Double Midline Intracranial Tumors of Vestigial Origin: Contiguous Intrasellar Chordoma and Suprasellar Craniopharyngioma

Case Report*

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This report describes the simultaneous occurrence of an intrasellar chordoma and a suprasellar craniopharyngioma in the same patient, a combination which to our knowledge has not previously been recorded. The diagnostic problems posed by the coincidence of 2 superimposed midline intracranial tumors, and the oncologic questions raised by the concomitant development of 2 different neoplasms of vestigial origin constitute the main interest of this case.

Case Report

History. A 53-year-old real estate broker (B.S., Hosp. #00-89-67) developed low back pain radiating to the left hip and leg in February, 1963. Examination at an outside hospital revealed a left foot drop with hypesthesia and muscle weakness in the 5th lumbar nerve root distribution, typical of intervertebral disc protrusion at L4-L5. This was confirmed by myelography. There was also an incomplete left 3rd nerve palsy. On March 4, 1963, laminectomy at L4-L5 on the left revealed a protruding disc at that level.

Several days later the patient developed prolonged mental confusion. Electroencephalography revealed diffuse slowing without focal abnormality. A roentgenogram of the skull demonstrated marked erosion of the sella turcica with extensive destruction of its floor, consistent with an intrasellar mass (Fig. 1). Pneumoencephalography confirmed the presence of this large mass extending apparently beyond the sella. The 3rd ventricle was not visualized.

Operation. On March 18, craniotomy disclosed a large encapsulated intrasellar tumor which contained numerous small cysts. Some of these were evacuated, and a large portion of the mass removed, the microscopic structure of which was reported to be that of a chordoma.

Course. Following operation the partial left 3rd nerve lesion increased to complete palsy. The patient also continued to show marked incoordination. Spinal puncture revealed increased intracranial pressure, and on April 24, 1963, a ventriculo-atrial shunt was performed. Radiotherapy (6000 r) was also directed to the sella. The ataxia and 3rd-nerve palsy progressively improved over the next 6 months. The ataxia then returned and, in December, 1963, an electroencephalogram showed spotty focal abnormality and slow-wave dysfunction. A pneumoencephalogram failed to fill the anterior portion of the 3rd ventricle; this was attributed to extension of the intrasellar mass. A second ventriculostomy was performed on the opposite side, followed by clinical relief provided both shunts were kept patent by pumping.

In May, 1964, however, ataxia and progressive disorientation returned, culminating in a marked confusion. Examination at the Palo Alto-Stanford Hospital elicited a complete left-sided ptosis, diminished visual acuity, normal visual fields, no papilledema, and no other abnormal physical signs. Laboratory investigations of blood, electrolytes and urine were normal. The cerebrospinal fluid obtained at pneumoencephalography was clear and colorless; it contained 10 white blood cells (5 neutrophils and 5 lymphocytes) per c. mm., 12 red blood cells per c. mm. and 172 mg. of protein per 100 ml. A millipore filter from the fluid was positive for tumor cells. A roentgenogram of the skull showed gross enlargement of the sella, with erosion of its floor, and thinning with posterior displacement of the dorsum; the anterior clinoid processes were, however, present. Pneumoencephalography and ventriculography demonstrated a large mass occupying most of the 3rd ventricle (Fig. 2). A lateral view disclosed that this mass was...
major findings outside the central nervous system consisted in an acute bilateral staphylococcal bronchopneumonia accompanied by septicemia.

The brain weighed 1300 grams. The pial surface showed slight yellowish discoloration indicative of old leptomeningeal hemorrhage. On retracting the frontal lobes, a greenish-grey gelatinous suprasellar mass, loculated and focally calcified, with a smooth inferior surface was found above the optic chiasm, widening the interpeduncular fossa. The intact pituitary stalk was noted to be in its normal position. The hypophysis was raised slightly above the diaphragm sellae and compressed by a second underlying intrasellar neoplasm unconnected with the first. This neoplasm was partly greyish-pink and gelatinous, partly hemorrhagic. It had eroded the enlarged sella, which measured 3 cm. in diameter (Fig. 4). It was well defined and partly encapsulated, but had extended into the sphenoidal and the right maxillary sinuses. The walls of the sella were softened throughout and could be cut with scissors.

