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Original article

The association between nutritional status and frailty characteristics among geriatric outpatients☆

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SUMMARY

Background: Frailty is a common clinical syndrome in older adults and is associated with an increased risk of poor health outcomes, e.g. falls, disability, hospitalization, and mortality. Nutritional status might be an important factor contributing to frailty. This study aims to describe the association between nutritional status and characteristics of frailty in patients attending a geriatric outpatient clinic.

Methods: Clinical data was collected of 475 patients who visited the geriatric outpatient department of a Dutch hospital between 2005 and 2010. Frailty was determined by: incontinence, Activities of Daily Living (ADL), Instrumental Activities of Daily Living (IADL), mobility, Geriatric Depression Scale (GDS) and Mini Mental State Exam (MMSE). Nutritional status was represented by the Mini Nutritional Assessment (MNA) and plasma concentrations of several micronutrients, whereby MNA< 17 indicated malnutrition and MNA 17–23.5 indicated risk of malnutrition. 'More frail' patients (≥3 frailty characteristics) were compared to 'less frail' patients (<3 frailty characteristics) with logistic regression analyses, adjusted for age, sex and other important covariates.

Results: Of 404 patients with complete data, mean age (SD) was 80 (7) years and 34% was male. Prevalence of 'more frail' patients was 47%. Prevalence of malnutrition and risk of malnutrition was 16% and 56% respectively. Malnutrition and risk of malnutrition were both independently related to being 'more frail', with ORs (95% CI) of 8.1 [3.5–18.8] and 3.1 [1.7–5.5] respectively. This association was driven by functional decline (ADL, IADL and mobility) and depression (GDS), but not by cognitive impairment (MMSE). None of the micronutrient plasma concentrations were related to frailty.

Conclusion: In geriatric outpatients, malnutrition is independently related to having ≥3 frailty characteristics. Assessing nutritional status could prove usefulness in early clinical detection and prevention of frailty.

1. Introduction

Frailty is a term used in geriatrics to describe older people that are at risk of dependency, (co)morbidity and early mortality due to a diminished physiological reserve. It is regarded a biological syndrome on its own, rather than a cluster of age-related pathology [1]. Due to the many different definitions of frailty, the prevalence varies widely amongst countries and studies (4.0–59.1%) [2].

Commonly, frailty is characterized by several parameters, some of which are physical performance, functional performance and cognitive performance [4–6]. However, there is still ongoing debate within the scientific community about which parameters should be used in the definition of frailty and a worldwide accepted frailty definition is lacking. While some researchers prefer a definition by physical and functional decline only [7], recent studies propose a broader approach, in which e.g. cognitive impairment, mood disorders and social inactivity are equally important [8,9].

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In the past, several characteristics have been suggested to be determinants of frailty. The most widely accepted include age, female gender [8] and physical inactivity [10]. Malnutrition may be a symptom of, or a contributive factor to frailty [11–16]. The prevalence of malnutrition among older adults is high and varies depending on living situation and definition (7–40%) [10,17]. The biological link between malnutrition and loss of both muscle and fat mass (and therefore loss of muscle strength) is plausible, but whether malnutrition is a direct causative factor of frailty is not yet clear [17]. Furthermore, most studies reporting associations between malnutrition and frailty have been performed in hospitalized patients, while data on independently living geriatric patients in the outpatient setting are uncommon [11–16]. Lastly, only physical and functional parameters have been used to describe this association thus far [11]. In our research we define frailty by a broader spectrum of outcome measures, including psychological parameters. Hence, this cross-sectional study aims to describe the relationship between nutritional status and frailty characteristics in a geriatric outpatient population. Our hypothesis is that patients suffering from malnutrition have higher odds of being frail than patients who are adequately nourished.

2. Methods

2.1. Study population

In this cross-sectional study, data was collected by a single geriatrician at the Haga Hospital located in The Hague, the Netherlands. The study sample consisted of 475 geriatric outpatients, who visited the outpatient clinic between October 2005 and March 2010. The patients were evaluated on physical, functional and cognitive condition and laboratory tests were performed. Nutritional status, cognition and symptoms of depression were assessed with validated questionnaires [3,19,20]. Functional and demographic data was obtained by interviewing. There were no non-respondents. After excluding those with missing frailty data, 404 patients were included. Ethical approval was granted for this study, but informed consent was waived as data were collected for clinical purposes.

