Abstract: BACKGROUND: Malnutrition is often overseen in elderly acute medical patients. It is a need for a simple and robust screening tool. OBJECTIVE: The aim was to evaluate, with regard to validity, the Mini Nutritional Assessment-Short Form (MNA-SF) as a screening tool for malnutrition in elderly acute medical patients. DESIGN: This is an observational study where a nurse’s scoring of MNA-SF is compared to comprehensive assessment by a clinical nutritionist (gold standard). Sixty-nine patients aged 70 years and older and admitted to a general medical department in year 2000 and 2001 were included. RESULTS: The mean MNA-SF score was 7.8 (SD +/- 2.88, range 2 to 12). Fiftyone patients (74%) scored positive for malnutrition or risk of malnutrition (MNA-SF<11), whereas only 21 (30%) were scored to have malnutrition by the nutritionist. Sensitivity of the MNA-SF was 1.0 and specificity 0.38, giving 0.57 correctly classified subjects. Best subset logistic regression showed BMI<23 to be the only item explaining the gold standard. When using BMI<23, 32 (46%) subjects screened positive for malnutrition (sensitivity 0.86, specificity 0.71), giving 0.75 correctly classified subjects. CONCLUSIONS: When screening elderly acute medical patients in general wards for malnutrition or risk of malnutrition, the MNA-SF have a high sensitivity and can be useful. The sole use of BMI<23 may be equally effective, but will give no information leading towards an explanation. We recommend that a score of BMI<23 should be followed by MNA-SF when the aim is to identify poor nutritional status in elderly acute medical patients.

Key words: MNA-SF, screening, malnutrition, risk of malnutrition, elderly, hospital.

Introduction

It is well known that many elderly people who are admitted to hospital for acute care are suffering from malnutrition. Malnutrition is often overseen and not considered when a treatment program for the elderly patient is created (1). It is a need for a simple and robust screening tool for malnutrition in elderly acute hospital patients. Such a tool should be easy to apply, not time consuming, and have a high inter-rater reliability. It should also be robust to pathology related to the patient’s acute diseases.

Available screening and assessment tools for malnutrition in the elderly include anthropometric measurements like Body Mass Index (kg/m², BMI), Midarm Circumference (MAC), recording of risk factors like insufficient food intake, weight loss and chronic diseases, and methods to measure the consequences of a poor nutritional status like muscle strength, albumin, length of stay in hospital and mortality.

BMI is simple to perform and a low BMI is an important predictor of mortality, independent of other clinical and functional variables, among elderly in hospitals and living at home (2,3). Mini Nutritional Assessment (MNA) (4) and Subjective Global Assessment (SGA) (5) are comprehensive assessment instruments that are measuring both nutritional status and risk factors. The SGA was developed for dialysis patients, not particularly for the elderly. A study of validity and reproducibility in patients older than 70 years of age showed a somewhat poorer reproducibility than among non-elderly subjects (6). The SGA is shown to have a good sensitivity (0.96) and specificity (0.83) in detecting malnutrition in cancer patients (7). A simple malnutrition-screening tool (MST) for risk factors in acute adult hospital patients is developed from the SGA and includes three questions about loss of weight and appetite (8). But, in a validation study of triggers for undernutrition in the Resident Assessment Instrument (RAI), the percentage of weight loss could not be calculated in almost half of the patients in home care (9), so the MST is probably not very useful in frail elderly persons. The RAI for acute care, the Minimum Data Set for Acute Care (MDS-AC), has triggers for undernutrition, but has not been validated (10).

The MNA is developed and validated in different settings like free-living elderly, frail elderly in nursing homes and hospitalised elderly. It has proved to be valuable for screening in a short form version, MNA-SF (11-15). Malnutrition identified by the MNA is associated with increased in-hospital mortality, a higher rate of discharge to nursing homes and a longer length of stay (16). Both the MNA and the SGA were correlated with increased mortality after one and three years in patients admitted to an acute geriatric ward (17). The MNA has proved to identify more elderly subjects at risk of malnutrition than the SGA in a study of older hospital patients where the two instruments were compared (18).

In community care and other settings were elderly are in a stable medical condition serum albumin has proved to be useful...
THE USEFULNESS OF MNA-SF

and correlates well with SGA (19). However, in hospitalised elderly discordance between albumin and SGA is common (20).

It is important that nutritional assessment tools are adapted as appropriate to healthy, frail or sick elderly persons, and different tools are useful in different settings. We find that neither of the instruments mentioned above are validated for acute ill elderly hospital patients in general medical wards. As we consider MNA-SF to be a promising instrument, our aim of this study was to test the validity of MNA-SF as a screening tool for malnutrition in elderly medical patients.

