Surgical Treatment of Unilateral Optic Nerve Gliomas

EDGAR M. HOUSEPIAN, M.D.

Department of Neurological Surgery, College of Physicians and Surgeons, Columbia University, and Neurological Institute of New York, Columbia-Presbyterian Medical Center, New York, N.Y.

Various manifestations of the unpredictable natural history of optic gliomas have resulted in controversy as to the best form of treatment. Some reports of successful partial removal of these tumors\(^1\)\(^-\)\(^12\) may be questioned because of the limited follow-up period at the time of reporting.

Taveras, et al.,\(^1\) described remissions and arrest with improvement in exophthalmos and vision in a group of patients treated by radiotherapy alone. On the basis of this experience they concluded that tumors limited to the orbital cavity may be treated successfully by intraorbital surgical removal but that all other cases should be treated by irradiation. Later, Chutorian and his co-workers\(^2\) at the same institution found four cases of recurrent optic nerve glioma following radiotherapy. One of these had been reported by Taveras, et al.,\(^3\) as free of recurrence after 21 years.

Some ophthalmological surgeons have advocated transorbital excision of optic nerve gliomas as adequate therapy.\(^10\),\(^14\) In one of the 13 cases in this report, the tumor recurred with chiasmal spread 6 years after orbital resection. These experiences lend credence to the impression that, although radiotherapy may be effective in nonresectable optic glioma, transcranial chiasmal inspection and prechiasmal resection is the treatment of choice when tumor is confined to a single optic nerve. Furthermore, excellent cosmetic results have been possible when the structures of the orbital apex have been meticulously approached by the frontal transcranial route.

The operative technique to be described is based on our surgical experience with nine cases of optic glioma. Proptosis and visual impairment were the most common presenting symptoms. The diagnosis of optic nerve glioma may be made on the basis of radiographic evidence of enlargement of one optic foramen.\(^6\) Pneumoencephalography has been useful in outlining the intracranial portion of the optic nerve. Preservation of the chiasmatic notch, between the optic and infundibular recesses of the anterior ventricle, usually indicates that the chiasm is not involved. Radioactive mercury scan has been of great value as supporting evidence for the presence of optic nerve or chiasmal glioma. Technetium scanning has proved to be less reliable.

Dandy,\(^4\),\(^5\) Love and Benedict,\(^7\) Love, et al.,\(^8\) and Matson\(^9\) have long advocated the transcranial approach to the orbit because it offers better access to the apical structures. Structures in the superior half of the orbital apex can only be approached by this route if functional integrity is to be preserved.

The main body of this report concerns the surgical anatomy and surgical techniques, stressing the excellent cosmetic outcome possible when the transcranial route to the orbit is selected.

Surgical Anatomy and Operative Technique

The coronal incision is favored for cosmetic reasons, but unilateral frontal craniotomy is sufficient for unroofing the orbit. It is useful to explore the chiasm intradurally first, for if there is chiasmal involvement, orbital exploration is usually not indicated. If the tumor is confined to a single optic nerve, and the presence of tumor has been proved intradurally, the nerve should be sectioned at this time as close to the chiasm as possible. Obviously there is no reason to save a stump of optic nerve; the farther the section from the tumor, the less likelihood that "straggling" tumor cells will grow at the resection margin. If tumor is not found by intradural inspection, it is wise to wait until the orbit is explored and tumor verified before prechiasmal optic nerve is sectioned.

Received for publication February 6, 1969.
Revision received June 9, 1969.

604
In either case, an extradural approach uncovering the floor of the anterior fossa is made toward the anterior clinoid. Orbital unroofing is quite simply achieved with a drill and a variety of small rongeurs. This process must be extended through the optic canal so that the dural sheath, continuous with the optic nerve, is uncovered. The periorbita, particularly in young children, is very thin but is a discrete structure and can easily be opened in a cruciate fashion. The orbital structures are difficult to identify in young infants, particularly when they are compressed, thinned, and attenuated. Magnification by operating loupes or the dissecting microscope can be helpful in these cases.

The major structures encountered initially are the levator and superior rectus muscles, and these must be identified (Fig. 1). The trochlear nerve is very difficult to identify because of its small size. In older children, when the structures are of sufficient size and exposure is large enough to allow manipulation, it has been possible to identify the levator origin and place a suture through it. Although the superior rectus muscle arises directly from the mid-portion of the annulus, the levator arises on the medial side of the annulus of Zinn and curves in a lateral direction over the optic nerve. If the nerve resection is to be accomplished in one piece, the annulus must be opened by sectioning the levator origin and by retracting laterally the levator, its nerve supply, and the superior rectus (Fig. 1).

The third and sixth nerves enter the orbit laterally through the superior orbital fissure and supply the levator, superior rectus, and lateral rectus muscles. The branches of the third nerve to the inferior and medial rectus and the inferior oblique muscles pass under the optic nerve. The trochlear nerve enters the orbit at the superior orbital fissure, and crosses over the levator to innervate the superior oblique muscle. It cannot be spared if the annulus is to be opened; however, the resulting deficit is virtually imperceptible and of no functional consequence after optic nerve resection. Thus, the superior rectus and levator muscles should be retracted lat-