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Chondroblastoma of the patella

Richard P. Moser, Jr., LTC, MC, USA[1, 5], Dean M. Brockmole, M.D.[2, 6], Tuyethoa N. Vinh, M.D.[3], Mark J. Kransdorf, MAJ, MC, USA[4, 5], and Jun Aoki, M.D.[1]

[1] Department of Radiologic Pathology, Armed Forces Institute of Pathology, Washington, D.C.,
[2] Department of Radiology, Polyclinical Medical Center, Harrisburg, Pennsylvania,
[3] Department of Orthopedic Pathology, Armed Forces Institute of Pathology, Washington, D.C.,
[4] Department of Radiology, Walter Reed Army Medical Center, Washington, D.C.,
[5] Department of Radiology and Nuclear Medicine, Uniformed Services University of the Health Sciences, Bethesda, Maryland,
[6] Formerly: Department of Radiology, Naval Regional Command, National Capital Region, Bethesda, Maryland, USA

Abstract. This study reviews 16 cases of chondroblastoma of the patella which constitute nearly 6% of a large group of chondroblastomas scattered throughout the skeleton. Both radiologic and histologic appearances of chondroblastomas of the patella are indistinguishable from those of chondroblastomas arising in other sites. A reasonable differential diagnosis, including chondromalacia patella, is discussed together with important therapeutic considerations.

Key words: Chondroblastoma – Bone tumor – Chondroblastoma of patella – Patella

Chondroblastoma of bone is a tumor of cartilaginous origin that arises characteristically in the epiphysis of a long bone; the tumor is usually benign. There is a male predominance of 2 to 1 [2, 7, 11, 22]. The diagnosis is strongly suggested when the lesion occurs in the epiphysis of a skeletally immature long bone, especially in its three most common locations, i.e.: distal femur, proximal tibia, or proximal humerus. The lesion may, however, arise uncommonly in round, short tubular, or flat bones. It may sometimes be confined to the metaphysis or may extend from the epiphysis into the adjacent metaphysis, following closure of the growth plate.

Address reprint requests to: Richard P. Moser, Jr., M.D., Department of Radiologic Pathology, Armed Forces Institute of Pathology, Washington, D.C. 20306-6000, USA

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This study has been conducted to describe the radiologic appearance of chondroblastoma in one of these unusual sites, the patella, where it has an estimated occurrence of 1–3% [2, 7, 20, 22]. The results include correlation of radiologic features with pathologic findings and permit speculation on why the patella should not be regarded as an unusual site for flat bone involvement of chondroblastoma.

Materials and methods

Our radiologic archives contain 282 cases of histologically proven and radiographically correlated chondroblastoma, accumulated through consultations over 40 years. Through retrospective review of radiographs, we collected a subset of 16 cases of chondroblastoma of the patella. The clinical, histologic, and radiographic findings in these 16 cases are reviewed. To the best of our knowledge, this study constitutes the largest series yet reported of chondroblastoma of the patella or any other nonlong bone site.

The original pathologic reports were available in all cases. The original biopsy material was available in 13 of 16 cases and varied from a single hematoxylin and eosin (HE) slide to multiple slides and special stains. All slides were reviewed (TNV) without prior knowledge of either clinical data or radiographic findings, to confirm the diagnosis of chondroblastoma. Histologic criteria for the diagnosis of chondroblastoma include (1) sheets of closely packed polygonal chondroblastic cells with interspersed multinucleated giant cells; (2) intercellular sulfated mucopolysaccharide matrix elaborated in a "chicken wire" pattern, sometimes identified on HE, but best appreciated on aldehyde fuscin stain; (3) islands of hypocellular eosinophilic cartilage matrix (common), focal areas of dystrophic calcification (uncommon), and cyst formation (common).

We assessed the size of the lesion, coexistent pathologic fracture or soft tissue mass, configuration and degree of sclerosis of the peripheral margin of the lesion, and extent of mineralization of tumor matrix. Additional data recorded included symptoms, age, and sex at presentation and lateralization to either left or right patella.

