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Factors Associated with Readmission within 30 Days after Discharge and In-Hospital Mortality after Proximal Femoral Fracture Surgery in the Elderly: Retrospective Cohort*

Fatores associados à reinternação em até 30 dias após a alta e à mortalidade intra-hospitalar após cirurgia por fratura do fêmur proximal em idosos: coorte retrospectiva

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Abstract

Objective To evaluate the factors associated with readmission within 30 days after discharge (R30) and in-hospital mortality (IHM) in elderly patients undergoing proximal femur fracture surgery (PFF).

Methods Retrospective cohort with data from 896 medical records of elderly ($\geq$ 60 years) patients submitted to PFF surgery in a Brazilian hospital between November 2014 and December, 2019. The patients included were followed-up from the date of hospitalization for surgery up to 30 days after discharge. As independent variables, we evaluated gender, age, marital status, pre- and postoperative hemoglobin (Hb), international normalized ratio, time of hospitalization related to the surgery, door-surgery time, comorbidities, previous surgeries, use of medications, and the American Society of Anesthesiologists (ASA) score.

Results The incidence of R30 was 10.2% (95% confidence interval [CI]: 8.3–12.3%), and the incidence of IHM was 5.7% (95%CI: 4.3–7.4%). Regarding R30, hypertension (odds

Keywords
- aged
- femoral fractures
- patient readmission
- mortality
- mortalidade

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ratio [OR]: 1.71; 95%CI: 1.03–2.96), and regular use of psychotropic drugs (OR: 1.74; 95%CI: 1.12–2.72) were associated in the adjusted model. In the case of IHM, higher chances were associated with chronic kidney disease (CKD) (OR: 5.80; 95%CI: 2.64–12.31), longer hospitalization time (OR: 1.06; 95%CI: 1.01–1.10), and R30 (OR: 3.60; 95%CI: 1.54–7.96). Higher preoperative Hb values were associated with a lower chance of mortality (OR: 0.73; 95%CI: 0.61–0.87).

Conclusion Findings suggest that the occurrence of these outcomes is associated with comorbidities, medications, and Hb.

Resumo

Objetivo Avaliar os fatores associados à reinternação em até 30 dias após a alta (R30) e à mortalidade intra-hospitalar (MIH) em idosos submetidos a cirurgia por fratura do fêmur proximal (FFP).

Métodos Coorte retrospectiva com dados de 896 prontuários de idosos ($\geq$ 60 anos) submetidos a cirurgia de FFP em hospital brasileiro, no período entre novembro de 2014 a dezembro de 2019. Os pacientes incluídos foram acompanhados desde a data de internação para a cirurgia até 30 dias após a alta. Como variáveis independentes, foram avaliados o sexo, idade, estado civil, hemoglobina (Hb) pré e pós-operatória, razão normalizada internacional, tempo da internação relacionada à cirurgia, tempo porta cirurgia, comorbidades, cirurgias prévias, uso de medicamentos e escore da American Society of Anesthesiologists (ASA).

Resultados A incidência de R30 foi de 10,2% (intervalo de confiança [IC] 95%: 8,3–12,3%) e a de MIH foi 5,7% (IC95%: 4,3–7,4%). Referente a R30, no modelo ajustado, associaram-se ter hipertensão (odds ratio [OR]: 1,71; IC95%: 1,03–2,96), uso regular de medicamentos psicotrópicos (OR: 1,74; IC95%: 1,12–2,72). Tratando-se da MIH, maiores chances estiveram associadas à doença renal crônica (DRC) (OR: 5,80; IC95%: 2,64–12,31), maior tempo de internação (OR: 1,06; IC95%: 1,01–1,10) e R30 (OR: 3,60; IC95%: 1,54–7,96). Maiores valores de Hb pré-operatória associaram-se à menor chance de mortalidade (OR: 0,73; IC95%: 0,61–0,87).

Conclusão Os achados sugerem que a ocorrência destes desfechos está associada à comorbidades, medicamentos e Hb.

