

## Otogenic brain abscess: management by otologist

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### Abstract

**Introduction:** Fifty per cent of brain abscesses in adults and 25 per cent of those in children are otogenic in origin. The current neurosurgical options are to drain the abscess repeatedly through burr holes or to excise it completely with the capsule. We successfully managed 10 cases of brain abscess by draining through the transmastoid route. The technique and its advantages are discussed.

**Material and methods:** The patients underwent surgery at two different institutions. Computed tomography scanning and magnetic resonance imaging were performed, along with diffusion-weighted imaging and *in vivo* proton magnetic resonance spectroscopy. The abscesses were drained via a transmastoid route.

**Results:** In eight cases, ear disease and brain abscess were treated in a single-stage procedure. In the remaining two cases, residual brain abscess was excised subsequently by our neurosurgical colleagues.

**Conclusions:** Transmastoid drainage of pus can successfully treat mastoid disease and brain abscess in a single surgical intervention. Residual abscess can be subsequently excised, with relatively reduced morbidity. Repeated needling is also avoided with this approach. Diffusion-weighted imaging and proton magnetic resonance spectroscopy are helpful.

**Key words:** Brain Abscess; Otitis Media; Otologic Surgical Procedures; Diffusion Magnetic Resonance Imaging

### Introduction

Fifty per cent of brain abscesses in adults and 25 per cent of those in children are otogenic in origin. In adults, abscess development usually follows chronic suppurative otitis media with cholesteatoma, while in children it is usually the result of acute otitis media. Cerebral abscess is seen twice as frequently as cerebellar abscess. Cerebral abscess develops as a result of direct extension of middle-ear infection through the tegmen or by retrograde thrombophlebitis, in which case the tegmen will be intact. Extradural abscess is often associated. Cerebellar abscess may also develop as a direct extension through Trautmann's triangle or by retrograde thrombophlebitis. This is often associated with extradural abscess, perisinus abscess, sigmoid sinus thrombophlebitis or labyrinthitis.<sup>1</sup>

The current neurosurgical options are to drain the abscess repeatedly through burr holes or to excise it completely with its capsule.<sup>2–4</sup> These procedures have their own disadvantages, and excision of abscess is associated with significant morbidity. The middle-ear disease, the source of infection, is then tackled in subsequent surgery, usually performed when the condition of the patient improves.<sup>1</sup>

We successfully managed 10 cases of brain abscess by draining through the transmastoid route. The technique and its advantages will be discussed.

### Material and methods

Out of the 10 cases of otogenic brain abscesses included in this study, five were operated upon at the Government Medical College, Amritsar, and the remaining five at the Sanjay Gandhi Post Graduate Institute of Medical Sciences, Lucknow, India. All 10 cases presented with a history of ear discharge, fever, headache, vomiting and drowsiness. In all cases, computerized tomography (CT) scanning and magnetic resonance imaging (MRI) were performed. Diffusion-weighted imaging (DWI) and *in vivo* proton magnetic resonance spectroscopy were performed in five cases. A temporal lobe abscess was found in six cases (Figures 1 and 2), while in the remaining four cases a cerebellar abscess was diagnosed (Figure 3). Pre-operative treatment was penicillin 200 000 units/kg/day intravenously (IV), chloramphenicol 100 mg/kg/day IV and mannitol 0.5 g/kg IV.

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FIG. 1

Axial section of contrast-enhanced computed tomography scan showing temporal lobe abscess.

#### Technique

Radical mastoidectomy was performed in all 10 cases via a postauricular route. In cases of temporal lobe abscess, the dural plate was found to be eroded. Granulations were present on the dura. A healthy portion of dura was exposed by burring out part of the dural plate and a contiguous part of the vertical portion of squamous bone. A needle was advanced into the abscess cavity through the healthy portion of dura, obtaining pus. An incision was made along the needle path with a number 15 blade and a glove drain inserted down this track into the abscess cavity.

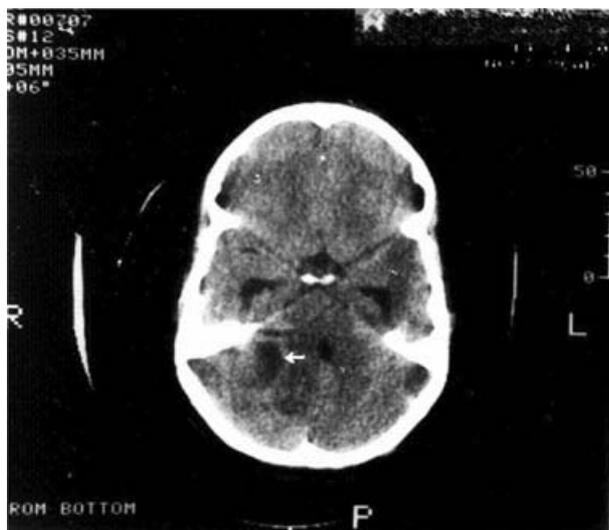


FIG. 2

Axial section of nonenhanced computed tomography scan showing right cerebellar abscess (hypodense area marked with white arrow).



