Osteochondral Abnormalities: Pitfalls, Injuries, and Osteochondritis Dissecans

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Osteochondral lesions most commonly occur about the knee but may affect any articular surface of the pediatric appendicular skeleton. Osteochondral lesions include osteochondritis dissecans, osteochondral fractures, and osteochondral abnormalities associated with secondary processes such as Legg-Calvé-Perthes disease. These abnormalities should not be confused with normal subchondral irregularities related to normal epiphyseal ossification. The purpose of this chapter is to review osteochondritis dissecans with emphasis on MRI as well as review other osteochondral lesions that may mimic osteochondritis dissecans.

Osteochondritis Dissecans

Osteochondritis dissecans is a poorly understood entity with multiple proposed causes, including repetitive microtrauma, ischemia, and genetic causes [1]. Osteochondritis dissecans most commonly occurs about the knee, affecting the lateral aspect of the medial femoral condyle (Fig. 1), followed by the weightbearing surface of the lateral femoral condyle (Fig. 2), and less commonly may affect the inferomedial pole of the patella and trochlear fossa (Fig. 3). Osteochondritis dissecans may also occur in the elbow, most commonly affecting the capitellum (Fig. 4). Osteochondritis dissecans may also occur about the talar dome, most frequently affecting the medial talar dome [2] (Fig. 5).

Osteochondritis dissecans is best delineated by MRI. Radiography may be helpful for identifying these lesions but provides little information regarding prognosis and the potential need for orthopedic intervention. On MRI, osteochondritis dissecans usually occurs along the subchondral bone with or without involvement of the overlying articular cartilage, with complete or incomplete fissuring extending from the articular surface to the subchondral bone. MRI features that suggest instability and therefore may be indications for orthopedic intervention include the presence of intraarticular loose bodies (Fig. 4), overlying articular cartilage thinning (Fig. 3), fluid insinuation between the fragment and parent bone (Fig. 2), and junctional cysts between the fragment and parent bone [3] (Fig. 5). Alternative methods for determining stability of osteochondritis dissecans include direct arthrographic administration of contrast material [4]. With direct arthrography, a lesion is considered unstable if there is direct insinuation of contrast material between the lesion and parent bone.

In osteochondritis dissecans of the knee, juvenile osteochondritis dissecans tends to be stable at presentation, whereas adolescent and adult osteochondritis dissecans tend to be unstable at presentation [5]. Prognostic factors related to successful conservative treatment include absence of MRI features of instability, small size, and presence of an open growth plate [5, 6]. Cahill et al. [7] reported that lesions responding to conservative treatment had a mean size of 309.5 mm^2 whereas lesions that failed to heal with conservative treatment had a mean size of 436 mm^2. Separately, De Smet et al. [6] observed that osteochondritis dissecans with a good result had a mean area of 194 mm^2 and those with a poor result had a mean area of 647 mm^2.

Keywords: Legg-Calvé-Perthes disease, MRI, osteochondritis dissecans

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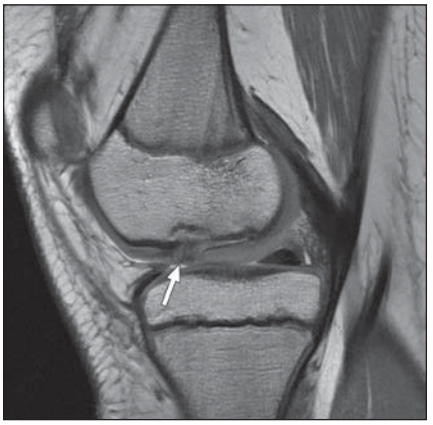
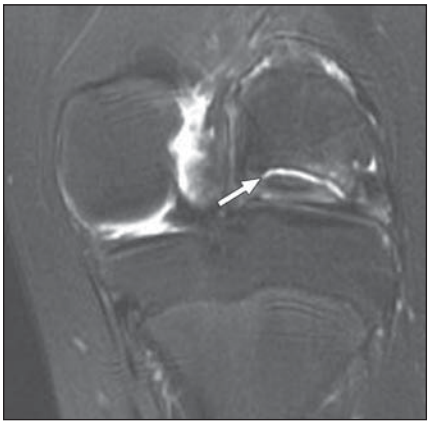
A



B

Fig. 1—10-year-old girl with unstable osteochondritis dissecans affecting the lateral aspect of medial femoral condyle.
A, Coronal proton density–weighted fat-saturated image shows fluid–signal interface between cartilage fragment and parent bone (*arrow*) and subchondral edema (*arrowhead*).
B, Sagittal proton density–weighted image shows overlying cartilage disruption (*arrow*).

A



B

Fig. 2—16-year-old boy with unstable osteochondritis dissecans affecting the weightbearing portion of the lateral femoral condyle.
A, Sagittal proton density–weighted image shows fragmentation and depression deformity.
B, Coronal proton density–weighted fat-saturated image shows fluid insinuation between parent bone and osteochondral fragment (*arrow*), indicative of instability.