Palavras-chave
- idoso
- fraturas do fêmur
- readmissão do paciente

Introduction

Proximal femur fractures (PFFs) tend to be increasingly common in the elderly due to the phenomenon of epidemiological transition caused by increased chronic-degenerative conditions. Proximal femur fractures are among the most prevalent health conditions and represent a major impact on public health due to the functional declines they cause in the lives of the elderly.[1–3] This is a condition related to high mortality and disability rates,[4] and it represents the second leading cause of hospitalization.[5]

It is estimated that, in 2025, there will be $\sim$ 2.6 million PFF cases worldwide, and this number could be between 4.5 and 6.26 million by 2050.[5,6] The incidence of PFF around the world reaches almost 600 fractures per 100,000 inhabitants[7] and, in Brazil, incidences from 194.6 to 215.3 per 100,000 inhabitants are reported.[8,9] Considering the relevance of the subject, metrics such as readmission within 30 days after discharge (R30) and in-hospital mortality (IHM) after PFF surgery are of great interest.

An Italian study reported a rate of R30 of 45.6% after PFF surgery.[10] Factors mentioned in the literature associated with readmission are female gender, American Society of Anesthesiologists (ASA) score, functional status, comorbidities, Charlson score, alcoholism, delay to perform surgery, and total hip arthroplasty.[10–12]

In Brazil, postsurgery mortality ranges from 4.3 to 7.5%.[8,13] Although PFF is more frequent in women, mortality is higher among men.[8] The predictors of mortality described in the literature are gender, ethnicity, delay in surgery, sarcopenia, higher ASA scores, comorbidities, hospitalization time, Charlson score, institutionalization, and weight loss.[1,2,13–15]

Considering the high incidence of PFF in the elderly, the great impact on public health, and the challenge of particularizing the care according to patient profile due to the few studies conducted in Brazil, the present study aims to evaluate the factors associated with R30 and IHM after PFF surgery in the elderly in a Brazilian private hospital.

Material and Methods

Retrospective cohort study with data analysis of medical records in a private hospital in the city of Belo Horizonte, state of Minas Gerais, Brazil. We included patients $\geq$ 60 years old admitted with PFF, submitted to surgical treatment performed between November 2014 and December 2019. Patients were followed up from the date of hospitalization up to 30 days after discharge. Cases with incomplete records, patients with oncological proximal femur fractures, and patients with other fractures associated with the proximal third of the femur were excluded.

The dependent variables evaluated were R30 and IHM, defined as death during hospitalization or in the readmission period within 30 days. Sociodemographic characteristics such as gender, age, and marital status were analyzed as independent variables. Clinical aspects were also raised: door-surgery time in hours, time of hospitalization in days, hemoglobin (Hb) before and after surgery in g/dL, international normalized ratio (INR), comorbidities: hypertension, diabetes mellitus, chronic kidney disease (CKD), respiratory diseases, cardiovascular diseases, psychiatric disorders, neurological diseases, and endocrine diseases; use of medications: antihypertensives, oral antidiabetics, and insulins, antiemetics/antisecretory, psychotropic drugs, neuroleptics, and anticoagulants; previous surgeries: cardiovascular, femoral fracture, cancer, abdominal, or other surgeries. The type of fracture and the surgical procedure performed and the ASA score were also described.

The present study was approved by the Ethics Committee on September 21, 2020, under opinion number 4,290,194. The waiver of the free and informed consent form was requested because it was a retrospective study guarding the commitment to the confidentiality of the information.

Sample Size

The sample size was calculated to test the proportion of PFF IHM in the elderly. Considering a significance level of 5% and a minimum power of 80%, to test a proportion with a minimum difference of 4% for that found in a reference study,[16] of 10.03%, would be necessary at least 591 elderlies in the sample. Historically, the hospital operated an average of 240 elderly patients with PFF per year.

Statistical analysis

The qualitative variables were presented as absolute and relative frequencies, and quantitative variables as $\pm$ standard deviation (SD) (median). The quantitative variables were submitted to the Shapiro-Wilk normality test.

