JOURNAL OF CASE REPORTS 2013;3(2):413-418

Otogenic Intracranial Abscesses: A Case Series

Rebecca Sin Mei Lim[1], Malcolm Baxter[1], Ker Fern Tan[2], Michael Harney[3], Kary Suen[4]
From the Department of Otorhinolaryngology[1] and Emergency Department[2], Southern Health, Melbourne, Australia and Royal Melbourne Hospital, Melbourne[4]. Department of Otorhinolaryngology[3], Bon Secours Hospital, Cork, Australia.

Abstract:

Objective: To aid clinicians in the early identification of life-threatening otogenic intracranial abscesses(OIA) through recognition of signs and symptoms.

Setting: Tertiary referral centre in Melbourne, Australia.

Subjects and Methods: 5 patients, aged 6-31, with otogenic intracranial abscesses, were identified with ICD-10 diagnostic codes. Charts were reviewed for history, examination, investigations, treatment and outcomes.

Results: Headache was the most common presenting symptom (5 of 5 patients), followed by fever (present in 4 of 5 patients), seizures (3 of 5 patients) and confusion (3 of 5 patients). Nausea with vomiting was seen in 2 patients, so was ear discharge. One patient developed complete left-sided facial nerve palsy with disdiadochokinesia and vertigo.

Conclusion: An OIA is a life-threatening condition requiring aggressive surgical and antibiotic therapy. Acute or chronic otitis media can lead to OIA, and the diagnosis should be considered in all such patients presenting with a headache, fever, seizures and confusion, especially after failing conservative treatment.

Keywords: Brain Abscess, Otitis Media, Epidural Abscess, Seizures, Vomiting, Vertigo.

Introduction

Otogenic intracranial abscesses are an uncommon but life-threatening complication of otitis media. Children and young adults tend to be affected by this condition which can be easily missed if the clinician does not have a high index of suspicion. The impetus for our study is to aid clinicians of all specialties in recognizing this complication, as well as provide some background information about the disease process and management.

Corresponding Author: Dr. Rebecca Sin Mei Lim
Email: rebecca1188@gmail.com
Received: September 15, 2013 | **Accepted:** October 6, 2013 | **Published Online:** November 20, 2013

Conflict of interest: None declared | **Source of funding:** Nil | **DOI:** http://dx.doi.org/10.17659/01.2013.0095

Methods

Clinical database records from our tertiary center were searched for patients with the diagnosis codes of otogenic brain abscess (G06.0 under the International Classification of Diseases). The date range was January 1, 1998, through September 30, 2008. 5 patients were identified. The presence of an otogenic brain abscess was defined by clinical signs of otitis media and an intracranial abscess on radiological scans.

With care delivered by numerous faculty members in different departments (e.g., Otolaryngology and Neurosurgery) and some radiologists considering Computed tomography (CT) and Magnetic resonance imaging (MRI) findings diagnostic in some cases, there was no uniform diagnostic protocol.

Results

Symptoms

5 patients met our criteria for having an otogenic intracranial abscess at an average age of 20.4 years (age range 6-31years). 3 were male and 2 were female. Patients presented most commonly with a headache (100%), which tended to be severe, fever (80%), nausea and/or vomiting (80%), seizures (60%) and confusion (60%).

On examination, 2 patients had signs of meningism (neck stiffness and photophobia). One patient experienced complete left sided facial nerve palsy with disdiadochokinesia and vertigo. Ear discharge was noted in 2 patients.

3 patients had been diagnosed with acute otitis media prior to being diagnosed with an intracranial abscess. The other 2 had been diagnosed with chronic otitis media. 3 patients also had mastoiditis diagnosed around the same time, while a 4th patient had a concomitant otitis externa. Of the 5 patients, 1 received oral antibiotics (Cephalexin) and 2 received Cefaclor and Sofradex (Framycetin sulfate, Gramicidin, Dexamethasone) drops from their respective general practitioners. The treatment given by the general practitioner of 2 patients could not be determined.

