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## Original Article

**Transtrochanteric fractures: evaluation of data between hospital admission and discharge**<sup>☆,☆☆</sup>Christiano Saliba Uliana<sup>a,b,\*</sup>, Marcelo Abagge<sup>a,b</sup>, Osvaldo Malafaia<sup>c</sup>, Faruk Abrão Kalil Filho<sup>b</sup>, Luiz Antonio Munhoz da Cunha<sup>b</sup><sup>a</sup> Hospital do Trabalhador, Curitiba, PR, Brazil<sup>b</sup> Hospital de Clínicas, Universidade Federal do Paraná, Curitiba, PR, Brazil<sup>c</sup> Faculdade Evangélica do Paraná, Hospital Universitário Evangélico de Curitiba, Curitiba, PR, Brazil

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## ABSTRACT

**Objective:** to evaluate the data obtained from patients with transtrochanteric fractures who were attended at a tertiary-level trauma referral hospital, between admission and discharge, gathered prospectively by means of the SINPE<sup>®</sup> software.

**Methods:** 109 consecutive patients who were admitted between April 2011 and January 2012 were evaluated using an electronic storage and analysis database in SINPE<sup>®</sup>. The data were gathered prospectively, including evaluations on personal information about the patients, history-taking, fracture classification (Evans-Jensen, AO/OTA and Tronzo), treatment and discharge.

**Results:** the sample was composed of 43 men and 66 women. Their ages ranged from 20 to 105 years, with a mean of 69 years. Falling was the trauma mechanism for 92 patients and traffic accidents for 17. The most prevalent chronic diseases were systemic arterial hypertension and diabetes mellitus. According to the AO/OTA classification, the commonest fracture type was 31 A1. According to the Tronzo classification, type III was commonest. The fracture was fixed by means of a cephalomedullary nail in 64 cases and a sliding screw-plate in 44 cases. One fracture was fixed with a 95° screw-plate. Seven patients presented some form of clinical complication and three died during the hospital stay. All the patients who were discharged were instructed to only partially bear weight on the repair.

**Conclusion:** through SINPE<sup>®</sup>, it was possible to evaluate the personal information, history-taking, classification, treatment and discharge of patients with transtrochanteric fractures, from hospital admission to discharge.

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## Fraturas transtrocantéricas – Avaliação dos dados da admissão à alta hospitalar

### R E S U M O

#### Palavras-chave:

Fraturas do quadril/etiologia  
Fraturas do quadril/epidemiologia  
Coleta de dados

**Objetivo:** avaliar os dados obtidos de pacientes com fratura transtrocantérica atendidos em um hospital de referência terciária de trauma, desde a admissão até a alta hospitalar, coletados prospectivamente por meio do Sinpe®.

**Métodos:** foram avaliados 109 pacientes consecutivos admitidos de abril de 2011 até janeiro de 2012. Usou-se uma base eletrônica de armazenamento e análise de dados, o *software* Sinpe®. A coleta dos dados deu-se de maneira prospectiva e informações sobre dados pessoais do paciente, anamnese, classificação das fraturas (Evans-Jensen, AO/OTA e Tronzo), tratamento e alta foram avaliadas.

**Resultados:** a amostra foi composta por 43 homens e 66 mulheres. A idade variou de 20 a 105 anos, com média de 69. A queda foi o mecanismo de trauma em 92 pacientes e os acidentes de trânsito foram em 17. As doenças crônicas mais prevalentes foram a hipertensão arterial sistêmica e o diabetes *mellitus*. Pela classificação AO/OTA, o tipo mais comum de fratura foi a 31 A1. Pela classificação de Tronzo, a tipo III foi a mais comum. A fratura foi fixada com haste cefalomedular em 64 casos e com placa-parafuso deslizante em 44 casos. Uma fratura foi fixada com placa-parafuso 95°. Sete pacientes apresentaram alguma complicação clínica e três foram a óbito durante o internamento. Todos os pacientes que receberam alta foram orientados a fazer apoio parcial.

**Conclusão:** por meio do Sinpe® foi possível avaliar as informações relacionadas a dados pessoais, anamnese, classificação, tratamento e alta de pacientes com fratura transtrocantérica desde a admissão até a alta hospitalar.

