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Study of Geriatric Nutritional Risk Index and Creatinine Index in Elderly Hemodialysis Patients for Nutritional Assessment

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ABSTRACT

Background: Patients undergoing hemodialysis (HD) frequently experience malnutrition, and this condition has strong causal relationship with mortality risk. Patients on hemodialysis typically use both the Geriatric Nutritional Risk Index (GNRI) and the Creatinine Index (CI) for evaluation of their nutritional status.

Objective: To compare CI and GNRI for evaluation of malnutrition in elderly hemodialysis patients.

Methods: This study included 60 patients aged ≥65 years on maintained hemodialysis who attended Hemodialysis Unit of Alexandria Main University Hospital. Full clinical assessment and routine laboratory investigations were done. Anthropometric measurements were estimated. Nutritional assessment using CI, GNRI, and Short Form Mini Nutritional Assessment. Cognitive function was evaluated using MMSE (mini mental status examination), Get up and Go Test (GUGT), (ADL), and (IADL) were assessed.

Results: 43.3% had normal nutrition, 33.3% at risk of malnutrition and 23.3% had malnutrition. BMI, hemoglobin and serum albumin were significantly lower in at risk and malnutrition groups but cholesterol, triglycerides and ESR were significantly higher in at risk and malnutrition groups. GNRI, CI and were significantly lower in at risk and malnutrition groups. All severe cognitive impairment cases (57.1%) were malnourished. 35.7% of mild cognitive impairment were malnourished and 7.1% of normal cognitive functions cases were malnourished. 38.3% had impaired instrumental activities of daily living (IADL), 26.7% had impaired activities of daily living (ADL) and 65% were at risk of falls.

Conclusion: GNRI is easy screening scoring tool for identifying the risk of malnutrition and has higher sensitivity and specificity compared to CI in hemodialysis elderly patients.

Keywords: Creatinine index, Elderly, GNRI, Hemodialysis, Malnutrition.

INTRODUCTION

Malnutrition is a major geriatric condition that is prevalent in older individuals, with serious effects for health outcomes and quality of life. Malnutrition is characterised by low nutrient intake and a poor nutritional state. The main causes of the nutritional and metabolic disturbances in uremic patients, however, are complicated issues other than inadequate intake.

Despite dietary protein and calorie intake that is based on conventional nutritional recommendations in these patients, blood and tissue proteins tend to be low [1]. Hemodialysis (HD) patients frequently experience malnutrition, which is strongly associated with an increased risk of passing away [2].

One of the most frequent risk factors for negative outcomes in ESRD patients has been identified as protein energy wasting, and numerous studies have showed that boosting diet could significantly cut mortality rates [3].

Examples of nutrient shortages include protein and other micro- and macronutrient losses through urine in nephrotic syndrome, lack of nutrient intake from food, dialysate loss, uremia, metabolic acidosis, and endocrine disorders such as insulin resistance and hyperglucagonemia and secondary hyperparathyroidism are some of the causes of malnutrition complicating kidney disease [4]. Patients with end-stage kidney disease (ESKD) who become malnourished suffer from worsening physical function, a lower quality of life, and higher rates of morbidity and mortality. Malnutrition affects a number of critical processes, including immune defence mechanisms, water/electrolyte balance, body temperature regulation, and tissue oxygenation. Malnutrition is thought to accelerate the transition from chronic kidney disease (CKD) to ESKD [5].

Malnutrition is linked to higher rates of morbidity and mortality, thus identifying it and treating it are top priorities. Therefore, combining both new and old scoring tools, a serial assessment of nutritional status has been created for the identification and management of malnutrition. The majority of the current nutritional evaluation techniques take a lot of time and are subjective. Therefore, accessible and uncomplicated instruments are needed for hemodialysis (HD) patients' early and personalised screening for malnutrition and assessment of the results following suitable treatments. There are simpler and more impartial nutritional evaluations available [6].

AIM

To assess malnutrition in senior hemodialysis patients and compare the creatinine index to the geriatric nutritional risk index.

