TRANSVENTRICULAR WOUNDS OF THE BRAIN

MAJOR WALTER G. HAYNES, M.C., A.U.S. (Retired)*

(Received for publication April 16, 1945)

A RECENT series of 342 penetrating brain wounds collected during the African, Sicilian and Western European campaigns drew attention to the technical difficulties peculiar to the repair of trans- and intraventricular penetrations. This group of patients exhibited a clear-cut clinico-pathologic pattern. They constitute a challenge and are of unusual interest to the neurologic surgeon.

The bad prognosis of ventricular wounds has been noted by Cushing: in 16 cases in which the projectile penetrated or traversed the ventricles there were no recoveries and the condition in most instances was a post-mortem finding. Other communications have not encompassed various types or locations of wounds, nor have they taken into consideration the picture presented and the treatment necessary for such wounds. In the personal series referred to above this was attempted, and attention was drawn to prognosis as to life, dependent upon the areas of brain involved. The surgical problem presented by ventricular penetrations will be discussed in detail in this communication.

The patients reported here were all operated upon by the author or by an assistant under the direct supervision of the author (Table 1).

PATHOLOGY

Ventricular wounds are caused by missiles lodging in or passing through any part of the ventricular system. Lesions including the aqueduct and the 4th ventricle were not seen for obvious reasons, but the lateral ventricles, commonly, and the third ventricle, rarely, were involved. The missile was usually small, sometimes of match-head size. These constitute a group of wounds technically difficult to repair, but causing a minimal amount of ependymal damage and offering the best prognosis.

The pathologic study of the brains suspected of harboring a ventricular wound was facilitated at necropsy by laying open the ventricular system by sagittal section of each cerebral hemisphere.

Missiles entering from any part of the cerebrum caused little brain damage throughout the course of their tract until the ventricle was pierced or the missile stopped. An explosive effect was noted at the end of the missile tract. Much damage, maceration of brain tissue and old bleeding was found there. The damage to the ventricle varied with the size of the missile. The ependyma was softened and macerated at the point of entrance and exit. The ventricle itself contained debris, and, if bleeding had occurred,

* Associate Professor of Surgery, Head of the Department of Neurosurgery, College of Medicine, University of Alabama, Birmingham, Alabama.
a sizable amount of old clotted blood. The bleeding was extensive if the choroid plexus had been struck. Those brains studied at necropsy, after suitable fixation, revealed the limits of damage necessary to cause death. The entire ventricular system, including the 4th ventricle, was filled with clotted blood and the ventricle involved was filled with old blood, macerated brain and ependymal tissue. The foramen of Monro was occluded in many such brains seen at necropsy. Those brains studied at surgery exhibited every gradation of the above pathology. Surgery was aimed at preventing or relieving the above conditions.

Larger missiles caused greater damage. Maceration of more than one-third of the ventricular wall seemed incompatible with life. Clean amputation of a macerated ventricle and cerebral lobe, under direct vision, carried a better prognosis.

Those patients presenting an occluded foramen of Monro also revealed a dilatation of the ipsolateral ventricle. This was noted in injuries only 24 hours old.

The presence of diffuse brain damage, manifested by scattered petechial hemorrhages, depended upon the size of the missile and consequent force of the blow. Most of the wounds were caused by tiny missiles and the diffuse brain damage was slight. Indriven bone fragments rarely extended as deep as the ventricle and usually hemorrhage into the tract was slight.

A transventricular wound, which usually meant one extending beyond the midline, revealed marked pathology on the distal side of the ventricle, as well as within the ventricle. Here was seen the explosive effect of the stoppage of the missile; the area of brain maceration and old hemorrhage was usually extensive.

Three cases of ventriculitis, studied at necropsy, revealed the above pathology, plus an extensive softening of the ependyma of only the lateral ventricle involved. The foramen of Monro was occluded by debris in both. The ependyma was soft, friable and edematous and was covered with a thick layer of cellular debris. There was no concomitant meningeal pathologic change and the missile tract was clean.

**SYMPTOMATOLOGY**

Patients sustaining ventricular wounds exhibit the usual neurologic deficits contingent upon the brain structure damaged during the passage of the missile. The actual functional brain damage was slight in most cases because the missile was small. The patient was usually, therefore, conscious, alert and oriented, and demonstrated only minimal neurologic signs.

A persistent, abnormally high temperature was a consistent finding in ventricular wounds. The temperature usually ascended as the patient’s general condition declined. A temperature of 106°–107° was not uncommon and vigorous means to combat this were necessary. Hyperthermia may be attributed to the leakage of blood into the 3rd ventricle and stimulation of the paraventricular nuclei of the hypothalamus.