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## Introduction

The incidence of proximal femoral fractures has been increasing significantly and, because of greater life expectancy among the population, it is expected to double over the next 25 years.<sup>1-3</sup> The functional results after treatment remain unsatisfactory because a significant number of patients do not return to their functional status prior to the fracture.<sup>4</sup> These fractures have the implication of social and financial impacts on the population and on the country.<sup>5</sup>

Among the fractures of the proximal femur, transtrochanteric fractures are an important group, given that they are common and generally affect patients who have been debilitated by comorbidities and are of advanced chronological age.<sup>6,7</sup>

Adequate data-gathering with regard to the incidence of transtrochanteric fractures and the profile of the group that is susceptible to them may aid in developing public policies for prevention and treatment. It may also aid in developing scientific studies, particularly if it is done without failings and if updated electronic files that supply statistically relevant data are obtained.<sup>8</sup>

Within the field of medical information technology, the Sinpe® software (acronym for integrated electronic protocol system) has been created. Sinpe® is a tool used by several medical specialties for the purpose of data gathering, application and validation in relation to diseases.<sup>9-11</sup>

## Objective

The present study had the aim of evaluating the data gathered prospectively by means of Sinpe®, from patients with

transtrochanteric fractures who were attended at a tertiary-level referral hospital for trauma, from admission to discharge.

## Materials and methods

This study was properly submitted to and approved by the Ethics Committee of our institution, and was registered under the protocol CEP-SESA/HT no. 294/2011.

The data were gathered by the first author and the Sinpe® software was used to electronically store the information. The data analysis to validate the results was done by means of the Sinpe Analizador® tool, which forms part of the Sinpe® software.<sup>12</sup>

The data were gathered between April 18, 2011, and January 30, 2012. All the patients included were admitted to and treated at a tertiary-level referral hospital for trauma in the city of Curitiba. The data-gathering took place prospectively, and 109 consecutive patients admitted to the hospital with transtrochanteric fractures of the femur were evaluated.

Table 1 shows the data evaluated in this study.

The data on the patients were gathered by means of an interview, directly with the individual or with his parents and/or with the rescue team.

Among the historical clinical data, the pain intensity was evaluated on numerical and verbal scales. On the numerical scale, the patient was encouraged to quantify his pain between zero and 10. Absence of pain was scored as zero and the worst pain ever experienced by the patient was scored as 10. On the verbal scale, patients were asked to classify their pain between five categories: intolerable, intense, moderate,

**Table 1 – Correlation of the data evaluated on each patient with a transtrochanteric fracture: patient’s data, history-taking, fracture classification, treatment conditions and hospital discharge.**

Patient’s data	History-taking	Classification	Treatment	Hospital discharge
Sex	Intensity of pain	Evans-Jensen	Surgical access	Weight-bearing permitted
Ethnicity	Trauma mechanism	AO/OTA	Implants used	
Age	Level of fall	Tronzo	Complications during hospital stay	
	Associated chronic diseases		Deaths during hospital stay	

mild and absent.<sup>13,14</sup> The mechanism through which patients suffered their trauma was stated both by the patient and by the pre-hospital rescue team. This item was subdivided into “traffic accident”, “fall”, “physical aggression” and “gunshot wound”. The level of the fall was divided into “fall from the same level” and “fall from a height”. In the case of falls from a height, the height of the fall in meters was evaluated. In taking the history, the patients were asked about the presence of any chronic diseases that they knew about, such as systemic arterial hypertension, diabetes mellitus and cerebrovascular diseases.

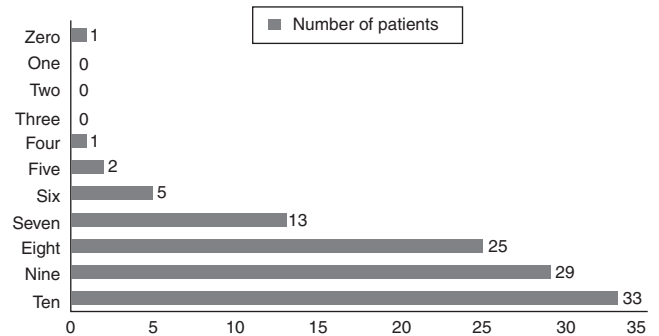
The fractures were classified by the first author based on radiographic analysis. The Evans-Jensen,<sup>15</sup> AO/OTA<sup>16</sup> and Tronzo<sup>17</sup> classification systems were used.

