







MORTALITY IN PATIENTS > 90 YEARS OLD WITH PROXIMAL FEMORAL FRACTURES SUBMITTED TO SURGERY

MORTALIDADE EM PACIENTES ACIMA DE 90 ANOS COM FRATURAS DO FÊMUR PROXIMAL SUBMETIDOS A CIRURGIA

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ABSTRACT

Introduction: Proximal femoral fractures have a high mortality rate among older adults, especially those aged > 80 years. **Objective:** To analyze predictive factors for hospital or late mortality of patients > 90 years old who showed proximal femoral fracture and subjected to surgery. **Methods:** The study included data from 230 patients aged > 90 years diagnosed with proximal femoral fracture and who underwent surgery between January and December 2017. The statistical evaluation was performed by multivariate analysis by a logistic regression. The associations were estimated by the odds ratio (OD) and confidence interval (95%). Statistical significance was determined with $p < 0.05$. **Results:** Late death occurred in 51.3% (118 patients) of the sample and hospital death in 3.5% (8 patients). Most patients were women (83.5%) and the most common fracture was transtrochanteric (57.0%). There was association between late death and the surgery duration ($p < 0.05$), and between hospital death and the presence of heart diseases ($p < 0.05$) or endocrinopathies ($p < 0.05$). **Conclusion:** Most patients aged > 90 years with proximal femoral fracture subjected to surgery died in less than one year. Late death was associated with the surgery duration and hospital death was associated with the presence of previous endocrinopathies or heart diseases, and the female gender was a protective factor from this outcome. **Level of Evidence III, Retrospective Case-Control Study.**

Keywords: Hip fractures. Mortality. Older adults.

RESUMO

Introdução: As fraturas do fêmur proximal têm alta taxa de mortalidade entre os idosos, especialmente entre os considerados superidosos (> 80 anos). **Objetivo:** Analisar fatores preditivos para mortalidade hospitalar ou tardia de pacientes com idade superior a 90 anos que apresentaram fratura do fêmur proximal e foram submetidos ao tratamento cirúrgico. **Métodos:** O estudo incluiu dados de 230 pacientes com idade superior a 90 anos que apresentaram diagnóstico de fratura do fêmur proximal e foram submetidos ao tratamento cirúrgico entre janeiro e dezembro de 2017. A avaliação estatística foi realizada pela análise multivariada por meio da regressão logística. As associações foram estimadas pelo valor de odds ratio (OD) e intervalo de confiança (95%). A significância estatística foi determinada com $p < 0,05$. **Resultados:** O óbito tardio ocorreu em 51,3% (118 pacientes) da amostra e o hospitalar em 3,5% (8 pacientes). A maioria dos pacientes foram do sexo feminino (83,5%) e a fratura mais comum foi a transtrocanteriana (57,0%). Houve associação do óbito tardio com a duração do procedimento cirúrgico ($p < 0,05$), e do óbito hospitalar com a presença de cardiopatias ($p < 0,05$) ou endocrinopatias ($p < 0,05$). **Conclusão:** A maioria dos pacientes com idade superior a 90 anos com fratura do fêmur proximal submetida ao tratamento cirúrgico evoluiu para óbito em menos de um ano. O óbito tardio foi associado à duração do procedimento cirúrgico e o óbito hospitalar à presença de endocrinopatias ou cardiopatias prévias, sendo o sexo feminino fator de proteção para tal desfecho. **Nível de Evidência III, Estudo Caso-Controlle Retrospectivo.**

Descritores: Fraturas do quadril. Mortalidade. Idoso.

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INTRODUCTION

The annual number of hip fractures is expected to exceed six million by 2050 due to the worldwide progressive population aging, which makes this condition a serious public health problem.¹ Femoral fractures are associated with bone and systemic frailty, which cause

high rate of functional loss and mortality. Death is estimated to occur in 12% to 37% of the older adults one year after the fracture and that one out of 15 older adults with hip fractures die while hospitalized.¹⁻⁴ Many studies focus on identifying patients with hip fractures who have a higher risk of morbidity and mortality because of the effect

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The study was conducted at Hospital Sancta Maggiore.

