Removal of Certain Hypophyseal Tumors by the Transantral-Sphenoid Route

HENDRIK J. SVIEN, M.D., AND THADEUS J. LITZOW, M.D.

Sections of Neurologic Surgery and Plastic Surgery, Mayo Clinic and Mayo Foundation, Rochester, Minnesota

In a previous publication on pituitary adenomas, it was pointed out that the postoperative mortality and morbidity were greater and the visual improvement less when the sella turcica was "excessively enlarged" than when the sella was only moderately enlarged. The sella was arbitrarily considered to be "excessively enlarged" if it exceeded 2.2 cm. in the anteroposterior diameter and 1.7 cm. in depth. The mortality rate for patients having such enlargement of the sella was 16.7 per cent, while for other patients it was 2.5 per cent. Extrasellar extension of the tumor, a factor which results in increased mortality, was present in about the same frequency in both groups of patients. Morbidity, as measured by the number of days in hospital and by the incidence of wound reopening, was significantly greater in the group of patients with "excessively enlarged" sellae. Vision was improved after operation in 44.8 per cent of cases in this group; in contrast, improvement occurred in 62.8 per cent of patients having only moderate sellar enlargement. At the time of the last follow-up examination, from 1 to 7 years postoperatively, 34.5 per cent of patients having large tumors had vision which was worse by at least 5 per cent, because of recurrence of the tumor or operative injury to the optic apparatus or its blood supply. For patients in the group with moderate sellar enlargement, the comparable figure was 11.4 per cent.

A transfrontal approach had been used for all patients treated surgically in the study just summarized. The results led us to investigate the trans-sphenoid route for removal of pituitary tumors associated with excessively enlarged sellae. Cushing employed the trans-septal-sphenoid approach for all pituitary tumors at the outset of his career, but later he expressed preference for the transfrontal route. Hirsch has continued to employ the trans-sphenoid approach to the present day, and Hamlin has followed him in this regard. During the past decade the trans-sphenoidal approach with or without modifications has been employed for hypophyseal tumors by British, French, and Scandinavian surgeons. Dott favors this approach for most hypophyseal tumors; as do Guiot and Thibaut; Deborsu reported its use in 80 cases. Hamberger et al. have modified the usual transnasal route, employing the Caldwell-Luck approach to the maxillary antrum, and proceeding thence to the sphenoid sinus.

Clinical Materials and Methods

This report concerns 10 patients with enlarged sellae who have been operated on by the approach to be described and who have been followed for at least 1½ years. Six of these patients had pituitary tumors (4, chromophobe adenomas and 2, acidophilic adenomas); 1 patient had a tumor confined to the enlarged sella that was almost entirely cystic and was considered pathologically to be craniopharyngioma; 2 patients had chordomas involving the sella; and 1 patient had a metastatic grade 4 carcinoma which eroded the sella and invaded the sphenoid sinus.

Five of the 6 patients with pituitary tumors and the patient with the craniopharyngioma had visual field defects. One of the 2 patients with acromegaly had no field defect, but had clinical signs and laboratory findings of progressing acromegaly despite a course of irradiation therapy.

Operative Technique. The approach that we have employed consists of lateral rhinotomy, entrance into the nasal cavity and adjacent maxillary antrum, and exposure of the sella through the sphenoid sinus.
The patient is placed in the horizontal supine position and anesthetized. An oral endotracheal tube is passed and, when in its proper position, is anchored in place by a wire which is led around the tube and secured to one of the lower bicuspid teeth. The hairs of the nostril are cut with scissors and both nasal cavities are then packed with cotton impregnated with a solution of 10 percent cocaine. The skin of the face is washed with soap and water for 5 minutes and prepared with a 75 percent solution of isopropyl alcohol. Head towels are applied, leaving the nose and the eye exposed on the side of the rhinotomy.

The position of the skin incisions is marked with an indelible pencil (Fig. 1), and the region is infiltrated with a solution of piperocaine (Metycaine), 1½ per cent, and adrenalin, 1:1000. After the skin is incised, the incision on the nose is deepened to divide the soft tissues of the nose from those of the cheek until the lower border of the nasal bone is exposed. With a chisel and mallet, the nasal bone is divided along the naso-

Fig. 1. Line of incision has been drawn with indelible pencil.

Fig. 2. Nose has been reflected to expose the nasal cavity.

maxillary suture line and elevated upward and medially. This permits the mobilized side of the nose to be reflected medially to expose the nasal cavity (Fig. 2). The soft tissues of the cheek are also reflected from the maxilla, exposing the rim of the pyriform fossa and the anterior wall of the maxillary sinus. The infraorbital neurovascular bundle is exposed and left intact.

