Giant cell tumor of bone is a locally aggressive benign neoplasm, which is composed of oval or plump, spindle-shaped mononuclear cells and uniformly distributed multinucleated giant cells. Bone or cartilage matrix production by the tumor cells is usually not seen. We present a pathologically proven case of giant cell tumor, arising in the acetabulum and pubic bone, with unusual cartilage matrix production. We also discuss the differential diagnosis from a chondroblastoma as well as a giant cell-rich osteosarcoma.

Key Words: Giant cell tumor, Cartilage

Giant cell tumors of the bone are benign, locally aggressive neoplasms, composed of sheets of neoplastic ovoid mononuclear cells which are interspersed with uniformly distributed large osteoclast-like giant cells. Radiographically, giant cell tumors of the bone are purely lytic, and exhibit well defined but nonsclerotic margins. Radiologically evident matrix production within tumors is quite rare. Histologically, abundant matrix production renders the diagnosis of giant cell tumor highly questionable.

Here, we report a case of giant cell tumor with unusual cartilage matrix production, and indicate the features which enable the differentiation of these tumors from chondroblastomas, and giant cell-rich osteosarcomas.

CASE REPORT

A 31-year-old man was admitted to our institution due to a pain in his right hip, of insidious onset, which had persisted for 2 months. There was no history of trauma. Upon physical examination, no palpable mass was detected in the region of the patient's hip joint and the range of movement was within normal limits. A plain radiograph of the pelvis evidenced a poorly-defined, osteolytic region of bone destruction in the right acetabulum and pubic bone, coupled with a large, contiguous, soft tissue mass. Evidence of mineralization was not found (Fig. 1). A magnetic resonance imaging verified the bone destruction in the right acetabulum and the large soft tissue mass, which measured 92 × 85 × 85 mm in size. The mass exhibited lobulated margins and a slightly high signal intensity, as compared with the adjacent muscles on T1-weighted coronal images (Fig. 2A), and diffuse high signal change on T2-weighted images (Fig. 2B). The fat-saturated, T1-weighted images showed diffuse enhancement with focal non-enhanced areas (Fig. 2C). An ultrasound-guided biopsy of the mass was conducted. The initial pathologic diagnosis of the condition was a chondroblastoma. Then an intra-lesional excision was performed. The mass was soft, fleshy, and tan to yellowish in color, with associated hemorrhage. Microscopically, this tumor consisted of round, ovoid or polygonal

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mononuclear cells, mixed with numerous, more or less uniformly
distributed osteoclast-like giant cells (Fig. 3). The nuclei of the
mononuclear cells showed an open chromatic pattern with one
or two small nucleoli, and exhibited no clefts or longitudinal
grooves (Fig. 4). The nuclei of the giant cells were quite similar
to those of the mononuclear cells. No atypical mitoses or cellular
pleomorphism were evident. Multiple areas of mature baso-
philic hyaline cartilage were apparent within the tumor (Fig. 5),
as were areas of calcification (Fig. 6). An immunohistochemical
staining result for S-100 protein was negative. The final patho-
logical diagnosis was a giant cell tumor with an unusual carti-
lage matrix. At the 14-month follow-up, the patient is well
without a recurrence.

**DISCUSSION**

Giant cell tumor of bone is a benign, but locally aggressive
neoplasm, which is characterized by large numbers of uniformly
distributed, osteoclast-like giant cells and a more diagnosti-
cally pertinent background population of plump, epithelioid to
spindle-shaped mononuclear cells. Radiologically, giant cell tumor
of bone is a purely lytic, eccentric subchondral lesion with well-

Fig. 1. Plain radiograph of the pelvis shows poorly defined, oste-
olytic bone destruction in the right acetabulum and pubic bone. The
medial portion of the right acetabulum shows extensive destruc-
tion with a bulging contour. In the medial portion of the pelvic cavi-
ty, a large soft tissue mass is noted, however, there is no evidence
of any mineralization.