Mid-sagittal section of the fixed brain demonstrated replacement of the posterior two-thirds of the 3rd ventricle by the suprasellar tumor, which was well circumscribed, partly cystic and partly solid, with a greyish gelatinous cut surface punctuated by yellowish foci (Fig. 5). The cystic areas were intersected by greyish-white strands of fibrosis. Anteriorly, the tumor was firmly tethered to the optic chiasm and optic nerves. Posteriorly, it was separate from the pineal, which was easily identified. Subsequent coronal sections demonstrated bilateral displacement of the thalami by the centrally located neoplasm, which also compressed the left substantia nigra and cerebral peduncle.

The left calcarine cortex was the site of an extensive old hemorrhagic infarct, and symmetrical foci of old infarction were also noted to involve both halves of the tegmentum in the more rostral portion of the pons. These lesions were interpreted as secondary to a previous episode of tentorial herniation.

Microscopic Study. The previous surgical biopsies were reviewed, and sections from various blocks of the 2 tumors found at autopsy, as well as from the adjacent

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Fig. 2. Pneumoencephalogram. Large midline mass replacing most of the third ventricle and invaginating its floor.

Second Operation. On June 2, 1964, a second craniotomy was performed, and the 3rd ventricle approached transventricularly. A biopsy of the mass from the 3rd ventricle revealed a tumor which, microscopically, was entirely different from the previous biopsy and whose histological appearances were typical of craniopharyngioma.

Course. The patient did not recover from the operation, remained comatose, and expired on August 10, 1964, 20 months after the onset of his symptoms.

Post-Mortem Examination. (Autopsy #4-319). The

Fig. 3. Pneumoencephalogram. Lateral view. Air in the subarachnoid space clearly separates the suprasellar from the intrasellar mass. Note also air filling only the posterior portion of the third ventricle (arrow).

Fig. 4. Autopsy specimen. Superior view of sella turcica, almost completely occupied by intrasellar chordoma. AC: Anterior clinoid process; DS: Dorsum sellae; ICA: Internal carotid artery; PS: Pituitary stalk.
Double Intracranial Tumor

brain and pituitary, were stained with hematoxylin and eosin; iron-hematoxylin and Van Gieson; the Holzer stain for neuroglia; Mallory’s phosphotungstic acid-hematoxylin; the periodic-acid Schiff reaction counterstained with orange G for the pituitary; and Russell’s modification of the Mallory’s acid fuchsin-aniline blue method for pituitary granules.

Sections from the suprasellar tumor show a microcystic neoplasm, the elements of which were arranged in thin cords of uniform, angulated columnar cells resting on a collagen basement membrane, and in more solid groups of squamous cells which displayed clear-cut intercellular bridges with the Mallory’s phosphotungstic acid-hematoxylin stain. In many areas the squamous cell-elements were arranged in whorls, or formed definite “pearls,” with the tinctorial reactions of keratin. In others, the columnar elements were separated by loosely distributed stellate cells in a scantily fibrillated matrix, but transitions were seen between these and the whorl-forming squamous cells on the one hand, and the tall-columnar epithelial elements on the other. These fields, which present a typical “adamantinomatous” pattern, included a scanty, loose connective-tissue stroma which was delicately vascularized. In places the large cystic spaces were filled with an amorphous, hyaline-looking material. The histologic structure of this tumor was therefore characteristic of the so-called adamantinomatous form of the craniopharyngioma (Fig. 6).

Sections from the intrasellar mass revealed a completely different histologic appearance. The tumor was characterized by well-defined lobules composed of large and small vacuolated stellate cells which were either interspersed or grouped in a mucinous-looking matrix reacting positively with the PAS stain. Throughout, the tumor cells displayed a characteristic physaliphorous appearance due to the large number of intracellular vacuoles which were usually unstained and, in places, appeared confluent (Fig. 7). In the less cellular areas, there was an abundant amorphous and finely granular matrix. In places, the cells assumed a syncytial appearance. Mitotic figures were absent. In some areas, calcification was found in the mucinous matrix; in others, fragments of irregular bone were enmeshed amongst the tumor, representing presumably the destroyed wall of the sella turcica. The tumor was encapsulated and intersected by bands of collagen of varying thickness. The histologic structure was typically that of a benign chordoma. A section of the pituitary compressed by the tumor revealed no significant microscopic abnormality.

