Nutritional status in a multicenter study among institutionalized patients in Spain

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Abstract. – Introduction: The aim of our study was to investigate and evaluate, in a multicenter study, the prevalence of malnutrition as well as the relationship between different anthropometric and biochemical markers with Mininutritional assessment (MNA) scores.

Subjects and Methods: A representative sample of the institutionalized Spanish population aged 65 and older (strictly speaking, born in 1942 or earlier), is covered in this cross-sectional survey. Anthropometric variables, MNA test and biochemical evaluation were performed by Geriatrics Units specialists.

Results: The percentage of patients classified as well nourished (27.8%) was larger in the 85-94 (39.4%) range than in the 65-74 (26.2%), 75-84 (24%) and >95 (14.8%) age ranges. A population of 254 patients (49.6%) were at risk of undernutrition, a number which was larger in 75-84 (52%), 65-74 (53.8%) and >95 (53.7%) than in the 85-94 (44.1%) ones. On the other hand, undernourishment (22.5%) was larger in those of 95 and older (31.5%) than in 85-94 (16.5%), 75-84 (24%) and 65-74 (20%) patients. According to our investigation females are worse nourished (Odd’s Ratio 0.51 CI95%: 0.33-0.79) and, consequently, more undernourished (Odd’s Ratio 2.36 CI95%: 1.48-3.74) than males. No significant differences in the “at risk of undernutrition category” (Odd’s Ratio 0.76 CI95%: 0.52-1.10) were observed but, in transferrin, iron, haemoglobin and total cholesterol, statistical differences among MNA classification were detected. MNA scores were correlated with iron, total cholesterol, albumin, transferrin, age and haemoglobin.

Conclusion: In this multicenter study, institutionalized patients have a high prevalence of undernutrition or are at-risk, as well as females are more undernourished than males.

Key Words:
Institutionalized patients, Malnutrition, Mininutritional assessment test.

Introduction

In recent years, malnutrition seems to be a prevalent problem between both hospitalized and institutionalized patients1-2. The increasing prevalence of malnutrition is confirmed by the research into this issue and, consequently, by all data emerged from those studies involving different Hospitals which have been designed to investigate malnutrition in terms of the patient outcome, hospital stay or public health expenditure5-6. As a matter of fact, clinical Nutrition Units have been gradually developed in hospitals in western countries7. In 2002, the resolution entitled “Food and nutritional care in hospitals: how to prevent undernutrition. Report and recommendations” was published by the Council of Europe8 It is nevertheless true that the lack of resources such as clinical nutrition units and nutritional training for medical staff, leads to an insufficient data to diagnose hospital malnutrition9.

Malnutrition is often undiagnosed and, consequently, left untreated. Anthropometry measurements such as BMI, mid-arm circumference, and triceps skin fold thickness are mainly considered as the easiest to use and noninvasive tools to provide information on nutritional status of the patients. Biochemical measurements such as serum albumin and lymphocyte count are also well known markers in terms of malnutrition and there’s no doubt they are the most widely used in the laboratory tests10. Should be taken into account that accurate, quick-and-easy to use tools are demanded in order to evaluate nutritional status in the elderly.

The Mini-Nutritional Assessment (MNA) test, based on those scores related to dietary intake, anthropometric, subjective and global assess-
ments\textsuperscript{11}, seems to be a perfect and accurate screening tool including multiple advantages, and that’s why it has been used in geriatric patients evaluation\textsuperscript{12,13}.

Epidemiology of undernutrition and risk of undernutrition mainly focused on those elderly Spanish patients living institutionalized, is one of our Health System’s top priority. We aimed to investigate and evaluate, in a multicenter study, the prevalence of malnutrition as well as the relationship between different anthropometric and biochemical markers with MNA scores.

Material and Methods

Subjects

A representative sample of the institutionalized Spanish population aged 65 and older (strictly speaking, born in 1942 or earlier), is performed in this cross-sectional survey. The local Clinical Research Ethics Committee of the Medicine School (University of Valladolid) approved the study. Forty-five centers were selected by means of probabilistic sampling, followed by selections of 20 individuals already hospitalized of each center.