Logistic regression models were used to evaluate the factors associated with the outcomes. The variables with $p < 0.20$ in the univariate analysis were included in a saturated model, and adopting the backward strategy, the final model was reached, in which the age was maintained regardless of significance for control. The quality of the fit was evaluated by the Hosmer-Lemeshow test. The results were presented as odds ratios (ORs) and their respective confidence intervals (CIs) of 95%. The analyses were performed in R software version 4.0.5 (R Foundation, Vienna, Austria), and statistical significance was considered when $p < 0.05$.

Results

Of the 947 medical records of patients eligible for the study, 51 were excluded because they were from patients with other fractures. The sample analyzed was one with 896 elderly patients submitted to PFF surgery. There was a predominance of females (77.9%), the mean age was 83.4 $\pm$ 8.3 years old, and 45.9% were between 80 and 89 years old. Regarding marital status, 41.8% were widowed and 36.6% were married (►**Table 1**).

Table 1 Sociodemographic and clinical characterization of the elderly with proximal femur fracture submitted to surgical procedure in a private hospital in Belo Horizonte ($n = 896$)

Features	Valid *n*	Statistics
Sociodemographic		
Gender	896	
F		698 (77.9)
M		198 (22.1)
Age (years old)	896	83.4 $\pm$ 8.3 (85.0)
60 to 69		68 (7.6)
70 to 79		202 (22.5)
80 to 89		411 (45.9)
$\geq$ 90		215 (24.0)
Marital status	892	
Married		326 (36.6)
Separated		35 (3.9)
Single		158 (17.7)
Widower		373 (41.8)
Clinics		
Door-surgery time (hours)	895	11.9 $\pm$ 7.9 (10.6)
Hospital stay (days)	896	4.8 $\pm$ 4.8 (3.5)
Readmission within 30 days after discharge	890	91 (10.2)
In-hospital mortality	879	50 (5.7)
Preoperative hemoglobin	823	12.3 $\pm$ 1.7 (12.5)
Postoperative hemoglobin	840	9.7 $\pm$ 1.8 (9.6)
INR	806	1.2 $\pm$ 0.5 (1.1)
Type of fracture	896	
Peritrochanteric fracture		797 (88.9)
Femoral neck fracture		99 (11.1)
Performed procedure	896	
Arthroplasty		18 (2.0)
Osteosynthesis		878 (98.0)
Comorbidities		
Hypertension	885	603 (68.1)
Diabetes mellitus	885	178 (20.1)
Chronic kidney disease	885	75 (8.5)

Table 1 (*Continued*)

Features	Valid *n*	Statistics
Respiratory diseases	885	57 (6.4)
Cardiovascular diseases	885	320 (36.2)
Psychiatric disorders	885	83 (9.4)
Neurological diseases	885	165 (18.6)
Endocrine diseases	885	164 (18.5)
Medicines		
Antihypertensive	840	563 (67.0)
Psychotropic	840	365 (43.5)
Antiemetic, anti-secretors	840	175 (20.8)
Oral antidiabetics and insulins	840	152 (18.1)
Anticoagulants	840	97 (11.0)
Neuroleptics	840	64 (7.2)
Previous surgeries	896	
Cardiovascular		84 (9.4)
Femur fracture		37 (4.1)
Cancer		21 (2.3)
Abdominal		90 (10.1)
Other surgeries		117 (13.1)
ASA	892	
1		46 (5.2)
2		546 (61.2)
3		261 (29.3)
4		39 (4.4)

Abbreviation: INR, international normalized ratio.

The mean door-surgery time was 11.9 ± 7.9 hours and the mean length of hospital stay was 4.8 ± 4.8 days. The incidence of R30 was 10.2%, and of IHM, 5.7%. The mean pre- and postoperative Hb values were 12.3 ± 1.7 g/dL and 9.7 ± 1.8 g/dL, respectively, and INR 1.2 ± 0.5 (►**Table 1**).