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on patients and their families, as well as on the health care system. Age > 85 years is considered an independent risk marker for death one year after proximal femoral fracture.⁵ Few studies analyze clinical outcomes, with representative sample, in the subgroup of patients with hip fractures and aged > 90 years.⁶⁻⁸ Therefore, this study aimed to analyze predictive factors for hospital or late mortality in patients > 90 years old diagnosed with proximal femoral fracture and who underwent surgery.

MATERIALS AND METHODS

The study was initiated after approval by the institutional ethics committee and Plataforma Brasil (CAAE: 30995420.2.0000.8114). The guideline to good clinical practice and the Declaration of Helsinki were respected during its implementation. The Strengthening the Reporting of Observational Studies in Epidemiology - STROBE guide for observational studies was used to design the methodology of the study.⁹

This is a clinical, observational, retrospective, case-control study, in which the medical records of patients of both genders, > 90 years old, subjected to surgery, diagnosed with isolated proximal femoral fracture (transtrochanteric or neck) between January and December 2017 were included, without convocation, interview or intervention. The signing of the informed consent form was unnecessary. The fracture was anatomically classified by an orthopedic physician specialized in the area, in the orthopedic emergency room, and confirmed by the orthopedic surgeon in the backup hospital. Exclusion criteria were: fractures related to bone tumor or osteomyelitis, patients with osteosynthesis revision or hip arthroplasty and medical records with incomplete data regarding the diagnosis or surgery performed.

A total of 399 medical records of patients > 90 years old diagnosed with proximal femoral fracture who underwent surgery were initially selected. However, a sample of 230 patients was found after applying the inclusion and exclusion criteria.

Data collection

Data from the study participants were collected from the TechSallus® electronic medical record (TechSallus – Health Intelligence and Information, 2015®). The variables included were gender, age, type of fracture, type of surgery, previous comorbidities, surgical time, surgical risk, hospital death and late death (post-hospital period). All patients were operated in the same hospital and by the same team specialized in the surgical treatment of orthopedic trauma.

Patient's preparation and surgical techniques

All patients underwent surgical risk assessment by the anesthetic team when they arrived at the study hospital, being operated in the shortest possible time, depending on the clinical condition and fasting time. They were followed up by a specialized clinical team in the postoperative period. The immediate postoperative occurred in the ICU only in case of acute clinical decompensation. The antibiotic for infectious prophylaxis was cefazolin at a dose of two grams 30 minutes before skin incision in the transtrochanteric fractures, and sodic cefuroxime at a dose of 1.5 grams in femoral neck fractures treated with hip arthroplasty. The antibiotic used for anesthetic induction was maintained for 24 hours. The antibiotic was changed according to the Hospital Infection Control Commission in case of associated infection (pneumonia, urinary infection, erysipelas). Standard prophylaxis of deep vein thrombosis was performed with enoxaparin at a dose of 0.5 mg/kg in the hospital and with rivaroxaban after discharge, with dose adjusted according to the patient's renal function and associated with the use of elastic stockings of medium compression 7/8 for 30 days. The intended hospital discharge was approximately of 24 hours after surgery,

depending on the patients' evolution and hemodynamic stability. The outpatient follow-up of these patients was performed by specialist orthopedists with > 10 years of experience in the area.

Transtrochanteric fracture

All patients included were operated on an orthopedic table using a cephalomedullary nail with conventional trochanteric entry (unstable fractures/insufficient lateral wall) or hip sliding screw system (DHS) – stable fractures and lateral wall competence – under image intensifier control. The nail used has a proximal locking system of the cephalic screw (locking pin) to avoid synthesis failure by rotational mechanical stress. The static locking screw was used in patients treated with short nail (190 mm) based on the guideline. A long nail with two distal blocks was manually used in patients with reverse oblique fractures or subtrochanteric extension. In the postoperative period, the load was protected with the aid of a walker for four to six weeks, according to clinical and functional evolution.

