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How to Diagnose Enchondroma, Bone Infarct, and Chondrosarcoma

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A B S T R A C T

Enchondromas are among the most common benign tumors seen in the skeleton. They are encountered frequently in routine clinical practice. The purpose of this review is to help radiologists confidently diagnose enchondroma and distinguish it from other entities, such as bone infarct, bone graft, and low-grade chondrosarcoma.

Introduction

Enchondromas are some of the most common benign tumors seen in the skeleton [1]. They are encountered frequently in routine clinical practice in various settings. The purpose of this review is to help radiologists confidently diagnose enchondroma and distinguish it from other common entities in the differential diagnosis, such as bone infarct, bone graft and low-grade chondrosarcoma. This review will focus on the imaging features described in the current literature that are helpful to distinguish problematic lesions from each other in long bones and allow for confident narrowing of the differential diagnosis. There will be only brief discussion of cartilage tumors at other skeletal sites. In the most recent World Health Organization classification, chondrosarcoma grade I is referred to as atypical cartilaginous tumor (ACT) [2]. The phrase "low-grade cartilage lesion" should be avoided since it is not synonymous with all of the above terms. Only malignant cartilage lesions are "graded" [2]. Some algorithms have been proposed to help with diagnosis and further imaging recommendations but they can be difficult to use in specific situations [3].

Enchondromas and Chondrosarcomas

In a large series, enchondromas are reported to represent up to 13% of benign tumors and about 3% of all bone tumors encountered [1]. In long bones, a common differential diagnosis for suspected enchondroma includes bone infarct and low-grade chondrosarcoma (Fig 1). Often, the radiographic findings are characteristic enough in long bones to allow a confident diagnosis of enchondroma particularly when they are encountered as an incidental finding not related to the reason for the imaging study, such as a humeral lesion on chest x-ray (Fig 2). Such benign findings include typical chondroid matrix mineralization, in stipples or arcs and rings, evenly distributed throughout a small (less than 3-5 cm) metaphyseal lesion with no aggressive features [4]. There should be no endosteal scalloping, no cortical breaks, no periosteal reaction or soft tissue mass. Such a lesion should be reported as an enchondroma with no further workup required so additional, expensive advanced imaging studies are avoided (Fig 3). A cartilage lesion is more likely to be malignant when initial x-rays show deep or. extensive endosteal scalloping, when there is cortical destruction or periosteal reaction or when there is an obvious soft tissue mass (Fig 4). Deep endosteal scalloping means more than two-thirds of the way through the cortex focally. Extensive endosteal scalloping means more than two-thirds along the length of the lesion regardless of the depth of the scalloping [4,5].

These are aggressive features of cartilage lesions and are concerning for the presence of chondrosarcoma. In general, the length of the lesion within the medullary canal of a long bone is not a useful discriminating feature in the individual patient. It is true that the mean length of enchondromas (< 5 cm) is less than the mean length of chondrosarcomas (> 5 cm) but there is considerable overlap [4]. A lesion longer than 5 or 6 cm in the humeral or femoral shaft should not be considered suspicious solely on the basis of its length if there are no other worrisome features. One should report such a lesion as an enchondroma with no further workup required (Fig 5). The fibula is an exception and is discussed later. Distribution of mineralization throughout the lesion also is not helpful for differentiation of enchondroma from low-grade chondrosarcoma [4].

Even with a history of "pain" as an indication for obtaining the radiographs or MR examination, no further workup is needed for characteristically benign cases. Clinical pain symptomatology in such benign cases is often related to some other nearby abnormality (Fig 6) or to the nearest joint. Although enchondromas are

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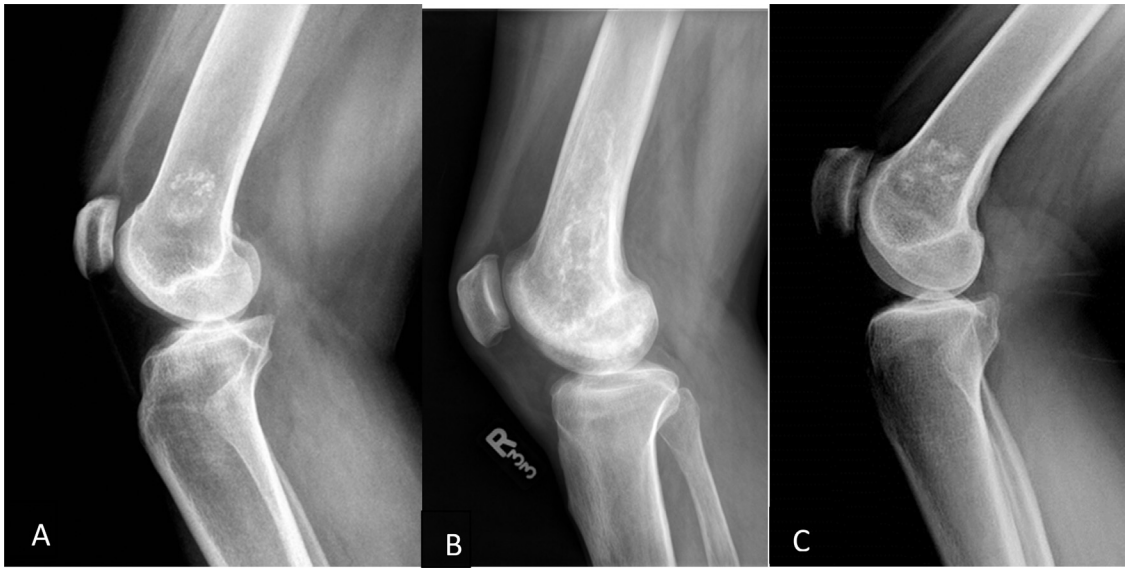

FIG 1. Lateral knee radiographs show examples of similar appearing distal femoral shaft abnormalities representing simple enchondroma (A), bone infarct (B), and grade 1 chondrosarcoma (C).

often painless incidentally discovered lesions, the presence of general pain is not a useful discriminating feature. Geirnaerdt et al reported on patient's with 35 enchondromas and 43 grade 1 chondrosarcomas. They elicited a history of pain in 37% of the patient's with enchondromas and in 58% of the patient's with grade 1 chondrosarcomas [6]. Only pain that is related convincingly to the site of the lesion during palpation is considered to be a potential discriminator by some authors [5,6].