Peritrochanteric fractures represented 88.9% of cases and femoral neck fractures, 11.1%. Osteosynthesis was performed in 98.0% of the cases; when applied to trochanteric fracture cases, they were fixed with intramedullary implants, and in neck fractures cases, with canulate screws. All arthroplasties performed were total hip arthroplasties. The most common comorbidities were hypertension (68.1%), cardiovascular diseases (36.2%), and diabetes mellitus (20.1%), and glycemic control was performed in all diabetic patients. The most used drug groups were antihypertensive (67.0%) and psychotropic (43.5%). The use of anticoagulants did not interfere in the performance of surgery. On previous surgeries, 10.1% underwent abdominal surgeries and 9.4% cardiovascular surgeries. ASA 2 score was reported for 61.2% of the patients (►**Table 1**).

Readmission within 30 days after discharge

Hypertension (OR: 1.77 95%CI: 1.07, 1.0;7) and psychotropic drugs (OR: 1.68; 95%CI: 1.08, 2.61) (►**Table 2**) were associated in the univariate analysis at the highest chance of R30 (OR: 1.77–2.75) and psychotropic drugs (OR: 1.68; 95%CI: 1.08–2.61) (►**Table 2**). In the multivariate model adjusted for age, the highest chance of R30 was associated with arterial hypertension (OR: 1.71; 95%CI: 1.03–2.96) and use of psychotropic drugs (OR: 1.74; 95%CI: 1.12–2.72) (►**Table 3**).

In-hospital mortality

Increase in age (OR: 1.05; 95%CI 1.01–1.09), increase in hospitalization time (OR: 1.07; 95%CI: 1.03–1.12), readmission within 30 days after discharge (OR: 2.64; 95%CI: 1.24–5.19) and chronic kidney disease (OR: 7.05; 95%CI: 3.41–14.10) presented with higher chances of IHM in the univariate analysis. The increase in pre- and postoperative Hb values were associated with a lower chance of IHM (OR: 0.73; 95%CI: 0.62–0.85 for preoperative hemoglobin and OR: 0.70; 95%CI: 0.58–0.84 for postoperative Hb) (►**Table 4**). In the final age-adjusted model, the following represented a higher chance of IHM: having CKD (OR: 5.80; 95%CI: 2.64–12.31), increase in hospitalization time (OR: 1.06; 95%CI: 1.01–1.10), readmission within 30 days after discharge (OR: 3.60; 95%CI: 1.54–7.96), and, with lower chances, increased preoperative hemoglobin (OR: 0.73, 95%CI: 0.61–0.87) (►**Table 3**).

Discussion

Proximal femur fracture in the elderly represents a public health problem worldwide due to its high incidence, morbidity, and mortality. Despite the large number of studies addressing the theme, knowledge about regional realities in contrast to what is already established in the literature can help in more accurate strategies in the care of these patients. In the present study, incidences of 10.2% of R30 and 5.7% of IHM were observed in patients with PFF undergoing surgical treatment. Hypertension added to the use of psychotropic drugs increased the chance of R30. They were associated with a higher chance of IHM having CKD, longer hospitalization time and R30, and the increase in preoperative Hb was associated with a lower chance of IHM. These findings suggest that the presence of comorbidities such as hypertension and CKD are related to outcomes, and possibly others that motivate the regular use of psychotropic drugs, in addition to higher values of preoperative Hb.

