Characterization of Fragility Hip Fracture, Causes of Surgical Delay, and Mortality in a Tertiary Center in Palmira, Colombia

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Abstract

Introduction: Fragility hip fractures in older adults are associated with high morbidity, mortality, and disability, with a detrimental impact on quality of life in the older adult population.

Methods: A retrospective cohort study was conducted in a tertiary clinic in Colombia from January 2021 to December 2023. The objective of the study was to describe the clinical characteristics of older adult patients hospitalized with fragility hip fractures and to establish the factors associated with mortality and early versus late surgery.

Results: A total of 191 patients were analyzed. The median age was 84 years. The cumulative mortality rate at 12 months of follow-up was 13%

(n=25/191). 48.7% of surgeries were performed in less than 48 hours. Factors associated with cumulative mortality at 12 months were a Charlson score greater than 5 and surgery performed more than 48 hours later. Factors associated with surgical delay were sarcopenia, CKD with a GFR < 45 ml/min, and hemoglobin levels on admission < 9 g/dL.

Conclusions: Elderly patients with hip fractures often have multimorbidity, which makes them more clinically complex. Medical evaluation should aim to identify and stabilize comorbidities to achieve early surgery. In Colombia, there may be gaps in achieving the goal of early surgery related to the type of health insurance. It is important to strengthen guidelines for the prevention of osteoporotic fractures and curb therapeutic inertia.

Keywords: hip fracture, geriatric syndromes, mortality, sarcopenia, anemia, chronic kidney disease, Charlson.

Introduction

Hip fracture is the most common fragility fracture in older adults, accounting for more than 37% of all osteoporotic fractures in this group in Colombia (1). This type of fracture is associated with high morbidity, mortality, and disability, generating a significant impact on quality of life and healthcare costs (2).

In Colombia, the care of these patients faces major challenges, both due to administrative barriers within the healthcare system and to difficulties related to rural settings and limited access to specialized services (3). Among the main factors influencing clinical outcomes is the time to surgery. Several studies have shown that surgical delays are associated with higher complication rates, poorer functional recovery, and increased mortality. A retrospective cohort study reported that 30-day mortality increased when surgery was performed after 24 hours (4).

However, the evidence is not entirely conclusive. An international randomized controlled clinical trial found no differences in mortality between patients who underwent accelerated surgery (within the first 6 hours) versus standard care (median of 24 hours); although a reduction in the incidence of delirium and urinary tract infections was observed in the early surgery group (5).

In Colombia, one-year mortality following hip fracture exceeds 32% (3). In addition, wide variations persist in the time to surgery, with average times that can exceed 96 hours (3,6).

The aim of this study was to describe the clinical characteristics of older adult patients hospitalized with fragility hip fracture in a tertiary care

hospital in Colombia and to analyze the factors associated with mortality and surgical delay (defined as surgery performed more than 48 hours after admission).

Materials and Methods

Study design and data collection

A retrospective observational cohort study was conducted at a tertiary referral center located in Palmira, Colombia, with a capacity of more than 100 beds. The observation period extended from January 2021 to December 2022. Data collection and analysis were carried out between December 2022 and December 2023. All older adult patients (≥65 years) diagnosed with hip fracture were included. Data were obtained through review of electronic medical records. Patients with incomplete medical records were excluded.

Clinical variables, medical history, comorbidities, and laboratory test results at hospital admission were collected. In addition, a stepwise logistic regression analysis was performed to identify factors associated with mortality and surgical delay (early vs. late surgery). The study was approved by the Ethics Committee of Clínica Santa Bárbara, Palmira, Colombia, and had administrative authorization.

Retrospective follow-up was performed up to 12 months after hospital discharge through review of electronic records, as the institution has a platform that integrates inpatient and outpatient care. No telephone or in-person contact was made with patients.