All data given in this study was gathered in the course of 2007 through in-person interviews with the patients involved. In addition, a physical examination to measure blood pressure and anthropometric variables was taken in second place. Interviewers were given a standardized training in order to administer the questionnaire and take blood pressure readings and anthropometric measurements. Finally, a total of 493 patients, 322 females and 171 males, were enrolled in this study.

Assays

Blood samples were taken after 12 hour overnight fast. Plasma glucose levels were determined by using an automated glucose oxidase method (Glucose analyser 2, Beckman Instruments, Fullerton, CA, USA). Serum total cholesterol and triglyceride concentrations were determined by enzymatic colorimetric assay (Technicon Instruments, Ltd., New York, N.Y., USA), while HDL cholesterol was determined enzymatically in the supernatant after precipitation of other lipoproteins with dextran sulphate-magnesium.

Fasting blood samples were drawn for measurement of albumin (3.5–4.5 g/dl) and transferrin (200–400 mg/dl) with an auto analyzer (Hitachi, ATM, Mannheim, Germany). Iron (30–300 ng/ml) was analyzed with an analyzer (Beckman Coulter, Inc, Los Angeles, CA, USA).

Anthropometric Measurements

Body weight was measured to an accuracy of 0.1 kg and height was measured in centimetres using a stadiometer. Body mass index computed as body weight in kilograms/(height in centimeters\textsuperscript{2}).

Mininutritional Assessment Test

The MNA test is composed of simple measurements and brief questions that can be completed in about ten minutes. These are: anthropometric measurements (weight, height and weight loss), global assessment (six questions related to lifestyle, medication, and mobility); dietary questionnaire (eight questions related to number of meals, food and fluid intake, and autonomy of feeding), and subjective assessment (self perception of health and nutrition). The sum of MNA score distinguishes between the following groups of patients: (1) adequate nutritional status (MNA >24); (2) at risk of malnutrition: MNA between 17 and 23.5; and (3) those with frank malnutrition: MNA <17. Patients were classified in two groups; 0 (adequate nutritional status) and 1 (at risk of malnutrition and with frank malnutrition).

Statistical Analysis

The results were expressed as mean±SD. The distribution of variables was analyzed with Kolmogorov–Smirnov test. Quantitative variables with normal distribution were analyzed with two-factor repeated measures ANOVA including interaction terms and Bonferroni (posthoc test) were used. Non-parametric variables were analyzed using the Mann-Whitney U test. Discrete variables were analyzed with the chi-square test, with Yates correction as necessary, and Fisher’s test. Odd’s Ratios were calculated to compare males and females. A $p$-value under 0.05 was considered statistically significant.

Results

A total of 493 patients were enrolled, mean age was 83.3±8.5 years, weight 64.1±15.1 kg and BMI 26.43±5.5. The sex distribution of patients
was 171 (34.7%) males and 322 (65.3%) females. In males, mean age was 81.2±8.5 years, weight 69.3±14.5 kg and BMI 25.3±6.5. In females, mean age was 84.5±8.2 years, weight 61.2±14.7 kg and BMI 27.4±5.6. Diseases of the patients were 56.8% hypertension, 32.6% diabetes mellitus, 35.4% ischaemic cardiovascular disease, 27.4% stroke, 27.6% dyslipemia and 15.3% obstructive chronic lung disease.

Table I shows the distribution of patients according to their gender, age range and nutritional state. In addition, the percentage of patients classified as well nourished (27.8%) was larger in the 85-94 (39.4%) range than in the 65-74 (26.2%), 75-84 (24%) and >95 (14.8%) age ranges (see Table I). A population of 254 patients (49.6%) were at risk of undernutrition, a number which was larger in 75-84 (52%), 65-74 (53.8%) and >95 (53.7%) than in the 85-94 (44.1%) ones. On the other hand, undernourishment (22.5%) was larger in those of 95 and older (31.5%) than in 85-94 (16.5%), 75-84 (24%) and 65-74 (20%) patients. According to our investigation, females are worse nourished (Odd’s Ratio 0.51 CI95%: 0.33-0.79) and, consequently, more undernourished (Odd’s Ratio 2.36 CI95%: 1.48-3.74) than males. No significant differences in the “at risk of undernutrition category” (Odd’s Ratio 0.76 CI95%: 0.52-1.10) were detected.

