

involves a complex pathophysiologic process (Liebig and Congeni, 2016). The hallmarks of a concussion are confusion and amnesia. The belief that loss of consciousness is the hallmark of concussion is a common misconception. A recent study among 182 adolescent athletes who sustain a concussion found that only 22% lost consciousness, while 34% experienced amnesia (Meehan, Mannix, Stracciolini, et al, 2013). Concussions usually resolve in 1 to 3 weeks without complications, but the child should rest until symptoms resolve, then resume activities gradually (Liebig and Congeni, 2016).

The pathogenesis of concussion is still unclear but may be a result of shearing forces that cause stretching, compression, and tearing of nerve fibers, particularly in the area of the central brainstem, which is the seat of the reticular activating system. It has also been suggested that the anatomic alterations of nerve fibers cause the release of large quantities of acetylcholine into the CSF and a reduction in oxygen consumption with increased lactate production.

Contusion and Laceration

The terms **contusion** and **laceration** are used to describe visible bruising and tearing of cerebral tissue. Contusions represent petechial hemorrhages or localized bruising along the superficial aspects of the brain at the site of impact (coup injury) or a lesion remote from the site of direct trauma (contrecoup injury). In serious accidents, there may be multiple sites of injury.

The major areas of the brain susceptible to contusion or laceration are the occipital, frontal, and temporal lobes. In addition, the irregular surfaces of the anterior and middle fossae at the base of the skull are capable of producing bruises or lacerations on forceful impact. Contusions may cause focal disturbances in strength, sensation, or visual awareness. The degree of brain damage in the contused areas varies according to the extent of vascular injury. Signs vary from mild, transient weakness of a limb to prolonged unconsciousness and paralysis. However, the signs and symptoms may be clinically indistinguishable from those of concussion.

Infants who are roughly shaken (referred to as *shaken baby syndrome* or *abusive head trauma*) can sustain profound neurologic impairment, seizures, retinal hemorrhages (usually bilateral), and