Pain that may be joint related, can be distinguished from true lesional pain, by injecting the joint with an anesthetic agent, such as lidocaine, if need be [4]. Patient's age, greater than 45-50 years, is typical of chondrosarcomas, but is not useful in the individual patient, as a stand alone feature, for discrimination [5,7].

However, there are many times when some feature of the bone lesion is not 100% in keeping with the diagnosis of a simple enchondroma and a concern will be raised for an "atypical cartilage tumor" or for development of a higher grade chondrosarcoma (Figs 7 and 8).

The differential diagnosis for atypical lesions also includes bone infarct and, on occasion, postsurgical changes related to bone grafting. One could stop the investigative algorithm at this point and advocate for curettage of all cartilage lesions that are worrisome but not clearly malignant. Indeed the current surgical treatment for long bone enchondroma and grade 1 chondrosarcoma or ACT is the same, that is, simple curettage, since grade 1 chondrosarcomas (ACTs) rarely metastasize or otherwise cause harm to the patient [8,9]. Additional imaging can be helpful in problematic cases and is discussed in the next sections.

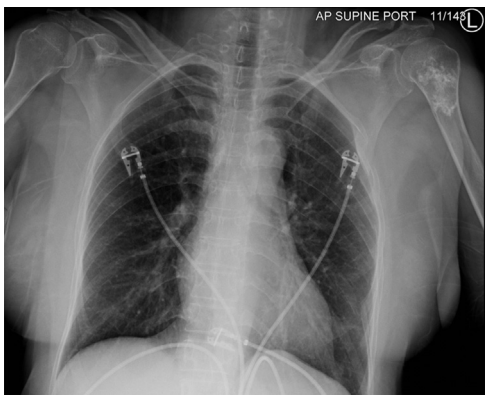

FIG 2. A 57-year-old woman involved in a motorcycle crash. Initial AP portable chest radiograph. Patient had no pain in the left shoulder region related to humeral lesion. Differential diagnosis was given including low-grade chondrosarcoma and additional studies including dedicated upper extremity CT and dedicated upper extremity radiographs (not shown) were all consistent with simple enchondroma.

Computed Tomography

Noncontrast computed tomography (CT) provides only anatomical information but the high spatial resolution and cross-sectional images can be very advantageous. The presence and pattern of mineralization can be determined. The true depth and extent of any endosteal scalloping can be precisely determined (Figs 3 and 7). Any cortical breakthrough or periosteal bone change can be appreciated and soft tissue masses can be identified. As the presence of such signs is worrisome for development of chondrosarcoma and can be precisely determined or excluded with CT, CT is a useful next study for all forms of cartilage tumors after initial radiographs [4]. If one of the differential considerations is bone infarct, the typical differences of the central enchondroma mineralization vs peripheral, serpentine linear bone infarct mineralization can be appreciated and a confident diagnosis of one or the other can be determined by using CT (Fig 19).

Magnetic Resonance Imaging

As with most bone tumors, magnetic resonance imaging (MRI) of cartilage tumors should be reserved for staging lesions that are likely to be malignant. MRI studies should be interpreted with comparison to the X-rays or other imaging studies whenever possible. Slice gaps between MR sections are disadvantageous. They may make evaluation of depth of scalloping and small areas of cortical breakthrough difficult to determine but might increase MR specificity [3]. Thin slice CT is better suited for evaluation of depth of scalloping and small areas of cortical breakthrough but has less specificity. The MR signal characteristics on standard spin-echo sequences, of enchondroma and low-grade chondrosarcoma, are not sufficiently different to distinguish between them. Both show low signal changes on T1 and high signal changes on T2-weighted sequences with a lobular growth pattern (Figs 3 and 7).

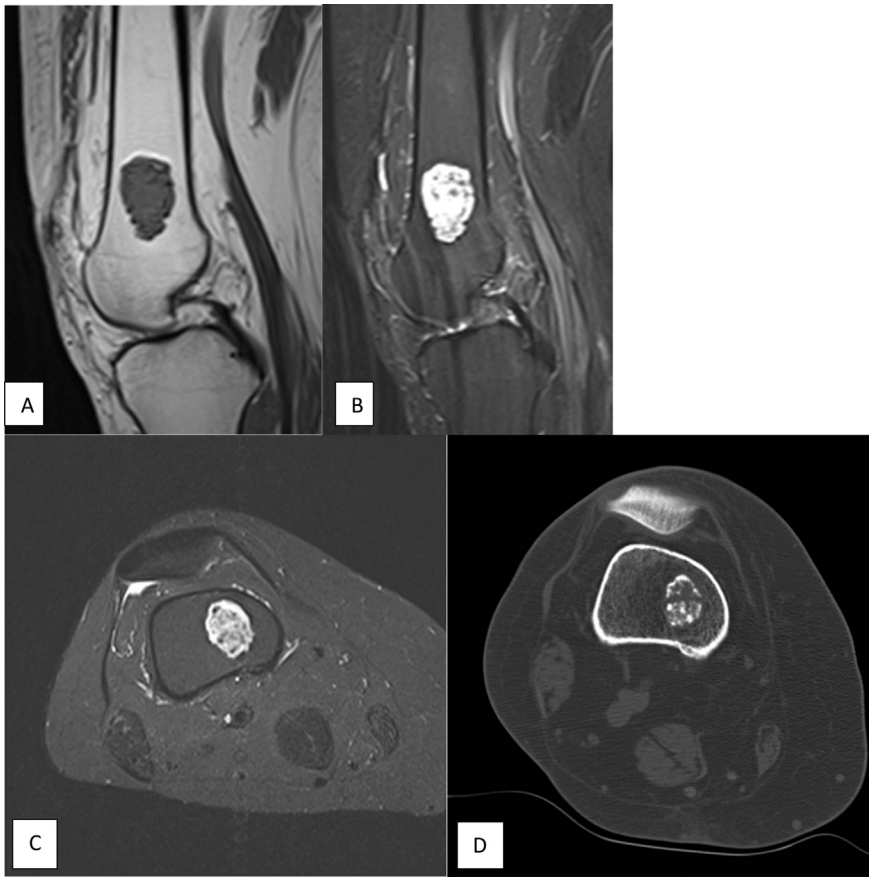

FIG 3. (A-D) A 46-year-old woman with myasthenia gravis. Same patient as Figure 1A. Referred for evaluation of bone lesion discovered incidentally on unrelated screening studies. Follow-up radiographs (Fig 1A) were reported as "sclerotic lesion, further evaluation with MRI may be helpful." MR images in sagittal (T1 and STIR) and axial (PD and T2 fat saturated) planes show typical signal characteristics of enchondroma, and were reported as "nonaggressive chondroid lesion most consistent with an enchondroma." Follow-up CT study done 1 year later was reported as "focal lesion most consistent with enchondroma or low-grade cartilage lesion." Such a case with no atypical features and no interval change should be reported as enchondroma with no differential diagnosis.

