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Original article

Admission handgrip strength predicts functional decline in hospitalized patients

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SUMMARY

Problem: Up to 35% of hospitalized patients may experience functional decline during or after hospitalization. Subjective Global Assessment (SGA) and handgrip strength at admission, have been proposed as simple and accessible tools to predict functional decline, but there are few studies in hospitalized patients to confirm these findings.

Objective: To assess the predictive value of handgrip strength at hospital admission, on functional decline after 30 days.

Methods: 125 non-critical patients hospitalized for medical and surgical conditions, were studied in El Pino hospital in Santiago, Chile. Upon admission, nutritional status was assessed by SGA, functional status through the Karnofsky index (KI), and handgrip strength by dynamometry. Change in functionality was assessed by the difference between KI at admission and 30 days later. Multivariate logistic regression models were used to establish associations between the variables at hospital admission, and subsequent functional decline.

Results: Thirty days post-hospital admission, 28.8% of the sample showed functional decline. In a multivariate analysis, only handgrip strength was associated with this decline ($\beta = -0.025$, OR = 0.974 (CI 0.956–0.992), $p = 0.007$).

Conclusions: Handgrip strength upon hospital admission can be a useful independent and early method to predict deterioration of functional status during hospitalization.

1. Introduction

Functional decline occurs in 24–35% of hospitalized patients [1,2]. It is defined as deterioration of preexisting functionality [3], and negatively impacts autonomy, quality of life, and morbimortality [4–8].

Many patients who suffer functional decline during hospitalization, fail to improve their baseline status despite recovering from their acute illness [9]. Several factors have been identified in its development, such as age [8,10,11], low functional status at admission [2,12], malnutrition [1,13], cognitive impairment [10], low educational level [14], number of comorbidities, polypharmacy, presence of cancer and marital status [15].

Handgrip strength at hospital admission could be a simple, non-invasive, objective and inexpensive predictive tool for prediction of functional decline during hospitalization and thereafter [1]. Muscle mass is the most important reservoir of amino acids, which are redirected to vital organs during metabolic response to injury [16,17]. Muscle strength, especially handgrip strength, is associated with several factors such as post-surgical complications, longer hospital stay, low functional status, and even mortality [18]. In older people, longitudinal declines in handgrip strength is associated with all-cause mortality [19]. Although its positive correlations with lean body mass are usually low [20,21], it is considered an indirect indicator of muscle mass. They are few studies that have evaluated handgrip strength at hospital admission as a predictor of functional decline during hospitalization [1,22], and most of these have been performed in healthy elderly or outpatients [23]. The aim of this study was to evaluate whether the hand grip strength at hospital admission is a predictor of the evolution of short-term functionality.

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2. Material and methods

Patients of both sexes, older than 18 years admitted to Services of Medicine and Surgery at El Pino Hospital, in Santiago, Chile, were included in the study. Exclusion criteria were: estimated hospital stay of less than 5 days, pregnancy, admission for elective surgery, subjects with physical disabilities which would preclude the performance of handgrip strength measurement (musculoskeletal or neuromuscular diseases) or inability to sign or understand an informed consent (coma, sedation, cognitive impairment and delirium). This study was approved by the Ethics Committees of the mentioned hospital and the Institute of Nutrition and Food Technology, University of Chile.

All patients underwent the following assessments within the first 72 h after admission to the hospital:

