

Cerebellar abscesses in children: excision or aspiration?

PARITOSH PANDEY, M.CH., SRIKANTHA UMESH, M.B.B.S., DHANANJAYA BHAT, M.CH., DWARAKANATH SRINIVAS, M.CH., ROJIN ABRAHAM, M.CH., SHIBU PILLAI, M.CH., ANANDH BALASUBRAMANIAM, M.CH., INDIRA DEVI, M.CH., SOMMANNA SAMPATH, M.CH., AND BENGALURU A. CHANDRAMOULI, M.CH.

Department of Neurosurgery, National Institute of Mental Health and Neuro Sciences, Bangalore, Karnataka, India

Object. Cerebellar abscesses are common neurosurgical emergencies in developing countries, and have a distressingly high mortality rate of 10 to 15% even today. There is still no consensus on the standard approach to these lesions, and controversy persists over whether these lesions should be treated with primary excision or aspiration.

Methods. The authors retrospectively analyzed 82 cases of cerebellar pyogenic abscesses in children treated at their institution over a period of 10 years. This represents the largest such series being described in literature. All lesions except 1 were otogenic in origin. The clinical and radiological features are discussed.

Results. Primary excision was undertaken in 66 patients (80%) and aspiration in 16 patients (20%). Five patients in whom the abscesses were initially treated with aspiration subsequently underwent elective excision. Nine (12.6%) of 71 patients in whom the abscesses were excised had residual abscesses on postoperative imaging; in those who had undergone aspiration as the primary treatment, 6 (54.5%) of 11 patients had recurrent abscesses. There were no deaths among the patients who underwent excision of the abscess. Also, excision of posterior fossa abscesses required fewer repeated procedures with lower recurrence rates, and statistically lower rate of complications.

Conclusions. Compared to primary aspiration, the authors found that primary excision is the preferred method for treating cerebellar abscesses. (DOI: 10.3171/PED-08/01/031)

KEY WORDS • aspiration • cerebellar abscess • excision • pediatric neurosurgery

CEREBELLAR abscesses are common neurosurgical emergencies in developing countries. Although they may be clinically silent at times or present with minimal symptoms, they can be fatal if not treated immediately. These lesions often tend to have an unpredictable course depending on the patient's level of consciousness at presentation, and the timing and aggressiveness of the intervention chosen. The overall rate of complications and death due to brain abscesses has progressively fallen because of the availability of antibiotic medications, the advent of better imaging modalities such as CT scanning, and improved surgical and anesthetic management of the patients. However, even in this modern neurosurgical era, the mortality rate due to cerebellar abscesses remains distressingly high at around 10 to 15% in various large series.^{4,11,15} There is still no consensus on the standard approach to these lesions, and controversy persists concerning the proper management of these lesions. The disagreement centers over whether these lesions should be managed by primary excision or by aspi-

ration. Extrapolating the logic that repeated aspirations are safe for supratentorial abscesses may be potentially catastrophic, as the posterior fossa has a smaller volume. Cerebellar abscesses can suddenly totally occlude the CSF pathway, leading to acute hydrocephalus, coma, and death. Cerebrospinal fluid obstruction can be more acute and dangerous in children, in whom it is more difficult to recognize and predict deterioration. Cerebellar abscesses are usually secondary to CSOM, which is a very common condition in children in the developing world.

To investigate whether cerebellar abscesses are better managed with excision or aspiration, we evaluated the management of cerebellar abscesses in 82 children over a period of 10 years (January 1995 to December 2004) at our institution.

Clinical Material and Methods

All children (18 years of age and younger) admitted to the Department of Neurosurgery at the National Institute of Mental Health and Neuro Sciences in Bangalore between January 1995 and December 2004 were included in this retrospective analysis. The medical records, surgical notes, and discharge summaries for all the patients were analyzed

Abbreviations used in this paper: CSF = cerebrospinal fluid; CSOM = chronic suppurative otitis media; CT = computed tomography; EVD = external ventricular drain; GCS = Glasgow Coma Scale.

retrospectively. Epidemiological, clinical, radiological, bacteriological, and outcome data were collated by a methodical analysis of the case files of these patients.