Regarding the treatment, a traction table was used to reduce the fracture in all cases. Only in cases in which the reduction on the traction table was unsatisfactory was it decided to perform direct reduction of the fracture. To stabilize the fracture, three surgical accesses were used: a lateral access below the vastus was used in cases of fixation with a plate and sliding screw; a lateral minimally invasive access proximal to the greater trochanter was used in cases of fixation with a cephalomedullary nail; and, in cases in which direct reduction was necessary, the access previous programmed was extended so as to expose the focus of the fracture, independent of the type of implant used. The implants used for fixation of the fractures were: sliding plate-screw, short or long cephalomedullary nail and 95° plate-screw. The clinical and orthopedic complications and the deaths that occurred during hospitalization were recorded.

At the time of hospital discharge, data relating to the type of weight-bearing that the patient was allowed (none, partial or full) were gathered.

**Results**

The sample consisted of 43 men (39.45%) and 66 women (60.55%). Their ages ranged from 20 to 105 years, with a mean of 69. The mean among the men was 64.3 years (20-105), which was younger than the mean among the women of 70.3 years



**Fig. 2 – Representation of pain intensity reported by the patients at the time of admission, according to the numerical pain scale.**

(20-104). Among the 109 patients of the sample, 90 (82.5%) were more than 54 years of age at the time of the fracture. Regarding ethnicity, 100 patients were white, two were black, two were mixed and five were classified as indeterminate (Fig. 1).

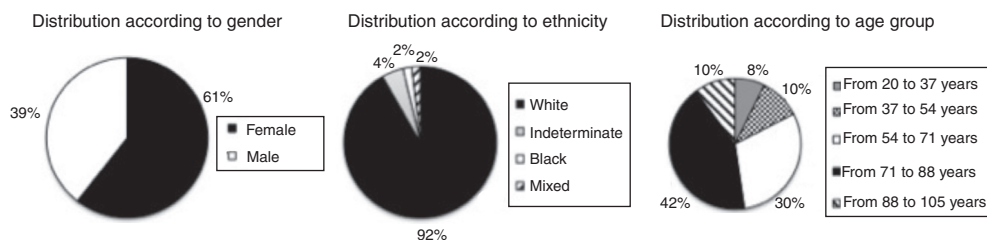
The numerical scale showed that the greatest number of the patients reported pain at level 10 (30.28%), followed by pain at level 9 (26.61%) and level 8 (22.94%) (Fig. 2).

The verbal scale demonstrated that the majority of the patients classified their pain as “intense” (53.21%), followed by those who considered that their pain was “intolerable” (30.28%) (Fig. 3).

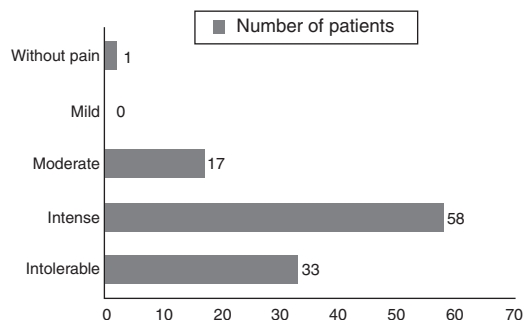
Falls were the most prevalent trauma mechanism and occurred in 92 patients (84.40%), followed by traffic accidents in 17 (15.6%) (Table 2).

Among the patients who suffered falls, 85 (92.39%) fell from the same level, while seven (7.60%) fell from a height (Table 3).