SUBJECTS AND METHODS

This prospective study included 60 patients

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aged ≥65 years with chronic kidney disease on maintained hemodialysis who attended the Hemodialysis Unit of Alexandria Main University Hospital for one year from November 2019 till October 2020 and were dialyzed three times weekly for more than three and half hours each session, using high flux membranes with evaluation of nutritional status. Patients with concurrent conditions such malabsorption syndromes, stroke, cancer, and chronic liver disease that may be the cause of malnutrition were excluded from the study. Full clinical assessment and the following laboratory investigations were done for all the patients: complete blood count (CBC), urea and creatinine, erythrocyte sedimentation rate (ESR), serum albumin, triglycerides, cholesterol, and estimated glomerular filtration rate (eGFR) was measured, anthropometric measurements including body weight (wt), height (ht) and body mass index (BMI).

Nutritional assessment of HD patients was done by using:

1. Mini nutritional assessment short form [7].
2. Creatinine index (CI) formula based on age, gender, predialysis serum creatinine concentrations, and spKt/V urea [8].

CI (mg/kg/day) =16.21+1.12 x (1 if male, 0 if female) -0.06 x age - 0.08 x spKt/V urea +O.OO9 x Crpre (mmol/l)

Kt/V is a measure of the effectiveness of hemodialysis treatment.

Urea clearance in K-dialyzer

t - dialysis time V - volume of urea dispersion, about equivalent to the patient's entire body water.

3. Geriatric nutritional risk index (GNRI) was determined using a straightforward algorithm that takes into account recent weight loss and serum albumin. A Nutritional Risk Index of >100 denotes that the patient is not undernourished, whereas a score of 97.5–100 denotes mild undernutrition, a score of 83.5–97.5 denotes moderate undernutrition, and a score less than 83.5 denotes severe undernutrition, weight loss, and low blood albumin [9]. GNRI=14.89 x albumin (g/dl) + 41.7x (body weight/ usual weight).

Get up and Go Test (GUGT) was used to determine fall risk. Patients used their regular footwear and could use a walking aid if normally used. They got up from their chairs and walked three metres before turning around and returning to their seats.

When the patient was seated, time paused. Patients who took ≥12 seconds to complete the test was at risk for falling [10].

- Assessment of The term "activities of daily living" (ADL) refers to a series of actions that define the basic abilities needed to take care of oneself independently, such as eating, bathing, and moving around, personal hygiene and maintaining continence. Scores 0-5 was considered impaired and scores=6 was considered not impaired [11].
- The administration of the Instrumental Activities of Daily Living (IADL) scale takes ten to fifteen minutes.
- It had eight items, each of which had a summary score ranging from 0 (poor functioning) to 8 (excellent) (high functioning). Sores 0-7 was considered impaired and score 8 was considered not impaired. Although not always needed every day, these tasks are crucial to being able to live freely. Basic communication abilities, travel, among them were food planning, grocery shopping, housekeeping, managing medications, handling personal finances, and laundry [12].

  Measuring cognitive ability with the 30-point MMSE (mini mental state examination). Scores 24 indicated normal cognitive capabilities, whereas scores 0–17 indicated significant cognitive impairment. Scores 18–23 indicated mild cognitive impairment. [13].

Ethical considerations

The Ethics Board by Alexandria University authorized the study. Patients were informed about the trial and each participant signed an informed written permission form. This work was done in agreement with the Ethics of the World Medical Association's Program (Helsinki's Declaration).

Statistical analysis

The computer-fed data were examined using the IBM SPSS software tool, version 20.0.

(IBM Corp., New York, Armonk). The Shapiro-Wilk test was used to confirm the normality of the distribution of the data. Qualitative data were presented as frequency and percentage and were compared by Chi-square test (Fisher or Monte Carlo). Quantitative data were presented as mean, standard deviation, median, and range and were compared by ANOVA test, and pairs of groups were compared using the post hoc test (Tukey). Kruskal-Wallis test and the post hoc test (also known as Dunn's multiple comparison test) were used to compare a quantitative variable with an irregular distribution between groups. The Receiver Operating Characteristic Curve was used to evaluate the diagnostic performance of the markers. The significance of the results was assessed at the 5% level.

