Chondroblastoma: a clinico-pathological analysis

Nasir-Ud Din

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INTRODUCTION
Chondroblastoma (CB) is a rare benign cartilage tumor accounting for < 1% of all bone tumors. It occurs in the second decade of life, typically in the epiphysis of long tubular bones such as humerus, femur and tibia with a predilection for men. This tumor arises from secondary centers of ossification, suggesting possible origin from cartilage growth plates. Kolodny for the first time described this tumor as a variant of giant cell tumor in 1927, which a year later was named as calcifying giant cell tumor by Ewing. It was termed epiphyseal chondromatous giant cell tumor by Codman in 1931. Finally, the term benign chondroblastoma was introduced by Jaffe and Lichtenstein in 1942. They described this tumor as a distinct clinico-pathological entity different from giant cell tumor with a predilection for humerus.

The objective of this study was to report the spectrum of morphological features seen on a cohort of chondroblastoma cases with any histological features predictive of recurrence.

METHODOLOGY
The authors retrieved hematoxylin and eosin (H and E) stained slides of 61 cases of chondroblastoma reported between 2000 and 2013 in the Section of Histopathology, the Aga Khan University Hospital, Karachi, Pakistan. Morphological features were noted for the following parameters; nuclear grooves/ indentation, chicken-wire calcifications, chondroid and osteoid matrix, multinucleated giant cells and majority had hemosiderin pigment. Chicken-wire calcifications and coarse calcifications were seen in 85% and 26% of cases respectively. A spindle cell component was seen in 54% of cases. ABC-like areas were seen in 10 cases. Mitosis ranged from 1 to 6/10 HPFs. Recurrence was seen in 2 cases. Recurrent tumor showed similar morphology when compared with the initial tumor.

RESULTS
Forty four males and 17 females were included in the series with a male to female ratio of 2.5:1. The age ranged from 10 to 38 years (mean 20 ± 1.98 years; M: F 2.5:1) with 61% patients in the second decade of life. Forty six cases occurred in long tubular bones; distal femur being most common site. Metaphysis, clavicle, temporal bone and metacarpal were also involved. Histologically, all CBs were composed of round to polygonal cells and scattered osteoclast-type multinucleated giant cells and majority had hemosiderin pigment. Chicken-wire calcifications and coarse calcifications were seen in 85% and 26% of cases respectively. A spindle cell component was seen in 54% of cases. ABC-like areas were seen in 10 cases. Mitosis ranged from 1 to 6/10 HPFs. Recurrence was seen in 2 cases. Recurrent tumor showed similar morphology when compared with the initial tumor.

Conclusion: CB is a benign tumor but has potential for recurrence. Males are more affected, second decade is more common and distal femur is most common site. Metaphysis, clavicle, temporal bone and metacarpal were the rare sites of CB. Histological features predictive of recurrence were not separately identified.

Key Words: Chondroblastoma. Bone tumors. Chicken wire calcification. Recurrence.
bone cyst in 5 and 3 of the cases respectively. No history was provided in 9 (14.7%) of cases.

Forty six (75.4%) tumors were located in long tubular bones; distal femur being most common site seen in 13 (21.3%) cases followed by proximal tibia and proximal humerus. Rare locations included clavicle, temporal bone and metacarpal seen in one case each (Figure 1). Site was not provided in 5 (11%) cases. The size of biopsy material ranged from 1 to 9 cm (mean 4 ± 1.98 cm; median 3.5 cm).