The middle and inferior turbinates on the side of the approach are removed, and the mucosa of the lateral wall of the nasal cavity is reflected from its bony attachment and removed. The lateral bony wall of the nasal cavity is then removed, converting the nasal cavity and maxillary sinus on the operative side into a single large cavity (Fig. 3). The confluence of these 2 cavities provides excel-

Fig. 3. Sketch shows partial removal of the anterior wall of maxillary sinus and lateral wall of nasal cavity to afford confluence of these cavities.

Fig. 4. Removal of posterior third of nasal septum provides access to both sphenoid sinuses.
Selective Trans-Sphenoidal Hypophysectomy

Figs. 5 and 6. Removal of anterior wall of sphenoid sinuses exposes large sella dipping deeply into conjoined sphenoid sinus. Subtotal removal rather than try for complete removal of the tumor and all of the capsule.

Bleeding is controlled by coagulation when possible, by packing with Surgicel and by temporary compression with cotton pledgets. A piece of fresh or homologous preserved muscle is packed into the cavity. Petroleum jelly-iodoform gauze is placed over the muscle graft, in order to hold it in place, and is also packed into the maxillary sinus and nasal cavity. The reflected nasal flap and bone are repositioned and sutured with interrupted 5-0 chromic catgut sutures in the mucosal and subcutaneous layers and with interrupted 5-0 silk sutures in the skin. The continuation of the skin incisions into the nasolabial fold is closed similarly. A small gauze dressing is taped in place.

Postoperatively minimal care is required. Procaine penicillin (1,000,000 units) is administered the evening before operation and is repeated every 4 hours for 1 week. Sulfadiazine (1 gm.

Fig. 7. Flaps of capsule of pituitary gland have been reflected to permit removal of tumor.
Irrigations of the nose are started about the 10th postoperative day. Warm tap water or equal parts of warm tap water and of 3 per cent hydrogen peroxide are flushed into the nose with a 2-oz. car-and-ulcer syringe. Any large crusts that are not flushed out are removed with bayonet forceps through a nasal speculum. After several days of intermittent irrigation, the patient is instructed how to do his own nasal irrigations. At first these are done daily; but gradually the frequency is reduced, for most patients manage to maintain good nasal hygiene without any or with only very occasional irrigation. The patient is again seen 3 months postoperatively, when the adequacy of nasal hygiene can be assessed.

No major problems have presented themselves in the group of patients operated on in the manner described. The surgical incision invariably has healed neatly, and within a few months the scar has become inconspicuous and has constituted little or no concern for the patient (Fig. 8).

Selection of Patients. When the decision is reached to operate rather than irradiate, roent-
genograms of the skull and often tomograms of the sella turcica are studied. If the sella is “excessively enlarged” as described in the first paragraph, if the sella dips deeply into the aerated sphenoid sinus, and if there are no indications of parasellar extension, such as choked disc, extraocular nerve palsies, temporal-lobe signs, or hemiparesis, the patient is considered for the trans-sphenoidal procedure just described. Fig. 9 demonstrates the types of sellae which we believe are suitable for this approach. It should be noted that in each case the sphenoid sinus is well aerated. The sinus must be aerated to such an extent that a portion of the floor and the entire anterior wall of the sella turcica are separate from the sinus bone. This is not the case if the sinus is incompletely aerated.

Fractional pneumoencephalography is useful in outlining the extent of the intracranial portion of the tumor. The pneumoencephalogram carried out in one of our cases (Figs. 10, 11) showed that the tumor was confined to the sella. By means of this appraisal, one can determine whether or not the tumor projects into the floor of the 3rd ventricle or posteriorly into the interpeduncular cistern. If so, the approach described is not suitable as a primary procedure. Ordinarily, the trans-sphenoidal technique should be reserved for cases in which the tumor is confined to the sella and the immediate suprasellar region. However, Hamberger et al. have employed this approach in one case of craniopharyngioma in which the tumor mass displaced the floor and anterior portion of the 3rd ventricle. Fortunately, the tumor was cystic which facilitated radical removal.

Angiography is not as effective as pneumoencephalography as a means of delineating the characteristics of the projection of the tumor beyond the confines of the sella; however, since aneurysms do infrequently occupy the sella and produce enlargement and erosion of this structure, and can simulate in every way the signs and symptoms produced by an intrasellar tumor, angiography does have a place in the preoperative study of some of these patients.