FIG. 3

Coronal section of contrast-enhanced computed tomography scan showing brain abscess.

The glove drain was gradually withdrawn during subsequent dressings and the cavity was allowed to collapse of its own accord, as shown in Figure 4. Using this technique, pus was never aspirated but was allowed to drain via the glove drain. This avoided not only the sudden collapse of the abscess cavity and its capsule, but also the repeated aspirations otherwise required in such cases.<sup>1</sup> To facilitate subsequent dressings, primary suturing of the postauricular incision was not performed. Five to seven days after surgery, when the pus had completely drained from the abscess cavity and the abscess cavity had collapsed, secondary suturing of the postauricular incision was performed.

Cerebellar abscesses were drained through Trautmann's triangle by the same procedure (Figure 5). Post-operatively, the patient's progress was assessed by repeat CT scanning and neurosurgical opinion. Post-operatively, patients were administered a third generation cephalosporin, metronidazole, chloramphenicol, aminoglycoside, antiepileptics and mannitol.

#### Results

All 10 cases were successfully managed by us. In eight cases, ear disease and brain abscess were treated in single-stage surgery. In the remaining two cases, residual brain abscess was excised by our neurosurgical colleagues. Pus drained from the brain abscesses was sterile in all 10 cases. No recurrence was noted after a minimum of one year's follow up.

In two cases not included in this study, there was a well defined, hyperintense lesion with perifocal



FIG. 4

Computed tomography scan following transmastoid drainage of temporal lobe abscess (the pre-operative scan of the same patient is shown in Figure 1).

oedema in the left temporal region. These lesions showed ring enhancement following administration of contrast. However, there was no restriction on DWI. Proton magnetic resonance spectroscopy findings (Figure 6) confirmed that these lesions were not brain abscesses but tumour cysts. Hence, these cases were not operated on using the above technique.



FIG. 5

Collapsing cerebellar abscess after transmastoid drainage of abscess.

## Discussion

Otogenic cerebral abscesses are twice as common as cerebellar abscesses.<sup>1</sup> In this study group, cerebral abscesses were found in 60 per cent of cases; cerebellar abscesses were found in 40 per cent of cases.

Computed tomography scanning was able to diagnose brain abscess and underlying ear disease in all 10 cases. An MRI provided additional information about the location of the abscess, degree of mass effect, midline shift and the staging of disease. Diffusion-weighted imaging and *in vivo* proton magnetic resonance spectroscopy was performed in five cases. In a parallel study conducted in this institute (S.G.P.G.I.M.S, Lucknow), it was found that demonstration of restricted diffusion on DWI, with reduced apparent diffusion coefficient, was highly suggestive of brain abscess. However, in the absence of restriction, proton magnetic resonance spectroscopy was mandatory in order to distinguish brain abscesses from cystic tumours.<sup>5</sup> Using this modality of investigation, two cases of cystic brain tumours giving a false impression of brain abscess (due to ring enhancement on MRI) were identified, thus avoiding inappropriate treatment with the above surgical technique.

- This paper describes the management of intracranial otogenic suppuration by an otological surgical approach
- Transmastoid aspiration of pus by this method can treat mastoid disease and brain abscess in a single surgical intervention, also avoiding repeated needling. Wide dissemination of an initially relatively well contained infection and permanent neurological deficits are less likely with this technique compared with neurosurgical approaches. Residual abscess, if remaining, can be excised subsequently, with relatively less morbidity
- Diffusion-weighted imaging and *in vivo* proton magnetic resonance spectroscopy are helpful in differentiating brain abscesses from other intracranial cystic mass lesions and should be done before undertaking aspiration

