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CDR Contemporary Diagnostic Radiology

Volume 43 • Number 5
February 28, 2020

A BIWEEKLY REVIEW OF CLINICAL RADIOLOGIC PRACTICE

Bone Lesions of the Hand and Wrist: Systematic Approach to Imaging Evaluation

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This module meets the American Board of Radiology's (ABR's) criteria for self-assessment toward the purpose of fulfilling requirements in the ABR Maintenance of Certification (MOC) program.

Please note that, in addition to the SA-CME credits, subscribers completing the activity will receive the usual ACCME credits.

After participating in this educational activity, the diagnostic radiologist should be better able to identify a systematic imaging approach, explain relative prevalence, and describe imaging characteristics of the most common bone lesions in the hand and wrist.

Category: General Radiology
Subcategory: Musculoskeletal
Modality: MRI

Key Words: Bone Lesions of the Hand and Wrist; Imaging of Bone Lesions of the Hand and Wrist

Hand and wrist bone lesions comprise a special subset of masses. When evaluating these lesions, relative tumor incidence always should be considered. For bone lesions occurring throughout the body, the incidence of primary bone tumors is much lower than that of nonneoplastic bone diseases, metastatic diseases, and hematolymphoid malignancies.[1] *In the hand, benign bone lesions greatly outnumber malignant lesions, as highlighted in a published case series on hand and foot bone lesions.*[1] *Of 52 bone lesions of the hands and feet evaluated with histopathology, the relative incidence was pseudotumors (38%), benign primary tumors (38%), inflammatory/postinfectious lesions (17%), and malignant tumors (12%).*[1] *A large percentage of benign bone lesions of the hand and wrist will have characteristic features on imaging and will not require histopathologic assessment. Appropriate management for indeterminate bone lesions of the hand and wrist will include imaging surveillance or biopsy. Comprehending relative incidence, relevant clinical features, and typical imaging characteristics of various bone lesions of the hand and wrist will assist in formulating a short and relevant differential diagnosis to guide management.*

Imaging Evaluation

Imaging modalities for hand and wrist bone lesions include radiography, CT, and MRI. Initial imaging always includes radiography, as it can prevent mass mischaracterization on advanced imaging. CT is valuable for matrix characterization and identification of lesion nidus (osteoid osteoma) or sequestrum (infection). MRI is superior for tissue characterization and local staging. The astute radiologist will incorporate

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lesion imaging appearance, location, clinical information, and prevalence of the different lesions to formulate a concise and appropriate differential diagnosis.

Benign Lesions

Intraosseous ganglia are common, benign hand lesions and are located most frequently in the carpal bones; the scaphoid is the most common bone involved. Intraosseous ganglia often arise primarily within the bone. They also can arise secondarily from penetration of a juxtaosseous ganglion, which can occur when a ligament or tendon cortical attachment is injured.[2] These cystic lesions are often multiloculated and contain fibrous tissue and mucoid material.[2] On conventional radiographs, they appear as lytic bone lesions with well-defined, often sclerotic borders. MR signal follows fluid on all sequences (low T1 signal intensity and high T2 signal intensity). Intraosseous ganglia often have thin rim or thin septal postcontrast enhancement without solid enhancing components. The presence of carpal intraosseous ganglia often is incidental, although ganglia causing wrist and hand pain have been reported.[2]

Intraosseous ganglia arise primarily within the bone, but they can occur secondarily from penetration of a juxtaosseous ganglion.

Aneurysmal bone cysts are located most commonly in long bone metaphyses; however, they can occur in the tubular bones of the hands. The most typical hand location is the metacarpal bones. Affected patients are typically 12 to 45 years of age.[3] Aneurysmal bone cysts are composed of multiple cavities filled with layering blood products. They sometimes form secondarily at the site of preexisting bone lesions. At radiography, they present as expansile, lucent lesions with thinned peripheral cortex.[3] MRI shows multiloculated lesions with multiple fluid-fluid levels. Lesions will have septal enhancement, but should not have nodular or mass-like enhancement unless they are coexisting with another bone lesion. Biopsy should be considered for any lesion with nodular or mass-like enhancing components, cortical disruption, or extraosseous soft tissue mass because telangiectatic osteosarcoma is another less common bone lesion with fluid-fluid levels.

