

# EPIDEMIOLOGY OF PROXIMAL FEMUR FRACTURE IN OLDER ADULTS IN A PHILANTHROPICAL HOSPITAL IN SÃO PAULO

## EPIDEMIOLOGIA DA FRATURA DO FÊMUR PROXIMAL EM IDOSOS EM UM HOSPITAL FILANTRÓPICO DE SÃO PAULO

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### ABSTRACT

**Objective:** To evaluate the age and anthropometry profile of patients with a diagnosis of fracture of the proximal femur in older adults admitted to a philanthropic hospital in São Paulo. **Methods:** Retrospective observational cross-sectional study. All patients older than 59 years with femoral fractures diagnosed and hospitalized between January, 2019 and April, 2020 were included. The analysis of the 85 medical records resulted in the data collected in the present study. Anthropometry, age, sex, ethnicity, presence of comorbidities and mechanism of trauma of these patients were considered in this study. Most traumas, as expected, presented low energy mechanisms. **Results:** Prevalence of 3:1 in females, aged between 60-104 and mean of 78.5 years, with an increased risk in patients over 80 years. The body mass index (BMI) between 16.53 and 39.80 with an average of 24.16 kg/m<sup>2</sup>. Being 89.4% cases of fall from own height. **Conclusion:** Proximal femur fractures in older adults occur more often in women, with a mean age of 78.5 years, normal BMI range, whose main trauma mechanism is fall to ground level. The most prevalent injury is transtrochanteric fracture, with a mean of 70.5% and the most performed treatment is internal fixation with cephalomedullary nail, with a mean of 66.1%. **Level of Evidence VI, Descriptive Epidemiological Study.**

**Keywords:** Causality. Epidemiology. Femoral Fractures. Aged.

### RESUMO

**Objetivo:** Avaliar o perfil de idade e antropometria dos pacientes com diagnóstico de fratura do fêmur proximal em idosos admitidos em um hospital filantrópico de São Paulo. **Métodos:** Estudo retrospectivo, observacional, transversal. Foram incluídos todos os pacientes com fratura do fêmur proximal e idade superior a 59 anos, internados em um hospital filantrópico de São Paulo entre janeiro de 2019 e abril de 2020. A análise dos 85 prontuários levantados resultou na coleta de dados antropométricos, idade, sexo e etnia, doenças associadas e uso de medicações, além de dados relacionados ao mecanismo de trauma. Como esperado, a maioria dos traumas apresentou mecanismo de baixa energia. **Resultados:** Houve predominância de 3:1 do sexo feminino, com idade entre 60 e 104 e média de 78,5 anos, havendo um risco maior para pacientes acima dos 80 anos. O índice de massa corpórea (IMC) foi de 16,53 a 39,80, com média de 24,16 kg/m<sup>2</sup>. Quanto ao mecanismo do trauma, 89,4% dos casos foram de queda da própria altura. **Conclusão:** Fraturas do fêmur proximal em idosos ocorrem mais em mulheres, com idade média de 78,5 anos, IMC na faixa normal e queda ao nível do solo como principal mecanismo de trauma. A lesão mais prevalente foi a fratura transtrocanteriana, com média de 70,5%, e o tratamento mais realizado foi a fixação interna com haste cefalomedular (66,1%). **Nível de Evidência VI, Estudo Epidemiológico Descritivo.**

**Descritores:** Causalidade. Epidemiologia. Fraturas do Fêmur. Idoso.

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### INTRODUCTION

A striking characteristic of the Brazilian and world age pyramids is the widening of their apex, older individuals (over 60 years), according to UN data.<sup>1</sup> The Brazilian Institute of Geography and Statistics (IBGE) estimates that the older population in Brazil corresponded to approximately 5.0% of the population in 1950; while in 2010, they already represented approximately 10.0%.<sup>2</sup> In addition, the projections for 2020 were confirmed, and today this population corresponds to about 13.0% of all Brazilians, totaling almost 28 million people.<sup>2</sup>

Contrary to what can be observed in young patients, the traumas most associated with proximal femur fractures are those of low energy, and some of the numerous related factors are advanced age, osteoporosis and osteopenia, sarcopenia, low calcium intake and vitamin-D deficiency, genetic predisposition.<sup>3-5</sup>

