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Transethmoidal Drainage of Frontal Brain Abscesses

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Abstract

Background: The frontal lobe is the second most common location for brain abscess after the temporal lobe. Since the advent of computed tomography and magnetic resonance imaging scanning, diagnosis has become easier, but the prognosis of brain abscess is still poor. Treatment is based on antimicrobial therapy and neurosurgical evacuation, but controversy still remains as to the merits place of each. *Methods:* This study describes 2 cases of patients with frontal abscesses treated by endonasal transethmoidal sinus surgery (ESS) and reviews the literature on this topic. *Results:* Follow-up revealed no cerebrospinal fluid leak in both patients, complete abscess drainage in one patient, and incomplete drainage in the other. *Conclusions:* ESS drainage of frontal abscesses is feasible in intracerebral and epidural abscesses if they have a thick shell and are in contact with the skull base. The procedure is minimally invasive and relatively simple. It allows for rapid microbial identification and an effective drainage.

Keywords

sinusitis, brain abscess, endonasal sinus surgery, transethmoidal surgery, skull base

Introduction

Despite the advent of modern neurosurgical techniques, new antibiotics, and new powerful imaging technologies, brain suppurations remain a potentially fatal central nervous system infection.[1,2]

The causative pathogens of brain abscesses vary with time, geographic distribution, age, underlying medical and/or surgical conditions, and mode of infection. In recent years, the decreased incidence of otogenic brain abscess and the increased incidence of posttraumatic or postoperative brain abscess have changed the epidemiology and clinical spectrum of brain abscesses.[3-5] Hence, the management of brain abscess has become increasingly complicated requiring close collaboration between infectious disease specialists, neurologists, neuroradiologists, and neurosurgeons. Paradoxically, ENT surgeons are rarely involved in the management despite the fact that most brain abscesses originate from otologic and sinus infections. Recent development of skull base surgery techniques by ENT surgeons has allowed a better knowledge and management of skull base, meningeal and brain pathologies, expanding the field of traditional endonasal endoscopic surgery. In that way, brain abscesses drainage could become a new challenge for ENT surgeons.

The aim of this article was to relate our experience of endoscopic management of frontal abscesses drainage.

Case 1

An 86-year-old woman with recent deterioration of mental function was referred to the Rennes University Hospital ENT Department with a frontal intracerebral abscess associated with anterior skull base defects. The patient has had multiple endonasal sinus surgeries several years previously for Wegener granulomatosis. A computed tomography (CT) scan showed bone defects of the ethmoidal roof, the cribriform plate, and the bony perpendicular lamina (Figure 1). Magnetic resonance imaging (MRI) showed a thick shell multilocular intracerebral frontal abscess in contact with the anterior skull base defect (Figure 2). After thorough review of the CT scans and MRI with neurosurgeons and

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Figure 1. Case 1: Coronal bone computed tomography scan showing bone defects of the ethmoidal roof, the cribriform plate, and the bony perpendicular lamina

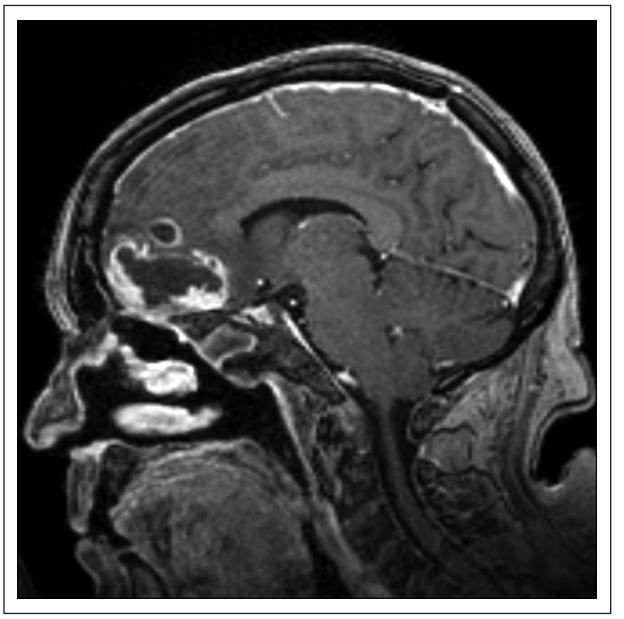

Figure 2. Case 1: Sagittal T1 weighted magnetic resonance imaging with gadolinium showing the multilocular abscess

