Angiolipomas are benign, slow-growing, soft-tissue tumors consisting of mature adipose tissue and a vascular component made of a mixture of arteries, veins, sinusoids, and capillaries (8). Angiolipomas may occur anywhere in the body, with the subcutaneous tissue of the trunk and upper limbs being the most common sites (8). Examples involving the craniospinal axis are uncommon and almost always occur in the epidural space (8).

Intraosseous angiolipomas are extremely rare. To our knowledge, the only examples reported so far involved the mandible and ribs (2, 4, 6, 9). In these cases, the lesion expanded cortical bone without erosion.

We present a case of an angiolipoma with an 11-year history that affected the parietal bone in a 50-year-old man. The 4 previously reported examples of intraosseous angiolipomas have been reviewed.

**OBJECTIVE:** We describe an intraosseous angiolipoma of the cranium and discuss the outcome. Angiolipomas are benign tumors that consist of mature adipose tissue and abnormal vessels. They occur predominantly in the subcutaneous tissue of the trunk and upper limbs. Only 4 intraosseous examples have been reported in the literature, all of which involved the mandible and ribs.

**CLINICAL PRESENTATION:** A 39-year-old man presented with a right parietal swelling. The patient initially refused surgery, so it was possible to follow this case for 11 years, allowing us to evaluate the natural history of this rare condition.

**INTERVENTION:** Complete surgical excision of the intraosseous lesion was achieved with a titanium cranioplasty performed at intervals. Fifteen months after surgery, no recurrence was seen.

**CONCLUSION:** This is the first known report of intraosseous angiolipoma of the cranium. Angiolipomas are rare benign, slow-growing tumors with an excellent prognosis. On preoperative neuroimaging, they may mimic intraosseous angiomas, lipomas, or intraosseous meningiomas. Total resection is curative.

**KEY WORDS:** Angiolipoma, Bone, Cranium, Intraosseous, Lipoma, Skull
enhancement of soft tissue was seen (Fig. 1). Cerebral angiography demonstrated a distinct hypervascular appearance together with a persistent delayed blush. The arterial supply was predominantly from the right meningeal artery, with minor components of supply from the superficial temporal and occipital arteries (Fig. 2). In view of the superficial temporal and occipital arteries, with minor components of supply from the right meningeal artery, with minor components of supply from the superficial temporal and occipital arteries, a provisional diagnosis of a menigioma was made, and surgical treatment was discussed with the patient. Magnetic resonance imaging (MRI) was not performed preoperatively.

Operation

The patient consented to a 2-stage procedure consisting of total excision of bone containing the lesion, followed by a titanium cranioplasty. Preoperative embolization was considered but not performed. To achieve complete removal, an en bloc removal of the bone flap containing the lesion with margins falling in macroscopically healthy bone was performed. Intraoperative image guidance was not used. No technical difficulties were encountered during surgery. Despite its extensive vascularization seen at angiography, bleeding was easily controlled with bone wax, cautery, and Surgicel (Ethicon, Inc., Somerville, NJ). The excised bone was sent for histopathological examination and confirmation of surgical margins. The patient was discharged home on the second postoperative day. A postoperative scan showed complete excision of the lesion, and the patient was symptom-free with no neurological deficit (Fig. 3). He was seen in the clinic 2 weeks later, at which time he remained symptom-free. A titanium cranioplasty was performed in May 2007.

Pathological Findings

A flap of thickened bone measuring 13 × 8 × 4 cm was sent for examination. The outer and inner cortical surface was irregular, but no gross erosion was present. After formalin fixation, the sample was decalcified in 100% formic acid for 2 weeks. Upon sectioning, the bone appeared to contain a yellow-brown lesion of variable consistency. Overall, 15 samples were taken; 5 from the central portion of the lesion and 10 from all around the margin. Tissue was wax-embedded, and 5-μm sections were cut and stained with hematoxylin and eosin. Microscopic examination showed a well-circumscribed, nonencapsulated lesion composed of mature adipose tissue with a prominent vascular component. The lipomatous component featured bands of fibrous connective aggregates of foamy macrophages and scattered mast cells. Residual bone within the lesion showed thin trabeculae containing osteocytes within bone lacunae, but lacking an osteoclastic rim and osteoblasts. No deposits of osteoid or calcium were present. The vascular component consisted of thin-walled vessels of variable size and, to a much lesser extent, small clusters of capillaries. No thrombosis was present. Abnormal vessels were mainly located and considerably bigger in the subcortical location, where they induced microscopic bone erosion (Fig. 4). Islands of hematopoietic marrow were only identified at the periphery of the lesion. Surgical margins were all free of pathological tissue.