One feature that may be of some use is peritumoral edema (Fig 18). A small series has reported this MRI feature as a way to distinguish between enchondroma and chondrosarcoma. Janzen et al [10], in 23 patients, (10 enchondromas and 13 chondrosarcomas) reported no peritumoral marrow edema around the enchondromas, but presence of peritumoral edema around all 13 chondrosarcomas in their series. Fayed et al [11] also described this MRI finding around 6 of 7 chondrosarcomas in the hands and feet. This finding has not been confirmed in large prospective studies. Static imaging after gadolinium contrast administration shows enhancement in peripheral and septal areas for both enchondroma and chondrosarcoma [12]. The role of dynamic contrast enhancement is debated. A study of 106 patient's by De Coninck et al [13], with 75 enchondromas and 31 chondrosarcomas, showed the accuracy of the standard MRI parameters to be the same as the dynamic contrast imaging parameters for distinguishing between the 2 entities. Other authors have stated that, "Dynamic contrast-enhanced MRI cannot differentiate enchondromas from grade 1 chondrosarcoma" [5]. More advanced MRI techniques such as diffusion-weighted imaging or hydrogen proton spectroscopy have not been proven to be useful to date [14]. Like CT, MRI can easily distinguish enchondroma from infarct.

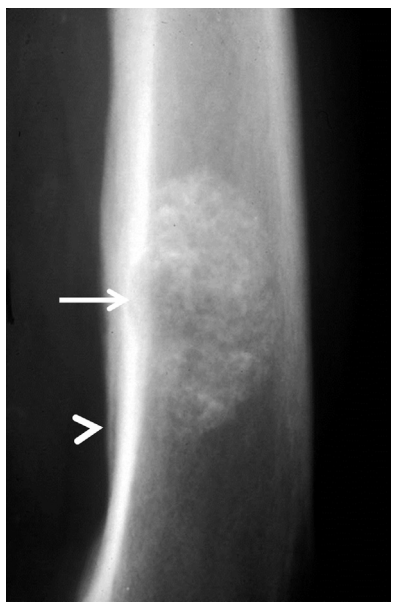

FIG 4. Patient with cartilage lesion in the distal femoral shaft demonstrating aggressive features with focal deep endosteal scalloping (arrow) and linear periosteal reaction (arrowhead) in this subsequently proven grade 1 chondrosarcoma.

Bone Scintigraphy

Technetium 99 m bone scintigraphy can be helpful for evaluation of cases of enchondroma vs chondrosarcoma. Comparison of

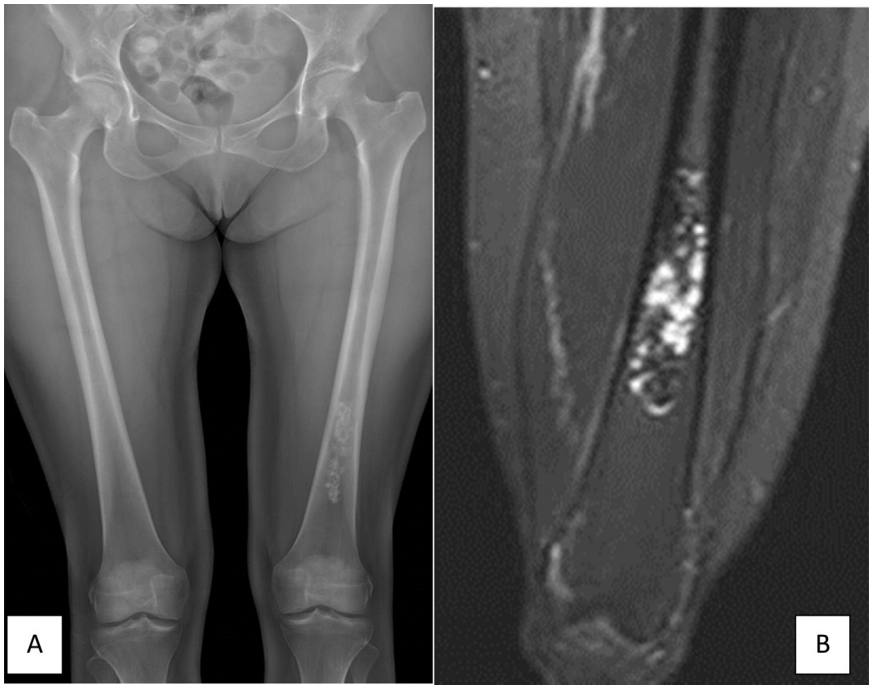

FIG 5. A 55-year-old woman with known diagnosis of smoldering multiple myeloma, screening skeletal survey study of the femurs revealed incidental cartilage lesion in the distal left femoral shaft that was more than 9 cm long (A) with no endosteal scalloping or other aggressive feature. Coronal T2-weighted MR image (B) shows typical lobular high fluid signal intensity. There are no aggressive features seen. Follow-up studies over an 11-year time period showed no change from the initial study.

lesion activity to the anterior superior iliac spine (ASIS) on the whole body image gives a reliable indication of lesion activity (Figs 7, 9, and 10). In a retrospective study of 187 cases with pathologic proof, Murphey et al reported that for 92 cases of enchondroma and 95 cases of chondrosarcoma, those lesions showing more intense uptake than the ASIS were chondrosarcoma 82% of the time. Those lesions showing less or equal uptake to the ASIS were benign enchondroma 79% of the time [4]. A prospective study of 133 cases by Ferrer-Santacreu et al confirmed the use of bone scanning in these types of patients. They found that 83% of their cases with lesions showing less intense uptake to the ASIS were benign enchondromas [3]. Similar use of bone scan findings has been reported in long bone cases, axial skeleton cases, and cases with lesions in the hands and feet [3,12]. The bone scan has the advantage of demonstrating biologic activity and providing whole body screening. It is widely available and has a relatively low cost. One should consider the radiation dose to the pelvic organs before recommending a bone scan, particularly if the patient is a young female.

