



Figure 28-22 Cerebral abscesses (arrows).

treatment, the otherwise high mortality rate can be reduced to less than 10%.

Subdural Empyema

Bacterial, and rarely fungal, infections of the skull bones or air sinuses can spread to the subdural space, producing a subdural empyema. While the underlying arachnoid and subarachnoid spaces are usually unaffected, a large subdural empyema may produce a mass effect or a thrombophlebitis of the bridging veins that cross the subdural space, resulting in venous occlusion and infarction of the brain. In addition to symptoms referable to the source of the infection, most patients are febrile, have headache and neck stiffness. The CSF profile is similar to that seen in brain abscesses, because both are parameningeal infectious processes. If untreated, focal neurologic signs, lethargy, and coma may develop. With prompt diagnosis and treatment, including surgical drainage, resolution and full recovery is possible, the only residuum being a thickened dura.

Extradural Abscess

Extradural abscess, commonly associated with osteomyelitis, often arises from an adjacent focus of infection, such as sinusitis or following a surgical procedure. When the process occurs in the spinal epidural space, it may cause spinal cord compression and constitute a neurosurgical emergency.

Chronic Bacterial Meningoencephalitis

Chronic bacterial infection of the meninges and the brain may be caused by *Mycobacterium tuberculosis*, *Treponema pallidum*, and *Borrelia* species.

Tuberculosis

Tuberculosis of the CNS may be part of active disease elsewhere in the body or appear in isolation following seeding from silent lesions elsewhere, usually the lungs. It may involve the meninges or the brain.

Clinical Features. Patients with tuberculous meningitis usually have headache, malaise, mental confusion, and vomiting. The CSF typically shows a pleocytosis made up

MORPHOLOGY

The most common pattern of tuberculous involvement is a diffuse **meningoencephalitis**. The subarachnoid space contains a gelatinous or fibrinous exudate that characteristically involves the base of the brain, effacing the cisterns and encasing cranial nerves. There may be discrete, white areas of inflammation scattered over the leptomeninges. On microscopic examination, involved areas contain mixed inflammatory infiltrates containing lymphocytes, plasma cells, and macrophages. Florid cases show well-formed granulomas with caseous necrosis and giant cells. Arteries running through the subarachnoid space may show obliterative endarteritis and marked intimal thickening. Organisms can often be seen with acid-fast stains. The infectious process may spread to the choroid plexus and ependymal surface, traveling through the CSF. In long-standing cases, a dense, fibrous adhesive arachnoiditis may develop, most conspicuous around the base of the brain. Hydrocephalus may result.

CNS involvement may also take the form of one or more well-circumscribed intraparenchymal masses (**tuberculomas**), which may be associated with meningitis. A tuberculoma may be as large as several centimeters in diameter, causing significant mass effect. These lesions usually have a central area of caseous necrosis surrounded by granulomas; calcification may occur in inactive lesions.

of mononuclear cells or a mixture of neutrophils and mononuclear cells, an elevated protein concentration (often, strikingly so), and a moderately reduced or normal glucose. The most serious complications of chronic tuberculous meningitis are arachnoid fibrosis producing hydrocephalus, and obliterative endarteritis producing arterial occlusion and infarction of underlying brain. When the process involves the spinal cord subarachnoid space, nerve roots may also be affected. Tuberculomas produce symptoms typical of space-occupying brain lesions and must be distinguished from CNS tumors.

CNS tuberculosis in patients with acquired immunodeficiency syndrome (AIDS) is pathologically similar, but there may be less host reaction than in immunocompetent individuals. HIV-positive individuals are also at risk for infection by *Mycobacterium avium-intracellulare*, usually in the setting of disseminated infection. These lesions typically contain confluent sheets of macrophages filled with organisms, with few or no granulomas.

Neurosyphilis

Neurosyphilis is a manifestation of the tertiary stage of syphilis and occurs in only about 10% of individuals with untreated infection. The major patterns of CNS involvement are meningovascular neurosyphilis, paretic neurosyphilis, and tabes dorsalis. Affected individuals often show incomplete or mixed pictures, most commonly the combination of tabes dorsalis and paretic disease (taboparesis). Individuals infected with HIV are at increased risk for neurosyphilis, particularly to acute syphilitic meningitis or meningovascular disease, because of impaired cell-mediated immunity. The rate of progression and severity of the disease are also accelerated, for the same reason.