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Case Report

Meningeal pure-bone mimicking parasagittal calvarial osteoma

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Abstract

We report a case of intracranial pure bone developed in the inner leaf of the dura mater. The patient, a 32-year-old woman, had suffered chronic headache over the previous two years. Physical and neurological findings on admission were unremarkable. Computed tomography scan revealed a homogeneous high-density mass without any enhancement and skull radiographs showed a dense calcified mass in the right frontal area. The mass was 3 cm in diameter and 2 cm in thickness. Total resection was performed under a preoperative diagnosis of calcified meningioma. However, histopathological findings revealed the mass to be "pure bone". Intracranial meningeal bone and/or osteoma are rare for a pathogenic origin. The literature on intracranial bone and/or osteoma of dural origin is reviewed.

Key wards: intracranial ectopic bone, intracranial osteoma, calcified meningioma

INTRODUCTION

Infant dura originally has an ostogenic potential (Liu YH, et al, 1995, and Guzel MZ, et al, 1995) and indeed meningeal osteoma is not rare (5%) in autopsy cases (Fallon MD, et al, 1982). Clinically, however, pathogenic intracranial osseous tumor is very rare, only 5 cases have been reported (Sugimoto K, et al, 2001, Haddad FS, et al, 1997, Lee ST and Lui TN, 1997, Choudhury AR, et al, 1995, and Aoki H, et al, 1998). Generally intracranial ectopic bone tumor is benign and is out of scope for surgical intervention if the patient does not show any neurological deficits.

In this report, a pure bone originating in the inner leaf of the parasagittal dura mater just beneath the lateral fontanel is presented and the diagnostic value of skull radiography is emphasized and the relevant literature on ectopic meningeal bone is reviewed. The scanty body of literature on this subject is briefly summarized, and the importance of this condition as a differential diagnosis from intracranial mass is outlined.

CASE PRESENTATION

A case of a 32-year-old female had a chronic headache in the forehead for several years. A persistent headache and inappropriate behavior consistent with a frontal lobe syndrome brought the patient to clinical and imaging evaluation, which revealed a large right frontal lobe bony mass. Computed tomography scan incidentally revealed a homogeneous high-density mass without any enhancement shown in Fig. 1. In the bone window CT, a small lucent foci like a nidus suggested osteoma. Skull radiographs showed a dense calcified mass in the right frontal area (Fig. 2). A lucent line between the tumor and the skull

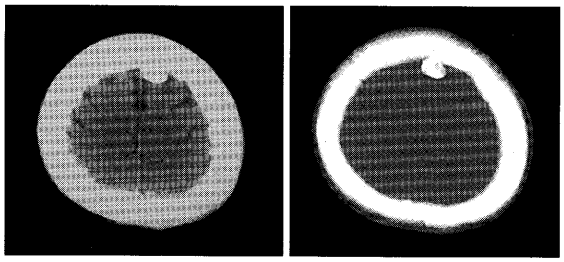

Fig. 1 Axial computed tomography scans (*left*: planar, *right*: bone window) showing a well-circumscribed high density extra axial mass at left parasagittal aspect of the dura mater mimicking osteoma and/or calcified meningioma

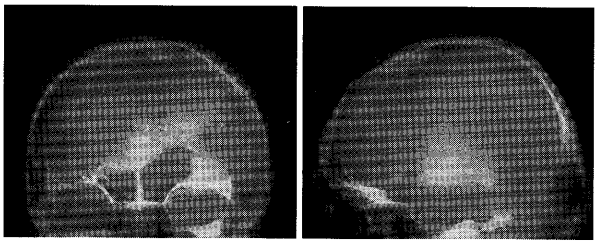

Fig. 2 Skull radiographs (left: AP view, right: lateral view) revealing a high density mass just beneath the left lateral of anterior fontanel. Lucent space between inner diploe and the tumor suggesting a menigeal osteoma and/or calcified meningioma

indicated a diagnosis of calcified meningeoma and/or meningeal osteoma. No neurological deficits were confirmed. Physical and neurological findings on admission were unremarkable. MRI was denied from the patient's feeling of fear against the very small platform of the MRI equipment.