All included patients had cerebellar abscesses as demonstrated on contrast-enhanced CT scanning. Patients with brainstem abscesses, tubercular abscesses, and fungal abscesses were excluded from the analysis, and only pyogenic abscesses were included. Patients with solitary infratentorial abscesses were selected. Patients with multiple intracranial abscesses were selected only if one of the abscesses was infratentorial. All patients were started on weight-appropriate intravenous doses of ceftriaxone sodium, amikacin sulfate, and metronidazole. The patients underwent emergency surgery, which was in most cases excision of the abscesses unless there were indications for aspiration (explained later). Patients did not routinely receive an EVD, but one was placed preoperatively if the patient was in a deep coma, or intraoperatively if there was cerebellar bulging. The patients continued to receive intravenous antibiotics for 2 weeks, followed by oral antibiotics for 4 weeks. A repeated CT scan was done in a majority of patients, preferably within 48 hours of surgery in both the excision and aspiration groups. No further scans were done if the initial scan showed total excision. In cases in which residual abscesses were found, these were managed in the same manner as described above. Samples of the abscess wall were sent for histopathological analysis, and the pus was sent for aerobic and anaerobic culturing; antibiotic regimens were modified according to the sensitivity pattern. Computed tomography scanning was also done to look for a decrease in ventricle size. If a ventricular drain had been placed, this was removed after gradually raising its level. Persistent ventriculomegaly was treated with placement of a ventriculoperitoneal shunt. All patients but one had CSOM as the source of the abscess, and these children were referred to an otologist for mastoidectomy after their discharge from the hospital.

Epidemiological values using the chi-square test with Yates correction were calculated to test for statistical significance. The chi-square test for combined significance was done using the Mantel-Haenszel test.

Results

During the study period, 82 children with cerebellar abscesses underwent treatment at our institution. These patients included 54 boys and 28 girls (male/female ratio 1.9:1), with ages ranging from 3 months to 18 years (mean 12.8 years). All the patients had pyogenic abscesses demonstrated on CT scans. In all but 1 of the children, CSOM was the causative factor for the abscesses. In this 1 patient, a 3-month-old boy, the abscess was secondary to an abscess in the thigh (a metastatic abscess). Tubercular and fungal abscesses were not included in the study.

On presentation, the patients' major symptoms were related to raised intracranial pressure and CSOM. Fever was a presenting symptom in 68 (83%) of 82 patients. Cerebellar signs were manifested in 54 patients (66%). Three patients presented with seizures, all of whom had associated supratentorial abscesses; 28 children (34%) were drowsy at presentation, and, of these, 10 children (12%) were comatose.

A contrast-enhanced CT scan was performed in all patients, which revealed a cerebellar abscess on the right side

in 42 patients and on the left side in 40. Sixty-six patients (80%) had hydrocephalus on their CT scan in the form of enlargement of the supratentorial ventricles, effacement of basal cisterns, presence of periventricular lucencies, and visualization of temporal horns in 2 or more CT slices. Associated lesions included epidural empyema in 5 cases, subdural empyema in 2, supratentorial abscess in 3, and lateral sinus thrombosis in 1 case.

Primary excision was performed in 66 patients (80%), and aspiration was the first procedure in 16 patients (20%). The indications for primary aspiration of the abscesses included a poorly formed abscess wall, a poor GCS score at presentation, rapid neurological deterioration, and severe anemia requiring preoperative correction. Excision in a poorly formed abscess wall, which is ill-defined and friable, would result in "berry picking" of the abscess wall, more injury to the surrounding cortex, and a very high chance of leaving behind bits of abscess wall. Because of these factors, we chose to aspirate the abscess for a definitive culture/sensitivity first and postpone excision until the wall was better formed. In 5 patients who underwent aspiration as the first treatment, the residual abscess was electively excised; thus, the abscess was excised in 71 patients (86.5%). In 30 patients (36.5%), an EVD was placed perioperatively. However, ventriculoperitoneal shunt placement was required in only 2 patients for persistent hydrocephalus. Nine patients (12.6%) in whom the abscesses were excised had residual abscesses on postoperative imaging; all of which were reexcised. On the other hand, in the patients who had undergone aspiration as the primary treatment, 6 (54.5%) of 11 patients had recurrent abscesses. Two of these were treated with repeated aspirations, and in another 4 patients the abscess was excised. There were complications in 5 patients, including CSF leakage in 4 patients, hydrocephalus in 2, ventriculitis in 2, and hematoma in 2. Four patients died (4.8% mortality rate), all of whom had undergone aspiration as the first treatment. Two of these patients had GCS scores of 3, and died despite emergency EVD placement and aspiration of the abscess. One of these patients died of ventriculitis, and in the other the sensorium worsened before he could undergo an excision. A postaspiration CT scan showed diffuse edema without any significant residual abscess. Among patients who underwent excision there were no deaths and only minimal complications. We also observed that excision of posterior fossa abscesses required fewer repeated procedures with lower recurrence rates and statistically fewer complications than those treated with aspiration (Table 1). Recurrence rates were calculated taking into consideration aspiration-treated cases that had shown recurrence after radiographically proven resolution (Fig. 1).

