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Grip strength in a cohort of older medical inpatients in Malaysia: A pilot study to describe the range, determinants and association with length of hospital stay

Victoria Keevil [a,b,*], Rizah Mazzuin Razali [c], Ai-Vyrn Chin [c], Karen Jameson [b], Avan Aihie Sayer [a,b], Helen Roberts [a]

[a] Academic Geriatric Medicine, Faculty of Medicine, University of Southampton, Southampton SO16 6YD, UK
[b] MRC Lifecourse Epidemiology Unit, Faculty of Medicine, University of Southampton, Southampton SO16 6YD, UK
[c] Division of Geriatrics, Department of Medicine, Faculty of Medicine, University Malaya Medical Centre, 59100 Kuala Lumpur, Malaysia

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ABSTRACT

Grip strength is a marker of sarcopenia, the age-related decline in muscle mass and function, and has been little researched in Asian populations. We aimed to describe the feasibility and acceptability of measuring grip strength in hospitalized, older people in Malaysia and to explore its range, determinants and association with length of stay. Patients admitted acutely to the geriatrics ward of a teaching hospital were consecutively recruited. Inability to consent or use the dynamometer led to exclusion. Maximum grip strength, anthropometric data, length of hospital stay, discharge destination, 3-point Barthel score, mini-mental state examination, falls history and number of co-morbidities and medications on admission were recorded. 80/153 (52%) eligible patients were recruited (52 women; age range 64–100 years). 9/153 (6%) refused to participate and 64/153 (42%) were excluded (34 too unwell, 24 unable to consent, 4 unable to use the dynamometer, 2 other reasons). 76/80 patients (95%) reported that they would undergo grip strength measurement again. Determinants were similar to those of Caucasian populations but grip strength values were lower. After adjustment for sex, age and height, stronger grip strength was associated with shorter length of stay [hazard ratio 1.05 (95% CI 1.00, 1.09; $P = 0.03$)]. This is the first report of grip strength measurement in hospitalized older people in Malaysia. It was feasible, acceptable to participants and associated with length of stay. Further research is warranted to elucidate the normative range in different ethnic groups and explore its potential use in clinical practice in Malaysia.

1. Introduction

Sarcopenia, the decline in skeletal muscle mass and function with age, has been proposed as a new 'Geriatric Giant' with estimated annual healthcare costs of $18.5 billion in the USA (Janssen, Shepard, Katzmarzyk, & Roubenoff, 2004). The term sarcopenia was coined by Rosenberg in 1989, but a universally accepted operational definition has proved elusive. In 2010, the European Working Group on Sarcopenia in Older People presented a consensus definition for sarcopenia, requiring two out of three of the following criteria to be fulfilled: low muscle mass, low muscle strength and/or low physical function (Cruz-Jentoft et al., 2010). Low hand grip strength has been shown to be associated with negative outcomes in older people, such as increased mortality (Newman et al., 2006; Ruiz et al., 2008), longer hospital inpatient stay (Kerr et al., 2006), falls (Sayer et al., 2006; Wickham, Cooper, Margetts, & Barker, 1989) and disability (Giampaoli et al., 1999; Rantanen et al., 1999).

Most studies to date have been conducted within Caucasian populations from high income countries limiting their generalisability (Bohannon, Peolsson, Massy-Westropp, Desrosiers, & Bear-Lehman, 2006). Thus, the validity of proposed definitions of sarcopenia when applied to Asian populations is debated (Wen, Wang, Jiang, & Zhang, 2011). For example, body composition varies significantly with ethnicity and young Asian men and women have lower muscle mass than Caucasians. The influence of ethnicity on population norms of skeletal muscle properties, their determinants and associations warrants further investigation.

Studies in Taiwan (Wu, Wu, Liang, Wu, & Huang, 2009) and Malaysia (Kamarul, Ahmad, & Loh, 2006) have described the mean grip strength of healthy adult Asian men and women to be up to 25% and 33% lower than the mean grip strength observed in

* Corresponding author. Present address: EPIC Institute of Public Health, University of Cambridge, Strangeways Research Laboratory, Wort's Causeway, Cambridge CB1 8RN, UK. Tel.: +44 01223 740168; fax: +44 01223 740177.
E-mail address: vlk20@cam.ac.uk (V. Keevil).

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Caucasians (Bohannon et al., 2006; Mathiowetz et al., 1985). Key determinants of stronger grip strength such as male sex and younger age appear similar across ethnicities, although research data is limited. In terms of associations, grip strength has been associated with falls in older Korean people (Hong, Cho, & Tak, 2010), cognitive decline (Auyeung, Lee, Kwok, & Woo, 2011) and osteoporotic fracture incidence (Cheung et al., 2012) in older Chinese people living in Hong Kong and increased mortality in middle aged men and women in Japan (Sasaki, Kasagi, Yamada, & Fujita, 2007).