RESULTS

The current study included 60 elderly patients with CKD and on maintained hemodialysis and they were classified into three groups after mini nutritional assessment (MNA): 43.3% normal, 33.3% at risk of malnutrition and 23.3% had malnutrition. There was no statistically significant difference in gender. Age difference between the normal and malnutrition groups and between the at-risk group and the malnutrition group was statistically significant. There was a significant difference

between the at risk group and the malnutrition group in body weight. Regarding the optimal body weight, there were no statistically significant changes. There were statistical significant differences between normal and malnutrition groups and between at risk and malnutrition groups regarding BMI. There were no statistical significant differences regarding the different risk factors of CKD including drug induced, hypertension, smoking or family history. 85% of the patients had arteriovenous fistula (AVF). There was statistical significant difference between normal and malnutrition groups regarding the vascular access (Table 1). There were statistical significant differences regarding hemoglobin levels between the different studied groups. There was significant difference between normal and at risk groups in terms of WBCs. In terms of platelet count, there were significant differences between the normal and malnutrition groups and between the at risk and malnutrition groups. In terms of cholesterol levels, there were significant disparities between the normal and malnutrition groups and between the at risk and malnutrition groups. Regarding triglyceride levels, there were significant differences between normal and at risk groups, as well as between normal and malnutrition groups. The studied groups' levels of albumin differed significantly from one another.

Regarding ESR and creatinine level there were significant differences between the normal and at risk groups and the normal and malnutrition groups. In terms of urea levels, there were significant disparities between the normal and at risk groups and between the at risk and malnutrition groups. In terms of KT/V, there was significant difference between the normal and malnourished groups. In terms of GNRI, there were statistically significant differences between the groups that were being evaluated. There were differences between the normal and malnutrition groups and the at risk and malnutrition groups in terms of CI. Regarding eGFR, significant differences were identified between the normal and at risk groups and the normal and malnourished groups. There were statistical significant differences between the studied groups regarding MMSE and IADL. There were significant differences between normal and malnutrition groups and between at risk and malnutrition groups regarding ADL and GUGT (Table 1).

Table (1): Comparison between the three studied groups according to different parameters

