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Bizarre Parosteal Osteochondromatous Proliferation-Like Lesion Originating in Soft Tissue: Report of a Case

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ABSTRACT

Many tumors are unique to the organs from which they arise. Over the last 20 years, however, most tumors that were thought to be primary in soft tissues (derived from the primitive mesenchyme) and thought not to have counterparts in bone, were found to, in fact, rarely arise as unique lesions from bone. Some examples include synovial sarcoma, rhabdomyosarcoma and leiomyosarcoma, to name but three. We now have begun to see the reverse with lesions that were initially thought to be unique to bone arising in soft tissue. While this has been well reported with osteosarcoma and Ewing's sarcoma, it has never been reported with Bizarre Parosteal Osteochondromatous Proliferation (BPOP), also known as Nora's lesion. This study explores the first reported case of a soft tissue lesion, with clinical, radiological and histopathological characteristics of BPOP.

Keywords: BPOP; Nora's Lesion; Soft Tissue

1. Introduction

Bizarre Parosteal Osteochondromatous Proliferation (BPOP) mostly commonly presents as an exophytic outgrowth from the cortical surface of bones. It was described in 1983 by Nora and colleagues, resulting in the eponym, Nora's lesion. Since then, approximately 160 cases have been presented in the peer-reviewed literature with a wide age range peaking in the 4th decade [1]. BPOP usually affects small tubular bones of hands and less commonly the feet; however, long bones, skull, and maxilla have been reported to be affected as well [2-4]. The first line of treatment is generally surgical excision (7). The frequency of recurrence of this benign lesion as well as its clinical presentation may cause it to be mistaken for malignant processes [5,6]. While BPOP was originally thought to be a reactive (non-neoplastic) process, cytogenetic analysis has identified a unique non-random molecular signature, thus suggesting that this lesion is neoplastic in nature [7,8].

There has been a trend building over the last 2 decades, to recognize tumors that were thought to arise primarily in soft tissues (derived from the primitive mesenchyme) to, in fact, rarely arise as unique lesions of bone. Examples include synovial sarcoma, rhabdomyosarcoma and leiomyosarcoma. While still exceedingly rare, the recognition of such primary bone lesions is now well accepted. Synovial sarcoma arising in bone for example, has been reported in three cases since its first report in 1997 [9]. Even rarer is the recognition of the reverse, with lesions that were initially thought to be unique to bone now identified as having arisen in soft tissue. While this has been well documented with osteosarcoma and Ewing's sarcoma, it has never been reported for BPOP. This study explores the first reported case of a BPOP-like lesion originating in soft tissue.

2. Case Report

The patient, a 48-year-old African American woman, was referred by her primary care physician because of near complete incapacitation by pain in her right wrist progressing over a three month's period. Physical examination revealed a mass on the lateral volar aspect of the ulna at the level of the distal radioulnar joint. Her past medical history included hypertension, dyslipidemia and coronary artery disease. She did not recall a history of trauma at this location. Conventional radiography revealed a cyst appearing soft tissue mass adjacent to the distal ulna with a rim of calcification (data not shown). Computed Tomography (CT) scan showed a 1.5-cm mass in the volar aspect of the wrist immediately anterior to the distal ulna at the level of the distal radioulnar joint. It demonstrated well-defined, incomplete curvilinear rim ossification peripherally and proximally, while a more irregular calcified component was observed on its radial

aspect (**Figure 1**). No extension into the distal radioulnar joint was seen, nor was erosion of the adjacent ulnar head cortex identified. The radiologic impression of this lesion was myositis ossificans (heterotopic ossification). MRI showed decreased T1 and increased T2 signal characteristics within the mass (data not shown).