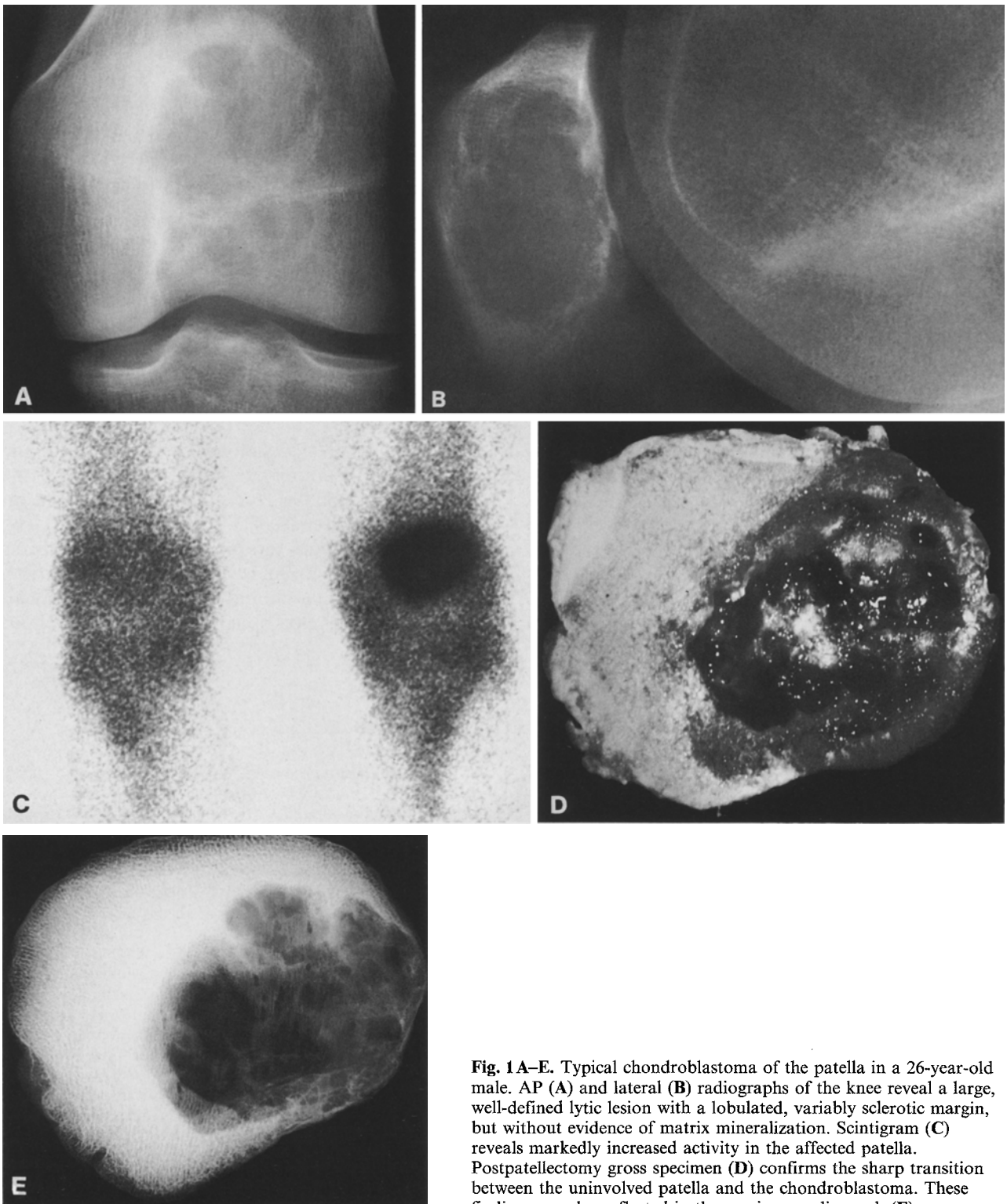
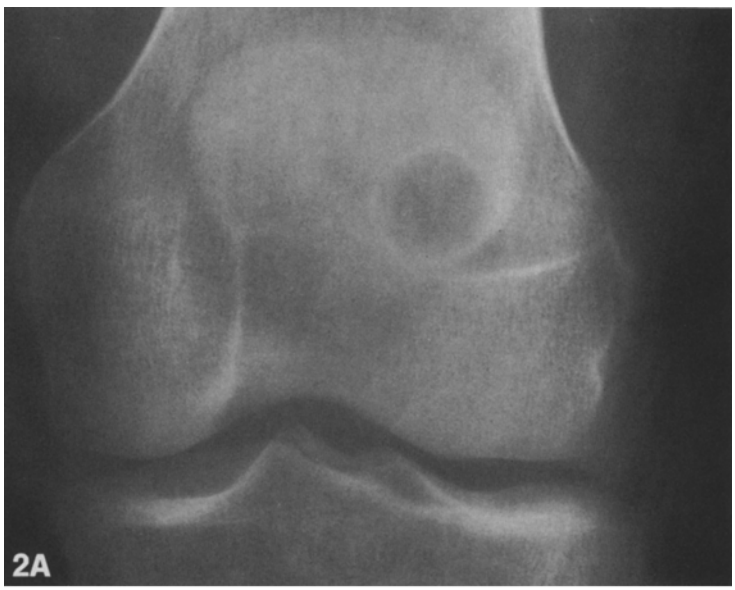
