

# Chapter 11

## Management of Brain Abscess and Metastases in the ICU



### 11.1 Introduction

Brain abscesses and brain metastases are critical neurological conditions that require prompt diagnosis and management in the intensive care unit (ICU). A brain abscess is a localized collection of pus within the brain tissue, resulting from infections that may spread from nearby structures (like the sinuses or ears), through the bloodstream from other body parts, or following head injuries or neurosurgical procedures. Brain metastases, on the other hand, are cancerous tumors that have spread to the brain from primary tumors located elsewhere in the body.

Managing these conditions necessitates a multidisciplinary approach involving neurosurgeons, infectious disease specialists, oncologists, and critical care physicians. Rapid and accurate diagnosis, along with effective treatment strategies, are crucial to improve patient outcomes and minimize complications [1] (Ref. Algorithm 11.1).

### 11.2 Initial Assessment

A thorough initial assessment is vital for both brain abscesses and metastases.

For Brain Abscesses:

- **Symptoms:** Common symptoms include headaches, fever, focal neurological deficits (such as weakness or numbness in specific body parts), confusion, seizures, and signs of increased intracranial pressure (like nausea, vomiting, or altered consciousness).
- **Medical History:** Obtain details about recent infections (dental, sinus, or ear), immunosuppressive conditions (e.g., HIV/AIDS, diabetes), previous neurosurgical procedures, head injuries, or intravenous drug use.

For Brain Metastases:

- **Symptoms:** Patients may present with headaches, seizures, cognitive or behavioral changes, and neurological deficits depending on the tumor location.
- **Medical History:** Assess for known primary cancers, symptoms suggestive of malignancy (unexplained weight loss, fatigue), and risk factors like smoking [2].

### 11.3 Imaging Modalities

Magnetic Resonance Imaging (MRI):

- **Action:** Perform MRI with diffusion-weighted imaging (DWI) and apparent diffusion coefficient (ADC) sequences, using gadolinium contrast.
- **Rationale:** MRI is the preferred modality for diagnosing both brain abscesses and metastases. For brain abscesses, MRI with DWI/ADC sequences has a sensitivity of 92% and specificity of 91%, aiding in differentiating abscesses from tumors [3].

If MRI Is Unavailable:

- **Action:** Perform contrast-enhanced computed tomography (CT) scan.

#### **Differentiating Between Abscesses and Tumors**

- **MR Spectroscopy:** Helps analyze the chemical composition of lesions, distinguishing abscesses (which may show amino acid peaks) from tumors (which often show elevated choline levels).
- **DWI/ADC Imaging:** Abscesses typically exhibit restricted diffusion due to thick pus, whereas tumors do not.

### 11.4 Severity of Disease

In Severe Cases:

- **Action:** Proceed with surgical intervention for abscess aspiration or excision. Collect samples for microbiological analysis.

In Patients Without Severe Disease:

- **Action:** Withhold antimicrobials until after aspiration or excision.

## 11.5 Empirical Antimicrobial Therapy

### For Community-Acquired Brain Abscesses

- Action: Initiate intravenous ceftriaxone (a third-generation cephalosporin) combined with metronidazole [4, 5]. This combination covers common causative organisms like streptococci and anaerobes.

### For Post-Neurosurgical Brain Abscesses

- Action: Use a combination of meropenem and vancomycin or linezolid [6]. This therapy targets a broad spectrum of pathogens, including Gram-negative bacilli and methicillin-resistant *Staphylococcus aureus* (MRSA).

### Duration of Therapy

Complete Abscess Removal:

- Action: Consider a shorter duration of intravenous antibiotics (e.g., 4 weeks).
- Rationale: Surgical excision reduces bacterial load, potentially allowing for a reduced course of antibiotics.

Partial Removal or No Surgery:

- Action: Continue intravenous antibiotics for 6–8 weeks.
- Rationale: Ensures thorough eradication of the infection to prevent recurrence.

### Definitive Antimicrobial Therapy

- Action: Adjust antibiotics based on culture and sensitivity results from aspirated material.

### Management of Brain Metastases

Diagnosis:

- Neuroimaging: MRI with contrast is the standard for detecting brain metastases, focusing on identifying solid or ring-enhancing lesions. CT scans are alternatives if MRI is not feasible.

Treatment Options:

Surgical Resection:

- Action: Recommended for patients with a single accessible brain metastasis and controlled systemic disease.

Whole-Brain Radiation Therapy (WBRT):

- Action: Often used after surgery to treat microscopic disease.

Stereotactic Radiosurgery (SRS):

- Action: An alternative to surgery for solitary or few metastases, especially in eloquent brain areas.

**Seizure Management****In Brain Abscesses:**

- Action: Monitor for seizures but do not routinely prescribe antiepileptic drugs prophylactically. Prophylactic antiepileptics are not generally recommended unless the patient has experienced seizures.

**In Brain Metastases:**

- Action: Consider antiepileptic prophylaxis, especially if lesions are near the cerebral cortex as cortical involvement increases the risk of seizures; prophylaxis may prevent seizure occurrence.

**Supportive Care****Corticosteroids:**

- Action: Administer dexamethasone to reduce cerebral edema in patients with significant mass effect (metastases/malignancy).

