

Meniscal ossicle: MR imaging appearance in three patients

Joseph S. Yu, M.D.¹, Donald Resnick, M.D.²

¹ Department of Radiology, Ohio State University Hospitals, Columbus, Ohio, USA

² Department of Radiology, Veterans Administration Medical Center, San Diego, California, USA

Abstract. Meniscal ossicles are rare. Radiographically, these ossicles often are mistaken for intra-articular bodies. We evaluated the application of magnetic resonance imaging to determine whether this technique is efficacious in differentiating meniscal ossicles from intra-articular bodies.

Key words: Meniscal ossicle – MR imaging – Intra-articular body

Focal ossification in the meniscus of the human knee is a rare phenomenon, although such ossicles may commonly be found in animals such as rodents [1, 2]. The cause of these ossicles is controversial. Because they can mimic intra-articular bodies, various imaging methods have been applied to aid in their diagnosis, but often at the expense of significant time or radiation exposure of the patient [3, 4]. Many patients eventually require arthroscopy or arthrotomy, to search either for an intra-articular body or for causes of internal derangement [5–11]. Recently, the use of magnetic resonance (MR) imaging in a single patient allowed the unequivocal diagnosis of a meniscal ossicle [12]. The MR imaging findings in the patients with meniscal ossicles are summarized in this article.

Materials and methods

We encountered a 49-year-old man with chronic left knee pain of several years' duration that had become worse in the past 3 months. Frontal and lateral radiographs of the knee demonstrated an 8×6 mm ossific density projected in the posteromedial aspect of the knee joint. An MR imaging examination of this knee was performed to evaluate this ossific density and to determine whether other causes for internal derangement existed. A retrospective search for other patients with a diagnosis of meniscal ossicle was performed on the basis of results of knee MR examinations in our

hospital and consultations at other institutions. Two other patients, both men, aged 51 and 56 years respectively, were identified with this condition.

Results

All three patients with a history of knee pain of variable duration and swelling. A joint effusion was noted in all cases. Radiographically, an intra-articular density demonstrating a conspicuous rim of cortex and internal trabeculation was noted, projecting within the joint space. Two distinct shapes, either triangular or rectangular, were documented.

The MR images clearly demonstrated the intra-meniscal location of the ossicle in all three patients. The signal intensities of these ossicles were identical to that of bone marrow in the adjacent bones (Fig. 1). Two were located in the posterior horn of the medial meniscus and one was located in the posterior horn of the lateral meniscus. Two patients had associated meniscal tears in the involved menisci; however, both have elected not to have surgery (Figs. 2, 3).

Discussion

The initial reports of meniscal ossicles were provided by H. J. Burrows [6] and Watson-Jones and Roberts [10] in 1934. Subsequently, approximately 30 additional cases have been reported. Radiographically, these ossicles may resemble intra-articular bodies. These ossicles are most frequently located in the posterior horn of the medial meniscus [4, 13] although there are reports of involvement in the anterior and posterior horn of both menisci. Over 90% of reported patients have been men ranging in age from 16 to 40 years, with a mean age of 25 years. Histologically, these ossicles represent mature lamellar and cancellous bone containing fatty bone marrow surrounded by hyaline cartilage [2, 13, 14]. Foci of increased vascularization and fibroblastic proliferation and

Correspondence to: Joseph S. Yu, M.D., Department of Radiology, Ohio State University Hospitals, 450 West Tenth Avenue, Columbus OH 43210, USA

