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High revision rate but good healing capacity of atypical femoral fractures. A comparison with common shaft fractures

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ABSTRACT

Introduction: Healing of complete, atypical femoral fractures is thought to be impaired, but the evidence is weak and appears to be based on the delayed healing observed in patients with incomplete atypical fractures. Time until fracture healing is difficult to assess, therefore we compared the reoperation rates between women with complete atypical femoral fractures and common femoral shaft fractures.
Methods: We searched the orthopaedic surgical registry in Östergötland County for patients with subtrochanteric and femoral shaft fractures (ICD-10 diagnosis codes S72.2, S72.3 and M84.3F) between January 1st 2007 and December 31st 2013. Out of 895 patients with surgically treated femoral shaft fractures, 511 were women 50 years of age or older. Among these we identified 24 women with atypical femoral shaft fractures, and 71 with common shaft fractures.
Results: Reoperations were performed in 6 and 5 patients, respectively, odds ratio 4.4 (95% CI 1.2 to 16.1). However, 5 reoperations in the atypical fracture group could not be ascribed to poor healing. In 3 patients the reoperation was due to a new fracture proximal to a standard intramedullary nail. In 2 patients the distal locking screws were removed due to callus formation that was deemed incomplete 5 months post-operatively. The one patient with poor healing showed faint callus formation at 5 months when the fracture was dynamised and callus remained sparse at 11 months. Among patients with common shaft fractures, 2 reoperations were performed to remove loose screws, 2 because of peri-implant fractures and 1 reoperation due to infection.
Discussion: Reoperation rates in patients with complete atypical femoral fractures are higher than in patients with common shaft fractures. The main reason for failure was peri-implant fragility fractures which might be prevented with the use of cephalomedullary nails at the index surgery. Fracture healing however, seems generally good. A watchful waiting approach is advocated in patients with fractures that appear to heal slowly.

Introduction

It is a common conception that atypical fractures of the femoral shaft heal poorly [1–4]. By definition, atypical fractures show a periosteal callus reaction–although small–indicating that the fracture has been present as an incomplete fracture for some time before it fractured completely with low-energy trauma [5,6]. Many patients with complete atypical fractures show incomplete fractures on the contralateral side [7], often associated with thigh pain, and atypical fractures are often preceded by prodromal pain [8]. All of this suggests that incomplete atypical fractures develop slowly before becoming complete, and that incomplete fractures have a poor ability to heal, similar to other types of stress fractures in cortical bone. There are cases of incomplete fractures that have lasted for years without healing, despite cessation of bisphosphonate treatment [5]. One possible explanation is that long-term exposure leads to severely suppressed bone turnover, which might decrease the anabolic response of the skeleton [4]. Another hypothetical explanation to the poor healing ability of incomplete fractures is based on the observation that the fracture crack is so thin, that even the slightest strain of the bone as a whole will cause disruptive strain within the crack [9–11]. This hypothesis is based on simple biomechanics [10], and one of its implications is that complete fractures would not be affected. If the hypothesis is correct, complete fractures would heal normally, since bisphosphonate treatment per se does

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not affect healing of shaft fractures but only remodelling of healed fractures [12]. The notion that surgically treated complete atypical fractures heal poorly relies mainly on case reports [13,14] and case series [3,4,15,16] without a control group. Therefore, we compared the healing of complete atypical fractures with that of common fractures of the femoral shaft in women of similar age. Healing time is difficult to define and estimate, but the number of reoperations can be objectively recorded. We therefore used the reoperation rate as a surrogate measure for healing. The regional ethics review board approved the study (DNR 2014/407-31).

Methods

We searched the orthopaedic surgical registry in Östergötland County for patients with subtrochanteric and femoral shaft fractures (ICD-10 diagnosis codes S72.2, S72.3 and M84.3F) between January 1st 2007 and December 31st 2013. Follow up data were registered until March 20th 2015. The registry contains personal identification numbers, date of surgery, diagnosis codes and treatment codes. The validity of the registry is considered high but has never been formally evaluated. We identified 895 patients with surgically treated femoral shaft fractures. Of these, 511 were women 50 years of age or older (Fig. 1) and constituted the cohort for investigation. The number of women on all types of bisphosphonates during the study period in Östergötland County was estimated to 3500, and the number of women, 50 years and older who were registered as residents in the County was 85 500.

Inclusion criteria

To identify patients with atypical femoral fractures and common fragility fractures of the femoral shaft we reviewed digitised radiographs of all patients. The classification of fracture types was blinded from all background information. Information on previous medical history and drug treatment was obtained from digitised medical records. Patients with primary or secondary bone tumors, metabolic disorders of the skeleton apart from osteoporosis, and those with any pre-existing hardware in the femur were excluded (Fig. 1). All fractures were associated with low energy trauma.

