Original Article

Relationship between Geriatric Nutritional Risk Index, functional dependence, and patient outcome among hospitalized Egyptian septuagenarians.

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Abstract

Background: Nutrition has an important role in promoting health and disease prevention. Many elderlies are already malnourished before hospitalization. Further deterioration can occur during hospitalization. malnutrition can affect the efficiency of several treatments, results in longer hospital stay and increased mortality. Therefore , assessment of patient function is as important as nutritional status as it can compromise patient quality of life and affect patient outcome. So, the aim of the current study is to determine the relationship between prehospitalization function and nutritional state and hospital outcome among hospitalized Egyptian septuagenarians (aged 70 years and above).

Methods: A cross sectional study was conducted included 100 patients 70 years and above both males and females admitted to internal ward of geriatric hospital in Ain Shams university hospitals. Data collection included demographic and clinical characteristics, functional assessment using ADL, nutritional assessment by MNA-SF and GNRI

Results: the MNA-SF had the highest diagnostic performance as the area under the curve was 0.832 and the cut off point was ≤ 8 with a significant P value (**<0.001**), with sensitivity 86.7% and specificity 69.4%. GNRI has the least diagnostic performance with area under the curve 0.506 and the cut off point 100. Independent variables affecting mortality were ADL= 0 and MNA-SF ≤ 8.

Conclusion: the study provides evidence supporting the predictive utility of MNA and ADL in identifying poor outcomes among hospitalized elderly patients.

Key words: malnutrition, function, septuagenarian, outcome

Introduction

Due to increases in life expectancy, one in six people on earth are predicted to reach 60 years of age or older by 2030. At this point, there will be 1.4 billion people over the age of 60, up from 1 billion in 2020. The number of people 60 and older in the world will double by 2050 (2.1 billion). It is anticipated that between 2020 and 2050, the number of people 80 years of age or older will treble, reaching 426 million [1].

Nutrition is a basic need. It has an important role in promoting health and disease prevention [2]. Prevalence of malnutrition in hospitalized adults ranging from 20 to 50% [3]. Those at highest risk of malnutrition are elderly people who are hospitalized or living in nursing homes. Many people are already malnourished before hospitalization with further deterioration of their nutritional status during hospitalization. Many reasons can explain this. Underlying diseases may also affect one's nutritional condition; metabolic and psychological issues may raise patients' needs or lower one's food intake. Moreover, recurrent fasting before many examinations and interventions can further compromise food intake [4,5]. Consequences of malnutrition are well known which includes impaired muscle function, cognitive impairment, decreased bone mass, increased risk of falls and fractures, longer hospital stay as well as increased mortality [6,7]

Furthermore, malnutrition can affect the efficiency of several treatments such as chemotherapy, radiotherapy, antibiotic therapy, or surgery. It also significantly increases healthcare costs. [6,7]. So, the nutritional status of the elderly needs more attention.

For this purpose, several nutritional screening tools have been developed and validated such as NRS [8], MUST [9], GNRI. [10]. Other tools have been developed to consider the risk factors for being malnourished. The Mini Nutritional Assessment (MNA) is the most well-known screening tool for elderly as it assesses other elements such as psychological distress and the mobility in addition to the parameters of the nutritional status [11]. Assessment of patient function is an important component in nutritional assessment as nutritional status can compromise patient function as well as quality of life [12]. So, the aim of the current study is to determine the relationship between prehospitalization function and nutritional state and hospital outcome among hospitalized Egyptian septuagenarians (aged 70 years and above).

Methods

Study design:

A cross sectional study was conducted in Geriatric hospital, Ain shams University hospitals, Cairo, Egypt. Eligible patients included patients 70 years and above both males and females admitted to internal ward of geriatric hospital in Ain Shams university hospitals. Patients with disturbed conscious level, limb amputation and patients with volume overload (ascites and oedema) were excluded from the study.

Sample size:

A sample size of at least 100 customers is needed to achieve a 95% confidence level and power 80% when the proportion of deaths account for 16.1% in Ambarukminingsih et al., study [13]. Until the sample size was reached, all eligible patients admitted to the internal ward of the Geriatric hospital were enrolled.

Data collection:

All participants were evaluated within 48 hours of admission. Demographic characteristics of the studied group including age, sex, marital status, living arrangement and smoking was obtained. Clinical data in the form of number and type of comorbidities, cause of hospital admission was also collected.