Diagnostic Testing

Diagnostic testing was primarily radiographic, including CT brain (80%) and MRI brain (100%). In all cases, the intracranial abscess was found in the hemisphere corresponding to the side of otitis media. The diameters of the abscess ranged from 1.0-3.5 cm. 3 abscesses were within the brain parenchyma, while the other 2 were epidural. 3 abscesses were supratentorial and 2 infratentorial. The temporal lobe was the most common region for abscesses to be found, followed by the cerebellum.

4 patients had a full blood examination and C-reactive protein (CRP) performed, which showed leukocytosis in all cases (white cell count 12.1 -15.3; reference range [RR], 4.0-11.0 $x10^9$/L), a neutrophilia (9.8-12.21; RR, 2.00-8.00 $x10^9$/L) and a raised CRP (20-232; reference range; RR, 0-5 $x10^9$/L). Blood cultures were taken in 3 patients which did not reveal any growth.

3 patients had lumbar punctures performed. 2 of these patients had high cerebrospinal fluid CSF protein (0.89 and 1.51 respectively; RR, 0.1-0.3 g/L), all had raised neutrophils (210 -3100) and lymphocytes (205 - 420), (total CSF white cell count; RR, 0-5 $x10^6$/L). 1 patient had no CSF glucose (RR, 2.5-5.0 mmol/L).

Group A *Streptococcus, Proteus mirabilis* and *Streptococcus Milleri* were grown from the ear swabs from 2 patients. The remaining 3 ear swabs were culture negative. *Enterococcus avium* was found in the post-operative analysis of the subdural abscess in 1 patient.

Treatment

All patients were treated with intravenous antibiotics prior to surgery. Intravenous Ceftriaxone 2-4g twice daily used alone or in combination with intravenous Vancomycin, Clindamycin or Metronidazole was empirical treatment of choice. One patient received intravenous Ticarcillin with Clavulanate, Gentamicin and Metronidazole instead of intravenous Ceftriaxone.

The surgical procedures involved included two mastoidectomies with concurrent craniotomies and drainage, a burr hole drainage and a myringotomy. One patient declined surgery and failed to attend subsequent outpatient clinics on discharge. Patients also received an average of 2.5 months of systemic antibiotics. All patients who underwent surgery had the procedure done within 2 weeks of admission to hospital and all tolerated the procedure well. No mortality was recorded.

Repeat CT scans post-surgery of the 4 patients successfully followed up showed that it took an average of 10.75 weeks from the time of admission before the CT scans no longer showed an intracranial abscess.

Discussion

Otitis media (OM) is a common and treatable medical condition that tends to affect Australia's young as well as our Indigenous community. In 2008, 659,000 Australians (3.1% of the total population) were diagnosed with OM, 65,000 of whom (9.9%) were Indigenous [1]. Of these, 365,000 Australians with OM were aged less than 15 years (55%), with 47,000 Indigenous in this age group (12.8%).

While most cases of OM are relatively benign, complications such as hearing loss, meningitis, and otogenic brain abscesses can occur [2]. Of these, intracranial complications, in particular otogenic brain abscesses, are important for the clinician to recognize, as while uncommon, these can be potentially life-threatening. Indigenous children are more likely to develop complications from OM than their non-Indigenous counterparts. To our knowledge, there are no data showing that intracranial complications are more common in the former group, but this has been suggested by O'Connor *et al* [2].

The impetus for this study was the observation that the cases of OIA were severe and tended to occur in young patients. Indeed, in 2008, 60,263 children under the age of 14 were diagnosed with chronic suppurative otitis media (CSOM) and 217 developed intracranial complications. This figure represented 56% of all cases of intracranial complications in patients with CSOM [1].

Overall, the rate of intracranial complications from otitis media in Australia is 0.36%,which is comparable to the rate of intracranial complications internationally - between 0.36% and 0.38% [1,3,4]. Prior to the antibiotic era, intracranial complications occurred in 2.3% of cases of OM [5].

