Malignant transformation of an osteoblastoma of the skull: an exceptional occurrence

Case report

DOMINIQUE FIGARELLA-BRANGER, M.D., MIGUELINA PÉREZ-CASTILLO, M.D., LOUISE GARBE, M.D., FRANÇOIS GRISOLI, M.D., DANIELLE GAMBArelli, M.D., and JACQUES HASSOUN, M.D.

Departments of Pathology and Neuropathology, Faculty of Medicine, and Department of Neurosurgery, Hôpital de la Timone, Marseille, France

What is apparently the first reported case of spontaneous malignant transformation of a benign osteoblastoma of the skull is described. The initial lesion was completely removed surgically and showed the histological features typical of a benign osteoblastoma. No radiotherapy was performed. Eleven years later the patient developed an osteosarcoma of the skull. Review of the literature showed that malignant transformation of benign osteoblastomas is extremely rare and could take place spontaneously. However, the risk of this occurring seems higher after inadequate initial treatment (curettage or partial excision). Follow-up monitoring of patients with osteoblastoma of the cranial vault is suggested.

KEY WORDS • skull • osteoblastoma • malignant transformation

A benign osteoblastoma is an uncommon tumor and rarely occurs in the skull. Moreover, the sarcomatous transformation is extremely rare: only six well-documented cases have been reported in the literature. Such cases are different from aggressive osteoblastomas and well-differentiated osteosarcomas. The diagnosis and management of these lesions are difficult for both neurosurgeons and neuropathologists who are not used to this pathology. We report here the spontaneous sarcomatous transformation of a benign osteoblastoma of the skull occurring 11 years after initial treatment.

Case Report

This 39-year-old man first presented in 1977, complaining of an occipital tumor. Clinical examination revealed a firm painful mass, measuring 4 × 3 cm, in the occipital region of the skull. The remainder of the physical and neurological examination was within normal limits. Radiographic studies demonstrated a well-circumscribed lytic lesion in the left occipital bone (Fig. 1 left). A technetium brain scan revealed an area of increased radioactivity in the left occipital region, which was apparent on the posterior and left lateral views. Left external carotid arteriography showed an enlarged middle meningeal artery leading into the lytic defect (Fig. 1 right). The preoperative diagnosis was intraosseus meningioma. The patient underwent craniotomy, and the tumor was surgically removed; the histological findings are depicted in Fig. 2. The postoperative course was uneventful.

The patient did well until March, 1986, when he complained of headache and vomiting. A computerized tomography (CT) scan showed a left subdural parieto-occipital hematoma. Surgical excision was performed but no pathological specimen was available. In May, 1986, the patient displayed a similar clinical picture, and a CT scan revealed a left intracerebral parieto-occipitotemporal hematoma. A craniotomy was performed; macroscopically, the lesion mimicked an angioma. Some tissue fragments were sent for pathological examination (Fig. 3).

In July, 1988, the patient returned to the hospital with headache. A CT scan revealed a large left intracerebral and extracerebral lesion and destruction of occipital bone (Fig. 4). Operative removal was attempted. The lesion exhibited a different histological pattern; some areas were telangiectatic and similar to the lesion re-
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Fig. 1. Radiographic findings of the benign osteoblastoma. *Left:* A well-circumscribed lytic lesion is seen in the left occipital bone. *Right:* Left external carotid angiogram showing the tumor vascularized by the middle meningeal artery.

Fig. 2. Photomicrographs of the benign osteoblastoma. Hematoxylin-phloxin-saffron. *Left:* The lesion consists of randomly distributed thin osteoid trabeculae. Plump osteoblasts devoid of cytological atypia line the trabeculae and occasional osteoclasts are seen. The stroma consists of whorls of plump or elongated fibroblasts and numerous capillaries. × 36. *Right:* The surrounding bone is slightly thickened and remains lamellar. Normal periosteum is also seen. × 220.

moved in 1986, whereas other areas showed an osteogenic osteosarcoma (Fig. 5). Radiotherapy was performed after surgery and the patient is alive and well 1 year later.

