Endonasal Trans-Ethmoidal Drainage of a Cerebral Abscess

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ABSTRACT

Cerebral abscesses are rare but often lethal complications of invasive *Aspergillus* sinusitis. Treatment is difficult and usually depends on a combination of neurosurgical drainage and intravenous antifungal therapy. We report a case of intracerebral frontal abscess in continuity with the anterior skull base in a 53-year-old immunocompromised female with invasive rhino-orbital aspergillosis. An aperture was created by drilling the anterior skull base during endonasal sinus surgery, and the abscess was drained through its lower pole. The aperture was left open after surgery to ensure complete abscess drainage. Follow-up at 8 months revealed no cerebrospinal fluid leak or meningitis, and no abscess recurrence. This case validates the feasibility of endonasal trans-ethmoidal drainage of intracranial abscesses.

KEYWORDS: Rhino-orbital sinusitis, invasive aspergillosis, brain abscess, endonasal sinus surgery, trans-ethmoidal access

Cerebral abscesses are rare but often lethal complications of invasive *Aspergillus* sinusitis.^{1,2} Treatment is difficult and usually depends on a combination of neurosurgical drainage and intravenous antifungal therapy.¹ We report the case of a 53-year-old immunocompromised woman with rhino-orbital aspergillosis complicated by an intracerebral frontal abscess. The abscess was successfully treated by endonasal sinus surgery with trans-ethmoidal access.

CASE REPORT

A 53-year-old woman with acute myeloblastic leukemia (AML) was referred to our ear, nose, and throat department with rhino-orbital invasive aspergillosis. On presentation she had left proptosis, blindness, and complete ocular palsy. A computed tomography (CT)

scan revealed complete opacity of the left sphenoid sinus and posterior ethmoidal cells, which were associated, on cerebral slides, with a left hypodensity in the frontal lobe without peripheral rim enhancement. Nasal fiberoptic examination demonstrated only slight edema of the tail of the middle concha and sphenoid ostium. Antifungal therapy was initiated and left posterior ethmoidectomy with sphenoidotomy was performed. Histopathological examination revealed the presence of intramucosal fungal hyphae and cultures yielded *Aspergillus fumigatus*, confirming the diagnosis of invasive aspergillosis.

Ophthalmological examination of the patient was unchanged, and postoperative magnetic resonance imaging (MRI) revealed evolution of the frontal opacity into an intracerebral abscess in contact with the meninges and ethmoidal roof (Fig. 1). After a thorough review of her

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Figure 1 Sagittal T1-weighted MRI with gadolinium enhancement showing the abscess. Note the frontal hyposignal (1) and the narrowed angle (2) between the abscess shell (3) and meninges (4) indicating an intracerebral abscess. The white arrow shows the endonasal access route.

CT scans and MRI findings with neurosurgeons and radiologists, a decision was made to attempt drainage through the lower pole of the abscess by endonasal sinus surgery. The procedure required drilling of the ethmoidal roof and creation of a meningeal aperture, but it was considered that no cerebrospinal fluid (CSF) leak would

occur if the lateral connection between the meninges and abscess shell was respected (Fig. 1). Left ethmoidectomy was completed and the middle concha was sacrificed to allow better exposure of the ethmoidal roof. The lower part of the abscess resting on the ethmoidal roof (clearly identified on the CT scan) corresponded in the operative field to a nonmucosal lining area lying on the ethmoidal roof (Fig. 2A). This “dead zone” is surrounded the posterior ethmoidal artery (PEA). The ethmoidal roof was drilled just in front of the PEA, revealing greenish dura matter (Fig. 2B). Opening of the aperture released a sudden gush of pus. The pus was aspirated and the access was enlarged to a diameter of 8 mm (Fig. 2C). A 45-degree sinus endoscope and atraumatic suction tube were then inserted inside the abscess cavity, allowing perfect vision and thorough cleaning of the cavity (Fig. 2D). As expected, there was no CSF leak. At the end of the intervention, the nasal cavity was packed for 24 hours to prevent bleeding.

The immediate postoperative course was uncomplicated, without CSF leak or meningitis. Direct examination of the aspirated material revealed septate filamentous hyphae resembling *Aspergillus*, but fungal cultures were negative. A 1-week postoperative MRI showed complete collapse of the abscess shell on the

Figure 2 Endoscopic view of the ethmoidal roof down to the abscess. (A) Note the absence of mucosal lining, termed the “dead zone” (white dashed lines). The drilling zone (black dotted lines) is just in front of the posterior ethmoidal artery. (B) Ethmoidal roof after drilling. (C) Abscess cavity after creation of the meningeal aperture. (D) Abscess cavity after cleaning. Posterior ethmoidal artery (1), suction tube (2), meninges (black arrow), abscess cavity (white arrow).