In reporting osteochondritis dissecans, the MRI report should address lesion location, lesion stability or instability, size of the lesion, and whether the physis is open or closed as well as determining if there are additional findings, such as meniscal tears, that may contribute to the patient's joint symptoms.

Normal Femoral Condylar Irregularities

Caffey et al. [8] in 1958 observed in asymptomatic pediatric knees that 66% of boys and 41% of girls had subchondral femoral condylar irregularities, most commonly affecting the lateral femoral condyle. Those authors concluded that these are normal variations of ossification of the femoral condyle and should not be construed as representing osteochondritis dissecans. Controversy exists related to the existence of normal femoral condylar irregularities as a distinct entity unrelated to osteochondritis dissecans, particularly when MRI of a child's knee is otherwise unremarkable and there is no explainable cause for the child's symptoms.

In general, femoral condylar irregularities when identified by radiography do not need advanced imaging, such as MRI. If femoral condylar irregularities are identified and are in a typical posterior femoral condylar location (Fig. 6), they should be observed without the need for further imaging. Unlike osteochondritis dissecans, these femoral condylar irregularities will have intact overlying cartilage without evidence of subchondral fissuring or other signs of instability on MRI.

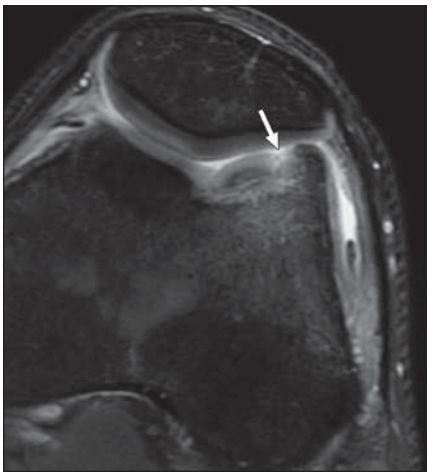


Fig. 3—17-year-old boy with unstable osteochondritis dissecans affecting the trochlear fossa. Axial proton density–weighted fat-saturated image shows lateral trochlear facet osteochondritis dissecans with full-thickness cartilage defect (*arrow*).

Sometimes, femoral condylar irregularities may show marrow edema of the parent bone and femoral condylar irregularity. Provided that there are no additional features to suggest osteochondritis dissecans, the presence of marrow edema should suggest the diagnosis of stress reaction of the femoral condylar irregularity and, less likely, developing osteochondritis dissecans.

Fig. 4—14-year-old boy with unstable osteochondritis dissecans affecting the capitellum.
A, Coronal T1-weighted image shows semicircular capitellar osteochondritis dissecans (*arrowheads*).
B, Sagittal proton density–weighted fat-saturated image shows flattening and cartilage thinning (*arrow*) as well as multiple cystlike lesions within capitellum (*arrowheads*).
C, Sagittal proton density–weighted fat-saturated image also shows loose body (*arrow*) in anterior joint space.

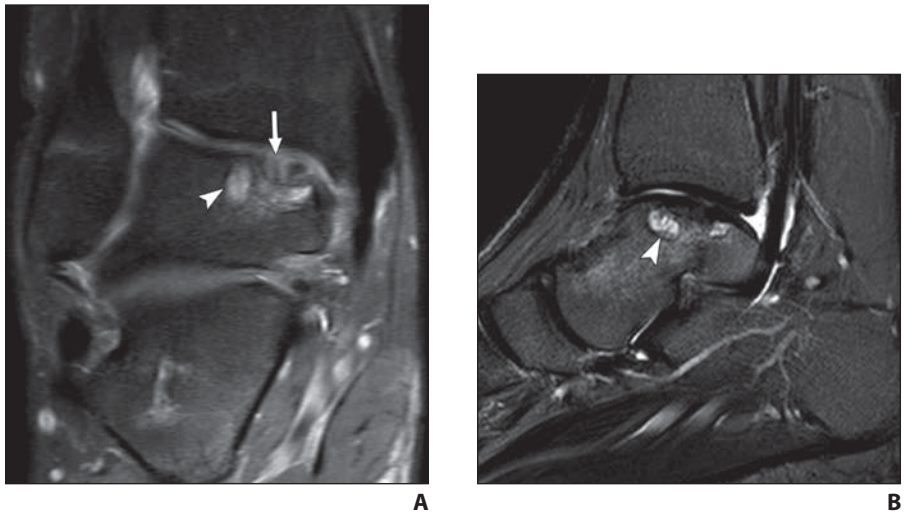


Fig. 5—12-year-old girl with unstable osteochondritis dissecans affecting the medial talar dome.
A and **B,** Coronal proton density–weighted fat-saturated (**A**) and sagittal STIR (**B**) images show junctional cysts (*arrowhead*) and overlying articular cartilage deficiency (*arrow*, **A**).

