

VARIABLES ASSOCIATED WITH FRAILTY IN A HOSPITAL POPULATION IN COLOMBIA

Variables asociadas a fragilidad en una población hospitalaria en Colombia

Diego Moreno Díaz^{a,b} , Andrés Ochoa^{a,b} , Mario Alberto Corzo^{a,b} ,
Miguel Cadena Sanabria^{a,b} , Claudia Lucía Figueroa^{a,b} 

ABSTRACT

INTRODUCTION: Frailty predicts functional decline and could be associated with adverse outcomes such as disability, multiple hospitalizations, falls, loss of mobility, and cardiovascular disease. In Colombia 12.5% of prevalence has been reported. In the present study, the different clinical variables associated with frailty were evaluated in a population of hospitalized patients older than 65 years in Bucaramanga, Colombia, in order to predict the behavior of these variables to generate measurement tools of greater applicability than that of currently existing tools. **METHODS:** An analytical observational cross-sectional study with non-probabilistic sampling was conducted from January 2016 to June 2017 in patients older than 65 years of follow-up > 48 hours by the internal medicine service. Fried criteria were used to evaluate patients on their last day of hospitalization. **RESULTS:** A total of 155 patients were included, of whom 60.6% were frail. A combined analysis of the variables that showed association with frailty revealed that a calf circumference lower than or equal to 31 cm, a gait speed lower than or equal to 0.8 m/s, and age above 75 years were associated with frailty. It was also shown that being male and having a BMI > 27 kg/m² are protective factors for frailty. **CONCLUSIONS:** The prevalence of frailty in hospitalized older adults was higher than that reported in local studies for the community population. According to multivariate analysis, the variables, when analyzed together, have a predictive ability of 92% to estimate frailty in hospitalized patients.

KEYWORDS: frailty; elderly; hospitalization.

RESUMEN

INTRODUCCIÓN: El síndrome de fragilidad puede asociarse a mayor riesgo de deterioro funcional y desenlaces adversos como discapacidad, múltiples hospitalizaciones, caídas, pérdida de movilidad y enfermedad cardiovascular. En Colombia se ha reportado una prevalencia del 12,5%. En el presente estudio, se evalúan las diferentes variables clínicas asociadas a fragilidad en una población de pacientes mayores de 65 años en una población hospitalaria en Colombia con el fin de predecir el comportamiento de estas variables y poder general herramientas de detección de mayor aplicabilidad que las que existen actualmente. **MÉTODOS:** Se realizó un estudio observacional analítico de tipo corte transversal con muestreo no probabilístico desde enero de 2016 a junio de 2017 en pacientes mayores de 65 años en seguimiento > 48 horas por el servicio de medicina interna. Se evaluó la presencia de fragilidad a través de los criterios de Linda Fried, medidos previo al egreso. **RESULTADOS:** Se incluyeron 155 pacientes, el 60,6% cumplió criterios de Fragilidad. Al realizar el análisis combinado de las variables que mostraron asociación con fragilidad se encontró que una circunferencia de la pantorrilla menor o igual a 31 cm, una velocidad de marcha menor o igual de 0,8 m/seg y ser mayor de 75 años tenían asociación de riesgo para tener fragilidad. También se evidenciaron que ser hombre y tener IMC > 27 kg/m², son factores protectores para tener fragilidad. **CONCLUSIONES:** La prevalencia de fragilidad en adultos mayores hospitalizados fue mayor de la reportada en estudios locales para población comunitaria. De acuerdo con el análisis multivariado, los criterios modificados de Fried incluyendo perímetro de pantorrilla, sin tener en cuenta dinamometría, tienen una capacidad predictiva del 92% para estimar fragilidad en pacientes hospitalizados. **PALABRAS CLAVE:** fragilidad; adulto mayor; hospitalización.

^aUniversidad Industrial de Santander, Hospital Universitario de Santander – Bucaramanga, Colombia.

^bGrupo de Investigación GERMINA – Bucaramanga, Colombia.