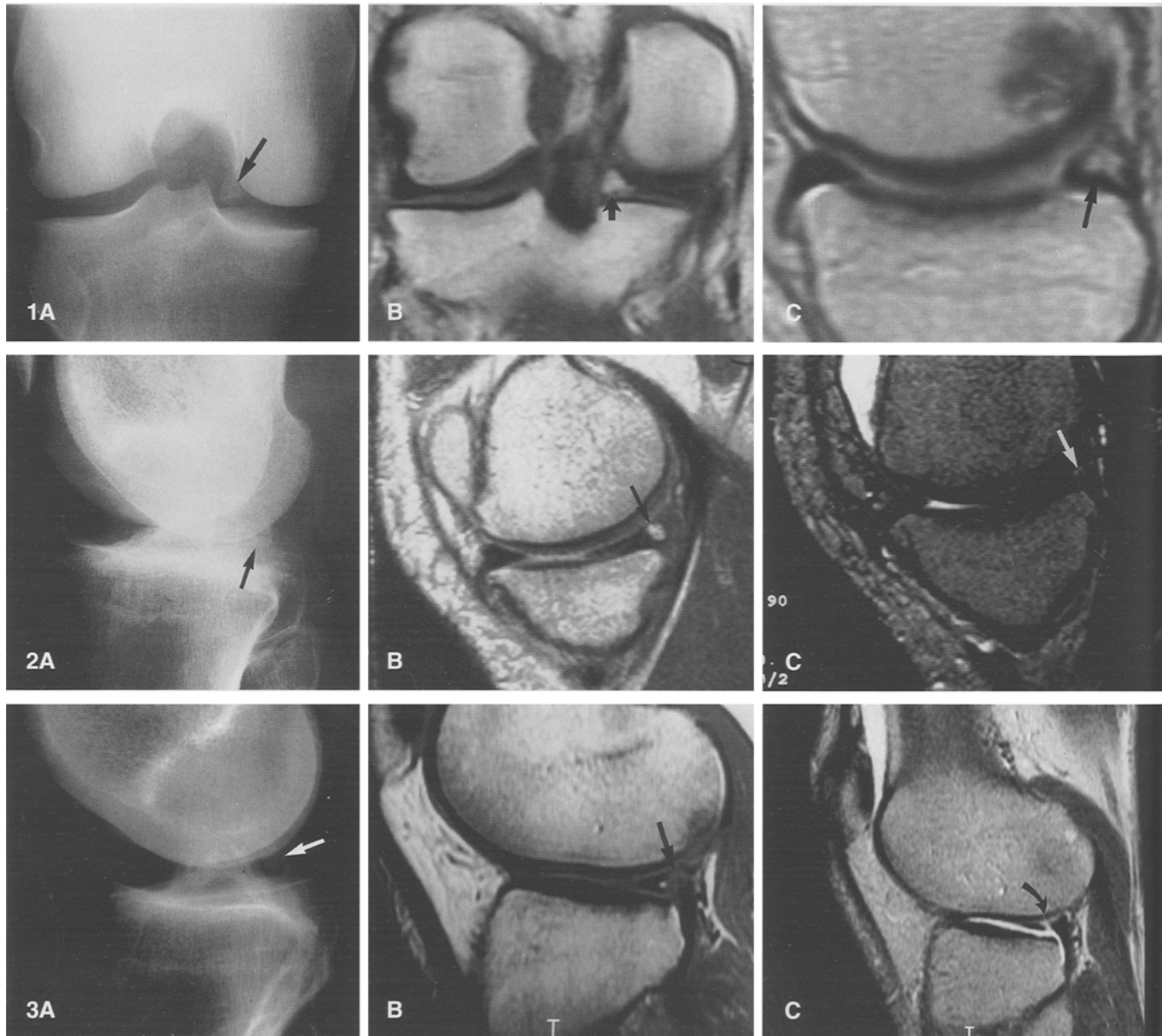


Fig. 1 A–C. A 56-year-old man with intermittent knee pain. **A** Frontal knee radiograph demonstrates an ossific density projected in the medial aspect of the joint (*arrow*). **B, C** Coronal and sagittal T1-weighted (TR600/TE20 ms) MR images demonstrate that the ossicle is surrounded by the fibrocartilage of the posterior horn of the medial meniscus (*arrows*)

