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Research paper

The cut-off point of short physical performance battery score for sarcopenia in older cardiac inpatients

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ABSTRACT

Objective: To demonstrate the relationship between short physical performance battery (SPPB) and sarcopenia, and to determine the cut-off point for sarcopenia using SPPB scores in older cardiac inpatients.
Methods: This cross-sectional study included 74 older cardiac inpatients (mean age 78.2 years; 43.2% women). We evaluated the presence of sarcopenia and the SPPB before hospital discharge. We defined sarcopenia using the Asian Working Group for Sarcopenia-suggested diagnostic algorithm. The SPPB scores were categorised into three groups (0–6, 7–9, and 10–12). Logistic regression models were used to estimate the odds ratios (OR) and 95% confidence intervals (CI) of the relationships between various SPPB categories and the presence of sarcopenia using univariate and multivariate analyses. The cut-off point of SPPB score for determining sarcopenia was evaluated using a receiver operating characteristic curve.
Results: The presence of sarcopenia in the 0–6, 7–9, and 10–12 of SPPB score groups were 87.5%, 78.6%, and 17.3%, respectively. After adjustments for conditions of cardiac diseases, the OR (95% CI) in reference to the patients with scores of 10–12 were 22.16 (1.53–321.45) in the patients with scores of 7–9, and 141.04 (1.90–10,481.96) in the patients with scores of 0–6. The cut-off point of SPPB score for determining sarcopenia was 9.5 (sensitivity, 0.92; specificity, 0.67; area under the curve, 0.84; 95% CI, 0.74–0.94; $P < 0.01$).
Conclusions: The SPPB score was significantly associated with sarcopenia. Additionally, the cut-off point of SPPB score for determining sarcopenia was 9/10 in older cardiac inpatients.

1. Introduction

Sarcopenia, which is low skeletal muscle mass and low skeletal muscle function, is a common clinical problem in older adults with cardiac diseases. Sarcopenia is caused by aging, diseases, malnutrition, and low activity [1–3]. The prevalence of sarcopenia is approximately 20% in older adults with cardiac diseases, which is higher than that of individuals without cardiac diseases at the same age [4,5]. Sarcopenia is one of the poor prognosis factors in older adults with cardiac diseases [6]. Therefore, sarcopenia with cardiac diseases pose a serious problem in countries with aging populations, such as Japan.

Sarcopenia is the leading causes of adverse outcome in cardiac patients. Sarcopenia is strongly linked to a reduction in exercise capacity and quality of life in cardiac patients [7]. Hospitalisation accelerates muscle wasting due to prolonged bed rest, inflammation, and malnutrition in addition to cardiac dysfunction [8]. Therefore, evaluating sarcopenia is important when considering interventions to improve exercise capacity and quality of life in hospitalised cardiac patients.

Physical performance indices measures are used to estimate sarcopenia [9]. The short physical performance battery (SPPB), which evaluates the ability of standing balance, walking, and sit-to-stand, is widely used in the clinical setting. The SPPB is reported as feasible and acceptable for use in older inpatients [10]. Thus, the SPPB, which is simple and inexpensive indicator, can be used widely for the screening of sarcopenia in older inpatients.

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However, the relationship between the SPPB and sarcopenia is still unclear in older cardiac inpatients. We hypothesized that the SPPB relates to sarcopenia, and that the specific value of the SPPB for determining sarcopenia exist in older cardiac inpatients. The aim of this study was to demonstrate the relationship between SPPB and sarcopenia, and to determine the cut-off point for sarcopenia using the SPPB in older cardiac inpatients.

2. Methods

2.1. Study design and participants

This cross-sectional study comprised of consecutive patients who were admitted to Kawasaki Municipal Tama Hospital, from April 2015 to March 2016, for cardiac diseases such as heart failure, myocardial infarction, and angina pectoris. Inclusion criteria were age 65 or older, and the capability of undergoing tests for the measurement of skeletal muscle mass index (SMI), handgrip strength (HS), gait speed (GS), and short physical performance battery (SPPB). The patients with cardiovascular implantable electronic devices were excluded, because these participants were not able to receive bioelectrical impedance. All data were collected before hospital discharge. The present study was conducted in accordance with the Declaration of Helsinki. The study protocol was reviewed and approved by the Institutional Committee on Human Research of St. Marianna University School of Medicine.

2.2. Demographic and clinical characteristics

Medical records were used to obtain information about demographic and clinical characteristics, including length of hospitalisation, length of bed rest, cardiac conditions, comorbidity, and cognitive function. Cardiac conditions were investigated using admission diagnosis, etiology of heart failure, medications, New York Heart Association (NYHA) classification, left ventricular ejection fraction (LVEF), and brain natriuretic peptide (BNP) concentration. Comorbidity was assessed using the Charlson comorbidity index [11]. Cognitive function was assessed with the Revised Hasegawa's Dementia Scale (HDS-R) [12].