Another type of case in which this approach is indicated is that in which a secreting pituitary tumor is confined to the enlarged sella which projects down into the sphenoid sinus; there may be no visual field defect. Fig. 10 shows a roentgenogram of the skull of such a patient who had progressive signs of acromegaly despite a course of irradiation therapy. Moreover the pneumoencephalogram (Fig. 11) indicated that there was no extension of the tumor beyond the confines of the sella. Since operation, the stigmata of acromegaly have diminished, and the patient has resumed menstruation; she had had no periods for 4 years before operation. Removal of such a tumor by the transfrontal route carries some risk of damage to the optic nerves and chiasm, particularly if the chiasm is of the prefixed type or the optic nerves have not been spread by the encroaching tumor.

Another type of patient for whom the approach should receive consideration is the acromegalic in whom the frontal sinuses are enlarged to the extent that a transfrontal flap, designed to avoid these sinuses, would be inadequate to provide necessary exposure of the optic nerves and chiasm. In our opinion, one should not deliberately open
the frontal sinuses in performing a transfrontal craniotomy because, by so doing, one invites serious complications, particularly infection.

Results

Effects of Operation on Visual Status. Six of our patients had preoperative visual field defects, and in each case improvement in visual status was noted early in the postoperative course. Visual improvement has been maintained in each case throughout the period of follow-up.

Fig. 12 a and b show preoperative and postoperative visual fields of a patient with chromophobe adenoma. The patient had been aware of impaired vision for 5 months before operation. The fields have remained normal during the 3 years since operation. A roentgenogram of the skull of this patient is shown in Fig. 9 c.

Fig. 13 a and b shows preoperative and postoperative visual fields of a patient with an acidophilic adenoma and early acromegaly (see the roentgenogram of the skull, Fig. 9 d). He first became aware of visual difficulty 2 months before operation. His field defect progressed despite a course of irradiation therapy, but his visual fields returned to normal before he was dismissed from the hospital on the 10th postoperative day and have remained so during a 3\(\frac{1}{2}\)-year follow-up. He has no signs of pituitary insufficiency. Since operation, there has been a definite regression of the stigmata of acromegaly.

Fig. 14 a and b depicts preoperative and postoperative visual field defects of a patient who had had visual loss for at least 5 months before operation (see roentgenogram of skull, Fig. 9 b). He was followed postoperatively for 5 months and then was returned to the hospital in status epilepticus. Examination revealed chocked discs and evidence of a large mass in the left temporal lobe. At operation, a large, necrotic, sterile, edematous mass of brain tissue (presumably a late reaction to intensive irradiation therapy) was removed. The patient had had irradiation therapy elsewhere 15 months before his operation on the pituitary gland. Because of marked personality change (Klüver-Bucy syndrome?), he has needed institutional care since the 2nd operation; consequently, it has not been pos-
Selective Trans-Sphenoidal Hypophysectomy

Fig. 13. a. Preoperative visual fields. b. Visual fields of same patient 8 days postoperatively, showing full return of vision.

Fig. 14. a. Preoperative visual fields. b. Visual fields of same patient 2 months postoperatively, showing decrease in size and in density of scotomata.
possible to determine the present status of his visual fields.

Fig. 15 a and b shows the visual fields of a patient with craniopharyngioma (see the roentgenogram of the skull, Fig. 9 a). She had had visual loss for at least 8 years before operation. Improvement during the 12 months since surgery has been slight, but definite, as is demonstrated by the lesser density of the scotomata after operation. In view of the long period of compression of the optic nerves before operation (8 years), one perhaps cannot expect more in this case.

Complications. Nine of the 10 patients on whom this procedure was carried out are living at the present writing. One patient who harbored a malignant pituitary tumor sustained a massive hemorrhage from the nose some weeks after operation. However, the tumor had produced a visual field defect and had eroded through the enlarged sella, completely filling the sphenoid sinus and invading the walls of this structure. Fig. 16 demonstrates the invasive aspects of the tumor and its extension into the sphenoid sinus. Spontaneous intracranial hemorrhage and massive nosebleed of this type have been observed even when no intervention has been carried out. It is likely that the tumor in these cases not only destroys bony canals through which the carotid arteries pass into

Fig. 15. a. Preoperative visual fields. b. Visual fields of same patient 10 months postoperatively, indicating lessening of density of scotomata.

Fig. 16. Tomogram of skull demonstrates invasion of sphenoid sinus and erosion of sella turcica and bony walls of sphenoid sinus by malignant tumor.
the skull but also invades and eventually destroys the vessel walls, and so produces massive hemorrhage.

Rhinorrhea did not occur in any of our trans-sphenoidal cases. If the surgeon does not cut the superior portions of the capsule of the tumor and removes only that portion of the capsule which is present in the depths of the enlarged sella, leakage of cerebrospinal fluid is not apt to occur.

Infection, manifested by meningitis or by abscess in the operative site, has not been encountered in this series.

References


3. Dott, N. Personal communication.


