

UNRELIABILITY OF COMBINED PNEUMOENCEPHALOGRAPHY AND SCINTICISTERNOGRAPHY

Thomas H. Milhorat, Techen Chien, Massoud Majd, and David L. Breckbill

Children's Hospital National Medical Center and George Washington University, Washington, D.C.

Evidence is presented that the radiopharmaceutical flow in cerebrospinal fluid may be significantly altered by pneumoencephalography. When both pneumoencephalography and scinticisternography are required in the same patient, the studies should be performed separately rather than as a combined procedure.

The widespread use of scinticisternography within the past decade has established this procedure as a safe and effective tool in the diagnostic evaluation of hydrocephalus, cerebrospinal fluid (CSF) leak, and a variety of disorders affecting the CSF system (1-4). With few exceptions, scinticisternography is performed in conjunction with other neurodiagnostic tests. In patients undergoing both pneumoencephalography and scinticisternography, a frequently posed question concerns the appropriate timing of these two procedures (3). In many clinics including our own, scinticisternography is performed several days before or after pneumoencephalography, primarily on the assumption that the presence of air within the CSF system will affect CSF flow. On rare occasions, when it seemed expeditious to do so, we have performed pneumoencephalography and scinticisternography as a combined procedure. Since previously published reports have failed to document alterations in CSF flow following pneumoencephalography, we are reporting a case that illustrates this point.

CASE REPORT

A 6-year-old boy was admitted to Children's Hospital National Medical Center for evaluation of impaired visual acuity. Birth and early development had been unremarkable. At 1 year of age, the patient was noted to have "crossed eyes" and a "large head." He exhibited no other unusual findings until severe visual loss was discovered by a school physician.

Physical examination produced the following positive findings: (A) head circumference of 58 cm (above 98th percentile for age); (B) bilateral optic atrophy without papilledema; (C) visual acuity of

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For reprints contact: Thomas H. Milhorat, Dept. of Neurosurgery and Radiology, Children's Hospital National Medical Center, George Washington University, Washington, D.C. 20009.

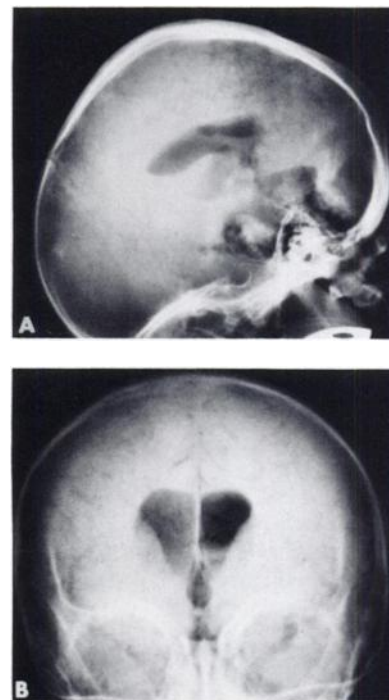


FIG. 1. Pneumoencephalogram of 6-year-old boy with macrocephaly and impaired visual acuity. (A) lateral view (upright position) showing enlargement of all four ventricles. Cisterna magna and basilar cisterns are capacious. (B) Anteroposterior brow-up view showing dilated lateral ventricles and limited filling of cerebral subarachnoid space.

20/40 left eye and 20/400 right eye; and (D) incomplete right abducens palsy.

Skull x-ray showed an abnormally large cranial vault without signs of increased intracranial pressure. Brain scan, electroencephalogram, and x-rays of the optic foramina were unremarkable. An EMI scan revealed moderate enlargement of all four ventricles.

To confirm the suspected diagnosis of communicating hydrocephalus, a pneumoencephalogram was performed. This revealed generalized ventricular dilatation, enlargement of the cisterna magna and basilar cisterns, and limited filling of the subarachnoid space over the cerebral convexities (Fig. 1). Approximately 65 cc of air was required to complete the study. Before removing the lumbar spinal needle, 150 μ Ci of $^{111}\text{In-DTPA}$ was injected into the lumbar theca. Cerebrospinal fluid imaging revealed the following: by 45 min, the radiopharmaceutical had ascended into the basilar cisterns with poor ventricular penetration, confined to the left lateral ventricle (Fig. 2); on the 2-hr and 6-hr scans, faint activity persisted within the left lateral ventricle as the radiopharmaceutical ascended into the sylvian fissure cisterns; on the 24-hr and 48-hr scans, no activity appeared within the cerebral ventricles and the radiopharmaceutical was diffusely distributed over both cerebral hemispheres.