Taylor claimed surgical excision to be the treatment of choice for brain abscesses, with a 6 per cent mortality rate in their series.<sup>6</sup> Agrawal *et al.* achieved zero per cent mortality in nine cases of posterior fossa abscess, using primary excision.<sup>4</sup> Excision is a major operation and is associated with a higher incidence of neurological deficit. It demands a high level of neurosurgical skill to minimize the risk of brain damage and of rupture of the abscess into the ventricle. Bidzinski and Koszewski suggested that surgical removal of brain abscess is rarely indicated.<sup>7</sup> Stapleton *et al.* advocated aspiration of pus under CT stereotactic control as the treatment of choice for brain abscess.<sup>2</sup> Strowitzki *et al.* recommended ultrasound-guided aspiration of brain abscess through a single burr hole as first-line treatment for abscesses larger than 25 mm.<sup>3</sup> Based on

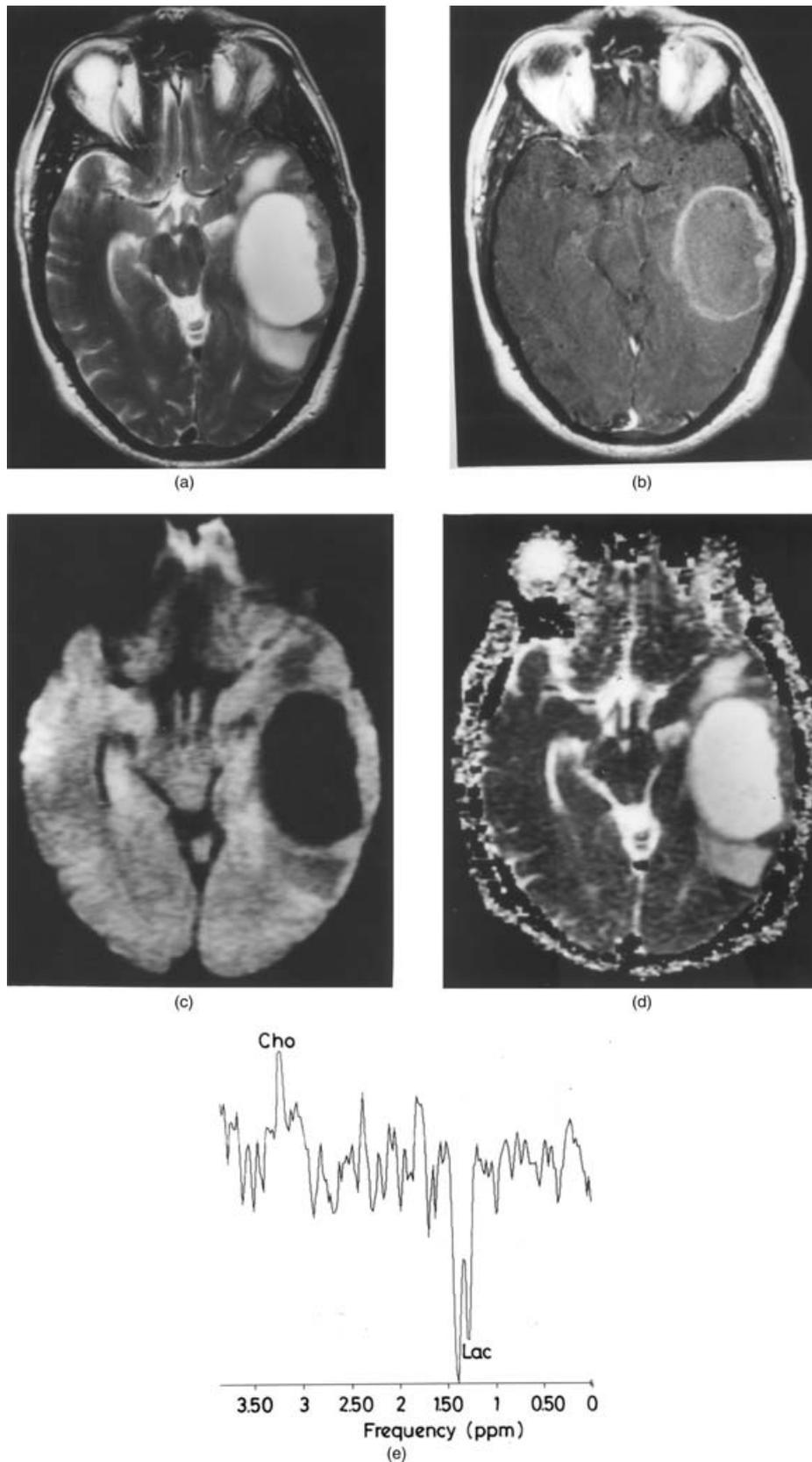


FIG. 6

MRI and CT scan was showing findings consistent with brain abscess but diffusion weighted imaging (DWI) and proton magnetic resonance spectroscopy (PMRS) findings confirmed it to be a tumor cyst (glioblastoma multiforme). (a) T2-weighted axial magnetic resonance imaging (MRI) shows a well-defined hyperintense lesion in the left temporal region with peritumoral edema; (b) lesion showed rim enhancement on postcontrast; (c) Corresponding DWI shows the cavity as hypointense with no restriction; (d) on the apparent diffusion coefficient map; (e) *in vivo* PMRS using spin demonstrates lactate (Lac, 1.33 ppm) and choline (Cho, 3.22 ppm) consistent with a tumour cyst.