Methods

Subjects

The setting for this study was the Department of General Internal Medicine in Ullevaal University Hospital, a general hospital with totally 270 medical beds. The department has a 10-bed stroke unit and a 10-bed general unit. The study patients were included from the general unit. In the study period, from 01.01.2000 to 31.10.2001, 1135 patients were admitted to the unit and mean length of stay was 5.8 days. Patients 70 years and older and with a length of stay in hospital of more than three days (totally 525 patients) could be considered for the study. To be included the patients had to be able to communicate verbally and be willing to give an informed consent. Exclusion criteria were severe dementia and terminal disease. Inclusion took place only on days when the study nurse was present. The intention was to include 100 patients, 94 were included, but the clinical nutritionist for practical reasons assessed only 69. The study population then consisted of 69 subjects.

Study design and clinical procedure

The study was a clinical observational study to test the validity of the MNA-SF (table 1) in screening for malnutrition in elderly acute hospital patients. The MNA-SF was developed for using as a first step for assessing nutritional status in elderly subjects. If MNA-SF is normal (>10) there should be no need to complete a “full” MNA (14). A nurse’s scoring of the MNA-SF was compared to an assessment of a clinical nutritionist, which was defined as the gold standard.

A study nurse performed the inception procedure and scored the MNA-SF. The patients were weighted in a chair scale. Height was measured by using an inextensible measuring tape preferably with the patients standing. Patients not able to stand were measured stretched out in bed. History of weight loss and decline in food intake was collected from the patients and from relatives if available. The same patients were within three days assessed by an experienced clinical nutritionist (AUG) who was blinded to the results of the MNA-SF scored by the nurse. The nutritionist’s assessment was based on the same principles as the method in the original validity studies of the MNA, namely clinical status and a comprehensive nutritional assessment including anthropometrical markers and history of dietary intake (12). She collected information by interviewing the patients about history of food intake prior to admission, did anthropometric measurements and observed clinical signs of malnutrition. MAC was measured using an inextensible tape half way between the tip of acromion and the olecranian process on the non-dominant arm. Triceps skin fold (TSF) was measured by using a Harpenden caliper in the middle and the back of the arm (the average of three measurements). From these two measurements the mid arm muscle circumference (MAMC) was calculated as described by Jeliffe (21). The elements of the nutritionist’s assessment are shown in table 2, and the conclusion of her assessment was severe malnutrition, moderate malnutrition or normal. Both categories of malnutrition (severe malnutrition and moderate malnutrition) were considered clinical malnutrition (the gold standard).

Table 1

The components of the Mini Nutritional Assessment Short Form (MNA-SF)

<table>
<thead>
<tr>
<th>Component</th>
<th>Score</th>
</tr>
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<tbody>
<tr>
<td>Has food intake declined over the past 3 months due to loss of appetite, digestive problems, chewing or swallowing difficulties?</td>
<td>0 = severe loss of appetite, 1 = moderate loss of appetite, 2 = no loss of appetite</td>
</tr>
<tr>
<td>Weight loss during last months?</td>
<td>0 = weight loss greater than 3 kg, 1 = do not know, 2 = weight loss between 1 and 3 kg, 3 = no weight loss</td>
</tr>
<tr>
<td>Mobility</td>
<td>0 = bed or chair bound, 1 = able to get out of bed/chair but does not go out, 2 = goes out</td>
</tr>
<tr>
<td>Has suffered psychological stress of acute disease in the past 3 months</td>
<td>0 = yes, 2 = no</td>
</tr>
<tr>
<td>Neuropsychological problems</td>
<td>0 = severe dementia or depression, 1 = mild dementia, 2 = no psychological problems</td>
</tr>
<tr>
<td>Body Mass Index (BMI) (weight in kg)/(height in m)</td>
<td>0 = BMI less than 19, 1 = BMI 19 to less than 21, 2 = BMI 21 to less than 23, 3 = BMI 23 or greater</td>
</tr>
</tbody>
</table>

Screening score total 14.
11 points or greater – Normal, not at risk. No need to complete assessment.
10 points or below – Possible malnutrition. Continue assessment.
Table 2
Clinical nutritionist’s assessment to identify clinical malnutrition (GOLD STANDARD)

<table>
<thead>
<tr>
<th>Protein and energy status / history of food intake prior to admission</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Number of meals per day</td>
</tr>
<tr>
<td>2. Number of slices of bread per day</td>
</tr>
<tr>
<td>3. Warm meal daily</td>
</tr>
<tr>
<td>4. Milk, egg, meat or fish daily</td>
</tr>
<tr>
<td>5. Fruit or vegetables daily</td>
</tr>
<tr>
<td>6. Butter, margarine or oil daily</td>
</tr>
</tbody>
</table>

Anthropometric and clinical assessment

<table>
<thead>
<tr>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Triceps skin fold (TSF)</td>
</tr>
<tr>
<td>2. Midarm muscle circumference (MAMC)</td>
</tr>
<tr>
<td>3. BMI</td>
</tr>
<tr>
<td>4. Clinical signs of malnutrition (loss of subcutaneous fat, slim)</td>
</tr>
</tbody>
</table>

All items classified in good, fair/at risk, and bad.