The patient underwent surgical excision of this lesion. On surgery, a notable mass was found over the volar surface of the distal ulna, and was dissected and removed from the surrounding soft tissues. Gross examination of the specimen revealed a glistening, tan-white cartilaginous and bony tissue measuring 2.0 × 1.7 × 1.5 cm. Histologically, the lesion was composed of a heterogeneous mixture of fibroblastic, cartilaginous and osseous elements with a poorly organized (non-zonal) distribution (**Figure 2(A)**). At higher magnification, a transition from one tissue type to another (chondro-osseous metaplasia) was evident (**Figure 2(B)**). Enlarged, bizarre, chondrocytes with maturation into bone were seen in areas, whereas proliferative spindle cell showed minimal cytologic atypia (**Figures 2(B)** and **(C)**). No atypical mitosis was discernable, nor was necrosis seen. Other fields showed less worrisome zones of hyaline cartilage and fibrocartilage (**Figure 2(D)**). Thus, the lesion closely resembled BPOP of bone histologically.

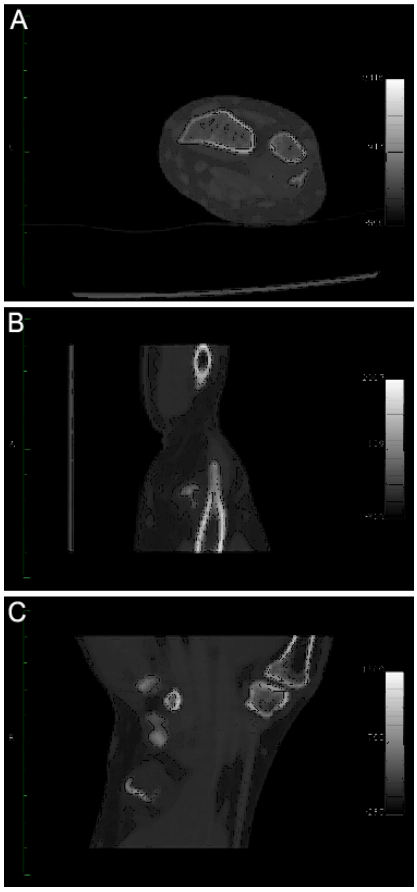

Figure 1. Computed Tomography scan. (A) Axial image of the right wrist showed the volar mass with well-defined calcification at the ulnar aspect and poorly defined mineralization at the radial aspect; (B) Sagittal reformatted image revealed a mass that was separated from adjacent distal ulnar shaft; (C) Coronal reformatted image showed a well-defined but incomplete inferior calcified rim.

Fluorescence in situ hybridization (FISH) analysis utilizing dual-color break-apart probe sets for the 1q and 17q chromosomal breakpoints described previously [7] showed weak and inconsistent hybridization signals with appropriate controls, and was judged to be unsuccessful after multiple repeated attempts (data not shown).

The patient's post-operative course was uneventful. She was well and ambulatory as of seven years following the removal of her wrist lesion.

3. Discussion

As the name implies, BPOP is a rare benign lesion that grows rapidly and has aggressive features on imaging studies as well as confusing findings histologically, thus it may lead to an erroneous diagnosis and inappropriate treatment. Microscopically, BPOP is characterized by some peculiar histological features including fibrocartilaginous tissue with high cellularity, scattered spindle chondrocytes varying in size, and immature bony trabeculae (so called "blue bone") with osteoblasts and enchondral ossification. The differential diagnosis of BPOP largely includes osteochondroma, subungual exostosis,