radiologists, a decision was made to attempt drainage by the lower pole of the abscess by exclusive endonasal transethmoidal sinus surgery (ESS). Using a 30° telescope, a puncture with a CHIBA needle was made in the meninges through the right ethmoidal roof defect directly under the location of the lower pole of the suspected abscess. Pus was immediately found and a 1-cm incision was made in the meninges to allow evacuation of the pus. There was no cerebrospinal fluid (CSF) leak during the procedure. The patient was discharged on day 2 with antibiotics (beta-lactams) and mental function rapidly recovered after surgery. Direct examination of the pus revealed gram+ diplococci, but culture remained sterile. Immediate postoperative CT scan and MRI at 4 months showed reduction of the right side of the frontal abscess, but no modification of the left component (Figure 3). The patient remained stable on a 6-month course of beta-lactams. After follow-up imaging and discussion with microbiologists, the remaining abscess was considered to be inactive and no further treatment given. At 1-year follow-up, the patient had no CSF leak.

Case 2

A 53-year-old woman with acute myeloblastic leukaemia was referred to the Limoges University Hospital ENT Department with invasive rhino-orbital aspergillosis. CT scan showed complete opacity of the left sphenoid sinus and posterior ethmoidal cells, associated with left hypodensity of the frontal lobe without peripheral rim enhancement on cerebral slices. Antifungal therapy was started and a left posterior ethmoidectomy with sphenoidotomy was performed urgently. Pathological examination revealed the presence of intramucosal filamentous fungi and fungal cultures grew *Aspergillus fumigatus* confirming the diagnosis of invasive aspergillosis.

A postoperative MRI showed the evolution of the frontal opacity into an intracerebral abscess in contact with the meninges and the ethmoidal roof (Figure 4). After review of CT scans and MRI with neurosurgeons and radiologists, a decision was taken to attempt drainage by the lower pole of the abscess by ESS. The procedure required drilling of the ethmoidal roof and creation of a meningeal aperture, but it was considered that no CSF leak would occur if the lateral connection between the meninges and abscess shell was left intact. Left ethmoidectomy was performed and the middle concha was sacrificed to allow better exposure of the ethmoidal roof. The lower pole of the abscess on the ethmoidal roof was clearly identified on the CT scan (Figure 5) and the ethmoidal roof was drilled under the presumed position of the abscess. A greenish dura mater was exposed and on opening pus discovered. The access was enlarged to a diameter of 8 mm (Figure 6), and a 45° sinus endoscope and an atraumatic suction tube were then inserted into the cavity, allowing a perfect view and precise cleaning of the cavity (Figure 7). As expected, there was no CSF leak.

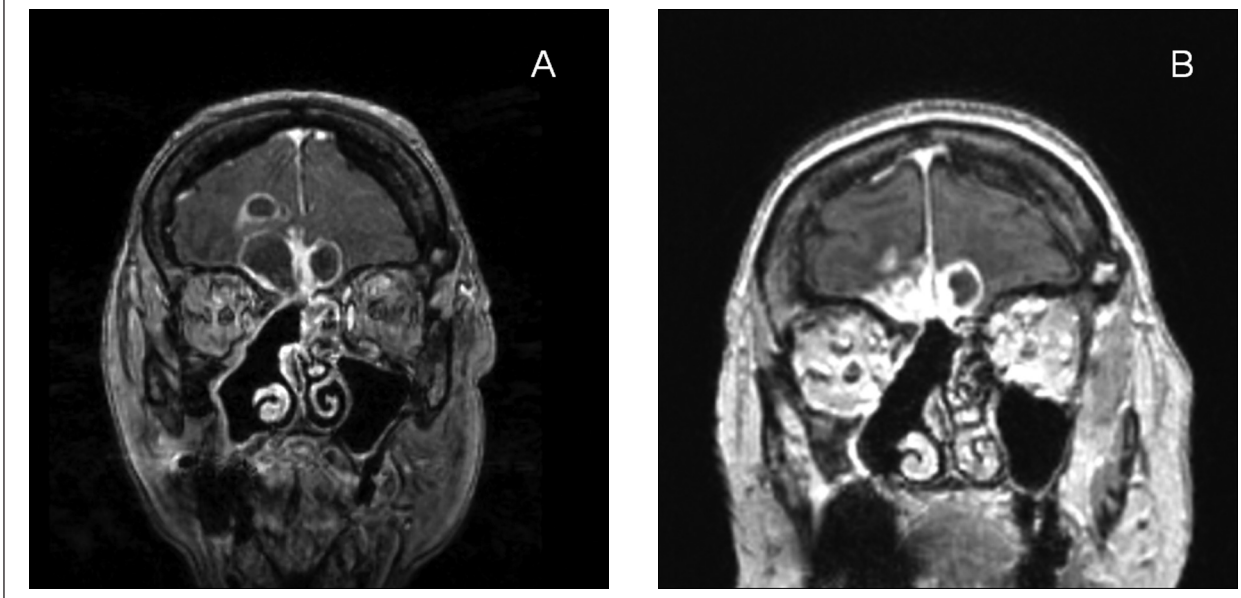

Figure 3. Case 1: Coronal T1 weighted magnetic resonance imaging with gadolinium showing the abscess preoperatively (A), and 4 months postoperatively (B)
Notice the abscess decrease on the side of the drainage (right side) and the stability on the other side (left side).

