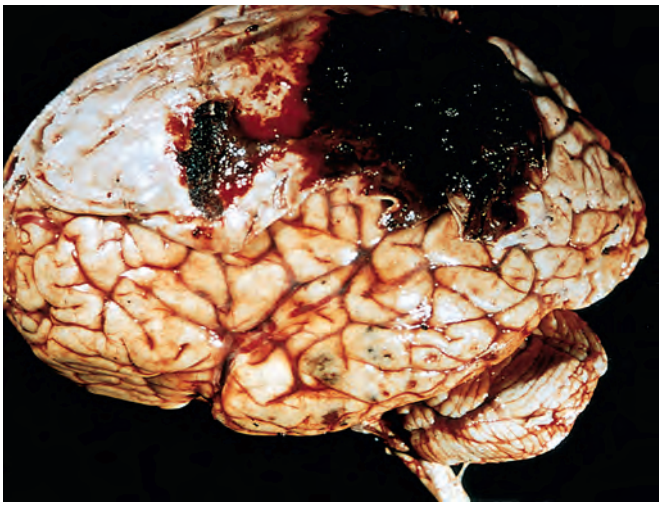

Figure 28-11 Epidural hematoma covering a portion of the dura. Also present are multiple small contusions in the temporal lobe. (Courtesy the late Dr. Raymond D. Adams, Massachusetts General Hospital, Boston, Mass.)

Subdural Hematoma

It is traditionally believed that between the inner surface of the dura mater and the outer arachnoid layer of the leptomeninges lies the subdural space. In reality, the dura is composed of two layers, an external collagenous and an inner border cell layer with scant fibrobalsts, and abundant extracellular space devoid of collagen. When bleeding occurs these two layers separate and create the "subdural space" in which blood accumulates. Bridging veins travel from the convexities of the cerebral hemispheres through the subarachnoid space and the subdural space to empty into the superior sagittal sinus. Similar anatomic relationships exist with other dural sinuses. These vessels are particularly prone to tearing along their course through the dural layers and are the source of bleeding in most cases of subdural hematoma. The brain is suspended in CSF, but the venous sinuses are fixed relative to the dura, so the displacement of the brain that occurs in trauma can tear the veins at the point where they penetrate the dura. In older individuals with brain atrophy, the bridging veins are stretched, hence the increased rate of subdural hematomas in these patients, even after relatively minor head trauma. Infants are also particularly susceptible to subdural hematomas because their bridging veins are thin-walled.

MORPHOLOGY

Grossly, **acute subdural hematomas** appear as a collection of freshly clotted blood along the brain surface, without extension into the depths of sulci (Fig. 28-12). The underlying brain is flattened and the subarachnoid space is often clear. Usually, venous bleeding is self-limited and the resulting hematoma is broken down and organized over time. This most often occurs in the following sequence:

- Lysis of the clot (about 1 week)
- Growth of fibroblasts from the dural surface into the hematoma (2 weeks)
- Early development of hyalinized connective tissue (1 to 3 months)

Typically, the organized hematoma is firmly attached by ingrowing fibrous tissue to the inner surface of the dura and is free of the underlying arachnoid, which does not contribute to healing. The lesion can eventually retract as the granulation tissue matures until only a thin layer of reactive connective tissue remains ("subdural membranes"). In other cases, however, multiple recurrent episodes of bleeding occur (**chronic subdural hematomas**), presumably from the thin-walled vessels of the granulation tissue. The risk of repeat bleeding is greatest in the first few months after the initial hemorrhage.

Clinical Features. Symptomatic subdural hematomas most often manifest within 48 hours of injury. They are most common over the lateral aspects of the cerebral hemispheres and are bilateral in about 10% of cases. Neurologic signs commonly observed are attributable to the pressure exerted on the adjacent brain. There may be focal signs, but often the clinical manifestations are nonlocalizing and include headache and confusion. Slowly progressive neurologic deterioration is typical, but acute decompensation may occur. The treatment of subdural hematomas is to remove the blood and associated organizing tissue.

Sequelae of Brain Trauma

A broad range of neurologic syndromes may become manifest months or years after brain trauma of any cause.

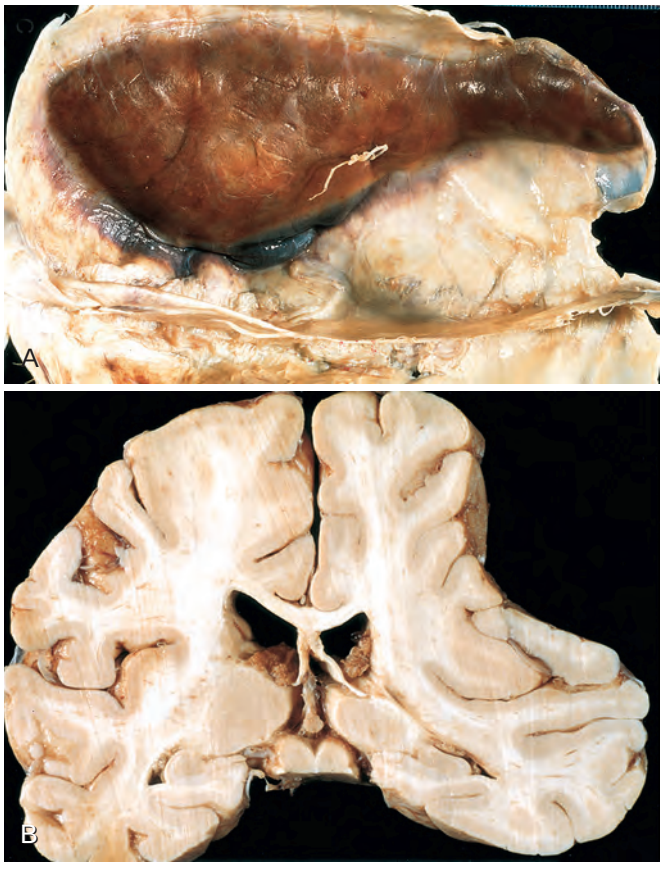

Figure 28-12 **A,** Large organizing subdural hematoma attached to the dura. **B,** Coronal section of the brain showing compression of the hemisphere underlying the subdural hematoma shown in **A**.