Enchondromas are benign hyaline cartilage intramedullary bone lesions. They are the most common primary bone tumors in the hand, and 40% of all enchondromas occur in the hand and wrist.[4] In the hand, they are most commonly located in the proximal phalanges but also are located frequently in the metacarpals and middle phalanges.[4] Enchondromas often are incidental findings on hand radiographs except in cases where pathologic fracture has occurred through the lesion. Sometimes CT is required to identify a subtle nondisplaced fracture lucency.[3] At imaging, enchondromas appear as lucent, well-marginated, intramedullary lesions with variable presence of cortical expansion and endosteal scalloping (Figure 1).[3] Lesions in the hand often have more cellularity and less ring and arc stippled chondroid matrix, as compared with lesions in the rest of the body.[4] Therefore, MRI appearance is often

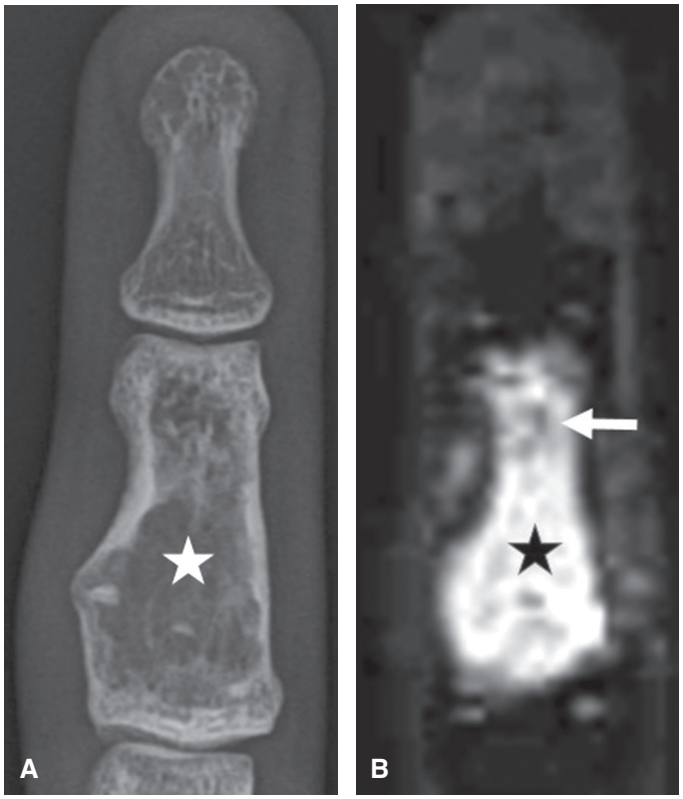

Figure 1. Enchondroma. *A*: PA radiograph of the ring finger shows an expansile lytic lesion (*star*) concentrically located within the middle phalanx. *B*: Coronal, T2-weighted, fat-saturated MR image shows a corresponding T2 hyperintense lesion (*star*), which is confined within the bony cortex. There are internal regions of T2 dark chondroid matrix (*arrow*).

The continuing education activity in *Contemporary Diagnostic Radiology* is intended for radiologists.

Contemporary Diagnostic Radiology (ISSN 0149-9009) is published bi-weekly by Wolters Kluwer Health, Inc. at 14700 Citicorp Drive, Bldg 3, Hagerstown, MD 21742. **Customer Service: Phone (800) 638-3030; Fax (301) 223-2400; E-mail: customerservice@lww.com.** Visit our website at LWW.com. Publisher, Stella Bebos.

more homogeneous with T1 hypointense and T2 hyperintense signal. Usually, there is only peripheral or septal enhancement.[3] Malignant degeneration to chondrosarcoma is rare but should be suspected with new pain (without fracture), interval lesion growth, loss of lesion margination, cortical disruption, extraosseous soft tissue mass, or periosteal reaction.[3] Nonhereditary enchondromatosis (Ollier disease) carries a 25% chondrosarcoma transformation risk with a higher malignant transformation risk in Maffucci syndrome (enchondromatosis with soft tissue hemangiomas).[4] Therefore, patients with enchondromatosis should have regular imaging surveillance of the affected regions.

Nonhereditary enchondromatosis (Ollier disease) carries a 25% chondrosarcoma transformation risk; Maffucci syndrome has a higher malignant transformation risk.

Periosteal chondromas (also termed juxtacortical chondromas) are benign hyaline cartilage tumors arising from the bone periosteum. Often found in long bones, they rarely occur in the hand and wrist.[3] Radiography and CT show a periosteal-based lucent lesion with erosion and "saucerization" of the adjacent bony cortex.[3] These features can be mistaken for aggressive periostitis.[3] MR features include intermediate T1 and high T2 lesional signal and thin peripheral enhancement, which is similar to features of other chondroid lesions.

Osteoid osteomas are benign bone-forming tumors most commonly presenting in the second and third decades. The hand and wrist are infrequent locations for osteoid osteomas, but when they occur here, there is a slight predilection for the proximal phalanges.[3] Nocturnal bone pain relieved by nonsteroidal anti-inflammatory medications is a classic clinical presentation, but lesions can be painless, especially when occurring in the fingers, and may present with finger swelling.[4] Osteoid osteomas are composed of a highly vascularized osteoid-producing nidus with varying degrees of surrounding reactive sclerosis.[3] Classic radiographic presentation is a lucent lesion with sclerotic rim. CT is the best modality for identifying the characteristic sclerotic central nidus.[3] On MRI, osteoid osteomas have peripheral T1 and T2 hypointensity reflective of the osseous sclerosis with often exuberant surrounding bone marrow and soft tissue edema (Figure 2). The nidus is T2 hypointense and is often more conspicuous on gadolinium postcontrast images or CT.[3]

