EXPERIENCE WITH SURGICAL TREATMENT IN TWENTY CASES OF PITUITARY ADENOMAS*

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RECENTLY, occasion arose to review the cases of hypophysial adenoma treated surgically at the Ochsner Clinic during the 12-year period from its founding on Jan. 1, 1942 through Dec. 31, 1953. All operations were performed by me in accordance with an arrangement whereby pituitary operations done elsewhere at the teaching hospitals affiliated with the Tulane Medical School were performed by my associates. Although this 12-year experience with private patients having pituitary tumors might lead the reader to expect an analysis of 50 or more cases, there were only 20 patients, and one of these had been operated on previously by another surgeon. In addition to this group of patients treated surgically, 10 patients with pituitary adenomas received deep roentgen-ray therapy only.

There are two chief reasons for this relatively small experience with pituitary adenomas. First, patients with the classical pituitary adenoma syndrome of bitemporal hemianopsia and an enlarged sella turcica are being referred directly to specialists in roentgenotherapy, who are now available in all but the smaller communities. Secondly, there are now approximately 850 practicing neurosurgeons in the United States, among whom the limited number of patients with pituitary adenomas is being distributed. No longer can an American neurosurgeon expect to accumulate a large series of cases of pituitary adenomas or any type of neurosurgical case other than ruptured intervertebral disk and head injury. This means that in the coming decades most neurosurgeons will have relatively limited experience with brain tumors, spinal cord tumors, trigeminal neuralgia, and the other diseases that once monopolized the neurosurgeon’s time. As a consequence, most neurosurgeons will devote an ever increasing portion of their time to complex neurological problems, such as intractable pain, headache, epilepsy and abnormal involuntary movements, which may or may not require surgical treatment.

TWO SURGICAL DIVISIONS OF PITUITARY TUMORS

Most writers have divided pituitary adenomas into two groups: those confined to the immediate region of the sella turcica and those with extension of a large portion into the brain or nasopharynx. There is good reason

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for this division because the surgical problems presented by the two types are unrelated and the mortality rate is much higher in the latter group. The mortality rates for the large tumors were 35 per cent in Olivercona's series,\(^1\) 33 per cent in Jefferson's series,\(^6\) and 34 per cent in Horrax's series.\(^5\)

**ADENOMAS WITH CEREBRAL EXTENSIONS**

Only 2 of my 20 patients had pituitary adenomas with large portions extending into the brain. The great size and formidable location of the lesions were demonstrated pneumoencephalographically and confirmed surgically as well as at necropsy. Both of these patients (Mrs. M.A.S., aged 27 years and Mr. C.C., aged 59 years) were stuporous prior to operation. In retrospect, these operations, performed in 1943 and 1946, were not well planned. The goal was to remove at one operation as much tumor as possible and to preserve the small amount of remaining vision. Probably it would have been better to plan a two-stage operation with removal of part of one frontal lobe and part of the tumor first. If this had resulted in restoration of consciousness and normal intracranial pressure, another operation could have been performed to remove still more of the tumor and decompress the optic apparatus.

Jefferson,\(^6\) White and Warren\(^3\) and others have written in an illuminating manner on the surgical management of these large tumors. Jefferson pointed out that operation on these patients is a course of doubtful wisdom and not often beneficial to the patient.

An example of nonintervention is the case of R.S., whom I examined in 1955. She had been successfully treated for a pituitary adenoma elsewhere many years before. The original operation had corrected the bitemporal hemianopsia and had enabled her to continue as manager of a large business office. Shortly after her retirement at the age of 65 years her sight began to fail, and when she consulted me, she was nearly blind. In spite of absence of manifestations of increased intracranial pressure, pneumoencephalograms showed extension of a large portion of the tumor into the right frontal lobe. Her insistent request for surgical treatment was not granted because she was healthy and happy and she had no living relatives to care for her if invalidism developed. This decision has thus far proved to be wise. When last seen on Oct. 20, 1956, she was still well and completely adjusted to total blindness.