Studies have shown that osteoporosis is the most relevant factor in fractures of the proximal third of the femur, as well as the higher incidence of falls.<sup>6</sup> Approximately one third of white women over the age of 65 have osteoporosis.<sup>7</sup> Studies estimate

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The study was conducted at the Department of Orthopedics and Traumatology of Santa Casa de Misericórdia de São Paulo School of Medical Sciences, "Pavilhão Fernandinho Simonsen". Correspondence: Thomas Abdal Perlaky. Rua Cubatão, 158, São Paulo, SP, Brazil, 04013000. [thomasabdal@gmail.com](mailto:thomasabdal@gmail.com)

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that 6,000,000 individuals worldwide will suffer proximal femur fractures in the year 2050.<sup>8</sup>

Other studies have shown that 2.1% of patients with proximal femur fractures die during hospitalization and 11.0% after four months.<sup>9</sup> Advanced age, comorbidity number, male gender, and cognitive impairments are four factors closely related to mortality.<sup>10</sup>

The high cost these fractures generate for the healthcare system due to prolonged hospitalization time, possible complications, morbidity and mortality, and hospitalization in intensive care, as well as rehabilitation for prolonged periods must be considered.<sup>11</sup> This study aims to evaluate the epidemiological profile of proximal femur fractures in older adults, studying the causes of trauma and the physical characteristics of patients with this type of injury who were hospitalized in the Department of Orthopedics and Traumatology “Fernandinho Simonsen Pavilion” of Irmandade da Santa Casa de Misericórdia de São Paulo between January 4, 2019 and April 25, 2020.

## METHODS

This is a retrospective cross-sectional observational study. The inclusion criteria were all patients with a proximal femur fracture, whether they were transtrochanteric fractures, femoral neck fractures, or subtrochanteric fractures, and age over 59 years, who were hospitalized in the Department of Orthopedics and Traumatology “Pavilhão Fernandinho Simonsen” of Irmandade da Santa Casa de Misericórdia de São Paulo in the period between January 4, 2019 and April 25, 2020.

Patients under 60 years of age were excluded.

Information was collected from this patient group by studying their medical records, obtaining anthropometric data, age, gender and ethnicity, associated diseases and use of medications, type of fracture, trauma mechanism, type of treatment performed, and classification of the fracture.

The analyses by age group were divided into five-year intervals to better estimate the collected data and to facilitate comparison with previous studies.<sup>3</sup>

Body mass index (BMI) was estimated in all patients to analyze the possible existence of a more susceptible group, and the interval between 18.5-24.9 was considered normal, as well as ethnicity, cause of fracture, previous use of medication, and other associated comorbidities.

For cause analysis, the patients were divided according to trauma mechanism. Accidents involving an external impact factor, such as automobile accidents and falls from higher than ground level, were considered high-energy traumas, while falls from ground level and patients who sought care after a few days of trauma (treatment was sought due to the pain, and trauma was then verified) were considered low-energy traumas.

AO Classification was used for fracture analysis.

The types of implants used for surgical treatment were: cephalomedullary nail, DHS, total hip arthroplasty, and non-conventional endoprosthesis.

Statistical analysis involved the quantification of descriptive data by mean and standard deviation for continuous variables and the use of percentage for categorical variables using the SPSS Statistics 21 software.

The study was submitted to and approved by the Research Ethics Committee of the institution, verified opinion No. 4.869.579.

## RESULTS

We identified 85 medical records with a proximal femur fracture diagnosis between January 4, 2019 and April 25, 2020.

Regarding age, we observed a mean of 78.5, covering patients aged 60 to 104 years, and distribution among patients aged 60-64 years of 9.4%; 65-70 years, 17.6%; 71-75 years, 10.5%; 76-80 years, 16.4%; and over 80 years, 45.88% (Figure 1).

Regarding sex, 22 were male (25.9%) and 63 were female (74.1%) (Table 1).

Average hospitalization time was 14 days. There was a predominance of white people (72.2%).

The ethnicity distribution found 60 Caucasian patients (72.2%), 19 mixed-race patients (22.8%), and four Asian patients (4.8%) (Figure 2).

Regarding trauma mechanisms, we observed the main one to be falls from one's own height in 76 cases (89.4%), followed by falls from higher heights in four cases (4.7%) (Table 2) (Figure 3).