Older adult was defined as any patient aged 65 years or older. Fragility hip fracture was defined as a fracture involving the proximal femur secondary to low-energy trauma, typically associated with osteoporosis, and was classified as intracapsular or extracapsular according to its relation to the articular capsule (7,8). Surgical delay was defined as surgery performed more than 48 hours after admission (8).

Among the clinical variables considered were geriatric syndromes. Polypharmacy was defined as the concurrent use of five or more medications (9). Functional independence was assessed from the Barthel Index recorded in the medical history (10). Sarcopenia was documented in patients with a diagnosis noted in the record, based on the SARC-F scale (11). Frailty was determined when reported using the Clinical Frailty Scale (12). The Charlson Comorbidity Index was retrospectively calculated to estimate disease burden (13). The presence of delirium was established according to the

Confusion Assessment Method (CAM) documented in the medical record (14). The glomerular filtration rate (GFR) was calculated from serum creatinine using the 2021 CKD-EPI formula (15). Pulmonary embolism diagnosis was considered only when documented through pulmonary artery CT angiography.

Statistical analysis

A descriptive analysis of the variables was performed. Normality was assessed using the Kolmogorov-Smirnov or Shapiro-Wilk tests, depending on sample size. Student's t test was used to compare continuous variables with normal distribution, while the Mann-Whitney U or Wilcoxon tests were applied for non-normally distributed data, as appropriate. Continuous variables were expressed as mean and standard deviation, or as median and interquartile range (IQR) when distribution was not normal. Categorical variables were presented as absolute frequencies and percentages.

The association between categorical variables was assessed using the Chi-square test or Fisher's exact test. Variables with a p value <0.10 in the bivariate analysis were included in a multivariate stepwise logistic regression model to identify factors associated with mortality and surgical delay. Statistical significance was assumed at p <0.05. Results were expressed as odds ratios (OR) with corresponding 95% confidence intervals (CI). The Hosmer-Lemeshow test was used to assess model fit, with a p value >0.05 considered acceptable (17). Statistical analysis was performed using IBM SPSS Statistics version 20.

Results

During the study period, a total of 26,351 older adults were treated in the emergency department. The prevalence of consultations for hip or femoral fracture, injury, or contusion in this population was 2.8% (n = 742/26,351), while the specific prevalence of hip fracture was 1.01% (n = 268/26,351). Figure 1 shows the flow diagram for patient selection.

The median age was 84 years (interquartile range [IQR]: 78–89), 69% were women, and 37% came from rural areas. In-hospital mortality was 2% (n = 4/191), and cumulative 12-month mortality was 13% (n = 25/191).

The most frequent comorbidities were arterial hypertension (70%), type 2 diabetes mellitus (26%), chronic obstructive pulmonary disease (21%), dementia (20%), primary hypothyroidism (17%), and history of ischemic stroke (11%). Admission to critical care occurred in 7.3% of cases. The median hospital stay was 5 days (IQR: 3–9) (Tables 1 and 2).

Table 1. General characteristics and variables related to patient mortality outcomes.

Variable	All the patients n=191(%)	Survivors (n=166)	12-month cumulative mortality (n=25)	P Value	OR	Confidence interval 95%
Age in years, median (IQR)	84(78-89)	83(77-89)	85(81-91)	0.1		
Subsidized health system insurance	39 (20)	32(19.3)	7(28)	0.3		
Origin in rural area	71(37)	62(37)	9(36)	0.8		
Admission to intensive care	14(7)	8(4.8)	6(24)	0.004	6.2	1.9 a 19
Women	133 (69)	118(71)	15(60)	0.2		
Surgery performed after 48 hours	98(51)	78(47)	20(80)	0.002	4.5	1.6 a 12.5
Assessment by geriatrics or internal medicine prior to surgery	35(18)	26(15)	9(36)	0.02	3	1.2 a 7.5
Charlson > 5 points	64(33)	48(28)	16(64)	0.001	4.3	1.8 a 10.5
Sarcopenia	27(14)	20(12)	7(28)	0.058	2.8	1.05 a 7.6
Barthel under 70 points	76(55)	60(52)	16(76)	0.04	2.9	1 a 8.5
Polypharmacy	71(37)	58(35)	13(52)	0.1		
Fragility	33(17)	25(15)	8(32)	0.04	2.6	1 a 6.8
Delirium	30(16)	22(13)	8(32)	0.03	3	1.1 a 7.8
CKD EPI 2021 GFR less than 60 mL/min	76(41)	60(37)	16(64)	0.01	2.9	1.2 a 7
Serum hemoglobin on admission less than 10 g/dL	49(26)	38(23)	11(44)	0.04	2.6	1 a 6.2