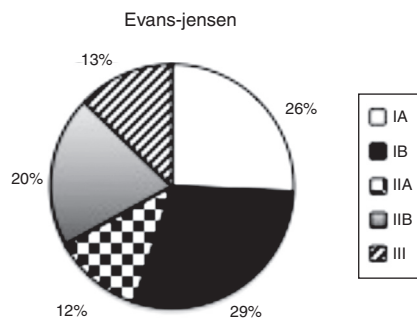
Systemic arterial hypertension was the chronic disease of greatest prevalence in the sample, reported by 55 patients (50.45%). Diabetes mellitus was the second most prevalent disease in the sample, affecting 21 patients (19.26%). Other diseases reported included cerebrovascular diseases, cardiopathies, chronic obstructive pulmonary disease and



**Fig. 1 – Distribution according to sex, ethnicity and age group among the 109 patients of the sample.**



**Fig. 3 – Representation of pain intensity reported by the patients at the time of admission, according to the verbal pain scale.**



**Fig. 4 – Percentage distribution of the fractures according to the Evans-Jensen classification.**

**Table 2 – Trauma mechanism that gave rise to the fracture, subdivided into “fall”, “traffic accident”, “physical aggression” and “gunshot wound”.**

Trauma mechanism	Number of patients
Fall	92 (84.40%)
Traffic accident	17 (15.6%)
Physical aggression	0 (0.00%)
Gunshot wound	0 (0.00%)

**Table 3 – Sample distribution according to the level of the fall that gave rise to the fracture.**

Level of fall	Number of patients
Same level	85 (92.39%)
1-2 m	2 (2.17%)
2-3 m	4 (4.34%)
3-4 m	0 (0.00%)
>4 m	1 (1.08%)

**Table 4 – Distribution of the chronic diseases presented by the patients of this sample.**

Associated chronic diseases	Number of patients
Systemic arterial hypertension	55 (50.45%)
Diabetes mellitus	21 (19.26%)
Cardiopathies	12 (11%)
Cerebrovascular disease	16 (14.67%)
Chronic obstructive pulmonary disease	2 (1.83%)
Chronic renal disease	1 (0.92%)

chronic renal disease. Table 4 shows the prevalence of the diseases and does not take into account the fact that some patients presented more than one comorbidity.

In relation to the Evans-Jensen classification, 60 patients (55%) presented type I fractures, followed by type II fractures

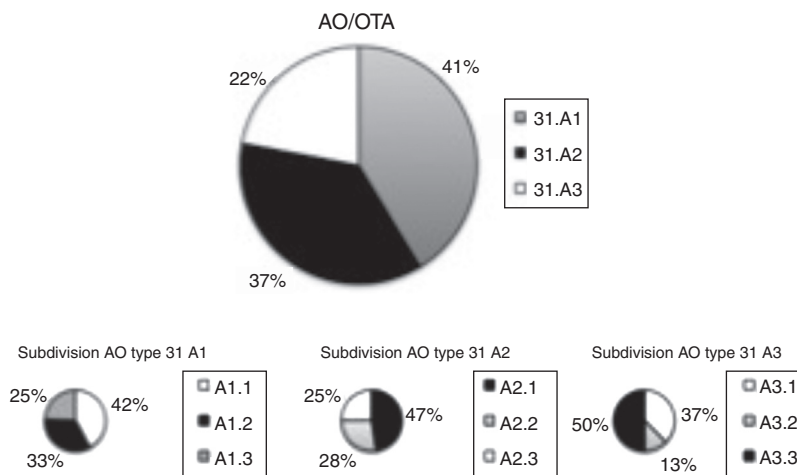
in 35 patients (22%) and type III fractures in 14 patients (12%) (Fig. 4).

According to the AO/OTA classification, the commonest type was 31 A1, which was found in 45 patients (41%), followed by type 31 A2, in 40 (36%), and type III, in 24 (22%) (Fig. 5).

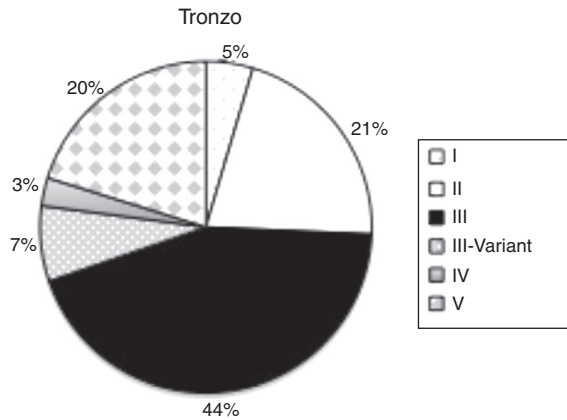
Regarding the Tronzo classification, type III was the commonest and affected 48 patients (44%). The second commonest was type II, in 23 (21.1%) (Fig. 6).

