Nontraumatic Intradiploic Arachnoid Cysts

—Report of Five Cases—

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Abstract

Five cases of nontraumatic intradiploic arachnoid cysts in elderly patients are reported. All cysts were located in the occipital bone and appeared as well-demarcated radiolucent lesions. The cysts were multiple in three cases. Presenting symptoms included headache or dizziness, but most lesions were asymptomatic and found incidentally. In the most recent three cases, magnetic resonance (MR) imaging revealed intradiploic cysts containing cerebrospinal fluid (CSF) with cerebellar herniation. Operation found the cysts filled with CSF and dural defects through which cerebellar tissue was herniating. In two patients, CSF leakage from the outer table occurred. Intradiploic arachnoid cyst seems to be congenital in origin but commonly found in the elderly. MR imaging is the most useful diagnostic method for differential diagnosis from other osteolytic skull lesions.

Key words: arachnoid cyst, diploic cyst, skull lesion

Introduction

Osteolytic skull lesions are a common incidental finding on plain skull x-ray films, which are still widely used. There are so many causes of osteolytic skull lesion that a definitive diagnosis may be difficult without a biopsy. Nontraumatic intradiploic arachnoid cyst is a rare benign osteolytic skull lesion in adults, and differentiation from other causes is possible by radiological studies. We report five cases of occipital osteolytic lesion caused by intradiploic arachnoid cyst.

Case Reports

Case 1: A 54-year-old female was admitted because of acute onset of headache. There was no history of head trauma. Plain skull x-ray films showed multiple symmetrical osteolytic lesions in the occipital bone (Fig. 1 *left*). Computed tomographic (CT) scans demonstrated a left parietal tumor with a hematoma and multiple osteolytic lesions in the occipital bone (Fig. 1 *right*). Angiograms showed the meningeal arteries feeding intracranial tumor but no abnormal vessels to the osteolytic lesions. A left parietal con-

Fig. 1 Case 1. *left*: Plain skull x-ray film, showing occipital symmetrical osteolytic lesions. *right*: CT scan with a bone window, showing extensive multiple intradiploic lesions.

vexity meningioma associated with an intracerebral hematoma, and the occipital multiple osteolytic lesions were removed. The outer table over the lesions was thin. The intradiploic cysts contained cerebrospinal fluid (CSF) and herniated cerebellar tissues which were avulsed when the bone flap was turned. The number of round dural defects matched the osteolytic lesions. Histological examination showed that the cyst contained arachnoid membrane and dysplastic cerebellar tissue (Fig. 2). The surgical

Fig. 2 Case 1. Photomicrograph of surgical specimen, showing herniated cerebellum (C) covered only by the arachnoid membrane (arrow) in the diploic space. Note the thin outer table (arrowheads). HE stain, $\times 20$.

bone defect was covered with a methylmethacrylate resin plate. The postoperative course was uneventful.

Case 2: A 70-year-old female was admitted for evaluation of left hemiparesis. There was no history of trauma. Plain skull x-ray films revealed a relatively large, well-demarcated osteolytic lesion in the right side of the occipital bone (Fig. 3 left). CT scans showed no abnormalities except erosion of the inner table of the right occipital region (Fig. 3 right). Angiograms found no vascular abnormality. Intraoperatively, the outer table was semitransparent. When the bone flap was turned, CSF gushed out and the cerebellum bulged from the dural defect. The herniated cerebellar tissue was removed and the small round dural defect closed using muscle tissue. The

Fig. 3 Case 2. Plain skull x-ray film (left) and CT scan (right), showing a single osteolytic lesion in the right occipital region.

bone defect was covered with a resin plate. She did well postoperatively.

Case 3: A 58-year-old female presented with vertigo, neck pain, and numbness of the left hand. There was no history of head injury. Plain skull x-ray films showed an osteolytic lesion in the left paramedian occipital bone (Fig. 4 left). CT scans showed an intradiploic lesion with erosion of the inner table (Fig. 4 center). Angiograms showed no vascular abnormality. Magnetic resonance (MR) images suggested this lesion communicated with the supracerebellar subarachnoid space (Fig. 4 right). Cervical MR images showed C5/6 disc herniation. Lifting the occipital skin flap exposed the outer table over the lesion which was thin and with CSF leakage. The intradiploic space was filled with CSF, and there were two small dural defects from which cerebellum was herniating. The herniating tissues were removed and

Fig. 4 Case 3. left, center: Plain skull x-ray film (left) and CT scan (center), showing a single osteolytic lesion in the occipital paramedian area. right: T₂-weighted MR image, suggesting communication of the cyst with the CSF space.