FDG PET-CT

Fluorodeoxyglucose positron emission tomography-computed tomography (FDG PET-CT) studies with small numbers of patients have indicated some utility in differentiating enchondroma from chondrosarcoma and low-grade chondrosarcoma from high-grade chondrosarcoma by standardized uptake values. Jesus-Garcia et al prospectively evaluated 36 patients with either enchondroma ($n = 17$) or chondrosarcoma ($n = 19$). Using SUVmax cutoff of 2.0 they separated patients into surgical or non-surgical groups. Only 1 of 17 patients with SUVmax $\leq$ 2.0 had a chondrosarcoma. Conversely, 18 of 19 patients with SUVmax $>$ 2.0 who went to surgery had pathologically proven chondrosarcoma [15]. Larger studies are needed to confirm these results. Other authors also have used FDG PET-CT to distinguish between low-grade chondrosarcoma and high-grade chondrosarcoma. However, this is not the clinical question being posed in this review.

Other Considerations or Anatomical Sites

Cartilage Rests

Cartilage rests are frequent incidental findings seen on routine MRI (Fig 11). One report by Walden et al [16] indicates a prevalence during knee MRI of 2.9%. Cartilage rests likely represent displacement of pieces of the normal growth plate into the adjacent metaphysis during normal development. They are typically less than 2 cm in size and within 2 cm of the physis. Rarely, they can be present within the epiphysis [16,17]. If radiographs are

FIG 6. A 65-year-old man with lateral knee pain. Coronal fat-saturated T2-weighted MR image shows extensive bone marrow edema in the lateral femoral condyle and a lateral meniscal tear with small meniscal cyst inferiorly. Enchondroma is noted incidentally within the distal femoral diametaphysis.

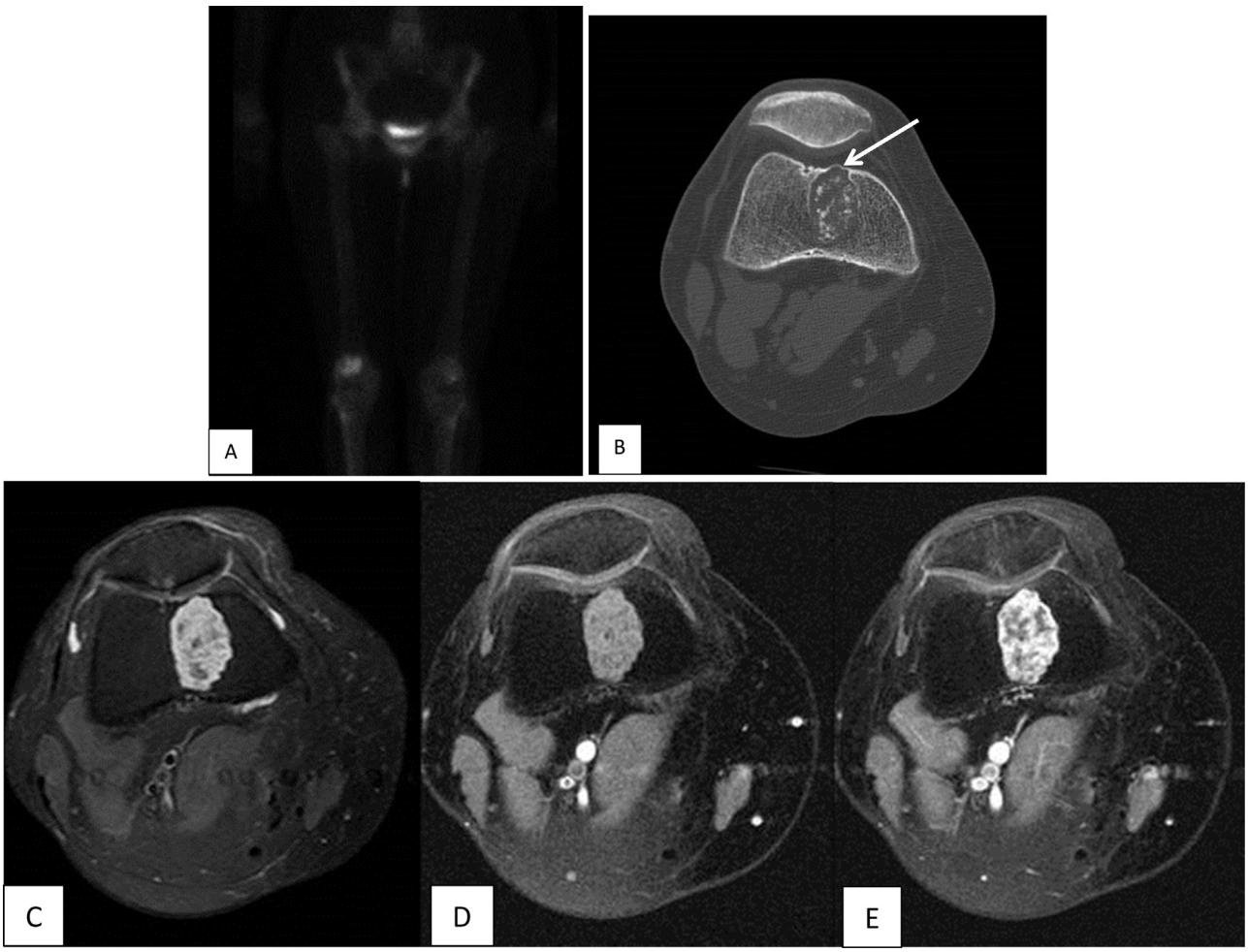

FIG 7. Patient with knee pain (same as Fig 1C). Lateral radiograph (Fig 1C) shows typical cartilage matrix mineralization in distal femoral metaphysis. No aggressive features were evident. Technetium 99 m bone scan image (A) shows focal uptake in the area of the cartilage lesion that is more intense than the activity in the anterior pelvis. Axial (B) CT image shows focal deep endosteal scalloping anteriorly (arrow). Axial MR images with fat-saturated T2 (C) as well as fat-saturated T1 before (D) and after (E) contrast administration show typical signal characteristics and typical contrast enhancement pattern in peripheral and septal areas of this proven grade 1 chondrosarcoma.