Regarding the surgical approach, a limited minimally invasive access proximal to the greater trochanter was the approach most used (56.88%), followed by a lateral access below the vastus (40.36%) (Table 5).

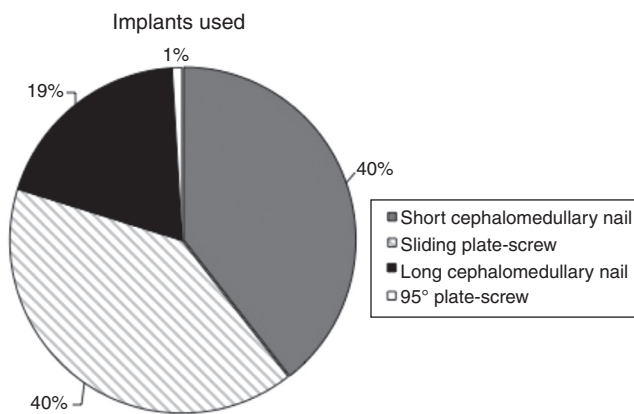
The implants used for fixation of the fracture were a sliding plate and screw in 44 cases (40%), a short cephalomedullary nail in 43 (40%), a long cephalomedullary nail in 21 (19%) and a 95° plate and screw in one (1%) (Fig. 7).



**Fig. 5 – Percentage distribution of the fractures according to the AO/OTA classification.**



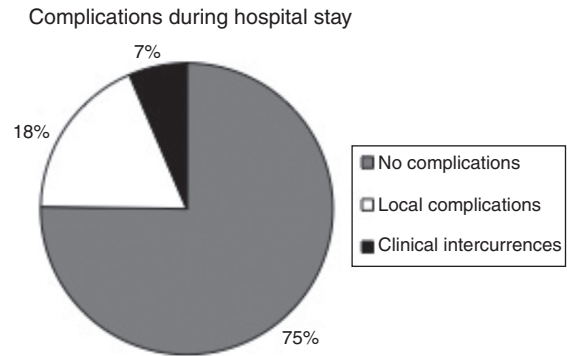
**Fig. 6 – Percentage distribution of the fractures according to the Tronzo classification.**



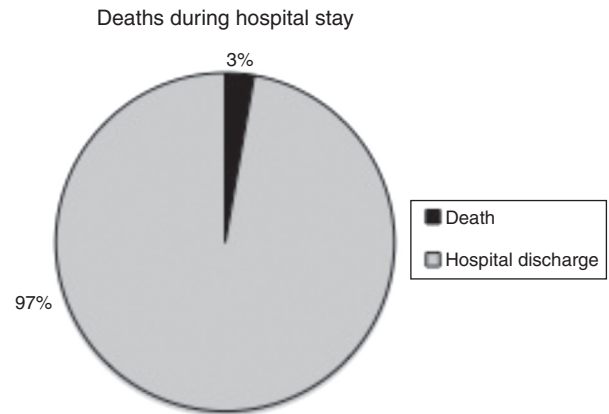
**Fig. 7 – Percentage distribution of the implants used for fracture fixation.**

In all the 109 patients studied, 82 (75%) did not present any type of complication during the hospital stay. Among the 20 (18%) who presented local complications, 16 (15%) evolved with superficial infection, three (3%) evolved with deep infection and one (1%) presented a fracture of the lateral cortical bone of the femur during the operation. In this case, in which fixation using a sliding plate and screw had been planned, the surgeon decided to change the plan and perform the fixation using a 95° plate and screw. A further seven patients (7%) presented clinical interferences during the hospital stay (Fig. 8).

During the hospital stay, three patients (2.75%) evolved to death and 106 (97.25%) were discharged from hospital (Fig. 9).



