Stress Fractures of the Distal Femur Involving Small Nonossifying Fibromas in Young Athletes

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abstract

Small nonossifying fibromas (ie, fibrocortical defects) are incidental findings commonly seen on radiographs of young patients evaluated for extremity pain or sport-related trauma. Although pathological fractures have been reported in larger lesions, the subcentimeter, intracortical defects are not generally thought to predispose to pathological fractures. The authors report on 2 young athletes who presented with knee pain after initiating conditioning exercise programs (cross-training). Both were diagnosed with transverse metaphyseal stress fractures involving fibrous cortical defects of the distal femur. Initial radiographs were interpreted without evidence of fractures. However, subsequent magnetic resonance imaging was informative, suggesting that magnetic resonance imaging may have value in identifying potential stress reactions in young athletes. In addition, subsequent plain radiographs of both patients showed subperiosteal new bone formation in these nondisplaced fractures, suggesting that serial radiographs and close clinical follow-up are warranted for patients with persistent symptoms. The authors propose that, in the appropriate clinical setting, the presence of a small nonossifying fibroma may be a clinical indication that further evaluation is needed when plain radiographs show normal findings, as the defect could be an unrecognized area of fracture initiation. [Orthopedics. 2016; 39(6):e1197-e1200.]

Case Report

Continued interest in childhood sports programs and increased emphasis on organized, sport-specific training may have effects on the immature skeleton that have not been fully elucidated, raising the possibility that increased levels of awareness by treating physicians may be warranted. Small nonossifying fibromas, previously called fibrous cortical defects, are thought to be caused by a benign and self-limited process, affecting the immature skeleton. These small lytic lesions are usually well-recognized radiographic abnormalities, which commonly resolve without long-term sequelae. In contrast, stress reactions and fractures can develop, often in normal bone, as overuse phenomena, which can be associated with training regimens; these may be difficult to diagnose in younger athletes. The authors report on 2 cases in which young, dedicated athletes developed deep and persistent leg pain associated with their sport and sport-related conditioning programs.

Case Reports

Patient 1

A healthy, 13-year-old boy presented with right knee pain and limp that began shortly after he started training for basketball season. Physical examination revealed tenderness along both femoral condyles without swelling. Radiographs ordered by his primary care physician showed a small fibrous cortical defect at the medial aspect of the right distal femur (Figure 1). Because of the limp and persistent pain, he was removed from sports.

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Radiographs obtained 3 weeks later revealed a periosteal reaction and linear sclerotic density through the distal metaphysis extending to the nonossifying fibroma in the medial femoral cortex (Figure 1). Subsequent magnetic resonance imaging confirmed the diagnosis of a fracture but raised suspicion of a potential underlying malignant process (Figure 2). After being evaluated in a pediatric tumor center, the patient was treated conservatively with activity restriction, limited weight bearing, and crutches.

At the 3-week follow-up, the patient reported poor compliance with his weight-bearing restrictions and continued pain and tenderness in his right knee. He was treated with a long leg cast and had complete resolution of pain and tenderness following 3 additional weeks of cast immobilization. Subsequent radiographs showed healing of the fracture with mature callous formation and progressive remodeling of the cortical defect (Figure 1). Within 3 months, the patient returned to full activity without restrictions (including basketball), having complete resolution of pain. One year following presentation, he had no recurrent symptoms or progression of the cortical defect.

Patient 2

A healthy, 13-year-old boy was referred to the orthopedic oncology program after reporting morning stiffness and right knee pain that worsened with sport-related activities. Prior to the onset of symptoms, the patient, at the suggestion of his coach, began running cross country to prepare for the basketball season. He continued to play basketball for the 3 weeks, presuming that he had developed a “knee strain,” and intermittently treated his symptoms with ice and nonsteroidal anti-inflammatory drugs. Radiographs from the original evaluation revealed a small radiolucent lesion consistent with a fibrous cortical defect of the medial right distal femur (Figure 3).

By the time of his specialty consultation, the patient had full range of motion without tenderness or swelling of the right knee. He had stopped both cross-country running and basketball 3 weeks previously, having eventual resolution of the pain. Repeat radiographs failed to show significant abnormalities or a change in the benign-appearing radiolucency. The patient was allowed to return to regular activities, including sports, with a clinical diagnosis of an overuse injury to the knee.

