Chapter 15
Solitary Osteochondroma

Nicola Fabbri and Davide Donati

Definition: Benign cartilaginous neoplasm derived from an aberrant subperiosteal germ of the physeal cartilage, which grows and matures according to normal enchondral ossification.

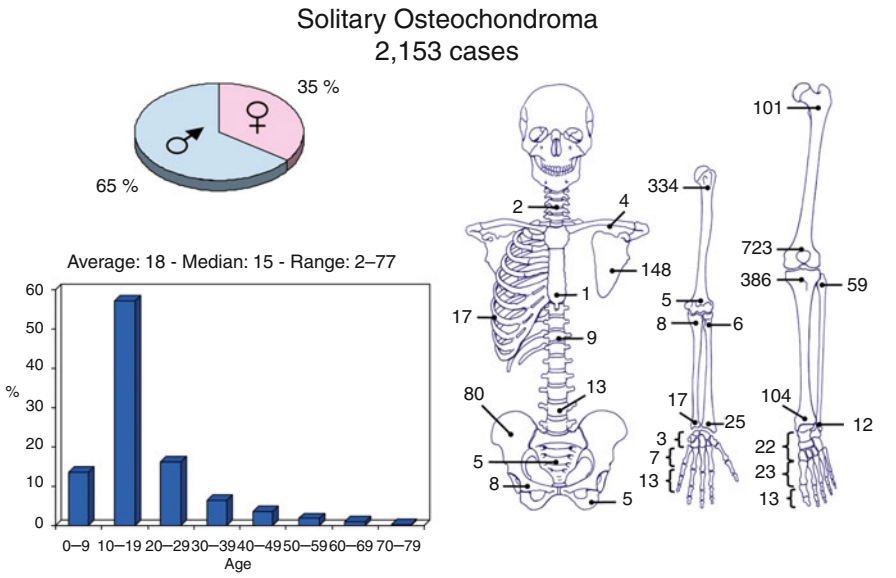
It originates from a misplaced, subperiosteal island of physeal cartilage. It may also be seen in children secondary to radiation therapy. Presumably irradiation favors the exclusion of a cartilaginous island, by partially arresting and disorganizing proliferation of the physeal plate.

Epidemiology: Osteochondroma is very frequent. It prefers males by 1.5–2 to 1. Originating in early infancy, it is usually first noticed between 6 and 20 years of age.

N. Fabbri, MD (✉)
Department of Surgery, Orthopaedic Service, Memorial Sloan-Kettering Cancer Center,
1275 York Avenue, New York, NY 10065, USA
e-mail: fabbrin@mskcc.org

D. Donati, MD (✉)
3rd Orthopaedic and Traumatologic Clinic Prevalently Oncologic,
Istituto Ortopedico Rizzoli, Bologna, Italy
e-mail: davide.donati@ior.it

P. Picci et al. (eds.), *Atlas of Musculoskeletal Tumors and Tumorlike Lesions*,
DOI 10.1007/978-3-319-01748-8_15,



Localization: The most frequent localization is in the long bones: distal femur, proximal humerus, and proximal tibia. It originates from the metaphysis, but, with skeletal growth, it tends to move toward the diaphysis. In the trunk, more frequently involved are the scapula and ilium. Osteochondroma is exceptional in the hand and foot, and it does not occur in bones originating from membranous ossification (skull) nor in the epiphyses and carpal and tarsal bones (except the calcaneus).

Clinical: Swelling is the main symptom, slowly increasing during skeletal growth. Osteochondroma is usually painless. More rarely, pain may be due to bursitis or activity-related discomfort, especially in large lesions. Occasionally, a bursa forms on the osteochondroma, due to chronic friction; when fluid collection occurs in this bursa, an apparent and rapid increase of the volume, accompanied by pain, can arise the suspicion of a malignant change. Exceptionally, osteochondroma compresses a peripheral nerve or the dural sac, thus causing neurological symptoms; or it rubs against a large artery thus producing a false aneurysm (femoropopliteal artery). Also exceptionally, as a result of traumatic fracture of its stalk, osteochondroma becomes painful and mobile, clinically simulating a muscular ossification or a loose articular body.