Clinical malnutrition diagnosis (gold standard) = Protein and energy status + anthropometric assessment:

- Good + good = Normal
- At risk/fair + at risk/fair = Moderate malnutrition
- Bad + bad = Severe malnutrition
- Bad + at risk/fair = Severe malnutrition
- Good + at risk/fair = Normal
- Good + bad = Moderate malnutrition

Albumin and C-reactive protein (CRP) was measured in serum. Albumin was analyzed using a bromocresolgreen method and CRP with a turbidimetric, latex-enhanced immunological method.

Statistics and ethics

The results from the MNA-SF were compared with the clinical nutritionist’s assessment and tested for sensitivity and specificity. The MNA-SF items were subjects for a correlation analysis (polychoric and polyserial) in the aim to identify correlations between items. Analysis to find independent items explaining the gold standard was done by logistic regression. Statistical analyses were performed with SPSS (version 11.0) statistical software program.

Written informed consent was obtained from the patients and the study was approved by the Regional Committee for Medical Ethics.

Results

Of the 69 patients included in the study, 48 (70%) were females and mean age was 81.5 years (SD +/-5.6). The most common reason for admission to hospital was cardiac problems (38%), in particular heart failure and chest pain with suspected or known coronary artery disease. Geriatric syndromes like falls, dehydration and delirium (25%), infections (12%), particularly pneumonia and urinary tract infections, and chronic obstructive pulmonary disease (11%) were also common. Malignancies counted for only 3% of the admissions. Average length of stay was 10.6 (SD +/-6.5) days. Mean weight was 62.9 (+/- 14.7) kg, height 164.5 (SD +/-8.6) cm, and BMI 23.2 (SD +/-4.9) kg/m². Mean TSF was 15.5 (SD +/-7.6) mm, MAMC 23.0 (SD +/-3.4) cm, albumin 36.2 (SD +/-5.1) g/l and CRP 42.5 (SD +/-56.8) mg/l.

Twenty-one (30%) were scored to have clinical malnutrition by the nutritionist. The mean MNA-SF score was 7.8 (SD +/-2.9), range 2 to 12, and 51 patients (74%) scored positive for malnutrition or risk of malnutrition (MNA-SF score less than 11). These results are shown in figure 1. Sensitivity for MNA-SF was 1.0 and specificity 0.38, giving 0.57 correctly classified subjects (table 3).

Table 3
Predictive accuracy of screening methods for clinical malnutrition

<table>
<thead>
<tr>
<th>Sensitivity</th>
<th>Specificity</th>
<th>Correctly classified subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>MNA-SF &lt;11 correctly identifying clinical malnutrition</td>
<td>1.0</td>
<td>0.38</td>
</tr>
<tr>
<td>BMI &lt;23 correctly identifying clinical malnutrition</td>
<td>0.86</td>
<td>0.71</td>
</tr>
<tr>
<td>MNA-SF &lt;11 and BMI &lt;23 correctly identifying clinical malnutrition</td>
<td>0.86</td>
<td>0.71</td>
</tr>
</tbody>
</table>

Correlation analyses (polychoric and polyserial) of BMI, weight loss, mobility, neuropsychological problems and food intake showed that the various items correlated badly, coefficient between 0.07 and 0.34. Thus, a factor analysis was not carried out. A logistic regression analysis was done to find...
the best subset explaining the result of the gold standard. BMI turned out to be the only explaining item, best functioning when dichotomised between highest value (BMI>22) and the others. When using BMI<23, 32 (46 %) subjects screened positive for malnutrition giving a sensitivity of 0.86 and a specificity of 0.71. Correctly classified subjects were 0.75. BMI<23 in addition to MNA-SF<11 for screening positive for malnutrition gave the same results as for BMI<23 alone, because all the subjects who scored BMI<23 also scored <11 on the MNA-SF (table 3).