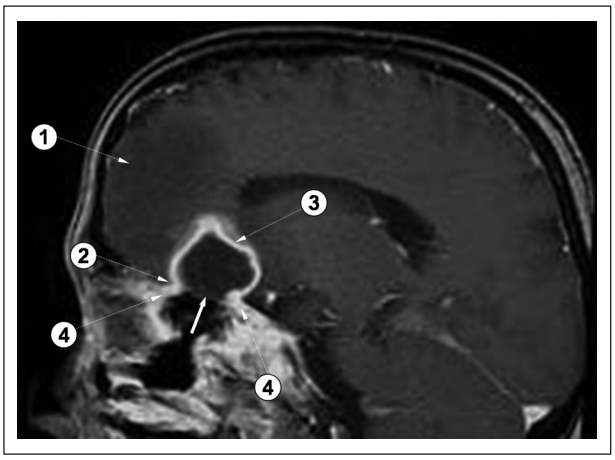

Figure 4. Case 2: Sagittal T1 weighted magnetic resonance imaging with gadolinium showing the abscess
Notice the hyposignal of frontal lobe (1), the narrowed angle (2) between the abscess shell (3), and the meninges (4) suggestive of an intracerebral abscess. Notice the enhancement of the shell (3) in continuity with meninges (4) and the absence of enhancement of the meninges at the lower pole of the abscess (white arrow).

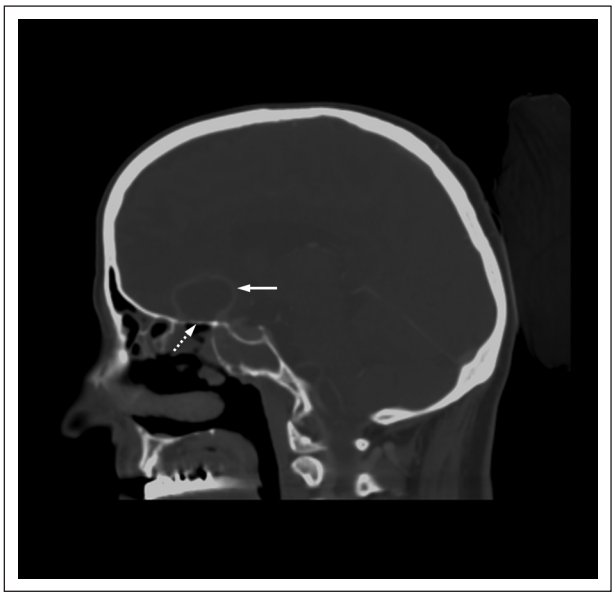

Figure 5. Case 2: Sagittal bone computed tomography scan showing the location of the abscess (white arrow) in relation to the ethmoidal roof (white dotted arrow)

Immediate postoperative course was simple, without CSF leak or meningitis. Direct examination of the pus revealed septated filamentous fungi suggestive of *Aspergillus*, but culture remained negative. MRI 1 week post-surgery showed complete collapse of the abscess shell on the skull base (Figure 8). The MRI obtained 8 months postoperatively showed stabilization of sinus fungal lesions and absence of residual abscess (Figure 9). The patient died of her leukemia 10 months after the drainage without evidence of CSF leak or meningitis.

Figure 6. Case 2: Endoscopic view of the inner abscess cavity (black arrow) after resection of the dura mater (white arrow)
White asterisk denotes the suction tube.