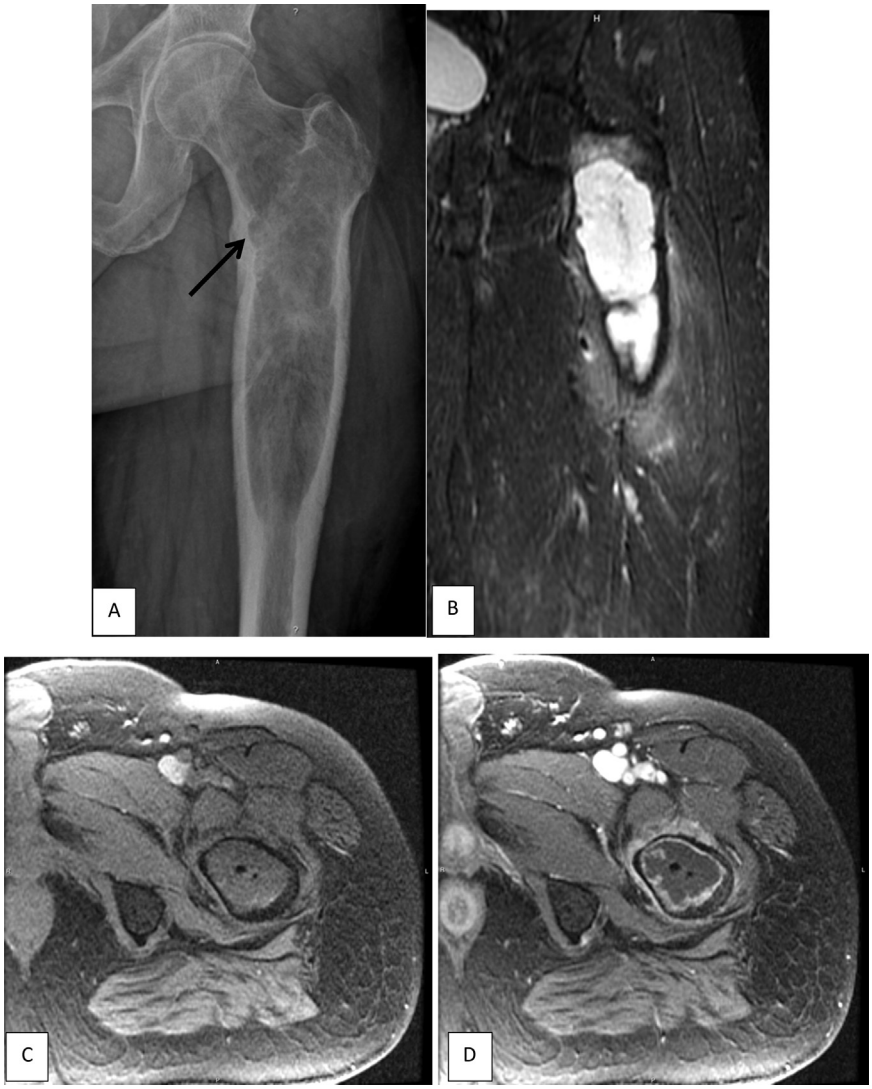

FIG 8. A 62-year-old man with complaints of low-back pain radiating to left side. Initial lumbar spine MRI was done 17 months after initial onset of symptoms. Radiographs of the hip and femur were obtained 18 months after initial onset of symptoms. Frontal (A) radiograph reveals long lytic lesion extending from the intertrochanteric area to the proximal femoral shaft with expanded remodeling. There is one focal area of endosteal scalloping at the level of the lesser trochanter (arrow) but no obvious matrix mineralization. MRI in coronal plane with T2-weighting (B) shows largely homogeneous high signal intensity with slight lobular external margins especially superiorly. Axial fat-saturated T1 images before (C) and after (D) intravenous contrast injection show peripheral enhancement of the intramedullary lesion and contrast enhancement surrounding the outer cortex. Punctate foci of low signal intensity are present internally. After curettage, pathology reported grade 1 chondrosarcoma.

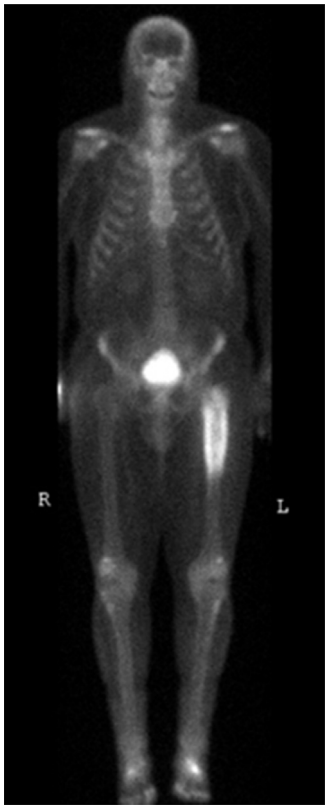

FIG 9. Same patient as Figure 8. Technetium 99m bone scan image shows increased uptake in the lesion that is much more intense than the anterior pelvis. This finding by itself is concerning for chondrosarcoma.

available for comparison, there typically is no matrix mineralization visible. If typical chondroid matrix mineralization is visible, the term enchondroma should be used since long bone enchondromas almost always have characteristic chondroid matrix mineralization seen on radiographs. Typical cartilage rests require no

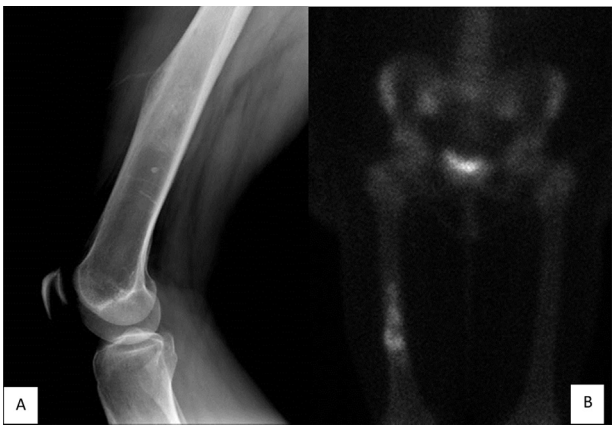

FIG 10. A 37-year-old woman with Crohn's disease. Initial radiographs obtained after a fall. Lateral radiograph of the femur (A) demonstrates hazy increased density below the midshaft and ill-defined lucency in anterior cortex with expanded remodeling. Technetium 99m bone scan image (B) shows focal uptake in the same areas that is slightly more intense than activity in the pelvis. Axial CT and MR images (not shown) revealed typical cartilage matrix mineralization within the medullary portion of the femur and extension of the lesion into the anterior cortex. After initial curettage pathology reported grade 2 chondrosarcoma.