		MNA Normal (n= 26)	**At risk (n = 20)**	**Malnourished (n = 14)**		
Sex						
Male	33 (55%)	16 (61.5%)	10 (50%)	7 (50%)	0.673	-
Female	27 (45%)	10 (38.5%)	10 (50%)	7 (50%)		
Age (years)						
Young old (65 – 74)	41 (68.3%)	25 (96.2%)	14 (70.0%)	2 (14.3%)		p_1=0.033*,
Old old (75 – 84)	16 (26.7%)	1 (3.8%)	6 (30.0%)	9 (64.3%)	<0.001*	p_2<0.001*,
Oldest old (≥85)	3 (5.0%)	0 (0.0%)	0 (0.0%)	3 (21.4%)		p_3=0.002*
Mean ± SD.	72.08 ± 6.47	68.92 ± 3.67	71.10 ± 5.50	79.36 ± 6.43		p_1=0.321,
Median (Min. – Max.)	70 (65 – 92)	69 (65 – 81)	69 (65 – 84)	77 (70 – 92)	<0.001*	p_2<0.001*, p_3<0.001*
Height (cm)						
Mean ± SD.	169.8 ± 4.64	168.3 ± 4.31	170.6 ± 3.02	171.4 ± 6.38	0.086	-
Median (Min. – Max.)	169(160– 188)	168(160 – 180)	170 (164 – 176)	169.5(164–188)		
Body weight(Kg)						p_1=0.159,
Mean ± SD.	68.28 ± 4.49	68.08 ± 4.20	70.40 ± 3.90	65.64 ± 4.57	0.015*	p_2=0.195,
Median (Min. – Max.)	69 (60 – 80)	68 (60 – 80)	70 (60 – 70)	66 (60 – 75)		p_3= 0.005*
Ideal body weight						
Mean ± SD.	63.57 ± 3.87	62.83 ± 3.54	64.07 ± 2.63	64.24 ± 5.64	0.435	-
Median (Min. – Max.)	63.4(57.5–78.5)	62.8(57.5–72.5)	64.3(58.4–69.5)	62.9(58.4–78.5)		
BMI (kg/m^2)						p_1=0.396,
Mean ± SD.	25.34 ± 2.55	36.70 ± 1.14	26.07 ± 1.94	21.76 ± 1.81	<0.001*	p_2<0.001*,
Median (Min. – Max.)	26.3 (19.8–28.6)	26.7(24.3–28.6)	26.3(20.3–28.6)	21.5(19.8–27.0)		p_3<0.001*
Drug induced	20 (33.3%)	10 (38.5%)	7 (35.0%)	3 (21.4%)	0.542	–
Hypertension (HTN)	35 (58.3%)	15 (57.7%)	10 (50.0%)	10 (71.4%)	0.458	–
Smoking	14 (23.3%)	6 (23.1%)	6 (30.0%)	2 (14.3%)	0.626	–
Family history	5 (8.3%)	1 (3.8%)	1 (5.0%)	3 (21.4%)	0.151	–
Vascular access						
AVF	51 (85.0%)	23 (88.5%)	19 (95.0%)	9 (64.3%)		p_1=1.000,
Permanent HD catheter	4 (6.7%)	2 (7.7%)	1 (5.0%)	1 (7.1%)	0.039*	p_2=0.081,
Temporary HD catheter	5 (8.3%)	1 (3.8%)	0 (0.0%)	4 (28.6%)		p_3=0.022*
Dialyzer type (High flux**)**	60 (100.0%)	26 (100.0%)	20 (100.0%)	14 (100.0%)	1	–