Functional assessment:

Assessment of the patient prehospitalization function using Arabic version of activities of daily living (ADL). It assesses the overall functional activities including: 1) Toileting, 2) Bathing, 3) Dressing, 4) Transfer, 5) continence and 6) Feeding. The total ADL score lies on an ordinal scale ascending from 0 to 6, where 6 entails complete functional independence and 0 complete functional dependence. The responses on the Arabic version of the ADL are 0, 0.5, or 1, with a 0 indicate complete functional dependence, 1 complete functional independence and 0.5 indicating partial functional independence (assisted) [14].

Nutritional assessment:

The MNA- SF and the GNRI and were used to assess prehospitalization nutritional status within 48 hours of admission.

The MNA-SF is a sensitive, reliable and validated screening tool which is designed specifically for elderly. It consists of six domains: appetite or decrease food intake in the past 3 months, loss of weight in the past 3months, mobility, acute illness/psychological stress, dementia or depression, and BMI or calf circumference which is used as an alternative if BMI is not available. Total scores of MNA-SF range from 0 to 14, and patients were divided into the following three categories according to the following cut-offs: well nourished (12–14 points), at risk of malnutrition (8–11 points), and malnourished (0–7 points) [15].

The Geriatric Nutrition Risk Index was calculated as GNRI = [1.489 × serum albumin (g/L)] + (41.7 × weight (kg)/ideal weight (kg)) [16]. The ideal weight was calculated by the following Lorentz formula [16]:

For men: Ideal weight= (height (cm) – 100) – [(height -150)/4]

For women: ideal weight= (height (cm) – 100) – [(height -150)/2.5]

Patient standing height was measured using a tape measure. When bedridden were involved, height was calculated from Knee-Heel (KH) length Using the equation [17]:

For men: H(cm) =[2.02∗KH (cm)][0.04 ∗age(y)]+64.19

For women: H(cm) =[1.83∗KH (cm)][0.24 ∗age(y)]+84.88

The following thresholds were used to classify the patients: moderate to severe risk of malnutrition: <92; low risk: 92 to 98; and no risk: >98.

Laboratory investigations:

Laboratory assessments done were haemoglobin (g/ dL), and serum levels of albumin (g/dL) both were collected within 48 hours after hospital admission.

Ethical consideration

Every patient or the patient's next of kin gave their informed consent for participation in the research and blood sample collection, and The Ethical Committee of Scientific Research (Ain Shams University, Faculty of Medicine) gave its approval to the study.

Statistical analysis:

Data was analyzed using statistical package for social science (SPSS) version 27.0, data was expressed as mean and standard deviation (SD), median (IQR) and frequency and percentage when indicated. The following tests were used: Independent samples t-test, Chi square test, Fisher’s Exact test, ROC analysis, and logistic regression analysis, the confidence interval was set to 95%, P value < 0.05 what's considered significant.

Results

The clinical and demographic features of the population under study were displayed in Table 1. Mean±SD Of age was 77.7± 6.4 years. Majority were females (70%). More than half was widow (58%). Minority were living alone (20%). More than three quarters were never smokers. As regarding clinical characteristics hypertension was the most frequent comorbidity (72%), followed by diabetes mellitus (43%). Renal disease was the most frequent cause of admission (27%), followed by pneumonia (16%).

Regarding the functional characteristics of the studied cases, Mean±SD of ADL score was 2.6± 2.4. The most frequent dependance was in dressing, bathing and toileting (47% for each), for nutritional characteristics mean±SD of MNA-SF and GNRI scores were 9.2±1.5 and 106.9±20 respectively.

In studying the relation between different studied variables and mortality the results of our study revealed that the number of comorbidities was higher in non survivors also functional dependence in different domains were more frequent in non survivors, hemoglobin, albumin and MNA scores were significantly lower in non survivors.

Based on ROC curve analysis of the diagnostic performance of predictors of mortality (**table 2 and 3, figure 1**) it showed that the MNA-SF had the highest diagnostic performance as the area under the curve was 0.832 and the cutoff point was ≤ 8 with a significant P value (**<0.001**), followed by hemoglobin with area under the curve was 0.779 and the cutoff point was ≤9.5 gm/dL with a significant P value(**0.001**), then albumin, and number of comorbidities both have a nearly similar diagnostic performance with area under the curve 0.675 and 0.682 respectively. Lastly the GNRI has the least diagnostic performance with area under the curve 0.506 and the cutoff point 100.