**Intracranial Pressure Management:**

- Action: Employ measures like head elevation, osmotherapy, and hyperventilation when indicated.

**Monitoring and Follow-Up****For Both Conditions:****Neurological Assessments:**

- Action: Regularly evaluate neurological status and vital signs.

**Imaging Studies:**

- Action: Schedule follow-up MRIs to monitor treatment response and detect recurrence.

**Specific to Brain Metastases:****Regular Surveillance:**

- Action: Adhere to EANO-ESMO guidelines recommending periodic neuroimaging.

**Rehabilitation and Long-Term Care****Early Rehabilitation:**

- Action: Initiate physical, occupational, and speech therapy as needed.

**Outpatient Follow-Up:**

- Action: Arrange regular follow-up appointments with neurology, oncology, and rehabilitation services.

## 11.6 Prognosis and Survival

### Brain Abscesses

- **Improved Outcomes:** Advances in imaging, surgical techniques, and antimicrobial therapy have significantly reduced mortality rates [7].
- **Recovery Rates:** Full recovery rates have increased from approximately 33% to 70%, reflecting better overall management.

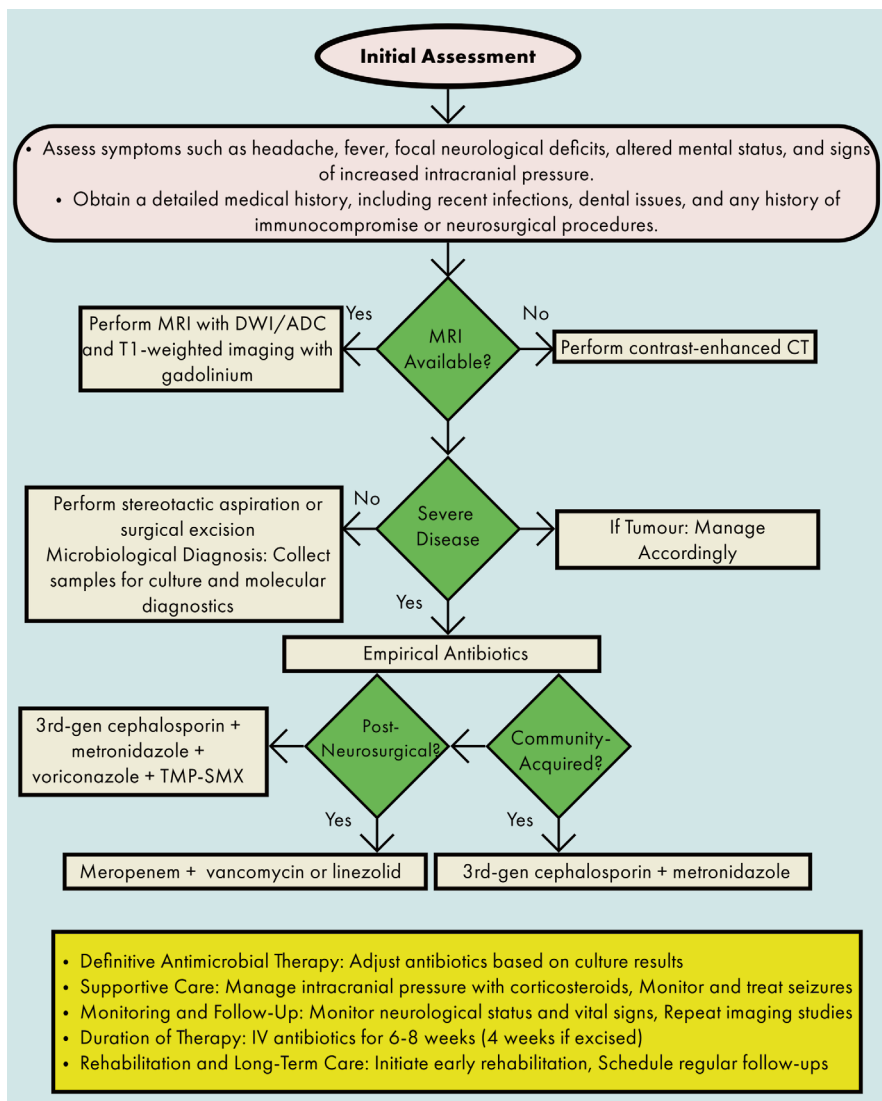
### Brain Metastases

- **Survival Factors:** Prognosis depends on factors like the number of metastases, control of the primary tumor, patient's performance status, and treatment modalities used.
- **Best Survival Rates:** Achieved with combined surgical resection and WBRT in patients with single brain metastases.

## 11.7 Conclusion

The management of brain abscesses and brain metastases in the ICU setting is complex and demands a rapid, coordinated, and evidence-based approach. Accurate diagnosis through advanced imaging techniques is essential for distinguishing between abscesses and tumors, which directly influences treatment strategies. Adherence to updated guidelines ensures optimal antimicrobial selection, surgical intervention, and supportive care.

Early intervention, tailored therapy, diligent monitoring, and comprehensive rehabilitation are pivotal in improving patient outcomes. With modern medical advancements, patients with these serious neurological conditions have a significantly better chance of recovery and improved quality of life.

**Algorithm 11.1: Management of brain abscess and metastases in the ICU**

## Bibliography

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