Chapter 12
Chondroma (Enchondroma)

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Definition: Intramedullary neoplasm made of well-differentiated hyaline cartilage.
Epidemiology: Rather frequent (only preceded by histiocytic fibroma and osteochondroma). No predilection for either sex. It may be diagnosed at any age.

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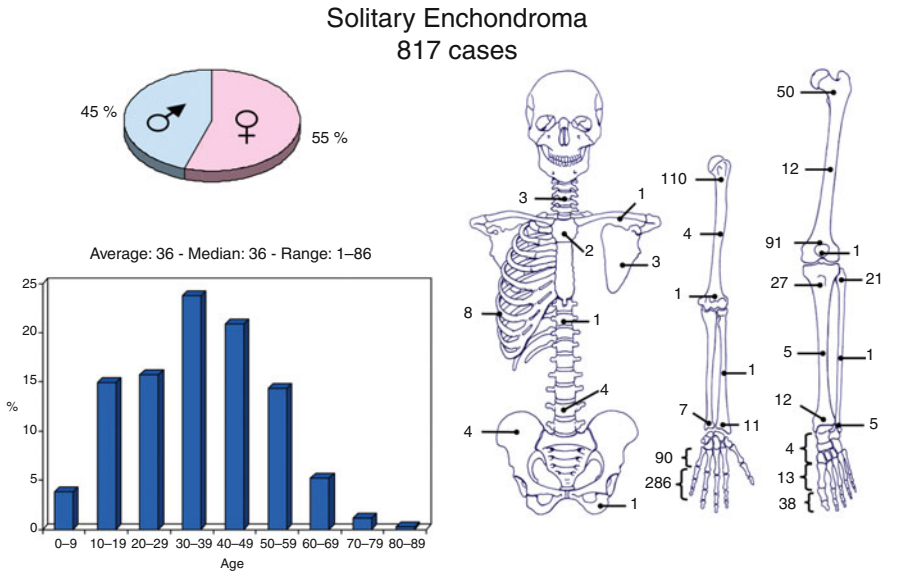


Localization: Chondroma occurs only in bones that are preformed in cartilage. Most cases are observed in tubular bones of the hand. Enchondroma is the most common bone tumor of the hands. The other chondromas are mainly distributed in the long bones, with preference for the femur. The real incidence of chondroma outside the hand is underestimated, as most of these lesions are asymptomatic.

Clinical: Because of its slow growth, minimal peritumoral reaction, and avascularity, chondroma is usually painless. In some active chondromas (mainly in young age), or after exercise, or because of pathologic fracture, immediate pain does occur. A mild expansion of the cortex can be seen or palpated in superficial bones, such as tubular bones of the hand or foot, ribs, and fibula where pathologic fractures are also common.

Imaging: The lesion is frequently central, sometimes eccentric or intracortical. It is an osteolysis, with rounded, lobulated, well-defined edges with a thin rind of reactive sclerosis. Usually the lesion contains granular, popcorn, ringlike opacities that represent calcification and ossification at the periphery of the lobules. Chondroma can reach considerable extension in the major long bones but rarely exceeds 6 cm; in small ones (hand, ribs, fibula), the cortex is thinned and the bone slightly to moderately expanded. CT scan demonstrates the lobular or multi-island nature of the lesion, its sharp limits, and its radiodensities, as well as the lack of permeative alterations of the cortex. MRI at best defines longitudinal extension; lesion is low signal in T1, high signal in T2; and calcifications are seen as black signal voids in both T1 and T2. Isotope scan is very hot in most lesions and sometimes reveals

asymptomatic chondromas when performed for staging or follow-up of other conditions; it is useful in showing asymptomatic chondromas.

Pathology: Lesion consists of lobules of cartilage. The aspect is typical of hyaline cartilage. Calcified areas appear as white opaque granules. Reactive or enchondral ossifications manifest as white-yellow hard rings and streaks around and between the lobules. The limits of the lesion are often irregular, as lobules of cartilage push toward the cancellous bone and excavate little niches in the cortex but always well defined. The chondrocytes are sparse, with small, round, dense nuclei, of relatively uniform size. Occasionally, isogenous groups of cells can be seen. Double-nucleated cells are present, usually rare, but can be moderate. This does not really distinguish well benign enchondroma from chondrosarcoma. While diagnosis of cartilage tumor is usually easy even on clinico-imaging findings alone, the real problem is to differentiate chondroma from grade 1 chondrosarcoma. Histologically, this distinction is difficult:

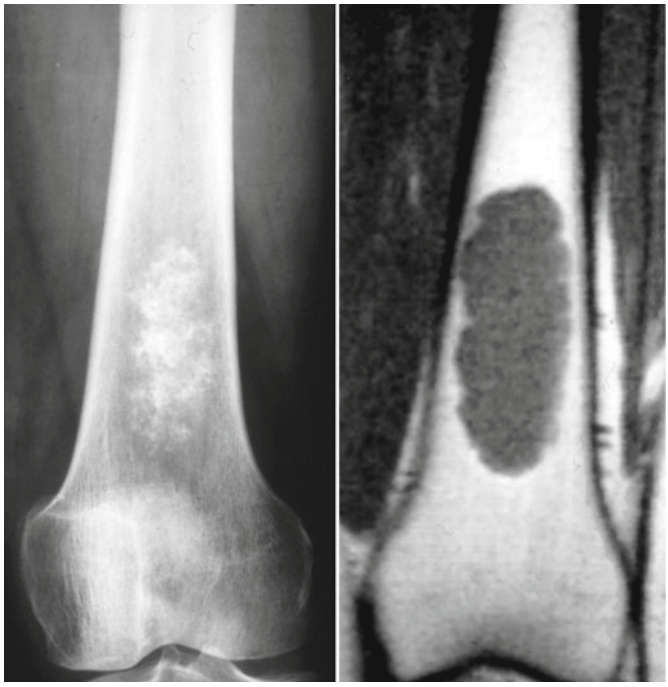
(a) Grade 1 chondrosarcoma has a higher cellularity, more plump nuclei, and more than four to five double-nucleated cells per high-power field, but such features are subjective.
(b) Areas of chondroma and grade 1 chondrosarcoma may be found in the same tumor.
(c) The histological indicators of low-grade malignancy are meaningless if the lesion is in the hand, or in a child, or periosteal, or in chondromatosis. A useful differential element is represented by the relationship between the tumor and host bone. Chondroma can present with cartilage islands scattered in the bone, usually encased by a shell of mature lamellar bone. Chondrosarcoma, on the contrary, permeates marrow spaces and Haversian channels of the host in at least 90 % of cases. The permeative pattern is 99 % accurate, although cartilage permeation-like areas can be found in advanced osteoarthritis and in post-fracture epiphyses.

Course and Staging: Until skeletal maturity, chondroma grows slowly, and then it tends to stop. Thus, chondroma is stage 2 in children and stage 1 in adults. The incidence of malignant transformation of a solitary chondroma is unknown and controversial. Very rare in the hand, probably less rare in the trunk and limb girdles.

Treatment and Prognosis: Diagnosis can usually be made on clinico-radiographic features. The majority of chondromas do not require biopsy or surgical treatment. Enchondromas of the hand are sometimes treated with curettage and bone grafting because of pain, pathologic fracture, or cosmesis. Rarely, biopsy may be indicated if diagnosis of enchondroma is unclear. Follow-up with serial radiograms is helpful in the differential diagnosis vs grade 1 chondrosarcoma. After the epiphyseal plate is closed, enchondroma shows little to no growth; chondrosarcoma growth is continuous, grows 1–2 cm per year or more, and is associated with increasing pain, often waking up patient at night.

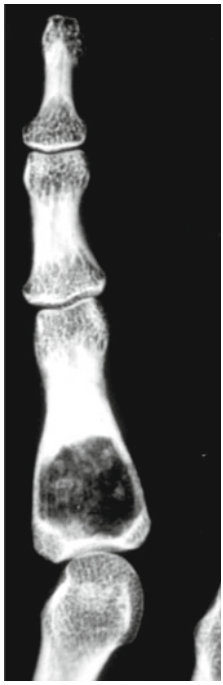
Key Points

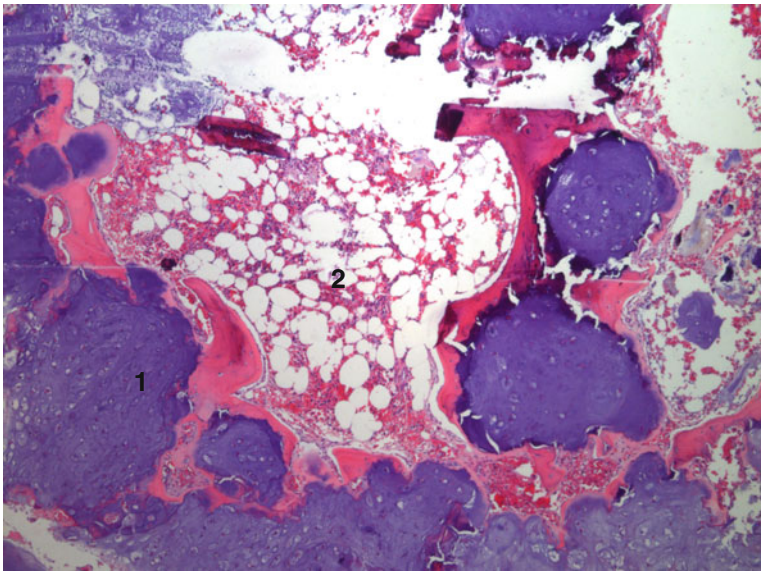
Clinical	Incidental findings
Radiological	Central, lobulated, granular, and ringlike calcifications
Histological	Lobules of benign cartilage ossified at the periphery without infiltration of the cancellous host bone
Differential diagnosis	Low-grade central chondrosarcoma



AP radiograph and coronal T1 MR of the distal femur. Well-limited lesion, centered in the medullary cavity, with typical cartilaginous calcifications (round with a clear center). The cortex and soft tissues are not involved

Radiograph of a finger. Well-limited lesion, containing cartilaginous calcifications





(1) Cartilaginous lobules with mature matrix. (2) Normal fatty marrow in between the cartilaginous lobules

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