Sample Profile

In the present study, it was observed that 77.9% of the patients were female. The predominance of females among the elderly with PFF is well described in the literature.[2,8–11,17] The mean age of the individuals evaluated in the present study was 83.4 ± 8.3 years old, 83.9 ± 8.2 years old for women and 81.4 ± 8.5 years old for men ($p < 0.001$). European studies reported a mean age of patients with PFF $>$ 80 years old;[10,17] however, Brazilian studies reported

Table 2 Association between patient characteristics and readmission within 30 days after discharge

Features	Readmission within 30 days after discharge			*p-value*
	No *(n = 799)*	Yes *(n = 91)*	OR (95%CI)	
Gender				
F	624 (78.1)	69 (75.8)	0.88 (0.54–1.49)	0.621
M	175 (21.9)	22 (24.2)	–	–
Age (years old)	83.2 ± 8.4 (85.0)	84.5 ± 7.4 (85.5)	1.02 (0.99–1.05)	0.184
60 to 69	64 (8.0)	4 (4.4)	–	-
70 to 79	177 (22.2)	23 (25.3)	2.08 (0.76–7.29)	0.192
80 to 89	369 (46.2)	40 (44.0)	1.73 (0.67–5.92)	0.309
≥ 90	189 (23.7)	24 (26.4)	2.03 (0.75–7.11)	0.205
Marital status				
Married	291 (36.6)	34 (36.3)	–	–
Separated	33 (4.2)	2 (2.2)	0.53 (0.08–1.87)	0.404
Single	145 (18.2)	12 (13.2)	0.73 (0.35–1.42)	0.371
Widower	326 (41.0)	44 (48.4)	1.19 (0.74–1.93)	0.475
Hospital stay (days)	4.8 ± 5.0 (3.5)	4.5 ± 3.2 (3.7)	0.99 (0.93–1.03)	0.671
Surgery waiting time (hours)	12.0 ± 7.9 (11.1)	10.9 ± 8.3 (8.9)	0.98 (0.96–1.01)	0.223
Preoperative hemoglobin	12.3 ± 1.7 (12.5)	12.2 ± 1.7 (12.1)	0.94 (0.82–1.07)	0.326
Postoperative hemoglobin	9.8 ± 1.8 (9.7)	9.6 ± 1.7 (9.6)	0.96 (0.85–1.09)	0.540
INR	1.2 ± 0.5 (1.1)	1.2 ± 0.4 (1.1)	0.80 (0.39–1.35)	0.479
Type of fracture				
Peritrochanteric fracture	705 (88.2)	86 (94.5)	2.29 (0.99–6.64)	0.079
Femoral neck fracture	94 (11.8)	5 (5.5)	–	–
Performed procedure				
Arthroplasty	17 (2.1)	1 (1.1)	–	–
Osteosynthesis	782 (97.9)	90 (98.9)	1.96 (0.39–35.46)	0.517
Comorbidities				
Hypertension	526 (66.8)	71 (78.0)	1.77 (1.07–3.04)	**0.031**
Diabetes mellitus	161 (20.4)	14 (15.4)	0.71 (0.38–1.25)	0.256
Chronic kidney disease	65 (8.2)	10 (11.0)	1.37 (0.64–2.67)	0.377
Respiratory diseases	55 (7.0)	2 (2.2)	0.30 (0.05–1.00)	0.098
Cardiovascular diseases	285 (36.2)	34 (37.4)	1.05 (0.67–1.64)	0.822
Psychiatric disorders	74 (9.4)	9 (9.9)	1.06 (0.48–2.09)	0.877
Neurological diseases	143 (18.1)	20 (22.0)	1.27 (0.73–2.12)	0.374
Endocrine diseases	147 (18.7)	14 (15.4)	0.79 (0.42–1.40)	0.446
Medicines				
Antihypertensive	493 (66.4)	64 (70.3)	1.20 (0.76–1.96)	0.448
Oral antidiabetics and insulins	139 (18.7)	11 (12.1)	0.60 (0.29–1.11)	0.124
Antiemetics, anti-secretors	147 (19.8)	27 (29.7)	1.71 (1.04–2.75)	**0.030**
Psychotropic	313 (42.1)	50 (54.9)	1.68 (1.08–2.61)	**0.021**
Neuroleptics	59 (7.5)	5 (5.5)	0.72 (0.25–1.68)	0.490
Anticoagulants	84 (10.7)	12 (13.2)	1.27 (0.64–2.35)	0.465
Previous surgeries				
Cardiovascular	76 (9.5)	7 (7.7)	0.79 (0.32–1.66)	0.572