Giant cell tumors are relatively common skeletal tumors accounting for up to 23% of benign bone neoplasms,[5] but only rarely occur in the hand. Ten percent of giant cell tumors occur in the distal radius and only 5% occur in other hand and wrist locations.[5] Metacarpals are the most common hand location,[3] and, rarely, giant cell tumors will occur in the phalanges.[4] Typical presentation ages are between 20 and 50 years, with peak prevalence in the third decade of life.[5] In the hand, giant cell tumors have similar location as compared with lesions in the appendicular long bones, including eccentric metaphyseal-epiphyseal location with closed physis and extension to the subchondral region. Radiography shows an expansile, lytic lesion lacking internal mineralization. Marginal lesion sclerosis is absent in most cases (Figure 3).[5] Lesion cystic components are common. In solid portions of the lesion, MR signal is low to intermediate on both T1 and T2 sequences with postcontrast enhancement.[5] As in other areas in the body, up to 20% of giant cell tumors will be locally aggressive, manifested by possible imaging features of periosteal reaction, cortical breakthrough, and extraosseous soft tissue mass.[3] Of all

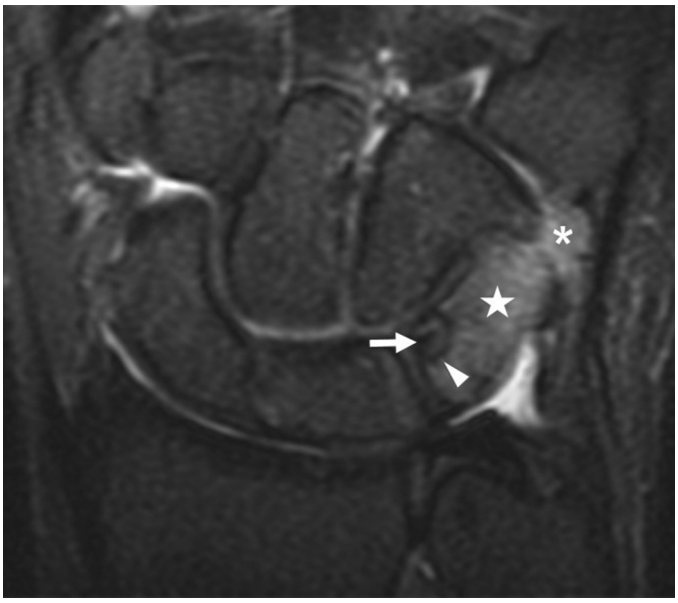

Figure 2. Osteoid osteoma. Coronal, T2-weighted, fat-saturated MR image shows a cortically based bone lesion in the triquetrum with dark signal sclerotic rim (*arrowhead*) and internal dark nidus (*arrow*). There is adjacent T2 hyperintense bone marrow edema (*star*) and adjacent soft tissue edema (*asterisk*).

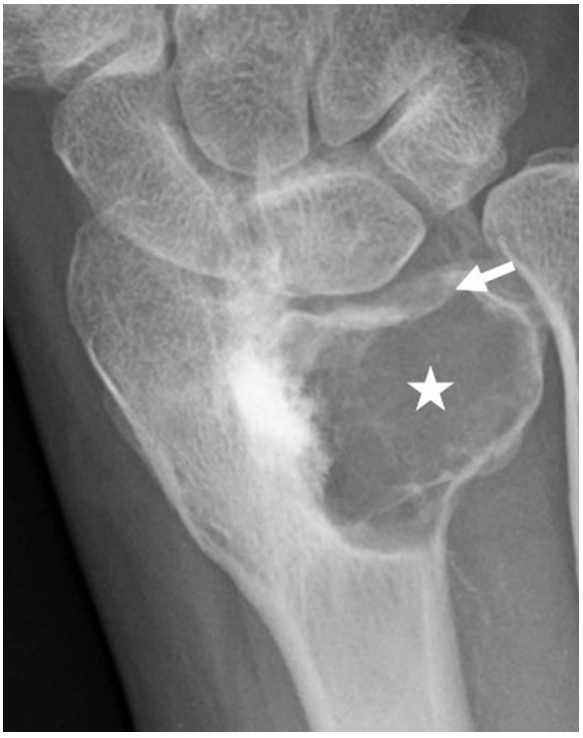

Figure 3. Giant cell tumor. PA radiograph of the wrist shows an expansile lytic lesion in the distal radius with eccentric intramedullary location (*star*). The lesion crosses the closed physis and extends to the subchondral region (*arrow*).

giant cell tumors, 5% to 10% are malignant with possible metastatic extension to the lung.[5]

Giant cell tumors are relatively common skeletal tumors, but only rarely occur in the hand; metacarpals are the most common location in the hand.

