Aspiration versus Excision in Management of Intracranial Abscesses

AYMAN T.M. MOHAMED, M.Sc.; AHMED Z.M. ZOHDI, M.D.; KHALED S.M. ANBAR, M.D.; MOHAMED M.M. SALAMA, M.D. and MOHAMED A.M. EL-BORADY, M.D.
The Department of Neurosurgery, Faculty of Medicine, Cairo University

Abstract

Background: Brain abscess can be defined as a localized infection within the brain tissue. It begins as a focal area of infection called cerebritis, which subsequently changed to a collection of pus in a well-vascularized capsule.

Objectives: Our aim of this work is to compare between aspiration and excision of brain abscesses to clinical outcome and radiological outcome, recurrence, complication rate, postoperative antibiotic needed, and the duration of hospital stay.

Patients and Methods: This work was done over 26 patients presenting between November 2013 and June 2015 presenting with intracranial abscesses managed surgically either by aspiration through a burr hole or excision with open craniotomy and then followed up clinically and radiologically.

Results: Six patients (23%) underwent excision of their abscesses as the primary surgery. The remaining twenty patients (77%) underwent aspiration via a burr hole. Seven of them only needed aspiration once. And ten patients had repeated aspiration twice (in eight cases) or three times (in two cases). Three patients of them needed surgical excision after failed repeated aspiration. There were no residual or recurrence in the excision group. Post-operative antibiotic duration was shorter in the excision group. Five patients presenting with recurrence after long term management and all are from the aspiration group. six cases (50%) of the those who managed by excision along the course of the disease showed surgical complications.

Conclusions: In our work, we found that excision gave a better result regarding the duration of antibiotics, hospital stay with less residual/recurrence rate and overall cost of treatment. But aspiration gave us better results regarding the rate of morbidity and complications in the neurological condition.

Key Words: Brain – Abscess – Infection.

Introduction

BRAIN abscess is defined as a focal infection within the brain tissue. It begins as focal area of cerebritis, which is subsequently converted into a collection of pus within a well-vascularized capsule [1,2].

Brain abscess is a dangerous and life-threatening condition. It may present by one of the following syndromes: Focal mass expansion, intra-cranial hypertension, brain tissue destruction, and focal deficit [3].

Therapy should be started with broad spectrum antibiotics which can cross blood-brain and blood-Cerebrospinal Fluid (CSF) barriers in high concentrations [4].

Two primary surgical approaches are used to manage brain abscesses: Aspiration and open craniotomy excision. Stereo tactically guided aspiration is the therapy of choice over excision because it is less invasive with less incidence of neurological sequelae. Despite modern neurosurgical techniques, including stereotactic biopsy and aspiration, better culturing methods, modern antibiotics, and new non-invasive neuroimaging procedures, brain abscess is still a neurosurgical challenge especially in developing countries. The microbiological spectrum has changed, with increasing numbers of immune-compromised patients developing such abscesses [5].

Patients and Methods

The study was done prospectively in the Neurosurgery Department, Cairo University on patients suffering from intra cranial abscesses presenting starting November 2013 through June 2015.

Twenty-six patients presenting with intracranial abscesses were managed surgically either by aspiration through a burr hole, excision with open craniotomy, or image-guided aspiration or excision and then followed-up clinically and radiologically. No exclusion criteria other than multiple scattered abscesses.
A proper history was taken for all patients including age, gender, fever, history of trauma, history of infection, congenital heart disease, diabetes mellitus, decreased immunity, septic focus, previous surgery, symptoms of elevated intracranial pressure (headaches, vomiting, bulging fontanelles in children, and deteriorating consciousness), neck pain, focal neurological deficits, seizures.

All patients were examined carefully for any clinical findings like: Altered level of consciousness on GCS, papilledema, meningism, cranial nerves affection, any neurological deficit (Hemiparesis,...), ear examination (discharge, otitis media,...), nose examination (sinusitis,...), scalp examination (scalp wounds of previous trauma or surgeries).