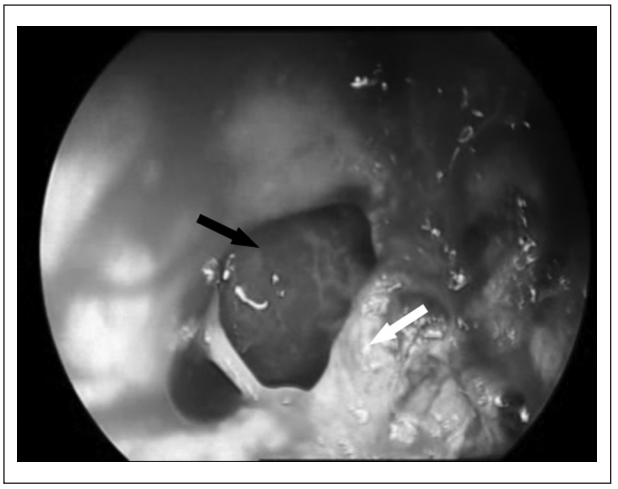

Figure 7. Case 2: Endoscopic view of the inner abscess cavity after cleaning (black arrow)
Notice the disappearance of infected tissue previously seen in Figure 6. White arrow indicates the dura mater.

Discussion

The 2 cases described demonstrate the feasibility of endoscopic drainage of cerebral frontal abscesses.

Three types of cerebral abscess have been described. Intracerebral abscess develops within the cerebral parenchyma, subdural abscess is located between the cerebral parenchyma and the dura mater, and extradural abscess is located between the dura mater and the cranial bone. Most of those lesions originate from otologic and sinus infections.[6] Diagnosis is usually made by CT scan, MRI, or biopsy. MRI is the preferred imaging modality for both diagnosis and monitoring the patient's response to

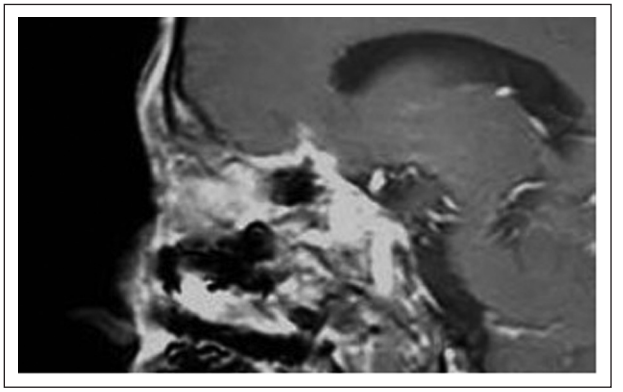

Figure 8. Case 2: Postoperative sagittal T1 weighted magnetic resonance imaging with gadolinium
Notice the collapse of the abscess wall on the anterior skull base and the absence of residual abscess cavity.

treatment. Despite the valuable information provided by CT or MRI, tissue diagnosis is often needed for antimicrobial identification. Before the era of CT scanning, most brain abscesses were diagnosed intraoperatively and resected totally. However, easier and safer diagnostic techniques make stereotactic aspiration a favorable treatment option, especially in multiple and noncortical lesions.[7-10] Although less invasive, mortality is still high at 3.5% to 19% and a morbidity of 4% to 18%.[11] Medical management alone may be considered if the patient is a poor candidate for surgery, if the lesion is multiple, <1.5 cm in diameter, located in eloquent areas, or if there is concomitant infection such as meningitis or ependymitis.[12] Nevertheless, there is still no consensus for treatment of brain abscesses and the need for surgical intervention and the type of procedure is still questionable.[12]

In our cases, abscesses drainage by ESS was preferred to stereotactic aspiration as it avoided intracerebral penetration and damage to the superior wall of the abscesses, which could led to abscess rupture into the ventricule or the subarachnoid space and pus leakage leading to ventriculitis or meningitis, respectively. It was hypothesized that performing a lower pole aperture in the abscesses would allow a total preservation of the thick shell superiorly and avoid communication with the cerebral parenchyma and CSF leak.

Contrary to stereotactic aspiration, the inferior drainage of the abscess without skull base closing also allowed a natural drainage into the nasal cavity. If despite our hypothesis a CSF leak occurred, we planned to use a local septal mucosal flap or abdominal fat with fibrin glue to seal the defect. A neurosurgeon was on standby in case of unexpected complication (cerebral hemorrhage, rupture of the superior shell of the abscess).

