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Original article

Sarcopenia: Prevalence and prognostic significance in hospitalized patients

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SUMMARY

Background: Sarcopenia is prevalent in older populations with many causes and varying outcomes however information for use in clinical practice is still lacking.
Aims: The aim of this report is to identify the clinical determinants and prognostic significance of sarcopenia in a cohort of hospitalized acutely ill older patients.
Methods: Four hundred and thirty two randomly selected patients had their baseline clinical characteristic data assessed within 72 h of admission, at 6 weeks and at 6 months. Nutritional status was assessed from anthropometric and biochemical data. Sarcopenia was diagnosed from low muscle mass and low muscle strength-hand grip using anthropometric measures based on the European Working Group criteria.
Results: Compared with patients without sarcopenia, those diagnosed with sarcopenia 44 (10%) were more likely to be older, have more depression symptoms and lower serum albumin concentration. The length of hospital stay (LOS) was significantly longer in patients diagnosed with sarcopenia compared with patients without sarcopenia [mean (SD) LOS 13.4 (8.8) versus 9.4 (7) days respectively, $p = 0.003$]. The risk of non-elective readmission in the 6 months follow up period was significantly lower in patients without sarcopenia compared with those diagnosed with sarcopenia (adjusted hazard ratio .53 (95% CI: .32 to .87, $p = 0.013$). The death rate was also lower in patients without sarcopenia 38/388 (10%), compared with those with sarcopenia 12/44 (27%), p-value = .001.
Conclusion: Older people with sarcopenia have poor clinical outcome following acute illness compared with those without sarcopenia.

1. Introduction

An important challenge of modern medicine is to distinguish physiological changes associated with the process of ageing from disease and adverse life style factors whose cumulative effects account for many of the adverse events in older people. Although a number of these changes and events lead to progressive decline in health many are responsive to treatment. This has created a need for additional knowledge of age-related changes, which has importance in the treatment and prevention of disease, and in maintaining good health and quality of life in an ageing population.

An important example of this challenge is sarcopenia, a condition which is prevalent in older populations with many causes and varying outcomes.[1] It is a syndrome characterized by progressive decline in skeletal mass, decreased strength and functional status and associated with physical disability, poor quality of life and death.[2,3] There are a number of mechanisms involved in the aetiology and pathogenesis of sarcopenia and their contribution vary over time. Recognizing underlying causes is expected to help guide treatment and therefore minimize adverse outcomes.[4–6] Currently the presence of low muscle mass and low muscle function (strength or performance) are used for the diagnosis of sarcopenia.[2,5,6] Although sarcopenia has emerged as an acceptable syndrome which predict outcomes not many data on hospitalized patients are available. Furthermore a valid and reproducible measurement technique of sarcopenia suitable for clinical practice is still a challenge. The aim of this report is to measure the prevalence and prognostic significance of sarcopenia in a cohort of acutely ill older patients.

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2. Methods

2.1. Subjects

Four hundred and thirty two unselected acutely ill older patients who took part in a randomized controlled trial with complete data were included.[7] Inclusion criteria were: age ≥ 65 years; stable medical condition and able to sign an informed written consent form. Patients excluded from the study were those with severe medical or psychiatric illness including those with malignancy, severe dementia and living in institution. The study received local research ethics committee approval.

All patients had baseline clinical assessment such as demographic and medical data, current diagnosis, history of chronic illnesses, smoking, alcohol and drug intake, nutritional status and disability measured using the Barthel score. The Barthel scores 10 functions on a scale 0 (fully dependent) to 20 (independent). The Barthel Score posses certain advantage, including completeness, sensitivity to change suitability for statistical manipulation and greater familiarity due to more widespread use. It is also a more reliable and less subjective score for assessing disability.[8] Nutritional status was assessed from anthropometric, haematological and biochemical data.[7] All anthropometric measurements were performed using standard methods with intra observer's differences assessed prior to the commencement of the study. Mid-arm circumference (MAC) and triceps skin folds (TSF) were measured by a flexible tape and Happened Skin fold callipers accurate to .2 mm (Practical Metrology Sussex UK) respectively and the mean of three measures was recorded. Dietary intakes were measured using a validated food diary.[6] The local Pathology Laboratory performed routine tests including haemoglobin, albumin and transferrin measurements. C-reactive protein (CRP) concentration, a marker of tissue inflammation (severity of illness) was measured by a modified latex-enhanced immuno-turbidimetric assay (normal range ≤ 10 mg/L). The inter-assay coefficient of variation (C.V.) was 3.9%.

