

EPIDEMIOLOGICAL AND RADIOLOGICAL EVALUATION OF FEMORAL SHAFT FRACTURES: STUDY OF 200 CASES

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ABSTRACT

Objective: to evaluate epidemiological and radiological characteristics of the femoral shaft fractures, surgically treated from 1990 to 2005 at Hospital de Acidentados – Clínica Santa Isabel – in Goiânia, Goiás, aiming to contribute to better preventive and therapeutic measures planning to adopt on those fractures. **Methods:** 200 patients' files and x-rays with femoral shaft fractures have been retrospectively evaluated. Patients below the age of 10 years were not included because the treatment for this group was conservative. 25 files have been discarded for not supplying all the necessary data to the study. The patients were assessed for sex, age, side of the fracture, bone exposure, mechanisms of trauma, classification of the fractures, associated trauma, time for bone healing and types of surgical devices. Statistic analyses were made by chi-squared, Fisher and Student's-t tests, adopting as a significance level $p < 0.05$. **Results:** significant results ($p < 0.05$) were found in: 70% of men, 80% closed fractures and 65% of women above the age of 60. Fractures resulting from simple

falls were more frequent in women, above 60 years old, with simpler traces, and the ones caused by projectiles of firearm in men, from 20 to 60 years, with unstable traces. Trampling accidents were prevalent among youngsters between 10 and 19 years old. Car accidents showed all the types of fractures, mostly associated to other traumas, reaching its peak incidence in the age group of 20-30 years. The treatment with Küntscher Nail resulted in a longer mean consolidation time, as well as fractures with unstable traces (B3,C1,C2,C3). **Conclusion:** we found a bi-modal characteristic the femoral shaft fractures, consistently to literature data, where the high energy mechanisms (traffic accidents, high falls and wounds from firearms), have been more frequent in young adults, men, generating unstable traces of fractures, with more serious associated trauma, while the other group with low energy trauma (simple falls), was more frequently seen in elderly female individuals with less unstable fracture traces, without associated trauma.

Keywords - Femoral fractures; Diaphyses; Epidemiology; Retrospective studies; Case studies

INTRODUCTION

The prevalence of femoral shaft fractures revolves around 3/10,000 people and continues to grow⁽¹⁾. Due to their high frequency, the types of trauma mechanisms, the high morbidity and mortality, and the high direct and indirect costs, these fractures are a public health problem. There are studies with epidemiological data of these fractures that show a bimodal feature with respect to the two most affected groups: young

people (between 15 and 40 years) involved in high-energy accidents (traffic, firearm injuries, falls from large heights), and the elderly (over 60) in low-energy accidents (falls from standing height or sprains)⁽¹⁻⁶⁾.

The aim of this study was to evaluate the epidemiological and radiological characteristics of femoral shaft fractures treated surgically at the Hospital de Acidentados, Goiânia, Goiás, from 1990 to 2005, seeking to improve the planning of preventive measures and treatment for such fractures.

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We declare no conflict of interest in this article

METHODS

This is a retrospective cohort study consisting of 200 patients who underwent surgical treatment for femoral shaft fractures. The study was conducted at the Hospital de Acidentados, Santa Isabel Clinic, Goiânia, GO, from 1990 to 2005.

Patients under 10 years of age were not included because they received conservative treatment. Twenty-five patients for which the records did not provide all data required for the study (epidemiological, radiological, and follow-up) were excluded. Patients undergoing femoral fracture surgery in another hospital and referred for reoperation were also excluded.

The study was approved by the Ethics Committee of the Hospital de Acidentados, Santa Isabel Clinic. The name, medical record number, and personal data of patients were not disclosed, published, or analyzed. There is no conflict of interest in this study and it was not sponsored by any public or private entities.

Data collection resulted from patient clinical assessments. The computed factors were gender, age in decades (10 to 90) and groups (10-19, 20-60, > 60 years), side of fracture, presence or absence of bone exposure, mechanism of trauma (traffic accidents, falls, injury from a projectile from a firearm (PF), direct trauma). Preexisting lesions (benign or malignant tumors), associated trauma (brain injury (TBI), thoracic, fractures of other bones, soft tissue injuries) were also evaluated. Radiological features (anteroposterior and lateral X-rays of the femur), fracture grouping by AO classification⁽⁷⁾, types of surgical fixation, and healing time (minimum, maximum, and average) were also evaluated.

The type of surgical fixation was determined by the same orthopedic surgeon and took into account criteria such as fracture classification, surgical material available in the city of Goiânia at the time of the visit, and the technical evolution of the types of treatment. We used the following materials: Küntscher intramedullary nails, locked intramedullary nails, plates (straight or bridge), and evaluated the advantages of one method over another.