In 55 patients (67%), the causative microorganism could be identified: 12 patients had monomicrobial growth, 20 had polymicrobial growth, 13 had mixed growth, and 10 had isolated anaerobic growth (Table 2). The patients were started on weight-appropriate doses of antibiotics (third generation cephalosporin, amikacin, and metronidazole), which were modified based on the results of the sensitivity report.

Follow-up was available in 59 patients, and 19 patients were lost to follow-up. The follow-up duration was 3 months to 13 years, with a mean follow-up of 8 months. All the patients were referred for a mastoidectomy at discharge, and all but 5 patients underwent cortical mastoidectomy. One of these patients had a recurrent abscess and was advised to

Pediatric cerebellar abscesses

TABLE 1

Comparison of outcome parameters between groups treated with primary excision and aspiration

| Parameter | Excision (71 patients) | Aspiration (11 patients) | p Value |
|---------------------|------------------------|--------------------------|---------|
| repeated procedures | 7 | 5 | 0.008 |
| recurrence | 9 | 6 | 0.003 |
| death | 0 | 4 | 0.001 |

undergo surgery but chose not to do so. Another patient died of pyogenic meningitis in the follow-up period even though there had been no abscess on imaging. All other patients were doing well at the last follow-up examination. As mentioned before, 2 patients needed ventriculoperitoneal shunt placement in the follow-up period, and all other patients who had had preoperative hydrocephalus had resolution of the same on follow-up imaging.

Discussion

Macewen⁸ in 1893 reported a mortality rate of 50% in treating cerebellar abscesses in 8 patients. Until now these lesions have been considered treacherous, with some authors reporting mortality rates of 20 to 50%.^{2-4,10} Very few studies have specifically addressed the treatment of cerebellar abscesses in children, although these lesions and their causative factors are the most common type of abscess in the pediatric age group. Cerebellar abscesses comprise 6 to 35% of all brain abscesses in various series.^{9,17}

The importance of CSOM in causing cerebellar abscess is undisputed. Various authors have reported that around 69 to 99% of the cerebellar abscesses are otogenic in nature.^{2,4,11,12} The varying incidence of an otogenic cause for cerebellar abscess encountered in different series and in different time periods may result from variations in the prevalence of sinus or mastoid disease in the communities studied.¹¹ Other causative factors such as metastatic abscesses, tubercular abscesses, and abscesses secondary to dermoid cysts have been reported rarely. In the present study, only pyogenic abscesses were considered. All but 1 abscess in the present study was otogenic. The spread is both via direct ex-

TABLE 2

Organisms cultured in 55 patients with positive cultures

| Identified Organism | No. of Patients |
|-------------------------------|-----------------|
| nonhemolytic streptococci | 21 |
| α-hemolytic streptococci | 5 |
| <i>Proteus mirabilis</i> | 13 |
| <i>Escherichia coli</i> | 2 |
| <i>Pseudomonas aeruginosa</i> | 2 |
| <i>Enterobacter</i> spp. | 2 |
| <i>Providentia</i> spp. | 3 |
| <i>Staphylococcus aureus</i> | 1 |
| <i>Morganella morganii</i> | 1 |
| <i>Bacteroides</i> spp. | 17 |
| <i>Peptostreptococci</i> spp. | 5 |

tension from a suppurative labyrinthitis and through retrograde suppurative thrombophlebitis.

Despite advances in neurosurgical, anesthetic, and imaging techniques and improvements in antibiotic therapy, the rates of death and complications in patients with these lesions is distressingly high. Various authors using different treatment methods such as aspiration or excision have reported mortality rates ranging from 10 to 50%.^{2-4,11,15,17} Although there has been no prospective randomized study comparing these 2 methods of treatment, many authors have advocated one over the other.