2.2. Domains of frailty

In this study, we acknowledged the domains of physical frailty and psychological frailty. As measures of physical frailty, the following parameters were obtained by interview: incontinence (urine and feces), ADL (Activities of Daily Living), IADL (Instrumental Activities of Daily Living) and mobility. As measures for psychological frailty, the parameters MMSE [18] (Mini Mental State Exam, max score 30, cut off $\leq$ 24 points), and GDS [20] (Geriatric Depression Scale, max score 15, cut off $\geq$ 6) were used, using validated questionnaires. They indicate cognitive impairment and depression, respectively.

All of these parameters were dichotomized such that each could be divided into 'impaired' or 'not impaired'. Incontinence for urine and incontinence for feces were aggregated into one variable: 'incontinence yes/no'. ADL-dependency and IADL-dependency initially consisted of the categories 'independent', 'partially dependent' and 'fully dependent'. Because ADL contains basic tasks (e.g. getting dressed, personal hygiene) 'partially dependent' or 'fully dependent' were considered 'impaired'. IADL consists of more complex tasks (e.g. shopping or managing finances). Therefore, only 'fully dependent' was considered 'impaired'. Mobility consisted of the categories 'good (with aid)', 'impaired without aid', 'impaired with aid', and 'bad'. The latter two were considered 'impaired'.

The aforementioned frailty characteristics were converted into a cumulative frailty score, whereby each parameter added 1 point to that score with a maximum 6 points. Hence, the more impairments a patient had, the more frail he/she was considered. To retain statistical power, patients with 1 or 2 impairments were allocated to the 'less frail' group, and patients with 3 or more impairments were allocated to the 'more frail' group. This cut-off was determined by observing the differences in the prevalence of malnutrition between each group (1–6) of the cumulative frailty score.

2.3. Nutritional status

The MNA (Mini Nutritional Assessment [21]) was used to identify older patients at risk of malnutrition [3]. Patients with a score higher than 23.5 were considered to have an adequate nutritional status, those with a score between 17 and 23.5 were at risk for malnutrition, and those with a score lower than 17 were considered malnourished. In addition, plasma concentrations of vitamin B1, vitamin B6, vitamin B12, folic acid and 25(OH)D were determined. The data of vitamin B1, B6, B12 and folic acid were divided into quartiles whereby the 2nd quartile represented normal values. 25(OH)D was dichotomized (cut-off 50 nmol/L). For all of these parameters, outliers (abnormally high levels, >1000 units), and patients without available laboratory data were excluded from the analysis.

2.4. Covariates

Number of comorbidities, number of prescribed drugs, marital status, education, and smoking and alcohol behavior were standard questions in the geriatric assessment. Smoking and alcohol status were categorized as 'never used', 'stopped using' and 'currently using'. The level of education was divided into lower (no/lower education), middle and higher education.

2.5. Statistical analysis

First, the population characteristics were calculated for the total sample and according to categories of MNA (<17, 17–23.5, >23.5). Differences across these categories were calculated with chi-square tests for dichotomous variables and ANOVA for continuous variables. Next, logistic regression analysis was used to assess the association between malnutrition (categories of MNA) and risk of being more frail. Malnourished patients and patients that were at risk of malnutrition were compared with adequately nourished patients. To gain insight into the domains of frailty that were most strongly related to MNA, effect sizes for all separate domains were obtained with logistic regression. Finally, the association between micronutrient values and overall frailty were analyzed with logistic regression. Except for 25(OH)D, the micronutrients were all divided into quartiles, as none of them showed a linear relation with overall frailty. The second quartile (falling within the normal range) always served as the control group. All analyses were adjusted for age, sex, smoking and alcohol (model 1) and additionally for number of prescribed drugs, number of comorbidities and marital status (model 2). For all analyses, a p-value <0.05 was regarded as statistically significant. All statistical analyses were performed with IBM SPSS Statistics version 23.

3. Results

3.1. Population characteristics

A total of 404 patients (mean age 80.2 years, 34.4% male) were included and 189 patients (46%) were 'more frail'. Nutritional status

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