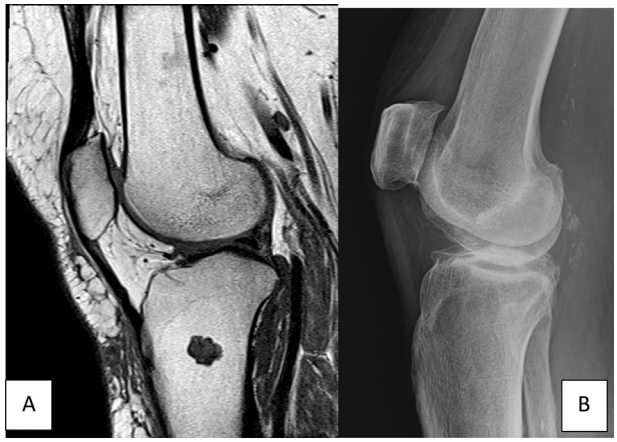

FIG 11. A 39-year-old woman with knee pain. Sagittal T1 (A) MR image demonstrates 7 mm lobular focus in the proximal tibial metaphysis that is just distal to the growth plate. Radiograph (B) shows no obvious mineralized matrix, characteristic of a cartilage rest. Medial meniscus tear (not shown) and tricompartmental osteoarthritis were sources of the patient's pain.

further workup or follow-up. If any atypical features are present, follow-up MRI is suggested for these otherwise invisible lesions [16,17].

Hands and Feet

Enchondromas are the most common primary bone tumors in the small tubular bones of the hands and feet (phalanges, metacarpals, and metatarsals). They are almost always benign in these locations even when they have an unusual appearance. Malignant transformation in these locations is considered rare [18]. Often, with enchondromas in these short tubular bones, there is no typical chondroid matrix mineralization but a typical lobular growth pattern is present (Fig 12). There may be extensive expansile remodeling and pathological fracture. Clues to the diagnosis of hand or foot chondrosarcoma include marked cortical destruction and surrounding soft tissue mass [b]. Extension of the typical metaphyseal or diaphyseal lesion to the end of the bone, that is, the epiphyseal area, occurred in 21 of 22 cases of chondrosarcoma reported by Fayed et al [11]. Concern for malignant change is warranted for cartilage tumors in the small bones of the foot if they exceed 5 cm, or if they arise in the midfoot or hind foot [19] and are not typical of chondroblastoma.

Enchondromatosis

Multiple lesions in cases of Ollier's disease or Maffucci's disease are typically present asymmetrically in 1 portion of the skeleton or can be diffusely present throughout the skeleton. The same imaging criteria cannot always be used to determine concern for development of chondrosarcoma as would be used for patients with a single enchondroma because some of the benign enchondromas can have fairly aggressive appearances in these patients (Fig 13). In a multicenter study reported by Verdegaal et al of 161 cases, 44% had enchondromas with cortical discontinuity or extension into the soft tissue. Another 40% of their patients developed true chondrosarcomas. Patients with enchondromas confined to the hands and feet had the lowest rate of

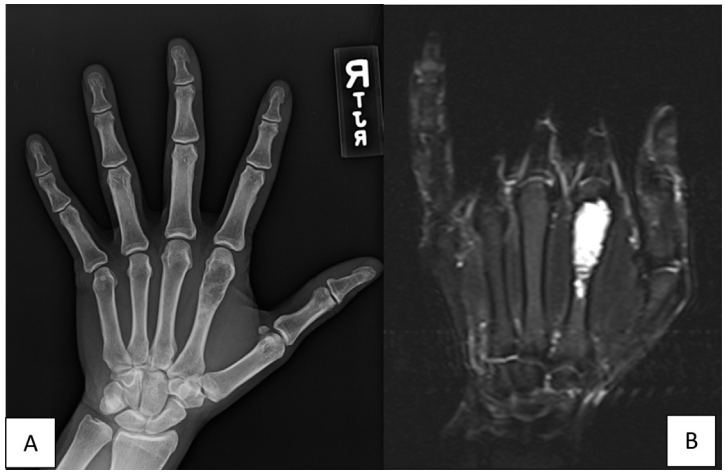

FIG 12. A 49-year-old woman with pain in index finger. Frontal (A) radiograph of the right hand demonstrates lobular lytic lesion in the distal aspect of the second metacarpal with slight expanded remodeling. There is faint internal matrix mineralization. Coronal fluid sensitive MR image (B) shows high signal intensity. Note that there is no extension of this enchondroma into the epiphysis or through the cortex or any surrounding soft tissue abnormality.

FIG 13. A 40-year-old man with enchondromatosis who had been followed since he was 10 years old. AP (A) and lateral (B) views of the right lower limb demonstrate multiple lucent lesions in the femur, proximal tibia, and fibula with some stipples of cartilaginous matrix mineralization most notable in the distal femoral shaft. There is marked expanded remodeling of the femur. Although the distal femoral shaft lesion appears somewhat aggressive this was stable over more than a 20-year time period.

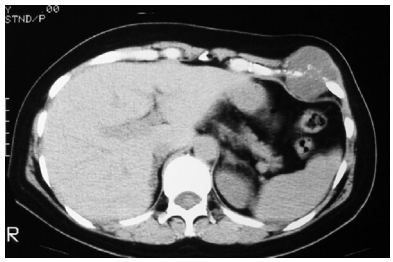

FIG 14. Axial CT slice shows lesion located at the anterior rib margin with soft tissue expansion both anteriorly and posteriorly and some internal matrix mineralization. This was subsequently proven to represent low-grade chondrosarcoma.