Table 2 (*Continued*)

Features	Readmission within 30 days after discharge			*p-value*
	No *(n = 799)*	Yes *(n = 91)*	OR (95%CI)	
Femur fracture	35 (4.4)	2 (2.2)	0.49 (0.08–1.65)	0.333
Cancer	18 (2.3)	3 (3.3)	1.48 (0.34–4.48)	0.537
Abdominal	85 (10.7)	5 (5.5)	0.49 (0.17–1.12)	0.130
Other surgeries	109 (13.6)	8 (8.8)	0.61 (0.27–1.22)	0.199
ASA				
1	43 (5.4)	2 (2.2)	–	–
2	487 (61.3)	55 (60.4)	2.43 (0.72–15.14)	0.229
3	235 (29.6)	26 (28.6)	2.38 (0.68–15.10)	0.249
4	30 (3.8)	8 (8.8)	4.73 (0.92–39.80)	0.074

Abbreviations: CI, confidence interval; INR, international normalized ratio; OR, odds ratio.

Table 3 Multiple models of factors associated with rehospitalization within 30 days after discharge and in-hospital mortality

Variables	OR	OR (95%CI)	*p-value*
Readmission within 30 days after discharge			
Intercept	0.04	(0.01–0.10)	< **0.001**
Age (years old)			
60 to 69	–	–	-
70 to 79	1.87	(0.68–6.62)	0.267
80 to 89	1.54	(0.59–5.30)	0.428
≥ 90	1.86	(0.68–6.57)	0.271
Systemic arterial hypertension	1.71	(1.03–2.96)	**0.045**
Use of psychotropic drugs	1.74	(1.12–2.72)	**0.015**
p-value H-L	0.870		
In-hospital mortality			
Intercept	1.17	(0.10–12.23)	0.870
Age (years old)			
60 to 69	–	–	–
70 to 79	0.64	(0.15–3.31)	0.515
80 to 89	0.57	(0.16–2.68)	0.400
≥ 90	1.10	(0.31–5.19)	0.909
Chronic kidney disease	5.80	(2.64–12.31)	< 0.001
Hospital stay (days)	1.06	(1.01–1.10)	0.005
Readmission within 30 days after discharge	3.60	(1.54–7.96)	0.002
Preoperative hemoglobin	0.73	(0.61–0.87)	< 0.001
p-value H-L	0.738		

Abbreviations: CI, confidence interval; OR, odds ratio.

a mean age < 80 years old.[9,13] Higher mean age in females has been reported by several studies.[2,9,13]

Brazilian studies describe average hospitalization times of 8.9 and 12.2 days.[8,13] In Minas Gerais, a mean hospitalization of 7.3 days was mentioned.[8] In Spain, Prieto et al.[17] found 11.5 days of average hospitalization time. In the present study, the mean length of hospital stay was 4.8 days, shorter than that found in the literature, which can be explained by the fact that they are data from a single private hospital.

Readmission within 30 days after discharge

Readmission within 30 days after discharge is an important metric because it represents the quality of care provided by the hospital unit and because it is an important predictor of mortality. A systematic review showed that the median readmission rate within 30 days was 10.1%, ranging from 4.5 to 23.1% in 22 analyzed studies.[12] The present study obtained an R30 of 10.2%, a value very close to that reported in the systematic review.

The association between arterial hypertension and R30 found in the present study corroborates the results obtained in an American study with > 8,000 patients.[18] An Indian study compared the bone mineral density (BMD) of patients with hypertensive and non-hypertensive PFF and observed that hypertensive patients had significantly lower BMD.[19] A recent American study pointed to hypertension as a factor associated with a higher chance of transfusion after PFF surgery, and transfusion is associated with a higher risk of mortality and readmission.[20] With the data from these two studies, it is verified that hypertension in patients with PFF seems to be associated with greater bone fragility of the elderly and the occurrence of severe outcomes associated with mortality.