Corresponding data

Diego Moreno Díaz – Rua 18, 30-31 – San Alonso – CEP: 680002 – Bucaramanga (Santander), Colombia. E-mail: dimmedo0523@gmail.com

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INTRODUCTION

Frailty, understood as a state of low physiological reserve and decreased capacity of responding to stressors,¹ has been investigated by many community studies, and, less often, in acute care settings. Several diagnostic criteria for this condition have been proposed; among them, one of the most described is the Fried frailty phenotype.^{2,3}

Reports on the prevalence of frailty have shown important variations worldwide.⁴⁻¹² In Colombia, Gómez Montes et al.³ found a prevalence of 12.5% using Fried criteria in a sample of 1878 individuals aged > 60 years from 4 Colombian cities. Results from the SABE Bogotá study showed a prevalence of frailty of 9.4%.¹³ Locally, the only study conducted at the community level reported a prevalence of 7.9%.¹⁴

There are no studies assessing either frailty in hospitalized older adults at the national level or the clinical factors associated with this condition, the reason for which this study was conducted.

METHODS

A cross-sectional observational study was conducted including patients aged 65 years or older admitted to the internal medicine service of Hospital Universitario de Santander (HUS) from 2016 to 2017. Patients were selected using a concurrent convenience sampling strategy. Inclusion criteria were the following: age equal to or greater than 65 years, being admitted to the internal medicine service, having accepted to participate in the study, and length of hospital stay equal to or longer than 48 hours. Conversely, the study excluded patients with diseases that prevented them from being in the standing position, such as severe dementia and chronic immobility syndrome with deterioration of motor functions for more than 6 months. No invasive procedures were performed. It was considered a minimum risk study, according to the Resolution 8430 of 1993 (Colombia). Participants were asked to provide written informed consent. This research was approved by the Research Ethics Committee of HUS and of Universidad Industrial de Santander (CEINCI).

According to HUS's statistics for 2014, an average of 2735 patients older than 65 years were discharged from the internal medicine service; and, considering an estimated prevalence of frailty of 12% in Colombia, sample size was set at 155 patients for a 95% confidence interval (95%CI) and power of 80%.

Variables

The following variables were obtained: age, sex, place of origin, educational level, marital status, length of hospital stay, comorbidities. Additionally, anthropometric variables, such as calf circumference, were obtained, and scales to assess functional capacity in basic and instrumental activities of daily living (Barthel and Lawton scales respectively) were administered, as well as Mini Mental State Examination (MMSE), Mini nutritional assessment, short version (MNA), and Charlson Index.

The definition of frailty was based on the Fried phenotype, considering the variables previously described in Colombia;^{3,14} assessment was conducted on the day of hospital discharge.

The diagnosis of frailty was established in the presence of 3 or more of the following criteria:

- Weight loss: this variable was assessed through the question from the MNE questionnaire that asked about self-reported unintentional weight loss within the last 3 months and was coded as: yes, no, or do not know. Participants who reported unintentional weight loss within the last 3 months or who had a body mass index (BMI) < 21 kg/m² were considered positive for this criterion;
- Grip strength: grip strength was measured using a Jamar hydraulic hand dynamometer model 5030J1, 2012, Serial 31112055. Two attempts were made, with a 1-minute interval between them, and the best of the attempts was recorded. Values below 20 kg/f for women and 30 kg/f for men were considered as low grip strength;
- Self-reported physical tiredness or fatigue: assessed using 2 questions belonging to the Center for Epidemiologic Studies Depression Scale-Revised (CESD-R). Participants were asked whether they felt that everything they did was an effort and if they were too tired to do anything in the previous week. The participants could answer rarely (0 or 1 day), some of the time (1 or 2 days), occasionally (3 or 4 days), and most of the time (5 or 7 days). Participants who answered "occasionally" or "most of the time" to some of the 2 questions were assigned with 1 point for this item;
- Gait speed: The test consisted of asking participants to walk along a 6-meter distance at their usual walking speed. The time required for this task was recorded. Participants with a gait speed below 0.8 m/s were considered as having a slow speed;

- Physical activity: According to the Reuben' Advanced Activities of Daily Living scale, participants were classified into four categories: frequent vigorous exercisers, frequent long walkers, frequent short walkers, and non-exercisers. Participants who reported not doing any exercise were considered as having low physical activity.