Amongst the potential intracranial complications of OM, two studies found meningitis (27.5 to 51%), venous sinus thrombosis (19-40%) and otogenic brain abscesses (42-75%) to be the most common complications [3]. These complications are life-threatening and even with early antibiotic treatment, can have a mortality rate of up to 18.4% [1]. In the preantibiotic era, the mortality rate from intracranial complications of OM was as high as 76.4% [6]. At present, the mortality rates are much greater in developing countries than developed ones. Two studies in developed countries had no mortality among their study sample, while the mortality rate in developing countries ranged from 26.3% to 36% [1,2]. The mortality rate from OIA ranged from 0% - 33.3%, with the most recent study having the lowest mortality [3,7,9].

A number of authors have confirmed that otitis media is the most common source of intracranial abscesses, and that acute as opposed to chronic otitis media, was more commonly associated with intracranial complications [8,10]. This was the case in our series.

The presentation of OIA can be insidious. In our study, headache, fever, nausea and vomiting, seizures and confusion were common. A pediatric study of 30 cases of OIA found fever (66.7% of cases), otalgia (56.7%) and headache (36.7%) to be the top three most common presenting symptoms [10]. Other presenting symptoms are demonstrated in Table 1.

Table 1: Presenting signs and symptoms of paediatric otogenic intracranial abscesses.

	N (%)
Fever	20 (66.7)
Otalgia	17 (56.7)
Headache	11 (36.7)
Otorrhoea	10 (33.3)
Postauricular swelling	10 (33.3)
Mental Changes	8 (26.7)
Nausea/Vomiting	7 (23.3)
Diplopia	5 (16.7)
Seizures	5 (16.7)
Extremity weakness	2 (6.7)

Otogenic intracranial abscesses are usually caused by *Streptococcus pneumoniae*, Group A *Streptococcus, Staphlococcus aureus* and *Proteus species* [2,11,12]. These micro-organisms can cause intracranial complications by direct extension of infection beyond the temporal bone to the intracranial cavity, usually through a bony defect in the Tegmenantri (in case of cerebral abscess) or in Trautmann's triangle (in case of cerebellar abscess) [9]. Otogenic cerebral abscesses are 1.2-2 times as common as cerebellar abscesses and the temporal lobe is a common location for otogenic cerebral abscesses [13].

CT scanning is useful in making the diagnosis of a brain abscess in most cases. MRI is sometimes used to provide additional information about the location of the abscess, degree of mass effect, midline shift and the staging of disease [14].

There is some controversy with regards to the treatment of OIA. While conservative management of OIA has been successfully utilized in certain cases, the World Health Organization warns that OIA and meningitis cases that initially respond to medical management are known to rupture later and kill seemingly asymptomatic patients [15]. Thus, currently, surgical drainage of the abscess via a radical mastoidectomy, canal wall up mastoidectomy or craniotomy, remains the treatment of choice [10]. The use of canal wall up mastoidectomy appears to be an acceptable alternative to radical mastoidectomy, with no significant difference in the mortality or morbidity between the two techniques [10,16]. Some suggest that the main indication for the latter technique is a cholesteatomatous ear [16]. A craniotomy performed concurrently with a mastoidectomy treats both the source of the infection and its complications and has been shown to be safe [17].

Less commonly, aspiration of an abscess through a burr hole under CT or ultrasound guidance has been used. This technique has been used as first-line treatment for abscesses larger than 25 mm [18]. The main drawback of this technique is that aspiration of the abscess usually needs to be repeated as total removal of pus is rarely possible in a single procedure [14]. In addition, up to 40% of brain

abscesses have been reported to be multilocular and therefore, are unable to be completely drained by aspiration alone [19].

Conclusion

OIA remains a life-threatening condition that requires prolonged systemic antimicrobial therapy as well as surgical intervention. They may develop in patients with either acute or chronic otitis media, and the presentation might be insidious. As such, clinicians should have a low threshold of suspicion when young patients with a seemingly simple middle ear infection develop neurological signs, especially those who fail to improve with conservative measures.

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