

Paediatric femoral shaft fractures: What are the concomitant injuries?

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ARTICLE INFO

Article history:
Accepted 7 February 2013

Keywords:
Femur fractures
Delayed diagnosis
Orthopaedic trauma
Epidemiology
Trauma
Paediatrics

ABSTRACT

Introduction: Trauma remains a substantial cause of paediatric morbidity and mortality. Femur fractures are common in children, and frequently are the result of high-energy mechanisms of injury. A complete description of missed injuries in this population has not previously been described.

Materials and methods: A retrospective chart review of patients presenting to the Alberta Children's Hospital with femoral shaft fractures was performed. Associated injuries, and injuries with delayed diagnosis were recorded.

Results: Twenty-percent of the patients suffered at least one other injury with their femur fracture. Six-percent of injuries had a delayed diagnosis, corresponding to three-percent of the patients reviewed.

Conclusion: There is a risk of missed injuries in the paediatric patient presenting with a femoral shaft fracture. Paediatric trauma teams and paediatric orthopaedic teams must be aware of this risk to help reduce the incidence of missed injuries. A tertiary trauma survey on children with paediatric femoral shaft fractures may help diagnose missed injuries.

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Introduction

Trauma is the leading cause of morbidity and mortality in the paediatric population worldwide.^{1–3} Musculoskeletal trauma accounts for a large proportion of paediatric trauma, with fractures being present in 10–27% of all injuries in children.^{1,3} In one study the prevalence of musculoskeletal trauma was such that nearly one-in-two boys and one-in-three girls will have sustained a fracture by the age of sixteen.³ Of these fractures, an estimated 0.9–2.3% are fractures of the femur, and more specifically 1.4–1.7% comprise femoral shaft fractures.^{1,3,4}

Many studies to date focus on the treatment options for paediatric femur fractures.^{4–7} The importance of treatment is indisputable, however choice of treatment may depend on concomitant injuries. In adult orthopaedic trauma patients, the presence of an ipsilateral femoral neck fracture associated with a femoral shaft fracture is between 1% and 9%, and may be increasing.^{8–10} The literature suggests that between 19% and 50% of these fractures are missed at initial evaluation.⁸ Our literature review revealed that this pattern of injury is rare in children.^{11,12} These observations lead us to ask “what are the

common concomitant injuries presenting with paediatric femur fractures, and moreover, are any commonly missed?”

Injuries associated with femoral shaft fractures are ill defined in the current literature. Many studies examine the proportion of femur fractures that present as poly-traumatized patients, however the other injuries are rarely defined.^{1,5,13–16} Broad categories of associated injuries have been documented, but further description of the injuries has not been performed.^{1,16} Missed injuries, or delayed diagnoses, occur in approximately 1–4% in the general paediatric trauma population.^{17,18}

Materials and methods

Design

Ethical approval was obtained from the Conjoint Health Research Ethics Board to examine the subject's charts. We performed a retrospective chart review, and included patients admitted for femoral shaft fractures between December 2003 and January 2009. This time frame was based upon accruing a reasonable number of subjects based on the average number of femur fracture admissions per year. Patients were identified in a regional trauma database (HDM – Health Records Database) using diagnostic codes (ICD-10-CA). Codes relating to the diagnoses of “fracture of shaft of femur”, “multiple fractures of femur”, and “fracture of femur, part unspecified” were used in the search.

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Codes referring to fractures of other parts of the femur were not included.

Inclusion criteria included paediatric patients from the ages 0–18 years who present to the hospital with a traumatic femoral shaft fracture. Exclusion criteria include previous ipsilateral femur fracture (to avoid cases of early refracture), age > 18, pathologic fracture, metabolic/genetic bone disease, connective tissue disease, fracture as a complication of another treatment, neuromuscular disorder, or malnourishment.

The primary outcome variable of the study is to determine the prevalence of concomitant injuries associated with paediatric femoral shaft fractures.

The secondary outcome variables of the study include: (A) determining which (if any) of these injuries are commonly missed, (B) defining the specifics of the concomitant injuries (type, location) and (C) exploring relationships between patient factors (age, gender), injury mechanism (energy imparted), fracture factors (location, pattern), and concomitant injury factors (presence/absence, type, location).