Complete history and review of the medical record: age, number of drugs prescribed, number of comorbidities, type of disease that led to hospitalization (medical, surgical, cancer), years of education, marital status, and 3 phone numbers for further contact were recorded. Physical examination and anthropometric measurements: patients were examined by one of the authors (TO), weighed in light clothing in a mechanical chair scale, Detecto® brand, with capacity of 180 kg × 100 g; height was estimated by the method of knee height (KH) [24], using a long bone anthropometer, Ross® brand and precision of 0.1 cm (Women Height (cm) = [1.83 × KH (cm)] − [0.24 × age (years)] + 84.88. Men Height (cm) = [2.02 × KH (cm)] − [0.04 × age (years)] + 64.19); weight and height were used to calculate body mass index (BMI) (weight (kg)/(height (m))2). Subjective Global Assessment (SGA) of nutritional status [25,26]: in our study, SGA considered only the nutritional parameters (changes in body weight and food intake, gastrointestinal symptoms and physical signs of malnutrition), to prevent that the included functional status assessment would interfere with the outcome of the study; according to the SGA, patients were classified as well nourished (SGA-A), moderately malnourished (SGA-B) or severely malnourished (SGA-C). A qualitative self-report of intake was carried out, through a visual questionnaire that included drawings of 5 dishes with different portions of food (100%, 75%, 50%, 25% and empty dish); patients chose the dish that represented their food intake in the last 24 h. In the cases of empty dish elections, the motive was registered (surgery, procedures, patients symptoms). This form of registration was based on the Nutrition-Day Survey Project, which showed that lower hospital food intake (as measured by a qualitative self-report) would be an independent risk factor for 30-day mortality (available at http://www.nutritionday.org/). We simplified the original questionnaire to 5 dishes, to ensure the application and adherence of the patients. Functional status using the Karnofsky index [27]: this consists of 11 levels, which are nominated as 0, 10, 20, 30, 40, 50, 60, 70, 80, 90 and 100; level 100 is the highest score reflecting normality and 0 indicates death. Functional status was classified into three categories: high functionality (IK ≥ 70), intermediate (IK <70 and >30) and low (≤30 IK) [28]. Handgrip strength was measured with a Lafayette® brand, model 78010 hand dynamometer, with 1 kg precision, using Klidjian's technique [29]. Three consecutive measurements were performed using the non-dominant hand, with brief pauses between them and recording the highest value. As age and gender are determinants of handgrip strength [30,31], the values obtained in our sample were compared with those previously reported in healthy Chilean subjects [32] and were expressed as percentage of the national standard, adjusted for sex and age.

Thirty days post-hospital admission, Karnofsky index was repeated in the hospital among patients still hospitalized, or by telephone in the case of discharged patients. The change in functionality was determined by the difference between both KI [1]. Functional decline was defined as a fall of at least two levels in the index.

2.1. Statistical analysis

Statistical analysis was performed using Stata ®, version 12 for Windows (StataCorp, College Station, Texas, USA. www.stata.com). Normality of all quantitative variables was assessed with Shapiro–Wilk test. The association between numeric variables were determined with Pearson Correlation Coefficient. Comparison of proportions was performed with Z-test for proportions, and means were compared by Analysis of Variance (normal distribution) and Kruskal–Wallis test (not normal). Multivariate analyzes were performed using logistic regression models; the goodness of fit of the models was assessed with Hosmer–Lemeshow test. A significance level of 5% ($\alpha = 0.05$) was used in all tests of hypotheses.

3. Results

During four-months, 148 patients were enrolled and 125 completed the study, aged between 22 and 68 years (59 females). Five patients could not be contacted by telephone at follow-up, and 18 patients were excluded due to early hospital discharge. No gender differences were observed for educational level, marital status, medication consumption and number of comorbidities.

Mean handgrip strength was 73.7% of the national standard, adjusted for sex and age. Eighty-three percent of patients had high functionality at hospital admission (Table 1). According to SGA, the prevalence of moderate and severe malnutrition was 23.2% (n = 29) and 32.8% (n = 41) respectively. Malnourished patients were older, had lower baseline functionality and higher rates of cancer as diagnosis at entrance, compared to their well-nourished counterparts (Table 1). At admission, no association was observed between nutritional status and handgrip strength, number of medications consumed, medical or surgical conditions, marital status or educational level.

Compared with those with a normal functionality, patients with low or intermediate baseline functionality were older (72.1 ± 10.5 and 58.3 ± 16.2 years respectively, $p < 0.001$) and frequently malnourished (66% v/s 26%, $p < 0.001$). No significant association was observed between handgrip strength and baseline functionality, marital status, educational level, intake of medications, number of comorbidities or type of disease that led to the hospitalization.

As expected, men had higher absolute handgrip strength than women (men 26.3 ± 9.8 kg v/s women 14.3 ± 4.9 kg, $p < 0.001$), but when expressed as percentage of the national standard, adjusted for age and sex, gender differences disappeared ($p = 0.202$).

Thirty days after hospital admission, 36 patients (28.8%) experienced deterioration in functional status. Upon admission, this group had a higher percentage of patients with severe malnutrition and with a diagnosis of cancer and lower handgrip strength, when compared with their counterparts that did not experience functional decline (Table 2). Weight loss in the last 6 months, expressed either as absolute value (kg) or percentage of usual weight, was the only parameter of the SGA that was different between these two groups (Table 2).

In our sample, there were no significant differences in food intake between the groups, including and excluding “nothing per os” by medical indication. This was not included in the final statistical analysis, since the high percentage of “nothing per os” at time of the evaluation (19.2% of the total sample) could limit and confuse the interpretation of these results.

A multivariate logistic model was performed, including the variables that were statistically different between groups with and

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