Discussion

In the case reported here, we observed the spontaneous transformation of a benign osteoblastoma to an osteosarcoma. The histological diagnosis of osteoblastoma made on the original tumor in 1977 was unanimously accepted by several pathologists and the diagnosis of osteogenic osteosarcoma made in 1988 was also without doubt. In contrast, pathological diagnosis of the first recurrence in 1986 was difficult. At that time, a diagnosis of cavernomatous angioma was made; however, the appearance of cells outlining the vascular spaces was inconsistent with this diagnosis. The cells had features of osteoblasts; some were atypical, and osteoid was found near the tumor cells. It is possible that in 1986 the lesion was already an osteosarcoma of telangiectatic type. However, no atypical mitosis was seen on the available pathological specimen and diagnosis of malignancy was hard to maintain at that time.

Spontaneous malignant transformation of benign osteoblastoma is extremely rare: six well-documented cases have been reported previously\(^{1,10,12,18-20}\) and eight cases have been mentioned.\(^{4,5,6,11,17}\) The clinical findings in the six previous cases and in our case are summarized

in Table 1. In this series of seven cases, there was a male predominance (six cases), the patients' age at onset ranged from 10 to 43 years, and a predisposition for involvement of short and flat bones was observed (four cases). The occipital case reported here is the first at that location. In most instances radiological examination showed features typical of osteoblastoma. In all cases, the pathological findings were typical of benign osteoblastoma as described by Jaffe in 1956. In all of these patients, the sarcomatous transformation developed several years after the initial osteoblastoma (ranging from 3 years to 11 years in our case, with an average of 6 years). In four cases, this transformation occurred after inadequate initial therapy (curettage or subtotal excision) and usually after several recurrences with the same histological features of osteoblastoma. However, in our patient and two others, spontaneous malignant transformation occurred in spite of adequate initial therapy. In 1964, Cohen, et al. reported one case of osteoblastoma transformation 10 years after surgery and radiotherapy of a fibrosarcoma. They pointed out the role of radiotherapy in sarcomatous degeneration; however, none of the seven patients reported in Table 1 had radiotherapy after initial surgery.

The malignant transformation of benign osteoblastoma must not be confused with osteoblastoma with atypical histological features described as malignant osteoblastoma by Schlajowicz and Lemos or as aggressive osteoblastoma by Dorfman. Aggressive osteoblastoma occurs most often in long bones and in patients during the third or fourth decade of life. They are histologically characterized by the presence of epithelioid osteoblasts, trabecular or sheet-like osteoid, and an increase of osteoclastic resorption with no tumor cartilage production, no atypical mitosis, and no lace-like osteoid.

Clinically, local recurrences without metastasis are observed. Since the first report of aggressive osteoblastoma by Dorfman in 1972, other cases have been reported in the literature with the same histological features. The behavior of aggressive osteoblastoma and their pathological features distinguished these tumors from the osteosarcoma resembling osteoblastoma reported by Bertoni, et al. These authors described 17 cases of well-differentiated osteosarcoma which could be confused histologically with osteoblastoma. However, roentgenographic findings showed evidence of malignancy in nine of 13 cases so studied. Histologically, epithelioid osteoblasts and numerous, often abnormal, mitotic figures were seen in all samples examined. In addition, the tumor cells were present between bony trabeculae and permeated bone at the edge of the
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![Image description]

**Fig. 5.** Photomicrographs of the osteosarcoma. The adjacent cerebral cortex showed hemorrhagic areas (not shown). Hematoxylin-phloxin-saffron. Left: Abundant bone production and well-formed trabeculae are rimmed with abnormal osteoclasts varying in shape with an eosinophilic cytoplasm, round nuclei, and prominent nucleoli. × 220. Right: Abnormal mitotic figures (arrows) are abundant, particularly in highly cellular areas. In addition, numerous abnormal vessels and foci of necrosis are seen. At the periphery of the lesion some normal bone was observed. × 360.

