Cartilaginous neoplasms of soft tissue and joints

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Abstract

Cartilaginous neoplasms of soft tissue and synovium are relatively uncommon. The vast majority is benign and the neoplastic matrix is usually hyaline in type. The heterogeneity in their histologic features, especially the degree of cellularity and cytological atypia may pose challenges in diagnosis. Immunohistochemistry and molecular analyses are helpful in only specific circumstances stressing the importance of accurate histologic interpretation.

Keywords chondroma; chondrosarcoma; joint; soft tissue; synovial chondromatosis

Introduction

Primary cartilage tumors that arise in the soft tissues and synovial lined structures are relatively uncommon. The majority is benign, arise in joints, and produce hyaline cartilage. Their pathogenesis is unknown; however, current theory suggests that they are derived from mesenchymal stem or cartilage precursor cells that undergo molecular derangements, which ultimately lead to their neoplastic transformation.

An overview of the clinicopathologic features of the important benign and malignant cartilage neoplasms that arise in the soft tissues and synovium is presented in this article. Extraskeletal myxoid chondrosarcoma, despite its name is not considered to have a cartilaginous phenotype,[1,2] and is discussed in this mini-symposium by Chebib and coworkers. Additionally, other extraordinarily rare entities such as chondroblastoma and chondromyxoid fibroma of soft parts,[3–5] which, have been reported only as single case reports, will not be included in this discussion.

Chondroma of soft parts

Chondroma of soft parts, also known as soft tissue chondroma or extraskeletal chondroma, is a benign neoplasm composed of cells that have a chondrocytic phenotype and secrete cartilage matrix.[6,7] Cytogenetic analyses have described many non-specific abnormalities involving chromosomes 5, 6, 7, 12 and 17, however, no consistent derangement has been discovered.[8,9] Interestingly, *IDH* mutations, which are frequent events in skeletal cartilage tumors, have not been identified in soft tissue chondromas.[10]

Chondroma of soft parts arises in patients that have a broad age range, but most are diagnosed during mid-adulthood with males affected more frequently than females at a ratio of 3:2. The majority of tumors develop in the soft tissues in the vicinity of tendon sheaths; approximately two-thirds originate in the fingers, and the remainder arise in the hands followed by the toes and feet. Chondroma of soft parts infrequently involves the dermis, subcutis, skeletal muscle (tongue), intracranial structures (meninges), fallopian tube, and joint capsule.[11] Tumors that are periarticular but extrasynovial often originate in the anterior infrapatellar region of the knee.[12] Interestingly, intracapsular chondromas have been reported in knees of three members of a family with familial dysplasia epiphysealis hemimelica.[13] There have been two other cases described in which cartilaginous hamartomas of the volar plates of the proximal and distal interphalangeal joints of the hands and feet were associated with peculiar hypertrophic skin lesions of the hand and hemihypertrophy of the limb. It is possible that these peculiar cartilaginous lesions represent an abnormality akin to the involvement of bones in enchondromatosis (Ollier disease and Maffucci syndrome).

Clinically, most soft tissue chondromas are solitary and present as a slowly enlarging, painless mass that can interfere with joint motion. Radiographically, they appear as an extraosseous well-delineated soft tissue mass that contains calcifications in 33–70% of cases which are either punctate or ring-like in appearance (Figure 1).[13]

Grossly, the tumors are ovoid, firm, blue-white, well-circumscribed masses of hyaline cartilage that are usually 1–2 cm in greatest dimension. Periarticular tumors, especially those that arise about the knee can achieve large size (8 cm).

