Handgrip strength predicts disability in older emergency department patients: a prospective cohort study

A força de preensão manual prediz a incapacidade de pacientes idosos no pronto-socorro: um estudo de coorte prospectivo

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Abstract

Objective: This study assessed handgrip strength as a predictor of disability in activities of daily living in older emergency department patients 60 and 90 days after discharge.
Methods: This prospective cohort study was conducted in the emergency department of a tertiary university hospital in Brazil. The sample consisted of 320 patients aged ≥ 65 years who were assessed within 48 hours of admission. The Katz Index was used to assess activities of daily living performance, and handgrip strength was measured with a hydraulic dynamometer. Participants were followed up 60 and 90 days after hospital discharge. The variables were entered into a bivariate regression analysis model.
Results: A total of 177 (55.3%) patients had reduced handgrip strength according to EWGSOP2 criteria. After 60 days, disability occurred in 17.8% and 5.6% of those with reduced and normal HGS, respectively (OR 3.94; 95%CI 1.52 – 10.19, p = 0.005). After 90 days, disability occurred in 15.1% and 4.1% of those with reduced and normal HGS, respectively (OR 4.44; 95% CI 1.50 – 13.14, p = 0.007).
Conclusions: Dynamometric measurement of HGS should be performed in all older emergency department patients to detect those at greater risk of medium-term disability.
Keywords: emergency care; sarcopenia; muscle strength dynamometer; Activities of Daily Living.

INTRODUCTION

The aging of the population is associated with a higher prevalence of chronic disease, resulting in more complex health needs and greater use of health services by older adults, especially emergency services. Emergency department admission subjects older patients to risks such as disability, polypharmacy, hospital infections, and lower quality of life.[1]

Disability is a serious negative outcome in older emergency services patients. It has been defined as the inability to perform or complete tasks or roles that could previously be performed without difficulty or with the help of another person. Functional decline is often defined as a reduced ability to perform self-care activities of daily living (ADL).[2] Classified as acute or sub-acute, it is associated with social isolation, lower quality of life, and mortality, and it is also a predictor of hospitalization, prolonged hospital stay, and emergency department readmission.[3] Some authors have reported that disability is a better predictor of mortality in older patients than severity of organ damage.[4]

In acute care hospitals, sarcopenia is another important predictor of unfavorable outcomes in older patients.[5-8] Sarcopenia is a progressive and generalized neuromuscular disorder that is associated with an increased likelihood of adverse outcomes, including falls, fractures, physical disability, and mortality. According to the European Working Group on Sarcopenia in Older People (EWGSOP2), reduced muscle strength is the primary parameter of sarcopenia, and the diagnosis is confirmed by an associated reduction in muscle mass.[9] Sarcopenia is probable when there is evidence of reduced muscle strength, which can be determined through handgrip strength (HGS). Although the chair stand test can assess muscle strength in the legs (quadriceps group), it may be unfeasible in acute situations.[10]

HGS correlates with strength in other body regions and is easy and inexpensive to measure.[9] A recent study suggested that the HGS can be used to screen for sarcopenia in the emergency department.[11] According to other studies, reduced HGS could be a consistent predictor of negative outcomes in older patients.[12-14] HGS is indicated for routine use in hospitals. The Jamar dynamometer has been validated for HGS measurement and is widely used.[15]

Despite its importance, HGS measurement is still uncommon in emergency services and its medium-term impact for the older adult population remains uncertain.[11,14-16] The lack of studies on this topic is even more pronounced in Latin America. Brazil's older adult population and emergency services, for example, have different characteristics and difficulties than those of developed countries.[17,18] In such countries, a simple and inexpensive marker of medium-term disability could help with stratification and transition of care for older emergency department patients. Therefore, this study investigated whether the HGS of older patients could predict disability in ADL 60 and 90 days after discharge from a Brazilian clinical emergency service.

