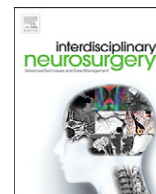


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## Case Reports & Case Series (CRP)

### Brain abscess associated with ethmoidal sinus osteoma: A case report



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#### ABSTRACT

Osteoma of the paranasal sinus is uncommon, and the occurrence of brain abscess associated with ethmoidal osteoma is particularly rare. We report here a case of a brain abscess complicating an ethmoidal osteoma in a 68-year-old man who presented with high-grade fever and disturbance in the level of consciousness. Computed tomography scanning and magnetic resonance imaging revealed a ring-enhancing mass in the left frontal lobe with surrounding edema and a bony mass in the ethmoidal sinus. We scheduled a two-stage operation. First, emergency aspiration and drainage of the abscess via the forehead were performed to reduce the abscess volume. These were followed by a left frontal craniotomy to totally remove both the brain abscess and the bony mass. The bony mass had breached the dura mater. After removing the bony mass, we repaired the anterior skull base using a pericranial flap. Pathological findings of the bony tumor were consistent with osteoma. The postoperative course was uneventful. In the case of a huge brain abscess associated with an ethmoidal osteoma, volume reduction by drainage followed by surgical removal of both lesions may help to control infection and achieve a cure. Use of a vascularized pericranial flap is important to prevent direct communication between the paranasal sinuses and the cranial cavity.

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#### Introduction

Osteoma of the paranasal sinus is uncommon, and the occurrence of a brain abscess associated with ethmoidal osteoma is rare. Although paranasal sinus osteoma is often detected incidentally, there are several neurosurgical reports of intracranial complications such as intracranial mucocele, [1,2] pneumocephalus, and brain abscess [1,3–5]. We herein report a favorable outcome for a patient with an ethmoidal sinus osteoma complicated by a brain abscess.

#### Case report

##### History and examination

A 68-year-old man was admitted to our department with a high-grade fever and altered level of consciousness following a 1-week history of headache and loss of appetite. The patient was confused (Glasgow Coma Scale 13: E3V4M6). He had no past medical history and remained independent in his activities of daily living. No other neurological deficit was noted. Blood analysis revealed leukocytosis ( $127.9 \times 10^2/\mu\text{l}$ ) and elevated C-reactive protein (2.69 mg/dl). Blood, sputum, and urine cultures were negative.

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##### Imaging findings

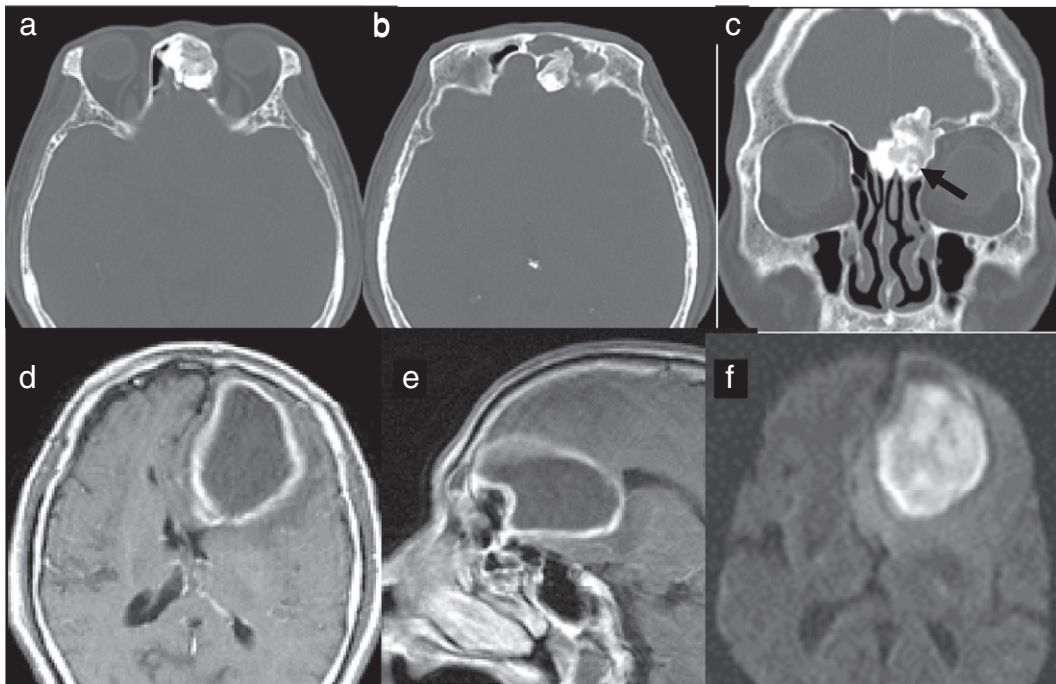
Head CT scanning showed a bony mass (2.8 cm × 1.9 cm × 3.0 cm) arising from the left ethmoidal sinus and extending to the frontal sinus and left anterior cranial fossa (Fig. 1a, b, c). The left nasofrontal duct was occluded by the bony mass, but the right duct was not occluded (Fig. 1c arrow). T1-weighted gadolinium-enhanced magnetic resonance imaging (MRI) showed a ring-enhanced cystic mass surrounded by brain edema in the left frontal lobe (Fig. 1d, e). The mass had a hyperintense signal on Diffusion Weighted (DW) images suggesting a brain abscess (Fig. 1f).