Many authors have advocated primary excision of cerebellar abscesses as the primary treatment modality. The first large series was published by Pennybacker,¹² followed by Krayenbuhl and Weber,⁷ both of whom reported good results after primary excision. Griffith⁶ has also advocated excision of all cerebellar abscesses. Very recently, Agrawal et al.¹ advocated primary excision of cerebellar abscess in all patients, and achieved a 0 mortality rate in a small series of 9 patients treated with this method.

On the other hand, Ch'ai and Ho⁵ chose to tap the abscesses, and in their series of 7 patients, 1 died. Their patients included 3 children (younger than 18 years of age), 1 of whom died of raised intracranial pressure after tapping. Schreiber¹³ also reported good results with tapping of the abscess, with 1 death in 9 children.

Until now, only 2 series have compared the 2 treatment methods. In 1975, Shaw and Russell¹⁴ retrospectively reviewed 47 cases of cerebellar abscesses, 93% of which were secondary to otogenic disease. They found that complete excision as a primary procedure was marginally better than aspiration. The superiority of the procedure was more apparent if recurrent abscesses were also considered. The overall mortality rate in their series was 41%. Brydon and Hardwidge⁴ reported on 16 cases of cerebellar abscesses, 9 of which were treated with excision and 7 with repeated aspirations. These authors did not find any significant difference in outcome between the 2 procedures, except in the incidence of hydrocephalus, which was higher in patients who underwent aspiration. Agrawal et al.¹ treated cerebellar abscesses in 9 children with primary excision, and did not have any deaths. In 1987, Van Dellen et al.¹⁶ reported on 34 cases of cerebellar abscesses, all of which were managed with small craniectomy and urgent catheter drainage of the abscess cavity, along with antibiotic therapy and EVD placement, if needed. Ten (29%) of their patients died, 5 remained disabled, and 2 were severely disabled, giving a

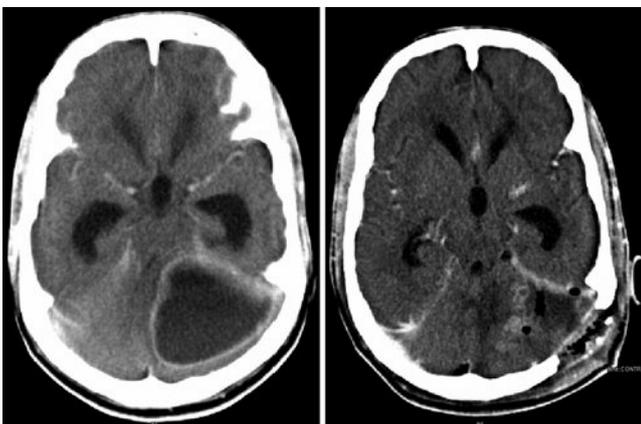


FIG. 1. Contrast-enhanced CT scans obtained in a 12-year-old boy with left cerebellar abscess. A preoperative view (left) and postoperative view (right) demonstrating complete excision after craniectomy and excision.

high complication rate of 21%. In a recent review from the same institution, Nadvi et al.¹¹ reviewed their 13-year experience with cerebellar abscesses. They reviewed 77 patients with cerebellar abscesses, and in the latter part of the series, instituted external ventricular drainage in all patients, even in those who were fully conscious. Fifteen of their patients died despite aggressive treatment, resulting in a mortality rate of 19.5%. All their patients underwent aspiration and catheter drainage of the abscess cavity through a suboccipital bur hole and a small craniectomy. In 43 of their patients, EVDs were placed immediately after diagnosis, regardless of the patient's neurological status. In the present series, with primary excision as the main management of these lesions, we achieved a mortality rate of 4.8%. Of the 4 patients who died, 2 had a GCS score of 3. In the present series, aspiration was done only in selected situations, and in many cases was followed up with excision. Although the difference in mortality rates between the patients undergoing excision and aspiration was statistically significant, 2 of the patients who died presented in very poor neurological state, and aspiration was performed as a last-ditch attempt, which might be a potential bias in comparing the mortality rates between the 2 groups. Excision was the preferred initial method of treatment in our study, and primary aspiration was used only as a salvage therapy. The small size of the posterior fossa in children makes CSF obstruction more likely than in adults, so the use of excision is especially important; children with these lesions may deteriorate rapidly if they are not treated promptly and aggressively. This has been shown by a marked reduction in the rates of complication and death in the present series.