DISCUSSION

We have reported an intraosseous angiolipoma that involved the parietal bone. The lesion presented as a hard, painless mass that doubled in size over a period of 11 years without causing significant bone erosion. Because of the decision of the patient, surgery was delayed for approximately 10 years. Therefore, this is the first report that demonstrates the natural history of these rare lesions.

Angiolipomas are benign, slow-growing, soft-tissue tumors that consist of mature adipose tissue admixed with a sizable vascular component made up of small and medium arteries, veins, sinusoids, and capillaries in various combinations. Capillaries often predominate and appear thrombosed (8). Most commonly involving the trunk and arms, angiolipomas may occur anywhere in the body, including the craniospinal axis, where they are usually seen in the spinal epidural space. Bone is an exceedingly uncommon location.

To our knowledge, this case represents the first example of angiolipoma of a cranial bone. We performed a PubMed search using “bone, lipoma, angiolipoma, and angioma” and found 4 reported cases, 3 of which involved the mandible and 1 of which affected the third rib (2, 4, 6, 9). All lesions presented as a slow growing-mass enlarging but not eroding...
bone. Preoperative differential diagnoses included angioma and lipoma and depended on the extent of the vascular component. Tissue for histology was taken in all cases. Management of patients included diagnostic biopsy and follow-up, or surgical en bloc resection. Two patients were reportedly asymptomatic at presentation, but the length of history was not clear as most lesions were discovered incidentally. Postoperative follow-up was only reported in 1 study where a biopsy rather than en bloc removal was performed, but no comment was made on any changes in size. The salient clinicopathological features are summarized in Table 1.

Preoperative diagnosis of a bone angiolipoma may be difficult, as its neuroimaging features may mimic those of an angioma, lipoma, fibrous dysplasia or, in the cranium, meningioma. The salient CT and MRI scan features of these lesions are summarized in Table 2. On histological grounds, the differential diagnoses of the lesion reported here included intrasosseous angioma, intrasosseous lipoma, and ossifying lipoma. Although our lesion was remarkably rich in vessels, the possibility of an intrasosseous angioma seemed unlikely. Angiomas of bone grow between trabeculae and may show variable amount of residual mature fat intermixed between vascular spaces, but the adipose tissue is never as prominent as seen in the present case (8). On the other hand, intrasosseous lipomas may contain a vascular network of thin-walled vessels, but they never reach the size and the number of vascular space observed in our lesion at angiography and histology (1, 7). The lack of extensive calcium deposits and osteoid formation ruled out the possibility of an osteolipoma, which represents the late stage of intrasosseous lipomas (7).

The present lesion was excised in toto and, because the defect was large, a titanium cranioplasty was performed as a second stage for acceptable cosmesis. We routinely perform a 2-stage procedure for the repair of large defects using a computer-generated titanium cranioplasty plate, molded and designed from a 3-dimensional reconstruction of a postoperative CT scan of the cranium. In our opinion, this provides the best cosmetic result for larger defects. Surgery is the treatment of choice for intrasosseous angiolipomas, but it should be performed at an early stage. Differences exist in the approach to angiolipomas, as compared with intrasosseous lipomas and bone angiomas. Unlike intrasosseous lipomas, angiolipomas have a more pronounced tendency to growth because of the vascular component, which is responsible for the progressive expansion of bone. As mentioned, the lesion reported here had progressed from 3 cm to 7 cm in diameter, and vessels of a larger size were predominantly located under cortical bone, accounting for expansion. In contrast to bone angiomas, the present lesion did not require preoperative embolization, and very little bleeding occurred during the operation.

Although MRI scanning was not performed in this case because of the initial diagnosis of a meningioma, MRI scans to assess the extent of adipose tissue combined with angiography would be helpful for correct preoperative planning. It is difficult to comment on the need of performing a radical removal. In the present case, the surgical margins were free at the time of histological examination; however, the follow-up

**FIGURE 4.** A, hematoxylin and eosin (HE) whole section showing an expanded bone containing mature fat and large vessels underneath cortical bone. B, large vessels causing microscopic erosion of the cortical bone and appearing to be underneath the periosteum (HE; original magnification, ×20). C, small and thin-walled vessels within the lipomatous component (HE; original magnification, ×10). D, the lipomatous component consisting of mature fat; residual, preexisting bone lacks an osteoclastic rim and osteoblasts (HE; original magnification, ×10).
### TABLE 1. Summary of cases of intraosseous angiolipoma