HB(gm/dl)						
Mean ± SD.	9.83 ± 1.59	11.24 ± 1.07	9.17 ± 0.67	8.11 ± 0.81	<0.001*	p_1<0.001*, p_2<0.001*, p_3=0.004*
WBCs(10^3/ml)						
Mean ± SD.	6.76 ± 1.05	7.54 ± 1.12	6.01 ± 1.91	6.40 ± 1.70	H0.041*	p_1=0.013*, p_2=0.171, p_3=0.409
PLTs (10^3/ml)						
Mean ± SD.	236.5 ± 7.31	258.6 ± 6.13	247.2 ± 8.06	180.2 ± 6.36	H0.008*	p_1=0.582, p_2=0.002*, p_3=0.015*
Cholesterol (mg/dl)						
Mean ± SD.	172.6 ± 4.39	150.3 ± 9.95	176.7 ± 37.53	208.2 ± 32.07	H<0.001*	p_1=0.032*, p_2<0.001*, p_3=0.033*
TG (mg/dl)						
Mean ± SD.	123.0 ± 4.84	100.5 ± 4.82	134.9 ± 4.69	148.0 ± 4.20	H0.001*	p_1=0.005*, p_2=0.001*, p_3=0.424
Albumin (gm/dl)						
Mean ± SD.	3.51 ± 0.64	3.97 ± 0.46	3.42 ± 0.47	2.78 ± 0.31	F<0.001*	p_1<0.001*, p_2<0.001*, p_3<0.001*
ESR						
Mean ± SD.	46.97 ± 4.19	32.77 ± 7.41	56.10 ± 5.97	60.29 ± 9.3	<0.001*	p_1=0.003*, p_2<0.001*, p_3=0.438
Creatinine (gm/dl)						
Mean ± SD.	8.83 ± 1.79	7.71 ± 1.48	9.55 ± 1.56	9.90 ± 1.51	<0.001*	p_1<0.001*, p_2<0.001*, p_3=0.786
Urea (gm/dl)						
Mean ± SD.	152.3 ± 4.54	117.7 ± 6.82	181.6 ± 7.19	174.9 ± 33.23	<0.001*	p_1<0.001*, p_2<0.001*, p_3=0.780
KT\V						
Mean ± SD.	1.22 ± 0.27	1.34 ± 0.28	1.19 ± 0.23	1.04 ± 0.18	0.002*	p_1=0.097, p_2=0.001*, p_3=0.196
GNRI						
Mean ± SD.	97.05 ± 10.20	104.3 ± 7.19	96.75 ± 6.52	84.07 ± 4.98	F<0.001*	p_1=0.001*, p_2<0.001*, p_3<0.001*
Median (Min. – Max.)	99.3(77.4–116.2)	104.8(80.9–116)	97.8(82.7–108.9)	82.99(77.4–96.3)		
CI						
Mean ± SD.	12.37 ± 0.55	12.47 ± 0.56	12.50 ± 0.49	12.01 ± 0.50	0.019*	p_1=0.983, p_2=0.030*, p_3=0.029*
Median (Min. – Max.)	12.2(11.3 – 13.4)	12.2(11.3 – 13.4)	12.3(11.5 – 13.3)	11.9(11.4 – 12.7)		
eGFR						
Mean ± SD.	7.15 ± 2.01	8.42 ± 1.72	6.69 ± 1.62	5.43 ± 1.45	H<0.001*	p_1=0.005*, p_2<0.001*, p_3=0.066
MMSE categories						
Severe (0 - 17)	8 (13.3%)	0 (0.0%)	0 (0.0%)	8 (57.1%)		p_1<0.001*,
Mild (18 - 23)	22 (36.7%)	3 (11.5%)	14 (70.0%)	5 (35.7%)	<0.001*	p_2<0.001*,
No cognitive impairment ≥24	30 (50.0%)	23 (88.5%)	6 (30.0%)	1 (7.1%)		p_3<0.001*
Mean ± SD.	23.05 ± 3.20	25.12 ± 1.95	23.35 ± 1.66	18.79 ± 2.64		p_1=0.014*,
Median (Min. – Max.)	23.5 (16 – 30)	25 (19 – 30)	23 (20 – 27)	17 (16 – 24)	F<0.001*	p_2<0.001*, p_3<0.001*
IADL						
Impaired (0 - 7)	23 (38.3%)	2 (7.7%)	9 (45.0%)	12 (85.7%)		p_1=0.005*,
Not impaired (8)	37 (61.7%)	24 (92.3%)	11 (55.0%)	2 (14.3%)	<0.001*	p_2<0.001*, p_3=0.016*
Mean ± SD.	7.50 ± 0.70	7.92 ± 0.27	7.45 ± 0.69	6.79 ± 0.70		p_1=0.014*,
Median (Min. – Max.)	8 (6 – 8)	8 (7 – 8)	8 (6 – 8)	7 (6 – 8)	F <0.001*	p_2<0.001*, p_3=0.003*
ADL						
Impaired (0 - 5)	16 (26.7%)	1 (3.8%)	5 (25.0%)	10 (71.4%)		p_1=0.072,
Not impaired (6)	44 (73.3%)	25 (96.2%)	15 (75.0%)	4 (28.6%)	<0.001*	p_2<0.001*, p_3=0.007*
Mean ± SD.	5.72 ± 0.49	5.96 ± 0.20	5.75 ± 0.44	5.21 ± 0.58		p_1=0.184,
Median (Min. – Max.)	6 (4 – 6)	6 (5 – 6)	6 (5 – 6)	5 (4 – 6)	F <0.001*	p_2<0.001*, p_3=0.001*
GUGT						
Not risk (<14)	21 (35.0%)	5 (19.2%)	5 (25.0%)	11 (78.6%)		p_1=0.726,
At risk (≥14)	39 (65.0%)	21 (80.8%)	15 (75.0%)	3 (21.4%)	<0.001*	p_2<0.001*, p_3=0.002*
Mean ± SD.	14.82 ± 2.65	15.92 ± 2.30	15.35 ± 1.95	12.0 ± 2.18		p_1=0.648,
Median (Min. – Max.)	15 (10 – 18)	16 (10 – 18)	15.5 (13 – 18)	11.5 (10 – 17)	F <0.001*	p_2<0.001*, p_3<0.001*

