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Audit of Atypical Femoral Fractures and a Description of Some of Their Features

Kevin Lian, MD^a, Jacques Trollip, MD^a, Supna Sandhu, MD^b, Mandana Moosavi, MD^b,
Amninder Gill, BEng^c, David Kendler, MD, FRCPC^b, Larry Dian, MD, FRCPC^b,
Brian Lentle, MD, DSc(hc), FRCPC^{a,d,*}

^aDepartment of Radiology, University of British Columbia, Vancouver, British Columbia, Canada

^bDivision of Endocrinology, University of British Columbia, Vancouver, British Columbia, Canada

^cBC Women's Health Centre, Vancouver, British Columbia, Canada

^dPrivate Consultant, The Project Management Institute, Canadian West Coast Chapter, Vancouver, British Columbia, Canada

Abstract

Purpose: Atypical femoral fractures (AFF) are recently described events related to osteoporosis and, potentially, a rare result of anti-resorptive treatment.

Methods: We set out to audit the diagnosis of AFF in an acute hospital. Charts and radiographs were reviewed retrospectively from patients diagnosed with subtrochanteric femoral fractures according to hospital discharge coding at Vancouver General Hospital (VGH), Canada, from January 2005 to March 2013.

Results: A total of 3084 patients were discharged from the hospital with a diagnosis of hip fracture between 2005 and 2013. Of these, 204 were coded as having had subtrochanteric fractures; 178 of the patients thus coded had radiographic evidence of other fracture types—usually intertrochanteric fractures. Eleven patients did not have available radiographs. Of the remaining 193 patients whose radiographs were reviewed, 24 (12.4%) fulfilled the published criteria for AFF.

Our observations were: 1) laterality: 13 of 24 AFF (54.2%) were right-sided; 2) there was only one incomplete AFF in this series: a completed fracture was an inclusion criterion, but 1 patient with an AFF had both that fracture and an incomplete fracture and further foci of periosteal or endosteal foci of new bone (PENB) involving the contralateral femur; 3) radiologists had only diagnosed AFF in only 1 of the 24 patients with characteristic radiographic signs of AFF; 4) all but 1 patient had a focus of periosteal and/or endosteal new bone (PENB) through which the fracture line invariably passed, and in the 1 exception the radiography was too poor to be sure of this but there was a symmetrical contralateral focus of PENB; 5) in 19 of 24 patients there was an adequate image of part of the contralateral femur and of these 12 (63%) had a contralateral focus of PENB situated ± 2.5 cm from the index lesion site when measured from the upper aspect of the greater trochanter, and in another patient a prior fracture of the contralateral femur had been treated surgically and it was at a symmetrical contralateral location from the index fracture.; 6) in 3 of the 19 patients multiple foci of PENB were detected on the lateral aspect of the contralateral femur even though the examination was of limited extent; and 7) AFFs were associated with bisphosphonate medication in 75% of the patients studied.

Conclusions: Hospital discharge coding misclassified a great majority of femoral fractures as subtrochanteric. As an essential criteria for diagnosing AFF is their subtrochanteric location, this misclassification impaired our ability to retrospectively search for AFF patients. Radiologists tended not to report AFF when typical radiographic characteristics were present. Bilateral and multifocal disease is of interest in pointing to the diagnosis and in suggesting that the mechanism of injury in respect of these unusual fractures is more complex than simple low-energy trauma.

Résumé

Objet : Les fractures atypiques du fémur ont récemment été décrites comme des phénomènes associés à l'ostéoporose et, possiblement, comme un contrecoup peu fréquent d'un traitement par inhibiteurs de la résorption osseuse.

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* Address for correspondence: Brian Lentle, MD, DSc(hc), FRCPC, 740-205 Kimta Road, Victoria, British Columbia V9A 6T5, Canada.
E-mail address: blentle@shaw.ca (B. Lentle).

Méthodes : Nous avons entrepris de vérifier les fractures atypiques du fémur qui ont fait l'objet d'un diagnostic dans un hôpital de soins de courte durée. Nous avons examiné, de façon rétrospective, les dossiers et les radiographies de patients qui, selon les abrégés de sortie de l'Hôpital général de Vancouver, au Canada, ont reçu un diagnostic de fractures sous-trochantériennes du fémur entre janvier 2005 et mars 2013.

Résultats : Au total, 3 084 patients ont été associés à un diagnostic de fracture de la hanche à leur sortie de l'hôpital au cours de la période visée. Parmi ceux-ci, 204 affichaient des codes de fractures sous-trochantériennes. De ce nombre, 178 présentaient des caractéristiques radiographiques évoquant d'autres types de fractures—pour la plupart des fractures intertrochantériennes. Onze dossiers ne renfermaient aucune radiographie. Parmi les 193 autres patients dont les radiographies ont été analysées, 24 (12,4 %) ont satisfait aux critères publiés de fracture atypique du fémur.