Fig. 2. (A) T1-weighted coronal image shows bone destruction
of the right acetabulum with a large soft tissue mass. The mass
shows lobulated margins and slightly high signal intensity, as
compared with the adjacent muscles. In the right hip, the intra-
articular fat is obliterated. (B) T2-weighted coronal image shows
diffuse high signal change with several foci of cystic changes. (C)
Fat-saturated, T1-weighted image shows diffuse enhancement
with focal non-enhanced areas.
Giant Cell Tumor with an Unusual Cartilage Matrix

defined margins, which is most frequently situated in the epi-
physis and metaphysis of the long bones. Usually, sclerosis is not
observed in the area surrounding the lesion.\textsuperscript{3,5} Although radio-
logically evident matrix can be produced within the tumor, usual-
ly in long-standing lesions, the presence of a sclerotic rim and a
calcified matrix with an open epiphysis are features which can
be used to differentiate cartilage-forming tumors, such as chon-
droblastomas, from giant cell tumors.\textsuperscript{1,3}

Small microscopic foci of bone formation can be observed with-
in giant cell tumors, especially after a pathologic fracture or a
biopsy.\textsuperscript{1} Prominent focal reactive bone formations can sometimes
be correlated with the presence of small cortical infractions. Re-
active fibrous tissue formation with a prominent irregular whorled
pattern and a xanthogranulomatous reaction have been reported
to be associated with reactive bone formation.\textsuperscript{6} A shell of reac-
tive bone is usually observed at the periphery of giant cell tumors
in both soft tissue and bone, as well as in pulmonary implants.\textsuperscript{4,5,7,8}
Cartilage matrix is not usually present in unfractured giant cell
tumors.\textsuperscript{2} Abundant production of matrix makes a diagnosis of
giant cell tumor highly questionable.\textsuperscript{1,2,4,6} In one study, however,
matrix production, ranging from focal to moderate, was found
to be present in approximately 9% of giant cell tumors with
otherwise typical microscopic features. The matrix was identified
as woven bone with osteoclastic rimming, woven bony trabec-
ulae interconnected without osteoblastic rimming, osteochond-
droid matrix, confluent hyaline cartilage, or calcification.\textsuperscript{9}

In our case, the patient was diagnosed with a giant cell tumor
of bone with unusual chondroid matrix production. The latter
feature is extremely rare, and when evident, the tumor must be
differentiated from giant cell rich cartilage-forming tumors, espe-

Fig. 3. Microscopically, the tumor is composed of a mixture of mono-
nuclear round to oval cells and multinucleated giant cells. The multi-
nucleated giant cells are distributed uniformly throughout the tumor.

Fig. 4. Background mononuclear cells are characterized by round
to oval nuclei with an open chromatin pattern and prominent nucle-
oli, and ill-defined cytoplasm. Nuclear grooves and indentations are
not present. The nuclei of the multinucleated giant cells are similar
to the nuclei of the mononuclear cells.

Fig. 5. Mature basophilic hyaline cartilage is seen within sheets of
characteristic mononuclear cells with uniformly scattered multini-
cleated giant cells.

Fig. 6. The cartilage matrix contains mature chondrocytes. Calci-
fication within the cartilage matrix is also noted.
cially a chondroblastoma. Microscopically, the background mono-
nuclear cells in chondroblastoma tend to harbor irregular and
indented nuclei with longitudinal clefts or grooves, whereas in
giant cell tumors, the cells resemble histiocytes, with nuclei sim-
ilar to those observed in giant cells. \textsuperscript{2,10,11} The chondroid matrix
of the chondroblastoma is eosinophilic in contrast to the basophilic
pattern observed in our case. The cells within the matrix tend to
maintain their chondroblastic appearance in a chondroblastoma,
rather than the appearance of mature chondrocytes, as observed
in our case. The fine network of pericellular calcification, which
is characteristic of the chondroblastoma is not observed in associ-
ation with giant cell tumors. \textsuperscript{10,12}

Osteosarcoma with a large component of reactive giant cells
and a paucity of osteoid also requires differentiation from giant
cell tumors. Microscopically, background mononuclear cells in
giant cell-rich osteosarcomas exhibit pleomorphism and atypi-
cal mitotic figures, rather than bland features as in giant cell
tumors.

In this report, we have detailed the pathological and radiolo-
gical features of a giant cell tumor of the pubic bone exhibiting
unusual cartilage matrix production, occurring in a 31-year-old
man. It is important that the correct diagnosis is made accord-
ing to a careful consideration of the features of the background
population of mononuclear cells, rather than the cartilage matrix,
when the tumor is composed of round to oval mononuclear cells
and multinucleated giant cells, and shows evidence of cartilage
matrix production.

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