Data were tabulated in Microsoft Excel 2000 and a descriptive study was performed of all variables. In the statistical comparison of qualitative variable groups in unpaired groups, we used the chi-square (χ^2) and Fisher's exact test when expected frequency was less than five. The Student's t-test was used for the quantitative variables

in unpaired groups. The statistical significance level was set at equal to or less than 0.05 ($p \leq 0.05$).

RESULTS

Of the 175 cases analyzed, 127 (70%) were men and 48 (30%) women. Regarding sides, 89 (50.5%) occurred on the left and 86 (49.5%) on the right, with 144 closed (80%) and 31 exposed (20%) fractures. Figures 1 and 2 show the distributions by age group: in patients aged over 60 years, 65% were female and 35% were male.

Figure 3 shows the distribution of gender in relation to the mechanism of trauma, where fractures were more commonly due to falls from standing height in women ($p \leq 0.05$) and to PF in men ($p \leq 0.05$)

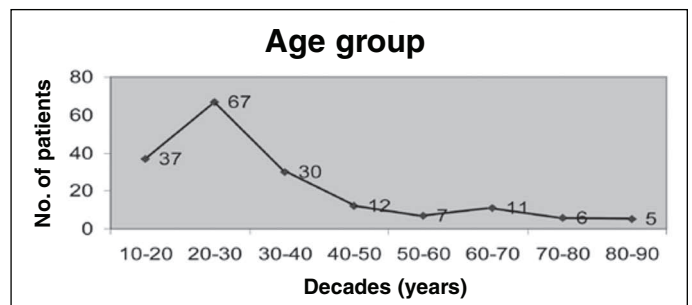


Figure 1 – Distribution by decades, showing the bimodal characteristics of the femoral shaft fractures (peaks at 20-30 and 60-70 years).

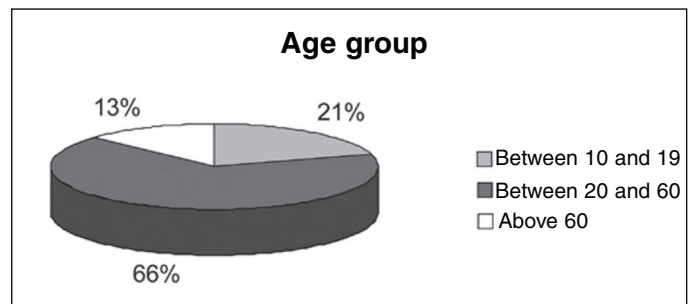


Figure 2 – Distribution by specific age groups of patients with femoral shaft fractures.

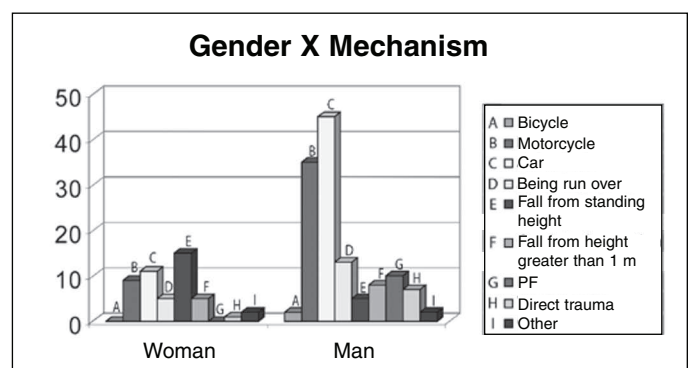


Figure 3 – Relationship between gender and trauma mechanism.

Figure 4 shows the age distribution in relation to the mechanism of trauma, where fractures from falls were more frequent for patients above 60 years ($p \leq 0.05$), from being run over for those between 10 and 19 years ($p \leq 0.05$), and from automobile and motorcycle accidents, from 20 to 60 years ($p \leq 0.05$).

Figure 5 shows the distribution of type A fractures in relation to the mechanism of trauma, where fractures from falls were more often type A1 ($p \leq 0.05$) and type A3 ($p \leq 0.05$) from traffic accidents.

Figure 6 shows the distribution of B-type fractures in relation to the mechanism of trauma, where fractures type B1 ($p \leq 0.05$) were predominantly from falls and type B2 ($p \leq 0.05$) were predominantly from traffic accidents.

Figure 7 shows the distribution of C-type fractures in relation to the mechanism of trauma, where C1 and C3 type fractures predominated in injuries by PF ($p \leq 0.05$).