##### Surgical and antibiotic therapy

The preoperative diagnosis was brain abscess associated with ethmoidal sinus osteoma. We scheduled a two-stage operation. First, emergency aspiration and drainage of the abscess via the forehead were performed to reduce the elevated intracranial pressure. These were followed by a left frontal craniotomy to totally remove both the brain abscess and the osteoma in the next stage after proper antibiotic therapy.

##### Drainage of abscess

Aspiration and drainage of the abscess were urgently performed on admission. To puncture the abscess at the shortest distance without using a navigation system, the frontal burr hole was placed in the forehead. The linear skin incision was made along a wrinkle of the forehead. The landmark of the burr hole was the supraorbital roof. The

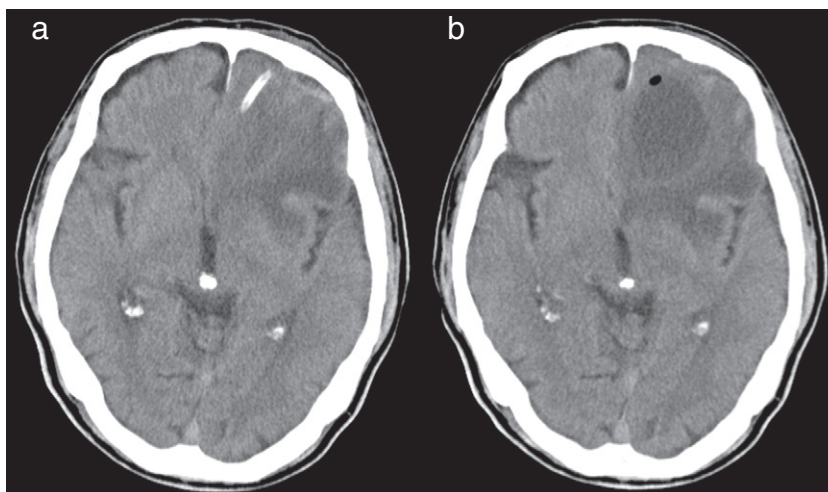


**Fig. 1.** Computed tomography (CT) scans with bone windows on admission showing a bony mass lesion arising from the left ethmoidal sinus and extending into the intracranial space. The left nasofrontal duct was obstructed by the bony mass (Fig. 1c arrow). a, b: Axial image bone window, c: coronal image bone window. d: Axial gadolinium (Gd) T1-weighted magnetic resonance image showing the ring-enhancing mass lesion in the left frontal lobe. e: Sagittal Gd T1-weighted magnetic resonance image showing the ring-enhancing mass lesion in the frontal lobe. f: The mass had a hyperintense signal on diffusion-weighted imaging.