Imaging: Osteochondroma is a bony excrescence with well-defined limits, having a thin outer cortex and an internal cancellous structure. The pathognomonic radiographic feature is that the cortex of the host bone flares into the cortex of the osteochondroma, and the cancellous bone of the osteochondroma blends with the cancellous bone of the metaphysis. In large lesions, areas or rarefied bone may alternate with irregular blotches of intense radio density, due to remnants of calcified cartilage, focal thickening of bone trabeculae, and bone necrosis. Some are

pedunculated with a globose, cauliflower-like summit or with a sharp hornlike extremity. Others have a broad sessile base. Pedunculated osteochondromas are usually inclined toward the diaphysis. Rarely osteochondroma reaches huge sizes (even 15–20 cm), which are not proof of malignancy. By chronic compression, osteochondroma can cause scalloping and bowing of an adjacent bone. CT, MRI, sometimes angiography, and ultrasound may be useful (a) to confirm diagnosis in atypical cases, (b) for preoperative planning (relationship with the vascular bundle), and (c) in cases of suspect malignant change (thickness of the cartilage cap, fluid collection in reactive bursitis). Isotope scan is hot in active osteochondromas during childhood and adolescence and remains weakly positive or becomes negative after skeletal maturity, becoming again positive in malignant changes and in some bursitis.

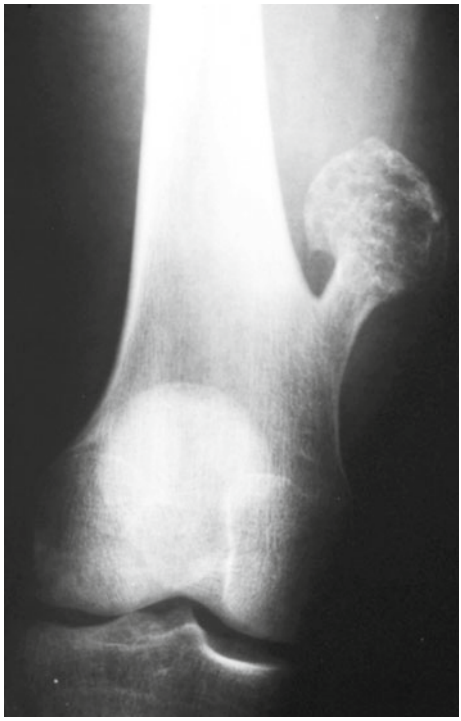
Pathology: In children, a cartilage cap covers osteochondroma with a thickness ranging from a few mm to 1 cm or more, and it appears as a light blue cartilage similar to that of the physeal plate. In the adult, this cap decreases in thickness and in some areas it disappears; residual cartilage is white and similar to articular cartilage. Limits of the cartilage with the underlying bone are well-defined. The inner part of osteochondroma is irregularly cancellous, with fatty or occasionally hemopoietic marrow. When osteochondroma is covered by a bursa, this may contain serous or hematic effusion, rarely osteocartilaginous loose bodies. In its active stage, the cartilage cap presents, although irregular, the same features of the normal growth plate. Some cellularities, plumpness of the nuclei, and hypertrophy of the cells are to be expected in children and adolescents. The bony trabeculae of osteochondroma are originated by enchondral ossification of cartilage. Cancellous bone may include remnants of calcified cartilage and/or areas of necrotic bone. Some parosteal reactive ossifications (so-called exostosis of the great toe, bizarre osteocartilaginous pseudotumor of the hand) may be composed by proliferating cartilage undergoing enchondral ossification and thus may be somewhat similar to osteochondroma; these lesions, however, lack the overall above-mentioned clinico-radiographic features characteristic of osteochondroma.

Course and Staging: Growth occurs during childhood and adolescence. After skeletal maturity, osteochondroma stops growing. Thus, it is a benign stage 2 lesion in children and adolescents, becoming stage 1 in the adult. The change of a solitary exostosis into peripheral chondrosarcoma is rare (probably <1 %) and does not occur before puberty. The risk of transformation depends on the site. It is less rare in the trunk and limb girdles, rare around the knee, and almost exceptional in the more distal extremities.

Treatment and Prognosis: In asymptomatic lesions, there is no indication for surgery. An exception can be made for osteochondromas in the trunk or limb girdles, when an adult patient may elect to have osteochondroma prophylactically removed to avoid the risk of secondary transformation to chondrosarcoma. When a child presents with a large osteochondroma located close to neurovascular bundles, surgery may be indicated to avoid further enlargement possibly encasing the neurovascular structures, making late surgery more complex.

