OSTEOBLASTOMA OF THE MANDIBLE:
CLINICOPATHOLOGIC STUDY OF FOUR CASES
AND LITERATURE REVIEW

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Abstract: Background. Osteoblastoma is a benign bone tumor accounting for 1% of all bone tumors; it commonly involves the spine and the sacrum of young individuals, with less than 5% being localized to the posterior mandible. In view of its rarity in the maxilla and mandible, osteoblastoma is rarely diagnosed as such in the absence of interdisciplinary cooperation.

Methods. A retrospective study of four benign osteoblastomas was performed based on a review of the clinical, radiographic, and histopathologic features of all cases.

Results. The tumors involved the posterior mandible of young patients (age range, 10–21 years; two male and two female patients) and appeared as painful bone expansions. Radiologically, they were poorly defined, radiolucent/radiopaque lesions containing calcifications and not showing sclerotic borders or periosteal reactions. Histologically, they were composed of osteoid and woven bone surrounded by plump osteoblast-like cells with interposed fibroblasts, inflammatory cells, and red blood cells. All patients were disease free after prolonged follow-up.

Conclusions. Osteoblastomas may be distinguished from other bone tumors, fibro-osseous lesions, and odontogenic neoplasms on the basis of integrated clinical, radiologic, and histologic features and usually manifest an indolent clinical course.

Keywords: osteoblastoma; bone tumors; osteoid osteoma; head and neck; mandible

Osteoblastoma is a rare benign bone tumor first described by Lichtestein1 and Jaffe2 as a distinct neoplasm in 1956. This disease accounts for less than 1% of all bone tumors and most commonly involves the spine and sacrum of young individuals.3–7 Less than 10% of osteoblastomas are localized to the skull, and nearly half of these cases affect the mandible, especially the posterior segments.8 The first well-documented case of osteoblastoma of the jaw bones was described by Borello and Sedano in 1967,9 and 69 additional cases have since been recorded.6 Clinically, osteoblastomas present mainly with pain, swelling, and expansion of the bone cortex.14–6 Radiographic features are variable, usually showing a combination of radiolucent and radiopaque patterns, depending on the degree of calcification,
but without perilesional sclerotic border or perpendicular periosteal reactions. Histologically, osteoblastoma is a bone-forming tumor characterized by osteoid and woven bone deposition and abundant osteoblasts that are frequently in close association with newly formed bone. Occasionally, osteoblastomas may appear richly cellular, contain an abundant osteoclast-like component, and show plump osteoblasts that may evoke a diagnosis of osteosarcoma, thus leading to unnecessary overtreatment.

In view of the purported benign nature of this tumor, conservative surgical excision is the treatment of choice, because recurrence is a rare event (13.6%) and usually attributable to incomplete excision.6

The current retrospective study was aimed at reporting the salient clinicopathologic features of four cases of osteoblastoma involving the mandible, three in the retromolar area (treated by surgical excision) and one occurring in the mandibular body (treated by en-bloc resection and reconstruction by free tissue transfer technique), all displaying a benign clinical course without recurrence at 3 to 25 years’ follow-up.

MATERIALS AND METHODS

All the clinical charts of the patients admitted to the Department of Dental Sciences and Surgery of the University of Bari during the period 1970 to 2002 who underwent surgical procedures for osseous lesions were retrieved and reviewed after approval of this study by the Internal Ethical Committee. These cases with histologic diagnosis of benign or malignant bone tumors were subjected to histopathologic review of the original preparations performed by two pathologists (EM and CG), which subsequently resulted in the identification of the four cases of osteoblastoma described herein.

The original paraffin blocks of each case were cut and stained with hematoxylin-eosin. The tissues had been previously fixed in 10% neutral buffered formalin and then decalcified in Osteodec (Bio Optica, Milan, Italy).

RESULTS

The salient clinicopathologic features of the cases are summarized in Table 1.

Overall, all cases occurred in adolescents or young adults, with a 1:1 male/female ratio. Three cases occurred in the left hemimandible, and one case occurred in the right hemimandible, with the same proportion of cases being located distally to the first molar or in the premolar-molar area. Most patients complained initially of pain and swelling of variable duration (2 weeks–2 years), with one case occurring simultaneously with the eruption of the third molar.

At clinical examination, in all four cases a firm mandibular mass was detected that was not associated with signs of local inflammation, pericoronitis, paresthesia, or mucosal ulceration (Figure 1). Two patients underwent extraction of teeth by a general dentist after a diagnosis of pericoronitis or odontogenic abscess.