**ADENOMA CONFINED TO REGION OF SELLA TURCICA**

The remaining 18 patients of the 20 in this series had relatively small adenomas confined to the immediate region of the sella turcica.

One of them (W.P.K.), a man aged 41 years, was operated on in 1941 by the late Walter Dandy, a left-sided approach having been used because vision was poorer on that side. Transient aphasia had followed operation but vision had promptly returned to normal.

When the patient consulted me 8 years later, he was again unable to read with the left eye and there was no vision in the temporal field of the other eye. At operation in 1949 via the old left-sided flap, an "empty" sella turcica was found. How-
ever, there was obviously extrasellar adenomatous tissue because the left carotid artery was displaced upward and medially, and this had, in turn, caused such acute angulation of the left optic nerve at its foramen that it was necessary to unroof the nerve into the orbit. The other optic nerve was not seen. Again, transient postoperative aphasia developed. Roentgen radiation was given for the first time.

When the patient was last examined 5 months after operation, the vision in the left eye was improved but bitemporal hemianopsia persisted. In August 1956 the patient wrote that vision had not deteriorated during the past 7 years and that he has "no trouble reading the newspapers and watching the girls." He is possibly correct in attributing the satisfactory results to the postoperative roentgenotherapy rather than to the operation.

Of the remaining 17 patients, 15 were operated on for failing vision and 2 for incapacitating headache. There were no deaths. Obviously, this has no statistical significance in view of the small number of cases. The operative mortality rate has always been low with this type of lesion, as indicated by a rate of 3.9 per cent in Horrax's series, 6.4 per cent in Olivecrona's series and 2 per cent in Jefferson's group. All but one of my 18 patients with small adenomas are still alive.

The patient (A.S.), a tailor 53 years old, had bitemporal hemianopsia that did not improve with radiation; actually, roentgenotherapy was discontinued because of decrease in visual acuity and enlarging bitemporal scotomata. At operation the adenoma consisted of a capsule containing chocolate-colored fluid. The capsule was completely dissected from the optic nerves and chiasm with resulting return of the visual fields and visual acuity to normal. The patient continued to work as a tailor until his death 17 months later from myocardial infarction.

*Indication for Operation.* It is my opinion that pituitary adenomas should be treated by radiation unless vision is already seriously threatened bilaterally. Of the 18 patients with adenomas confined to the immediate region of the sella turcica 6 were operated on because irradiation had failed to improve vision or relieve headache. The remaining 12 were operated on without a trial of irradiation because of bitemporal hemianopsia. Nine of the 12 also had one partially blind eye.

*Vision Made Worse by Operation.* The only patient (L.A.W.) whose vision was made worse by operation was a man 22 years old who had bitemporal hemianopsia of 6 months' duration and headache.

The adenoma, exposed through a right-sided craniotomy in 1946, proved to be solid and vascular. A retrochiasmal nodule was pulled down and under the optic chiasm in the manner described by Cushing. Complete blindness of the contralateral eye and ipsilateral 3rd nerve palsy resulted. The latter subsided in 6 months. Radiation therapy is still being kept in reserve.

When the patient was last seen in September 1956, he was working and in good health. He cautiously drives a car in a rural area with nothing more than central and nasal vision in one eye. He reads slowly, never for pleasure. Inasmuch as the patient and his relatives believe that the result of the operation was miraculously successful, only the surgeon is disappointed.
Cases of Recurring Visual Failure. In 3 patients visual failure recurred at intervals of 8, 6, and 3 years after operation.

One of them (W.O.), a man aged 33 years, was operated on in 1946 for a cystic adenoma that was causing bitemporal hemianopsia, without stigmata of hypopituitarism. When seen 5 years later, he could read with either eye but he still had no temporal vision in the right eye. Eight years after operation, the patient returned with blindness of the left eye and poor vision on the right. His vision had been failing for 6 months but he had been afraid to undergo another operation.