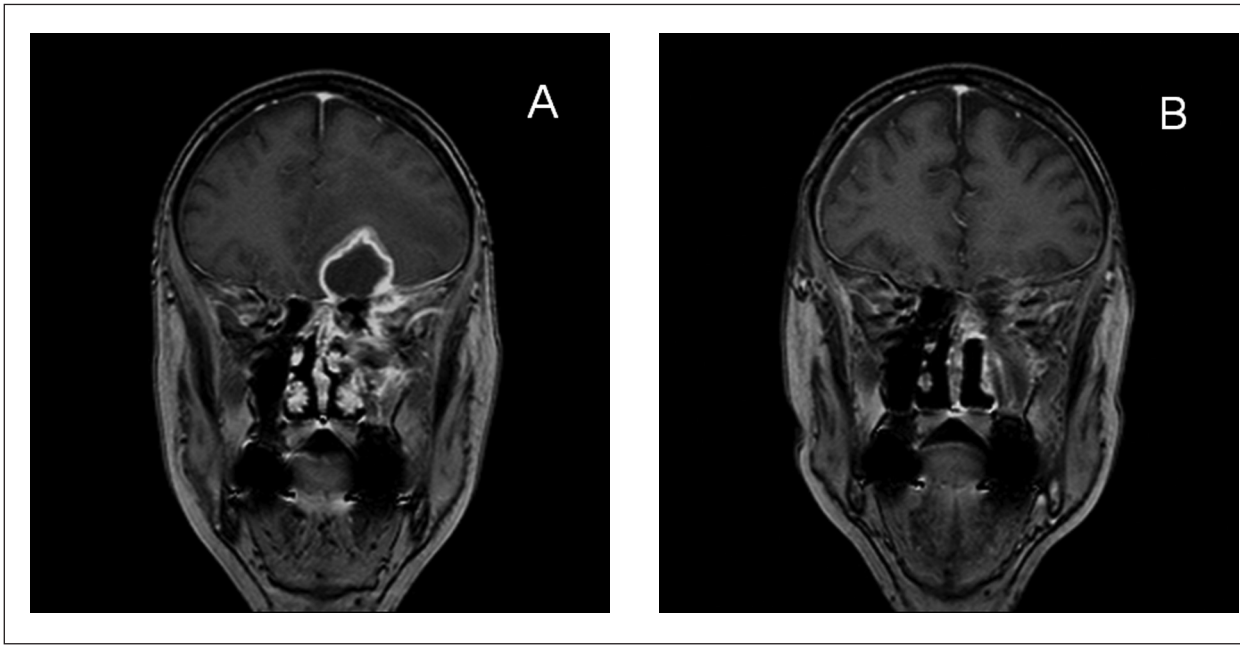

Figure 9. Case 2: Coronal T1 weighted magnetic resonance imaging with gadolinium showing the abscess preoperatively (A) and its disappearance 8 months postoperatively (B)

In case 1, the abscess persisted because of its multilocularity and, consequently, to its incomplete drainage. However, iterative drainage of persistent intracerebral abscesses using stereotactic techniques is not rare and has been reported to be necessary in nearly 30% to 70% of patients.[13,14] In case 2, a single ESS procedure allowed complete drainage with no recurrence at 8-month follow-up.

The percentage of brain abscesses amenable to our technique is difficult to estimate. Although incidence of intracranial complications following sinus infections have been reported in 0.5% to 24% of patients hospitalized with sinusitis,[15,16] we found no data that establish the percentage of brain abscesses in contact with the anterior skull base.

To our knowledge, only 3 cases of ESS drainage of epidural abscesses have been reported.[17-19] Of these, 2 involved frontal lobe epidural abscesses, and the third was a planum sphenoidale epidural abscess. All these cases were in children and followed acute bacterial sinusitis and were successfully treated by the exclusive opening of the anterior skull base. Two cases were performed by drilling the skull base.[17,18] In the planum sphenoidale case, the procedure was done under fluoroscopy using a Frazier suction tube.[19] In one case, the bone defect was closed using a mucosal free graft taken from the middle concha.[17] The authors reported no complications or recurrence after 2 to 12 weeks follow-up. After 1 year and 8 months of follow up, respectively, none of our 2 patients demonstrated CFS leak or meningitis, indicating that no skull base reconstruction was needed.

According to our experience and to the literature review, we think that endonasal endoscopic drainage of frontal abscesses must always be considered. This approach may be indicated and suitable in the following situations:

1. Intracerebral abscess secondary to subacute and chronic sinus infections, when the abscess has a thick shell and is in contact with the anterior skull base.
2. Epidural abscess secondary to acute sinus infections, when the abscess is in close contact with the anterior skull base.

Conclusion

The drainage of frontal epidural and intracerebral abscesses that are in continuity with the skull base can be easily performed by ESS without any complication. It is a minimally invasive and relatively simple technique with a simple outcome allowing rapid microbial identification and an effective drainage of the abscess. The decision to perform ESS drainage must be made in conjunction with a multidisciplinary team involving neurosurgeons, radiologists and ENT surgeons. As in stereotactic surgery, several procedures may be necessary to achieve a complete drainage.

Authors' Note

This study was presented at the 116th meeting of the French Society of Oto-Rhino-Laryngology Head and Neck Surgery, October 2009.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interests with respect to the authorship and/or publication of this article.

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