All patients underwent CT scan with contrast and/or MRI with contrast imaging before a decision was made about the management and the following were assessed: Localization, size, stage of the abscess, number and multiplicity of the abscess, multilocular or unilocular, hydrocephalus, elevated intracranial pressure or midline shift, edema, mass effect on neighboring brain tissue with flattening of gyri, relation of the abscess to the ventricles, associated intracranial infections like subdural empyema, ventriculitis. Routine labs were done for all patients including TLC, ESR and CRP and blood culture.

The entire twenty-six patients are candidate for surgical management. Two methods were used:

A- Aspiration through a single burr hole: The shortest trajectory to the abscess was chosen avoiding traverse through ventricle or vital neural or vascular structures (image guided technique was used in five cases). Follow-up imaging was done 24 hours after aspiration then done regularly to detect either decrease in size or recollection. If recollection occurred aspiration was repeated for maximum twice before excision.

B- Excision with open craniotomy: Through a small bone flap, the abscess wall was resected after evacuation of its content, (image guided technique was used in one case). It was used in cases of well-organized chronic abscesses, posterior fossa abscesses, multilocular, recollected abscesses after two trials of tapping, abscesses associated with foreign bodies or fungal lesions.

The broad spectrum antimicrobial therapy was given until the results of the cultures appeared. If it was positive, the antimicrobial therapy was changed accordingly and if it was negative the broad spectrum antimicrobial therapy was continued throughout the length of the course. The course of antimicrobial therapy after surgery was continued for 4 weeks and changed to oral form after 2 weeks.

Each patient was evaluated regarding:

1- Radiological evaluation: Follow-up CT brain with contrast and/or MRI brain with contrast was used to assess the progression of the cases regarding the size of the lesion, surrounding edema, progression of the lesion towards the ventricle, maturity of the lesion, development of associated pathology (hydrocephalus, subdural empyema,...), mass effect and midline shift.

2- Clinical evaluation: Improvement of manifestation of increased intracranial pressure, conscious level on GCS, motor power, and control of seizures.

Beside all the previous data, the following data was also collected: Surgical way of management, organism cultured, duration and type of antibiotics used, duration of hospital stay, wound status, the need of more surgical intervention.

Results

There were sixteen males (61.5%) and ten females (38.5%) with male to female ratio (1.6:1), ranging in age from 12 months to 70 years (median 32 years) at time of presentation.

At the time of presentation fifteen patients (57.6%) complained of headache, eleven patients (42.3%) had fever or other signs of meningeal irritation, eight patients (30.7%) complained of epilepsy, focal neurological deficits were present in twelve patients (46.1%), twenty-three patients (88.5%) were fully conscious and three (11.5%) were had disturbed consciousness, eight patients (30.7%) were complaining of other symptoms like ataxia, behavioral changes, proptosis, or discharge.

Regarding the predisposing factors, fourteen patients (53.8%) had nearby cranial infection (chronic otitis media, paranasal sinus infection, or periorbital infection), two patients (7.6%) had heart or lung diseases (congenital heart diseases or pneumonia), two patients (7.6%) had post traumatic abscesses, two patients (7.6%) had postoperative abscesses, and six (23%) had no identifiable predisposing cause. Seven patients (26.9%) had associated medical diseases which may predispose or aggravate the abscess formation or may help in recurrence (diabetes mellitus), one patient (3.8%)
is drug abuser, and one (3.8%) patient had history of lymphoma followed by adjuvant chemotherapy.

The temporal lobe was the most common site of the abscess in our study in ten patients (38.4%), followed by the frontal region in seven patients (26.9%), then the parietal in five patients (19.2%), then occipital in one patient (3.8%), one patient (3.8%) had cerebellar abscess, another patient had an intraventricular one (3.8%), and one patient (3.8) had multiple abscesses.

There were three cases (11.5%) with multilocular abscesses, a case (3.8%) presenting with the abscess associated with hydrocephalus, and another case (3.8%) associated with subdural and extradural empyema.

Six patients underwent surgical excision of their abscesses with craniotomy as the primary surgery (Table 1).