The trauma associated with fractures of the femur were diagnosed as: TBI in 24 (13.5%) patients, of which 50% were in automobile accidents, 25% were run over, 20.5% were in motorcycle accidents and

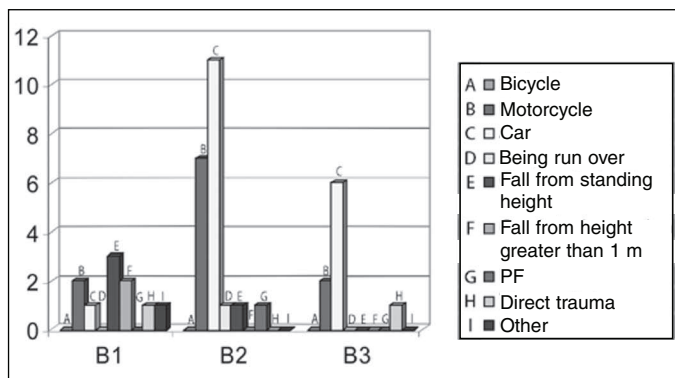


Figure 6 – Relationship between the type B fractures and mechanism of trauma.

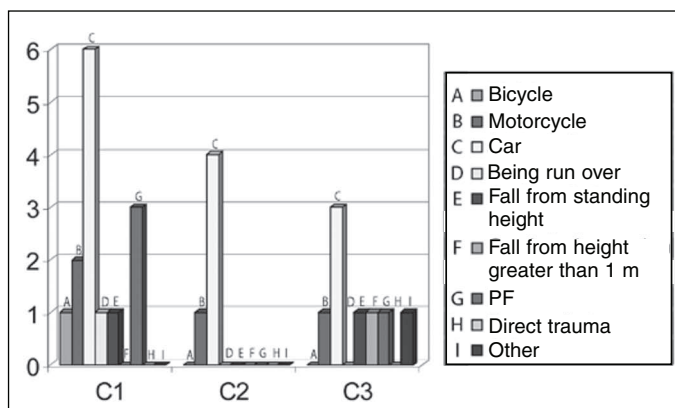


Figure 7 – Relationship between C-type fractures and mechanism of trauma.

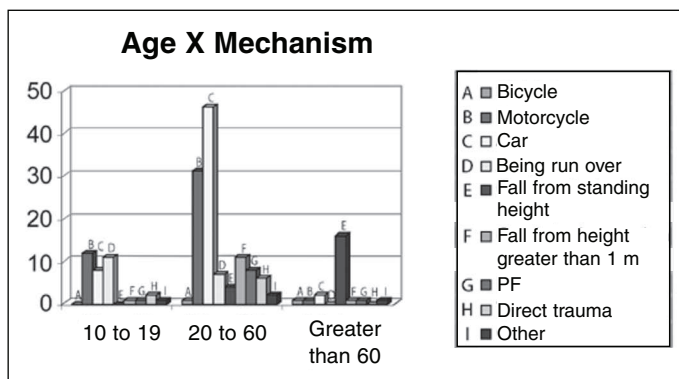


Figure 4 – Relationship between age and mechanism of trauma.

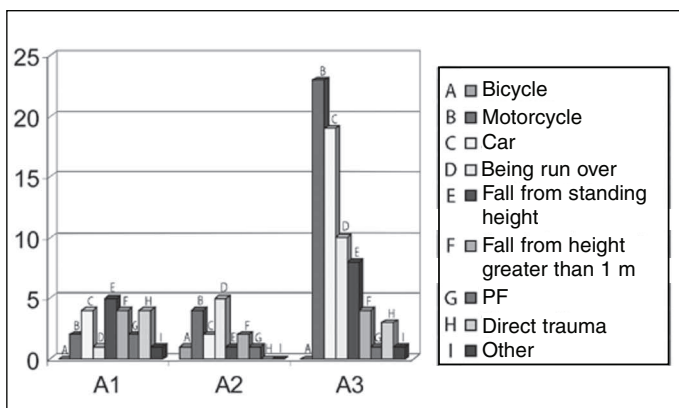


Figure 5 – Relationship between type A fractures and mechanism of trauma.

4.5% were due to a fall from an ultralight aircraft. We identified four patients (2%) with thoracic trauma, three of which as a result of an automobile accident and one was due to a fall from an ultralight aircraft. Among the patients, 23 (13%) had an ipsilateral tibial fracture: 40% as a result of an automobile accident, 40% from a motorcycle accident, and 20% from being run over. We detected 45 patients (25.5%) with fractures of other bones: 60% as a result of automobile accidents, 20% as a result of motorcycle accidents, 14% from being run over, and 6% from falls down stairs. Soft tissue injuries occurred in 27 patients (15.5%), 45% of which were a result of motorcycle accidents (50% requiring skin flap), 40% resulting from an automobile accident (25% requiring skin flap), 11% were run over, and 4% fell from an ultralight aircraft.

Regarding the healing time of fractures, of the 175 patients analyzed, in 52 fixations with Küntscher nails (30%), the average union was 14 months (3-42 months). In 37 fixations with locking nails (21%), the average was nine months (4-21 months), and in 86 plates (49%), the average was eight months (2-21 months). There was a significant difference ($p \leq 0.05$)

in healing time between the higher stability methods (locking nails and plates) and Küntscher nails.