Regarding type of fracture, we estimated 60 cases of transtrochanteric fractures (70.5%), followed by 21 cases of femoral neck fracture (24.6%), and four cases of subtrochanteric fractures (4.7%) (Table 3).

Regarding Body Mass Index (BMI), we found normal range predominance in 58 patients (68%), overweight in 19 patients (22%), grade 1 obesity in four patients (4.7%), and grade 2 obesity in 4 patients (4.7%), and no cases were observed in patients with higher obesity degrees (Figure 4).

The patients were questioned about their comorbidities. Systemic arterial hypertension was the most prevalent, with 47 cases (32.1%); followed by type 2 diabetes mellitus, with 21 cases (14.3%); Alzheimer's disease, with nine cases (6.1%); cerebrovascular accident

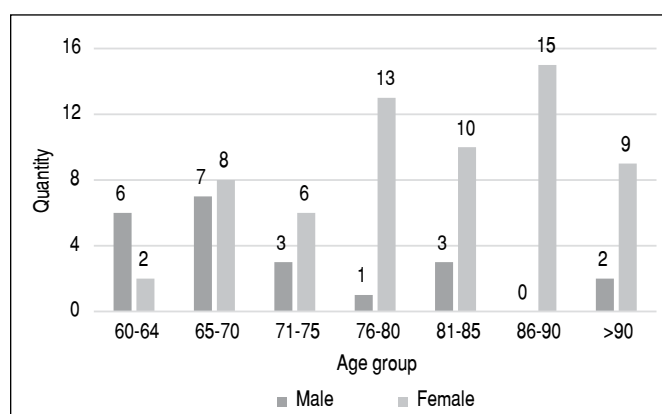


Figure 1. Case number distribution.

Table 1. Descriptive data.

Characteristics	Total
Sample size	85 (100%)
Age (years old)	78.5 (± 10.5)
Weight (Kg)	61.4 (± 12.2)
Height (m)	1.59 (± 9.1)
Body Mass Index (BMI)	24.16 (± 5.06)
Hospitalization days	14.9 (± 10.2)
Sex	
Female	63 (74.1%)
Male	22 (25.9%)
Race	
White	60 (72.2%)
Mixed-race	19 (22.8%)
Asian	4 (4.8%)
Laterality	
Right	34 (40%)
Left	51 (60%)

Kg: kilograms; m: meters.

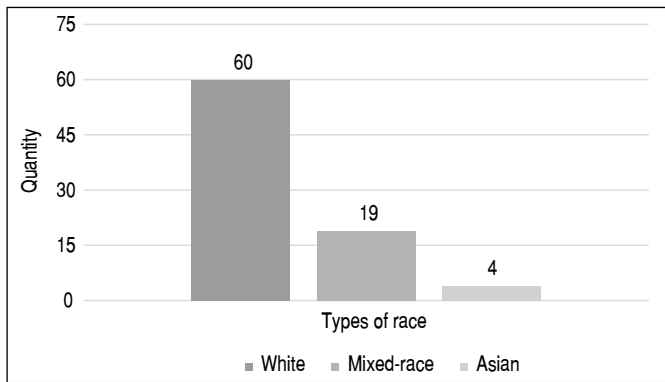


Figure 2. Phenotypical characteristics.

Characteristics	Total
Fall from one's own height	76 (89.4%)
Fall from other heights	4 (4.7%)
Automobile accidents	1 (1.1%)
Unknown	3 (3.5%)
Other	1 (1.1%)

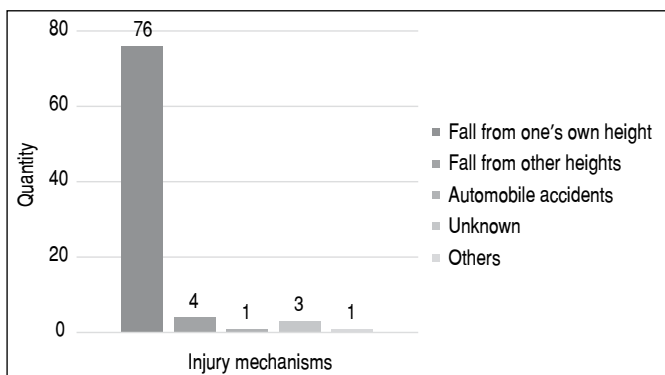


Figure 3. Injury mechanisms.

and smoking, with seven cases each (4.7%); acute myocardial infarction and osteoporosis, with five cases each (3.4%); and other comorbidities, with 37 cases (25.3%) (Table 4).