The remaining twenty patients underwent aspiration via a burr hole. Seven of them only needed aspiration once. And ten patients had repeated aspiration twice (in eight cases) or three times (in two cases). Three patients of them needed surgical excision after failed repeated aspiration (Table 1).

Table (1): Types of management of patient in this study.

<table>
<thead>
<tr>
<th>Type of management</th>
<th>Number of cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excision as primary surgery</td>
<td>6</td>
<td>23</td>
</tr>
<tr>
<td><strong>Aspiration:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Once</td>
<td>7</td>
<td>26.9</td>
</tr>
<tr>
<td>Repeated</td>
<td>10</td>
<td>38.4</td>
</tr>
<tr>
<td>Followed by excision</td>
<td>3</td>
<td>11.5</td>
</tr>
<tr>
<td>With image guidance</td>
<td>6</td>
<td>23</td>
</tr>
</tbody>
</table>

Discussion

The treatment of brain abscesses usually aims to reduce the space-occupying effect, reduces the elevated intracranial pressure, and eradicates the microorganism. The anatomical site, number and size of abscesses, stage of the abscess, age and neurological status of the patient can change our strategy for managing such lesions [6].

In our study, surgical management was chosen if the abscess is being more than 2.5cm, presence of mass effect, the abscess being near to the ventricle, traumatic abscess especially if there is foreign bodies, multiloculated, in cases of failure of medical treatment, or the diagnosis was suspicious.

Image guided surgical techniques was used in six patients (23%), three of them were multilocular abscesses and three were unilocular. It was used in one case for excision and five cases for aspiration (Table 1).

Regarding to the clinical outcome twenty patients was completely improved. Six patients showed incomplete recovery (four patients of them had moderate residual weakness, one of them had residual visual field defect, and one had hearing deficit). One patient had postoperative complication in the form of wound infection which was managed and resolved after regular repeated dressing (Table 2).

Five patients presented again to us after complete radiological improvement and completion of the course of medications with recurrence. By analysis of the old data we found that three of them were diabetic, all of them were managed by surgical aspiration through a burr hole which was needed to be repeated in four of them. The results of culture were MRSA in four cases and no growth in one case. After recurrence three cases were managed by surgical excision. Two cases were managed medically. All of them improved both radiologically and clinically except one case that developed a new persistent residual weakness.

Table (2): Clinical outcome.

<table>
<thead>
<tr>
<th>Clinical outcome</th>
<th>Number of patients</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completely improved</td>
<td>20</td>
<td>76.9</td>
</tr>
<tr>
<td><strong>Incomplete recovery:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residual weakness</td>
<td>4</td>
<td>15.3</td>
</tr>
<tr>
<td>Visual field defect</td>
<td>1</td>
<td>3.8</td>
</tr>
<tr>
<td>Hearing deficit</td>
<td>1</td>
<td>3.8</td>
</tr>
</tbody>
</table>

In this study comparing both approaches of surgical management (aspiration vs excision) was done regarding the duration of post-operative antibiotic use, the duration of hospital stay, rate of recurrence, improvement in neurological condition, residual morbidity, and mortality. Some previous studies were done for comparing both approaches like that done by Mut et al., in 2009, Tan et al., in 2010, and Sarmast et al., in 2012 [7-9].

Twenty-six patients were managed surgically. Six patients (23%) underwent excision as a primary surgery and twenty patients (77%) underwent abscess aspiration. We found that three cases out of the twenty (15% of aspiration group) showed failure of repeated aspiration and needed excision.
with complete radiological improvement after excision. There were no residual or recurrence in the excision group.

Post-operative antibiotic duration was shorter in the excision group, with the length of hospital stay shorter due to a shorter period of intravenous antibiotics. There was a shorter time of follow-up and less possibility for the need of another surgery because of no residual or recurrence in this group.