Table 2. Variables related to the outcome of early versus late surgery.

Variable	All the patients n=191(%)	Surgery in the first 48 hours, n=93(%)	Surgery after 48 hours. n=98 (%)	P Value	OR	IC95%
Age in years, median (IQR)	84(78-89)	83(78-89)	84(76-90)	0.7		
Subsidized health care insurance	39(20)	8(8)	31(31)	0.001	4.9	(2.1-11)
Health care through contributory insurance	147(77)	83(89)	64(65)	0.001	0.2	(0.1-0.4)
Cumulative mortality in 12 months	25(13)	5(5)	20(20)	0.002	4.5	1.6 a 12.5
Women	133(69)	62(66)	71(72)	0.3		
Rural residence area	71(37)	34(36)	37(37)	0.8		
Median hospital stay days (IQR)	5(3-9)	3(3-5)	7.5(5-10)	0.001		
Hours from admission to surgery, median (IQR)	51(32-90)	32(24-43)	88 (67-118)	0.001		
Barthel, median (IQR)	60(30-85)	60(30-88.75)	57.5(35-85)	0.9		
Charlson Comorbidity Index, median (IQR)	5(4-6)	5(4-6)	5(4-6.25)	0.02		
Charlson Comorbidity Index >5 points	64(33)	25(26)	39(39)	0.05	1.7	(0.9-3.3)
Sarcopenia	27(14)	8(8.6)	19(19)	0.03	2.5	(1.05-6.1)
Fragility	33(17)	10(10)	23(23)	0.02	2.5	(1.1-5.6)
Glomerular filtration rate (by CKD-EPI), >59 ml/min	108/84(58)	61/87(70)	47/97(48)	0.003	0.4	(0.2-0.7)
GFR 0-44 mL/min (CKD-EPI)	38/184(20)	12/87(13)	26/97(26)	0.03	2.2	(1.07-4.8)
Hemoglobin levels on admission < 9 g/dL	18/189(9.5)	3/92(3)	15/97(15)	0.004	5.4	(1.5-19)
Hemoglobin levels after surgery, median (IQR), g/dL	9 (8-10.4)	9.4(8.1-11)	8.6 (7.8-10.2)	0.049		

Hip fracture characteristics:

A total of 191 surgical procedures were performed, of which 48.7% (n = 93) were carried out within 48 hours. Extracapsular fractures were the most frequent, with 82% intertrochanteric and 8.4% subtrochanteric; the remainder corresponded to intracapsular fractures. The median time from admission to surgery was 51 hours (IQR: 32–90). The surgical site infection rate was 0.5%.

Geriatric syndromes:

Regarding geriatric syndromes, the study population showed a high disease burden. The Charlson Comorbidity Index had a median of 5 points (IQR: 4–6). The prevalence of sarcopenia was 14%, frailty 17%, and demen-

tia 20%, with a median score of 5 (IQR: 4–6) on the Global Deterioration Scale (GDS). The Barthel Index had a median of 60 points (IQR: 30–85), and polypharmacy was present in 37% of patients at admission.

Clinical laboratory results:

Laboratory results showed a mean hemoglobin level at admission of 11.2 g/dL (standard deviation: 1.7). The prevalence of anemia at admission was 70%. After surgery, median hemoglobin levels decreased to 9 g/dL (IQR: 8–10.4), and 29% of patients required red blood cell transfusion. The median glomerular filtration rate (GFR) was 64 ml/min (IQR: 48–84), and was below 60 ml/min in 41% of cases.