Giant cell reparative granulomas are infrequently encountered benign lesions that are classified as reactive processes instead of primary bone lesions.[5] Although they contain giant cells and other fibrous elements, they are histologically distinct from giant cell tumors, and giant cell reparative granuloma's histologic appearance is closer to that of brown tumor of hyperparathyroidism.[5] The majority of giant cell reparative granulomas occur in the mandible, but the second most common location is in the small bones of the feet and hands (phalanges > metacarpals > carpals).[5] Giant cell reparative granulomas typically occur in the second and third decades of life, and up to 74% of patients are younger than 30 years at presentation, whereas giant cell tumor peak prevalence is in the fourth decade.[5] Radiography shows a lytic, expansile lesion with thinned, intact cortex (Figure 4).[4] MRI often shows a solid lesion with intermediate T1 and T2 signal and rare cystic components.[5]

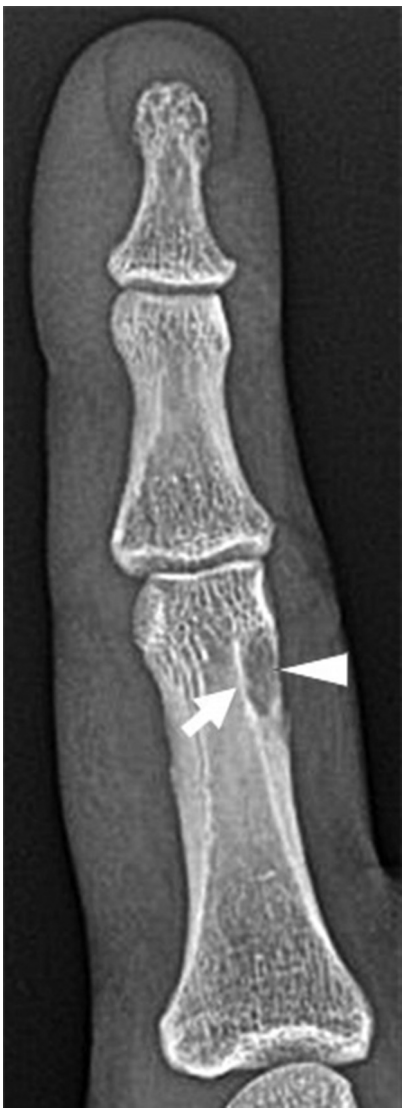

Figure 4. Giant cell reparative granuloma. PA radiograph of the index finger shows a cortically based lytic lesion with sclerotic rim (*arrow*) in the proximal phalanx. There is thinning of the associated bony cortex (*arrowhead*).

Osteochondromas are the most common primary bone tumors in the body, accounting for approximately 35% of benign osseous tumors. Ten percent of osteochondromas occur in the hands and feet,[3] and the proximal phalanx is a common location.[4] Osteochondromas often are found incidentally at imaging, or they may present with deformity, fracture, neurovascular impingement, or adventitial bursa formation.[3] Osteochondromas are composed of cortical and medullary bone elements that are contiguous with the parent bone (Figure 5). A variably sized hyaline cartilage cap is often present.[3] Osteochondromas characteristically occur at the bone metaphysis and are classified as sessile (broad-based) or pedunculated. Pedunculated lesions will have a pedicle with apex oriented away from the nearest joint.[3] Radiographic appearance of the above features often is diagnostic, but CT or MRI may be needed to confirm marrow continuity with the parent bone or evaluate for impingement on the adjacent soft tissues. MRI is the best modality for evaluating the cartilage cap thickness, which is an indicator for lesion malignant transformation when the cap thickness measures greater than 2 cm. Mineralized portions of the cap have low signal on all sequences, whereas nonmineralized hyaline portions have high T2 and intermediate T1 signal. Osteochondromas frequently grow through adolescence. After skeletal maturity, lesion growth and cortical erosion should raise suspicion for malignant degeneration to low-grade chondrosarcoma, which has a reported 1% incidence.[3] Multiple hereditary exostosis is an autosomal dominant condition manifested by polyostotic osteochondromas. From 20% to 30% of these individuals will have lesions in the hand, with lesional malignant degeneration risk of 3% to 5%. Therefore, surveillance imaging of the affected regions is recommended.[3]

Bizarre parosteal osteochondromatous proliferation (BPOP; also known as Nora lesion) is named for its atypical