Calf circumference was measured with individuals in the seating position and legs 30 cm apart from each other with an angle of 90 degrees.

Statistical analysis

Sociodemographic and clinical variables were expressed as frequencies, percentages, medians, means, according to the level of measurement, together with their corresponding dispersion measures. The variables that were significantly associated with the outcome (frailty) in the bivariate analysis were incorporated into the multivariate model to estimate the independent predictive value of each parameter, with statistical significance set at $p < 0.05$. Odds ratios (OR) and their 95% confidence intervals were calculated for each variable included in logistic regression. The area under the receiver operating characteristic (ROC) curve was used to assess the sensitivity and specificity of continuous and dichotomous variables with statistical significance, considering the Fried frailty criteria as the reference standard. Data analysis was conducted using the STATA 12 statistical package.

RESULTS

During the research period, 182 patients were selected as eligible. However, 13 met exclusion criteria, 5 did not complete

the functional evaluation, and 9 withdrew consent. Finally, a total of 155 patients were included, of which 65.1% ($n = 101$) were male. The prevalence of frailty according to Fried criteria was 60.6% ($n = 94$), being higher among women (75.9%). Frail patients had a median age of 76 (IQR, 69 – 81) years and a median length of hospital stay of 10 (IQR, 6–15) days. As for anthropometric measures, mean BMI was 23.6 (SD 5.1) kg/m^2 , and mean calf circumference was 31.8 (SD 4.5) cm. With regard to biometric factors, mean grip strength was 19.4 (SD 5.9) kg/f , and mean gait speed was 0.6 (± 0.2) m/s .

Assessment of physical activity level showed that 40.6% ($n = 66$) of patients were non-exercisers, 25.8% ($n = 40$) walked frequent short walkers, and only 14.8% ($n = 23$) were vigorous exercisers performed vigorous physical activity. Conversely, with regard to the questions from the CESD-R that assessed self-reported fatigue, 41.4% of respondents ($n = 39$) answered that they felt that everything they did was an effort most of the time (5 – 7 days). The demographic characteristics of the study population are shown in Table 1.

Multivariate analysis

The bivariate analysis between the variables that showed association with frailty found that a calf circumference lower than or equal to 31 cm, a gait speed lower than 0.8 m/s , and age above 75 years were associated with risk for frailty, with an OR equal to 4.2 [95%CI 1.74 – 10.15; $p = 0.001$]; 7.5 [95%CI 3.41 – 16.7; $p < 0.001$], and 2.8 [95%CI 1.23 – 6.48; $p = 0.014$] respectively, with a ROC curve of 0.82. When presence of fatigue and physical inactivity were added to these variables, the association between these variables and risk for frailty remained, and the value of the ROC curve increased to 0.92 (Table 2 and Graph 1).

Conversely, the present study found that some variables tended to be protective, since cross-sectional analysis revealed

Table 1 General characteristics of the study population.

Variable	Total $n = 155$ n (%)	Non-frail $n = 61$ (39.35) n (%)	Frail $n = 94$ (60.65) n (%)	p-value
Sociodemographic characteristics				
Sex				
Male	101 (65.16)	48 (78.69)	53 (56.38)	0.004***
Age*	73 (Q1 = 68, Q3 = 8)	71 (Q1 = 67, Q3 = 75)	76 (Q1 = 69, Q3 = 81)	< 0.001*****

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Table 1 Continuation.

