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RCR RADIOLOGY CASE REPORTS

Musculoskeletal

Post-traumatic osteochondroma of the distal femur

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ABSTRACT

Osteochondroma are the most common benign primary bone tumor. They are bony outgrowths surrounded by a characteristic cartilaginous cap, most commonly arising from the long bones. They are most often asymptomatic, usually discovered as incidental findings before the third or fourth decade of life. Although the exact pathogenesis is not fully established, there have been reports of these tumors arising after incidents such as fractures, trauma, radiation, and stem cell transplants. There have been only a few cases describing the development of osteochondroma after traumatic events. This report presents a documented case of an osteochondroma arising at the site of a previous femoral fracture, 10 years after the initial trauma.

Introduction

Osteochondromas are a benign bone tumor that most commonly affects long bones such as the femur and tibia. They are estimated to affect 1%-2% of the population, with most cases being asymptomatic. Diagnosis is most commonly made with plain films, but may also be seen on computed tomography (CT) and magnetic resonance imaging (MRI). The exact pathogenesis of is not fully established, but there have been several reported cases of osteochondromas arising after trauma. Here, we present a rare case of an osteochondroma arising at the site of a Salter II fracture of the distal femur 10 years after the initial injury and repair.

Case report

A 24-year-old woman with no pertinent medical history presented to the orthopedics department at our institution with complaints of pain and discomfort in both the anterior and the posterior aspects of her right knee for several months, which is worsened with activity. She had a Salter Harris II fracture of her right distal femur in 2006 at the age of 13 after being involved in a motor vehicle accident. This fracture was repaired with open reduction and internal fixation, with subsequent removal of hardware in 2007.

Her initial X-ray of the symptomatic knee taken at this visit revealed an osseous protuberance arising from the posterior aspect of the distal femoral diametaphysis, suggestive of an osteochondroma. This finding is in the same anatomic location of the prior Salter Harris type II fracture (Fig. 1A and B).

Additional CT image of the right knee taken shortly after the trauma showed fracture through an open physis, demonstrating that the patient exhibited growth potential at the time of trauma (Fig. 2A and B). A radiograph of the left knee from the date of trauma is also provided to demonstrate the unclosed physis (Fig. 3). A radiograph of the right knee shortly after fixation is also provided (Fig. 4A and B).

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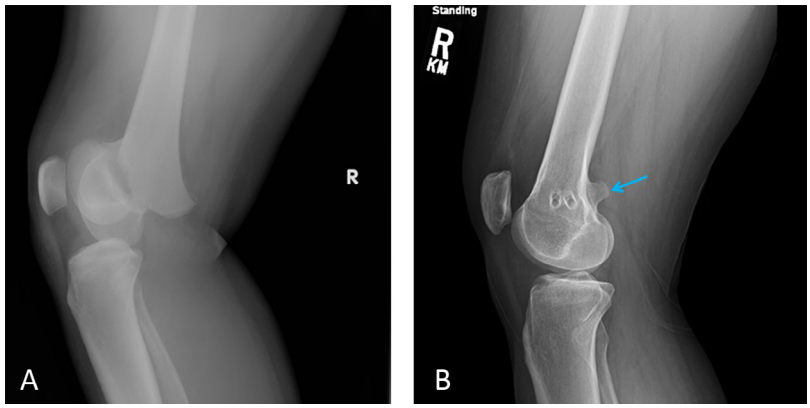

Fig. 1 – (A) Radiograph of right knee taken in emergency department in 2006 shortly after initial trauma. Salter Harris type II fracture is noted. (B) Radiograph of right knee taken approximately 10 years after the initial inciting traumatic event. Note the osseous protuberance (blue arrow) arising from the posterior aspect of the knee, in the same location as the initial fracture.

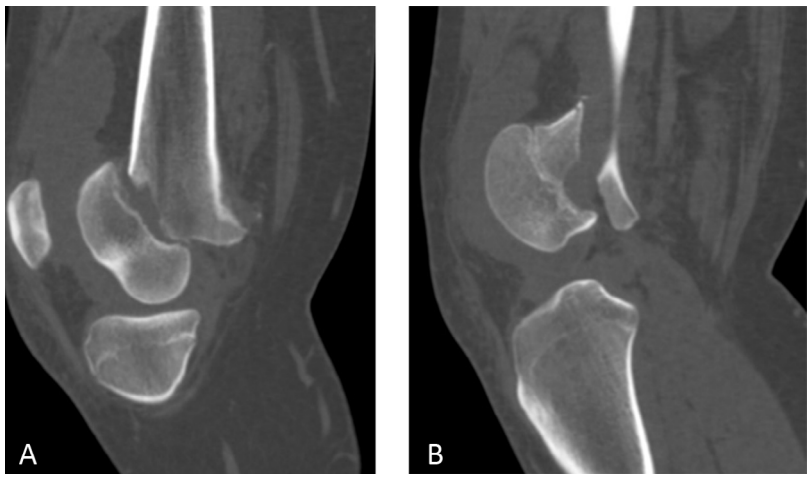

Fig. 2 – Computed tomography (CT) of right lower extremity on the day of initial trauma, showing (A) fracture through the physis of the right femur. (B) Sagittal reconstruction obtained at the same level of the fracture in a more lateral location, showing unfused physis, indicating skeletal immaturity at time of trauma