Nos observations sont les suivantes : 1) Latéralité: 13 des 24 fractures atypiques du fémur (54,2 %) touchaient le côté droit. 2) Une seule fracture était incomplète: bien que les critères d'inclusion englobaient les fractures complètes, un des patients présentait à la fois une fracture atypique complète du fémur et une fracture incomplète avec foyer de nouveau tissu périostique et endostéal (NTPE) du fémur controlatéral. 3) Les radiologistes n'ont diagnostiqué qu'un cas de fracture atypique du fémur parmi les 24 patients qui présentaient des caractéristiques radiographiques évocatrices d'une telle fracture. 4) Tous les patients sauf un présentaient un foyer de NTPE traversé par un trait de fracture. Nous n'avons pas été en mesure de nous prononcer pour le cas d'exception en raison de la piètre qualité des images, mais un foyer controlatéral symétrique de NTPE a été observé. 5) Parmi les 24 patients, 19 comptaient une image adéquate d'une partie du fémur controlatéral. De ce nombre, 12 (63 %) présentaient un foyer controlatéral de NTPE situé à $\pm 2,5$ cm de la lésion de référence (mesuré à partir de la face supérieure du grand trochanter). Chez un autre patient, les images ont révélé le traitement chirurgical d'une fracture antérieure du fémur opposé dont l'emplacement était symétrique et controlatéral à la fracture de référence. 6) Des foyers multiples de NTPE ont été décelés sur la face latérale du fémur controlatéral chez 3 des 19 patients, malgré la portée limitée de l'examen. 7) Dans 75 % des cas étudiés, les fractures atypiques du fémur ont été associées à une pharmacothérapie à base de bisphosphonates.

Conclusions : La majorité des fractures fémorales ont été codifiées à tort comme des fractures sous-trochantériennes dans les abrégés de sortie de l'hôpital. L'un des critères qui régissent le diagnostic d'une fracture atypique du fémur est son emplacement sous-trochantérien. La classification erronée des fractures a miné notre capacité à retrouver les patients présentant une fracture atypique du fémur. Nous avons relevé une tendance à ne pas déclarer les fractures atypiques du fémur malgré la présence de caractéristiques radiographiques évocatrices. Les affections bilatérales et multifocales peuvent aiguiller le diagnostic. Elles révèlent aussi que le mécanisme de blessure associé à ces fractures inhabituelles est plus complexe que celui d'un simple traumatisme de faible intensité.

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Key Words: Osteoporosis; Atypical fractures; Femora; Multifocal disease; Bisphosphonates; Audit

Osteoporotic fractures are a burgeoning cause of morbidity and mortality in Western populations, a situation likely to increase given the aging demographic [1]. Bisphosphonates (BP) are effective at preventing bone loss, increasing bone strength, and preventing fractures and to date have been the mainstay of treatment for postmenopausal, male, and glucocorticoid-induced osteoporosis [2]. With increasing BP use, reports began to appear in 2005, suggesting that they may be associated with an uncommon and previously unrecognized type of fracture of the proximal femur [3]. These fragility fractures of the subtrochanteric region of the femur were called atypical femoral fractures (AFF) [4]. Numerous reports have subsequently confirmed the characteristics of this type of fracture [5–15] and suggested that they are related in some, but perhaps not all cases, to bisphosphonate therapy—a matter that remains controversial [16].

Prior to AFF, patients may complain of thigh or groin discomfort. The fractures themselves are characterized by their subtrochanteric location, transverse orientation, foci of peri- or endosteal new bone (PENB) on the lateral femoral cortex at the site of the fracture, and commonly with medial spikes of bone but little or no comminution. Incomplete AFF also occur and these may reveal focal periosteal or endosteal reaction with cortical lucent lines as incomplete (“stress”) fractures—potential precursors of overt fracture [17,18], although not

all such lesions progress to fractures. Rarely bones other than the femora may be involved [19]. More recently there have been reports of AFF in patients treated with denosumab [20,21].

To better define AFFs, in 2010 the American Society of Bone and Mineral Research (ASBMR) developed an initial case definition for the diagnosis of AFF [22] and then updated this in 2014 [23]. These definitions included both major and minor criteria. The most recent definition requires 4 of 5 major criteria to be present [23]. The later major criteria are that the fracture be in a location distal to the lesser trochanter, it results from minimal precipitating trauma, only minor amounts of comminution accompany the fracture, it is a largely transverse fracture possibly with a medial spike, and it extends through the either the entire bone or cortex. To date, no studies have directly compared these 2 sets of criteria, which differ in that to fulfill the new criteria 4 of the 5 features are required, with the presence of a focus of PENB being elevated to a major criterion. Cortical thickening has remained a minor criterion in both case definitions with its usefulness limited by the lack of data about the expected normal ranges. The newer case definition also specifies the required degree of fracture obliquity [23].

Meanwhile radiological analyses and pedagogical guides to the recognition of various features of AFFs have also been published [17,24–29].

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