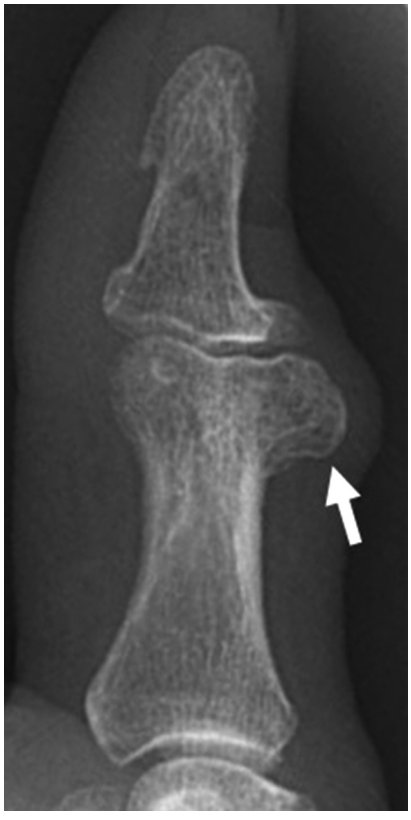

Figure 5. Osteochondroma. PA radiograph of the thumb shows an exostosis (*arrow*) centered at the metaphysis, which has medullary contiguity.

and "bizarre" histologic appearance.[3] It is a benign, reactive bone surface lesion thought to occur after periosteal trauma and is described as a middle-stage lesion in a spectrum that includes earlier florid reactive periostitis and later turret exostosis.[4] The most common age of onset is 25 to 45 years.[4] The hand and foot are the most common sites for lesions, and 92% of hand lesions occur in the phalangeal metaphyses and diaphyses.[3] As a bone surface lesion, *cortical discontinuity* of BPOP distinguishes it from an osteochondroma.[3] The lesions consist of reactive heterotopic mineralization at the periosteum of intact cortex and show no medullary involvement.[3] Radiography will show a calcified surface lesion usually without periosteal reaction.[3] CT and MRI will show cortical and medullary discontinuity with the underlying affected bone (Figure 6). On MRI, the lesions are characteristically T1 hypointense and T2 hyperintense, with enhancement on gadolinium-enhanced images.[3] Histologically, cartilage atypia may be present, which could lead to an erroneous pathologic diagnosis of chondrosarcoma after biopsy, so the radiologic appearance must be communicated to the pathologist.[4] Excision is considered in symptomatic cases, but recurrence rates range up to 55%.[3]

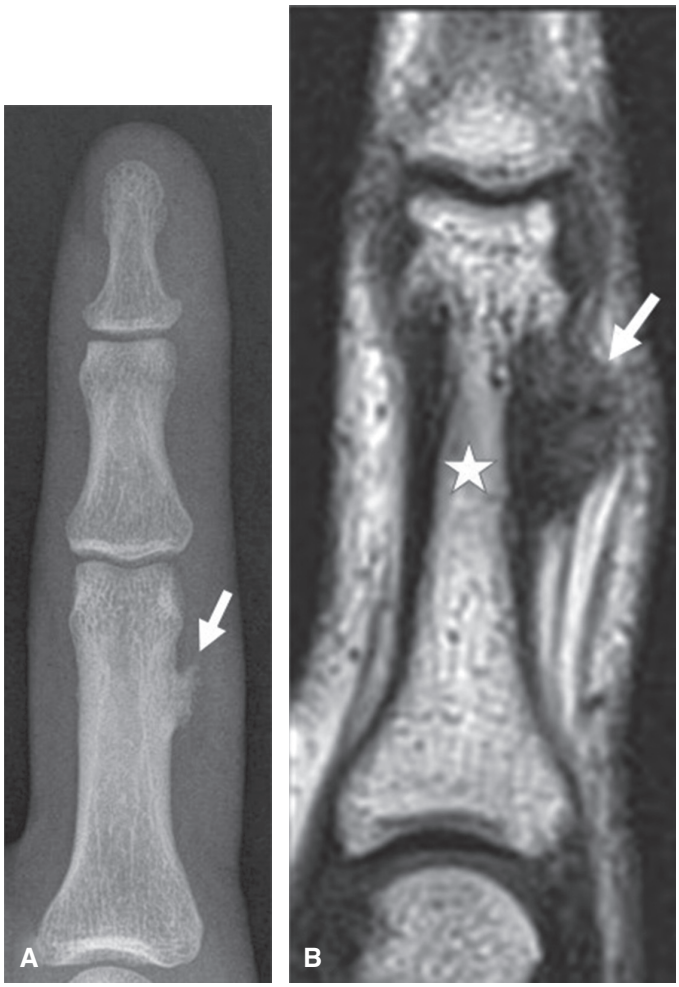

Figure 6. Bizarre parosteal osteochondromatous proliferation. *A*: PA radiograph of the long finger shows a parosteal lesion (*arrow*) arising from the diaphysis of the proximal phalanx with questionable intramedullary contiguity. *B*: Coronal, T1-weighted, MR image of the same region shows that the lesion (*arrow*) has mixed dark and intermediate signal. There is absence of intramedullary contiguity, as the lesion contains no T1 hyperintense bone marrow signal (*star*). There was no associated bone marrow edema or soft tissue edema on T2-weighted, fat-saturated MR images (not shown).

As a bone surface lesion, cortical discontinuity distinguishes BPOP (Nora lesion) from an osteochondroma.