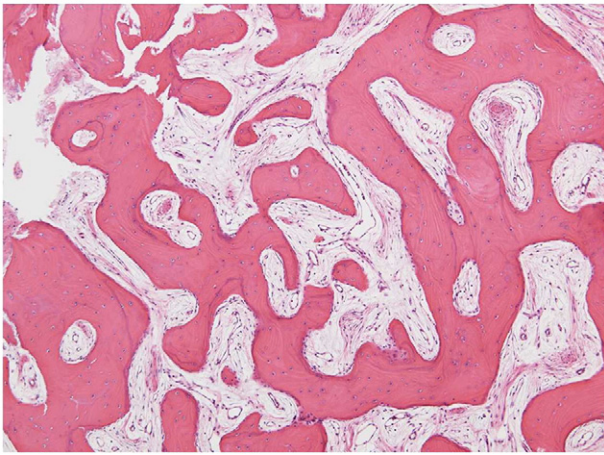
extradural drain (SILASCON®, KANEKA MEDICAL) was placed in the abscess. The drain was removed 6 days after the drainage procedure because the outflow of purulent material had stopped. The patient was initially treated with a 14-day course of carbapenem. *Streptococcus pneumoniae* was cultured from the aspirated materials. The antibiotic regimen was then changed from carbapenem to penicillin because liver dysfunction developed as a side effect of carbapenem. Penicillin was continued for 12 days. The abscess size was reduced (Fig. 2a) after drainage and his level of consciousness improved (Glasgow Coma Scale 14: E4V4M6). However, the abscess gradually enlarged (Fig. 2b) thereafter and his consciousness level decreased again 10 days after removal of the drain.

#### Craniotomy

We decided to make a left frontal craniotomy via a bicoronal skin incision 26 days after drainage. Left frontal craniotomy to the level of the orbital roof was placed across the center. The bony mass was approached from the frontal sinus. There was no direct communication between the frontal sinus and the intracranial abscess. The left nasofrontal duct in the bony mass was found to be occluded as suggested by imaging. We followed the bony mass over the ethmoidal sinus, and found that the osteoma breached the dura mater and abutted the frontal lobe. Careful dissection along the arachnoidal plane was performed. The bony mass was resected and then the brain abscess was



**Fig. 2.** a: The axial plane CT after the first operation (drainage procedure). The abscess was drained. b: The axial plane CT before the second operation (craniotomy). The abscess had enlarged.



**Fig. 3.** Photomicrograph of the tumor showing an osteoma consisting of a proliferation of mainly laminar bone (hematoxylin and eosin stain, original magnification  $\times 100$ ).

microsurgically removed in an en bloc fashion using a microscope. The dural defect was repaired with an autologous fascial graft. The frontal sinus was cranialized, and the opened frontal sinus was covered with a vascularized periosteal graft. The pathological finding was an osteoma consisting of a proliferation of laminar bone (Fig. 3).

#### Postoperative course

The postoperative course was uneventful. The postoperative CT scan and MRI showed no residual brain abscess (Fig. 4). Antibiotic therapy was continued for 2 weeks after craniotomy. The patient was discharged 3 weeks after craniotomy and had no postoperative complications such as cerebrospinal fluid (CSF) leak. His short-term memory deficit persisted, but otherwise he returned to a preoperative functional level. No recurrence has been observed 3 years after the surgery, which was confirmed by MRI.