**Fig. 8 – Percentage incidence of complications presented by the patients during hospital stay.**

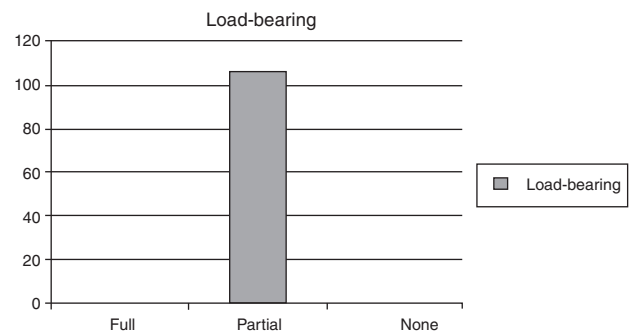


**Fig. 9 – Relationship between deaths during hospital stay and patients who were discharged.**

For all the 106 patients (97.25%) who were discharged from hospital, it was recommended that they should only partially bear weight on the limb (Fig. 10).

## Discussion

The present study used the Sinpe® system as the storage database, which enabled secure data recording and provided statistical analysis through the analyzer module of Sinpe®. Other studies that have given support for using medical files



**Fig. 10 – Demonstration that 106 patients who were discharged from hospital were instructed to only place partial weight on the fractured limb.**

**Table 5 – Distribution of accesses used for fracture fixation.**

Surgical access	Number of patients
Limited minimally invasive proximal to greater trochanter	62 (56.88%)
Lateral below vastus	44 (40.36%)
Extended for direct reduction	3 (2.75%)

in computerized manner have also used Sinpe<sup>®</sup> and have corroborated the efficacy and good functioning of this system.<sup>9,10</sup> Like in the present study, on the other occasions in which Sinpe<sup>®</sup> was used, a database was firstly developed with bibliographic support and then was incorporated electronically into the protocol.

Electronic data-gathering has many advantages in relation to manual gathering. To cite a few of them, data that are gathered manually are generally not structured or standardized, such that they may present flaws at the time of interpretation. The protocol used in this study laid out the data in a structured and hierarchical manner. The information was gathered prospectively, with direct input to the software by means of a personal-use laptop. This data-gathering method made it possible to standardize and validate the information with a high statistical power at the time of the epidemiological evaluations.<sup>8</sup>

The protocol that was developed and applied in this study made it possible to gather more than 18,000 data records on each patient with a transtrochanteric fracture. This amount of information that could be extracted from each case gave the researcher many possibilities for data correlation, thus making it possible to generate a wide spectrum of statistically relevant analyses.

Despite the high quality of the data gathered, in statistical terms, the protocol applied presented some flaws. Some information that is considered relevant within orthopedics, such as preoperative planning, date of the operation, date of hospital discharge, time interval between admission and the operation and admission to and release from the intensive care unit, could not be gathered because the protocol did not allow their entry. However, this was the first time that this protocol was applied to the field of orthopedics and it is expected that the protocol will undergo corrections and updating in order to provide support for other studies in the future. Another point that could be a disadvantage is that the data-gathering was very extensive and became tiring for the patients.

The demographic data regarding predominant sex and age demonstrated that females and the population over the age of 50 years were more prevalent in the sample. Previously published studies also showed this sex and age predominance in relation to fractures of the proximal femur.<sup>6,7</sup> However, we found proportions of 3:2 between female and male patients, whereas the literature general indicates proportions of 2:1. This finding may be explained by the fact that most studies relating to fractures of the proximal femur have evaluated elderly patients, i.e. over the age of 65 years. When younger patients were included in the sample, the predominance of female patients was inverted, given that younger patients suffer high-energy trauma and the male population is more susceptible to traffic accidents or falls from a height. Among the 24 victims of high-energy trauma, there were 16 male patients (66.66%).