Complications:

Delirium was the most frequent complication, occurring in 16% of patients. Other complications had a lower incidence, including urinary retention (2.1%), pulmonary embolism (4.2%), pneumonia (4.2%), pressure ulcers (2.1%), and acute myocardial infarction (2.6%).

Logistic regression analysis: factors associated with 12-month cumulative mortality: In the logistic regression analysis to identify factors associated with 12-month cumulative mortality, the bivariate analysis showed associations with variables such as admission to intensive care, surgery performed after 48 hours, Barthel Index <70 points, Charlson Index >5 points, heart failure, sarcopenia, frailty, and the presence of delirium. No significant association was found with fracture type or rural vs. urban origin. A GFR >59 ml/min behaved as a protective factor (OR: 0.34; 95% CI: 0.1–0.8; p = 0.013), while a GFR <60 ml/min was associated as a risk factor (OR: 2.9; 95% CI: 1.2–7; p = 0.013). Finally, in the multivariate logistic regression model, the variables that remained significantly associated with 12-month mortality were a Charlson Index >5 points and surgery performed after 48 hours (Table 3).

Table 3. Logistic regression, factors associated with 12-month cumulative mortality

Variable	OR	P Value	CI95%
Charlson Comorbidity Index >5 points	3.8	0.003	1.5 a 9.5
Surgery performed after 48 hours	3.9	0.01	1.3 a 11.3

* In the logistic regression analysis, the Omnibus test of model coefficients yielded a p-value of 0.001; Nagelkerke's R^2 was 17.7% (0.177); and the Hosmer-Lemeshow goodness-of-fit test showed a p-value of 0.984.

The logistic regression analysis for factors associated with surgical delay showed, in the bivariate analysis, that the variables associated with delayed surgery were subsidized insurance, a Charlson Comorbidity Index >5 points, sarcopenia, frailty, chronic kidney disease with GFR <45 ml/min, and hemoglobin levels <9 g/dL at admission. Contributory insurance was associated with early surgery. No association was found with age, place of origin (rural or urban), Barthel Index, or fracture type. It is noteworthy that many arthroplasties were not performed at the study center but were transferred to other hospitals due to administrative orders from health insurers (Figure 1). In the multivariate logistic regression model, the factors that remained significantly associated with delayed surgery were sarcopenia, chronic kidney disease with GFR <45 ml/min, and hemoglobin <9 g/dL at admission (Figure 1 and Table 4).

Figure 1. Flowchart of the patient selection process for time-to-surgery analysis.

