)	19.0
	≥15	NA	NA	NA	NA	

MELD=Model for End-stage Liver Disease; PPV=positive predictive value; NPV=negative predictive value; CI=confidence interval; RFH-SGA=Royal Free Hospital Subjective Global Assessment; RFH-NPT=Royal Free Hospital-Nutritional Prioritizing tool; LDUST=Liver Disease Undernutrition Screening Tool; MUST=Malnutrition Universal Screening Tool; SENPE=Spanish Society of Parenteral, the Enteral Nutrition; CONUT=Controlling Nutritional Status; PNI-O= Prognostic Nutritional Index; NRI=Nutritional Risk Index; NA=not available

NA of sensitivity, specificity, PPV, NPV were not evaluated due to malnutrition 100% in the group

as the screening tools of malnutrition in cirrhotic patients[19].

SGA was first reported in 1982 by Baker and Detsky[8], it is simple, easy-to-apply, and inexpensive. The accuracy of SGA depends on the expertise of the examiners, but SGA has a high interobserver agreement[12]. SGA has been applied in surgical patients, oncology patients, HIV patients, and patients with kidney disease[8]. Accumulating extracellular fluid in cirrhosis leads to weight gain, ascites, and edema, which may affect the result of SGA. SGA predicted the overall survival of cirrhotic patients[9,20]. Malnourished patients assessed by SGA need more blood transfusion and have longer hospital stay after undergoing liver transplantation[21]. SGA underpowered the prevalence of malnutrition in cirrhotic patients especially in CTP A and B[10].

NRI was first introduced by Buzby et al for identifying patients with risk of complication after surgery[18,22]. NRI can be easily calculated. It was validated in various conditions such as cancer patients[23], acute decompensated heart failure[24], severe aortic stenosis undergoing transcatheter aortic valve replacement[25], multiple myeloma undergoing autologous stem cell transplantation[26], and hematologic diseases undergoing allogeneic hematopoietic cell transplantation[27]. It can predict non-infectious postoperative complications of the digestive system and abdominal wall surgery[28]. NRI has high sensitivity comparing with SGA in peritoneal dialysis patients[29]. NRI is more accurate than SENPE and CONUT in identifying malnutrition in cirrhosis[16]. In the present study, NRI had higher sensitivity than the other tools. It should be used as a screening test in cirrhotic patients at high risk of malnutrition.

LDUST is easily performed and take a short time. LDUST has a high PPV but a low NPV[30]. LDUST is a more predictive malnutrition assessment tool than MUST[31]. The present study demonstrated that LDUST had high sensitivity, specificity, PPV, and NPV.

In cirrhosis CTP A and MELD score less than 15, NRI had 100% sensitivity. Sensitivity of NRI in cirrhosis CTP B, C, and MELD score greater or equal to 15 was not performed due to 100% malnutrition in this group. LDUST had the highest sensitivity in cirrhosis CTP A, B, and MELD score greater or equal to 15. In the advanced stage of cirrhosis, malnutrition is easily detected without nutritional screening tools. Nutritional screening tools should have high sensitivity in the early stage of cirrhosis. NRI is the

most proper nutritional screening tool in patients with early stage of cirrhosis as compared with SGA.

Although easy to perform, SGA consists of eight parameters, some parameters require trained personnel and need patient cooperation. Fluid overload within six months may affect the accuracy of SGA. To evaluate NRI, only three parameters are needed. NRI is easy to perform, less time-consuming, and it can be used in non-cooperative patients. NRI can be used as the nutritional screening test in outpatient setting. Patients at risk of malnutrition should be further evaluated by nutritional dietitian. Recent fluid retention due to decompensation may affect the accuracy of NRI. Body weight and serum albumin may be changed during decompensation, which may affect the result of NRI. In the present study, the patients with history of acute decompensation in the past three months were excluded.

Strengths of the present study included multiple global assessment tools were validated and most of the patients were CTP classification A and B as malnutrition is usually obvious in patients with CTP classification C cirrhosis. Nutritional screening tools are crucial in the early stage of cirrhosis. However, there were some limitations in the present study. First, clinical outcome was not assessed in the present study. Further studies of these nutritional screening tools in predicting clinical outcome should be done. Second, the analysis of the diagnostic properties of the present study was performed in cirrhotic patients in a single tertiary care academic referral center. In addition, some tools were subjective, leading to potential recall bias and observer bias.

Conclusion

The present study indicated that the NRI had the highest sensitivity and NPV for detecting malnutrition in cirrhotic patients. Meanwhile, the LDUST had the highest specificity and PPV. Therefore, the NRI should be the screening tool in patients with early stage of cirrhosis.

What is already known on this topic?

Cirrhotic patients are at risk of malnutrition. Malnutrition adversely affects the outcome of cirrhotic patients. There are no gold standard methods of nutritional screening in patients with cirrhosis.

What this study adds?

For screening nutrition status in cirrhotic patients, NRI is advised.

Acknowledgement

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Conflicts of interest

The authors declare no conflict of interest.

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