Histologically, all CBs were composed of round or polygonal cells with indented or grooved nuclei and eosinophilic cytoplasm with usually well-defined cell borders. Scattered osteoclast type multinucleated giant cells were seen in all cases, present singly dispersed between the tumor cells or in small groups. These cells were generally small to medium sized, with irregular cell contours containing < 20 nuclei (Figure 2A). The characteristic chicken-wire calcifications were seen in 52 (85%) and coarse calcifications in 16 (26%) cases (Figures 2 B and C). Hemosiderin pigment was seen in 47 (77%) cases. Mostly it was present in the cytoplasm of macrophages, but in some cases deposited in the tumor cells (Figure 2D). A spindle cell component was seen in 33 (54%) cases and in 11 (18%) of cases, it was fibromyxoid resembling chondromyxoid fibroma (Figure 3A). Chondroid and osseous metaplasia was seen in 32 (52%) and 52 (85%) cases respectively (Figure 3B). True hyaline cartilage was not seen. The osseous metaplasia was both immature/woven and mature. Ten (16%) had ABC-like areas (Figure 3C). Majority of the cases having ABC component were of long tubular bones and in the third and fourth decade. Two cases of cuboid and a single case of clavicle also had it. Focal aggregates of foamy histiocytes were seen in 2 cases. The mitotic figures ranged from 1 to 6/10 HPFs (mean 2.1 ± 1.51, median 2 /10 HPFs). No atypical mitosis was seen. Focal necrosis was seen in 10 (16%) cases. The necrosis was associated with calcification, but 4 cases had genuine palisading necrosis (Figure 3D). Four (6.5%) cases showed adjacent bone invasion. No vascular invasion or soft tissue extension was noted.

Special stains (PAS with diastase and reticulin stain) were applied in all cases. Abundant glycogen was seen...
Comparison with other reported large series.

(1972) Ref. 3 (60%) tibia areas
(2003) Ref. 14 (60%) femur
Current study (61%) femur
(1992) Ref. 12 (96.8%) tibia
(1970) Ref. 4 (75.3%) femur areas

Duration ranging from 2 weeks11 to 8 years.3 A history of long tubular bones in majority of the cases 2 and 82% in this series.

The male to female ratio was 1.5:1 to 2:1, and 2.5:1 in the current study.3,10-12 and distal femur in this study, while proximal femur4,14 and proximal humerus was noted in other series.5,13 Metaphyseal chondroblastoma is rare.15

Two tumors in this series were located in the femur neck, with one presenting with pathological fracture. The other less involved sites are bones of foot, patella and craniofacial bones.1 Seven cases in this series were involving the foot bones. One case in this series was located in the clavicle, which is a very rare event and only 2 cases are previously reported.15,16

Histologically, chondroblastoma is composed of mononuclear cells with nuclear grooves and scattered osteoclast type multinucleated giant cells. Chicken-wire calcification is delicate surrounding around individual tumor cells. It is virtually pathognomonic for chondroblastoma, but is not present in cases subjected to decalcification, hence not necessary for the diagnosis. In various studies, these were noted in 35%20 to 52.8%12 of the cases and 85% in this series. Osteoclast type multinucleated giant cells are present in every case. Chondroid and osseous matrix is variably seen and the former was noted in 95%20 of the cases in one study and 52% in this series and the latter in 85% of our cases.

A spindle cell component with foci resembling chondromyxoid fibroma is another feature noted in the previous studies.3,4,14 and in this as well. Mitotic activity was none to > 4 in one study;14 however, no atypical mitosis was noted. Mitosis were seen in 87% of these cases and ranged from 1-6/10 HPFs. More than 4 mitoses were seen in 7.5% of these cases. Necrosis was noted in 14%21 to 41%14 of the reported cases and we noted in 16% of the cases. A secondary aneurysmal bone cyst was associated with chondroblastoma in 10%3 to 38%20 of cases and 16% in this series.

Recurrence rate of chondroblastoma ranged from 5.7%4 to 32%11 in the reported cases. The association of an ABC component was initially thought to be a risk factor for recurrence,22,23 but this was not confirmed by others14 and here as well. Histological features of malignancy such as mitosis, necrosis, atypia were not associated with recurrence.14 Similar is also noted in the present series.

**CONCLUSION**

CB is a benign tumor but has the potential for recurrence. Males were more affected and proximal tibia was the most common site. Metaphysis, clavicle, temporal bone and metacarpal are rare sites of CB.
histological features predictive of recurrence are seen. Chicken-wire calcification is pathognomonic but not present in cases subjected to decalcifications. Therefore, it is very important not to lose this useful diagnostic feature by decalcifying an epiphyseal tumor from a young patient.

REFERENCES