Table II shows the means of the variables in each MNA classification for each gender and for the total group. Furthermore, statistical differences among MNA classification were detected in transferrin, iron, haemoglobin and total cholesterol.

Table III shows the correlation analysis performed between MNA scores and some parameters. In addition, MNA scores were correlated with iron, total cholesterol, albumin, transferrin, age and haemoglobin.

**Discussion**

In the present study, the frequencies of undernutrition (22.5%), risk of undernutrition (49.6%) and well nourished (27.8%) among institutionalized Spanish patients, were within the range presented in the literature.

Undernutrition in the institutionalized geriatric population is a quite common and serious condition, which is closely related to poor clinical outcomes. So many previous studies have focused attention on the nutritional status in clinical practice, in this area being discussed using nutritional status parameters as weight, BMI, skinfolds, body circumferences, albumin and prealbumin or Subjective Global assessment technique (SGA). This latter is hardly difficult to make a proper and useful comparison among them due to the targeted population groups and the criteria performed in the nutritional assessment. In addition, there are many different nutritional assessment variables used in clinical practice, which vary in their ability to discriminate malnutrition as well.

The Mininutritional Assessment Test (MNA) is a valid, quick-and-easy to use screening tool to detect and evaluate nutritional status. Validation studies have disclosed that MNA score is correlated with clinical, anthropometric and biological variables. In 32 studies focused on institutionalized elderly subjects (n=6821 elderly), the prevalence of malnutrition was 21% (range 5-71%) and risk for malnutrition was 51% (range 27-70%) by using the MNA test. The prevalence of well-nourished subjects was 29% (range 4-61%). This wide range in prevalence of malnutrition is partly due to the level of dependence, the conditions offered by different institutions, personal nutrition and general state of health of the patients, as well as, their gender, age range and social, economical and cultural differences, among others.

As it’s mentioned above, the MNA score is a simple and low cost nutritional assessment instrument and it’s even associated with the length of hospital stay. Some studies pointed that MNA score is well correlated with all the nutritional parameters whereas another studies have suggested that a low MNA score is found to be predictive of a wide range of adverse clinical events during hospitalization and it’s closely associated with a higher mortality risk. Furthermore, the MNA test is the first stage of the selection process in order to determine undernourishment and it’s highly acceptable to the target audience because measurement or biochemical markers are not required.

In the present research, it was detected that the female patients are more undernourished than males. Previous studies imply that the prevalence of undernutrition and risk of undernutrition in institutionalized female patients is very variable around the world, varying from 7.9% and 61.8% to 15% and 58%. Our data mean that nutritional problems were more severe in females than in male patients, a situation which might be,
Table I. Patients according to gender, age range and nutritional status.

<table>
<thead>
<tr>
<th>Age range</th>
<th>Well nourished</th>
<th>At risk of undernutrition</th>
<th>Undernourished</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>M</td>
<td>T</td>
<td>F</td>
</tr>
<tr>
<td>65-74 years</td>
<td>6 (18.2)</td>
<td>11 (34.4)</td>
<td>17 (26.2)</td>
<td>18 (54.5)</td>
</tr>
<tr>
<td>75-84 years</td>
<td>23 (18.9)</td>
<td>26 (31.7)</td>
<td>49 (24)</td>
<td>65 (53.3)</td>
</tr>
<tr>
<td>85-94 years</td>
<td>21 (16)</td>
<td>7 (17.9)</td>
<td>28 (39.4)</td>
<td>52 (39.7)</td>
</tr>
<tr>
<td>&gt; 95 years</td>
<td>10 (27.8)</td>
<td>7 (38.9)</td>
<td>17 (14.8)</td>
<td>19 (52.8)</td>
</tr>
<tr>
<td>Total:</td>
<td>50 (18.1)</td>
<td>51 (29.8)</td>
<td>111 (27.8)</td>
<td>154 (46.4)</td>
</tr>
</tbody>
</table>