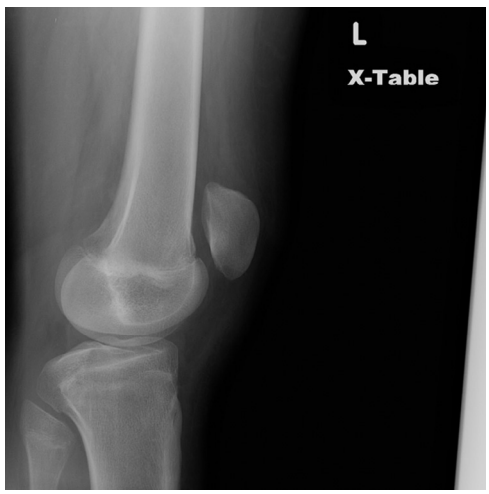

Fig. 3 – Radiograph of left knee from day of trauma, showing open physis, supporting maintained growth potential at time of trauma.

A follow-up MRI of the extremity was performed 1 month after the orthopedics department visit to correlate with the CT examination performed during the initial trauma. This MRI revealed a 1.1 × 1.4 cm osseous protuberance arising from the region of the prior trauma, specifically the posterior medial aspect of the distal femoral metaphysis near the insertion of the adductor magnus tendon. This lesion showed marrow continuity with the adjacent metaphysis, a finding compatible with osteochondroma (Fig. 5A-D).

The patient was managed conservatively with physical therapy and serial follow-ups. Over the course of 6 months, the patient reported improvement in pain with physical therapy.

Discussion

Osteochondromas are the most common benign bone tumor. They are bony outgrowths surrounded by a cartilaginous cap and arise on the external surface of bones [1]. They can occur

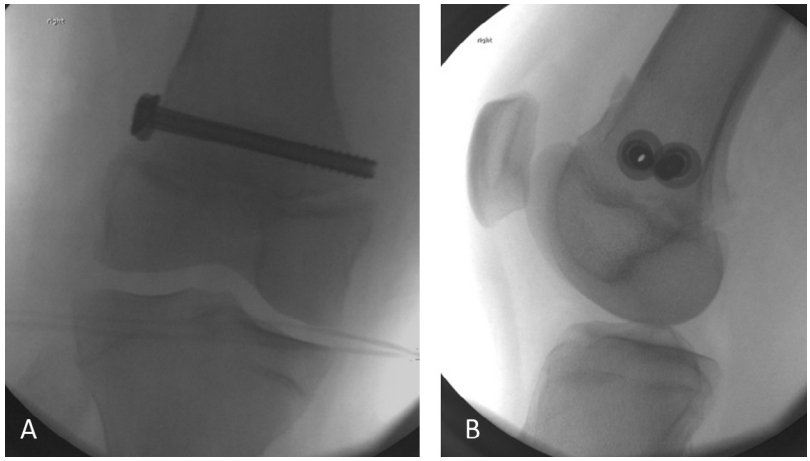

Fig. 4 – (A and B) Radiographs of the right knee status post fixation in 2006.

as single or multiple lesions. Solitary osteochondromas most commonly affect the long bones such as the femur and tibia, but any bone of the body can be affected [1,2]. Multiple osteochondromas present as a part of an autosomal dominant condition known as hereditary multiple osteochondromas [1]. The exact pathogenesis of osteochondromas is still not determined, although there have been multiple theories to explain their development. The Virchow theory is one of the earliest proposed theories, which states that osteochondromas may arise from cartilage that separates from the growth plate [3]. An addition to this theory was made by Keith who suggested that the separation of the cartilage from the growth plate may be caused by some sort of defect in the periosteal cuff of bone that normally surrounds the vacuolating zone of the physis during early life [3]. There have also been studies showing the possible role of genetic mutations such as those in the exostosin