METHODS

This prospective cohort study was conducted at the internal medicine service of the emergency department of the University of São Paulo Ribeirão Preto School of Medicine University Hospital, which is a reference hospital for clinical and surgical emergencies. The metropolitan area of Ribeirão Preto includes approximately 1.4 million inhabitants.

The sample consisted of older residents of metropolitan Ribeirão Preto who were admitted to the hospital's emergency department between August 2020 and February 2021 and were evaluated within 48 hours of admission. The study included persons of both sexes aged ≥ 65 years who were admitted due to clinical emergencies that did not require surgical, orthopedic, or neurological intervention. The patients had to be able to understand and answer the interview questions and provide written informed consent to participate (or have a companion do so).

The exclusion criteria were:
1. COVID-19 infection and
2. Severe hearing or visual impairment or changes in consciousness level or sense perception that impeded communication when there was no companion or when the companion had the same limitations.

The data were collected through interviews and analysis of the hospital's electronic medical records. In addition to HGS measurement, the participants were assessed using a specially-designed structured questionnaire covering 26 clinical and laboratory variables that influence outcomes in older patients during hospitalization, including ADL.

HGS was measured in the baseline assessment, which was performed within 48 hours of admission to the acute care unit. HGS was measured using a JAMAR hydraulic hand dynamometer (Sammons Preston Rolyan, Bolingbrook, IL, USA), with the results expressed in kg of force. During measurement, the patient remained upright with the dominant elbow unsupported and flexed at 90º. When patients could not sit in an upright position, the measurement took place in bed with the body at a 30º degree angle. Three measurements were performed with a 1-minute interval between them and the mean score was used in the analysis. HGS was classified as low if < 27 kg in men and < 16 kg in women.[9]

ADL performance was assessed using the Katz index,[19] which measures the degree of dependence in 6 self-care activities: eating, sphincter control, transfers, personal hygiene, dressing, and showering. Scores range from 1 to 6; categorized for this study as independent (5 or 6), moderately dependent (3 or 4), or very dependent (1 or 2) in the 2 weeks before admission.[20] After hospital discharge, the patients were followed up at 60 and 90 days by telephone contact, in which the Katz Index was reapplied. For data analysis, patients whose classification worsened compared to baseline (admission) were considered to have a disability.

Variables were entered into a bivariate regression analysis model and the odds ratio (OR) was used for the analysis. HGS during hospitalization and at 60 and 90 days after discharge was assessed using Fisher's exact test. $p < 0.05$ was considered statistically significant and the results include 95% CI. The analysis was performed in STATA 15.0. The covariates used as adjustment variables in the bivariate analysis were mortality and unplanned readmissions at 60 and 90 days.

Sample size calculation was based on Peduzzi et al., who evaluated the effect of the number of events per variable for logistic regression analysis.[21] In their study, > 10 cases for each independent variable ensured application of logistic regression. Given the variables used in the present study, at least 260 cases would make logistic regression analysis appropriate. Thus, our final sample of 320 participants represents a good relationship between sample size and the number of variables, ensuring the credibility of the results.

This study was analyzed and approved by the hospital's research ethics committee (approval 3.892.735/2020) and began thereafter. Informed consent was obtained from each participant and all ethical precautions pertaining to research with human beings were observed and respected. Participants were included only after the nature of the study had been explained and written consent had been obtained from the patients and/or family members.

RESULTS

Over the course of 6 months, 621 patients were admitted to the emergency department, of whom 322 were recruited. Of these, 1 was excluded due to COVID-19 infection during hospitalization and 1 was lost to follow-up, thus the sample consisted of 320 participants. Figure 1 shows the participant recruitment and follow-up process.