CT staging, Srinivasan *et al.* treated 37 cases of encapsulated brain abscess with repeated elective aspiration through a burr hole and intracavity application of antibiotics on alternate days, until two consecutive negative aspirations were obtained; the mortality rate was 2.7 per cent and the morbidity rate 8.3 per cent.<sup>8</sup> Brydon and Hardwidge concluded that burr hole aspiration with regular CT was a satisfactory method of treatment for cerebellar abscess.<sup>9</sup>

However simple, aspiration needs to be repeated as total removal of pus is not possible in a single procedure. Also, as the capsule of the abscess collapses it thickens, so that there is the risk of the cannula glancing off and damaging adjacent white matter.<sup>1</sup> Repeated needling was avoided in our technique as the drain was sited along the needle and then gradually withdrawn during subsequent dressings, allowing the abscess cavity to collapse. Stephanor reported that 40 per cent of brain abscesses are multilocular and that total removal of pus by aspiration is not possible.<sup>10</sup>

Eight cases were managed in a single procedure in our study group. In the remaining two cases, surgical excision of a residual abscess was required. However, in these two cases, the size of the abscess was significantly reduced due to the initial transmastoid aspiration, so subsequent neurosurgical deficits were minimal as less tissue was excised.

In suppurative otitis media with intracranial complications, it is accepted practice to treat the neurosurgical complication first, followed by mastoidectomy at a later date after the patient has been stabilized. Kurien *et al.* found craniotomy with concurrent mastoidectomy not only to be safe but also to remove the source of infection at the same time as treating the complications, thus avoiding reinfection while the patient is awaiting ear surgery.<sup>11</sup> In patients in this study group, undergoing the transmastoid technique, mastoid disease and brain abscess were treated in a single-stage procedure and through the same incision.

Aspirated pus was sterile on culture, due either to prolonged antibiotics or to failure to identify obligatory anaerobes.

## References

- 1 Harold L. Complications of suppurative otitis media. In: John BB. *Scott-Brown's Otolaryngology*, 6th edn. Oxford: Butterworth Heinemann, 1997;3:16–21
- 2 Stapleton SR, Bell BA, Uttley D. Stereotactic aspiration of brain abscesses: is this the treatment of choice? *Acta Neurochirurgica* 1993;121:15–19
- 3 Strowitzki M, Schwerdtfeger K, Steudel WI. Ultrasound-guided aspiration of brain abscesses through a single burr hole. *Minim Invasive Neurosurg* 2001;44:135–40
- 4 Agrawal D, Suri A, Mahapatra AK. Primary excision of pediatric posterior fossa abscesses – towards zero mortality? A series of nine cases and review. *Pediatr Neurosurg* 2003;38:63–7
- 5 Mishra AM, Gupta RK, Jaggi RS, Reddy JS, Jha DK, Husain N *et al.* Role of diffusion-weighted imaging and *in vivo* proton magnetic resonance spectroscopy in the differential diagnosis of ring-enhancing intracranial cystic mass lesions. *J Comput Assist Tomogr* 2004;28:540–7
- 6 Taylor JC. The case for excision in the treatment of brain abscess. *Br J Neurosurg* 1987;1:173–8
- 7 Bidzinski J, Koszewski W. The value of different methods of treatment of brain abscess in the CT era. *Acta Neurochir Wein* 1990;105:117–20
- 8 Srinivasan US, Gajendran R, Joseph MJ. Pyogenic brain abscess managed by repeated elective aspiration. *Neurol India* 1999;47:202–5
- 9 Brydon HL, Hardwidge C. The management of cerebellar abscess since the introduction of CT scanning. *Br J Neurosurg* 1994;8:447–55
- 10 Stephanor S. Experience with multiloculated brain abscess. *J Neurosurg* 1978;49:199–203
- 11 Kurien M, Job A, Mathew J, Chandy M. Otogenic intracranial abscess: concurrent craniotomy and mastoidectomy – changing trends in a developing country. *Arch Otolaryngol Head Neck Surg* 1998;124:1353–6

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Dr R Syal takes responsibility for the integrity of the content of the paper.

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