Femoral neck fracture

The decision of the method of treatment of these fractures was based on deviation, patient's age and previous functional status. Fractures without deviation (confirmed by front and profile radiographic examination and computed tomography) were treated with osteosynthesis using three 7.0 mm cannulated screws. The deviated fractures were treated with hip arthroplasty by direct lateral access (Hardinge). Total or partial arthroplasty was performed after analyzing the patient's functional level before the fracture and estimating the patient's survival within 10 years according to Charlson's comorbidity score.¹⁰ Active patients without neurological impairment, with life expectancy \geq 50% within 10 years and/or with previous symptomatic degenerative osteoarthritis in the hip were subjected to total hip arthroplasty. Patients who did not meet these criteria were subjected to partial hip arthroplasty. Only one patient was subjected to resection arthroplasty due to being previously bedridden and with contracture in the hip flexion-adduction. In the postoperative period, the load was protected with the aid of a walker for four to six weeks, according to clinical and functional evolution.

Statistical analysis

The analyses were performed by the R software. Categorical variables were described by their proportion and continuous variables by mean and standard deviation.

The univariate analysis of predictors for hospital or late mortality was initially used, and only the variables that showed $p < 0.20$ were included in the multivariate analysis. The multivariate analysis was performed based on a logistic regression by the iteratively reweighted least squares (IRLS) method. The associations were estimated by the odds ratio (OR) and confidence interval (95%). Statistical significance was determined with $p < 0.05$.

RESULTS

The sample consisted of data from 230 patients, 83.5% women and mean age of 92.6 years with standard deviation (SD) of 2.5, ranging from 90 to 104 years old. Hospital death occurred in eight patients (3.5%) and late post-hospital death, within one year postoperatively, in 118 older adults (51.3%), totaling 54.7% of death of the population. The most common proximal femoral fractures were transtrochanteric with 132 cases (57.4%), followed by neck fracture (33.0%), subtrochanteric (8.7%) and only two cases of periprosthetic fracture (0.9%).

Surgical procedure

The mean duration time in minutes was 104.0 minutes (SD 37.7), ranging from 25 to 230 minutes. The most common surgery was the cephalomedullary nail (65.7%), followed by cemented

partial hip arthroplasty (21.3%), non-cemented partial arthroplasty (7.4%), osteosynthesis with cannulated screws (2.6%), hip sliding screw (DHS) and total hip arthroplasty (1.3%), and one case of resection arthroplasty (0.4%).

Regarding comorbidities, most were diagnosed with systemic arterial hypertension (64.3%). However, some comorbidities did not represent the majority, such as dementia, which was found in 24.3% of the study population, heart disease (26.5%), lung disease (3.9%), previous stroke (6.1%) and endocrinopathies – diabetes and thyroid diseases (33.5%).

Early hospital death × control

We found as a risk factor the presence of heart disease, with odds ratio (OR) = 5.95 and $p = 0.02$, or endocrinopathy, OR = 7.5 and $p = 0.01$. Table 1 shows the analysis.

Table 1. Result of the univariate and multivariate analysis on hospital mortality outcome.

Outcome	Univariate	Multivariate	
	p-value	OR (95% CI)*	p-value
Women	> 0.05	-	-
Surgery duration	> 0.05	-	-
Age	> 0.05	-	-
Type of fracture	> 0.05	-	-
Type of surgery	> 0.05	-	-
Surgical risk	> 0.05	-	-
Systemic arterial hypertension	> 0.05	-	-
Dementia	> 0.05	-	-
Heart disease	0.03	5.95 (1.36; 30.92)	0.02
Lung disease	> 0.05	-	-
Stroke	> 0.05	-	-
Endocrinopathy	0.02	7.53 (1.63; 53.61)	0.01

OR: odds ratio; CI: confidence interval.

Late death × control

Table 2 shows the result of the univariate and multivariate analysis of the predictors for late post-hospital death within one year postoperatively, compared to the control group. Associating the surgical time with the highest mortality rate ($p = 0.007$) and the female gender as protection factor ($p = 0.02$).

Table 2. Result of the univariate and multivariate analysis on late mortality outcome.