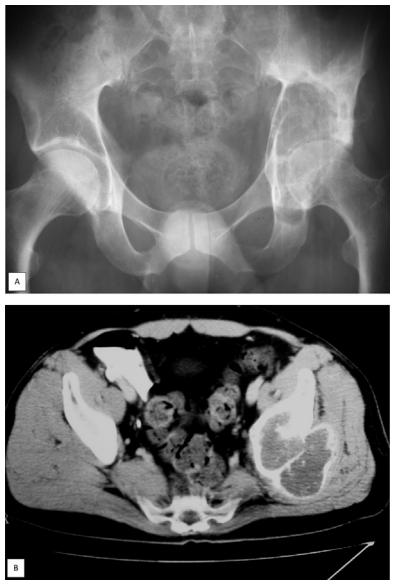

FIG 15. A 42-year-old man with hip pain. Pelvic radiograph (A) shows large lytic lesion centered on the left acetabulum. Axial CT image (B) shows expanded remodeling with stipples of cartilage mineralization in a background of myxoid tissue in this myxoid chondrosarcoma. (B) A 42-year-old man with hip pain. Axial CT image (B) shows expanded remodeling with stipples of cartilage mineralization in a background of myxoid tissue in this myxoid chondrosarcoma.

FIG 16. A 28-year-old woman with hip pain. AP hip radiograph shows multilobular lytic lesion centered on the triradiate cartilage junction. This was proven chondroblastoma.

chondrosarcoma at 15%, whereas those with any involvement of the long bones or pelvis had higher rates of chondrosarcoma, up to 46%. It is recommended that the latter group of patients be followed more closely [20].

Rib Lesions

Chondrosarcomas are more common than simple enchondromas in the ribs, particularly at the costochondral junctions. These chondrosarcomas typically present in men over the age of 50 as a rounded mass with or without internal chondroid matrix mineralization (Fig 14). There may or may not be an associated soft tissue mass. Chondrosarcomas at these sites may be myxoid with a fluid like appearance on CT or MR images [21].

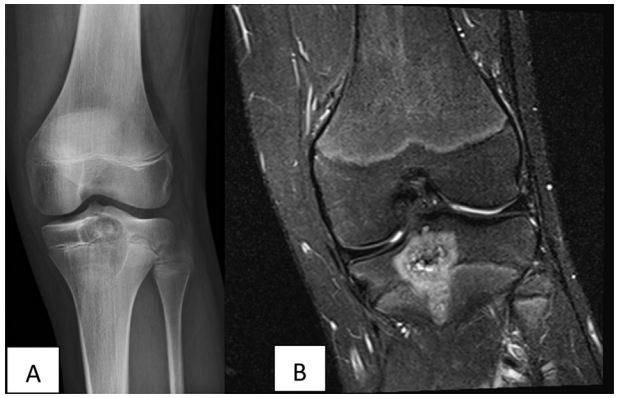

FIG 18. A 13-year-old boy with knee pain. AP radiograph (A) shows lytic lesion with punctate mineralization in the central portion of the tibial epiphysis. The lesion does extend through the growth plate. Coronal fat-saturated T2-weighted image (B) confirms extent of lesion. Note that there is not any surrounding edema as is often seen with chondroblastoma. Histopathology of curettage specimen showed typical enchondroma with no immature cartilage tissue.

Spine or Pelvis

Enchondromas are exceedingly rare in the bones of the spinal column or flat bones of the pelvis but can occur in these sites. It has been suggested that such lesions be followed closely to ensure that they remain stable. Any cartilage tumor in the pelvis of an adult patient, greater than 5 cm in size, should be regarded as a chondrosarcoma (Fig 15) until proven otherwise [6]. Pelvic chondrosarcomas are typically treated by surgical excision, not simple curettage even for grade 1 lesions [22]. Chondroblastoma would be a consideration in a child or young adult for a lesion centered in the triradiate cartilage junction between ilium, ischium and pubis (Fig 16).

Fibula

As the fibula has such a narrow medullary cavity, typical enchondromas often have an unusual appearance in this long bone (Fig 17). In a report of 54 fibular enchondromas and 39

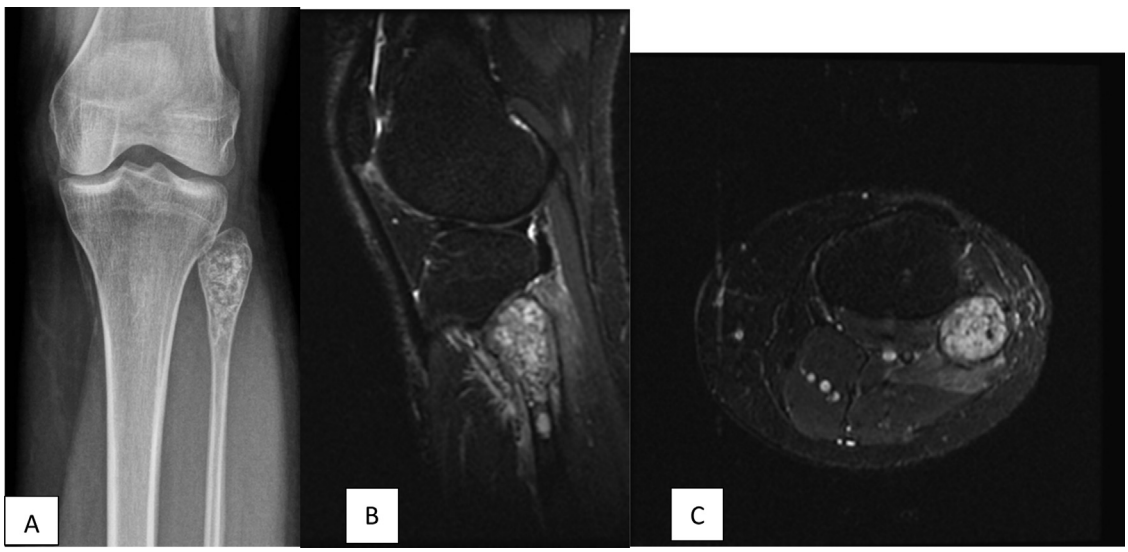

FIG 17. A 43-year-old woman with radiographs done after twisting ankle injury. Patient had no previous history of leg pain. AP (A) radiograph shows lobular lytic lesion within the fibular neck with arcs and rings of cartilaginous matrix mineralization. There are no aggressive features. MR images in sagittal (B) and axial (C) planes confirm typical cartilaginous features of this enchondroma.