<table>
<thead>
<tr>
<th>Series (ref. no.)</th>
<th>Age(years)/sex</th>
<th>Location</th>
<th>Signs/symptoms</th>
<th>Other</th>
<th>Radiographic findings</th>
<th>Treatment</th>
<th>Follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polte et al., 1976</td>
<td>39/M</td>
<td>Left body of mandible</td>
<td>Hyperesthesia of lower lip and chin</td>
<td>Previous left molar extraction</td>
<td>Well-circumscribed radiolucency</td>
<td>Surgical removal of mass</td>
<td>No information available</td>
</tr>
<tr>
<td>Lewis et al., 1980</td>
<td>56/F</td>
<td>Left body of mandible</td>
<td>Postoperative anesthesia after removal of “cyst” from same region 15 years before</td>
<td>Previous left molar extraction</td>
<td>Multilocular radiolucency with evidence of external resorption</td>
<td>Incisional biopsy alone</td>
<td>No information available</td>
</tr>
<tr>
<td>Hall et al., 1986</td>
<td>27/M</td>
<td>Right 3rd rib</td>
<td>Asymptomatic</td>
<td>Incidental finding</td>
<td>CT showed expanding ovoid extrapleural lesion arising from posterior segment of 3rd rib</td>
<td>En bloc resection of lesion</td>
<td>No information available</td>
</tr>
<tr>
<td>Mangaro et al., 1994</td>
<td>51/F</td>
<td>Left body of mandible</td>
<td>Asymptomatic</td>
<td>Left molar missing with no history of extraction</td>
<td>Moderately well-defined mixed radiolucent-opaque area in mandibular ramus</td>
<td>Incisional biopsy alone</td>
<td>Asymptomatic at 1-year follow-up</td>
</tr>
<tr>
<td>Yu et al., 2008</td>
<td>50/M</td>
<td>Right parietal skull</td>
<td>Asymptomatic</td>
<td>Increasing size of swelling over right parietal area; history of minor trauma to area</td>
<td>CT and angiography showed large focal hypodense lesion involving full thickness of cranium with bony spicules within, associated with hypervascularity</td>
<td>En bloc resection of lesion with titanium cranioplasty</td>
<td>Asymptomatic at 3-month follow-up</td>
</tr>
</tbody>
</table>

*CT, computed tomographic

### TABLE 2. Differential diagnosis of intraosseous angiolipoma of the cranium and radiological features*

<table>
<thead>
<tr>
<th></th>
<th>CT</th>
<th>MRI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intraosseous lipoma</td>
<td>Hypodense mass lesion with expansion of cortex and medulla. Density of the lesion between −40 and −110 HU with calcific foci and osseous septations.</td>
<td>Hyperintense on both T1 and T2. STIR images show focal areas that are hypointense on T1. Heterogeneous intensity on T2. Peripheral enhancement in hypointense areas on T1 after gadolinium contrast enhancement.</td>
</tr>
<tr>
<td>Fibrous dysplasia</td>
<td>Expanded bone showing a ground-glass appearance, usually around cranial base.</td>
<td>Hypointense on T1. Hyperintense on T2. Lesion enhances brightly with gadolinium contrast.</td>
</tr>
<tr>
<td>Cavernous hemangioma</td>
<td>Osteolytic hypodense mass lesion. Hemosiderin deposits may also be seen.</td>
<td>Heterogeneous isointensity on T1, heterogeneous hyperintensity on T2. Diffuse contrast enhancement.</td>
</tr>
<tr>
<td>Meningioma</td>
<td>Mass lesion with homogenous contrast enhancement. Spiculated calcified areas with osteolysis.</td>
<td>Hypointense on T1 and Hyperintense on T2. Homogenous enhancement with gadolinium on T1. Variable intracranial extradural extension.</td>
</tr>
<tr>
<td>Angiolipoma</td>
<td>Focal expansile hypodense lesion involving full thickness of cranium with bony spicules, associated with hypervascularity.</td>
<td>(In spinal angiolipomas) Hyperintense lesions on T1-weighted images. Gadolinium enhancement on fat-suppression sequences.</td>
</tr>
</tbody>
</table>

*CT, computed tomographic; MRI, magnetic resonance imaging; HU, Hounsfield unit; STIR, short-t inversion recovery
period is too short to confirm complete excision, particularly of the fatty component.

CONCLUSION

We have reported a unique case of an angiolipoma involving the parietal bone. Although fully benign in nature, intracranial angiolipomas show a tendency to expand over years. Total resection is curative.

REFERENCES

Author Query

AQ 1: Spell out “NHS” in affiliations if appropriate.

AQ 2: Please provide an affiliation for Dr. Roncaroli.

AQ 3: Please cite Reference 3 in the text or mark for deletion. If marked for deletion, do not renumber references.

AQ 4: Please cite Reference 5 in the text or mark for deletion. If marked for deletion, do not renumber references.

AQ 5: Please cite References 10, 11, and 12 in the text or mark for deletion. If marked for deletion, do not renumber references.

AQ 6: Provide original magnification for Figure 4, Part A.