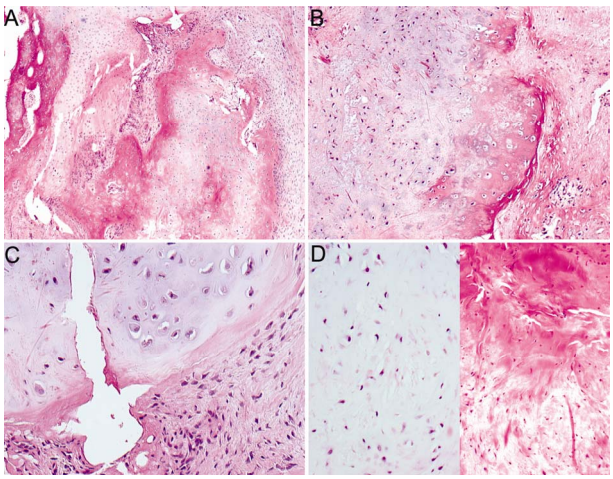

Figure 2. Histologic characteristics of the lesion (H&E stains). (A) The lesion was composed of a heterogeneous mixture of fibroblastic, cartilaginous and osseous elements with a poorly organized distribution (original magnification ×40); (B) A transition from one tissue type to another was evident (original magnification ×200); (C) Enlarged, bizarre, chondrocytes were seen in areas, whereas proliferative spindle cell showed minimal cytologic atypia (original magnification ×400); (D) Other fields showed unremarkable hyaline cartilage and fibrocartilage (original magnification ×100).

and less commonly, periosteal chondroma, juxtacortical chondrosarcoma and parosteal osteosarcoma. While osteochondroma and BPOP both demonstrate continuity to the parental bone, the cartilage and endochondral ossification in the latter are typically less well organized than that in the former. Subungual exostosis is an uncommon, slowly growing, and painful lesion of the distal phalanx that usually affects the dorsomedial aspect of the great toe, although a periungual location without disturbance of the nail itself has been also found. Other cartilaginous and osteogenic lesions should be excluded by their clinical, radiological and histologic characteristics.

The differential diagnosis of the present case included osteochondroma, chondroma of soft parts (soft tissue chondroma), extraskeletal osteosarcoma, and myositis ossificans, an extra-osseous non-neoplastic growth of new bone that typically occur after trauma. The fact that there was no continuity of the lesion with the underlying medullary bone radiographically, and that an organized endochondral ossification mimicking the growth plate was lacking histologically, has led to the exclusion of an osteochondroma. Chondroma of soft parts may rarely undergo ossification. However, the lesion typically consists of mature hyaline cartilage arranged in distinct lobules with sharp borders, like its counterpart in bone. Extraskeletal osteosarcoma was excluded by the absence tumor osteoid.

Myositis ossificans may present as a rapid enlargement and significant pain, as the present case. However, the lesion typically demonstrates a zonal distribution of ossification. CT scan helps delineate a central radiolucency surrounded by a dense periphery. On pathologic examination, myositis ossificans characteristically exhibits a shell of bone that matures at the edge/periphery of the lesion and a central fibroblastic proliferation. There may be a cartilage component as well but typically not a prominent finding. Thus, the presence of a heterogeneous mixture of fibroblastic, cartilaginous and osseous elements in a non-zonal distribution in this case renders a myositis ossificans unlikely. Although not all of the histologic features for BPOP (such as blue bone) were observed in this case, to this end, all of the differential diagnostic considerations were rejected because of the incompatible clinical, radiologic or histologic features, leaving a BPOP-like lesion the most reasonable possibility.

While a recurrent t(1;17) (q32; q21) or variant translocations involving 1q32 or 17q21 were detected in a significant proportion of BPOP cases and thus considered as the sole anomalies of this entity [7,8], these unique aberrations of chromosomal rearrangements were not identified in our case. This may have been due to an inadequate number of cells in the sample or more likely a minimum ratio of nucleated chondrocytes in large lacunae as compared to extracellular matrix. However, it is noteworthy that additional cytogenetic anomalies have also been reported in sporadic cases of BPOP, including ring chromosome derived from chromosome 12 and inversion of chromosome 7 [10,11]. While it is worthwhile to confirm the diagnosis by molecular/cytogenetic modalities, given the fact that cytogenetic heterogeneity is not an uncommon feature in bone and soft tissue tumors, the lack of unique chromosomal aberrations does not exclude a particular entity. Thus, additional studies to include a larger number of cases are needed to further characterize the significance of these rearrangements in the pathogenesis of BPOP.

In summary, we presented an unusual mesenchymal lesion with clinicopathological characteristics of BPOP. To our knowledge, a BPOP-like lesion originating in soft tissue has not been recorded in the English language literature. Thus, re-classification of the group of lesions with features of BPOP regardless of tissue origin may become necessary. Further studies are needed to elucidate the pathogenesis of this unique entity.

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