Radiographically, all lesions were poorly defined and displayed mixed radiolucent/radiopaque features (Figure 2) with focal to well-evident intralesional calcifications, which were particularly evident on CT scans (Figure 3). No periosteal reactions, sclerotic borders, or peripheral speculation, and no root resorption of adjacent teeth were evident.

After the provisional clinical differential diagnosis of odontogenic neoplasms (eg, odontogenic myxoma, fibro-osseous bone lesion, or central cemento-ossifying fibroma), three patients underwent local excision or curettage under general anesthesia. The remaining patient underwent an incisional biopsy, which was sent for intraoperative examination and resulted in a provisional diagnosis of low-grade osteosarcoma. This diagnosis was probably based on the presence of hyperchromatic osteoblast-like cells with large nuclei interpreted as malignant cells on cryostatic sections. Consequently, an en-bloc resection of the

<table>
<thead>
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<th>Case no.</th>
<th>Age, y</th>
<th>Sex</th>
<th>Disease site</th>
<th>Duration of symptoms</th>
<th>Clinical diagnosis</th>
<th>Size, cm</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>16</td>
<td>F</td>
<td>47</td>
<td>2 mo</td>
<td>Odontogenic neoplasm</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>M</td>
<td>37</td>
<td>2 wk</td>
<td>Odontogenic abscess</td>
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</tr>
<tr>
<td>3</td>
<td>21</td>
<td>F</td>
<td>38</td>
<td>2 y</td>
<td>Pericoronitis</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>20</td>
<td>M</td>
<td>36–37</td>
<td>3 mo</td>
<td>Odontogenic myxoma</td>
<td>3</td>
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affected segment of the mandible was performed, followed by free tissue transfer reconstruction.

Macroscopically, the tumors were reddish to brown in color and of friable consistency. Those tumors that were enucleated intact were irregularly round to oval and appeared rather well demarcated.

Histologically, all tumors contained abundant mineralized material both as osteoid and as woven bone trabeculae (Figure 4) that were distinctly separated from the adjacent trabecular bone. The newly formed trabeculae were of different size and sometimes closely packed upon each other. At higher-power resolution, the tumors were composed of a double cell population: plump osteoblast-like cells, with eosinophilic cytoplasm and large nuclei, that were frequently juxtaposed to the newly formed bone trabeculae, and less abundantly intermingled spindle cells with poorly visible cytoplasms and rounded to oval nuclei (Figure 5). Frequently, the osteoblast-like cells were arranged concentrically to osteoid accumulations (osteoblastic rimming), whereas the fibroblast-like component was loosely packed and intermingled with inflammatory cells, red blood cells, and an abundant capillary component (Figure 6). Cells displaying overt dysplastic features or abnormal mitotic activity were not detected, and there was no cartilaginous differentiation.

DISCUSSION

Osteoblastoma is a rare bone-forming tumor that very rarely involves the maxilla and mandible, particularly the posterior mandible. This diagnostic challenge may cause relevant problems with the differential diagnosis in view of the tumor's rarity, ambiguous clinicoradiologic presentation, and histopathologic features, which sometimes resemble osteosarcoma.

The first osteoblastoma of the jawbones was described relatively recently. To date, with single case reports and other large series, including our cases, a total of 69 cases of osteoblastomas occurring in the mandible have been reported.

Overall, the age range in the reported cases was 5 to 69 years, with a slight predominance in male patients (58%) and a definite prevalence in the mandible (74%) versus the maxilla. Spontaneous pain was identified in 54 cases (78%), whereas bone swelling was observed in 62 cases (90%). The roots of the adjacent teeth were involved in 20 cases (29%), but root resorption was evident in only four. Cytologic atypia (including hyperchromasia and pleomorphism) were observed in four cases (7%).

Conceptually, osteoblastoma shares similar clinicopathologic features with cementoblastoma,
with the exception of strict relationships of the latter with roots of a tooth. Nevertheless, because of the difficulty of distinguishing true cementum from bone in heavily mineralized lesions, and because of the overlapping clinical management of both lesions, we prefer to consider these as variants of a single entity.

Diagnosing osteoblastoma at first clinical presentation is usually difficult because of its rarity and nonspecific presentation. At clinical inspection, a bone expansion of hard consistency from bone in heavily mineralized lesions, and because of the overlapping clinical management of both lesions, we prefer to consider these as variants of a single entity.

Radiologic assessment is commonly performed and highlights mixed radiolucent/radiopaque lesions with more or less defined borders, and these usually lack sclerotic borders, periosteal reactions, or perpendicular bone speculations. In the presence of such findings, osteosarcoma should be considered in the differential diagnosis.