Nadvi et al.¹¹ have advocated preoperative CSF diversion in all patients with cerebellar abscesses. They compared patients who underwent surgery before and after the introduction of a policy of aggressive CSF diversion. The mortality rates with and without mandatory CSF diversion were 11.6 and 29%, respectively. However, in our experience, the decision to undertake CSF diversion with external ventricular drainage should be made on an individual basis according to the patient's neurological condition. Mandatory CSF diversion may be unnecessary in some cases, and has many potential hazards such as infection and upward herniation. In the present series, 30 patients (36.5%) required EVD placement, and only 2 patients required ventriculoperitoneal shunts for persistent hydrocephalus.

As emphasized by all the other authors, proper antibiotic management and elimination of the source of the infection are the cardinal principles of the management of abscesses. In the present study, all patients underwent mastoidectomy at discharge. Since our institution does not have otorhinolaryngologists, we have no experience with concurrent mastoidectomy as proposed by some authors. However, Agrawal et al.¹ seem to have valid objections to concurrent mastoidectomy due to the increased operative time, and because revision surgery is necessary in about 14% of cases.

Conclusions

Primary excision of cerebellar abscesses is a preferable method of treatment in children. The present study is the largest series of pediatric patients with cerebellar abscesses, and with emphasis on excision, antibiotic treatment, proper management of hydrocephalus, and elimination of the source of infection, we have achieved complication and mortality rates of 6 and 4.8%, respectively. There were no deaths among the children in the excision group.

References

1. 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* **38**:63–67, 2003
2. Arseni C, Ciurea AV: Cerebellar abscesses. A report on 119 cases. *Zentralbl Neurochir* **43**:359–370, 1982
3. Bradley PJ, Manning KP, Shaw MD: Brain abscesses secondary to otitis media. *J Laryngol Otol* **98**:1185–1191, 1984
4. Brydon HL, Hardwidge C: The management of cerebellar abscess since the introduction of CT scanning. *Br J Neurosurg* **8**:447–455, 1994
5. Ch' ai WH, Ho CF: Cerebellar abscess; the advisability of treatment by tapping. *Endokrinologie* **49**:403–413, 1965
6. Griffith HB: Factors in mortality of cerebellar abscesses. *J Neurol Neurosurg Psychiatry* **31**:89, 1968
7. Krayenbuhl H, Weber G: [Therapy and diagnosis of acute brain abscesses and thrombophlebitides.] *Acta Neurochir (Wien)* **2**:281–295, 1952 (Ger)
8. Macewen W: **Pyogenic Infective Diseases of the Brain and Spinal Cord; Meningitis, Abscess of the Brain, Infective Sinus Thrombosis**. New York: Macmillan & Co., 1893, p 61
9. McClelland CJ, Craig BF, Crockard HA: Brain abscesses in Northern Ireland: a 30 year community review. *J Neurol Neurosurg Psychiatry* **41**:1043–1047, 1978
10. Morgan H, Wood MW: Cerebellar abscesses: review of seventeen cases. *Surg Neurol* **3**:93–96, 1975
11. Nadvi SS, Parboosing R, van Dellen JR: Cerebellar abscess: the significance of cerebrospinal fluid diversion. *Neurosurgery* **41**:61–67, 1997
12. Pennybacker J: Cerebellar abscess: treatment by excision with the aid of antibiotics. *J Neurol Neurosurg Psychiatry* **11**:1–12, 1948
13. Schreiber F: Cerebellar abscesses of otitic origin in nine children: eight recoveries after cannulation. *Ann Surg* **114**:330–335, 1941
14. Shaw MD, Russell JA: Cerebellar abscess: a review of 47 cases. *J Neurol Neurosurg Psychiatry* **38**:429–435, 1975
15. Unnikrishnan M, Chandu MJ, Abraham J: Posterior fossa abscesses: a review of 33 cases. *J Assoc Physicians India* **37**:376–378, 1989
16. Van Dellen JR, Bullock R, Postma MH: Cerebellar abscess: the impact of computed tomographic scanning. *Neurosurgery* **21**:547–550, 1987
17. Yang S: Brain abscess: a review of 400 cases. *J Neurosurg* **55**:794–799, 1981

Manuscript submitted June 20, 2007.

Accepted September 20, 2007.

Address correspondence to: Paritosh Pandey, M.Ch., Department of Neurosurgery, National Institute of Mental Health and Neuro Sciences, Bangalore-29, India. email paritosh2000@gmail.com.