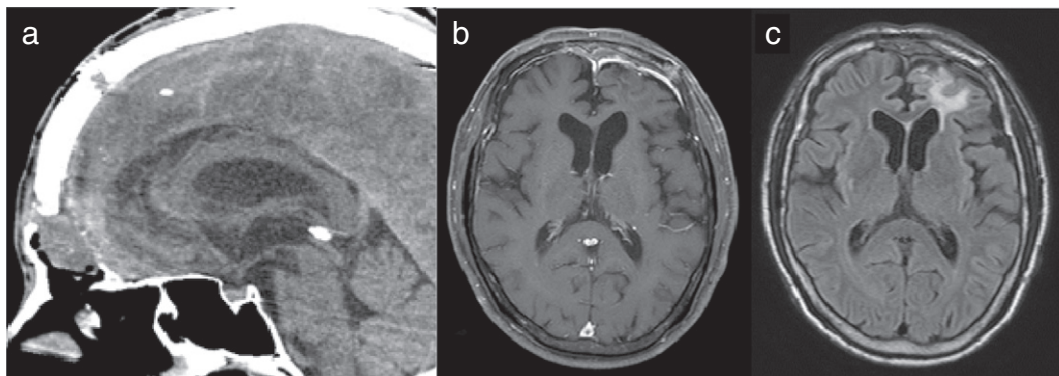
#### Discussion

Paranasal sinus osteoma is a benign tumor with an incidence of less than 1% in the general population in the current era of computed tomography (CT) [3]. The most common site is the frontal sinus and

ethmoid sinus, followed by the maxillary and sphenoid sinuses [5]. Approximately 80% of paranasal sinus osteomas occur in either the frontal sinus or ethmoidal sinus, or in both [4,5]. Several etiologies of osteoma have been proposed and include responses to inflammation, trauma, and nasal surgery [5]. If the tumor grows intracranially or obstructs the nasofrontal duct, it can cause secondary rhinorrhea, pneumocephalus, mucocele, [1,2] brain abscess, [1,3–5] or a combination of these conditions [1]. Approximately 1% of paranasal osteomas present with a brain abscess [3]. Only 8 cases of brain abscess associated with paranasal osteoma have been reported [1,3–5]. In our case, the osteoma developed mainly from the ethmoid sinus. The osteoma destroyed the anterior skull base directly, eroded the dura, and projected into the brain. Although the osteoma obstructed the nasofrontal duct resulting in improper drainage to form an abscess in the frontal sinus, there was no direct communication between the frontal sinus and the intracranial abscess. Therefore, it is possible that the brain abscess developed as a result of a direct communication between the paranasal sinus and the cranial cavity with destruction of the frontal skull base and dura mater.

Treatment for asymptomatic osteoma is somewhat controversial. Generally, if the lesion is small and asymptomatic, radiological follow-up should be performed to monitor its size. A symptomatic osteoma or an enlarging osteoma tends to be treated surgically. The surgical approaches for paranasal osteoma are the transcranial approach and transnasal endoscopic approach. When the osteoma extends intracranially, intraorbitally, or into the lateral part of the frontal sinus, the transcranial approach is necessary.

Appropriate treatments for brain abscess include antibiotic therapy, drainage, and surgical excision. Drainage and antibiotic treatment are often initiated in patients with a supratentorial brain abscess. However, a brain abscess associated with paranasal osteoma cannot be treated with either antibiotic therapy or aspiration drainage only. For brain abscess associated with frontoethmoidal osteoma, removal of the osteoma and abscess by craniotomy alone has been reported [4,5]. In addition, there have been reports of initial aspiration drainage and antibiotic therapy, followed by removal of the osteoma and abscess by craniotomy a few weeks later [1]. Lunardi et al. reported that it is important to close the dural and bone defects with pericranium, muscle grafts, and cancellous bone harvested during craniotomy or taken from a donor site in the exposed skull to prevent such communication [2]. In our case, the brain abscess was bulky with surrounding edema, and patient had disturbance in the level of consciousness. Removal of the abscess and osteoma by craniotomy following drainage to reduce intracranial pressure was effective. It is



**Fig. 4.** a: Postoperative sagittal CT image. The osteoma and brain abscess were removed. The frontal base was cranialized and the defect was packed with a pericranial flap. b: Postoperative axial T1-weighted magnetic resonance image showing no evidence of a brain abscess. c: Postoperative axial Gd T1-weighted magnetic resonance image showing no evidence of a brain abscess.

important to interrupt the direct communication between the paranasal sinuses and the cranial cavity to prevent CSF leak and recurrence of the brain abscess.

### Conclusion

The treatment of a large abscess and sinus osteoma may require volume reduction by emergency drainage and identification of the bacteria, followed by total removal. In addition, the use of a vascularized pericranial flap to prevent direct communication between the paranasal sinuses and the cranial cavity is necessary to prevent recurrence of the brain abscess.

### Disclosure

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

### Acknowledgments

None.

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