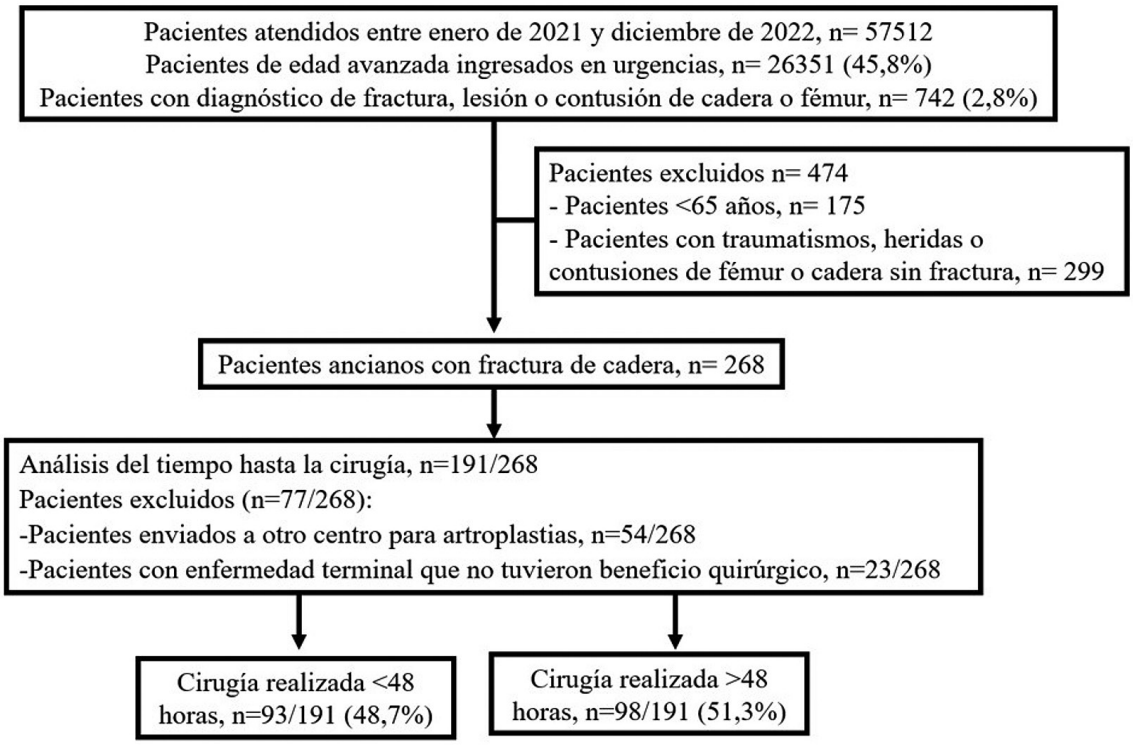

Table 4. Logistic regression, risk factors for delay in surgical intervention*

Variable	OR	P value	CI95%
Sarcopenia	2.54	0.044	1.027-6.30
Chronic kidney disease, GFR <45 ml/min (CKD-EPI)	2.41	0.026	1.11-5.26
Hemoglobin levels on admission < 9 gr/dL	5.89	0.007	1.6-21.5

* In the logistic regression analysis, the Omnibus test of model coefficients yielded a p-value of 0.001; Nagelkerke's R^2 was 12.4% (0.124); and the Hosmer-Lemeshow goodness-of-fit test showed a p-value of 0.803.

Discussion

The findings of this study are consistent with the available literature supporting early surgery within the first 48 hours. The benefits of timely surgical intervention are evident. In our cohort, the cumulative 12-month mortality was 5.4% among patients who underwent early surgery, compared with 20.4% in those with delayed surgery (p = 0.01; OR: 3.9; 95% CI: 1.3–11.3). These results are comparable to those reported in another Colombian cohort study (18) and are similar to international reports (5,18,19).

Surgical delay in hip fractures remains common. In our population, only 8.5% underwent surgery within 24 hours. This finding reflects the complex-

ity of managing elderly patients, who often present with multiple geriatric syndromes that complicate clinical decision-making. Although surgical times at our center were better compared with other national reports (3,6,18), data availability in Colombia is limited, and it is likely that many centers do not report their surgical outcomes.

A higher Charlson Comorbidity Index score was a predictor of mortality, which is consistent with the high burden of chronic disease and advanced age in this group. Multimorbidity in these patients often requires clinical stabilization before surgery, which partially explains the observed delays. Strategies to reduce surgical waiting times should include early evaluation and comprehensive medical optimization of geriatric patients (20).

Another relevant finding was the association between chronic kidney disease and surgical delay. In our cohort, 40% of patients had a GFR <60 ml/min. This condition reflects the high burden of comorbidity and frailty, as chronic kidney disease not only increases fracture risk (21) but also adds clinical complexity to preoperative management (22).

The causes of surgical delay are multifactorial. It has been documented that 33% of delays are due to acute clinical conditions and up to 60% to logistical limitations, such as availability of operating rooms, personnel, or surgical materials (23). In Colombia, administrative barriers related to insurance type are also a determining factor. In our cohort, 79% of patients insured under the subsidized regime experienced delayed surgery, compared with 43% in the contributory regime ($p = 0.001$; OR: 4.9; 95% CI: 2.1–11). This finding highlights inequities in access to timely care.