Fig. 2 A–C. A 49-year-old man with chronic progressing knee pain. **A** Lateral knee radiograph demonstrates an ossific density in the posterior aspect of the knee joint (*arrow*). Because the ossicle could not be seen in the frontal view (not shown), an intra-articular body was suspected. **B, C** Sagittal T1 (TR700/TE20) and T2-weighted (TR2000/TE80) MR images show that the ossicle is

located within the posterior horn of the medial meniscus. Note that the signal of the meniscal ossicle is isointense with that of bone marrow in both sequences (*arrows*)

Fig. 3 A–C. A 51-year-old man with acute onset of pain. **A** Lateral and frontal (not shown) knee radiographs demonstrate a rectangular ossific density in the posteromedial aspect of the knee joint (*arrow*). **B** A sagittal proton density (TR2000/TE20) MR image demonstrates an intrameniscal ossicle in the posterior horn of the lateral meniscus (*arrow*). **C** Sagittal T2-weighted (TR2000/TE80) MR image just lateral to the ossicle demonstrates a vertical tear of the meniscus (*arrow*)

evidence of osteogenic activity have been noted [6, 11, 14, 15].

The cause of these meniscal ossicles is not clear. Four predominant theories have emerged to explain their occurrence. The ossicles may be the result of a degenerative phenomenon, with impaired nutrition to the meniscus resulting in replacement of areas of mucoïd degeneration by bone [1]. A second theory suggests that the ossicles

represent a sequela to a post-traumatic event, with metaplasia and development of heterotopic ossification within the meniscus [4, 6, 7, 10, 11, 15]. Foci of increased vascularization and fibroblastic proliferation have been noted adjacent to the ossicle, suggesting that fibrous tissue about the ossicle is indicative of a reactive metaplastic phenomenon [11, 14, 15]. Burrows reportedly documented evidence of osteogenic activity in areas

contiguous to the meniscal ossicle in one of his two patients, indicating that the process of heterotopic ossification had occurred [6]. Proponents of a third theory suggest that the meniscal ossicle is a vestigial structure [2, 9, 14], citing that its presence in lower class mammals and lack of reactive tissue adjacent to the ossicle in many situations render the possibility of an acquired lesion unlikely. A fourth theory suggests that meniscal ossicles are bone fragments resulting from avulsion of the tibia at the site of attachment of the posterior horn of the medial meniscus [5, 8].

With one reported exception [4], patients with meniscal ossicles are symptomatic. Some investigators suggest that all meniscal ossicles eventually become symptomatic because they alter the contour of the meniscus, thus increasing the risk of meniscal tear or degeneration [7, 11, 12, 14]. Others have suggested that all ossicles are associated with longitudinal tears of the meniscus [6]. Clinically, intermittent pain is the predominant symptom. More noteworthy, however, is the absence of a history of locking of the knee joint, a symptom that would be expected in the presence of an intra-articular body. Swelling, joint effusion, and findings of an internal derangement of the knee (when the meniscus is torn) also have been reported.

With routine radiographs, an intra-articular corticated density is evident most commonly in the posteromedial aspect of the knee joint. Diagnostic considerations, in addition to an intra-articular body [6, 10], include a detached calcified or ossified osteochondral lesion [3, 5] a bone avulsion at the attachment of the posterior horn of the medial meniscus [8], an avulsion of either the semimembranosus [17] or popliteus tendon insertion [18], or chondrocalcinosis [19]. With fluoroscopy, the ossicle moves with the tibia during rotation of the knee [4]. Arthrographically, the ossicle is seen as a discrete ossified structure within the body of the meniscus with contrast outlining the contour of the meniscus [3]. None of our patients underwent fluoroscopy or arthrography. Instead, MR imaging was selected for further imaging owing to its multiplanar capability and lack of ionizing radiation.

