SECTION II

Basic Science Aspects of the Headaches

Chapter 9

Anatomy of Muscles, Tendons, Joints, Blood Vessels, and Meninges

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Vital organs of the body are encased by the skeletal system, either completely or in association with elements of connective tissue and the muscular system. The brain is completely surrounded by the bones of the skull. The spinal cord is almost completely protected by bony parts of the vertebrae, although some apertures are filled by strong connective membranes or ligaments. The contraction of a muscle would be ineffectual if one end were not firmly attached to the fixed portion of the skeletal system and the other end equally firmly attached to the skeletal member of the body part to be moved.

THE SKULL

The skull bones may be divided into two groups: those forming the cranium (the "brain box") and those forming the face. The cranial bones enclose the cranial cavity, which is divided into anterior, middle, and posterior portions. The bones of the face form mainly the anterior part of the skull. The primary function of the skull is to protect the brain and the associated organs for vision, hearing, taste, and smell. It also provides attachment for many of the muscles of the head and neck.

Although it is thought of as a single bone, the skull is composed of 28 separate bones. Many of these bones are considered to be flat, consisting of two thin plates of compact bones enclosing a narrow layer of cancellous bone. In terms of shape, however, the bones are far from flat and can show pronounced curvatures. *Diploe* is used to describe the cancellous bone within the flat bones of the skull.

One may also subdivide the skull into neurocranium and viscerocranium. In humans, the neurocranium is extraordinarily large. The very size and dominance of the human brain emphasizes the skull's cerebral function, overshadowing others. Even in this limited role, the cranium cannot be considered merely protective. Sporadic protection of the brain from external impacts is of undoubted value; the need for a barrier against stresses from the play of powerful masticatory and axial musculature is less obvious, but continual. In addition to these extraneous forces, the rigid cranial walls provide continuous isolation for the cerebral circulation. Moreover, the reputed buffering by meninges, subarachnoid space, and contained fluid could be effective only within a rigid container.

The brain's dependence on uninterrupted blood flow is well known; independence of cerebral arterial pressure from extracranial variations, caused by some form of autoregulation, the basic nature of which is still unidentified, is also well established (5). It appears likely that localization of a brain in a rigidly maintained space is a factor in such mechanisms, despite lack of precise evidence. However, the cranial cavity is not closed. Cerebrospinal fluid passes freely through the foramen magnum, displaceable in either direction. Variability in volume of fluid in the cerebral venetricular system and numerous connections between intra- and extracerebral veins add to the complexity of the fluid circulation. Nevertheless, it appears undeniable that enclosure of the brain in an otherwise invariable space must be a crucial factor in the control of the cerebral circulation.

THE CERVICAL VERTEBRAE

This part of the vertebral column is extremely flexible, permitting a wide range of movements of the head and neck. The seven cervical vertebrae are smaller than those lower