Malignant Masses

Chondrosarcoma rarely occurs in the hand and wrist, yet it is the most common primary malignant bone tumor of the hand.[3,6] In the hand, the proximal phalanx is the most common site of occurence.[3] Lesions may arise from preexisting enchondromas or osteochondromas or may occur de novo.[3] Radiography and CT will show a lytic, intramedullary lesion, which may be expansile and have endosteal scalloping or cortical erosion. Like enchondromas found in the hands, the presence of chondroid mineralized matrix is variable.[3] MR signal for chondrosarcoma is similar to enchondroma with T1 intermediate and T2 hyperintense signal. Postcontrast sequences often will show nodular enhancement of the chondrosarcoma portion of the chondroid lesion. Differentiating phalangeal enchondromas and chondrosarcomas with imaging is difficult because both can have similar radiographic and MR characteristics. Deep endosteal scalloping is helpful in distinguishing these lesions in the long bones; however, in the phalanges, endosteal scalloping often is present in both lesions.[6] Imaging findings, which may distinguish chondrosarcoma from enchondroma, include lysis of chondroid matrix seen on previous images, permeative radiographic appearance, extension through the cortex, and associated enhancing soft tissue mass.[6] In contradistinction to chondrosarcomas in other regions of the body, phalangeal lesions rarely metastasize.[3]

Differentiating phalangeal enchondromas and chondrosarcomas with imaging is difficult because both can have similar radiographic and MR characteristics.

Other primary malignant tumors in the hand and wrist include osteosarcoma and Ewing sarcoma both of which are extremely rare.[7] Both lesions feature aggressive periosteal reaction. Fewer than 5% of Ewing sarcomas occur in the hand.[8] Ewing sarcoma typically will exhibit lytic, permeative, and destructive features on radiographs and MRI with enhancing components. Dense, cloudlike osteoid matrix is sometimes present.[8] Osteosarcoma will have similar aggressive characteristics, but it can have variable aggressive lytic or sclerotic presentation based on subtype and osseous matrix production.

Juxtacortical osteosarcomas are variants that arise outside the medullary space, often forming soft tissue osteoid matrix before eroding into the medullary space. Subcategories of juxtacortical osteosarcomas include parosteal, periosteal, and high-grade surface osteosarcoma (Figure 7). Categorizing bone surface lesions as nonaggressive or aggressive is crucial, as most encountered bone surface lesions will be benign and will not require biopsy. However, it is essential to