Histologically, the tumors are typically composed of lobules of mature hyaline cartilage.[14] The lobules are frequently well demarcated by fibrous connective tissue and are often

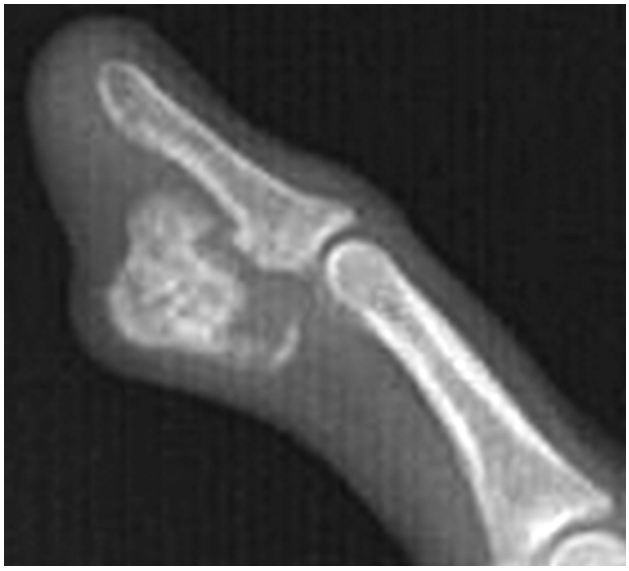

Figure 1 Radiograph of a soft tissue chondroma of the finger shows a well-circumscribed mass. The tumor is extensively mineralized with ring-like radiodensities.

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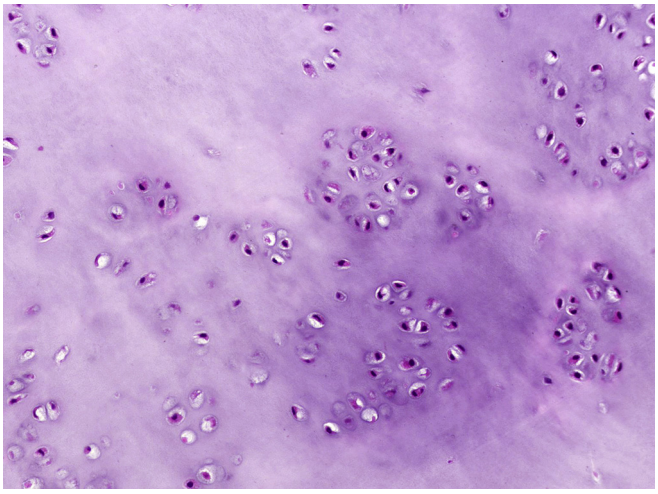

Figure 2 Soft tissue chondroma is composed of hyaline cartilage containing small chondrocytes within lacunar spaces.

hypercellular and contain chondrocytes that reside within lacunar spaces (Figure 2). The chondrocyte nuclei are generally small, round, and dark with fine or coarse chromatin, and may contain small nucleoli and exhibit mild to moderate pleomorphism. The cartilage may undergo coarse calcification or endochondral ossification and become surrounded by bone. In a minority of cases the cartilage is myxoid with stellate shaped chondrocytes that appear to "float" in mucinous stroma (Figure 3). Myxoid chondromas can be cellular and the chondrocytes may demonstrate limited cytologic atypia, a feature that can cause confusion with chondrosarcoma.[15] Infrequently, the tumors exhibit morphologic features that resemble chondroblastoma and this type of tumor has been designated chondroblastoma-like chondroma of soft tissue.[16] Chondroblastoma-like chondroma of soft tissue is composed of large chondrocytes that have moderate amounts of eosinophilic cytoplasm and nuclei that are often grooved or cleaved (Figure 4). The chondroid matrix has delicate calcifications and contains numerous osteoclast-like multinucleated giant cells. Necrosis may be present.

