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Outcomes between older adults with atypical and typical femoral fractures are comparable

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ABSTRACT

Introduction: Atypical femoral fractures (AFFs) are rare but a serious complication associated with prolonged use of bisphosphonates. However little is known about clinical outcomes of AFFs. The aim of this study is to compare the characteristics and postoperative outcomes between older patients with AFFs and typical femoral fractures (TFFs).

Methods: A retrospective matched cohort study (each AFF was age- and sex-matched with three TFFs) of patients aged 65 years or older who were admitted to The Queen Elizabeth Hospital, South Australia between January 2011 and December 2013 was undertaken. Baseline characteristics of both groups were compared. The primary outcomes evaluated were level of independence in mobility at discharge and 3 months after surgery. Secondary outcomes included length of hospital stay, post-operative complications, rate of surgical revision, discharge destination (after acute hospital stay or rehabilitation), 28-day hospital readmission and 12-month mortality.

Results: Ten patients (mean age: 78.1 years) with AFFs were compared with 30 matched TFFs. Patients with AFFs were predominantly female (90%) and 80% had been taking oral bisphosphonate. Nine of the AFFs had their fractures fixed with an intramedullary (IM) nail. The level of independent mobility at discharge (OR 0.31; 95%CI: 0.06–1.71; $p = 0.26$) and at 3 months (OR 0.51; 95%CI: 0.10–2.53; $p = 0.47$) were comparable between the two groups. Only one AFF patient treated with plate and screws required surgical revision, compared with none in the TFF group. Secondary outcomes were not significantly different between the two groups.

Conclusion: Recovery of mobility and reoperation rates after surgery of patients with AFFs were favourable and did not differ significantly from TFFs. Further consideration should be given to using IM fixation in the management of AFFs in older people.

Introduction

The use of bisphosphonates has been increasing because of an ageing population confronted by a rising prevalence of osteoporosis [1]. Evidence from clinical trials supports the effectiveness of bisphosphonates in reducing the risk of vertebral and non-vertebral fractures in postmenopausal women and older men with osteoporosis [2]. However, over the last decade, growing evidence has supported a link between bisphosphonates use and atypical femoral fractures (AFFs), especially after prolonged exposure [3,4].

AFFs differ from typical femoral fractures (TFFs) in at least three main ways: mechanism, location of fracture and radiological appearance [5,6]. AFFs involve low-velocity impact and are mostly subtrochanteric in location [5,6]. Radiologically, the fracture is either transverse or short oblique with minimal or no comminution, and has features of localized lateral periosteal reaction and cortical thickening [5,6]. The standardized identification of AFFs is currently based on the revised American Society of Bone and Mineral Research (ASBMR) task force definition, published in 2014 [6].

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Despite the increasing recognition of AFFs, surgical management, postsurgical complications and healing rates of this atypical fracture have not been well documented [7]. Only a few studies have examined the postoperative outcomes of AFFs but results have been conflicting [8,9]. One retrospective cohort study of 33 female patients with AFFs reported that fracture union after surgery was slow and many experienced prolonged period of immobility [9]. However, another study reported generally a favourable healing rate [10].

No study has so far compared other postoperative outcomes, including length of stay, change in residential destination post discharge and readmission rates between AFFs and TFFs in older people. Therefore this retrospective matched cohort study aims to compare the characteristics and postoperative outcomes between AFFs and TFFs among patients aged 65 years and above in an Australian hospital. We hypothesized that older patients with AFFs have poorer postoperative outcomes compared to those with TFFs.

Patients and methods

Study design and patient selection

A retrospective matched cohort study of eligible patients aged 65 years or older with hip fractures admitted to the orthopaedic unit at The Queen Elizabeth Hospital (TQEH), a general hospital in South Australia, between 1 January 2011 and 31 December 2013, were included. The institutional Human Research Ethics Committee approved this study (approval number: HREC/14/TQEHLMH/253).