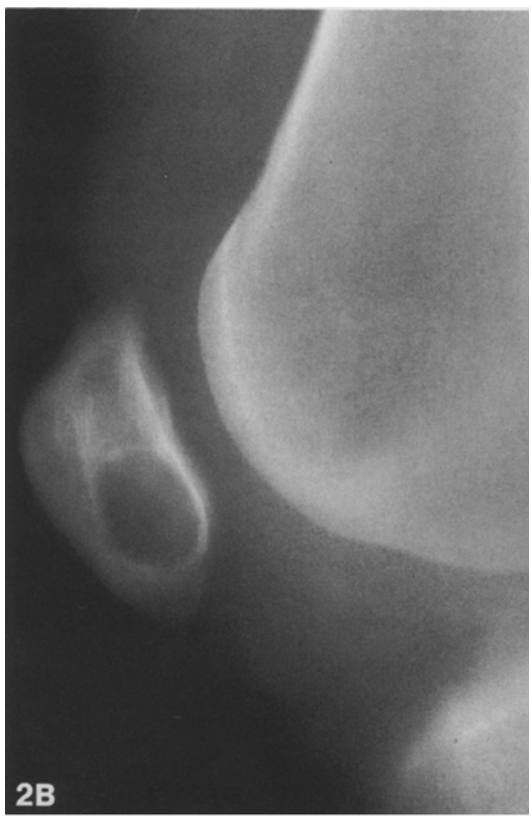
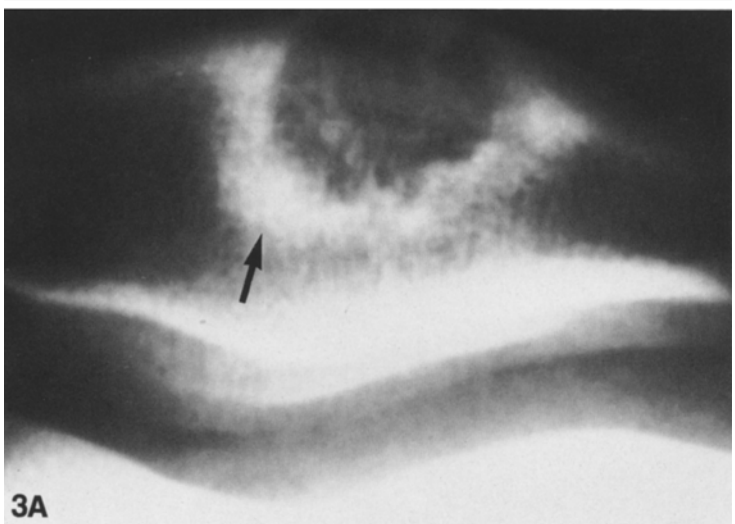