On the basis of the preceding characteristics, the differential diagnosis may include the following: (1) fibro-osseous lesions (such as ossifying fibroma, fibrous dysplasia, periapical cemento-osseous dysplasia, and central giant cell granuloma), (2) bone tumors (including osteoid osteoma), and (3) odontogenic tumors (such as ameloblastoma and calcifying epithelial odontogenic tumor).4

Ossifying fibroma and fibrous dysplasia of bone may share many similarities with osteoblastoma but usually are less mineralized lesions, revealing fine calcifications rather than large clusters of mineralized material. In addition, fibrous dysplasia is less circumscribed radiologically than osteoblastoma and may be multifocal, a feature that is exceedingly rare for osteoblastoma.

Periapical cemento-osseous dysplasia is a painless fibro-osseous lesion that involves the apical root region of a tooth and may share simi-
lar radiographic and histopathologic features with osteoblastoma. Nevertheless, the former is a self-limited process of small size (<1 cm), with the exception of the so-called florid periapical cemento-osseous dysplasia. This is a rare condition that involves several dental elements, a feature that is exceptionally rare for osteoblastoma of the jaws and has never been reported in the English language literature. Central giant cell granuloma at its early stage of development can exhibit the same clinicoradiologic features that osteoblastoma exhibits. Central giant cell granuloma has a propensity for crossing the midline, especially in the maxilla, with divergence of tooth roots and resorption of lamina dura and roots, and usually appears multilocular on radiographs, with wispy internal septa at advanced stages.16,17

Osteoid osteoma is extremely rare in the jaws, commonly shows a well-defined sclerotic host bone reaction with a radiolucent center (nidus) on radiographs, and, conventionally, should be smaller than 2 cm in larger dimension.13 Ameloblastomas, especially the multicystic and solid types, usually show scalloped borders with tiny, irregular intralesional calcifications, whereas the calcifying epithelial odontogenic tumor may be radiologically similar to osteoblastoma but much more frequently arises in association with impacted teeth.

Histologic examination is paramount in confirming a definitive diagnosis and excluding osteosarcoma. The examination of small tissue fragments, as for intraoperative examination, can be ominous occasionally and lead to an incorrect diagnosis, as occurred in one of the cases in this series. Furthermore, frozen section analysis is limited to soft tissues, because bone fragments, needing decalcification, cannot be cut during this procedure. Nevertheless, on permanent sections, and even after decalcification, the diagnosis of osteoblastoma versus osteosarcoma may still be difficult to accomplish. This is mainly due to the presence of plump or even bizarre-appearing osteoblast-like cells in osteoblastoma, often bordering osteoid substance, mimicking the atypical cells that characterize osteosarcoma. In such instances, the diagnosis is greatly facilitated by the accurate interpretation of the histologic features in view of the radiologic findings that do not disclose the aggressive characteristics of osteosarcoma. In addition, osteoblastoma never shows peripheral permeation of the neoplastic tissue into the adjacent lamellar bone and has a more loosely arranged supportive stroma rich in capillary blood vessels, which also contains inflammatory cells and red blood cells. More important, the absence of lace-like osteoid and cartilaginous differentiation is classic in osteoblastoma.6,8

Aside from osteosarcoma, the histologic differential diagnosis of osteoblastoma compared with fibro-osseous lesions and odontogenic tumors usually does not represent a problem. Although osteoid osteoma shares the same histologic characteristics as osteoblastoma, it is a lesion limited in size to 2 cm or less. The diagnosis is mainly based on the characteristic architectural distribution of the mineralized and nonmineralized tissues in osteoid osteoma, the abundant fibroblastic stroma and peculiar morphologic features of the bony spicule in ossifying fibroma and fibrous dysplasia, the rich giant cell component in giant cell granuloma, and the definite presence of an epithelial component in ameloblastoma and calcifying epithelial odontogenic tumor.

The preceding distinctions are clinically relevant in consideration of the attenuated biologic behavior of osteoblastoma as demonstrated by the current short series of cases; in all of these cases, the patients are disease free even after prolonged clinical observation. Nevertheless, osteoblastoma may show a low tendency to recur (13.6%)6 and, very uncommonly, aggressive behavior or sarcomatous changes.18–20

It should be emphasized that some osteoblastoma variants, namely the so-called toxic osteoblastoma and the aggressive osteoblastoma, may display unusual features, such as fever, anorexia, hypergammaglobulinemia, and cachexia in the former and epithelioid osteoblasts, atypical mitoses, and lace-like osteoid in the latter. Both of these tumor variants may possibly show an aggressive clinical course.8 The debate is still ongoing as to whether these variants represent true osteoblastomas or poorly characterized osteosarcomas, and it may be that some previously reported cases of osteoblastoma affecting the jawbones and manifesting sarcomatous changes, multiple recurrences, or distant metastases could have been categorized into these variants.

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