Table 3 showed that MNA-SF score ≤ 8 had the highest diagnostic characteristics in predicting mortality with sensitivity 86.7% and specificity 69.4% this was followed by hemoglobin level ≤9.5gm/dl with sensitivity 73.3% and specificity 78.8%.

Regarding logistic regression analysis of independent variables affecting mortality **table 4** showed that cardiovascular comorbidities, ADL= 0 and MNA-SF ≤ 8 were significant independent risk factors that increases the risk of mortality.

Discussion

Maintaining good nutritional status during hospitalization is important, as hospital infections, longer hospital stay, increased treatment cost and higher morbidity and mortality are linked to malnutrition. Early detection of malnourished patients could significantly enhance their prognosis.

In this study we aimed to determine the relationship between prehospitalization function and nutritional state and hospital outcome among hospitalized Egyptian septuagenarians. The results of the study revealed that MNA-SF score of 8 or lower was the strongest predictor of death with sensitivity 86.7% and specificity 69.4%. Hemoglobin levels below 9.5 grams per deciliter (g/dL) were also a good predictor of mortality, with sensitivity 73.3% and specificity 78.8%. Having existing cardiovascular comorbidities, being completely dependent on others for daily activities (ADL=0), and poor nutritional status (MNA-SF ≤ 8) were all independently identified as factors that significantly increase the risk of death.

Numerous studies have demonstrated the association between malnutrition assessed by MNA and poor outcomes in hospitalized elderly patients. For example, a meta-analysis by Correia and Waitzberg (2003) found that malnutrition diagnosed by MNA was significantly associated with increased length of hospital stay, higher complication rates, and elevated mortality risk among older adults [18]

According to Liu et al., 2022, by using MNA-SF, elderly patients who were malnourished had greater mortality rates than those who were well-nourished (OR 5.738, 95% CI 3.473–9.48; 10.29% vs. 1.23%). [19]

Similar results were reported by Agarwal et al. who indicated that patients with malnutrition had a 90-day in-hospital mortality rate that was between 1.09 to 3.34 times higher than that of those with adequate nutrition[20].

While GNRI may have some utility as a nutritional screening tool, particularly in certain populations or settings, its ability to independently predict mortality in older adults may be influenced by various factors such as comorbidities, functional status, and other prognostic indicators.

In the current study GNRI couldn't predict mortality in the hospitalized Egyptian septuagenarians, this was contradictory to previous reports [16,21, 22]

This difference could be attributed to other confounders as comorbidities including anemia, cardiovascular comorbidities, and functional dependency.

Functional dependency can be a consequence of frailty and medical comorbidities, and it can affect the recovery of older adults. In the current study, we found an independent association between ADL dependency and mortality. The severe disability was strongly associated with mortality among inpatients aged ≥ 70 years. This is in accordance with Takata et al., who reported that mortality was 2.8 times higher in ADL dependent subjects. [23]

Nakazawa et al. found dose–response association between ADL level and mortality, ADL level predicted short-term mortality among institutionalized older adults [24]

Covinsky and colleagues assessed the association between prehospitalization ADL function and mortality among older adults. They found that impairments in ADL function prior to hospitalization were independently associated with increased mortality risk over one year of follow-up. Even after adjusting for demographic factors, comorbidities, and severity of illness, prehospitalization ADL function remained a strong predictor of mortality [25].

Conclusion

In conclusion, our prospective study provides evidence supporting the predictive utility of MNA and ADL in identifying poor outcomes among hospitalized elderly patients. Incorporating assessments of ADL and MNA into hospital admission can aid prognostication and patient risk stratification allowing for better resource allocation.