Total resection was performed under a preoperative diagnosis of calcified meningioma. The whitish bony tumor was extirpated totally via a parasagittal craniotomy. The outer surface of the dura mater looked normal. There was no any tissue intervention between the dura mater and the skull. The tumor was tightly fusing with the inner leaf of the dura mater. Perhaps the tumor was considered to generate from the inner leaf of the dura mater. However histopathological inspection revealed the mass to be "pure bone" (Fig. 3). The patient discharged without any neurological deficits and crescendo alleviation of headache.

DISCUSSION

The coordinate growth of the brain and skull is achieved through a series of interactions between the developing brain, the growing bones of the skull, and the fibrous joints, or sutures, that unite the bones (Liu YH, et al, 1995). However, there are many developmental anomalies of the skull ; ex. Craniosynostosis, Encephalocele, and so on. Infant dura mater has osteogenic potential (Guzel MZ, et al, 1995). Skull and some parts of the facial bones are generated from ectoderm (neural crest) although another skeleton are from mesoderm. We suspect that the dura mater and the skull grow in coordination with totipotential mesenchymal tissue (primitive dura mater) (Fig. 4). The dura mater and the skull do not independently developed from the mesenchymal tissue. It might be convenient to suppose that the dura mater and the skull are a family and they are developed from the same origin (primitive dura mater), since a cat has an osseous tentorium cerebelli.

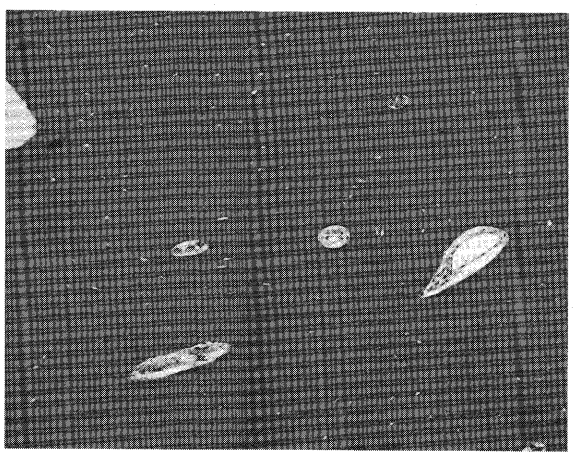

Fig. 3 Photograph of the removed specimen showing pure bone (HE stain, original magnification×100)

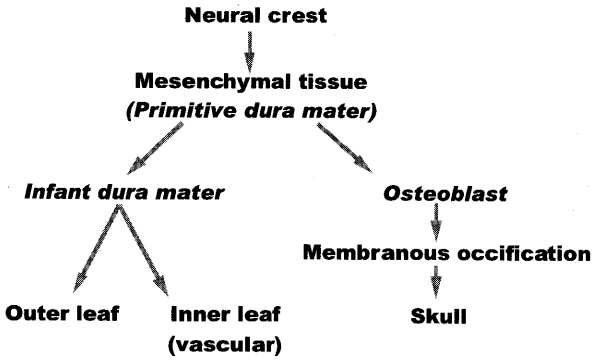

Fig. 4 Neural crest family developing the skull and the dura mater. Primitive dura mater is totipotential for developing skull and infant durra. Primitive dura mater, osteoblast and infant dura work together in coordination among them according to the growth of brain parenchyma