Fig. 5 Case 4. *left*: Plain skull x-ray film, showing multiple lytic occipital lesions. *right*: CT cisternogram with a bone window, showing contrast medium injected intrathecally filling the cyst (*arrow*).

Fig. 6 Case 4. T_1 - (*left*) and T_2 -weighted (*right*) MR images, showing cerebellar herniation into the cyst.

the dural defects repaired using muscle tissue. The bone defect was covered with a resin plate. The postoperative course was uneventful.

Case 4: A 71-year-old male presented with dizziness and headache persisting for 3 weeks. He had no history of head injury. Physical examination reveal-

ed small irregular depressions in the suboccipital area. Plain skull x-ray films showed multiple well-demarcated osteolytic lesions in the suboccipital area (Fig. 5 *left*). CT scans demonstrated erosion of the outer and inner tables. CT cisternograms demonstrated the CSF space communicated with this intradiploic lesion (Fig. 5 *right*). Angiograms showed no blood supply to the lesion. MR images revealed cerebellum herniating into the intradiploic lesion (Fig. 6). There was no abnormal uptake of technetium-99m methylene diphosphonate in this lesion or any other site of the body. At surgery, turning the skin flap exposed a small bone defect from which CSF was leaking. There were multiple areas of thin semitransparent outer table. When this thin outer table was removed with an air drill, clear CSF gushed out. There were multiple small dural defects from which dysplastic cerebellar tissues were herniating. The multiple dural defects were covered with lyophilized dura and the bone defect repaired with a resin plate. The postoperative course was uneventful.

Case 5: A 74-year-old female was admitted with partial left oculomotor nerve paralysis. Radiological studies showed a large left internal carotid-posterior communicating artery aneurysm, which was treated surgically. Preoperative work-up found occipital multiple lytic lesions (Fig. 7 *left*). MR imaging showed these lesions as isointense to CSF on both T_1 - and T_2 -weighted images (Fig. 7 *center, right*). The lesions were not explored surgically. She has remained well without symptoms related to these occipital lesions.

Discussion

Lytic lesions of the skull have a variety of causes, including benign and malignant neoplasms, infection,

Fig. 7 Case 5. *left*: Plain skull x-ray film, showing multiple occipital osteolytic lesions. *center, right*: T_1 - (*center*) and T_2 -weighted (*right*) MR images, showing cystic nature of these lesions.

trauma, and granuloma. Intradiploic arachnoid cyst is a rare skull lesion, accounting for only 4.2% of all skull lesions in our hospital over the past 22 years. Only three cases of intradiploic arachnoid cyst have been reported.^{2,7)} Weinand *et al.*⁷⁾ first proposed the term "intradiploic arachnoid cyst" in 1989. They reported two cases of multiple posterior parietal and occipital osteolytic lesions in elderly males. The dural defects were small, and the cysts did not extend beyond the outer table. The other reported case was unusual, with hemorrhage into the cyst in the frontotemporal area.²⁾ Similar lesions have been described as "growing fracture,"⁵⁾ "traumatic arachnoid cyst without fracture,"⁶⁾ or "intradiploic CSF fistula."¹⁾

The absence of trauma history and morphological differences from post-traumatic arachnoid cyst or growing fracture suggest that intradiploic arachnoid cyst is caused by a congenital defect of the dura mater and subsequent development of the arachnoid cyst into the diploic space.⁷⁾ Trivial forgotten trauma may result in skull fracture with dural tearing and subsequent development of a post-traumatic arachnoid cyst even in adults,⁴⁾ but a multiple, symmetrical distribution of lesions and small dural defects are unlikely to result from trauma. Why these congenital lesions occur in the elderly is not understood. Kaufman *et al.*³⁾ described acquired spontaneous CSF fistula from the middle fossa in adults and claimed that normal anatomical and physiological factors can cause acquired bone, dural, and arachnoid dehiscence.

The natural history or prognosis of intradiploic arachnoid cyst is not well known. Most cases were found incidentally. The lesion is apparently slowly progressive and can penetrate whole layers of the skull as seen in our Case 4. Surgery is only indicated for progressive types with local pain or localized swelling. Intradiploic arachnoid cyst is characterized

by multiple, symmetrical well-demarcated occipital osteolytic lesions on plain skull x-ray films in the elderly. A single osteolytic lesion needs further radiological studies. MR imaging can demonstrate communication of the cyst with the arachnoid space and cerebellar herniation, achieving the correct diagnosis.

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