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# Periosteal lesions: Clinicopathologic dilemmas and problems of their distinguishing

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## INTRODUCTION

A parosteal lesion arises from the periosteum or soft tissue in the immediate proximity of the cortex of a bone. A synonym for the term parosteal is juxtacortical and periosteal (if a lesion is believed to be derived from the periosteum itself). Only two entities violate the rule that parosteal, juxtacortical and periosteal are synonymous terms. The parosteal osteosarcoma and periosteal osteosarcoma are two separate tumors, two clinicopathologic entities in which the term parosteal and periosteal are not to be construed as synonymous. Differentiation and understanding of these lesions are extremely important because some of them are hyperplastic, reparative lesions and most of them are caused by trauma, while the others are benign or malignant neoplasms (1). Periosteal lesions can be predominantly bony, fibroblastic, cartilaginous or myxoid. The similar to all periosteal lesions, as well are confined to the periosteum, is the fact that hyperplastic or reparative lesions in their early to midphases of development show the marked cellularity, nuclear plumpness and numerous mitoses and can easily be confused with that of malignant conditions. The reason of that is their periosteal origin or their location in apposition to the periosteum and metaplastic and/or reactive ossification. Bone production renders more difficult differential diagnosis of these lesions by cytological parameters alone.

Periosteal lesions could be classified at four groups:

predominantly bony and fibroblastic (periostitis ossificans, parosteal fasciitis, periosteal osteoid osteoma, osteoblastoma etc. - as the most common benign lesions and parosteal fibrosarcoma, parosteal osteosarcoma and high grade surface osteosarcoma)

cartilaginous lesions (osteochondroma, osteochondromatosis and chondromatous transformation of osteochondromatosis)

predominantly cartilaginous to myxoid lesions (parosteal chondroma, myxoma and malignant - parosteal chondrosarcoma and periosteal osteosarcoma) miscellaneous rarities (parosteal lipoma, ganglion, glomus, etc.)

From those numerous and heterogeneous group of lesions we analyzed

periostitis ossificans, parosteal chondroma, parosteal chondrosarcoma and periosteal osteosarcoma. - to point at problems and dilemmas that pathologist has in making diagnosis.

## Periostitis ossificans

Periostitis ossificans encompassed those reparative and injury-related lesions of the periosteum unassociated with bone fracture. The reaction in the periosteum consequent to fracture, however, can be identical to those of periostitis ossificans. The clinicopathologic principles of this entity are quite similar to those of myositis ossificans and callus. The lesions often arise in the wake of a blunt or a tearing injury and can be evoked from running, jumping and many other athletic excesses. So, periostitis ossificans is a complication of bleeding into the periosteum. Periostitis ossificans can be seen to double in size every few days for the first 1 to 2 weeks. (2) After 5-7 weeks it should stabilize in size and may regress. Sarcomas grow quickly, but rarely do they double in size every few days. The radiological feature are quite variable and can be similar to that seen in malignant tumors. Most lesions are eccentrically, longitudinal with prominent Codman's triangle, sometimes bilateral. In the early stages of development periostitis ossificans may show eccentric "onion skinning". The lesions usually comprise a mixture of slightly hypercellular fibroblastic tissue with "injury" type capillaries. All cases involve osteoid and/or woven bone to variable degree. In some cases cartilage is seen and the peripheral osseous tissues are more mature than those in the central regions. Sometimes focal sheet of immature osteoid are set in a cellular stroma and it could be mistaken for osteosarcoma.