Chart review

Between December 2003 and January 2009, a total of 202 subjects were identified based on the search criteria above. Of these, 197 subjects were deemed to meet the inclusion and exclusion criteria. The excluded subjects included one with osteogenesis imperfecta, three with cerebral palsy, and one with Ehlers Danlos syndrome. Charts were reviewed to obtain demographic information, mechanism of injury, fracture characteristics, description of associated injuries, and any delay in the diagnosis of the associated injuries.

To facilitate a consistent approach, characteristics of the femoral shaft fracture were recorded as described in the surgeon's dictated operative note. When not enough information was present, admission notes and diagnostic imaging reports were reviewed. Fracture characteristics recorded included mechanism of injury, location of fracture (proximal, middle, or distal shaft), and type of fracture (transverse, oblique, spiral, or comminuted).

Associated injuries were recorded based on dictated operative notes, admission notes, multi-disciplinary progress notes, and discharge summaries. The same sources of information were used

to ascertain any delays in diagnosis of secondary injuries. Data recorded included the area of injury (body region, axial versus ipsilateral versus contralateral), type of injury, and a brief written description of each injury.

One researcher reviewed all charts, and all data was recorded electronically at the time of the chart review.

Statistical analysis

Frequency distribution graphs were created for all appropriate variables, and measures of central tendency, skewness, and dispersion were calculated using standard methods.

Crosstab analysis was used to investigate all relationships between data categories. This included using the Pearson chi-square test and Fisher's exact test.

To determine if any relationship existed between patient age and mechanism of injury, one-way ANOVA testing was performed. The results of this were confirmed using the Kruskal–Wallis test for nonparametric data.

Results

Demographics

In our study group the majority of femoral shaft fractures occurred in males (71%). The mean age of the patients was six, with a range of zero (less than one year old) to seventeen years old (Fig. 1).

Mechanism of injury

For analytical purposes, the injury mechanisms were condensed into two categories based on the energy involved. The injuries were categorized based on a simplified version of that used by Tiderius et al.^{14,19} High-energy mechanisms of injury included: falls from a height (above 0.5 m), motor vehicle collisions, motorized recreational vehicle associated injuries, pedestrian or cyclist versus motor vehicle injuries, and high energy sports (skiing, tobogganing, equestrian, cycling). Low-energy mechanisms included ground level falls, being struck by object (object falls on subject), low energy sports (hockey, football, soccer, etc.), and unwitnessed injuries.

Age Distribution (percent)

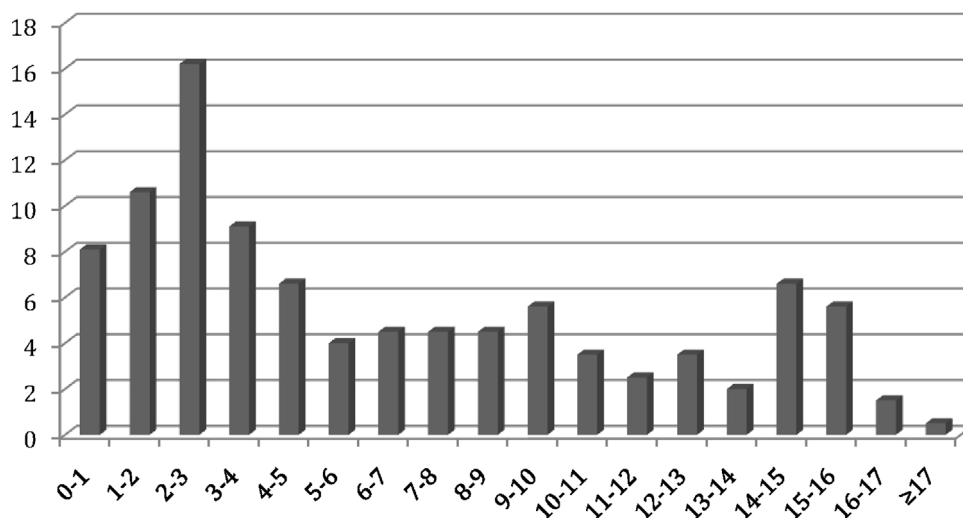


Fig. 1. Age distribution.

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