On Dec. 29, 1954 the chiasmal region was approached from the opposite (left) side. A large arachnoidal cyst containing 10 cc. of bright yellow fluid was found to be the principal cause of the failing vision. After the cyst was removed, the capsule of the adenoma was reopened and found to be empty. Parts of the capsule were dissected away, but apparently too much traction was exerted because 3rd nerve paralysis on the contralateral side appeared after operation.

Although the patient went home on the 7th postoperative day, he returned 11 days later with meningitis, from which he completely recovered. The last correspondence with him in September 1956 indicated that he was well and driving a tractor at a paper plant. He still had bitemporal hemianopsia but had no trouble in reading. The oculomotor nerve palsy disappeared. He denied having symptoms of hypopituitarism.

The second patient (W. S.), a man aged 44 years, was operated on in 1946 for a solid adenoma of the pituitary gland that had caused blindness on the left and loss of vision in the temporal field on the right during a period of 3 years. At operation the tumor not only bulged upward between the optic nerves but also protruded between the right optic nerve and right carotid artery. It was not adherent to the optic nerves and chiasm, and reasonably good decompression of these structures was accomplished. Roentgenotherapy was given a few weeks after operation.

In spite of periodic ophthalmologic examinations, the patient had to be led into my office 6 years later. His eyesight had been failing for 5 months and vision had disappeared abruptly from the useful eye (right) the day before. At operation on the next day the tumor was not much bigger than it had been originally but contained 10 cc. of chocolate-colored fluid. The right optic nerve was completely decompressed and the left optic nerve, which had long been useless, was severed; this permitted the right optic nerve and optic tract to migrate a few millimeters away from the thick capsule of the adenoma. Vision in the right eye gradually returned, and the patient went back to work in 60 days.

When last examined in October 1956, he had 20/20 vision in the right eye but a constricted temporal field. He was well, had no symptoms of hypopituitarism and was working as a salesman in a clothing store.

The final patient (E.L.S.), a woman aged 62 years, to have recurrence of visual failure after operation was operated on in 1951 because of bitemporal hemianopsia caused by a solid adenoma of the pituitary gland. A pneumoencephalogram was made preoperatively because of mild mental confusion, which was later attributed to barbiturates. The capsule of the adenoma was tight and some of the soft contents escaped when it was incised. Conservative and reasonably satisfactory decompression of the optic nerves was accomplished, and the patient left the hospital on the 7th postoperative day. The bitemporal hemianopsia disappeared and her
only residual complaint was complete anosmia. Roentgenotherapy was completed 6 weeks after operation.

Nearly 3 years later she was again having trouble reading, and a second course of irradiation was given. Correspondence with the patient’s brother and physician in October 1956 disclosed that she had just completed her third and final course of roentgenotherapy. She is still able to read but has lost interest in reading. Her memory is said to be poor; she is slightly confused at times, and does not eat well. She may be becoming senile at the age of 68 years.

**Operation for Incapacitating Headache.** Two patients had no visual disturbance but were operated on because of incapacitating headaches and enlarged sella turcica. One had acromegaly. Roentgenotherapy failed to relieve the headache in both cases.

The acromegalic patient (C.A.), a man aged 28 years, had not worked for 2 years because of severe bitemporal and frontal headache. At operation the capsule of the adenoma was found to be slack, and removal of its contents had no effect on the headache. However, the patient began working part time 1 year after operation, is now working full time as a policeman, and has noted 50 per cent improvement in the headache. Hypogonadism has persisted.

The other patient (R.B.), a man aged 28 years, had a pneumoencephalogram (normal) and bilateral arteriograms (normal) because unexplained somnolence developed 1 year after ineffective irradiation. At operation the diaphragm of the sella was hidden by large veins and was not opened. Paradoxically, the headache was relieved, and some of the less annoying symptoms are now controlled by testosterone. When last seen 6 years later in September 1956, the patient was still well, working full time, and complaining only of decreased sexual vigor.

