Unusual Pneumoencephalogram Following Fragment 
Wound of the Brain
Case Report

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W e are reporting the unusual pneu- 
moencephalographic findings in a 
young soldier who received multiple 
fragment wounds of his body including the 
head.

Case Report

On June 5, 1968, this 19-year-old soldier 
was wounded by an explosive device in the 
Republic of Viet Nam. He received multiple 
wounds of the head, trunk, and extremities. 
He was sluggish, restless, and agitated on 
admission to his first medical unit, but ap-
parently moved all extremities. There were 
small superficial wounds of the right fronto-
temporal and posterior auricular areas and 
large wounds of the right arm, leg, buttock, 
and abdomen. X-rays of the cranium re-
vealed several small metallic fragments in 
the left parietal area. There was no evidence 
of indriven bony fragments.

Under local anesthesia the superficial 
wound of the right frontotemporal area was 
explored; the calvarium was intact, and the 
wound was therefore closed uneventfully. 
The patient then underwent an exploratory 
laparotomy for closure of penetrating 
wounds of the sigmoid colon and ileum and 
for a laceration of the urinary bladder. A co-
lostomy and a suprapubic cystotomy were 
performed. Initial treatment of the extremity 
and buttock wounds was carried out at the 
same time.

In the immediate postoperative period his 
level of consciousness improved. Within a 
few days, however, low-grade papilledema 
was evident. Echoencephalography carried 
out at that time was reported as normal. He 
was evacuated by air to Japan 9 days after the 
injury.

Received for publication April 10, 1969.
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noted. Electroencephalography performed on June 18, 1968, was considered abnormal, showing excessive slowing and disorganization throughout both hemispheres but more predominantly in the right frontotemporal region.

Hospital Course. Because of the presence of bilateral papilledema, it was felt that a developing intracranial mass lesion had to be ruled out, especially in the left hemisphere. Therefore, shortly after admission, bilateral carotid angiography was performed under local anesthesia. There was no displacement of the midline vasculature but in the lateral view the left Sylvian group of vessels appeared to be unequivocally elevated when compared with the right side. The probability of an intracranial mass related to the left parietal fragment seemed reasonable at this time, and pneumoencephalography was performed. Lumbar puncture revealed clear spinal fluid under a pressure of 260 mm of water with 18 mg% of protein; 35 cc of air were instilled with no further removal of fluid than that sent for laboratory examination. The air outlined a diagonal path extending from the right cerebellum to the site of the fragment in the left parietal lobe (Fig. 1). A small bulbous enlargement at the point of the fragment was noted. The fourth ventricle was questionably displaced to the left, but an absolute midline position of the head could not be maintained because of the patient's inability to cooperate completely. There was no deviation of the lateral or third ventricles.

However, with the left side of the head in the dependent position, the tract emptied only to fill again with the left side placed in the "up" position (Figs. 1 right and 2 left). This suggested a patent communication with the ventricular system or the subarachnoid pathways. The temporal horns filled normally and showed no displacement. There was satisfactory filling of the subarachnoid spaces over the convexity. The cause of the apparent elevation of the left Sylvian group of vessels could not be ascertained and was considered to be a spurious finding. The procedure was well tolerated.

The patient's clinical condition showed steady improvement over the ensuing 2 weeks. As he became more cooperative and better oriented, detailed examination was possible. This revealed signs of a combined left cerebral and right cerebellar lesion, including bilateral nystagmus, mild weakness, and dysdiadokokinesis of the right arm, increased deep tendon reflexes on the right, and an intermittent right Babinski sign. These findings were all quite compatible with the pneumoencephalograhic changes. The patient was eventually able to walk with help prior to transfer to a medical facility in the United States for long-term follow-up care. Cerebrospinal fluid pressure prior to discharge was 160 mm of water, and the papilledema had resolved.

Fig. 1. Pneumoencephalograms of initial posterior fossa series with 10 cc of air showing diagonal tract of air from the right cerebellum to left parietal area. Left: Anteroposterior view. Right: Lateral view.
Discussion

Air in the ventricular system was first visualized (accidentally) on a skull film taken in 1913 by Luckett. Ventriculography and pneumoencephalography were introduced by Dandy in 1918 and 1919. Two years later, Bingel, in Germany, unaware of Dandy's work, performed a lumbar subarachnoid injection of air and coined the term "pneumoencephalography." A large volume of literature concerning encephalography has naturally accumulated since then, primarily directed toward the diagnosis of intracranial neoplasms. The procedure has no essential value in the acute traumatic situation although it has been used to demonstrate the late sequelae of traumatic cerebral wounds. Robertson mentions the changes in shape and size of the ventricles following gunshot wounds of the head. Tavera and Wood in their encyclopedic publication present similar material; but neither work contains a case similar to ours. This is also true for the volumes on military neurosurgery released from the Surgeon General's Office following World War II, and the Korean conflict. Nor has an extensive search of the neurosurgical literature uncovered any other case demonstrating these curious findings. We therefore believe that this is the first case reported containing these unusual pneumoencephalographic changes.

Summary

We have reported the pneumoencephalographic demonstration of the tract of a missile fragment as it entered a soldier's brain.

References