Variable	Total n = 155 n (%)	Non-frail n = 61 (39.35) n (%)	Frail n = 94 (60.65) n (%)	p-value
Marital status				
Single	33 (21.29)	10 (16.39)	23 (24.47)	0.025***
Married	47 (30.32)	21 (34.43)	26 (27.66)	
Widowed	43 (27.74)	11 (18.03)	32 (34.04)	
Divorced	15 (9.68)	10 (16.39)	5 (5.32)	
Civil union	17 (10.97)	9 (14.75)	8 (8.51)	
Educational level				
None	50 (32.26)	18 (29.51)	32 (34.04)	0.398***
Elementary (1 to 5 years of study)	90 (58.06)	39 (63.93)	51 (54.26)	
Secondary (6 to 11 years of study)	15 (9.68)	4 (6.56)	11 (11.70)	
Place of origin				
Santander	137 (88.39)	53 (86.89)	84 (89.36)	0.638***
Other	18 (11.61)	8 (13.11)	10 (10.64)	
Urban area	117(75.48)	48 (78.69)	69 (73.40)	0.455***
Clinical characteristics				
Days of hospitalization*	9 (Q1 = 5, Q3 = 14)	7 (Q1 = 3, Q3 = 12)	10 (Q1 = 6, Q3 = 15)	0.0067*****
Anthropometric measures				
BMI**	24.10 ± 5.04	24.74 ± 4.17	23.69 ± 5.14	0.1800*****
Maximum circumference of the calf (cm) ²	32.80 ± 4.38	34.28 ± 3.77	31.83 ± 4.50	< 0.001*****
Greater hand grip strength (kg/f) ²	21.86 ± 7.00	25.64 ± 6.78	19.40 ± 5.99	< 0.001*****
Gait speed (m/s) ²	0.73 ± 0.27	0.90 ± 0.23	0.62 ± 0.23	< 0.001*****
Self-reported fatigue according to CESD-R				
1, I felt that everything I did was an effort				
Rarely (0 to 1 day)	63 (40.65)	38 (62.30)	25 (26.60)	< 0.001***
Some of the time (1 to 2 days)	20 (12.90)	7 (11.48)	13 (13.83)	
Occasionally (3 to 4 days)	25 (16.13)	8 (13.11)	17 (18.09)	
Most of the time (5 to 7 days)	47 (30.32)	8 (13.11)	39 (41.49)	
2, I was too tired to do anything				
Rarely (0 to 1 day)	105 (67.74)	43 (70.49)	62 (65.96)	0.047***
Some of the time (1 to 2 days)	14 (9.03)	9 (14.75)	5 (5.32)	
Occasionally (3 to 4 days)	14 (9.03)	5 (8.20)	9 (9.57)	
Most of the time (5 to 7 days)	22 (14.19)	4 (6.56)	18 (19.15)	
Physical activity				
None	63 (40.65)	7 (11.48)	56 (59.57)	< 0.001***
Mild	40 (25.81)	23 (37.70)	17 (18.09)	
Moderate	29 (18.71)	17 (27.87)	12 (12.77)	
Intense	23 (14.84)	14 (22.95)	9 (9.57)	
Lawton & Brody index				
Autonomous	84 (54.19)	43 (70.49)	41 (43.62)	0.002****
Mild	43 (27.74)	13 (21.31)	30 (31.91)	
Moderate	24 (15.48)	4 (6.56)	20 (21.28)	
Severe	3 (1.94)	0 (0.0)	3 (3.19)	
Total	1 (0.65)	1 (1.64)	0 (0.0)	

Continue...

Table 1 Continuation.