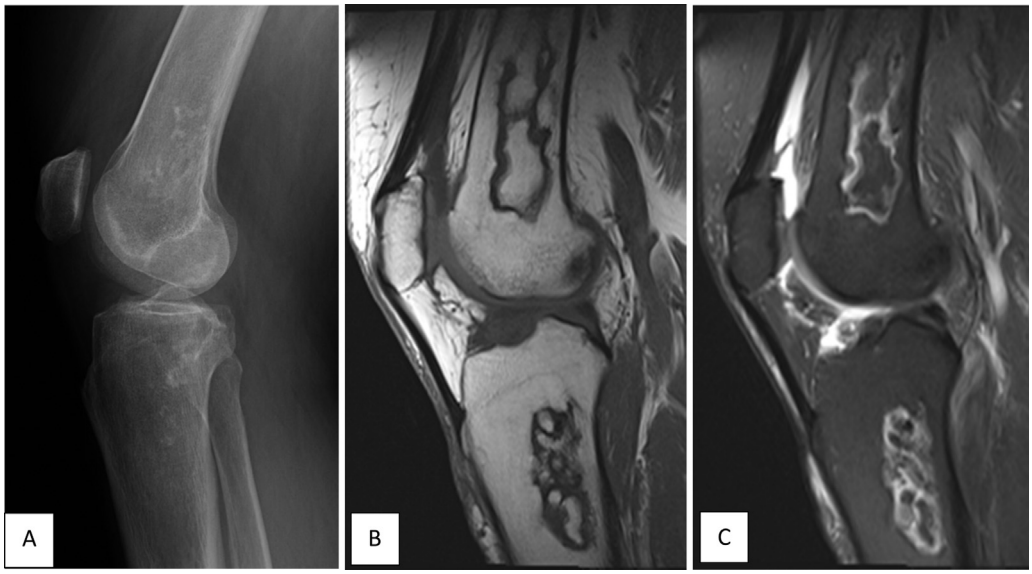

FIG 19. A 50-year-old woman with report of knee pain and swelling. Initial lateral radiograph (A) reveals multiple small calcifications centrally within the distal femoral and proximal tibial metaphyses. These were not felt to be diagnostic of any particular lesion and MRI was suggested for further evaluation. Sagittal MR images with T1 (B) and inversion recovery (C) demonstrate characteristic changes of bone infarcts with serpentine low signal borders and centrally preserved normal marrow fat. MRI was obtained 2 months after initial radiographs. Additional clinical history revealed Crohn's disease and chronic steroid usage.

FIG 20. Typical MR findings of simple enchondroma (A and B) vs bone infarct (C and D) in 2 different patients. Oblique sagittal T1 (A) and fat-saturated T2 (B), weighted images of the shoulders show findings typical of enchondroma with lobular low signal intensity on T1 and lobular high signal intensity on the fat-saturated T2-weighted image. Compare this with oblique sagittal T1 (C) and fat-saturated T2-weighted image (D) of the shoulder in a patient with a proximal humeral shaft bone infarct. Note the low signal intensity serpentine border on T1 and typical double line sign on the T2-weighted image. There is no lobular internal high signal intensity to suggest a cartilage matrix.

Fig. 21. A 51-year-old man status post proximal tibia fracture and screw fixation. AP (A) radiograph shows punctate mineralization in the proximal tibia mimicking enchondroma. This was bone graft in graft harvest site. Typical infarcts are present in distal femur and distal tibia, better shown on CT image (B).

low-grade chondrosarcomas, Kendell et al, reported 5 radiographic features that were shown to favor the presence of chondrosarcoma over simple enchondroma. These were; size greater than 4 cm, cortical thickening, cortical disruption, periosteal reaction, and soft tissue mass [23].

Children

Matrix mineralization is only present on the order of 20%-40% of typical enchondroma cases found in children [24]. Epiphyseal chondroblastoma may be encountered more often than enchondroma in young children. However, since cartilage rests can be found in the epiphyses and since metaphyseal enchondromas can extend into the epiphyses, one must keep enchondroma in the differential diagnosis for any atypical epiphyseal lesion in a child (Fig 18).

Bone Infarcts

Infarcts often have a characteristic radiographic appearance of a metaphyseal or diaphyseal abnormality with serpentine sclerotic border (Figs 19 and 20). If the features are not diagnostic, one should carefully examine the subchondral regions for findings that might indicate additional areas of osteonecrosis (Fig 1B). CT imaging will show the typical peripheral mineralization. Usually the internal marrow fat is visible in an area of infarcted bone as opposed to internal cartilage matrix mineralization or soft tissue with an enchondroma. MRI of infarcts (Figs 19 and 20) again shows typical peripheral mineralization and normal internal marrow fat [25].

Bone Graft

Bone graft and bone substitutes come in many different types, materials, sizes, and shapes. There will be a variable appearance depending on the exact material composition and length of time it has been in place [26]. In some cases, it can mimic an enchondroma particularly if the surgical history is not provided (Fig 21).

Needle Biopsy

Percutaneous needle biopsies are discouraged by pathologists in the attempt to distinguish enchondroma from low-grade chondrosarcoma. Expert bone tumor pathologists agree that histologic distinction is difficult [5] and have stated, “The distinction between low-grade chondrosarcoma and enchondroma cannot be made on a needle biopsy” [27]. As curettage is an accepted standard treatment, there is no need for a separate percutaneous or open biopsy. Biopsy could be reserved for cases with even more aggressive features that suggest higher grade (2 or 3) chondrosarcoma to guide surgical planning that would typically include more extensive resection [28].

Conclusion

This review of the current literature has shown how each imaging modality, from conventional radiography to FDG PET-CT, may provide unique information in an individual case to allow confident diagnosis of enchondroma or to indicate that a more aggressive cartilage tumor or alternative condition should be considered.

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