2.2. Diagnosis of sarcopenia[2,3]

The European Working Group on Sarcopenia in Older people (EWGSOP) criteria was used to diagnose sarcopenia. The EWGSOP recommends using the presence of both low muscle mass and low muscle function (strength or performance) for the diagnosis of sarcopenia. For this study we used the anthropometric measures of low muscle mass and low muscle strength-hand grip as a measure of muscle function.

2.2.1. Muscle strength-hand grip

This was measured using a handgrip dynamometer (Practical Metrology, Sussex, and UK). Subjects used their dominant hand unless this was unusable (arms in plaster, recent stroke weakness). Three measurements were taken and the mean calculated. Using the cut-off points of the EWGSOP low muscle strength was classified as muscle strength-hand grip less than 30 kg and 20 kg in men and women respectively.

2.2.2. Muscle mass assessment

The muscle mass was measured by mid-arm muscle circumference (MAMC) using the following formula:

MAMC = MAC − (3.14 × triceps skin fold thickness). Low muscle mass was classified as MAMC less 21.1 cm and 19.2 cm in men and women respectively.[2,3]

2.3. Statistical analyses

Statistical analyses were performed with SPSS software, version 19.0 (SPSS Inc., Chicago). Descriptive tests (mean [SD]) were used to describe the baseline characteristics of the subjects. Independent student-t test was used to test between group differences with a p-value of <.05 regarded as statistically significant. A Cox proportional hazards model was used to examine the 6-month risk of non-elective readmission and mortality between patients with sarcopenia and those without sarcopenia after adjusting for other clinical risk indicators including age, disability (Barthel score), smoking, body mass index (BMI), tissue inflammation (CRP)] and serum albumin. Risks of readmission and 6-month mortality presented graphically using the Kaplan–Meier (K–M) survival curve and assessed using the log rank test.

3. Results

All 432 acutely ill older patients who took part in a previously published randomized controlled trial with complete data were included in this analysis.[7] Forty- four out of 432 patients (10%) were diagnosed with sarcopenia. Table 1 shows baseline clinical characteristics according to the presence of the diagnosis of sarcopenia including gender, smoking, alcohol consumption, disability, depression and quality of life scores, tissue inflammation (CRP), haemoglobin, albumin and transferrin. Compared with patients without sarcopenia, those diagnosed with sarcopenia were more likely to be older, have more depression symptoms and lower serum albumin concentration. Stratification of subjects into groups according to body mass index (BMI) categories revealed that 62% (13/21) of those underweight (BMI < 18.5) had sarcopenia compared with 13% (22/174) of those with normal weight (BMI 18.5–24.99) and 2% (4/199) in overweight/obese patients (BMI ≥ 25) [$p = 0.001$].

The length of hospital stay (LOS) was significantly longer in patients diagnosed with sarcopenia compared with patients without sarcopenia [mean (SD) LOS 13.4(8.8) versus 9.4(7) days respectively, mean difference 4 days (95% C.I 2–6), p .003]. Cox regression analysis showed that the risk of non-elective readmission in the 6 months follow up period was significantly lower in patients without sarcopenia compared with those diagnosed with sarcopenia after adjustment for other clinical risk indicators, with a hazard ratio of .53 (95% CI: .32 to .87, $p = 0.013$) (Table 2). Significantly higher number of patients with sarcopenia 24/44 (55%) were readmitted to hospital in the 6 months follow up period compared with those without sarcopenia 125/388 (32%), $p = 0.001$ (Fig. 1). After adjustment for other clinical risk indicators Cox

Table 1
Baseline characteristics of subjects according to presence or absence of sarcopenia.

Variable		Sarcopenia ($n = 44$)	Not sarcopenia ($n = 388$)
Age (SD) *		79 (7)	77 (6)
Gender, female		29 (66)	176 (45)
Smoking	Never smoked	17 (39)	118 (30)
	Ex smoker	16 (36)	200 (52)
	Current smoker	11 (25)	70 (18)
Alcohol ≥ 14 units		5 (11)	51 (13)
Barthel score		15.3 (4.8)	16.1 (4.6)
Geriatric depression score *		21.2 (4)	20 (3)
SF-36 score		75 (19)	80 (21)
C-reactive protein mg/L		51 (59)	52 (74)
Haemoglobin g/dl		12.3 (2)	12.7 (2)
Albumin g/L *		35.5 (5)	38 (5)
Transferrin g/L		2.03 (.58)	2.17 (.49)

*$P < 0.05$.