Three months later, all activity-related pain had resolved; however, radiographs obtained at the follow-up appointment...
showed signs of periosteal reaction and healing of a previously unrecognized, transverse fracture of the distal femur that involved the fibrous cortical defect seen on the original radiographs (Figure 3). The patient continued active participation in sports, without recurrent symptoms, 6 months following the injury. Radiographs obtained 1 year after the fracture showed additional remodeling, normal physal growth, and no recurrence (Figure 3).

**Discussion**

Metaphyseal fibrous defects are the most common benign tumors of bone and have been estimated to be present in up to 30% of children prior to skeletal maturity. These benign tumors are characteristically found in the metaphysis of long bones and are commonly subdivided into the smaller, fibrous cortical defects (10 to 30 mm and involving only cortical bone) and the typically larger, nonossifying fibromas that involve the medullary cavity. Metaphyseal fibrous defects have a diagnostic appearance of a radiolucent lesion with a thin and well-demarcated rim of sclerotic bone. They typically involve the cortex and are located eccentrically.

The natural history of fibrous cortical defects is progressive involution with skeletal maturity. However, there have been multiple reports of pathological fractures associated with nonossifying fibromas, which generally occur through larger lesions. The degree of cortical weakening and probability of fracture is hypothesized to be proportional to the dimensions of the defect. Arata et al suggested that the risk of pathological fracture warrants prophylactic intervention when the defect exceeds 50% of total diameter in weight-bearing bones or is greater than 33 mm. In their retrospective review, Shimal et al identified 12 patients during 18 years with stress fractures involving nonossifying fibromas. Among those patients sustaining fractures, the involved nonossifying fibromas had a mean length of 30 mm, with anteroposterior and lateral average measurements of 12.5 mm and 16 mm, respectively. In addition, a biomechanical study showed decreased torsional bone strength with cortical defects greater than 20% of bone diameter, but did not identify a significant effect on bone strength with defects of 10% or less of bone diameter.

Stress fractures are most common in the lower extremities of athletes engaged in high-volume, repetitive activities that involve running, jumping, skating, or marching. The prognosis for such stress reactions is good, with most patients returning to pain-free activity after treatment. However, some stress reactions can progress to frank fracture and may predispose, in high-risk lesions (such as the tibial shaft), to delayed unions or nonunions. Optimal management of stress fractures in athletes requires a balance between deconditioning from activity limitations and avoiding complete fractures or nonunion. One method guiding treatment is stratification into risk groups based on the anatomic location, fracture recurrence rate, and forces placed on a fracture pattern. A lack of consensus persists regarding appropriate methodology for evaluating a suspected stress fracture. Conventional radiographs are most commonly used initially. However, they lack sensitivity and may lead to false-negative results, particularly in the early stages, when the false-negative rate has been estimated to be as high as 85%. In contrast, magnetic resonance imaging represents the most sensitive and specific evaluation and, compared with nuclear scintigraphy, computed tomography scans, and conventional radiographs, limits ionizing radiation exposure. On the basis of a meta-analysis of imaging modalities, Wright et al proposed an algorithm for the evaluation of suspected stress fractures. They recommend using magnetic resonance imaging when conventional radiographs are uninformative for high-risk locations.

**Conclusion**

Orthopedic surgeons, pediatricians, and family practice physicians should be familiar with the diagnosis and natural history of metaphyseal fibrous defects because of their prevalence among skeletally immature patients. Given the relatively common occurrence of these small abnormalities, often found incidentally on radiographs obtained to evaluate injury or pain, only a few may be associated with stress fractures. However, the high rate of false-negative (ie, normal) findings on plain radiographs during radiographic workup of suspected stress fractures may indicate that further study is needed if symptoms are out of proportion or do not resolve promptly. An occult stress fracture in a young athlete may require further evaluation with magnetic resonance imaging for persistent activity-related pain, particularly in the presence of a potential stress riser such as a small metaphyseal fibrous defect that in all other respects appears completely benign. The prompt and accurate diagnosis of a stress fracture is particularly important for young athletes, who desire a quick return to full activities and who, without intervention, may be at an increased risk for recurrent stress reactions or frank pathological fractures.

**References**