F: females; M: males; T: total. Number in parentheses represent the percentage value.
at least, partly justified by the difference in the average age between both genders. Nevertheless, the effect of age is not always observed in malnourished subjects and those at risk of malnutrition\textsuperscript{23,24}. Even so, as our data reveal, the highest rate of undernutrition was observed in the age >95, as well as a negative correlation was verified for age and MNA values, too.

The three MNA categories showed statistically significant differences among MNA scores as well as total cholesterol, haemoglobin, transferrin, and iron, so that lower values were detected in those patients with malnutrition by comparison with those found in well-nourished. The comparison by gender, showed statistical significance between total cholesterol levels and age. Significant differences between genders were not observed, except for MNA, transferrin, iron, albumin, haemoglobin, triglycerides and glucose.

A positive correlation of total cholesterol, haemoglobin, transferrin, iron and albumin was verified by MNA values. This might be explained because undernutrition is caused primarily by an inadequate intake of dietary energy, regardless of whether any other specific nutrient is a limiting factor and, consequently, it may develop slowly from progressive undernutrition rooted in the effects of a series of functional and biochemical changes such as those in haemoglobin, transferrin, iron and total cholesterol, which can occur with aging. These changes were significantly correlated with MNA scores, so that MNA test is considered to be a highly useful and accurate tool.

As conclusion, in this multicenter study, institutionalized patients have a high prevalence of undernutrition or are at risk of undernutrition by MNA test score. Females are more undernourished than males. MNA test presented true de-
Dependences with haemoglobin, total cholesterol, transferrin and iron, which prompted us to consider MNA as a crucial tool in the clinical evaluation of those elderly institutionalized patients with a burden of co-morbidities which, obviously, affect their nutritional status and, consequent-
ly, make them to be considered a nutritionally vulnerable group.

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Independent variable</th>
<th>Gender</th>
<th>r Pearson</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>MNA</td>
<td>Age</td>
<td>Total</td>
<td>-0.14</td>
<td>0.047</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Female</td>
<td>-0.05</td>
<td>0.386</td>
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<tr>
<td></td>
<td></td>
<td>Male</td>
<td>-0.06</td>
<td>0.170</td>
</tr>
<tr>
<td>MNA</td>
<td>Total cholesterol</td>
<td>Total</td>
<td>0.10</td>
<td>0.034</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Female</td>
<td>0.113</td>
<td>0.047</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Male</td>
<td>0.16</td>
<td>0.041</td>
</tr>
<tr>
<td>MNA</td>
<td>Hemoglobin</td>
<td>Total</td>
<td>0.22</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Female</td>
<td>0.14</td>
<td>0.014</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Male</td>
<td>0.27</td>
<td>0.001</td>
</tr>
<tr>
<td>MNA</td>
<td>Transferrin</td>
<td>Total</td>
<td>0.28</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Female</td>
<td>0.27</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Male</td>
<td>0.41</td>
<td>0.001</td>
</tr>
<tr>
<td>MNA</td>
<td>Iron</td>
<td>Total</td>
<td>0.19</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Female</td>
<td>0.13</td>
<td>0.049</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Male</td>
<td>0.19</td>
<td>0.019</td>
</tr>
<tr>
<td>MNA</td>
<td>Albumin</td>
<td>Total</td>
<td>0.15</td>
<td>0.003</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Female</td>
<td>0.11</td>
<td>0.101</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Male</td>
<td>0.17</td>
<td>0.046</td>
</tr>
</tbody>
</table>

Table III. Nutritional characteristics by quartiles of los.


References

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