

## BRAIN ABSCESS

### Introduction

Brain Abscess is a true neurosurgical and infectious disease emergency, with high morbidity and mortality if not recognized early.

Its incidence has decreased over recent decades with the aggressive treatment of many predisposing ENT infections. In the more modern setting “atypical” infections are being seen in the setting of the immunosuppressed, including those with HIV/ AIDS.

### Pathophysiology

#### Organisms:

May include the following:

- Streptococcus species
- Staphylococcus aureus
- Bacteroides species

In the immunocompromised:

- Toxoplasmosis, (in particular seen in patients with HIV)
- Tuberculosis
- Nocardia
- Aspergillus
- Candida

#### Predisposing factors:

1. Spread of infection from contiguous structures:
  - Dental abscess
  - Sinusitis, ethmoidal, frontal, maxillary and sphenoidal.
  - Middle ear infection

- Mastoiditis.
2. Haematogenous spread
    - Septic emboli from bacterial endocarditis
  3. Immunocompromised
    - HIV/ AIDS
  4. Post neurosurgical procedures.
    - This group may include patients who have long term intra-cranial devices in place such as ventricular shunting devices.
  5. Post cranial trauma, including
    - Fracture base of skull
    - Fractured cranial vault
    - Fractured posterior wall of the frontal sinus.

### Complications

Mortality is high if untreated.

Neurologic sequelae, of which seizures are the most common, are high (up to 30 to 60 percent of patients).<sup>2</sup>

Sequelae in survivors may include:

- Residual focal neurological defects
- Increased incidence of seizures due to scar tissue foci
- Neuropsychiatric changes.

Rupture of an abscess into the ventricular system significantly increases mortality and morbidity.

### Clinical Features

Brain abscess can be a difficult diagnosis to make clinically especially in early presentations. **A high index of suspicion must be maintained in those who have risk factors for this condition.**

Presenting symptoms classically include:

1. **Fever**, (may be absent however).
2. **Altered conscious state**
3. **Headache.**
4. **Seizures**
5. **Nausea and vomiting**

There may in addition be focal neurological signs

6. Focal neurological signs:
  - Visual disturbances
  - Unilateral Weakness
  - Unilateral Paraesthesia
  - Speech disturbances
7. Loss of balance/ coordination.
  - This may be due to cerebellar involvement, but may also be due cerebral involvement, particularly in cases of multiple abscesses.

### **Investigations**

Note that none of the above clinical features are specific or pathognomonic for brain abscess. Early cases may merely present as unexplained headache.

The decision to investigate for possible brain abscess in milder clinical presentations will need to be guided by the **risk profile** of the patient, (such as HIV or a recent neurosurgical procedure)

#### **Blood tests:**

1. FBE
2. U&Es/ glucose
3. CRP
4. Blood cultures, (hematogenous spread may be the source).

*Others as clinically indicated which may include:*

5. Toxoplasmosis serology
6. HIV

CT scan brain:

**Any patient suspected of having a space occupying lesion of the brain must have a CT scan, before leaving the department.**

Besides the lesion itself found on a CT scan, the following important features will also need to be looked for:

1. Whether the lesion alters with contrast.
  - IV contrast will often need to be given. An important “space occupying” finding identified by IV contrast will be the “ring enhancing” lesion.
2. Whether there are signs of cerebral edema.
  - Cerebral edema may be divided into 2 principle types on CT scan, vasogenic or cytotoxic.
3. Whether there are signs of raised intra-cranial pressure.

Causes of Ring Enhancing Lesions on CT include:



*Typical appearance of a ring enhancing lesion on IV contrast CT scan, there is also mass effect and vasogenic edema.*

1. Malignancy:

- Primary
  - Secondary metastases
  - Lymphoma, (in HIV infected patients)
2. Abscess:
    - Bacterial
    - Toxoplasmosis, (in HIV infected patients)
  3. Demyelination, (active)

Less commonly:

3. Infarction.
4. Resolving hematoma
5. Radiation necrosis

#### *Vasogenic Cerebral Edema:*

The blood brain barrier is disrupted and the edema is predominantly extracellular.

On CT fluid is seen to accumulate predominantly within the white matter, and there is good **preservation of the grey-white matter interface.**

Causes include:

1. Tumors.
2. Infection, (abscess).
3. Contusions.
4. Radiation.

#### *Cytotoxic Cerebral Edema:*

The blood brain barrier is intact and edema is predominantly intracellular.

On CT scan there is **blurring of the grey-white matter interface.**

Causes include:

1. Hypoxia

2. Ischemia, (including infarction)
3. Toxins, including encephalopathies.

#### Features of Raised Intra-cranial Pressure:

These include:

1. Effacement of sulci.
2. Midline shift.
3. Obliteration of the ventricles.
4. Obliteration of the quadrigeminal plate
  - This is the basal cistern, the subarachnoid space surrounding the midbrain.
  - Its normal appearance is the so called “smiley face”.

#### MRI

- This will usually be done to more clearly define a suspicious or equivocal lesion detected on initial CT scan.
- It does not need to be routinely done in the ED when there is a clear lesion on CT and it is evident that patient will require transfer to a neurosurgical unit.

#### Lumbar puncture

- Lumbar puncture is **contra-indicated** in any case for which brain abscess or other space occupying intra-cranial lesion is suspected because of the potential for CNS herniation.

#### Echocardiography

- This should be done when a septic embolus from a cardiac source (bacterial endocarditis) needs to be excluded.

#### Management

**Any patient with a suspected brain abscess must receive urgent antibiotics and neurosurgical referral.**

1. **ABC issues**
  - Treat as clinically indicated.
2. **Antibiotics**

- Antibiotics should be given urgently if the diagnosis of brain abscess (or meningitis) is suspected.
- They should be given even before CT scan has been done.
- Choice of antibiotics will depend on the index of suspicion for any particular pathogen. The best first up, empiric choice should include: <sup>1</sup>

**IV Benzyl penicillin plus metronidazole plus cefotaxime.**

For brain abscess post neurosurgical procedures:

**IV vancomycin plus ceftazadime plus meropenem.**

**For specific dosage and “atypical” organism requirements see latest Therapeutic Antibiotic Guidelines.**

**Infectious diseases physician consultation should also occur, especially in cases of immunosuppressed patients or where atypical or unusual organisms are suspected.**

3. **Seizures**

- Seizures should be treated aggressively in order to decrease the risk of sustained increases in intracranial pressure.
- A loading dose of IV phenytoin may be given.

4. **Headache and vomiting:**

*Nausea and vomiting*

- Maxalon, stemetil or ondansotron, as indicated.

*Headache*

- IV narcotic analgesia may be required.

5. **Steroids:**

- The role of steroids in brain abscess is controversial. In cases where there is significant edema and/ or altered conscious state they are probably best given to reduce the effects of raised intra-cranial pressure but the decision to give them must be weighed against the possible adverse effects in this setting.

If in doubt about the need to give steroids, discuss the case with the neurosurgeon.

## 6. **Surgery**

Neurosurgical intervention will be necessary in most cases for:

- Aspiration to obtain infected material for microbiological analysis including culture and sensitivity studies.
- Drainage/ excision of the lesion.

### Disposition

**Any patient with brain abscess must be discussed urgently with the on-call neurosurgeon to arrange transfer for further management.**

### References

1. Therapeutic Antibiotic Guidelines, 13<sup>th</sup> ed 2006.
2. Seydoux, C, Francioli, P. Bacterial brain abscesses: Factors influencing mortality and sequelae. Clin Infect Dis 1992; 15:394.

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