Outcome	Univariate	Multivariate	
	p-value	OR (95% CI)	p-value
Women	0.02	0.40 (0.18; 0.86)	0.02
Surgery duration	0.007	1.009 (1.002; 1.017)	0.01
Age	0.13	1.10 (0.99; 1.24)	$p > 0.05$
Type of fracture	> 0.05	-	-
Type of surgery	> 0.05	-	-
Surgical risk	> 0.05	-	-
Systemic arterial hypertension	> 0.05	-	-
Dementia	0.19	1.74 (0.92; 3.33)	$p > 0.05$
Heart disease	0.03	-	-
Lung disease	0.05	6.89 (1.13; 133.25)	$p > 0.05$
Stroke	> 0.05	-	-
Endocrinopathy	> 0.05	-	-

OR: odds ratio; CI: confidence interval.

DISCUSSION

Our main findings are that the overall mortality of patients > 90 years old with proximal femoral fracture, within one year postoperatively, was 54.7%. The main risk factors for early hospital mortality were the presence of heart disease and/or endocrinopathy before the surgery; and the risk factor for late post-hospital mortality were the increase in surgical time (each minute increased in surgical time increased the probability of late death by 0.9%), and the female gender was a protective factor for this outcome.

The study by Smith et al.⁵ from 2014 states that patients > 85 years old have a higher mortality rate within one year after fracture, which is similar to our study. Age can be considered an isolated predictor of the risk of death after fracture of the proximal extremity of the femur.¹¹

We found a high mortality rate within one year (54.7%) compared to the study by Bolton, Bush and Wallace¹² (38.1%), which can be attributed to population risk factors intrinsic to the Brazilian population (poor control of chronic diseases, scarcity of access to the health care system during life, failure of clinical-geriatric follow-up in the postoperative period, inadequate rehabilitation). Previous studies on the national reality have found high mortality, even in younger patients.^{13,14}

We found a higher prevalence of transtrochanteric fractures and mostly in women, similar to the literature,¹² since osteoporosis is a risk factor for the occurrence of these fractures and women are prone to this condition due to hormonal factors related to aging.¹⁵ Although fractures are more prevalent in women, the female gender was protective regarding postoperative death, similar to the study by Xu et al.¹⁶

The presence of diabetes, thyroid dysfunctions and heart disease before the surgery were significant when comparing the mortality risk factors regarding the patients. The study by Xu et al.¹⁶ shows similar findings, in which the authors found that the most relevant for mortality in patients with hip fracture were: multiple comorbidities, high level of ASA, cognitive impairment, low pre-fracture functional status, hospital discharge with low functional level, heart disease, frailty, cancer, renal failure, stroke, diabetes, delirium, malnutrition, low hemoglobin levels, delay in surgery > 48 hours, extra-capsular fractures, intraoperative fracture, advanced age, male gender and institutionalized patients were associated with higher mortality rates, risk criteria similar to other related studies.¹⁷

The literature shows that the patient's previous clinical conditions and non-modifiable epidemiological characteristics are the main responsible for mortality in case of proximal femoral fracture. However, we found, in an unprecedented way, that the surgery duration was a determining factor in the late death rate.

This fact emphasizes the need of a well-structured orthopedic service, a trained and specialized team to conduct orthogeriatric patients, and it questions the need to train surgeons focused on solving trauma in older adults.¹⁸ A one minute delay beyond the mean time foreseen for the procedure increased the probability of late death, within one year postoperatively, by 0.9%.

The main limitation of our study is the information bias since it is based on information from medical records taken retrospectively. Besides, mortality was not stratified according to the surgeon's time of experience and specialization.

The health care service was completely restructured after the results found. The surgeries of older adults with hip fractures were aimed at a small group of surgeons with > 10 years of experience in general trauma and dedicated to the management of geriatric trauma. The patient is followed up in the pre and postoperative periods with a team of medical clinic and anesthesiology. Future data will be published on outcomes after the adopted intervention measures.

CONCLUSION

Most patients aged > 90 years with proximal femoral fracture subjected to surgery died within one year of postoperative. Late

death was associated with the surgery duration and hospital death was associated with the presence of previous endocrinopathies and/or heart diseases, and the female gender was a protective factor from this outcome.

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