The use of psychotropic drugs can be a proxy for depression, which was associated with rehospitalization within 3 months in a Finnish study.[11]

Table 4 Association between patient characteristics and in-hospital mortality after fracture surgery of the proximal third of the femur

Features	In-hospital mortality			*p-value*
	No *(n = 829)*	Yes *(n = 50)*	OR (95%CI)	
Gender				
F	651 (78.5)	34 (68.0)	0.58 (0.32–1.10)	0.085
M	178 (21.5)	16 (32.0)	–	–
Age (years old)	83.2 ± 8.2 (84.0)	86.2 ± 8.7 (87.0)	1.05 (1.01–1.09)	**0.012**
60 to 69	63 (7.6)	3 (6.0)	–	-
70 to 79	194 (23.4)	6 (12.0)	0.65 (0.17–3.14)	0.550
80 to 89	383 (46.2)	21 (42.0)	1.15 (0.38–4.98)	0.823
≥ 90	189 (22.8)	20 (40.0)	2.22 (0.73–9.65)	0.209
Marital status				
Married	303 (36.7)	16 (32.0)	–	–
Separated	34 (4.1)	1 (2.0)	0.56 (0.03–2.86)	0.576
Single	152 (18.4)	4 (8.0)	0.50 (0.14–1.39)	0.220
Widower	337 (40.8)	29 (58.0)	1.63 (0.88–3.13)	0.129
Hospital stay (days)	4.6 ± 4.0 (3.5)	7.7 ± 11.9 (4.4)	1.07 (1.03–1.12)	**0.001**
Door-surgery time (hours)	11.8 ± 7.9 (10.5)	12.2 ± 7.9 (12.7)	1.01 (0.97–1.04)	0.762
Readmission within 30 days after discharge	80 (9.7)	11 (22.0)	2.64 (1.24–5.19)	**0.007**
Preoperative hemoglobin	12.4 ± 1.7 (12.6)	11.3 ± 1.6 (11.6)	0.73 (0.62–0.85)	< **0.001**
Postoperative hemoglobin	9.8 ± 1.8 (9.7)	8.8 ± 1.5 (8.6)	0.70 (0.58–0.84)	< **0.001**
INR	1.2 ± 0.4 (1.1)	1.3 ± 0.6 (1.1)	1.35 (0.74–2.11)	0.248
Type of fracture				
Peritrochanteric	733 (88.4)	49 (98.0)	6.42 (1.38–114.25)	0.067
Femur neck	96 (11.6)	1 (2.0)	–	–
Performed procedure				
Arthroplasty	17 (2.1)	1 (2.0)	–	–
Osteosynthesis	812 (97.9)	49(98.0)	1.03 (0.20–18.67)	0.980
Comorbidities				
Hypertension	563 (67.9)	27 (69.2)	1.07 (0.54–2.21)	0.863
Diabetes mellitus	167 (20.1)	7 (17.9)	0.87 (0.35–1.89)	0.738
Chronic kidney disease	61 (7.4)	14 (35.9)	7.05 (3.41–14.10)	< **0.001**
Respiratory diseases	52 (6.3)	5 (12.8)	2.20 (0.73–5.39)	0.115
Cardiovascular diseases	298 (35.9)	18 (46.2)	1.53 (0.79–2.91)	0.198
Psychiatric disorders	78 (9.4)	3 (7.7)	0.80 (0.19–2.29)	0.719
Neurological diseases	155 (18.7)	6 (15.4)	0.79 (0.29–1.79)	0.604
Endocrine diseases	151 (18.2)	7 (17.9)	0.98 (0.39–2.14)	0.966
Medicines				
Antihypertensive	525 (66.6)	26 (72.2)	1.30 (0.64–2.87)	0.486
Oral antidiabetics and insulins	143 (18.1)	7 (19.4)	1.09 (0.43–2.40)	0.844
Antiemetics. anti-secretors	160 (20.3)	11 (30.6)	1.73 (0.80–3.50)	0.142
Psychotropic	339 (43.0)	20 (55.6)	1.66 (0.85–3.29)	0.143
Neuroleptics	59 (7.1)	3 (7.7)	1.09 (0.26–3.13)	0.892
Anticoagulants	93 (11.2)	3 (7.7)	0.66 (0.16–1.87)	0.496