A total of 53.1% of the participants were women and the sample's mean age was 74.8 (SD, 7.45) (range, 65 – 95) years. The sample's sociodemographic characteristics are shown in Table 1.
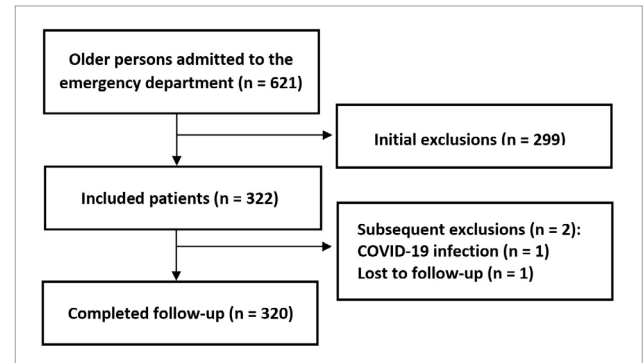

FIGURE 1. Recruitment and follow-up flowchart.

TABLE 1. Sociodemographic characteristics of the participants.

Variables	n (%)
Age (years)	
65–74	174 (54.4)
75–84	107 (33.4)
85–94	38 (11.9)
≥ 95	1 (0.3)
Sex	
Female	170 (53.1)
Male	150 (46.9)
Marital status	
Married or in a civil partnership	140 (43.8)
Single or divorced	54 (16.9)
Widowed	126 (39.3)
Education (years)	
Mean (SD)	3.0 (2.2)
Minimum-maximum	0.0 – 25.0

n = 320. SD: standard deviation.

During the in-hospital assessment, HGS was normal in 143 (44.7%) patients and low in 177 (55.3%). Regarding baseline functional status, 250 (78.1%) patients were independent, 29 (9.1%) were moderately dependent, and 41 (12.8%) were very dependent.

Nine in-hospital deaths occurred. After 60 days, 82 of the patients had died and 3 were hospitalized at the time of the telephone call. Thus, a total of 231 were assessed, of whom 11.3% had a disability. Of those with low HGS, 17.8% developed a disability, compared to 5.6% of those with normal HGS, which was a significant difference (p = 0.003). Logistic regression revealed an OR of 3.94 (95%CI 1.52 – 10.19, p = 0.005), as shown in Table 2. After 60 days, the mean HGS was 16.1 kg and 21.7 kg among those with and without functional decline, respectively.

At 90 days, 3 deaths had occurred and 2 patients were hospitalized at the time of the telephone call. Thus, 226 patients were assessed and disability occurred in 9.3%. Of those with

TABLE 2. Bivariate regression analysis model for 60-day functional decline in older people with low handgrip strength.

	OR	95%CI	p-value
Outcome: 60-day functional decline			
Low handgrip strength	3.94	1.52 – 10.19	0.005

OR: odds ratio; CI: confidencial interval. Number of observations = 231; Pseudo-R2 = 0.0286.

TABLE 3. Bivariate regression analysis model for 90-day functional decline in older people with low handgrip strength.

	OR	95%CI	p-value
Outcome: 90-day functional decline			
Low handgrip strength	4.44	1.50 – 13.14	0.007

OR: odds ratio; CI: confidencial interval. Number of observations = 226. Pseudo-R2 = 0.0311.

low HGS, 15.1% developed disability, compared to 4.1% of those with normal HGS, which was a significant difference (p = 0.004). Logistic regression revealed an OR of 4.44 (95%CI 1.50 – 13.14, p = 0.007), as shown in Table 3. After 90 days, the mean HGS was 17.2 kg and 21.5 kg in participants with and without functional worsening, respectively.

DISCUSSION

Our results demonstrate that older emergency department patients with low HGS are at greater risk of medium-term disability (60 and 90 days after hospital discharge). This indicates that HGS is related to functional reserve in older adults, given the difficulty restoring baseline functional status after emergency department admission in those with reduced muscle strength.

Disability after 60 days may reflect functional impairment during hospitalization and post-hospital syndrome. Post-hospital syndrome is an acquired and transient condition of elevated vulnerability after hospitalization that results from the synergistic effects of an acute problem, comorbidities, and the hospital environment (e.g., immobility, sleep deprivation, polypharmacy, poor nutrition, uncontrolled pain, chronic disease, and iatrogeny).[22] Thus, our study shows the importance of systematic functional assessment in emergency departments, as well as the need to begin rehabilitation for older patients during hospitalization.