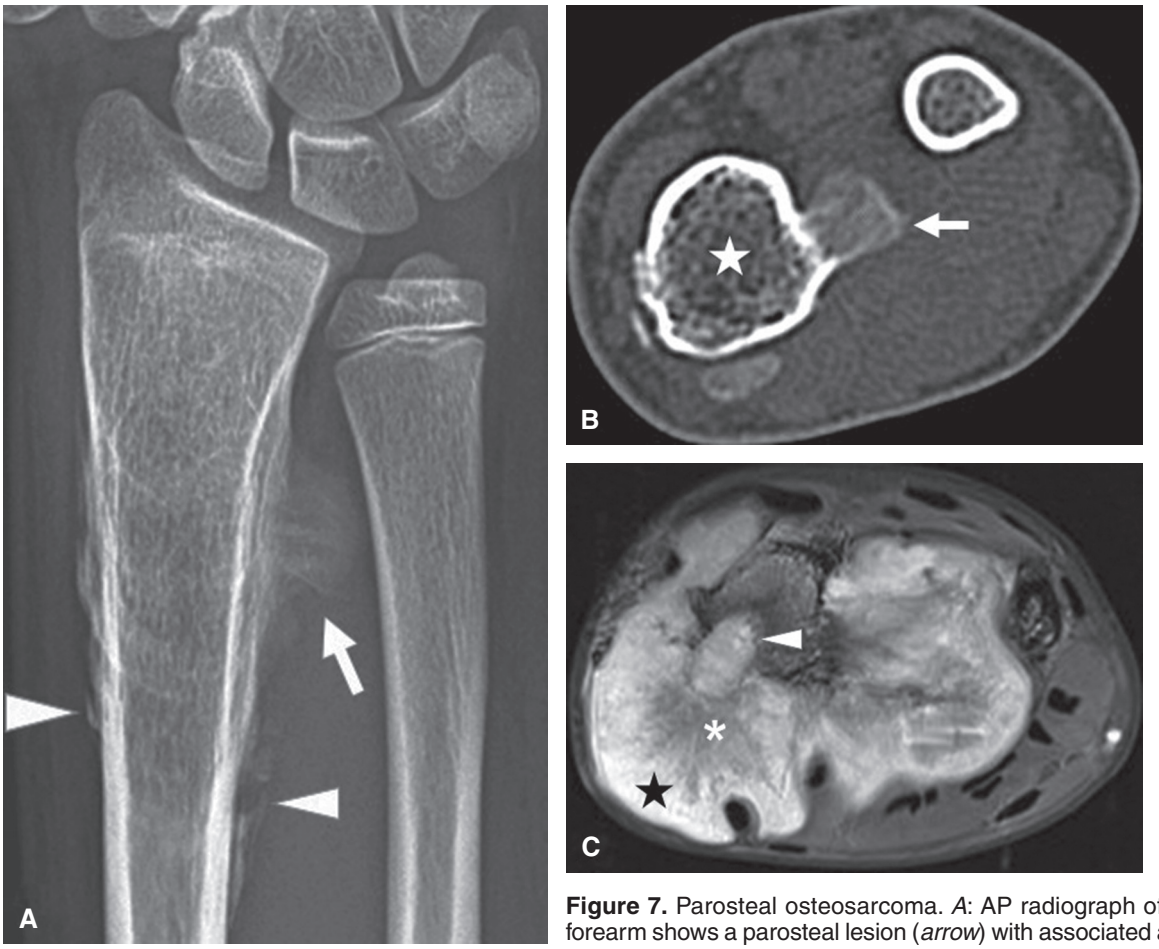

Figure 7. Parosteal osteosarcoma. *A*: AP radiograph of the distal forearm shows a parosteal lesion (*arrow*) with associated aggressive periosteal reaction (*arrowheads*) surrounding the distal metadiaphysis of the radius. *B*: Axial, CT scan shows immature parosteal osteoid matrix (*arrow*). The lesion does not extend into the intramedullary space (*star*). *C*: Two years later, axial, T1, fat-saturated, postcontrast MR image shows aggressive growth of the lesion, which has enhancing components (*star*) and hypoenhancing necrosis (*asterisk*). The lesion extends through multiple forearm muscle compartments and has infiltrated the radius bony cortex (*arrowhead*).

understand the imaging features of malignant bone surface lesions so they can be appropriately diagnosed and managed (Table 1).

Osseous metastasis in the hand is extremely rare, representing 0.1% of all osseous metastatic lesions in the body.[7] Distal phalangeal subungual metastatic tumors can

Table 1. Imaging Characteristics of Parosteal Lesions

Imaging Characteristic	Osteochondroma	BPOP	Surface Osteoma	Parosteal Osteosarcoma
Medullary contiguity	Yes	No	No	No
Cartilaginous cap	Yes	Maybe, focal and discontinuous	No	Rare
Cortical destruction	No	No	No	Yes
Medullary invasion	No	Rare	No	Yes
Soft tissue mass	No	No	No	Yes
Adjacent soft tissues	Displaces, distinct interface	Displaces, distinct interface	Displaces, distinct interface	Invasion, indistinct interface
Direct adjacent bone extension	No, extrinsic erosion	Extrinsic erosion is rare	No	Direct extension or extrinsic erosion
Cleavage plane	No	Yes, early on	No	Yes, two-thirds of the time
Wraps around bone	No	No	No	Yes
Lucencies with tumor	No	No	No	Yes
Periphery to base lesion density	Periphery > base	Periphery = base	Periphery = base	Periphery < base

BPOP, bizarre parosteal osteochondromatous proliferation.

include primary disease from the lung, kidney, breast, or distant squamous cell carcinoma.[3] Osseous metastatic disease in the hand confers a very poor prognosis.[3]

Osseous metastasis in the hand is very rare (0.1% of all osseous metastatic lesions in the body); however, it confers a very poor prognosis.

Conclusion

Formulating a relevant differential diagnosis of hand and wrist bone lesions requires an understanding of relative lesion incidence, pertinent clinical features, and characteristic features on various imaging modalities. The radiologist should use a systematic approach to arrive at a short list of possible diagnoses. An accurate lesion differential diagnosis will assist in designating the lesion as nonaggressive or indeterminate/aggressive, which may prompt further management options including imaging surveillance or tissue sampling to exclude malignancy.

References

1. Shirazi N, Gupta V, Kapoor I, et al. Osteolytic lesions of hand and feet: a seven-year experience from a tertiary referral centre of North India. *Malays J Pathol*. 2014;36(2):115-124.
2. Magee TH, Rowedder AM, Degnan GG. Intraosseous ganglia of the wrist. *Radiology*. 1995;195(2):517-520.
3. Melamud K, Drape J, Hayashi D, et al. Diagnostic imaging of benign and malignant osseous tumors of the fingers. *Radiographics*. 2014;34(7):1954-1967.
4. Plate AM, Lee SJ, Steiner G, et al. Tumorlike lesions and benign tumors of the hand and wrist. *J Am Acad Orthop Surg*. 2003;11:129-141.
5. Murphey MD, Nomikos GC, Flemming DJ, et al. From the archives of AFIP. Imaging of giant cell tumor and giant cell reparative granuloma of bone: radiologic-pathologic correlation. *Radiographics*. 2001;21(5):1283-1309.
6. Murphey MD, Walker EA, Wilson AJ, et al. From the archives of the AFIP: imaging of primary chondrosarcoma: radiologic-pathologic correlation. *Radiographics*. 2003;23(5):1245-1278.
7. Ahmed O, Moore DD, Stacy GS. Imaging diagnosis of solitary tumors of the phalanges and metacarpals of the hand. *AJR Am J Roentgenol*. 2015;205(1):106-115.
8. Murphey MD, Senchak LT, Mambalam PK, et al. From the radiologic pathology archives: Ewing sarcoma family of tumors: radiologic-pathologic correlation. *Radiographics*. 2013;33(3):803-831.