**ENDOCRINOLOGIC FACTORS**

Chromophobic adenomas of the pituitary gland that have caused expansion of the sella turcica and have recently compressed the optic nerves and chiasm rarely produce much clinical or laboratory evidence of hypofunction of the endocrine glands. Decrease in libido and potenxia in men and amenorrhea in women are the commonest endocrinologic symptoms. Low basal metabolic rate, obesity, loss of sexual hair, hypotension and anemia are sometimes present in surgical patients but overt failure of the adrenal glands rarely has taken place at the time that vision begins to fail. In brief, although the patient with a chromophobic adenoma may have some subjective or objective stigmata of hypopituitarism, complete investigation by the endocrinologist rarely discloses laboratory evidence of serious pituitary insufficiency. Nevertheless, every candidate for surgical or roentgen-ray therapy of a hypophysial adenoma should be studied by an endocrinologist and observed at regular intervals thereafter.

In view of this relatively normal function of the pituitary gland despite physical compression and distortion by a chromophobic adenoma, it is not surprising that most patients subjected to surgical removal or irradiation of the adenoma have always done well without support from such agents as
corticotrophin or cortisone. However, during the past 6 years most surgeons have been giving ACTH during the period of surgical stress as a routine precaution. It is not possible to know whether this is of real value in the majority of cases, but Raaf and coworkers obtained the impression that such medication decreases postoperative edema of the face, and presumably of the brain, and helps control the postoperative fever. It was the impression of Horrax and associates that ACTH decreases the possibility of fatal hyperthermia.

Only 2 patients in this series (R.E.P. and J.T.) had serious postoperative disturbances of pituitary function.

The former, a man aged 58 years, had blindness in one eye, a temporal defect in the other and moderately severe headaches. At operation in 1950 a solid adenoma with retrochiasmal extension was removed. The course was stormy and he did not leave the hospital until the 20th postoperative day. He was drowsy, thirsty and incontinent. Probably, these symptoms were caused primarily by injury of the hypothalamus.

Nothing was known about the patient until 6 years later when a diagnosis of severe hypopituitarism was made elsewhere. In October 1956 the patient’s son reported that the patient was working, happy and reasonably well except when his supply of thyroid extract and cortisone became exhausted. His vision was about the same as before operation and he was able to read.

The other patient (J.T.), a man aged 47 years, had removal of a solid adenoma including a retrochiasmal extension on Feb. 4, 1953. This lesion had caused blindness of one eye, temporal blindness of the other and mild headaches. The nerve to the already blind right eye was sacrificed in order to accomplish adequate decompression of the chiasm. The postoperative course was stormy and the patient was drowsy and disoriented for several days. The blood pressure was low, and thirst and urinary output increased. The temperature did not rise above 104°F. When the patient was able to leave the hospital on the 21st postoperative day, he was still lethargic and disinterested. It was presumed that these symptoms were caused by injury of the hypothalamic region.

The patient is now receiving a maintenance dose of Hydrocortone Acetate® and Depo-Testosterone®. In October 1956 he was still reasonably well, working long hours and free of complaints. Vision in one eye is normal except for a field cut in the lower temporal quadrant.

**Pertinent Features in Remaining Cases**

Of the 20 cases of pituitary adenomas treated surgically, 12 have been described briefly or at some length. The remaining 8 cases are of no special interest and can be summarized as follows. Three were operated on in 1948, 1 in 1949, 2 in 1950, 1 in 1952, and 1 in 1953. Two had acromegaly, all had bitemporal hemianopsia, 5 had one blind or nearly blind eye, all obtained improvement in vision which was still being maintained in August 1956 or later, and all are active, working and reasonably well. The follow-up periods

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* R.P., female, 69 years; I.B., female, 39 years; J.H., female, 46 years; A.B., female, 52 years; M.S., male, 37 years; C.P., female, 26 years; M.H., female, 46 years, and W.M., female, 69 years.
for these 8 patients ranged from nearly 3 to 8 years. Only the 2 acromegalic patients have overt evidence of pituitary dysfunction.