2.3. Short physical performance battery

We assessed patients using the SPPB, which consists of the standing balance test, the 4 m usual-paced walk test, and the chair standing time test. Each test was scored from 0 to 4. A score of 0 represented an inability to complete the test, and a score of 4 represented the highest level of performance. Thus, the total scores (SPPB scores) ranged from 0 to 12, and a higher SPPB score indicated a higher level of performance. The SPPB scores were categorised into three groups (0–6, 7–9, and 10–12). The procedures used to measure and group patients were followed from reports by Guralnik et al. [13,14].

2.4. Body composition

We measured body composition to estimate skeletal muscle mass, body weight and fluid status. Body composition was measured with a bioelectrical impedance data acquisition system (Inbody 770; Inbody Japan Inc, Tokyo, Japan). Skeletal muscle mass was estimated by calculating the lean body mass of each limb. The SMI was calculated as the muscle mass of the four extremities divided by height squared (kg/m^2). Body weight was divided by height squared to calculate the body mass index (BMI). The BMI was stratified into the following groups based on criteria set forth by the World Health Organization: underweight (less than 18.5 kg/m^2), normal (18.5 to 24.9 kg/m^2) and obese (25.0 kg/m^2 or more) [15]. Fluid status was estimated by calculating the ratio of extracellular water to total body water (ECW/TBW).

2.5. Definition of sarcopenia

We defined sarcopenia using the Asian Working Group for Sarcopenia-suggested diagnostic algorithm which evaluates the presence of both low SMI and low physical function (low HS and/or low GS) [16]. Low SMI was defined as less than 7.0 kg/m^2 in men and less than 5.7 kg/m^2 in women. Handgrip strength was measured by using a standard adjustable-handle JAMAR dynamometer (Bissell Healthcare Co., Grand Rapids, MI). The patients squeezed the dynamometer at the second grip position with their dominant hand at maximum isometric effort. The better value from the two measurements was used as the representative value of HS. Low HS was defined as less than 26.0 kg in men and less than 18.0 kg in women. We measured GS using a 5 m usual gait speed. The patients walked 11 m at a usual pace. The time required to walk 5 m (between the 3 m and 8 m point) was measured by a stopwatch. Gait speed was calculated as 5 m divided by time required (m/sec). The better value of the two measurements was used as the representative value of GS. Low GS was defined as 0.8 m/sec or less.

2.6. Statistical analysis

The normality of variables was assessed using the Shapiro-Wilk test. Unpaired t-tests, Mann-Whitney U tests, and chi-squared tests were used to test for differences between patients with sarcopenia and non-sarcopenia. Logistic regression models were used to estimate the odds ratios (OR) and 95% confidence intervals (CI) of the relationships between various SPPB categories and the presence of sarcopenia in univariate (Model 1) and multivariate analyses. In the multivariate analyses, our estimations used two models (Model 2 and 3). Model 2 was adjusted by age and gender, and Model 3 was adjusted by variables that showed a significant difference between the two groups. The cut-off point of the SPPB score for determining sarcopenia was evaluated using a receiver operating characteristic (ROC) curve. We used the value that Youden Index was the highest, as a criterion for determining the cut-off point. Statistical significance was defined as $P < 0.05$ for all analyses. Statistical analyses were performed with SPSS (version 21, IBM SPSS Japan, Tokyo, Japan).

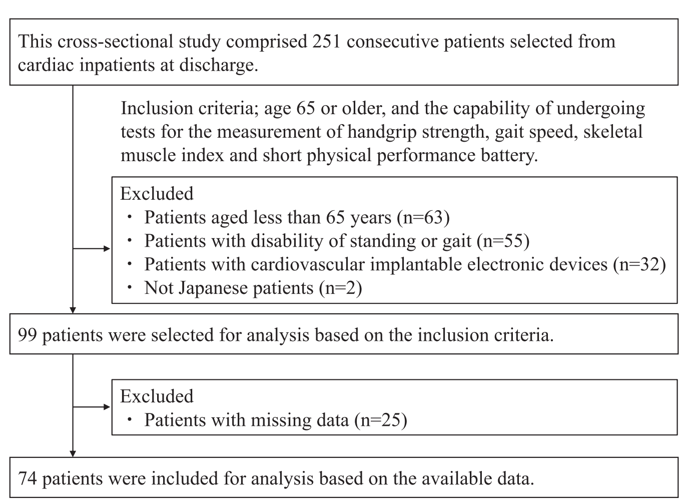

Fig. 1. Diagram of the patient selection process.