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1. Which one of the following is the *most* common location of a giant cell reparative granuloma in the hand?
- **A.** Scaphoid
- **B.** Lunate
- **C.** Triquetrum
- **D.** Phalanges
- **E.** Metacarpals

See Reference No. 5 for further study

2. Which one of the following is the single *best* imaging feature of BPOP (Nora lesion) that distinguishes it from an osteochondroma?
- **A.** Medullary involvement
- **B.** Patient age
- **C.** Periosteal reaction
- **D.** Cortical discontinuity
- **E.** Peripheral enhancement

See Reference No. 3 for further study

3. As a distinguishing feature, endosteal scalloping in the phalanges is *not* always helpful when discriminating between
- **A.** BPOP and osteochondroma
- **B.** infection and Ewing sarcoma
- **C.** enchondromas and chondrosarcomas
- **D.** aneurysmal bone cyst and telangiectatic osteosarcoma
- **E.** bizarre parosteal osteochondromatous proliferation and juxtacortical osteosarcoma

See Reference No. 6 for further study

4. Figure 8 is a radiograph of a hand. The *most* harmful complication of the bone lesions present in this patient is
- **A.** fracture
- **B.** chondrosarcoma
- **C.** BPOP
- **D.** Ewing sarcoma
- **E.** osteosarcoma

See Reference No. 4 for further study

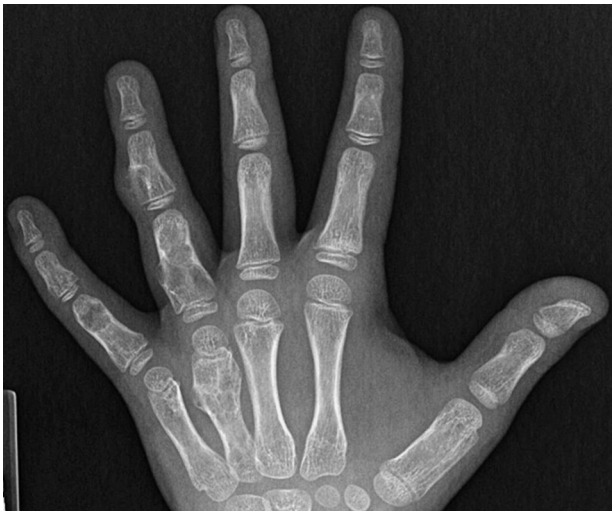

Figure 8.

5. The *most* common site of giant cell tumors in the hand is
- **A.** metacarpals
- **B.** distal tuffs
- **C.** proximal phalanges
- **D.** distal carpal row
- **E.** middle phalanges

See Reference No. 3 for further study

6. All of the following MR characteristics are useful to differentiate enchondroma from chondrosarcoma in the hand and wrist, *except*
- **A.** extension through the cortex
- **B.** associated enhancing soft tissue mass
- **C.** lysis of chondroid matrix seen on previous imaging
- **D.** medullary continuity

See Reference No. 7 for further study

7. Which one of the following statements regarding the prevalence of bone lesions of the hand is *false*?
- **A.** Benign tumors are more common than malignant tumors.
- **B.** Malignant tumors are less common than pseudotumors.
- **C.** Malignant tumors are less common than inflammatory/infectious lesions.
- **D.** All lesions require biopsy and histopathologic assessment.
- **E.** A large percentage of benign lesions will have characteristic imaging features.

See Reference No. 1 for further study

8. Which one of the following is the *most* common malignant bone tumor in the hand and wrist?
- **A.** Chondrosarcoma
- **B.** Conventional osteosarcoma
- **C.** Ewing sarcoma
- **D.** Fibrosarcoma
- **E.** Telangiectatic osteosarcoma

See Reference No. 6 for further study

9. Which one of the following bones of the hand is the *most* common site of an intraosseous ganglion?
- **A.** Lunate
- **B.** Scaphoid (navicular)
- **C.** Hamate
- **D.** Metacarpal of the thumb
- **E.** Distal phalanx of the index finger.

See Reference No. 2 for further study

10. Which one of the following is the *most* common primary bone tumor in the hand?
- **A.** Intraosseous ganglion
- **B.** Aneurysmal bone cyst
- **C.** Enchondroma
- **D.** Giant cell tumor
- **E.** Osteoid osteoma

See Reference No. 4 for further study