Fig. 1A–E. Typical chondroblastoma of the patella in a 26-year-old male. AP (**A**) and lateral (**B**) radiographs of the knee reveal a large, well-defined lytic lesion with a lobulated, variably sclerotic margin, but without evidence of matrix mineralization. Scintigram (**C**) reveals markedly increased activity in the affected patella. Postpatellectomy gross specimen (**D**) confirms the sharp transition between the uninvolved patella and the chondroblastoma. These findings are also reflected in the specimen radiograph (**E**)







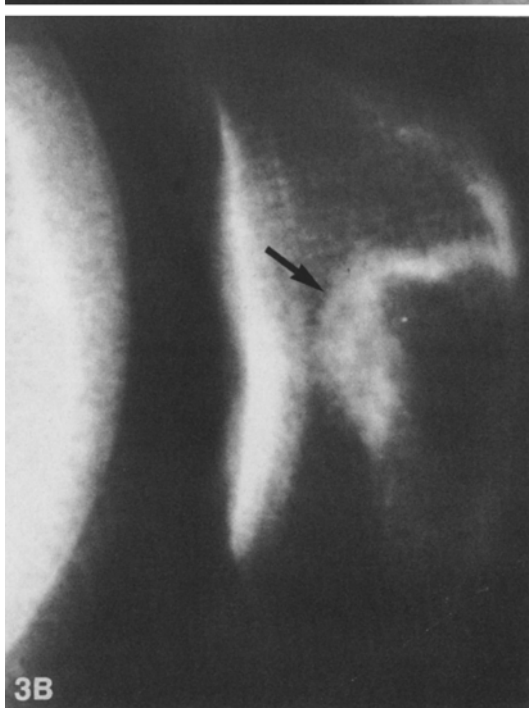


Fig. 2A, B. Round chondroblastoma of the patella in a 28-year-old male. AP (**A**) radiograph and lateral (**B**) plain tomogram reveal a small round chondroblastoma with a sclerotic margin, but without evidence of matrix mineralization

Fig. 3A, B. Chondroblastoma of the patella in a 35-year-old male with unusual sclerotic rim. Sunrise (**A**) and lateral (**B**) radiographs reveal a lytic lesion without definite matrix mineralization. The margin is mildly lobulated and demonstrates an unusually wide sclerotic rim (*arrows*) that merges imperceptibly into the surrounding patella

