81. Osteochondral Lesions, Knee

Normal articular cartilage consists of three separate zones, variably visualized as distinct layers on fluid sensitive MRI pulse sequences with appropriate spatial resolution. At lower resolutions truncation artifact, which occurs at interfaces of high tissue contrast, may mimic this trilaminar appearance. On T1WI there is little intrinsic tissue contrast between synovial fluid and articular cartilage, therefore FSE T2 or PDWI, which give an arthrographic effect (partially aided by magnetization transfer), are preferred for visualization of articular cartilage defects. Choice of longer echo times can however impair delineation of cartilage from subchondral bone. Other disadvantages with FSE T2WI include the image blur, which can be minimized by reducing echo-train length. Chemical shift effects can be eliminated with fat suppression techniques. The thinness of articular cartilage renders 3D MRI desirable due to the achievable higher spatial resolution without interslice gaps. Postoperative evaluation is optimally performed with FSE imaging. Low field MR has been shown inferior for the detection of cartilaginous lesions due to problems in achieving appropriately high spatial resolution and implementing the above techniques. Direct MR arthrography confirms a detaching fragment when contrast extends underneath the fragment, although the invasiveness of the technique, especially in the serial MR evaluations which are often performed, should be considered.
Cartilaginous injury may be graded from 1-4: Grade 1 injuries correlate with softened cartilage, demonstrating increased SI on MR without a surface defect. The increased SI seen in this cartilage lesion is thought to reflect the increased water and decreased proteoglycan content therein, as well as increasing cartilaginous disorganization. Substance defects of articular cartilage consuming less than or greater than half of cartilaginous thickness constitute Grade 2 and 3 lesions, respectively. Complete absence of articular cartilage or exposed subchondral bone constitutes a Grade 4 lesion. The FSE FS PDWI of Fig. 81.1A demonstrates a 5 mm full-thickness (grade 4) defect at the central aspect of the medial femoral condyle. Adjacent marrow edema—with abnormal high SI—suggests a recent traumatic etiology or subarticular stress reaction related to altered mechanics from the defect. In the same patient, at a more posterior section an internal osteophyte is seen in the subchondral region of the medial femoral condyle (Fig. 81.1B). This term refers to an osteophyte occurring along the articular surface, with bone marrow often filling the entire thickness of the cartilage defect as opposed to typical osteophytes that occur at the joint margin. A large osteochondral lesion is illustrated in Fig. 81.2A,B on sagittal PDWI and coronal FS PDWI, respectively. This lesion involves the lateral femoral condyle and demonstrates subchondral degenerative changes, most prominent on the (A) sagittal PDWI.

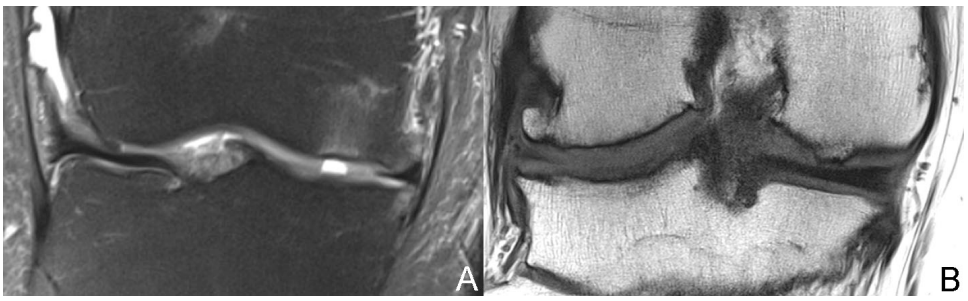

Fig. 81.1

Disruption of the overlying articular cartilage is present anteriorly, while fluid-like SI is seen undercutting the lesion in Fig. 81.2B. The presence of this finding indicates instability, which may lead to lesion dissociation and formation of a free intra-articular joint body. The medial femoral condyle is the most common site of osteochondritis dissecans—an idiopathic osteochondrosis of children and adolescents—typically involving the inner margin. The first MR finding with this disease is the development of subchondral marrow edema demonstrating typical fluid-like SI. A fracture line later develops demonstrating low SI on T1WI and high SI T2WI, respectively, eventually disrupting the articular surface. Instability of such lesions is suggested by fluid-like SI on T2WI along the interface of the fragment and underlying bone marrow, entering the defect from articular cartilage disruptions, and the formation of peripheral subchondral cysts.

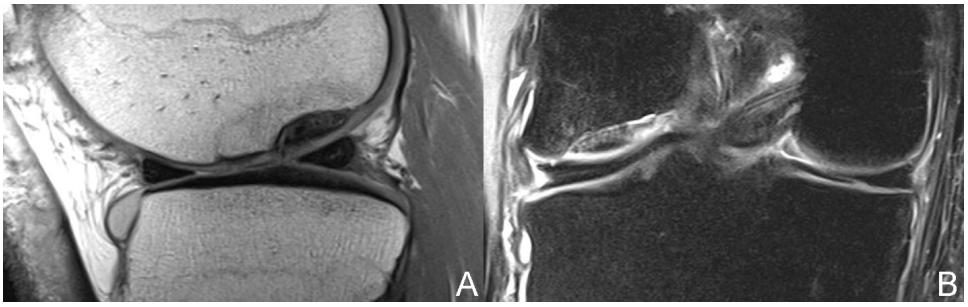

Fig. 81.2

Due to its avascularity, cartilage has a low-potential for independent repair and operative intervention is frequently required. A microfracture repair-type is based on the release of stem cells from underlying marrow when microfractures are induced. This undifferentiated cell population responds by producing fibrocartilage. On MRI, such newly formed cartilage is initially hyperintense, while subjacent marrow edema is present due to the utilized surgical technique. With time the marrow edema should regress with the in-growing fibrocartilage demonstrating hypointense signal. However, if osteoblastic differentiation occurs, reactive bone overgrowth will fill the defect instead of cartilage. Autologous grafts,

often from the intercondylar notch, are utilized for osteochondral transplantation and demonstrate early subchondral edema post-operatively. Persistence of this SI beyond 6 months, continued high SI at the implant interface, or graft collapse raise the concern of rejection. Low SI at the plug periphery may reflect condensation of trabecula if press-fit or osseous integration techniques were utilized. Autologous chondrocyte implantation involves the injection of chondrocytes derived from autologous tissue culture under harvested periosteum. These are held in place over the defect by glue or fibrin. Initial hyperintense transplanted cartilage is seen with subchondral bone edema, findings which diminish thereafter.