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Care of Older Adults

Comparison of Geriatric Nutritional Risk Index scores on physical performance among elderly patients with chronic obstructive pulmonary disease

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ABSTRACT

Objectives: The Geriatric Nutritional Risk Index (GNRI) is a new prognostic indicator for nutritional status-related complications and mortality among the elderly. Here we aimed to compare 6-min walk distance (6MWD) between high and low GNRI groups for patients with COPD.
Methods: We enrolled 63 elderly men with COPD. These subjects were divided into two groups based on their GNRI scores: high GNRI group (≥92 points; $n = 44$) and low GNRI group ($n = 19$); we compared 6MWD between these groups.
Results: The subjects' characteristics between the high and the low GNRI groups were similar, except for BMI and serum albumin levels. 6MWD were significantly lower in the low GNRI group (279.5 ± 112.3 m versus 211.1 ± 125.3 m; $p = 0.03$).
Conclusions: The GNRI has a more close relation with exercise tolerance and may be a useful nutritional assessment scale for elderly patients with COPD.

Introduction

Chronic obstructive pulmonary disease (COPD) is characterized by chronic airflow limitation that is not completely reversible. Weight loss is a major complaint of patients with COPD and is related to systemic inflammation, increased respiratory muscle energy consumption, and others.[1] Underweight status is associated with increased dyspnea[2] and reduced exercise performance[3] and quality of life[4] and results in increased mortality independent of the degree of airflow limitations.[5,6] Thus, undernutrition status is a serious problem for patients with COPD.

The Geriatric Nutritional Risk Index (GNRI) is a new prognostic indicator of nutritional status-related complications for the elderly. It is determined from patients' current body weight, ideal body weight, and serum albumin level.[7] The GNRI is a simple and valid tool for identifying undernutrition status,[8] associated with increased mortality among elderly patients in both acute settings[9] and long-term care settings.[7,10] Moreover, the utility of the GNRI as a predictor of mortality has been demonstrated in patients with heart failure[11] and those on chronic dialysis.[12] The literature assessing the GNRI for patients with several disease states has been reported[7–12]; however, there is little information regarding its use in patients with COPD is available.

Cereda et al recently reported that the GNRI was a good predictor of physical performance for older institutionalized patients.[13]

Abbreviations: BMI, body mass index; COPD, chronic obstructive pulmonary disease; CRP, C-reactive protein; FEV1, forced expiratory volume in 1 s; FVC, forced vital capacity; GNRI, Geriatric Nutritional Risk Index; LTOT, long term oxygen therapy; 6MWD, 6-min walk distance.

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A similar relationship has been identified between the GNRI scores and physical performance in male and female heart failure patients.[14,15] Thus, we hypothesized that the GNRI scores is associated with physical performance of patients with COPD.

The primary aim of this study was to compare physical performance as assessed by 6-min walk distance (6MWD) between high and low GNRI groups for patients with COPD.

Methods

Study design and subjects

This was a cross-sectional comparative study. We initially recruited 46 male inpatients and 44 male outpatients who were diagnosis with COPD and were being followed in four hospitals in Japan. Inpatients were being hospitalized for COPD exacerbation, and data collection was performed after the symptoms had subsided to be able to start pulmonary rehabilitation and perform ambulatory exercise. All outpatients regularly received outreach nursing and underwent no exacerbations within 4 weeks. We excluded those subjects who were aged ≤64 years and/or had a documented history of musculoskeletal disease, cerebrovascular disease, nephrotic syndrome, liver disease, cardiac disease, or cancer. This study was approved by the ethics committee of Kobe University Graduate School of Health Sciences, and all subjects provided written informed consent according to the ethical standards set forth in the Declaration of Helsinki.

Measurements

Age, height, body weight, serum albumin levels, and C-reactive protein (CRP) levels were obtained from subjects' medical records. Height and body weight were measured using a stadiometer and a scale to the nearest 0.1 cm and kg, respectively. BMI was calculated as follows: BMI = body weight (kg)/height $(m)^2$.

Postbronchodilator forced expiratory volume in 1 s (FEV1) was measured using a spirometer in accordance with the guidelines of the Japanese Respiratory Society.[16] The % predicted value of FEV1 was calculated based on data from the Japanese Respiratory Society.[17] The severity of airflow limitation was based on the Global Initiative for Chronic Obstructive Lung Disease (GOLD) criteria for grade 1 (mild), 2 (moderate), 3 (severe), and 4 (very severe); these were defined by FEV1 ≥80% predicted, 50% ≤ FEV1 <80% predicted, 30% ≤ FEV1 <50% predicted, and FEV1 <30% predicted, respectively.[18]

A 6-min walk test (6MWT) was performed indoors along a flat, straight course according to standard protocols.[19] Subjects were allowed to stop and rest depending on their fatigue and dyspnea. Researchers did not unify and the researchers handled the oxygen. The use of long term oxygen therapy (LTOT) and oxygen flow rates during 6MWT tests were also recorded.