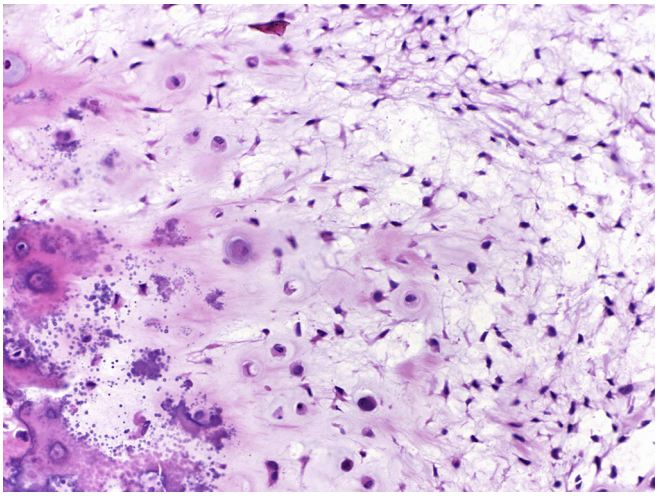

Figure 3 Soft tissue chondroma has areas of hyaline cartilage with myxoid foci in which the tumor cells are not residing in lacunar spaces. Note the granular purple calcifications in the matrix.

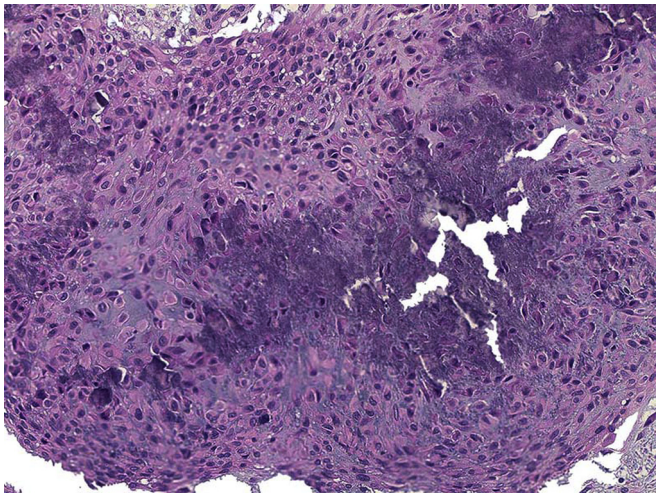

Figure 4 The chondrocytes in chondroblastoma-like chondroma of soft parts are large and the matrix surrounding the cells is mineralized.

Soft tissue chondromas have little mitotic activity and abnormal mitotic figures are not observed. Areas of necrosis, especially associated with areas of matrix calcification may be present. The tumors have a pushing margin and do not have an infiltrative growth pattern. Immunohistochemistry is usually not required for diagnosis; however the chondrocytes express S-100 protein.

The treatment of choice of soft tissue chondroma is simple excision. Although these tumors may recur in a minority of cases, they do not have metastatic potential.[6,11,15,17]

Tumors in the differential diagnosis of soft tissue chondroma include mixed tumor, chondrosarcoma, myxoma, extraskeletal myxoid chondrosarcoma, and tumoral calcinosis-like lesions of the digits. Mixed tumors may contain foci of cartilaginous differentiation, but the presence of an epithelial component in the form of glands permits distinction from chondroma of soft parts. Soft tissue conventional chondrosarcoma is usually very large and demonstrates a significantly greater degree of cellularity and cytologic atypia. However, in some cases the distinction between a chondroma with atypia and chondrosarcoma can be subjective and difficult. Myxomas do not contain hyaline cartilage, and unlike chondroma the tumor cells are spindle and stellate shaped and they do not express S-100 protein. In contrast to soft tissue chondroma, extraskeletal myxoid chondrosarcoma does not contain hyaline cartilage; the tumor cells are arranged in cords and solid clusters, and this neoplasm is associated with a translocation that involves *EWSR1*. Tumoral calcinosis-like lesions have abundant amorphous and sometimes psammomatous calcifications associated with numerous histiocytes. This combination of features can mimic a cellular calcified soft tissue chondroma or the chondroblastoma-like variant. Immunohistochemistry can be helpful as the histiocytes express markers such as CD68 and CD163 but are negative for S-100 protein.

Synovial chondromatosis

Synovial chondromatosis is an uncommon condition characterized by the formation of one or more nodules of hyaline cartilage within the subsynovial connective tissue of joints, bursae, and