Of the 80 cases we evaluated in relation to the type of treatment, 77 (96.25%) underwent surgical procedures and only three (3.75%) were treated conservatively.

The surgical procedures performed were: cephalomedullary nail, with 51 cases (66.23%); hip sliding screw, with 12 cases (15.5%); hip arthroplasty, with eight cases (10.3%); cannulate screw, with three cases (3.8%); non-conventional endoprosthesis (NCEP), with two cases (2.5%); and we had one case of untreated evasion (Table 5) (Figure 5). Fractures type 31A (71.4%) were predominant, followed by fractures type 31B (25%), fractures type 32A (2.3%), and fractures type 32B (1.1%) (Table 6).

## DISCUSSION

We observed a predominance of proximal femur fracture among female patients (3:1) and a mean age of 78.5 years. These values are like those found in similar studies, with a prevalence between women and men ranging from 1.3:1 to 3.8:1 and with ages ranging from 72 to 80 years for women and 63 to 77 years for men.<sup>4,5,12,13</sup> The difference between the sexes is partly explained by the lower female bone density after menopause.<sup>14</sup>

Table 3. Diagnosed injuries.

Characteristics	Total
Transtrochanteric fracture	60 (70.5%)
Femoral neck fracture	21 (24.6%)
Subtrochanteric fracture	4 (4.7%)

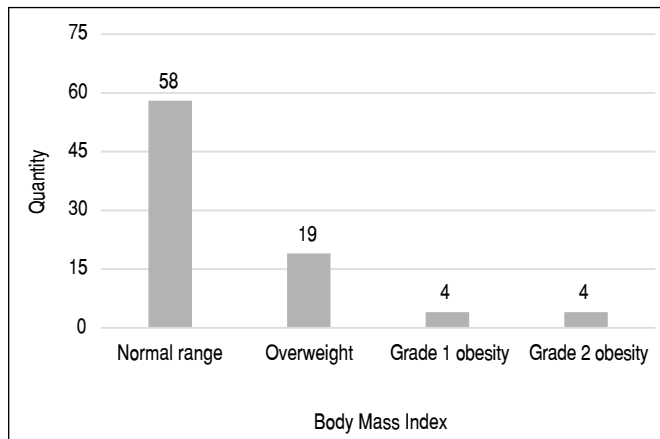


Figure 4. Distribution of participants by body mass range.

Table 4. Comorbidities found.

Comorbidities	Total
Systemic arterial hypertension (SAH)	47 (32.1%)
Type 2 diabetes mellitus (DM)	21 (14.3%)
Alzheimer's disease	9 (6.1%)
Cancer	8 (5.4%)
Cerebrovascular accident (CVA)	7 (4.7%)
Smoking	7 (4.7%)
Acute myocardial infarction (AMI)	5 (3.4%)
Osteoporosis	5 (3.4%)
Others	37 (25.3%)

Table 5. Types of materials used in surgical treatment.

Surgical procedure	Total
Cephalomedullary nail	51 (66.1%)
DHS	12 (15.5%)
Total hip arthroplasty	8 (10.3%)
Cannulated screw	3 (3.8%)
NCEP	2 (2.5%)
Total	76 (100%)

DHS: dynamic hip screw; NCEP: non-conventional endoprosthesis.

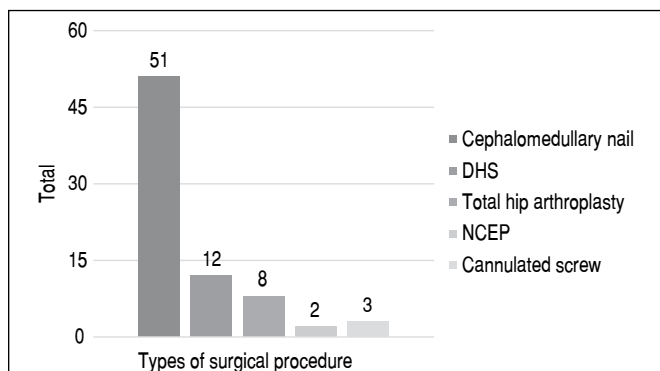


Figure 5. Surgical procedures.