All measurements were performed within a 1-week duration, and serum albumin and CRP levels were obtained within the same duration of 1 week. Each measurement was performed by experienced doctors, nurses, and physical therapists in each hospital.

The GNRI was calculated using the following formula[7]:

$$\text{GNRI} = (14.89 \times \text{serum albumin level, g/dl}) + (41.7 \times \text{current body weight/ideal body weight}).$$

$$\text{Ideal body weight} = \text{height (m)} \times \text{height (m)} \times 22$$

If the current body weight exceeded the ideal body weight, a score = 1 was assigned to the current body weight/ideal body weight. To calculate ideal body weight, several studies have used estimated height which was derived from knee height and age.[7,10,13] The height of all subjects in our study could be measured in the standing position using a stadiometer. We used the actual survey height to the nearest 0.1 cm, as described previously.[8,11,14,15] Body weight was measured using a scale to the nearest 0.1 kg, as described previously.[10,13] Nutritional risk categories were defined as follows: severe risk, GNRI of <82; moderate risk, GNRI of 82 to <92; low risk, GNRI of 92–98; no risk, GNRI of >98.[7]

Statistical analysis

Subjects with COPD were divided into two groups: high GNRI group (≥92; low or no nutritional risk) and low GNRI group (<92; moderate or severe nutritional risk), based on previous studies.[11,14,15] All results are denoted as means ± 1 standard deviation (SD) or numbers and percentages. The normality of measurements was tested using the Kolmogorov–Smirnov test. Chi-square test, independent *t*-test, and Mann–Whitney *U* test were used to compare the measurements between these two groups. Subject characteristics that were significantly different between two groups were adjusted for the comparison of 6MWD. In addition, we also divided the subjects into two groups based on serum albumin levels and BMI and compared the subject characteristics and 6MWD. The cut-off values used were serum albumin of 3.5 g/dL and BMI of 21 kg/m^2, as GNRI = 92 was determined by serum albumin level = 3.5 g/dL and current body weight/ideal body weight = 0.95 (approximately BMI = 21).[7] All statistical analyses were performed using an SPSS statistical package (version 17.0 for Windows). *p*-values of <0.05 were considered significant.

Results

A total of 63 elderly male subjects with COPD met the criteria for this study (mean age: 78.1 ± 6.6 years; age range: 65–92 years). According to the GOLD criteria for the severity of airflow limitation, 8 patients (12.7%) were at grade 1, 18 patients (28.6%) at grade 2, 19 patients (30.2%) at grade 3, and 18 patients (28.6%) at grade 4.

Among these patients, 44 (69.8%) were classified as a high GNRI group (no risk: $n = 30$; low risk: $n = 14$), and 19 (30.2%) were in a low GNRI group (moderate risk: $n = 12$; high risk: $n = 7$). Except for

Table 1
Comparison subject characteristics between high GNRI group and low GNRI group.

	High GNRI group ($N = 44$)	Low GNRI group ($N = 19$)	*p*-value
Age (years)[a]	77.5 ± 7.1	79.4 ± 5.2	0.31
Inpatients/outpatients (n)[c]	18/26	3/16	0.06
LTOT (n)[c]	30	13	0.99
Oxygen flow (L/min)[a]	1.8 ± 1.8	1.6 ± 1.5	0.61
BMI (kg/m^2)[a]	21.8 ± 3.0	18.3 ± 2.3	<0.001
Serum albmin (g/dL)[b]	4.1 ± 0.3	3.4 ± 0.3	<0.001
CRP (mg/dL)[b]	0.6 ± 1.3	1.5 ± 2.2	0.17
FEV1 predicted (%)[b]	49.9 ± 26.9	43.6 ± 22.1	0.51
GOLD classification 1/2/3/4 (n)[c]	6/13/14/11	2/5/5/7	0.64
6MWD (m)[a]	279.5 ± 112.3	211.1 ± 125.3	0.03

GNRI: Geriatric Nutritional Risk Index; LTOT: long term oxygen therapy; BMI: body mass index; CRP: C-reactive protein; FEV1: forced expiratory volume in 1 s; GOLD: global initiative for chronic obstructive lung disease; 6MWD: 6-min walk distance. Values are mean ± standard deviation unless otherwise stated. High GNRI group ≥92 (low or no nutritional risk); Low GNRI group <92 (moderate or severe nutritional risk).

[a] *t*-test.

[b] Mann–Whitney *U* test.

[c] Chi-square test.