ANGIOGRAPHY AND PNEUMOGRAPHY

In recent years much has been learned about the appearance of pituitary adenomas in pneumoencephalograms and angiograms as explained by List,7 Gurdjian et al.,4 Bakay and White2 and others. Apparently, these diagnostic procedures are being performed frequently in many hospitals. On the other hand, Horrax et al.5 have been reluctant to carry out such investigations in patients with definite clinical evidence of small adenomas impinging on the visual apparatus. However, all agree that pneumoencephalography or cerebral angiography is indicated if the symptoms are atypical and compatible with such diagnoses as craniopharyngioma, large aneurysm, meningioma of the tuberculum sellae or extrasellar extension of a pituitary adenoma. In order to rule out lesions simulating small pituitary adenomas, pneumoencephalograms were made on 6 of the 20 patients in this series, including the 2 who had huge extensions of the adenoma into the frontal lobe. Only 1 patient (R.B.) had bilateral arteriograms.

TECHNICAL CONSIDERATIONS

In this series the incisions in the scalp were either of the coronal type or unilateral and just behind the hairline. The bone flaps were small, fashioned with four burr holes, and medially placed. A left-sided flap was used on four occasions because vision was nearly absent on that side. In one instance the 1.5-inch circular trephine was satisfactorily used but an opening of this size could be a handicap if complications arose. The dura mater was opened near the edge of the bone flap instead of at the sphenoid wing. No attempt was made to close the dura mater tightly. Although preoperative spinal drainage was carried out in all cases, in 2 instances partial right frontal lobectomy was necessary to obtain adequate exposure. The olfactory nerve was frequently avulsed when the frontal lobe was retracted. Indeed, on three occasions both olfactory nerves were avulsed.

On two occasions the optic nerve to a nearly blind eye was deliberately sacrificed in order to relieve tension on the chiasm and functioning optic nerve. On three occasions a retrochiasmal nodule was delivered by pulling it down and under the chiasm. However, it is possible that a retrochiasmal extension of the tumor was overlooked on one or more occasions. The anterior cerebral artery has not been severed between silver clips.

The capsule of the adenoma was usually coagulated and opened between the optic nerves but in 2 cases the tumor also presented itself between the optic nerve and carotid artery and was also opened there. One adenoma was opened posterior to the anterior cerebral artery as well as between the optic nerves. On several occasions decompression of the optic chiasm and nerves has been inadequate because of the vascularity of the tumor or because of the thickness of the capsule. Indeed, the contralateral optic nerve was not always
seen. Possibly I have been too conservative in the attack on the adenoma but the danger of damage to an optic or third nerve has been the restraining factor. No patient was returned to the operating room because of suspected intracranial hematoma but this was seriously considered in one instance (J.T.).

FOLLOW-UP STUDIES

The 2 patients having large extensions of pituitary adenomas into the cerebral hemisphere died in the hospital after operation. Another patient died of myocardial infarction 17 months after a successful operation. On Aug. 1, 1956, the remaining 17 patients were alive; thus, the survival period for these ranged from approximately 3 to 10 years. All 17 had vision and all but 1 were working. This woman (E.L.S.), aged 68 years, has become senile.

SUMMARY

Twenty consecutive patients with hypophysial adenomas were treated surgically during the 12-year period ending Dec. 31, 1953. Ten others received deep roentgen-ray therapy only. The only 2 patients whose adenomas invaded the brain were stuporous before operation and died in the hospital. One patient died 17 months after operation of myocardial infarction. In the other 17 patients vision was being maintained on or after Aug. 1, 1956, a follow-up period of approximately 3 to 10 years. All patients are working except a woman, 68 years old, who has become senile. Pituitary adenomas should be treated by roentgen-ray therapy unless vision is already seriously threatened bilaterally.

REFERENCES