Figure 3 Postoperative sagittal T1-weighted MRI with gadolinium enhancement. Note the collapse of the abscess wall on the anterior skull base and the absence of a residual abscess cavity.

skull base (Fig. 3). The final MRI, obtained 8 months postoperatively, revealed stabilization of the fungal lesions in the sinus and the absence of residual abscess. The patient died from AML 10 months after abscess drainage, without any evidence of CSF leak or meningitis.

DISCUSSION

Aspergillus infections of the paranasal sinuses are, in most cases, benign mycetomas and have a good prognosis. Invasive aspergillosis differs by its trend toward bone, orbital, and intracranial invasion, and its rapid and aggressive evolution. It usually occurs in patients with comorbid conditions such as diabetes mellitus, leukemia, human immunodeficiency virus infection, or long-term steroid treatment.³

In immunocompromised patients, intravenous antifungal treatment should be started without delay, as soon as the diagnosis is suspected. Surgical debridement of invaded tissue is recommended, even though its effectiveness is controversial and it is associated with significant morbidity, particularly in immunocompromised patients. Thus, the decision to perform surgery is usually multidisciplinary, involving surgeons, anesthesiologists, and hematologists.

When intracranial invasion occurs, even systemic antifungal therapy combined with surgical debridement may fail to control the disease and the evolution is often fatal.^{1,4} Several approaches to neurosurgery have been described in such cases. Stereotactic aspiration is the most popular technique. This allows abscess drainage and irrigation of the abscess cavity. A rigid endoscope can be used at the end of the procedure to remove residual pus, and a catheter can be left in situ to allow irrigation with antifungal drugs or isotonic sodium chloride solution. Abscess removal by frontal craniotomy can also be performed, but this is associated with higher morbidity.

After discussion with neurosurgeons and radiologists, abscess drainage by endonasal sinus surgery was

preferred to stereotactic aspiration because of the poor health of the patient and because it avoided intracerebral penetration and rupture of the upper wall of the abscess that could lead to meningitis. It was considered that drilling through the ethmoidal roof to create a meningeal aperture was safer, given the connection between the meninges and the abscess shell: this access enabled us to keep the upper thick shell of the abscess intact, avoiding communication with the cerebral parenchyma and CSF leak (Fig. 1). As expected, there was no CSF leak and the abscess gradually collapsed in on itself allowing complete abscess drainage and effective sealing of the access route (Fig. 3). If, despite our hypothesis, a CSF leak occurred, we planned to use a local septal mucosal flap with fibrin glue to seal the defect. To our opinion, a nonvascularized graft would not be appropriate considering the devascularization of the ethmoidal roof.

To our knowledge, this is the first report of an intracerebral abscess treated by endonasal sinus surgery. Three cases of endonasal sinus drainage of epidural abscesses have been reported^{5–7}: two concerned frontal lobe epidural abscesses, and the third, a planum sphenoidale epidural abscess. All three cases were associated with acute bacterial sinusitis in children and were successfully treated by opening the anterior skull base. Two cases were treated by drilling the skull base.^{5,6} In the planum sphenoidale case, the procedure was performed under fluoroscopic guidance using a Frazier suction tube.⁷ In one case, the bone defect was closed using a mucosal-free graft taken from the middle concha.⁵ The authors reported no complications after 2 to 12 weeks follow-up.

In our patient, a “dead zone” was present, with no mucosal lining covering the skull base, extending down to the suspected lower pole of the abscess. This observation can be explained by devascularization of the ethmoidal roof and infected meninges secondary to vascular thrombosis induced by *Aspergillus* invasion,² and by mucosal removal provoked by the first ethmoid surgery. It is likely that this dead zone was secondary to the lack of healing after mucosal removal. It is also likely that thrombosis of the PEA that crossed the dead zone promoted this devascularization (Fig. 2A). The fact that we never observed any dead zone in our previous endonasal revision surgeries made us consider that the abscess was the main cause for the dead zone.

If present during surgery, the dead zone can be used by surgeons as a landmark to confirm the drilling zone, but it does not replace a thorough reading of the CT scan. If available, the use of a navigation system is in our opinion highly recommended. Unfortunately, in our report, the navigation system was not informative because of important parameter setting problems.

In conclusion, drainage of an intracerebral abscess that has developed in continuity with the skull base can be performed by endonasal sinus surgery. This procedure

is minimally invasive and relatively simple to perform. As opposed to stereotactic neurosurgery, it allows effective abscess drainage without intracerebral penetration. No meningeal closure or skull base reconstructions are necessary. In our case, only one procedure was necessary to remove the abscess and the postsurgical outcome was straightforward, without any complications. This case validates the feasibility of endonasal trans-ethmoidal drainage of intracranial abscesses.

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