Radiographic Localization of a Spontaneous Cerebrospinal Fluid Fistula
Case Report

H. F. W. Pribram, M.B., A. C. Hass, M.D., and H. Nishihoka, M.D.

Departments of Radiology (Neuroradiology) and Neurosurgery, College of Medicine, State University of Iowa, Iowa City, Iowa

Cerebrospinal fluid fistula is a dangerous condition which frequently leads to recurrent attacks of meningitis, cerebral abscess and death. The occurrence of a spontaneous fistula without antecedent trauma, surgery or tumour is rare. Although in many of the reported cases the fistula originated in the cribriform plate,6,10 spontaneous fistulae have also been described arising in the middle6 or posterior fossa1,2,5-7,9,11,12 and for this reason precise localization is of the utmost importance.

The radiological investigation includes routine skull as well as oblique films of the cribriform plate region. These are followed by tomograms of the sphenoid sinus and the petrous temporal bones in lateral and frontal position. Radioactive isotopes may be used to identify small leaks.5

The most reliable and objective method is to delineate the fistula with positive contrast. Pantopaque injected into the lumbar subarachnoid space is manipulated under fluoroscopic control, preferably with image intensification, onto the clivus. Each cerebellopontine angle is examined by turning the patient’s head 45° to the vertical axis in the prone position. This will lead to identification of a posterior fossa fistula. Once it has been outlined, multiple views including tomograms are obtained. Considerable time may elapse before the fistula is opacified, and for this reason the contrast medium must be left in each position for at least 10–15 minutes. The use of a new low density (15 per cent iodine) pantopaque might offer advantages.4

A copious flow of cerebrospinal fluid suggests that the fistula communicates with the ventricular system. Positive contrast ventriculography is recommended in such cases. In the cribiform plate region, positive contrast may be instilled into the nasal cavity as recommended by Teng and Edalatpour.12 Although we have found encephalography very useful in the evaluation of a post traumatic fistula, it probably offers little in cases of spontaneous fistula.

The following case illustrates the identification of an unusual type of fistula.

Received for publication October 11, 1965.

Case Report

S.M., age 11, was admitted to the University Hospitals on August 17, 1964. In October, 1963, she had been treated at a local hospital for meningitis; she had recovered completely and returned to school. In November, 1963, she again developed meningitis and was treated successfully with antibiotics. However, there was recurrence of headache, fever and cerebrospinal fluid pleocytosis on January 7 and again on February 24, 1964. Each episode responded satisfactorily to antibiotics. She returned to school in March. In April, 1964, she first noticed the presence of watery fluid in the left nostril on awakening one morning. This recurred repeatedly and she was admitted to University Hospitals for investigation. Repeated nasopharyngeal examinations and x-rays of the skull failed to confirm cerebrospinal fluid leakage or a defect in the cranial vault. During this hospital stay the rhinorrhea spontaneously ceased. She was discharged from the hospital on July 28.

No further leakage occurred until August 17, 1964, when she awoke with fluid in the left nostril. By the time she arrived at the hospital a few hours later she was complaining of headache and was febrile with neck stiffness.

Examination. Lumbar puncture revealed turbid fluid containing 1,000 white cells. The protein was 110 and the cerebrospinal fluid sugar 36 with a concomitant blood sugar of 73. Smear revealed numerous gram positive diplococci. She was immediately placed on intravenous penicillin and sulfadiazine with rapid resolution of symptoms and fever as well as clearing of the cerebrospinal fluid. The rhinorrhea recurred at varying intervals. X-rays of the skull, sinuses and petrous temporal bones as well as tomograms were normal. Indigo carmine injected into the subarachnoid space was not recovered in the nasopharynx.

On September 2, 1964, positive contrast encephalography was performed using 2 cc. of pantopaque. The opaque medium was directed into the left cerebellopontine angle and under direct fluoroscopy no tract could be seen. However, after a lapse of approximately one-half hour a clear tract could be delineated leading from the posterior fossa into the nasopharynx (Fig. 1). Tomograms did not identify the precise point of exit from the cranial fossa. A small amount of contrast medium was trapped at the petrous apex.

Operation was undertaken on September 8, 1964. Through a low left temporal craniotomy flap the entire floor of the middle fossa was visualized intradurally from the sphenoid wing back to the petrous ridge and medially to the cavernous sinus. No defect was seen in the dura. The tentorium was cut back from the petrous
ridge for approximately 2 cm. exposing the ocularomotor and trochlear nerves. The dorsum sellae was palpated with a nerve hook placed anterior to the midbrain and pons but no defect identified. The trigeminal nerve was then exposed. The roof of Meckel's cave was found to be bony with a large opening 5–7 mm. in diameter through which the trigeminal nerve measuring about 3 mm. entered the cave. This opening was considered abnormal and consistent with the pantopaque localization. The opening was gently packed with fibrin clot and muscle.

Postoperative Course. The patient was given isoaminoacaproic acid postoperatively for 3 weeks. Except for a transient trochlear nerve paresis which cleared within 1 week, she suffered no ill effects from the exploration.

The pantopaque study was repeated on September 25. No contrast medium could be seen leaving the posterior fossa but the medium was not freely mobile in the operative area presumably due to postoperative adhesions. In retrospect, a thin bony bridge was noted, over what could now be considered an enlarged 5th nerve canal. The patient was discharged asymptomatic and neurologically normal on September 26.

Repeated follow-up examinations have been carried out, the most recent being September 9, 1965. One year after surgery there has been no recurrence of the rhinorrhea. Since surgery, the patient has sustained 2 minor head injuries and 3 episodes of upper respiratory tract infection. In neither of the latter instances did she show any evidence of meningitis, although this possibility has been borne in mind constantly by her parents and local physician.

Discussion

The petrous temporal bone is fertile territory for a spontaneous fistula. It is intimately related to the subarachnoid spaces of the middle and posterior fossa. The inner ear is in close proximity to the cerebello-pontine angle cistern as well as the temporal lobe. The subarachnoid space extends into the cochlear aqueduct and into the internal auditory meatus where it blends with the periosteum.

There are several possible sites of a posterior fossa fistula. A defect in the tegmen may communicate with the middle ear and then the eustachian tube. Unilateral deafness would be anticipated in such a case as in those with a developmental defect of the inner ear. Our patient had no discernible deafness nor could any fluid be seen behind the drum. This makes it unlikely that the fistula involved the middle ear. The internal auditory canal has been reported to be the site of such a fistula, but in our case it was normal. This leaves the possibility of a fistula arising from the dural sleeve of the 5th nerve. Such an abnormality was found at surgery. The 5th nerve directly overlies the eustachian tube and possibly the fistula communicated with it.

We cannot be sure that the anomaly at the entrance to Meckel's cave was the defect through which the cerebrospinal fluid left the subarachnoid space. The trans-tentorial approach to the area did not allow direct visualization of any tract. It would have been equally impossible to visualize this area via the posterior fossa. Final conclusions must be based upon continued long term follow-up.

Summary

We have reported the successful localization and treatment of a non-traumatic cerebrospinal fluid fistula in an 11-year-old girl, and have outlined the radiographic technique involved in localizing the fistula.

References