Using the local hip fracture database, patients with subtrochanteric fracture and fracture of femoral shaft were identified by the International Classification of Diseases (ICD) 10 codes for these type of fractures (S72.2 and S72.3, respectively). Patients were classified as having AFFs if their fractures met the revised criteria [6]. To be considered atypical, the location of fracture must be below the lesser trochanter to just above the supracondylar condyles and four out of five major features must be present which include: (a) fracture is associated with minimal or no trauma (fall from standing height or less), (b) fracture line originates at the lateral cortex and can be transverse in orientation or oblique as it progresses medially, (c) complete fractures extending to both cortices, (d) fracture is non-comminuted or minimally comminuted and (e) presence of localised periosteal or endosteal thickening of the lateral cortex ('beaking' or 'flaring') [6].

The control group consisted of three patients with TFFs who were randomly selected to match for age and sex with each case of AFF from the same study period. TFFs are defined as fractures located at the subtrochanteric or femoral shaft region in the absence of any atypical features described above. A radiologist who was blinded to the clinical history independently performed the classification into AFFs or TFFs.

Patients who had (a) high-energy trauma, (b) fractures associated with malignancy or other bone diseases except for osteoporosis (i.e. Paget's disease or osteomalacia) and (c) periimplant fractures were excluded from this study.

Management approach

All hip fractures included in this study were treated surgically but the orthopedic surgeons determined the types of fixation device. Postoperatively, patients were allowed to weight-bear as tolerated and they received physiotherapy on a daily basis from Day 1 after surgery. Use of bisphosphonate was discontinued once AFF was diagnosed.

Data collection

The following data were extracted by reviewing medical records: patients' demographic information; circumstances and subtypes of fractures; comorbidities; type and duration of bisphosphonate used; other medications used prior to fracture and type of surgical procedure. The Charlson's comorbidity index (CCI) was calculated according to the original description [11].

Outcome variables

The primary outcome evaluated was mobility at discharge and three months after surgery. Secondary outcomes included length of hospital stay, post-operative complications, rate of surgical revision, discharge destination (after acute hospital stay or rehabilitation), 28-day hospital readmission and 12-month mortality.

Mobility status was classified into two groups: (a) independent or minimal assistance, or (b) moderate to total dependence. Minimal assistance included patients using walking aid but did not require physical help. Moderate assistance included patients using walking aid and required physical help. This information was obtained from clinical records. Patients' discharge destination was obtained from their discharge summaries.

Postoperative complications were categorized into orthopaedic and non-orthopaedic related ones. Orthopaedic-related complications were any that were directly related to the surgical procedure, including surgical site infection and postoperative anaemia. Non-orthopaedic complications were those not directly related to surgical procedure such as delirium, infections other than surgical site, acute cardiac or respiratory adverse events.

Data on length of acute hospital stay and readmission within 28 days and a year of discharge were obtained from patients' medical records. Information about mobility at 3 months was obtained from medical records of follow-up clinic attendances and any hospital readmissions in close proximity to this time point. Information on 12-month mortality was retrieved from the Birth, Marriages and Deaths Registry in South Australia.

Statistical analysis

Continuous data were expressed as mean with standard deviation or median with interquartile range (IQR). Categorical data were described as count and percentages. Any differences in clinical characteristics and clinical outcomes among subjects with AFFs and TFFs were compared using the Student's *t*-test for continuous variables and Fisher's or chi-square tests, as appropriate, for categorical variables to evaluate any univariate association. Odds ratio (OR) is presented with 95% confidence interval (CI) and *p* values. A two-sided *p* value of <0.05 was considered statistically significant. Analyses were performed using Statistical Package for Social Sciences Version 21.0 (SPSS Inc, Chicago, IL, USA).

Results

During the study period, 710 patients were admitted with hip fractures to TQEH, of which 55 patients were subtrochanteric and femoral shaft fractures. Fig. 1 shows 10 patients were found to have features of AFFs consistent with the revised ASBMR Task Force criteria. Thirty age and sex matched controls were selected from the remaining patients with TFFs (Fig. 1). AFFs represented 1.4% of all hip fractures but 18% of subtrochanteric and shaft fractures managed at this institution during the study period.

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