



cortical or temporal lobe abscesses. Anticonvulsants that can be administered intravenously are the drugs of choice.

Successful antibiotic management of brain abscess is based on knowledge of proven or suspected pathogens and antibiotic properties, such as CNS drug penetration capabilities and the spectrum of activity. Empirical antibiotic therapy without surgical intervention may be used if the primary source of infection outside of the CNS is identified, in patients with cerebritis without capsule formation, or in those with multiple, small abscesses or abscesses in basal ganglia or brain stem. If the organism is unknown, empirical therapy may include vancomycin, metronidazole, and a third-generation cephalosporin. In brain stem abscesses, the possibility of *Listeria* infection should be considered, and treatment should include intravenous ampicillin. In HIV-infected patients with multiple ring-enhancing lesions, empirical therapy for toxoplasmosis should be initiated even if the patient is seronegative for *Toxoplasma*.

Patients undergoing empirical therapy should be followed with repeated CT or MRI. Those who fail to respond should undergo surgical intervention. An important aspect of the management strategy is eradication of the predisposing condition or cause of the brain abscess, such as an oral, ear, cardiac, or pulmonary infection.

PARAMENINGEAL INFECTIONS

Definition

Parameningeal infections include those infections that produce suppuration in potential spaces covering the brain and spinal cord (i.e., epidural abscess and subdural empyema) and those that produce occlusion of the contiguous venous sinuses and cerebral veins (i.e., cerebral venous sinus thrombosis).

Subdural Empyema

Definition

Subdural empyema refers to infection in the space separating the dura and arachnoid.

Pathology and Pathophysiology

Two thirds of subdural empyemas result from frontal or ethmoid sinus infections, 20% from inner ear infections, and the remainder from trauma or neurosurgical procedures. The empyema is caused by direct or indirect extension from infected paranasal sinuses through a retrograde thrombophlebitis. Unilateral empyema is most common because the falx prevents passage across the midline, but bilateral or multiple empyemas can occur. Cortical venous thrombosis or brain abscess develops in about one fourth of patients. In some patients, the subdural empyema may be associated with an epidural abscess or meningitis. These infections occur more often in children than in adults.

Clinical Presentation

Initial symptoms are caused by chronic otitis or sinusitis with superimposed lateralized headache, fever, and obtundation. Vomiting, meningeal signs, and focal neurologic abnormalities (i.e., hemiparesis or seizures) follow. If untreated, obtundation

progresses, and the septic mass and swollen underlying brain produce venous thrombosis or death from herniation.

The major differential diagnosis is meningitis. Nuchal rigidity and obtundation occur in meningitis and subdural empyema, but papilledema and lateralizing deficits are more common in empyema.

Diagnosis

Lumbar puncture should be avoided in patients with subdural empyema to prevent cerebral herniation. Contrast-enhanced CT or MRI can be diagnostic of empyema, showing an extra-axial, crescent-shaped mass with an enhancing rim lying just below the inner table of the skull over the cerebral convexities or in the interhemispheric fissures. On MRI, subdural empyemas have decreased signal intensity on T1-weighted imaging and increased signal intensity on T2-weighted scans. Similar to brain abscess, subdural empyema has high signal intensity on diffusion-weighted images and low signal intensity on ADC maps.

Treatment

Treatment requires prompt surgical drainage of the empyema cavity and high-dose intravenous antibiotics directed at organisms found at the time of craniotomy.

MALIGNANT EXTERNAL OTITIS

Chapter 91 discusses infections of the head and neck.

SPINAL EPIDURAL ABSCESS

Definition and Epidemiology

A *spinal epidural abscess* is an infection in the epidural space between the dura and the bones of the spine around the spinal cord. It can cause paralysis and death. The incidence is 0.5 to 1.0 cases per 10,000 hospital admissions in the United States, and the frequency is increased among injection drug users.

Pathology and Pathophysiology

Infections of the epidural space originate from contiguous spread or through hematogenous routes from a distant source. Cutaneous infection, particularly in the back, is the most common remote source, especially among injection drug users. Abdominal, respiratory tract, and urinary sources are also common. As the use of epidural catheters has increased for pain management, epidural abscess and hematoma have been increasingly reported.

The anatomy of the epidural space dictates the location of the abscess. Because the size of the intravertebral canal remains relatively constant but the circumference of the spinal cord changes, abscess formation is maximal in the thoracic and lumbar regions and minimal at the cervical spine enlargement. Due to the loose connections between the dura and the bones of the spine, the abscess can extend to multiple levels, causing severe and extensive neurologic manifestations.

Causative organisms can be identified by culture or Gram stain from pus obtained at exploration (90% of patients), blood cultures (60% to 90%), or CSF (20%). *S. aureus* is most common, followed by streptococci and gram-negative organisms. Tuberculous abscesses may occur in as many as 25% of patients in high-risk populations. In a recent epidemic, iatrogenic infection