Table 4 (*Continued*)

Features	In-hospital mortality			*p-value*
	No *(n = 829)*	Yes *(n = 50)*	OR (95%CI)	
Previous surgeries				
Cardiovascular	73 (8.8)	8 (16.0)	1.97 (0.83–4.15)	0.093
Femur fracture	33 (4.0)	3 (6.0)	1.54 (0.36–4.50)	0.487
Cancer	19 (2.3)	2 (4.0)	1.78 (0.28–6.36)	0.449
Abdominal	83 (10.0)	5 (10.0)	1.00 (0.34–2.36)	0.996
Other surgeries	111 (13.4)	3 (6.0)	0.41 (0.10–1.15)	0.143
ASA				
1	39 (4.7)	5 (10.0)	–	–
2	514 (62.3)	18 (36.0)	0.27 (0.10–1.06)	0.065
3	238 (28.8)	23 (46.0)	0.75 (0.29–2.35)	0.589
4	34 (4.1)	4 (8.0)	0.92 (0.21–3.74)	0.904

Abbreviations: CI, confidence interval; INR, international normalized ratio; OR, odds ratio.

In-hospital mortality

The in-hospital mortality rate found in the present study was 5.7%, 8.1% among men and 4.9% among women ($p = 0.117$), values that corroborate the literature of both Brazilian and international studies. Studies conducted in southern Brazil had an IHM of 4.3 to 7.5%,[9,13] while European studies reported 2.1 and 3.8%.[10,17] Higher mortality among men was pointed out by previous studies.[8,21]

The association of CKD with mortality was described by a Spanish study[2] and in an American study,[15] and CKD was also the cause of readmission of 2.4% of the cases described in an Italian study.[10] Renal failure was identified as a complication of PFF surgery in 14.1% of the cases.[17] The relationship of CKD with a higher chance of IHM found in the present study can then be explained by being a possible evolution of a complication of surgery and because it is the cause of readmission, another independent factor associated with IHM. In the present study, CKD was not directly associated with R30.

Longer hospital stay was associated with a higher chance of IHM in this sample. The association of IHM with hospitalization is still little described in the literature, but it is expected that the elderly with longer hospitalization time present more severe conditions, which would explain a higher chance of death. Some studies address the time until surgery as a risk factor for mortality,[1,13–15] which was not observed in the present study. One hypothesis would be the fact that the waiting time until surgery is low in the present study (mean $\sim$ 12 hours), because it is a private hospital.

Kates et al.[22] reported that 18.6% of patients die during readmission. As demonstrated with the data of the present study, the factors associated with readmission suggest a profile of more frail elderly people, with chronic disease and using various medications. This scenario could be a hypothesis for the association between R30 and IHM demonstrated in this sample. Low Hb values are associated with anemia, which is an important risk factor for hospitalization, morbidity, and mortality in the elderly,[23] so the ratio of higher preoperative hemoglobin values with lower chance of mortality is consistent with the literature.

The present study had as limitation the fact that it is a retrospective search for data from medical records, so that only the available variables could be used and thus it was not possible to evaluate important information, such as functional independence status, body mass index, smoking, and alcohol consumption. Another limiting point is the fact that it is a single-center study, which does not allow the generalization of results.

Conclusion

In the present article, factors associated with R30 and IHM outcomes were evaluated in a cohort of 896 patients $\geq$ 60 years old, diagnosed with PFF and undergoing surgical treatment. The results of this study raise the hypothesis that the occurrence of these outcomes is associated with the presence of comorbidities, medication use, and the value of preoperative Hb.

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Conflict of Interests
The authors have no conflict of interests to declare.

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