SD: Standard deviation, H: Kruskal-Wallis test, F: ANOVA test, P: p: The p-value for comparing the groups investigated,
*: Statistically significant

p: p value for comparing between the studied groups
p_1: p value for comparing between **Normal** and **At risk**
p_2: p value for comparing between **Normal** and **Malnourished**
p_3: p value for comparing between **At risk** and **Malnourished**
BMI: Body mass index
AVF: arteriovenous fistula HD: hemodialysis
HB: hemoglobin
WBCs: White blood cell counts
PLT_s: platelets
TG: triglycerides
ESR: erythrocyte sedimentation rate
GNRI: Geriatric Nutritional Risk Index
CI: Creatinine index
MMSE: mini mental status examination
IADL: instrumental activity of daily living
ADL: activity of daily living
GUGT: get up and go test

ROC curve for CI and GNRI revealed that the optimal cutoff value of GNRI was ≤101.4 in predicting at risk of malnutrition with significant difference, which revealed that GNRI was more accurate to discriminate at risk of malnutrition than CI (figure 1).

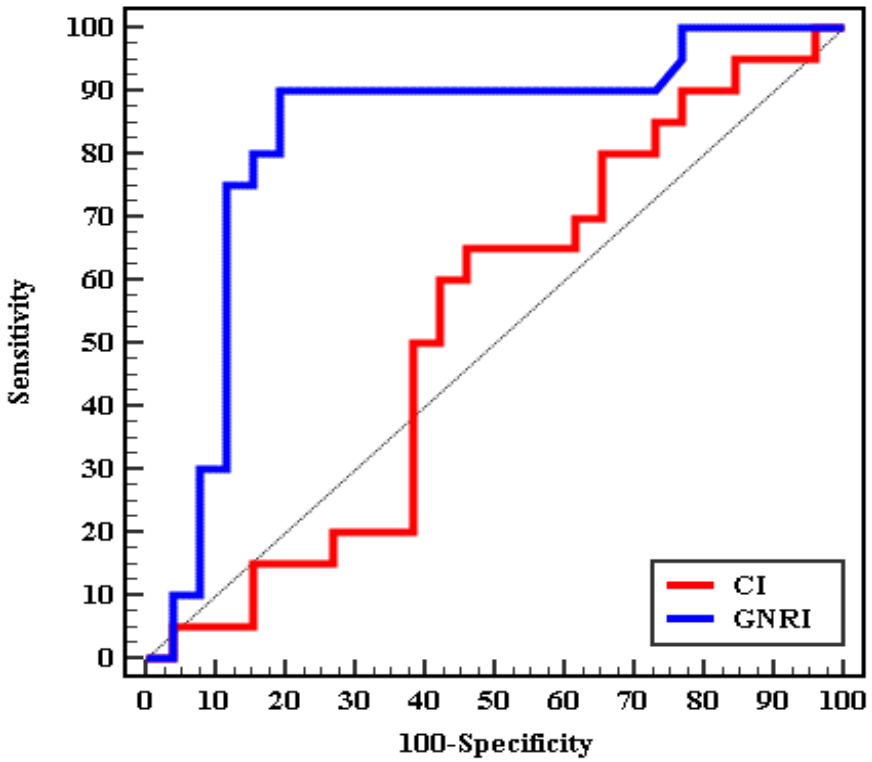

Figure (1): ROC curve for CI and GNRI to prognose MNA at risk (n = 20) from normal MNA (n = 26)

ROC curve for CI and GNRI revealed that the cutoff value was >12.05 for CI in predicting malnutrition while cutoff value was >83.34 for GNRI in predicting malnutrition, which revealed that GNRI was more accurate to discriminate malnutrition than CI (figure 2).

