Determination of Superior Sagittal Sinus Patency with an Ultrasonic Doppler Flow Detector in Parasagittal Meningioma

Technical Note

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The state of patency of the superior sagittal sinus is of critical importance in the treatment of meningiomas posterior to the entrance of the rolandic veins. This information can usually be obtained from the arteriographic studies and every effort should be made to settle the matter preoperatively. However, because of hyperostosis of the overlying bone or a strong tumor blush, this issue can not always be decided with confidence prior to surgery. Although a sinogram can be performed before or during surgery to determine patency of the sinus, it is somewhat cumbersome. This is a report of a case in which patency of the sagittal sinus could not be determined preoperatively in spite of repeated attempts during arteriography; the patency of the sinus was established simply at operation by the application of a transcutaneous doppler flow detector to the unopened dura.

Case Report

This 43-year-old woman had a 4-month history of bilateral headaches, worse over the posterior regions of the head, which would awaken her from sleep. No personality changes were noted until 48 hours prior to admission when she became confused and restless and failed to recognize her relatives. She was admitted to her community hospital, and the following day was noted to be more lethargic. She was referred to the Medical College of Virginia.

Examination. On admission the patient was noted to be restless and irritable, complaining of pain in the back of her head. She would fall asleep quickly if left undisturbed, and had a moderate right hemiparesis and aphasia. The left pupil was slightly larger than the right and responded poorly to light. She improved dramatically with the administration of Dexamethasone and the following day she was alert, moved the right side well, and had minimal aphasia. Bilateral carotid arteriography with selective internal and external carotid injections revealed a 1.5 cm shift of the internal cerebral vein with a questionable tumor stain in the left parietal region. Several delayed injections were obtained in an effort to visualize the superior sagittal sinus, but continuity of the sinus in the parietal region could not be definitely verified. A technetium99m pertechnete brain scan revealed a large increase in radioactive concentration in the left parasagittal parietal region which appeared to extend across the midline on the posteroanterior projection. Laboratory studies were normal, as was the electrocardiogram.

Operation. On the third day following admission, in the supine position, biparietal scalp and bone flaps were reflected to expose the parieto-occipital dura bilaterally. There was considerable bleeding from the external carotid branches penetrating the left parietal bone. With removal of the bone flap, the tumor could be palpated in the left parietal region. No tumor could be palpated on the right side. At this point, the Doppler flow detector, which had been gas sterilized, was utilized to trace the sagittal sinus. The signal from the sinus was a clear venous “windstorm” signal and could be traced easily past the tumor. Moving the transducer laterally over the tumor or over the brain failed to produce a signal so unquestionably the superior sagittal sinus was patent. Thus, a subtotal tumor resection was carried out leaving a small cuff or tumor along the superior sagittal sinus.

Postoperative Course. The patient did well, and when last seen 6 months postoperatively had no neurological deficit.

Discussion

The transcutaneous ultrasonic flow detector, developed in 1965 by Watson and

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B.W. Rushmer,4 consists of two piezo-electric crystals, a transmitting crystal, and a receiving crystal. The transmitting crystal generates a 5 megacycle/sec ultrasonic signal which passes through soft tissue. Blood flowing through a vessel causes a shift in frequency of the signal according to the Doppler effect and this is picked up by the receiving signal. The transmitted frequency of 5 Mc/sec is filtered out of the signal and the shifted frequencies are amplified into an audible signal. The pitch of the signal is related to the angle of application of the crystal to the column of blood and to the velocity of blood flow. The normal arterial signal is very characteristic and readily identified by the sharp changes in pitch. Likewise the venous signal is easily identified by its characteristic undulating pitch, sounding somewhat like a "windstorm." This instrument does not measure the amount of blood flow but has proven to be valuable in the preoperative evaluation of peripheral arterial and venous disease.5,3 This report demonstrates the usefulness of this tool in determining the patency of the superior sagittal sinus during surgery for parasagittal meningiomas by applying the instrument to the unopened dura.

Summary

We have reported a patient in whom patency of the superior sagittal sinus could not be determined prior to the operative exposure of a parasagittal meningioma. The use of the Doppler flow detector during the operation proved to be a simple and conclusive way to determine patency of the sinus.

References