Regarding the intensity of the pain that patients present after transtrochanteric fractures, there is little information in the literature. Most studies have dealt with postoperative pain and state that the pain is generally intense, but it may be mild if the fracture does not present any displacement.<sup>18</sup> The data analyzed confirm that most of the patients experience

episodes of intense pain. Curiously, the two patients who reported lower intensity of pain (0 and 4 on the numerical scale) presented displaced and comminuted fractures. In comparing the two systems for measuring pain intensity, it was perceived that there was no correlation between them, given that on the numerical scale, the majority of the patients reported having pain of level 9 or 10, while on the verbal scale, the majority reported "intense" pain and not "intolerable" pain, which would have been the term corresponding to "9" and "10". This shows the difficulty in objectively measuring subjective complaints such as pain. Another point that needs to be analyzed is that patients may find it easier to translate into words, such as "intense" or "mild", than into numbers from 0 to 10.

Morrison et al. indicated that low-energy complaints are responsible for 86–95% of osteoporotic bone fractures.<sup>19</sup> In our sample, the commonest trauma mechanism was a fall from the same level and, in agreement with the literature, this accounted for 84.4% of the cases. In our setting, Pereira et al. conducted a study that included 246 patients over the age of 65 years who were victims of fractures of the proximal femur. In that study, the female population accounted for 72.7% of the sample.<sup>20</sup> In the present study, in correlating the data on falls from the same level with sex, we found that 78.8% of the patients were female, which represents a proportion of approximately 4:1.

Among the 24 patients who were victims of high-energy trauma, the mean age was 50 years, 14 (58.33%) were under the age of 65 years and 16 were male (66.66%), which confirms the bimodal epidemiological profile of patients with transtrochanteric fractures.

In a study that included 1904 patients who suffered fractures, Gerber et al.<sup>21</sup> gathered data relating to the association between fractures of the proximal femur in elderly individuals and the presence of comorbidities. They found that the most prevalent disease was systemic arterial hypertension (SAH) (66%), followed by cerebrovascular diseases (33%) and diabetes mellitus (16%). In our sample, the prevalent disease was also SAH (50.45%), but the second most prevalent was diabetes mellitus (19.26%), followed by cerebrovascular diseases (14.64%).

The fractures were classified by the first author using three systems that have become established in the literature.<sup>15–17</sup> Since the protocol can be used in a multicenter manner, the software allows researchers to classify the fractures into seven different systems. In comparing the incidences of the fracture types AO 31 A3, Tronzo V and Evan-Jensen III of the present study with the articles that describe these classification systems, it could be seen that the prevalence of these fracture types of greater severity were higher. This demonstrates the current trend toward trauma produced by mechanisms of higher energy, such as traffic accidents.

Regarding the implants used for fixation, the literature suggests that for stable transtrochanteric fractures, surgical fixation with a sliding plate and screw provides results that are similar to those using cephalomedullary nails.<sup>22–24</sup> However, for unstable fractures, fixation using nails or a 95° plate and screw is recommended.<sup>25</sup> In the present study, there was predominance of fixation with cephalomedullary nails, given

that 59% of the fractures were fixed in this manner. It is likely that the availability and easy access to nails that exists in our institution is the reason why some stable fractures were also fixed using nails. All the unstable fractures and those extending to the diaphysis were fixed using cephalomedullary nails or a 95° plate and screw.

The deep infection rate was found to be 3%, which is within the parameters expected in trauma referral hospitals. Harrison et al. studied 6905 cases of hip fractures and found a deep infection rate of 0.7%.<sup>26</sup> The reports in the literature demonstrate that the deep infection rate following a transtrochanteric fracture ranges from 0.15% to 15%.<sup>27</sup> The mortality rate in the literature is high, with a range from 12% to 41% over the first six months after the operation.<sup>28,29</sup> In our sample, three deaths occurred during the hospital stay, all resulting from clinical complications. These three patients were smokers and alcohol abusers, and they presented comorbidities.

While in the hospital, the patients had daily physiotherapy sessions, during which they were encouraged to get out of bed early on and take some steps with the aid of a walking frame. Since one of the objectives of the surgery was to return to the previous level of physical activity, all the patients were instructed at the time of hospital discharge to partially place weight on the operated limb.

## Conclusion

Through Sinpe®, it was possible to evaluate the information relating to personal data, history-taking, classification, treatment and hospital discharge of patients with transtrochanteric fractures, from admission to discharge.

## Conflicts of interest

The authors declare that there were no conflicts of interest.

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