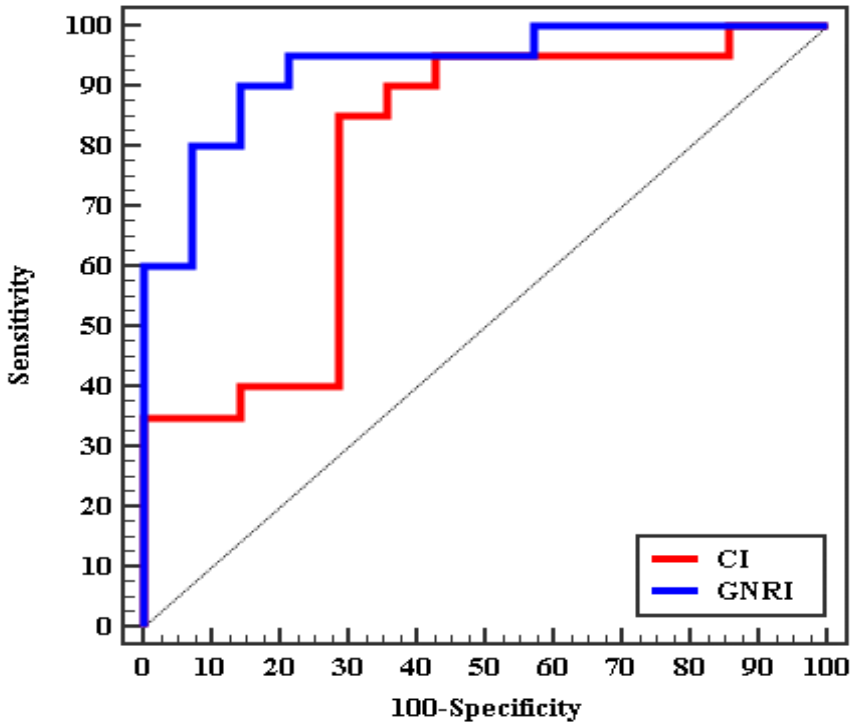

Figure (2): ROC curve for CI and GNRI to prognose MNA at risk (n = 20) from malnourished MNA (n = 14)

DISCUSSION

The current study was conducted on 60 elderly patients with CKD and on maintained hemodialysis. The results of the current study revealed that nearly more than half of the patients were either at risk of malnutrition or suffered from malnutrition and these findings were similar to the study performed by ***Badrasawi et al.*** [14] who found that nearly half of the studied subjects had malnutrition. The study's findings showed no appreciable nutritional status disparities between men and women. These findings concurred with those of a research by ***Tayyem et al.*** [15], which indicated no discernible nutritional status differences between males and females. Within the groups that were analysed in the current investigation, there were statistically significant age disparities, with the majority of the old old and all the oldest old having significant malnutrition. These findings were consistent with a research by ***Oluseyi and Enajite*** [16] that discovered malnutrition was much more prevalent in elderly CKD patients. This pattern is expected given that ageing and malnutrition in the elderly are linked, even in the absence of CKD.

In the present investigation, in comparison to the at-risk group, the malnourished group's body weight and BMI were much lower, and these findings were consistent with those of the study by ***Ming et al.*** [17] who stated that patients with malnutrition and on maintenance hemodialysis had lower body weight and BMI and also the study performed by ***Irem et al.*** [18] who found the BMI was decreased in elderly malnourished with ESRD. In the current study there were no significant differences between the studied groups regarding the etiology of ESRD as either drug induced, hypertension, smoking or family history and this may be explained by the small sample included in this study. In the current study hemoglobin levels and albumin levels were lower but cholesterol and TG were higher in malnutrition group and these results were partially similar to the study performed by ***Nagabhushana et al.*** [19] who found that serum albumin was decreased in elderly patients with CKD. Similar to non-CKD individuals, CKD patients had analogous factors that regulate hepatic synthesis and catabolism of serum albumin, which may include compromised protein intake and nutrient absorption, raised serum concentration of pro-inflammatory cytokines, changes in the volume of distribution (including hemodilution), protein degradation, body losses, comorbidities, malnutrition, sarcopenia and aging [20]. The results of this study were also similar to the study performed by ***Holzer et al.*** [21] who found that serum levels of TG and cholesterol were elevated in elderly patients with ESRD. Because the metabolism of TG-rich lipoproteins (TRL) is changed in CKD patients, TRL clearance from plasma is delayed,

resulting in hypertriglyceridemia. [22]. In the current study the levels of ESR were higher in malnutrition group and this was similar to the study performed by ***Bulent et al.*** [23] who found that ESR was higher in malnutrition patients and this may be related to the chronic inflammatory diseases.