Conflict of interest

No conflict of interest

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Table (1): The demographic and clinical characteristics of the studied groups:

Characteristics		Mean±SD	Range
Age (years)		77.7±6.4	70.0–94.0
		n	**%**
Gender	**Male**	30	30.0%
	Female	70	70.0%
Marital status	**Single**	7	7.0%
	Married	35	35.0%
	Widow	58	58.0%
Living alone		20	20.0%
Smoking	**Current**	9	9.0%
	Ex	12	12.0%
	Never	79	79.0%
		Mean±SD	**Range**
Number of comorbidities		2.4±1.0	0.0–4.0
		n	**%**
Comorbidities	**Hypertension**	72	72.0%
	Diametes mellitus	43	43.0%
	Neurological	38	38.0%
	Cardiovascular	33	33.0%
	Chronic kidney	29	29.0%
	Chronic liver	23	23.0%
	COPD	4	4.0%
Causes of admission	**Renal disease**	27	27.0%
	Pneumonia	16	16.0%
	Hepatic disease	12	12.0%
	DM complications	12	12.0%
	UTI	9	9.0%
	Gastroenteritis	7	7.0%
	Cardiovascular	6	6.0%

	Dehydration	6	6.0%
	Anemia	5	5.0%

Table (2): Diagnostic performance of hemoglobin, albumin, ADL score, MNA-SF score and GNRI score in predicting mortality:

Factors	AUC	SE	p-vlue	95% CI	Cut point
Number of comrbidities	0.682	0.090	**0.025***	0.505–0.858	≥8.0
Hemoglobin	0.779	0.064	**0.001***	0.653–0.904	≤9.5 gm/dL
Albumin	0.675	0.083	**0.031***	0.513–0.838	≤2.8 gm/dL
ADL score	0.626	0.081	**0.121**	0.467–0.785	=0.0
MNA score	0.832	0.049	**<0.001***	0.735–0.928	≤8.0
GNRI score	0.506	0.098	0.938	0.314–0.698	≤100.0

AUC: Area under curve. SE: Standard error. CI: Confidence interval.

*Significant

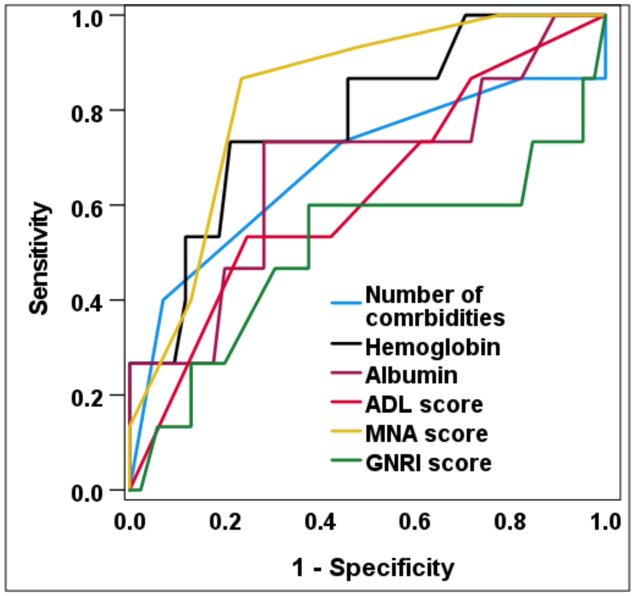

Figure (1): ROC curve for hemoglobin, albumin, ADL score, MNA-SF score and GNRI score in predicting mortality.

Table (3): Diagnostic characteristics of hemoglobin, albumin, ADL score , MNA-SF score and GNRI score cut points in predicting mortality.

	Sensitivity	Specificity	sticaccuracy	'sindex	Predictive	e Predictive
Comrbidities ≥8.0	73.3%	55.3%	58.0%	28.6%	22.4%	92.2%
Hemoglobin ≤9.5 gm/dL	73.3%	78.8%	78.0%	52.2%	37.9%	94.4%
Albumin ≤2.8 gm/dL	73.3%	71.8%	72.0%	45.1%	31.4%	93.8%
ADL score =0.0	53.3%	75.3%	72.0%	28.6%	27.6%	90.1%
MNA score ≤8.0	86.7%	69.4%	72.0%	56.1%	33.3%	96.7%
GNRI score ≤100.0	60.0%	62.4%	62.0%	22.4%	22.0%	89.8%

Table (4): Logistic regression for independent variables affecting mortality:

Factors	**β**	**SE**	**p-vlue**	**95% CI**
Constant	-6.16	1.49	**<0.001***	
Cardiovascular comrbidities	2.08	0.85	**0.015***	8.04 (1.51–42.85)
ADL=0.0	2.70	0.93	**0.004***	14.81 (2.39–91.60)
MNA score ≤8.0	3.68	1.06	**0.001***	39.53 (4.95–315.92)