**TABLE 1**

Summary of clinical and histological features of seven patients with osteoblastoma transformed into osteosarcoma

<table>
<thead>
<tr>
<th>Authors &amp; Year</th>
<th>Age (yrs), Sex</th>
<th>Site of Lesion</th>
<th>Initial Treatment</th>
<th>Recurrence Prior to Transformation</th>
<th>Time to Transformation</th>
<th>Treatment of Recurrence*</th>
<th>Metastasis</th>
<th>Outcome</th>
<th>Follow-Up Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mayer, 1967</td>
<td>43, M</td>
<td>hip bone</td>
<td>curettage</td>
<td>yes</td>
<td>9 yrs</td>
<td>surgery, XRT</td>
<td>no</td>
<td>died</td>
<td>13 yrs</td>
</tr>
<tr>
<td>Seki, et al., 1975</td>
<td>10, M</td>
<td>femur</td>
<td>curettage</td>
<td>no</td>
<td>7 yrs</td>
<td>amputation</td>
<td>no</td>
<td>alive &amp; well</td>
<td>8 yrs</td>
</tr>
<tr>
<td>Stutch, 1975</td>
<td>21, M</td>
<td>tibia</td>
<td>surgery</td>
<td>no</td>
<td>7 yrs</td>
<td>surgery, XRT</td>
<td>yes</td>
<td>died</td>
<td>8½ yrs</td>
</tr>
<tr>
<td>Unni &amp; Dahlin, 1979</td>
<td>18, M</td>
<td>tibia</td>
<td>surgery</td>
<td>no</td>
<td>3½ yrs</td>
<td>surgery</td>
<td>yes</td>
<td>died</td>
<td>?</td>
</tr>
<tr>
<td>Merryweather, et al., 1980</td>
<td>16, F</td>
<td>rib</td>
<td>subtotal excision</td>
<td>yes</td>
<td>6 yrs</td>
<td>surgery</td>
<td>yes</td>
<td>died</td>
<td>8 yrs</td>
</tr>
<tr>
<td>Beyer &amp; Kuhn, 1985</td>
<td>11, M</td>
<td>clavicle</td>
<td>curettage</td>
<td>no</td>
<td>3 yrs</td>
<td>surgery, chemotherapy</td>
<td>no</td>
<td>alive &amp; well</td>
<td>7 yrs</td>
</tr>
<tr>
<td>Figarella-Branger, et al., 1991</td>
<td>39, M</td>
<td>occipital bone</td>
<td>surgery</td>
<td>yes</td>
<td>11 yrs</td>
<td>surgery, XRT</td>
<td>no</td>
<td>alive &amp; well</td>
<td>12 yrs</td>
</tr>
</tbody>
</table>

* XRT = x-ray therapy.

The tumor. Follow-up monitoring of these patients showed early metastasis and death in 50%.

It is clear that in some instances, an accurate distinction between aggressive osteoblastoma and osteosarcoma may be difficult. Mitchell and Ackerman reported two unusual cases of metastatic and pseudomalignant osteoblastoma. Jackson and Bell reported one case of osteoblastoma that underwent malignant transformation only 7 months after initial diagnosis. This short delay between osteoblastoma and sarcomatous transformation suggests that the first lesion was an osteosarcoma, despite the fact that no atypical histological feature was found on histological examination. In such cases, ploidy determination may provide decisive diagnosis information.

The case reported here shows that sarcomatous transformation of benign osteoblastoma may occur even in the skull, but it remains exceptional and must be clearly differentiated from aggressive osteoblastoma and well-differentiated osteosarcoma. Surgery alone (total excision) remains the preferred treatment of benign osteoblastoma, while radiotherapy could be added in cases of aggressive osteoblastoma. Follow-up monitoring of cases of benign osteoblastomas seems suitable.
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References


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