Discussion

In this study the nutritionist’s assessment identified 21 of 69 subjects to have clinical malnutrition while the MNA-SF identified the same 21, but also another 30 (totally 51 subjects), to either have malnutrition or to be at risk. The sensitivity of the MNA-SF is then high, but there are many false positive cases. This can be explained by the difference in aims between the nutritionist’s assessment and the MNA-SF, because the MNA-SF is developed to identify not only patients with clinical malnutrition, but also those at risk. There are evidence that identifying not only patients with malnutrition, but also those at risk are useful. The MNA has been shown to identify those who are in need for help from the public sector (meals-on-wheels and assistance for shopping) among non-acute old patients in general practice (22). The same study also demonstrated that many in the at-risk group already had low BMI values (21). Also in this study we found some patients with low BMI values among those who scored normal from the nutritionist, but positive for MNA-SF<11.

However, in acute care, the usefulness of MNA-SF in identifying elderly at risk for malnutrition may not be obvious. The MNA-SF score may be changed by the consequences of an acute disease, like decline in food intake, reduced mobility and the fact that the patient has “suffered psychological stress or acute disease in the past three months” (item D). False positive subjects in this study probably include patients with acute disease who will not profit on nutritional supplementation either because their risk will be elucidated when the disease is treated or because the effect of the disease makes it difficult to improve outcomes (23).

One important question is which subjects are worthwhile to identify because they will profit from nutritional intervention. There is evidence that protein-energy oral supplementation in elderly hospitalised patients at risk of undernutrition, based on their MNA score, maintains bodyweight and increases MNA score during and after hospitalisation (24). The same effect is seen in nursing home patients (25). One alternative to screen acute elderly medical patients for malnutrition or risk of malnutrition is to give nutritional supplements to all while they are in hospital. Even the studies mentioned above show that patients at risk will profit from nutritional supplements, this is not necessary so with all acute ill patients and has to be studied further. Another argument to do screening, and not just to give supplements to all, is that screening will give some information about the patient’s nutritional status to communicate to primary care. Length of stay in hospital is short and for most patients nutritional intervention and follow up must be continued after discharge to be effective (26). It is well known that malnutrition is very common in post-acute facilities (27) and nutritional supplements provided after discharge has proved to be useful (24,28).

One problem of false positives in screening can be unnecessary anxiety for a problem (29). However, if the screening is followed immediately by a full assessment and the patient gets advices for sufficient nutrition, this should not represent a problem. Another problem of identifying too many is the increased working load on the nurses. The next step after having identified patients by screening is to do a comprehensive assessment, either by MNA or by an assessment of a nutritionist. The MNA can be performed by the nurses in the ward and is easy to fulfil when the MNA-SF is already done. The result of this assessment is the basis for nutritional intervention and is probably worth the effort for the nurses in the aim to give optimal care.

Although the nutritionist’s assessment is chosen as the gold standard, it may have some weak points. This method allows a patient to be classified as normal with a low BMI if all other parameters are normal. It is possible that the gold standard identifies too few subjects to have malnutrition. Two patients with BMI<20 were classified as normal because they communicated a normal food intake and had no history of weight loss. They might have been misclassified because misreporting of dietary intake can occur and slim patients may have a tendency to overestimate their food intake (30). The method also includes assessment of clinical signs of malnutrition like loss of subcutaneous fat and a slim appearance that might be affected by the nutritionist’s subjective opinion of what is normal and not.

If the aim is to identify cases of clinical malnutrition only and not those at risk, BMI<23 is the item best explaining the result of our gold standard. BMI<23 has an acceptable sensitivity and specificity and can be used for screening purposes. Important information related to nutrition, like history of weight loss and poor appetite, will then not be available. Such information might give a lead to the causes of malnutrition or the risk of malnutrition in the single patient. There is also a problem using BMI alone in this patient population because many are suffering from cardiac failure with rapid alterations in body composition. If using BMI alone, patients with excess body water or dehydration should be treated to gain their normal body weight before assessment for malnutrition. In such situations the MAC, or perhaps MAMC, is probably better. MAC has also proved to be a useful method to monitor changes in nutritional status, and a positive change or no change in MAC is associated with increased survival.
To screen elderly acute medical patients in general wards for malnutrition or risk of malnutrition the MNA-SF can be used. The method has a high sensitivity, reproducibility and inter-observer agreement when used by nurses (32,33) and is easy and not too time consuming to perform. If the aim is to screen such patients for a poor nutritional status, BMI<23 may be a better method, but will give no additional information about possible causes for the compromised nutritional status. We recommend that a positive score of BMI<23 should be followed by MNA-SF when the aim is to identify poor nutritional status in elderly acute medical patients in a general ward.

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