**Table 6.** AO Classification.

AO Classification		Quantity
3.1.A	3.1A1	24 (28.5%)
	3.1A2	32 (38%)
	3.1A3	4 (4.76%)
Total		60 (71.4%)
3.1.B	3.1B1	12 (14.2%)
	3.1B2	3 (3.5%)
	3.1B3	6 (7.1)
Total		21 (25%)
3.2.A	3.2A1	1 (1.1%)
	3.2A1	1 (1.1%)
Total		2 (2.3%)
3.2.B	3.2B3	1 (1.1%)
Total		1 (1.1%)
Total		84 (100%)

Corroborating other studies, considering males, the percentage of cases varied in different age groups, with a decrease in fracture incidence from 70 years of age (Figure 1).

Our study verified a mean body mass index (BMI) of 24.16 ( $\pm$  5.06) (with no significant difference between men and women), against the mean of 22.6 found,<sup>3</sup> demonstrating maintenance of the patient's physical pattern in recent years and that fractures occurred mostly in patients with BMI within the normal range (68%). Other authors also observed this.<sup>12,15,16</sup> Different factors can explain this occurrence: older individuals with higher BMI generally present a greater amount of muscle and fat tissue, with increased stress in the bone, leading to lower mineral loss<sup>15</sup> and, in addition, fat excess and greater musculature, present due to load excess, can act as a cushion for the pelvis, softening traumas in the region.

Mixed-race patients showed a lower frequency (22.8%), significantly lower than in the Caucasian population (72.2%), but higher than the values of Black/mixed-race cases found in the literature.<sup>3,4</sup> This difference possibly occurs due to greater bone mass accumulation in the Black/mixed-race population, which should be related to a greater renal reabsorption of calcium and resistance to the bone action of parathyroid hormone (PTH);<sup>17</sup> according to some studies, Black individuals also have lower levels of osteocalcin, the bone fraction of alkaline phosphatase and urinary hydroxyproline.<sup>14,18</sup>

In total, 89.4% of the fractures happened due to low-energy traumas, a result higher than the 73.5% found in the literature,<sup>4</sup> but like that found by Hungria Neto, Dias, and Almeida,<sup>3</sup> of 87.3%. Considering only cases related to low-energy trauma, we noted a predominance

of cases in which patients suffered the fall while walking or just standing still, but mostly in orthostatic position.

Regarding comorbidities, most of the patients included in the study already have diagnosed diseases and continuous use of medications for them. Hypertension and diabetes mellitus are the predominant diseases. We believe that osteoporosis is less reported due to the disease's subdiagnosis among the analyzed patients.

This study lacked assessment of daily physical activity, including a control group. However, the literature<sup>15,19,20</sup> shows a retrospective history of low daily physical activity in individuals with proximal femur fractures compared to individuals in the group without the same fracture. Authors found that, in both sexes, an increase in physical activity, such as walking, climbing stairs, and working at home and in the garden, is a protective factor for proximal femur fractures.<sup>19</sup> This is due to increased muscle strength, resulting in a greater load on the bones and, consequently, an increase in bone mineral density, in addition to muscle mass itself acting as local protection against trauma.

Of the patients whose fractures occurred due to low-energy traumas, we observed that a considerable number of accidents could have been avoided, since they were falls from their own height. For such purpose, simple and economical epidemiological measures that guide and instruct the older population to get up cautiously (whether from bed in the morning, from a chair, or when leaving the car), use of handrails when going down stairs, and more support mechanisms for them (support bars in the bathroom, corridors, and stairs), can reduce the incidence of proximal femur fractures, bringing great benefits to the older population's quality of life, in addition to a great reduction in morbimortality and socioeconomic costs for the Unified Health System and supplementary health system of this progressively frequent condition, with the increase of the older population.

Undoubtedly, the evolution of medicine, considering prevention, screening, and treatment, contributes significantly to an increased life expectancy and a change in the age constitution of the population. However, it also increases the incidence of diseases typically related to aging and its consequences, such as proximal femur fractures.

## CONCLUSIONS

The study showed that proximal femur fractures in older adults occur more frequently in women, with a mean age of 78.5 years, normal BMI range, and whose main trauma mechanism is fall at ground level. The most prevalent type of injury is transtrochanteric fracture, with a mean of 70.5%, and the most performed treatment is internal fixation with cephalomedullary nail, with a mean of 65%.

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