## Parosteal chondroma

Parosteal chondroma is the periosteal counterpart of the intramedullary enchondromas. Unless the lesions are of sufficient size to result in a palpable mass, lesions remain silent. In general population, the number of undetected parosteal chondromas of the long bones must exceed that of detected lesions. On the contrary, one half off all periosteal chondromas and enchondromas are discovered within the small tubular bones. Most parosteal chondroma are oriented longitudinally or along the grow axis of the bone. The classic radiological features are those of an eccentric, juxtacortical mass that contain small, rounded densities ("popcorn-like") and a rind of host bone sclerosis. The lesion apparently begins in the periosteum, but with growth inward leads to focal erosion of the cortex and involvement of the medulla (3). If the lesion grows outward, it demonstrates a soft tissue mass component. The lesion often displays a lobular arrangement at low power. Its external surface is covered by a fibro-periosteal tissue (perichondrium) and at base of lesion there is marked proliferation of reactive trabecular bone. Lobules hyaline cartilage show quite variable degree of cellularity ranges from very low to alarmingly high. Most lesions show numerous chondrocytes arranged in clusters. Nuclei are usually round, dark, fairly numerous and moderately variable in shape. Mitoses are rarely. Double-nucleated chondrocytes are often noted, usually 1-2 per high power fields (4,5). Because of high degree of cellularity in many cases of periosteal chondroma the lesion can easily be confused with that of malignant conditions (chondrosarcoma).

## Malignant, predominantly cartilaginous periosteal tumors

Two malignant, chondroblast-rich tumors (periosteal osteosarcoma and a pure periosteal/parosteal chondrosarcoma) exist and can be distinguished only on the basis of clinical, radiological and pathological feature (6). Both tumors were common in the second decade but with periosteal chondrosarcoma there is also a high incidence later in life. Periosteal chondrosarcoma is more prevalent in the long bones, while periosteal osteosarcoma occurred exclusively in them. Periosteal chondrosarcoma tends to affect the metaphysis, while periosteal osteosarcoma more often affects the mid-diaphysis. The chondrosarcomata were usually painless and ran a slow indolent course, but osteosarcomata behaved more aggressively with an average of only six months.

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In contrast to periosteal osteosarcoma that is a fusiform long mass, periosteal chondrosarcoma is round to ovoid. Radiographic periosteal chondrosarcoma contains minimal to moderate amounts of granular densities ("popcorn"). The underlying cortex often appears thickened and sclerotic around saucer-shaped erosion. At the margins of the tumor there is often a sclerotic spur (Codman's triangle), due to the chronic periosteal reaction (7). A perpendicular striation to the cortex (sunburst) is the most characteristic feature of periosteal osteosarcoma. A periosteal reaction with slender Codman's triangles may be seen at the periphery of the tumor. Periosteal osteosarcoma is more or less lytic lesion with saucerization of cortex or sclerosis at its attachment to bone. Eccentric invasion into medulla is unusual but possible. Histological periosteal chondrosarcoma is lobulated with cartilaginous features. The cartilage may show foci of dystrophic calcification and metaplastic ossification, but never direct osteoid production by tumor cells. The degree of anaplasia is variable but mostly gr. I-II.

The dominant tissue of periosteal osteosarcoma is chondrosarcomatous too. The tumors have lobular pattern, usually very cellular, with poorly differentiated mesenchymal cells either at the periphery of the lobules or scattered throughout the tumors. The histological grade of chondroid areas varied, sometimes even within the same case, from gradus I to gradus III (8,9). In some cases fibroblastic differentiation is present. All lesions manifest direct osteoid or primitive woven bone production from the malignant spindle cell stroma, which is usually quite close to lobules or sheets of malignant cartilage.

The major diagnostic difference between periosteal chondrosarcoma and periosteal osteosarcoma is that the periosteal chondrosarcoma is pure chondrosarcomatous tissue gradus I or II (rarely gradus III) malignancy. The periosteal osteosarcoma is rich chondrosarcomatous tissue with some degree of malignant tumor bone evident in every case. Tumor malignancy mostly is gradus II-III (10,11).

Sometimes these lesions (periosteal chondrosarcoma and osteosarcoma) can be confused with periostitis ossificans. The growth pattern of periostitis ossificans is different from the clinical behavior of sarcomas and histological passes through phases as callus and myositis ossificans also pass.

In summary, we suggest that clinical and radiological correlation with adequate, well stained, preparation can provide essential information to ensure an absolute diagnosis of periosteal lesions.

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