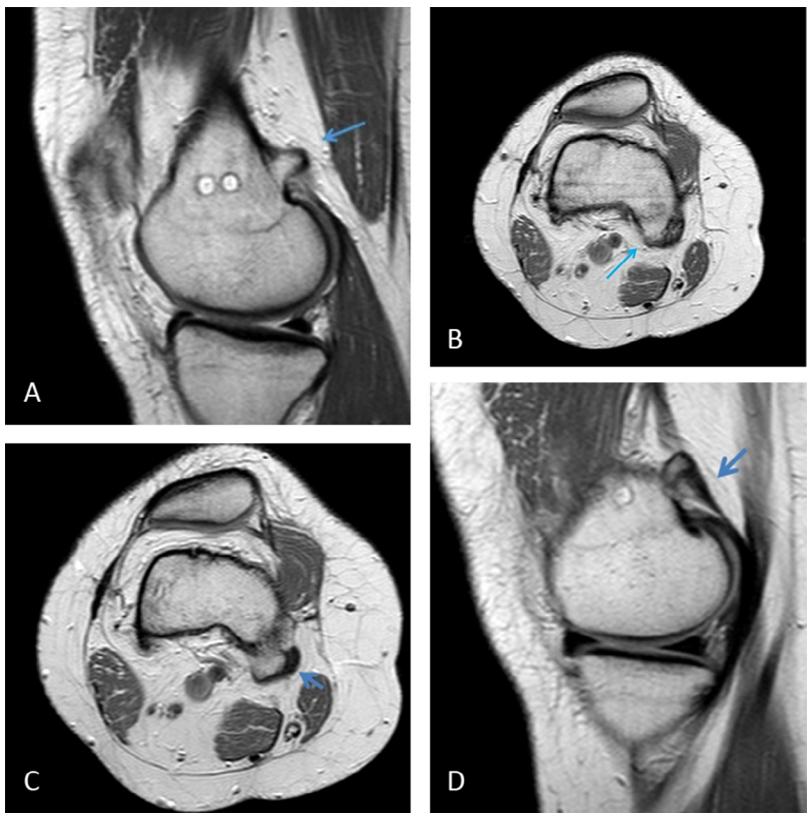

Fig. 5 – T1-weighted magnetic resonance imaging (MRI) images of the same anatomic region in sagittal (A) and axial (B). Cortical and medullary continuity of the lesion is clearly demonstrated, most consistent with an osteochondroma. (C and D) Adductor magnus tendon and medial gastrocnemius tendons, respectively, in close proximity to but with no clear attachment to lesion.

gene, causing accumulation of heparan sulfate proteoglycans within the cytoplasm, which prevent them from participating in the normal diffusion of Indian hedgehog ligands in the extracellular space. This results in loss of normal polarity, causing chondrocytes in the growth plate to grow in the wrong direction [1,4].

Diagnosis of osteochondromas typically begins with radiography. On plain film, the lesion is seen as a bony mass consisting of medulla and cortex [4]. The cortex is continuous with the bone from which it arises [3,4]. The marrow of the source bone can also be seen blending into the spongy portion of the outgrowth [3]. Furthermore, over time, the lesion may appear to be within the metaphysis, separate from the epiphyseal plate [3]. In addition, a common finding is areas of calcification seen within the cartilaginous component [1]. CT and MRI may also be used if the lesion is in areas with more complex anatomy such as the pelvis or shoulder girdle [4]. In addition, these imaging modalities can be used to assess the thickness of the cartilage cap and for planning biopsies [3]. MRI is preferred for imaging of complications arising from osteochondromas [4]. Treatment for osteochondromas is generally surgery if the lesion is symptomatic [1,3].

Osteochondromas most often come to attention before the third or fourth decade of life [2,3]. They usually are asymptomatic and are found incidentally [1]. The most common presentation is a nontender, insidiously growing lump on the bone [4]. Pain may be the presenting symptom, commonly caused by tendonitis or bursitis [3]. They may also result in fractures, deformities of bone, joint problems, as well as compressions of adjacent nerves and blood vessels, resulting in neurovascular symptoms such as numbness, weakness, and decreased pulses [1]. It is reported that osteochondromas affect 1%-2% of the general population, with most cases being asymptomatic. Symptomatic cases tend to be more common in younger patients, with 75% of such cases presenting before age 20. Approximately, 50% of osteochondromas involve the lower limb, with the femur being the most commonly affected bone, comprising 30% of all cases. The humerus is involved in 10%-20% of all cases, and less commonly reported cases in other areas such as the bones of the hands, feet, scapula, and pelvis [4].

Although the majority of these lesions are found incidentally without specific inciting event, there have been reported cases of osteochondromas arising after fractures, trauma, radiation, and hematopoietic stem cell transplants [4]. Specifically, the post-traumatic development of this lesion is presented in only a handful of case reports. The availability of documented images showing the evolution of the injured osseous structure into osteochondroma is exceedingly rare. Only 2 cases involving the distal femur were found during our literature search [5,6]. Of note, other anatomic locations have also been documented, including within the knee, fibula, ankle, and hallux [7–10].

The case presented here demonstrates an osteochondroma arising at the site of a previous fracture at the distal femoral diametaphysis. The continuity of the lesion with the cortex and marrow is strongly suggestive of an osteochondroma vs diagnoses such as heterotopic ossification or post-traumatic cortical thickening. Although osteochondromas have been reported at the site of a previous trauma, there is a scarcity of cases that provide images of lesions, showing progression from an inciting traumatic event to an osteochondroma. As the pathogenesis of osteochondromas is still not fully established, it is important to include this case in the literature to bring more attention to the role of trauma in the development of this tumor.

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