In Malaysia, sarcopenia has been little researched. Grip strength has been measured in healthy adult Malaysians (Kamarul et al., 2006) and in community dwelling elders as a marker of nutrition and functional status (Shahar, Ibrahim, Ruhi, Fatah, & Abdul, 2007). However, grip strength has not been measured in hospitalized older persons in Malaysia or used to predict clinical outcomes in this group. Improved healthcare in Malaysia has resulted in increased male and female life expectancy with a rise in the proportion of the population aged $\geq$ 60 years. This proportion is expected to reach 15% by 2030 (Department of Statistics Malaysia: www.statistics.gov.my) and the identification of vulnerable older people will become increasingly important.

We aimed to determine if it was feasible and acceptable to measure grip strength in older medical inpatients in Malaysia, prior to describing the range and determinants of grip strength in this population and exploring whether there was evidence of an association with a health outcome, length of hospital stay.

2. Methods

2.1. Study sample and measurements

Patients admitted to the Geriatrics Ward of University Malaya Medical Centre (UMMC), Kuala Lumpur between December 2008 and April 2009 were recruited consecutively into a prospective cohort study. Recruitment and data collection were carried out twice weekly by four researchers. Patients were eligible if they had been admitted to hospital as an emergency within the last 7 days and were aged $\geq$ 65years (age rounded to the nearest year). Exclusion criteria were inability to consent or use the dynamometer. Patient information leaflets and consent forms were provided in English and Malay. Where necessary, information was translated into other languages or read to the patient (14/80 patients [17.5%] were illiterate). The study received ethical approval from the Medical Ethics Committee, University Malaya.

Information was obtained from the hospital notes with respect to admission date, discharge date and destination, number of medications and co-morbidities on admission, admission diagnosis, admission weight, three-item Barthel score (urinary continence 0–2, bed-chair transfers 0–3 and indoor mobility 0–3) (Ellul, Watkins, & Barer, 1998) and mini-mental state examination (MMSE) (Folstein, Folstein, & McHugh, 1975). Length of hospital stay was calculated as the time in days from the date of admission to the date of discharge. Additional information collected included falls history and patients were asked 'Have you fallen in the last year?'. Clinical assessments of forearm length (as a proxy for height) (Haboubi, Hudson, & Pathy, 1990), actual height (measured approximately whilst lying in bed) and isometric hand grip strength were performed. Body mass index (BMI) was calculated by dividing admission weight (kilograms, kg) by actual height squared (meters, m^2).

Grip strength was measured using a Jamar dynamometer (Promedics, UK) with a standard protocol allowing three attempts on each side (Roberts et al., 2011). During each measurement, patients were sitting with their shoulder adducted and elbow flexed to 90°. The maximum value achieved from all six attempts was used in analyses. Participants were then asked if they would do the test again or if they had experienced any pain or tiring as a result of using the dynamometer. The Jamar dynamometer is the most commonly used tool for measuring grip strength with low reported between observer variability (Peolsson, Hedlund, & Oberg, 2001) and good test re-test reliability (Bohannon & Schaubert, 2005).

2.2. Statistical analysis

Characteristics of male and female participants were described using means and standard deviations (SD) for continuous variables or percentages (and numbers) for categorical variables. For continuous variables with a non-normal distribution median values and inter-quartile ranges were used. Differences in baseline characteristics between male and female participants were evaluated using unpaired Student's *t*-test, chi-squared or Mann–Whitney tests as appropriate.

The association between maximum grip strength and length of hospital stay was evaluated using Cox proportional hazards regression, since length of hospital stay exhibited a positively skewed distribution and not all patients were discharged back to their usual residence. Cox proportional hazards regression can account for the censoring of some participants who do not experience the outcome within the study timeframe. This type of regression is most commonly used to analyze survival data, where time to an event such as death or recurrence of disease is modeled. In this study the 'event' was set as 'Discharge to Usual Residence'. Those participants who died or were not discharged to their usual residence were censored.

In this study the hazard ratio represents the likelihood of being discharged back to usual residence, as a proxy for length of hospital stay. Statistical significance for all tests was set at the 0.05 level.

3. Results

3.1. Feasibility and acceptability of grip strength measurement

153 patients were admitted to the ward during the study period. Of these, 9 (6%) declined to participate in the study and 64 (42%) were excluded for the following reasons: 34 were too unwell, 24 were unable to consent, 4 were unable to use the dynamometer and 2 for other reasons. Those unable to use the dynamometer had burns to their hands, injured fingers, gout in wrists or were unable to sit up due to a pressure sore.

Of the 80 patients recruited to the study, 76/80 (95%) reported that they would undergo grip strength measurement again although 11/80 (14%) reported discomfort and 14/80 (18%) tiring with use of the dynamometer.

3.2. Study sample and associations of grip strength and length of hospital stay with baseline characteristics

80/153 (52%) patients of Chinese (57.5%), Malay (18.8%), Indian (20.0%) and other (3.8%) ethnicity were recruited (Table 1). Men and women had similar age distributions but women were shorter than men with considerably weaker grip strength and lower cognitive function, as assessed by the MMSE.

Gender was a strong determinant of grip strength with men significantly stronger than women (18.4 kg versus 12.6 kg, $P < 0.001$). Further analysis of the associations of grip strength, after adjustment for gender, revealed positive associations with BMI, weight, MMSE and three-item Barthel score (Table 2).