On the basis of a single, previously published report, a meniscal ossicle appears in MR images as an intra-meniscal lesion with signal characteristics identical to those of medullary bone [12]. Our results and those of Yao and Yao [12] indicate that MR imaging is capable of distinguishing meniscal ossicles from most other differential diagnostic considerations and in particular, intra-articular bodies. The multiplanar capability of MR imaging enabled demonstration that the low signal from the meniscal fibrocartilage completely surrounded the ossicles, unequivocally localizing their position outside the joint space. However, it should be emphasized that correlation with radiographs solidifies the diagnosis of a meniscal ossicle when this abnormality is encountered on the MR examination and an intra-articular ossific

density is seen radiographically, although in our experience the MR findings are sufficiently characteristic to allow the diagnosis even in the absence of radiographs. The added advantage of MR imaging is that abnormalities of other intra-articular structures, such as ligamentous and meniscal tears occurring in affected patients, are easily detected.

The appropriate course of therapy is controversial. Some authors propose that surgical excision is necessary in nearly every situation [6, 7, 14–16], whereas others have suggested a more conservative approach with immobilization and anti-inflammatory medication [3, 4, 9].

References

- Harris HA. Calcification and ossification in the semilunar cartilages. *Lancet* 1934; 1: 1114–1116.
- Pedersen HE. The ossicles of the semilunar cartilages of rodents. *Anat Rec* 1949; 105: 1–7.
- Bernstein RM, Olsson HE, Spitzer RM, Robinson KE, Korn MW. Ossicle of the meniscus. *AJR* 1976; 127: 785–788.
- Glass RS, Barnes WM, Kells DU, Thomas S, Campbell C. Ossicles of knee menisci: report of seven cases. *Clin Orthop* 1975; 111: 163–171.
- Berg EE. The meniscal ossicle: the consequence of a meniscal avulsion. *J Arthrosc Rel Surg* 1991; 7: 241–243.
- Burrows HJ. Two cases of ossification in the internal semilunar cartilage. *Br J Surg* 1934; 21: 404–410.
- Mariani PP, Puddu G. Meniscal ossicle: a case report. *Am J Sports Med* 1981; 9: 392–393.
- Richmond J, Sarno RC. Posttrauma intracapsular bone fragments: association with meniscal tears. *AJR* 1988; 150: 159–160.
- Rosen IE. Unusual intrameniscal lunulae. Three case reports. *J Bone Joint Surg [Am]* 1958; 40: 925–928.
- Watson-Jones R, Roberts RE. Calcification, decalcification, and ossification. *Br J Surg* 1934; 21: 461–499.
- Weaver JB. Ossification of the internal semilunar cartilage. *J Bone Joint Surg* 1935; 17: 195–198.
- Yao J, Yao L. Magnetic resonance imaging of a symptomatic meniscal ossicle. *Clin Orthop* 1993; 293: 225–228.
- Resnick D, Niwayama G. *Diagnosis of bone and joint disorders*, 2nd edn. Philadelphia: Saunders. 1988: 389–390.
- Conforty B, Lotem M. Ossicles in human menisci: report of two cases. *Clin Orthop* 1979; 144: 272–275.
- Symeonides PP, Ionannides G. Ossicles in the knee menisci: report of three cases. *J Bone Joint Surg [Am]* 1979; 54: 1288–1292.
- Richmond JC, Sarno RC. Arthroscopic treatment of medial meniscal avulsion fractures. *J Arthrosc Rel Surg* 1988; 4: 117–120.
- Yao L, Lee J. Avulsion of the posteromedial tibial plateau by the semimembranosus tendon. Diagnosis with MR imaging. *Radiology* 1989; 172: 513.
- Naver L, Aalberg JR. Avulsion of the popliteus tendon: a rare cause of chondral fracture and hemarthrosis. *Am J Sports Med* 1985; 13: 423.
- Jensen PS, Putnam CE. Current concepts with respect to chondrocalcinosis and the pseudogout syndrome. *AJR* 1975; 123: 531.