In the current study GNRI was significantly lower in both at risk of malnutrition and malnutrition groups and these results were similar to the study done by ***Panichi et al.*** [24] who stated that GNRI was lower in malnutrition groups. The results of this study revealed that CI was significantly lower in malnutrition groups and this was similar to the study done by ***Desmeules et al.*** [25]. The levels of eGFR in this study was significantly lower in malnutrition groups and this was in agreement with the study done by ***Guzin et al.*** [26]. Regarding MMSE in the current study 57.1% of malnutrition group had severe cognitive impairment and 35.7% had mild cognitive impairment and only 7.1% had normal cognitive functions and these results were similar to the study done by ***Abdulan et al.*** [27] who found that there was strong association between malnutrition and cognitive impairment but these results were opposite to the study done by ***Said et al.*** [28] who found that the cognitive function was normal in patients with ESRD. Several pathways have been proposed as potential causes of cognitive impairment in ESRD, while the exact cause is unknown. At the conclusion of the 1-year dialysis treatment, a significant reduction from baseline was observed in a study by ***Bossola et al***. [29] comparing the year-1 MMSE data from baseline to 80 HD patients. This was attributable to neuronal loss and hemodynamic stress brought on by the cyclic HD treatment brought on by toxic-metabolic variables. HD recipients' impaired cognition may be related to subcortical microvascular illness. Similar to the study conducted by ***Yang et al.*** [30] who found that 64.7% of malnutrition cases reported severe limitation of IADL and 28.6% reported limitation of ADL, 85.7 percent of the malnourished group in the current study had impaired IADL and 71.4 percent had impaired ADL.

However, these results were partly in contrast to the study done by ***Hettiarachchia et al***. [31] who found that malnutrition cases were associated with limitation of ADL but no limitation in IADL. Regarding GUGT in this study about 80.8% of normal nutrition, 75% of at risk and 21.4% of malnutrition groups were at risk of falls and physical limitations and these results were similar to the study done by ***Ramsey et al***. [32] who found that time up and go test was associated with physical limitation. In the current study the cutoff value of GNRI for differentiating at risk of malnutrition from normal was less than 101.4 and more than 83.34 differentiating at risk of malnutrition from malnutrition and the cutoff value of CI was more than 12.05 for differentiating at risk of malnutrition from malnutrition, so GNRI is considered more accurate for evaluation of malnutrition in elderly patients with ESRD and these results were similar to the study done by ***Ikue et al.*** [33] who reported that GNRI was a useful tool for the assessment of nutritional status of chronic hemodialysis patients. Studies have contrasted GNRI and CI. A typical nutritional evaluation method for HD patients was discovered to be CI, and variations in CI over time revealed more information about the patient's nutritional condition for protein and muscle mass than the absolute CI values did. As an extensive database study of 549 HD patients who were followed for more than 20 years found [8].

According to the malnutrition inflammation score MIS, a study of 422 HD patients indicated that the GNRI was the most straightforward and trustworthy risk factor for identifying HD patients at nutritional risk, by employing multiple simplified nutritional screening techniques except CI. [33]. In the current study both at risk of malnutrition and malnutrition cases can be detected by using GNRI but at risk of malnutrition cases could not be differentiated from normal by using CI, which prognoses only at risk from malnutrition cases. In the current study GNRI was more accurate for detection of at risk of malnutrition and malnutrition. In contrast to this study the results of the study done by ***Wonsun et al.*** [34] who stated that CI was considered as a good tool for assessment of malnutrition in hemodialysis patients than GNRI.

CONCLUSION

When used on senior patients receiving sustained hemodialysis, GNRI had higher sensitivity and specificity than CI at identifying the risk of malnutrition.

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