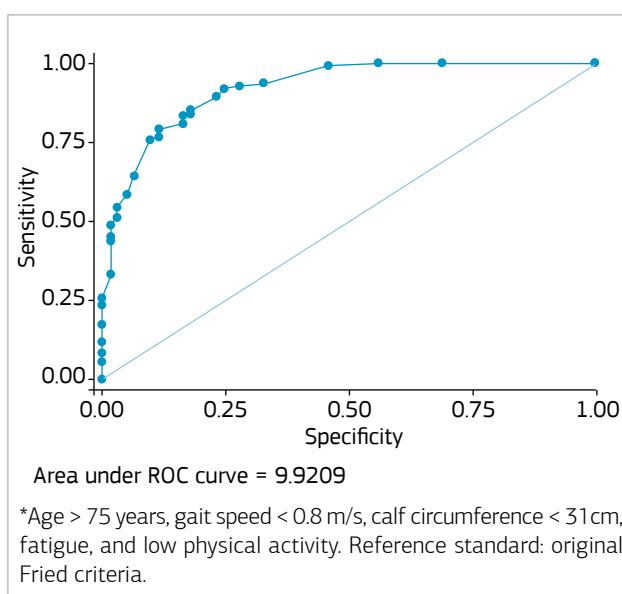
Variable	Total n = 155 n (%)	Non-frail n = 61 (39.35) n (%)	Frail n = 94 (60.65) n (%)	p-value
Barthel index				
Independent	75 (48.39)	42 (68.85)	33 (35.11)	< 0.001****
Slight dependency	73 (47.10)	19 (31.15)	54 (57.45)	
Moderate dependency	7 (4.52)	0 (0.0)	7 (7.45)	
Mini-Mental (MMSE-30)				
Normal	4 (2.58)	2 (3.28)	2 (2.13)	0.598****
Mild deficit	78 (50.32)	35 (57.38)	43 (45.74)	
Mild cognitive impairment	39 (25.16)	12 (19.67)	27 (28.72)	
Moderate cognitive impairment	27 (17.42)	10 (16.39)	17 (18.09)	
Severe cognitive impairment	7 (4.52)	2 (3.28)	5 (5.32)	
Charlson index				
High	40 (25.81)	9 (14.75)	31 (32.98)	0.007***
Absent	69 (44.52)	36 (59.02)	33 (35.11)	
Low	46 (29.68)	16 (26.23)	30 (31.91)	
Mini Nutritional Assessment MNA				
Normal nutritional status	23 (14.84)	18 (29.51)	5 (5.32)	< 0.001***
At risk for malnutrition	86 (55.48)	34 (55.74)	52 (55.32)	
Malnourished	46 (29.68)	9 (14.75)	37 (39.36)	

*Continuous variables presented as median and interquartile range; **continuous variables presented as mean and standard deviation; ***Chi2 test; ****Fisher's exact test; *****Mann-Whitney U test; *****Student's test; BMI: body mass index; CESD-R: Center for Epidemiologic Studies Depression Scale-Revised; MMSE-30: Mini Mental State Examination; MNA: Mini Nutritional Assessment.

Table 2 Multivariate analysis of risk variables for frailty.

Variable	Odds ratio	95% confidence interval	p-value
Maximum calf circumference ≤ 31 cm	5.79	1.86–18.01	0.002
Speed gait ≤ 0.8 m/s	7.63	2.74–21.19	0.000
Age > 75 years old	4.99	1.71–14.54	0.000
Fatigue	7.98	2.52–25.29	0.000
Physical inactivity	17.44	5.69–53.44	0.000

that being male and having a BMI > 27 kg/m² are protective factors for frailty, with OR equal to 0.20 [95%CI 0.08 – 0.50; p = 0.001] and 0.25 [95%CI 0.10 – 0.62; p = 0.003] respectively.



Graph 1 ROC curve for the association between modified Fried criteria* and frailty.

DISCUSSION

The prevalence of frailty in hospitalized older adults was 60.6%, a value much higher than that reported in local studies for the community population.^{3,13,14} A higher prevalence was observed in women. As for anthropometric variables, it is worth noting that the group of frail individuals showed a lower calf circumference. A previous study has described an association between calf circumference below 31 cm and gait difficulties, falls, and fear of falling.¹⁵ Similarly, frailty was also associated with longer length of hospital stay. Belga et al.¹⁶ found that frail individuals higher risk for 30-day readmission and mortality, considering an assessment made 24 hours after discharge using the clinical frailty scale, Fried criteria, and the Up and Go test. According to multivariate analysis, calf circumference ≤ 31 cm, gait speed ≤ 0.8 m/s, age > 75 years, fatigue, and physical inactivity, when analyzed together,

have a predictive ability of 92% to estimate frailty in hospitalized patients.

FINAL CONSIDERATIONS

Based on these results, the present study proposes an easy-to-use modified scale for frailty that does not require the use of additional devices, such as dynamometer. However, the predictive ability of this scale with regard to adverse outcomes requires larger studies for its validation.

CONFLICT OF INTERESTS

The authors declare not having any conflict of interests.

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