Another clinical factor associated with surgical delay was severe anemia (hemoglobin <9 g/dL), which was a significant risk factor (OR: 5.89; $p = 0.007$; 95% CI: 1.6–21.5). Similarly, sarcopenia was unexpectedly associated with delayed surgery. While sarcopenia has previously been linked to increased mortality (24), its association with surgical delay has not been widely reported and warrants further investigation.

Need for orthogeriatric services

Only 18% of patients received an assessment by an internist or geriatrician prior to surgery. International evidence has shown that orthogeriatric care models reduce long-term mortality (OR: 0.62; 95% CI: 0.48–0.80) compared with traditional models without integrated geriatric care (25). It has also been documented that time to surgery tends to be shorter when admission occurs under orthopedics (median: 12 hours) compared with internal medicine (median: 18.5 hours) (26).

In our setting, the implementation of an orthogeriatric model is limited, making it essential to prioritize the participation of internists or geriatricians in clinical optimization. In the comparative analysis, patients who required internal medicine or geriatric assessment presented greater clinical complexity, as evidenced by a Charlson >4 (OR: 4.8; 95% CI: 1.9–12; p = 0.001), Barthel <80 (OR: 3.6; 95% CI: 1.1–11.1; p = 0.02), polypharmacy (OR: 2.3; 95% CI: 1.1–4.9; p = 0.02), frailty (OR: 3.3; 95% CI: 1.4–7.7; p = 0.003), delirium (OR: 3.2; 95% CI: 1.3–7.6; p = 0.005), GFR <45 ml/min (OR: 4.1; 95% CI: 1.8–9.1; p = 0.001), and anemia with hemoglobin <10 g/dL (OR: 2.2; 95% CI: 1.04–4.9; p = 0.03). This reinforces the need for interdisciplinary teams, especially in settings without formal orthogeriatric services.

Osteoporosis management and therapeutic inertia

A marked therapeutic inertia was identified in osteoporosis management. Although 37% of patients had a prior diagnosis of osteoporosis, only 7% were receiving treatment before the fracture. Furthermore, at hospital discharge, only 8.5% received a prescription to initiate antiresorptive therapy, most commonly denosumab (68%) and bisphosphonates (31%). These findings are consistent with other Colombian studies, where post-fracture treatment rates are equally low (1). This highlights poor adherence to management guidelines and a concerning degree of inertia in secondary prevention.

Limitations

This study has limitations inherent to its retrospective design, such as underreporting of relevant clinical data and reliance on the quality of electronic records. As a single-center study, the results may not be generalizable to other settings. Additionally, although follow-up up to 365 days was achieved in 41% of patients, it was incomplete in some cases, which may have affected the true estimation of mortality. Laboratory variables were only analyzed at admission, without considering their evolution during hospitalization. These limitations reinforce the need for prospective studies to more accurately assess mortality, factors associated with surgical delay, and quality of care in hip fracture patients within the Colombian population.

Conclusions

Older adults with hip fractures present a high burden of multimorbidity, which increases their clinical complexity and demands a comprehensive medical evaluation aimed at the timely stabilization of comorbidities. This approach is essential to prevent delays in surgical intervention. The

evidence from this study supports early surgery, ideally within the first 24 to 48 hours, as surgical delays are significantly associated with increased 12-month mortality.

Therefore, each institution should implement organizational and care strategies that ensure clinical optimization and prioritize surgery in these patients. In Colombia, inequities related to insurance type may constitute a major barrier to achieving this goal, requiring attention from both public policy and institutional management. While immediate in-hospital mortality is low, the increase in medium-term mortality reinforces the need to establish structured postoperative follow-up programs for this population. Finally, a concerning therapeutic inertia was identified in the management of osteoporosis, both in primary and secondary prevention, highlighting the urgent need to strengthen strategies for detection, treatment, and adherence in order to reduce the incidence of fragility fractures in the aging population.

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