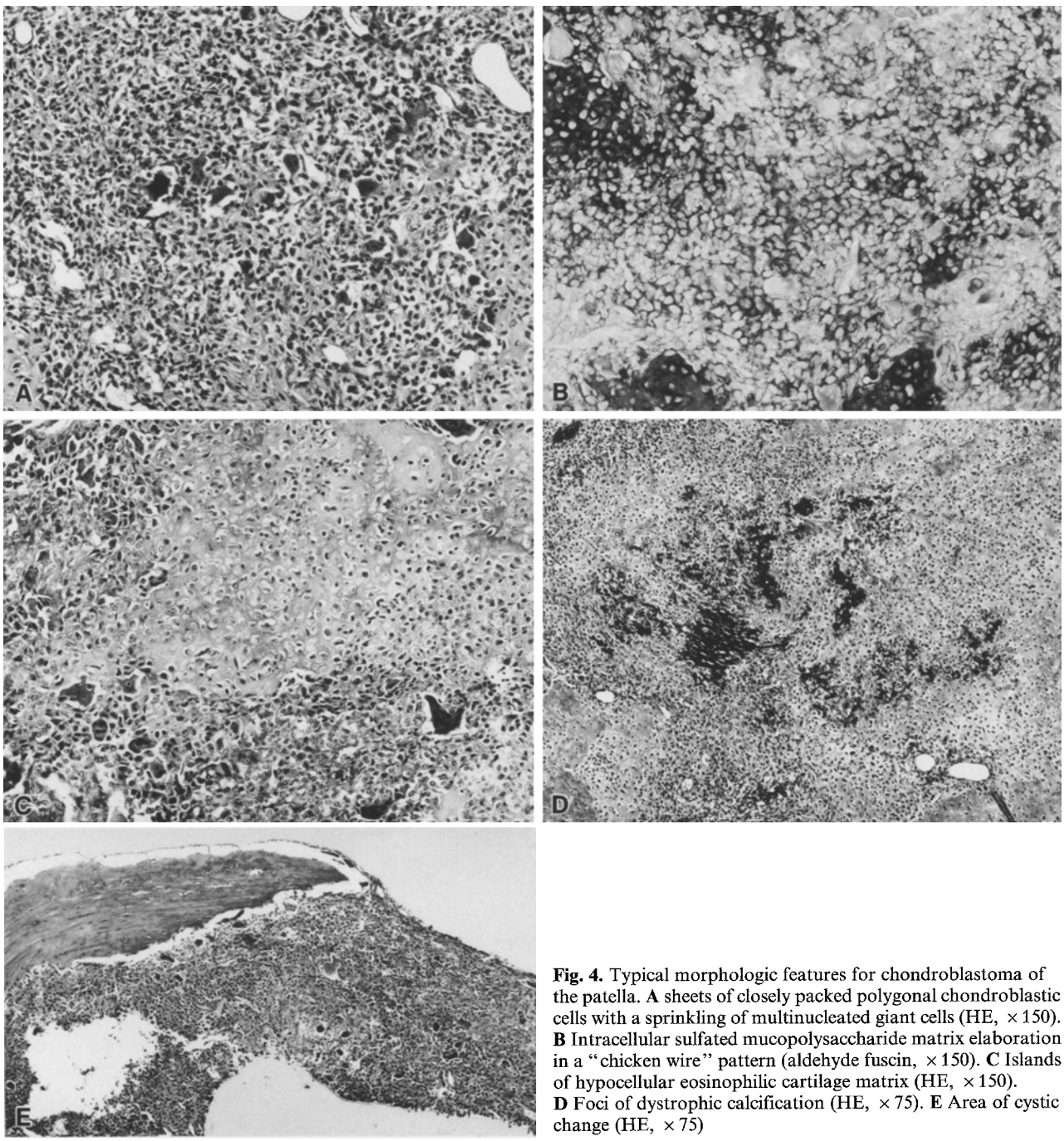


Fig. 4. Typical morphologic features for chondroblastoma of the patella. **A** sheets of closely packed polygonal chondroblastic cells with a sprinkling of multinucleated giant cells (HE, ×150). **B** Intracellular sulfated mucopolysaccharide matrix elaboration in a "chicken wire" pattern (aldehyde fuscin, ×150). **C** Islands of hypocellular eosinophilic cartilage matrix (HE, ×150). **D** Foci of dystrophic calcification (HE, ×75). **E** Area of cystic change (HE, ×75)

Results

Presenting symptoms were recorded in 11 of 16 cases and always included pain. The duration of the pain varied from acute to chronic. Three patients experienced intermittent pain of 12–18 months duration. Infrequent presenting findings, always associated with pain, included trauma (three cases), pathologic fracture (two cases), and intermittent swelling (two cases). In the remaining five cases the presenting complaint was unknown.

The patient's age and sex were known in 15 of 16 cases. The male to female ratio was approximately 7 to 1 (13 males, 2 females, 1 case of unknown sex). The two affected females were 15 and 18 years of age at presentation. The age range of the male patients at presentation was 13 to 35 years. Average age at presentation, regardless

of sex, was 21 years. Variation for presenting age included: under 10 years of age – no patients; 11–20 years of age – 8 patients; 21–30 years of age – 6 patients; greater than 30 years of age – one patient, who was 35 years old. Localization failed to demonstrate predilection for either right (8 cases; 6 male, one female, one patient of unknown sex) or left (8 cases; 7 male and one female) patella.

