Cavernous Sinus Venography and Stereotaxic Cryohypophysectomy*

ROBERT W. RAND, M.D., AND WILLIAM N. HANAFEE, M.D.
Department of Surgery and Department of Radiology, U.C.L.A. School of Medicine, Los Angeles, California

The dimensions of a normal pituitary gland can be approximated by roentgenographic studies of the sella turcica. Tumors in this region, however, frequently grow in a lobulated asymmetrical fashion so that the osseous walls of the sella do not give a true representation of the tumor size. Pneumoencephalograms will show suprasellar tumor extensions, and bilateral carotid angiography will, in some cases, demonstrate lateral and (less well) suprasellar growth patterns. X-ray studies are most useful to rule out internal carotid aneurysms simulating nonsecretory pituitary tumors.

Lateral extensions of pituitary tumors present diagnostic and therapeutic problems. Opacification of the cavernous sinuses by percutaneous retrograde injection, however, has allowed accurate delineation of the lateral extensions of pituitary adenomas and their relationships to the carotid siphon and the cranial nerves of the cavernous sinus. These anatomicopathological findings have made possible accurate placement of cryoprobes during stereotaxic cryohypophysectomy.

History

Retrograde jugular venography has been used for study of glomus jugular tumors by Gejrot and Lindbom. In their technique, a small vascular catheter was passed percutaneously into the internal jugular vein, and the injected contrast solution was refluxed into the transverse sinus. Satisfactory opacification of the cavernous sinuses did not occur.

Stereotaxic cryohypophysectomy was developed in 1963 to replace yttrium-90 sphere hypophysectomy in the palliative treatment of metastatic mammary cancer and progressive diabetic retinopathy causing loss of vision. Certain intrasellar pituitary tumors, especially those causing hyperpituitary syndromes (acromegaly, Cushing's syndrome, and Nelson's syndrome), have also been successfully removed with this cryosurgical procedure.

Anatomy

The paired cavernous sinuses are irregularly quadrangular structures, lying extradural and adjacent to the body of the sphenoid bone. In the lateral walls are the oculomotor nerves, trochlear nerves, and first divisions of the trigeminal nerves. The abducens nerves lie lateral to the carotid arteries. They are connected to each other by two venous sinuses lying both anterior and posterior to the pituitary gland that are called the anterior and posterior intercommunicating sinuses. The portions of the intercommunicating sinuses lying beneath the diaphragma sellae are sometimes spoken of as circular sinuses. Thus, the pituitary gland is surrounded by venous channels. The cavernous sinuses extend from the superior orbital fissure anteriorly where they receive the ophthalmic veins and tributaries of the pterygoid plexus to the dorsum sellae posteriorly. An excellent surgical description of the cavernous sinuses has been made by Parkinson.

The inferior petrosal sinuses drain from the posterior inferior quadrant of the cavernous sinus toward the region of the jugular foramen. Most anatomy texts show the inferior petrosal sinuses draining into the jugular bulb at the level of the jugular foramen. Our radiographic investigations (Fig. 1) have shown that the inferior petrosal sinus drains in four patterns:

1. The inferior petrosal sinus drains directly into the internal jugular vein.
2. The inferior petrosal sinus ends in a communicating vein which joins the deep cervical plexus with the internal jugular vein.

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3. Occasionally the inferior petrosal sinus is not a single channel, but a slight exaggeration of the plexus of veins which lies on the dorsum sellae and clivus. These channels drain both into the internal jugular vein and deep cervical plexus.

4. The inferior petrosal sinus may drain directly into the deep cervical veins.

**Technique**

The initial technique and results of cavernous sinography, which consists of passing a catheter percutaneously via the internal jugular vein cephalad into the inferior petrosal sinus under fluoroscopic control, have been reported previously. We are now reporting the method in more detail because of technical changes and improvement in the procedure.

The patient’s head and neck are slightly hyperextended. The skin of the neck is prepared and then anesthetized with 1% xylocaine infiltrated 3 cm above the sternal end of the clavicle along the medial border of the sternocleidomastoid muscle. A 2 to 3 mm stab-wound incision is made to allow easier passage of the polyethylene catheter (Becton, Dickinson XRP 0.045I radiopaque) since the outside diameter of the catheter is slightly larger than the puncture needle. A 3½ inch 18-gauge thin-walled needle without a stylet is attached to a 10 cc syringe containing 5 cc of 1% xylocaine. This needle is inserted and directed about 5 mm lateral to the internal carotid artery. The tip of the mastoid process may be used as an osseous landmark to direct the angle of puncture. The attached syringe is used to aspirate frequently since the pressure of the internal jugular vein is insufficient to cause blood to flow spontaneously from the needle. If the patient experiences pain, small amounts of xylocaine are injected as needed.

*Fig. 1. Patterns of drainage of inferior petrosal sinuses observed during performance of cavernous sinus venography.*