Patients with atypical femoral fractures were identified by the radiographic pattern consisting of a transverse fracture line on the lateral side of the femoral shaft with focal thickening (callus reaction) around the fracture and no or minimal comminution, according to the American Bone and Mineral Research Taskforce major criteria, 2nd version. [1] Common fractures were defined as spiral, oblique or comminuted shaft fractures below the lesser trochanter and above the supracondylar flare.

Study patients

We identified 28 patients with 31 atypical femoral fractures. In patients with bilateral fractures during the study period only the first fracture was included and patients with incomplete fractures (4 patients) were not included in the analysis. The final cohort consisted of 24 patients with complete atypical femoral fractures, median age 78 years (range 62–84 years, SD 8.3 years) and 71 patients with common fractures, median age 85 years (range 50–94 years, SD 8.4 years).

Patients with atypical femoral fracture used bisphosphonates more often (83%), mean duration of use 6.5 years (range 1–16 years, SD 4 years) compared to those with common shaft fractures (11%), mean duration of use 4.9 years (range 2–7 years, SD 1.9 years). The mean follow-up time for patients with atypical fractures and common shaft fractures was 3.5 years (range 8 months to 7.3 years) and 3.1 years (range, 1 month to 7.3 years).

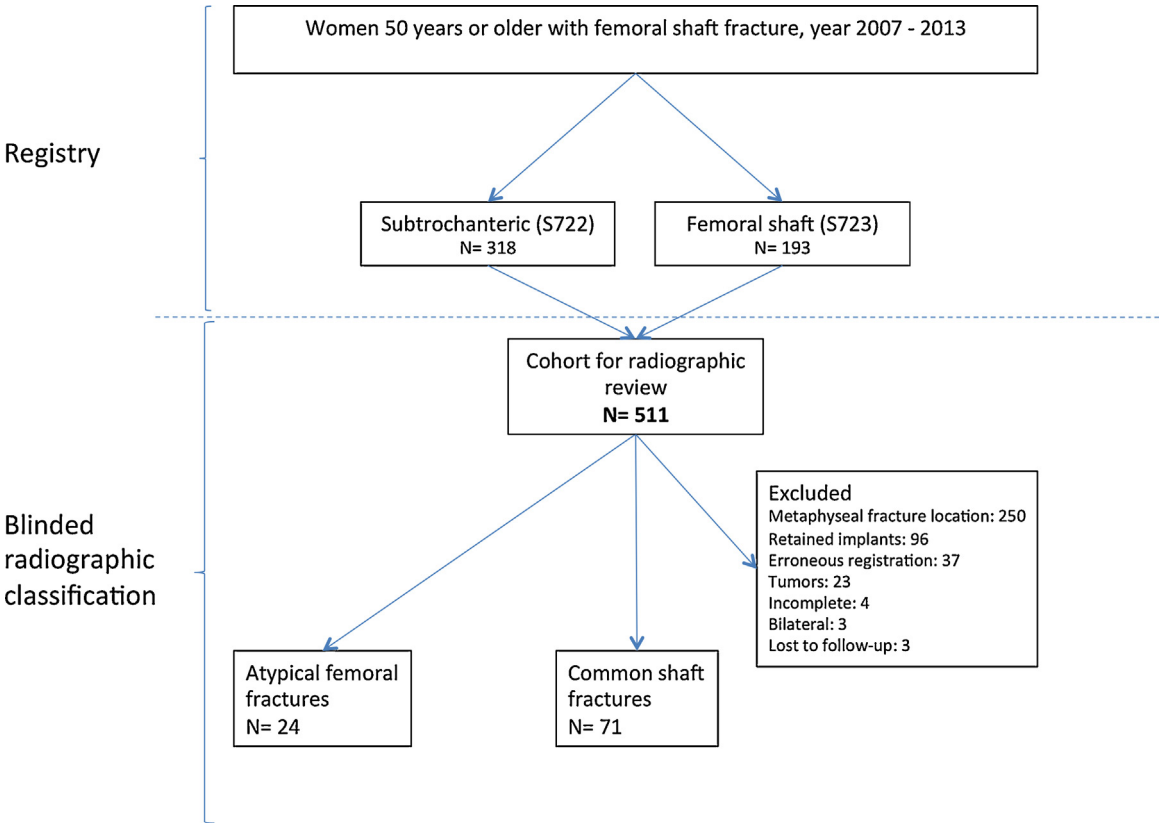

Fig. 1. Identification of patients with atypical femoral fractures and common shaft fractures in the study population.