Concerning the time of consolidation, comparison of the more stable fractures by AO classification (A1/A2/A3/B1/B2), with an average of nine months, with the unstable fractures (B3/C1/C2/C3), with average of 12 months, revealed a significant difference ($p \leq 0.05$).

DISCUSSION

The femoral shaft fractures usually result from high-energy trauma. Most occur in young adults during traffic accidents, falls from a height, or injury by firearm. Its greater strength is due to muscular forces and its role in supporting body weight, requiring a force of 250 newtons/meter to fracture the shaft of young adults⁽³⁾. The most common mechanism of injury is the flexion load, resulting in a transverse fracture. High-energy injuries cause varying degrees of fracture comminution.

Pathological fractures associated with osteoporosis occur at the metaphyseal regions (spongy bone) or the shaft when the cortex is thinner. Pathological bones are prone to spiral fractures after minor torsional loads. These fractures are rarely comminuted or associated with significant soft tissue damage.

Femoral shaft fractures are very common in the day to day life of orthopedists. Femoral shaft fractures mortality is due to episodes of respiratory distress syndrome in adults (thromboembolism, fat embolism) that occur in 2% of cases, and bleeding and arterial lesions. Morbidity occurs as a result of shortening, rotation, malunion, infection, joint stiffness, delayed union, pseudarthrosis, neural injury, and heterotopic ossification⁽¹⁻³⁾.

The types of trauma mechanisms, the high morbidity, and the high direct and indirect costs of these fractures are a public health problem. Epidemiological studies have examined the characteristics of these fractures and found a well-established bimodal feature⁽¹⁻⁶⁾.

We observed a characteristic bimodal presentation of femoral shaft fractures in our work similar to that described in the literature, where high-energy mechanisms, such as traffic accidents, falls from heights, and PF injuries were more frequent in young adults (66%), with a peak between 20 and 30 years, who were male (70%), generating unstable fracture characteristics, associated with more severe trauma. For

this group, work should be done to prevent violence in urban areas (PF), work accidents (falls from heights), and traffic accidents, in all aspects.

With respect to the trauma associated with fractures of the femur (25.5%), all of them were linked to traffic accidents or falls from great heights, for they are high-energy mechanisms. Accidents involving automobiles accounted for 50% of these injuries, it is important to note that accidents involving motorcycles generated the greatest number of soft tissue lesions requiring flaps (10 patients). Firearm-related injuries caused serious, though localized, injuries and falls from standing height involve a low-energy mechanism, which caused no associated injuries.

The other group of patients was involved in low-energy mechanisms, such as falls from standing height, more common in the elderly, peaking from 60 to 70 years, who were female (65%), with traces of less unstable fractures, without associated trauma. The prevention of fractures in this group should seek to prevent falls through muscle strengthening programs for the elderly, ophthalmological improvement, home safety projects, and the prevention and treatment of osteoporosis in all its stages, in diet, exercise, hormone replacement, calcium supplements, vitamins, and specific medications.

The AO classification of fractures proved itself to be useful to this research. We observed that the more stable appearances (A1, A2, A3, B1, B2) required less healing time (nine months) when compared with the more unstable appearances (B3, C1, C2, C3) (12 months) ($p \leq 0.05$).

The treatment of femoral shaft fractures was performed non-surgically from the ancient times to the early twentieth century⁽⁶⁻¹⁴⁾.

Today, AO fractures of types A and B are preferably treated with intramedullary nails locking proximally and distally. Type C can be treated with locking nails or bridge plates. If the patient is in severe condition or soft tissue damage is extensive, we recommend the use of an external fixator at first, to be later exchanged for a locking nail or bridge plate. Treatment should not be performed with Küntscher nails due to its worst results in terms of stability, nor with straight plates with absolute stability and large dissections, except in locations where there are no other methods available⁽¹⁵⁻²⁸⁾.

In our study, we also observed better results with the locking nails and plates as to the time of consolidation, with an average of nine and eight months ($p \leq 0.05$), when compared with Küntscher nails (14 months), confirming the decision of the authors. Küntscher nails and straight plates with absolute stability were used in the first years due to the lack of more modern instruments available in our area at the time. We currently use locking nails and bridge plates.

CONCLUSIONS

We found a characteristic bimodal presentation of femoral shaft fractures similar to the literature, where high-energy mechanisms (traffic accidents, high falls, and PF injuries) were more common in young male adults, and generated unstable fractures associated with more severe trauma. The other group involved in low-energy trauma (falls from standing height) was more common in the elderly, in females, showing traces of less unstable fractures without associated trauma.

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