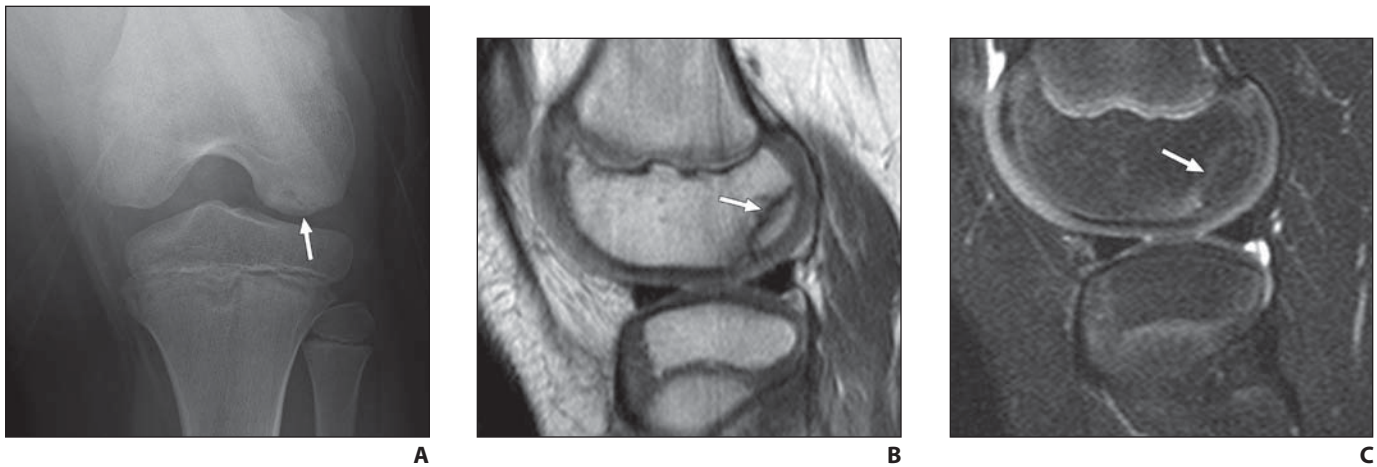
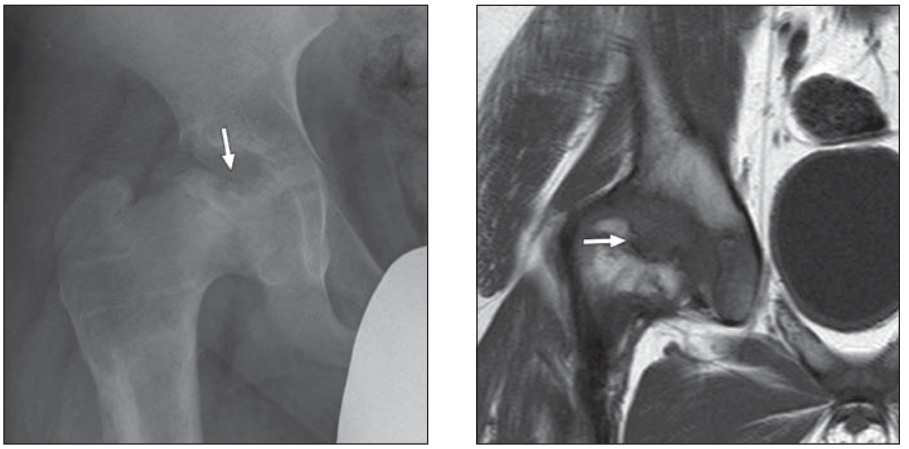


Fig. 6—10-year-old boy with normal femoral condylar irregularity affecting the posterolateral femoral condyle.
A–C, Radiograph (**A**) and sagittal proton density–weighted (**B**) and sagittal T2-weighted fat-saturated (**C**) images show fragmentation of the posterolateral femoral condyle (*arrow*). Note absence of significant marrow edema and overlying articular cartilage is intact.

Fig. 7—11-year-old boy with nondisplaced subchondral fracture of the medial femoral condyle. Coronal proton density–weighted fat-saturated image shows diffuse marrow edema and subchondral fracture line (*arrow*).



A **B**

Fig. 8—9-year-old boy with right-sided Legg-Calvé-Perthes disease.
A and **B,** Radiograph (**A**) and coronal T1-weighted image (**B**) show large central osteochondral lesion (*arrow*) related to Legg-Calvé-Perthes disease.

Other Osteochondral Lesions

Osteochondral fractures related to an acute event should not be confused with osteochondritis dissecans. Findings suggestive of an acute osteochondral fracture include appropriate history and MRI findings such as an acute fracture plane, large joint effusion, and extensive bone marrow edema (Fig. 7).

Osteochondritis dissecans may also occur as a secondary process to other entities. In the hip, osteochondritis dissecans can occur as an isolated finding or in conjunction with a secondary process such as Legg-Calvé-Perthes disease [9] (Fig. 8). When these children present for MRI, a similar descriptive approach as taken for characterizing osteochondritis dissecans should be performed.

Conclusions

Osteochondral lesions encompass a wide spectrum of disorders, including normal variations of femoral condylar ossification. The most common and symptomatic lesion is osteochondritis dissecans, and care should be taken to distinguish osteochondritis dissecans from normal variations of subchondral ossification, osteochondral fractures, or secondary osteochondral lesions related to processes such as Legg-Calvé-Perthes disease.

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