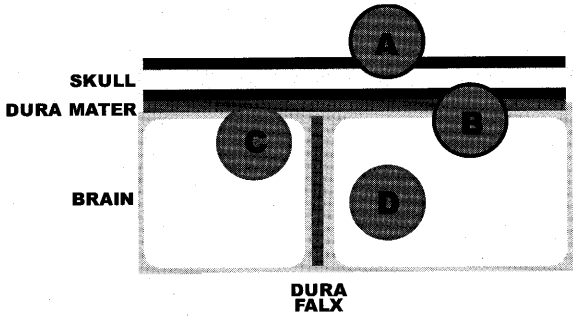

Fig. 5 Schematic drawing of osteoma family developing in the parasagittal area. An osteoma is generally developed on suture lines and fotanels that show high osteogenic potential in infant. A and B: calvarial osteoma, C: meningeal osteoma (6 cases) and D: solitary parenchymal osteoma (2 cases)

6 cases of osteoma originating in the dura mater have been reported including our case (Fig. 5). A new comprehensive classification for cranial osteomas is proposed: (1) intraparenchymal, (2) dural, (3) skull base, and (4) skull vault (Hadded FS, et al, 1997). The latter is in turn, subdivided into exostotic and enostotic variants. The meningeal osteoma might be a developmental disorder that is similar with osteoma originating in the skull (calvarial osteoma). In our case, perhaps infant dura mater developed ectopic pure bone tissue (clinically osteoma) in the inner leaf of the dura mater. The solitary parenchymal osteomas that do not connect with the dura mater are very rare, and their origin is unknown and controversial (Vakaet A, et al, 1983, Pau A, et al, 2003). Most cranial osteomas are asymptomatic and need not be resected. Those that are symptomatic should be managed properly. Their excision, if nor properly performed, may lead to unforeseen cerebral complications.

Osteomas, although usually found in the frontal and ethmoid sinuses or the mandible (skull base), may be located on the inner table of the skull. Fullon et al, University of Pennsylvania, reported the incidence, distribution, histologic features, and clinical correlates of intracranial osteomas arising in the dura mater and the falx cerebri in 200 consecutive adult autopsies. Ten patients (5 per cent of autopsies) were found to have meningeal osteomas. The tumors were usually located at the dural-falx junction at the superior longitudinal sinus. Histologically, they resembled with osteomas arising from other sites, but undecalcified sections generally demonstrated histologic features of active bone remodeling, namely the presence of abundant osteoid and numerous osteoclasts, and, in some instances, osteitis fibrosa. Thus, intracranial osteomas may be more common with pathological variety than was previously recognized. In some instances, as a non-developmental anomaly, the abnormal biochemical state accompanying chronic renal failure may stimulate new bone formation in the osteogenic tissue of the dura mater.

The differential diagnosis comprises: fibrous dysplasia, osteoma, blastic metastasis and calcified meningioma. On surgical point of view, especially, it is important to differentiate between calvarial osteoma and meningeal osteoma that require surgical maneuvers on the parenchyma via dural opening. MRI might be essential for making differential diagnosis. In this case, a lucid sign between the tumor and the dura mater on skull radiograph has also diagnostic value. Calvarial osteomas are most common in the frontal area but may occur in all parts of the skull, including the skull base. They also frequently are found in the parasagittal region near suture lines. They usually involve the outer table but can be found in the inner table or diploic space. Outer table osteomas are almost always of the compact variety. They produce a hard mass under the scalp. Those originating from the inner table or dipole, or both, usually are cancellous and must be distinguished from other slowly expanding, slightly inhomogeneous lesions. A meningioma with osseous invasion must show an adjacent soft-tissue mass, which is not found in osteoma (Zizmor, J., and Noyek, A. M., 1973). The rarer intraosseous meningioma can be very difficult to distinguish on a single imaging study, but this lesion almost always grows more quickly than does an osteoma.

CONCLUSION

Pathogenic intracranial osteomas that leads to surgical procedures are very rare. Those that are symptomatic should be managed properly. Their excision, if nor properly performed, may lead to unforeseen cerebral complications. Skull radiography can make a differential diagnosis between calvarial and meningeal osteomas.

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