Disability after 60 days and its persistence after 90 days represent the difficulty of older persons with reduced muscle reserve to return to baseline functional status after emergency department admission. Although some studies have shown that low HGS has short-term (30 days) effects after hospital discharge,[23] according to our results, reduced muscle reserve assessed through HGS can also predict medium-term disability.

Thus, for older patients with low HGS, physical rehabilitation must be included in the care plan at hospital discharge.

In hospitalized older adults, ADL assessment prior to admission has predictive validity and important results for functionality, especially among those dependent in ADL.[24] We defined prior functionality as the ability to perform ADL in the 2 weeks prior to admission to reduce the influence and impact of the underlying disease responsible for emergency department admission. This is in accordance with previous studies, which have shown that functionality 2 weeks before hospitalization can predict functional deterioration.[25,26]

HGS is the best and simplest method of assessing muscle strength and function in clinical practice.[27] Function can be influenced by muscle wasting, lack of mobility, or sarcopenia secondary to chronic inflammation or aging. In older adults, acute illness and some exacerbated chronic diseases lead to tissue inflammation and the release of inflammatory cytokines. These cytokines may lead to symptoms such as fever, hyporexia, and metabolic changes. These changes lead to decreased food intake, body weight, and muscle function, thus contributing to reduced muscle strength.[28]

HGS reflects an older person's global health and can be considered a "vital sign" in emergency departments. Thus, emergency physicians should search for the underlying causes of clinical worsening when reduced HGS is observed.[29] This is very important for older patients in emergency care, where physicians and health care professionals must quickly evaluate and indicate precise actions.

Certain factors must be considered when measuring HGS, such as participation level, cognitive functioning, musculoskeletal disease, medication, and operator skills.[30] Nevertheless, HGS is an easy to perform, simple, inexpensive, reliable, accurate, and reproducible method of assessing muscle strength if used in standardized conditions. Health care professionals require minimal training, and a calibrated dynamometer can be used multiple times.

Using HGS assessment as a screening tool could help emergency service physicians identify patients at higher risk of adverse outcomes and implement early interventions. For example, HGS may help detect patients at risk of disability and could help individualize discharge planning, including nutrition care and physical rehabilitation. In settings where human resources are limited and care for older patient is challenging, a simple screening test could help clinicians focus on patients with worse prognoses.

It will be challenging to define a specific cut-off point for this population, since most studies assess HGS in older outpatients or those hospitalized without acute illnesses. In this study, EWGSOP2 values were used as cut-off points.[9] Some

parameters helped standardize the results, such as: the use of a properly calibrated Jamar hydraulic hand dynamometer, which is the most widely used device and has well-established reliability and reproducibility; all patients were assessed within 48 hours of admission, which reduced the impact of lost strength and muscle mass during hospitalization; the same device was used to measure HGS in all patients; and all measurements were performed by the same researcher.

It is possible that the COVID-19 pandemic has changed the profile of older patients referred to emergency services. Nevertheless, all of the participants, except for the one excluded from follow-up, had negative test results and all presented normal clinical demands. Despite the pandemic, the health demands of the older population continued as normal, and thus our sample reflects the situation of older patients treated in emergency care services.

This study showed the importance of systematic functional assessment in emergency departments, as well as the importance of using HGS to predict disability at 60 and 90 days after hospital discharge in older patients treated at a clinical emergency service. It also demonstrated the difficulty older emergency department patients with low muscle reserve have in recovering baseline functional status. Future studies should investigate the benefits of beginning physical and nutritional rehabilitation in older patients with reduced HGS while they are still hospitalized.

CONCLUSION

Dynamometric measurement of HGS should be performed in all older emergency department patients to detect those at greater risk of medium-term disability, which will help provide humanized care focused on preserving functionality and autonomy.

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DECLARATIONS

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