On the other hand, in our study we found that there were twelve cases (46% of all cases managed surgically) managed by excision along their course (six cases underwent excision as a primary management, three cases underwent excision after failed repeated aspiration, and three cases underwent excision after long term recurrence). Six cases of the twelve (50%) experienced surgical complications (five cases of persistent weakness and one case of wound infection) and the other six cases (50%) passed without any complications.

Was the excision the cause of these complications with all the five patients already presenting with limb weakness in their first presentation. What was observed the grade of weakness had slightly improved in one case after excision but did not improve in the other four cases after excision. In our study, we found that two cases had weakness and were operated upon by excision that showed marked clinical improvement.

Fourteen cases (54% of all cases that were managed surgically) were managed by aspiration only (in seven cases of them it was once and it needed to be repeated in seven cases out of the fourteen) along their long course of the disease. This group of patients had a longer course of antibiotic therapy and a longer course of hospital stay needed for regular follow-up after each aspiration and the need for repeating the aspiration. And all these cases had no complications regarding their neurological condition. There were two cases of them presenting with limb weakness which had markedly improved after surgery.

Comparing our results with other previous studies we found in the study done by Mut et al., [7] in 2009 over twenty patients all were managed surgically (not including medical management as we did in our study), nine cases (45%) underwent excision and eleven patients (55%) underwent aspiration. There were three residual/recurrence cases in the aspiration group that needed a second go aspiration. No residual/recurrence was found in the excision group. Post-operative duration of antimicrobial use was shorter and the length of hospital stay was also shorter in the excision group.

In the study of Sarmast et al., [8], they included forty seven patients. Aspiration was done in twenty-nine patients (61.7%) of whom seven patients needed second go aspiration, and eighteen patients (38.3%) underwent excision. They also found that the duration of antibiotic use and duration of hospital stay in the excision group was shorter. In addition, they found earlier improvement in the neurological function and lower rate of re-surgery in the excision group.

In the study of Tan et al., [9], fifty-one cases were included. Twenty-eight patients (54.9%) underwent excision and twenty-three patients (45.1%) underwent aspiration. They found that the excision group showed earlier improvement in neurological function and better radiological improvement and a lower rate of re-surgery, but with no difference between the two groups regarding to neurological improvement at 3 months of morbidity and mortality.

The results of our study match with the results of other studies regarding the excision group with a shorter duration of antibiotics, shorter hospital stay, less residual/recurrence rate, and less overall cost of treatment. But our results differ in the aspiration group which gave us better results regarding the rate of morbidity and complications in the neurological condition while their results had no difference between the two groups.

The recurrence after complete recovery in this study had five patients (19.2%) presenting with recurrence. We found that: (1) Three were diabetic. (2) All of them were managed in the first time by aspiration that needed to be repeated in four cases. (3) Four of them had MRSA proved by culture. After the recurrence, the three cases were managed by surgical excision and two were managed medically. One case had post-operative weakness as a complication after excision of the recurrent abscess.

We had no abscess recurrence in the cases operated immediately by excision. This matches with the results of other studies done by Mut et al., [7], Tan et al., [8], and Sarmast et al., [9].

Aspiration of the abscess can be done either freehand, or using ultrasound or stereotactic or image guidance. Image guided aspiration is more safe and accurate and therefor may be even performed in patients who are surgically poor candidates. In the study carried out by Gadgil N. et al., in 2013 he found that there is marked decrease in
mortality and morbidity after the usage of image guided techniques as it reduce the possibility of residual collections and reducing the need for repeating the procedures and also reducing the rate of complications, and it was helpful in the aspiration of deep seated lesions and those in eloquent locations [10].

**Conclusion:**

The ideal method of surgical management in brain abscess is still a matter of controversy. The principal ways for surgical management are either open evacuation and excision or aspiration through a burr hole and most recently by using imaged guided surgical techniques.

In our study, we found that excision gave a better result regarding the duration of antibiotics, hospital stay with less residual/recurrence rate and cost of treatment. But aspiration gave us better results regarding the rate of morbidity and complications in the neurological condition.

Image guided surgical techniques may be very useful especially in multilocular lesions and help to decrease the rate of residual or recurrence.

**References**