Radiographs were available in all cases, although in two cases the only radiographs were made following biopsy/curettage. In the remaining 14 cases with preoperative radiographs, the lesion was always lytic. The overall contour of the patella was never enlarged. Additionally, there was no evidence of internal mineralization. The diameter of the lesion varied in size from approximately 1 cm to 3.5 cm, averaging 2.5 cm. The lesions typically demonstrated a scalloped, lobulated, or convoluted contour (Fig. 1), but four were round (Fig. 2). The round chondroblastomas were the four smallest lesions in the series: one of 2 cm diameter, one of 1.5 cm diameter, and two of 1 cm diameter. The peripheral margin was always well-defined and usually sclerotic. Uncommonly, the sclerotic margin was either faint (one case) or unusually thick. It was ill-defined in a single case which, interestingly, was the oldest patient in the series, a 35-year old male (Fig. 3). Not surprisingly, the margins were always better appreciated on either lateral or sunrise radiographs, due to the absence of a superimposed distal femur.

Because of the superficial location and relatively small size of the patella (as well as the 40-year period over which the material accumulated), angiographic, computed tomographic, and magnetic resonance scans were not available in any case. Scintigraphy, available in three cases, revealed increased radionuclide activity in the affected patella (Fig. 1C). Plain tomography, available in two cases, confirmed the findings noted on plain radiograph, including the absence of matrix mineralization (Fig. 2B). Pathological fracture was noted in two cases. Radiographic evidence of soft tissue swelling was not apparent in any case.

In all 13 cases in which the original pathologic material was available, the histology confirmed the diagnosis of chondroblastoma in accordance with the criteria previously outlined (Fig. 4). There was no evidence of malignancy.

Discussion

The literature on chondroblastoma of bone is relatively meager, probably reflecting the fact that this lesion constitutes only 1–3% of primary bone tumors [2, 5, 13, 19, 20, 22]. One of the largest series was reported by Bloem and included 104 cases, 80 tumors in long bones and the remaining 24 in flat or short tubular bones [2]. In the latter group, six cases each occurred in the calcaneus and talus, three each in the hand and patella, two in the ilium, and one each in the sternum, rib, vertebra, or small foot bone [2]. Isolated case reports or small series have described chondroblastomas in a variety of "unusual" locations outside the epiphysis of long bones; the preoperative differential diagnosis rarely included chondroblastoma at these sites [3, 4, 6, 8–10]. This observation is confirmed by the fact that few cases of chondroblastoma of the patella have ever been reported, and these were usually "surprise" diagnoses following patellectomy [2, 7, 12, 17, 20]. In our series, approximately 6% of chondroblastomas occurred in the patella.

The male to female ratio of 7 to 1 in our series is striking and far more biased towards males than has been reported for chondroblastomas in general. Perhaps this can be attributed to an idiosyncratic referral pattern, although these 16 cases of chondroblastoma of the patella were received in consultation from 15 different institutions.

As is true for essentially all skeletal neoplasms, presenting symptoms usually include pain and are disappointingly nonspecific. Of interest in this series is that three patients (19%) presented with chronic pain of 12–18 months duration. Patients with chondroblastoma of the patella are easily confused clinically with those suffering from chondromalacia patella.

Among other authors, Bloem maintains that patients with chondroblastomas of short tubular or flat bones tend to present at a significantly older age (mean age 28 years) than those with long bone involvement (mean age of 16) [2]. This discrepancy of age at presentation was less pronounced in our series, in which we noted a mean age of 21 and in which eight patients (50%) presented during the second decade of life. Predilection for one side of the body is rarely encountered in skeletal neoplasms. Accordingly, in this series the right and left patella were equally affected.

In his discussion of postnatal skeletal development of the patella and tibial tuberosity, Ogden has emphasized that the patella can be considered an "epiphysis-equivalent" [16]. Therefore, it is not surprising that chondroblastoma, being a benign tumor of cartilaginous origin, can arise in the patella. In fact, the occurrence of chondroblastomas of the patella should be less surprising, perhaps, than in other nonlong bone sites that lack an ap-

parent epiphysis-equivalent, such as the calcaneus, talus, or skull.

Radiographic "descriptions" of chondroblastoma and other neoplasms have frequently used the term "cystic". This is an unfortunate choice of words since, in most instances, the radiologist cannot accurately assess the degree of "cystic" change when describing the radiographic appearance of a skeletal lesion. The "cystic" nature of a lesion can never be determined with certainty from the plain radiograph alone. Therefore, the radiologist should select more precise words, such as "lytic" or "radiolucent". However, the word "cyst" may be included in the "differential diagnosis", i.e.: simple bone cyst, subchondral cyst.