Five days after combined pneumoencephalography and scintiscisternography, a repeat $^{111}\text{In-DTPA}$ cisternogram was performed. This revealed significant ventricular reflux with symmetrical activity in both lateral ventricles at 30 min (Fig. 3). On the 3-hr and 6-hr scans, activity persisted in both lateral ventricles as the radiopharmaceutical ascended into the sylvian fissure cisterns. The 24-hr and 48-hr scans showed a distribution of activity similar to that in the initial study.

The patient subsequently underwent a ventriculoperitoneal shunt. An EMI scan performed 6 weeks later revealed that the cerebral ventricles had returned to normal size.

DISCUSSION

As far as can be determined, no significant alterations in CSF flow have been reported following pneumoencephalography. Since the movement of a radiopharmaceutical reflects the bulk flow of fluid within the CSF cavities (1-4), it is not unreasonable to expect that tracers presumably will fail to enter or will have limited access to cavities filled by air (5).

In the case reported herein, $^{111}\text{In-DTPA}$ was injected into the lumbar theca at the conclusion of a pneumoencephalogram in a patient with mild communicating hydrocephalus. A comparison of this study with one performed 5 days later revealed no

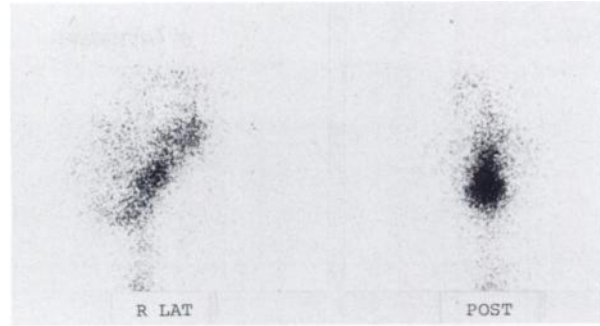


FIG. 2. Isotope cisternogram performed at conclusion of pneumoencephalogram. Scan (45-min) shows considerable activity in basilar cisterns on right lateral and posterior views and faint activity in left lateral ventricle. Subsequent scans revealed no further increase in ventricular penetration.

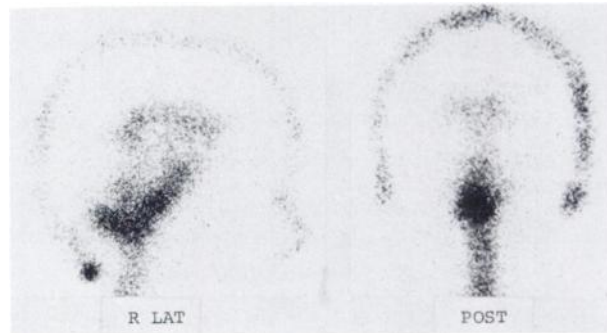


FIG. 3. Isotope cisternogram performed 5 days after combined study. On right lateral and posterior views, 30-min scan shows considerable activity in basilar cisterns and both lateral ventricles. Subsequent cerebrospinal fluid imaging was typical of communicating hydrocephalus.

obvious differences in subarachnoid flow. During the initial study, however, there was limited ventricular penetration of the radiopharmaceutical and activity was confined to one lateral ventricle. Whereas alterations in intracranial pressure caused by pneumoencephalography may have contributed to this finding, the most likely explanation is that the bulk flow of cerebrospinal fluid into the air-filled ventricles was impaired. The finding of activity in one lateral ventricle and not the other was probably due to asymmetric filling of the ventricles with air during CSF imaging.

On the basis of the foregoing observations, it seems reasonable to conclude that combining pneumoencephalography with scintiscisternography has inherent limitations and should be avoided whenever possible. With the increasing availability of EMI scanning, this procedure can probably be substituted for pneumoencephalography in some cases.

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