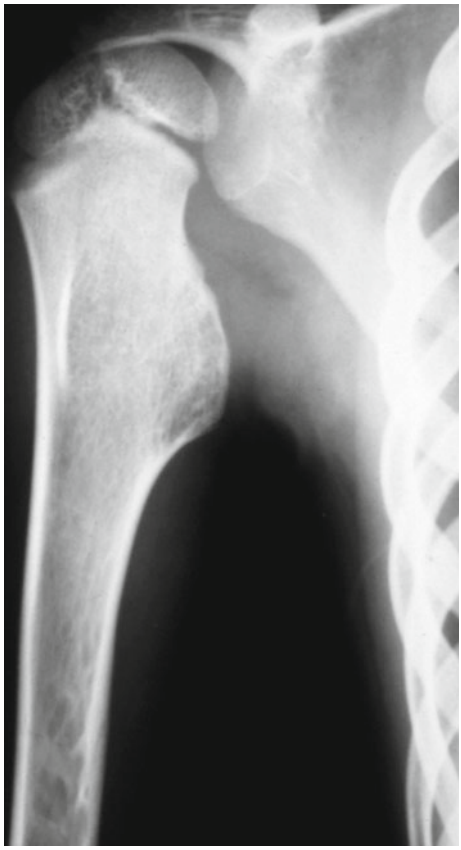
Key Points

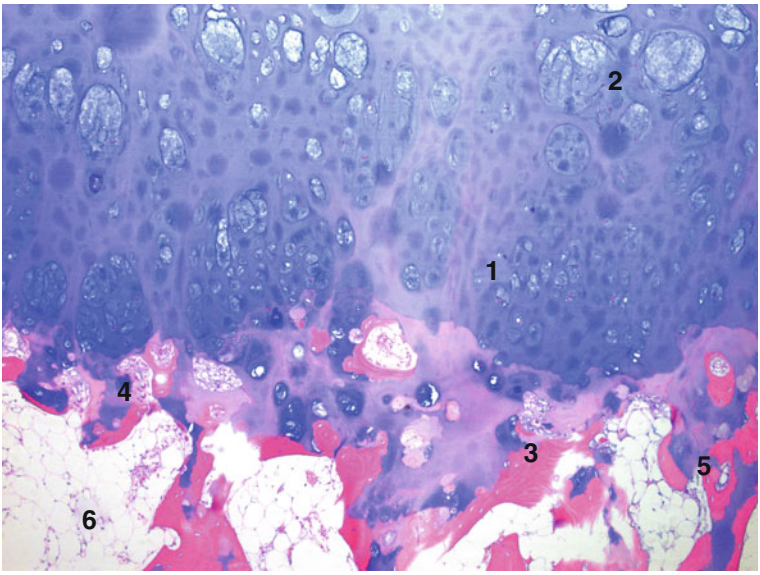
Clinical	Increasing swelling during growth age
Radiological	Bony excrescence without interruption of the cancellous bone: "finger glove sign"
Histological	Cartilage cap (max 1.5–2 cm) covering the normal cancellous bone
Differential diagnosis	Low-grade peripheral chondrosarcoma



Pedunculated osteochondroma. Radiographs of the distal femur. The cortex of the osteochondroma is in continuity with that of normal bone

AP radiograph. Sessile osteochondroma of the proximal humerus





It commonly arises, in bones formed by enchondral ossification, at the region of the edge of the epiphyseal plate. During the growth phase, the cartilage cap presents the same aspects of normal growth cartilage, although less regular. Progressive transformation of proliferating cartilage in the underlying bone also mimics the epiphyseal growth mechanism, but it is much less orderly. (1) Irregular columns of swollen chondrocytes. (2) Degeneration of chondrocytes. (3) Calcified cartilage containing empty lacunae left after chondrocyte autolysis. (4) Vascular mesenchymal cells invading the calcified cartilage and maturating into osteoblasts. (5) Seams of osteoid formed by the osteoblasts are laid on the framework of the calcified cartilage. (6) Normal marrow

Selected Bibliography

Brien EW, Mirra JM, Luck JV Jr (1999) Benign and malignant cartilage tumors of bone and joint: their anatomic and theoretical basis with an emphasis on radiology, pathology and clinical biology. II. Juxtacortical cartilage tumors. Skeletal Radiol 28(1):1–20. Review

Canella P, Gardini F, Boriani S (1981) Exostosis: development, evolution and relationship to malignant degeneration. Ital J Orthop Traumatol 7(3):293–298

Florez B, Mönckeberg J, Castillo G, Beguiristain J (2008) Solitary osteochondroma long-term follow-up. J Pediatr Orthop B 17(2):91–94

Saglik Y, Altay M, Unal VS, Basarir K, Yildiz Y (2006) Manifestations and management of osteochondromas: a retrospective analysis of 382 patients. Acta Orthop Belg 72(6):748–755

Valdivielso-Ortiz A, Barber I, Soldado F, Aguirre-Canyadell M, Enriquez G (2010) Solitary osteochondroma: spontaneous regression. Pediatr Radiol 40(10):1699–1701