All of our cases of chondroblastoma of the patella were "lytic". They ranged in size from 1 to 3.5 cm and caused no enlargement or "expansion" of the patella. This latter finding conflicts with Bloem's contention that expansion was found more often in chondroblastoma of flat bones (63%) than in chondroblastoma of long bones (31%), although the only case he used to illustrate "expansion" was a chondroblastoma of the sternum in a 34-year-old female [2].

The four smallest lesions in our series demonstrated a round contour on the radiograph, indicating that the lobulated contour seen in the remaining cases, which is also typical of chondroblastoma occurring in long bone, may be merely a function of the larger size of the lesion. In the larger lesion, there is multidirectional growth (i.e.: inhomogeneous biologic activity across the lesion) that results in the lobulated contour seen on the radiograph or in the gross specimen.

In our series, the margin of chondroblastoma of the patella was always well-defined and usually sclerotic, reflecting indolent biologic activity and favoring benign histology [15]. Consistent with this observation, none of our cases demonstrated histologic evidence of malignancy. However, since follow-up data are lacking, some caution is necessary in this inference. Nevertheless, chondroblastoma of bone is typically a benign lesion [2, 7, 11, 22]. Interestingly, a significant percentage of reported "malignant chondroblastomas" were diagnosed following surgical manipulation and radiation therapy. Perhaps these should be classed as postradiation sarcoma rather than true malignant chondroblastoma [2].

Radiographs failed to demonstrate tumor matrix mineralization in any of our cases of chondroblastoma of the patella. Conversely, Bloem maintains that approximately one third of his cases of chondroblastoma demonstrate radiographic evidence of calcification [2]. In his article, however, there is only a single anteroposterior (AP) radiograph demonstrating a lytic lesion with associated coarse trabeculations which could be confused with central matrix calcification. The absence of either lateral radiographs or plain or computed tomography in his case does not permit adequate assessment of the matrix pattern [2].

Radiologic differential diagnosis of chondroblastoma of the patella includes benign tumors and metastases [14]. Primary malignancies arising in the patella are rare while scattered reports of patellar metastases have appeared [1, 18, 20, 21]. A metastatic etiology for a patellar lesion can be excluded by the following criteria: (1) Skeletal metastases are typically multiple. On the other hand, multiple chondroblastomas with patellar involvement have never been reported. (2) Patellar metastases typically have radiographically apparent suprapatellar and infrapatellar masses. On the other hand, soft tissue involvement was not detected radiographically in any of our cases of chondroblastoma of the patella. (3) Patellar metastases may have both a blastic and lytic component. Typically the lytic area demonstrates a nonsclerotic, ill-defined radiographic margin. On the other hand, all of our cases of chondroblastoma of the patella were lytic and had well-defined, typically sclerotic radiographic margins. (4) Most patients with patellar metastases have a previously diagnosed primary malignancy. Therefore, initial presentation with knee pain is distinctly unlikely for the patient with patellar metastases. (5) Most patients with patellar metastases are older, whereas the average age of presentation of our patients was 21 years. (6) Finally, patients with patellar metastases typically have a combination of the preceding five situations.

As noted above, the radiographic appearance of chondroblastoma of the patella suggests a benign process, the differential diagnosis of which would include simple bone cyst, giant cell tumor, nonmineralized osteoblastoma, hemangioma, and subchondral "cyst". In addition, the morphologic features in all our cases of patellar chondroblastoma are indistinguishable from those found in typical locations.

All physicians involved in managing young patients with knee pain for which a clinical differential diagnosis of chondromalacia patellae is raised should be aware of the frequency and typical radiographic appearance of chondroblastoma of the patella. This awareness has important significance for clinical practice since preoperative consideration of a diagnosis of chondroblastoma might al-

low substitution of a more conservative procedure such as curettage, for a more serious operation such as patellectomy [9].

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