Discussion

The recognition of an intrasellar chordoma alone, aside from the almost impossible diagnostic challenge posed by its association with another intracranial neoplasm, may be difficult on clinical grounds. However, the diagnosis of chordoma should be included in a consideration of symptoms referable to a space-occupying lesion encroaching upon the sellar or parasellar structures, such as uni- or bilateral cranial-nerve palsies, brainstem compression, involvement of the optic chiasm or optic nerves, and invasion of the nasopharynx.

The differential diagnosis should include pi-
chordomas from craniopharyngiomas; in the former, the pneumoencephalogram may reveal a characteristic layer of air in the subarachnoid space which separates the tumor from the other intracranial structures, as was demonstrated in this case. With craniopharyngiomas, especially of large size, the pneumoencephalographic findings are characteristically those of a suprasellar mass, with the production of deformity or obliteration of the hypothalamic portion of the 3rd ventricle. In some cases they may deform the inferior margins of the frontal horns, and cause obstruction of the foramen of Monro with consequent intracranial hypertension.

Both tumors appear at any age, which is therefore of no help in the differential diagnosis. Though 70% of craniopharyngiomas appear clinically before the age of 20, they are not uncommon in later life, although rather rare after 50 years of age. Chordomas usually manifest themselves in middle or late adult life, but have been recorded in subjects as young as 5 years.

From the oncological point of view the interest
tuitary adenoma, suprasellar meningioma, craniopharyngioma, carcinoma of the nasopharynx, and mucocele of the sphenoidal sinus. Suprasellar meningiomas usually produce primary optic atrophy and spare the base of the skull. Pituitary adenomas and craniopharyngiomas usually manifest themselves clinically by endocrine disturbances, none of which were evident in the present case.

Roentgenograms may suggest the diagnosis of chordoma by revealing an unusually extensive destruction of the sella turcica, its floor or the clivus. When malignant, it may also expand above the tentorium and involve the 3rd ventricle. The presence or absence of calcification is of relatively little value from the differential diagnostic point of view. Although craniopharyngiomas are credited with fairly constant calcification demonstrable in plain roentgenograms (70 to 80% of of cases in Tavernas and Wood's material), intrasellar chordomas have been shown to contain calcium deposits or bony sequestra in one-third of the cases. An important feature, seen at pneumoencephalography, may serve to distinguish

*Fig. 6. "Adamantinomatous" pattern of craniopharyngioma (suprasellar tumor).*

*Fig. 7. Microscopy of intrasellar tumor (chordoma). Intra- and extracellular vacuolations giving the typical "physaliphorons" appearance.*
of this case lies in the unique occurrence of 2 midline cerebral tumors both of which are vestigial in origin but histologically unrelated.

Multiple or multifocal primary brain tumors of identical histologic types have been repeatedly reported and discussed. They are usually tumors of the glioma group, most often glioblastomas,\textsuperscript{14,18} The simultaneous occurrence of multiple intracranial tumors of diverse types is also well documented; Elam and McLaurin have reviewed the association of intracranial glioma with meningioma in 19 reported cases,\textsuperscript{2} a concurrence which, on statistical grounds, Russell and Rubinstein regard as probably coincidental.\textsuperscript{18} The association of gliomas with chromophobe adenomas has also been reported.\textsuperscript{24} A multiplicity of cerebral tumors of different histologic types, meningiomas, schwannomas and gliomas, is a well-known feature of the central form of von Recklinghausen's neurofibromatosis.\textsuperscript{1,18}

It might reasonably be expected that congenital intracranial tumors of maldevelopmental origin would show a greater tendency to multiplicity than neoplasms belonging to other types. In actuality, the literature indicates an extreme paucity of authenticated examples of this kind. In the group of intracranial teratomas and teratoid tumors, Ingraham and Bailey have described the occurrence of bilateral frontal teratomas;\textsuperscript{21} Russell mentions the association, in one of her cases, of an atypical teratoma of the pituitary (so-called "ectopic pinealoma") with a minute dermoid cyst of the pineal gland;\textsuperscript{17} James and Dudley reported the simultaneous occurrence of a typical teratoma of the pineal with an atypical teratomatous infiltration of the neurohypophysis.\textsuperscript{12}

The origin of the craniopharyngioma is still a matter of debate. The generally assumed hypothesis that it is derived from Rathke's pouch and its derivatives\textsuperscript{8} has been questioned;\textsuperscript{18} although it is often stated that the tumor arises from embryonic nests of squamous cells situated mostly near the junction of the pituitary stalk with the pars distalis and widely regarded as representing remnants of the original Rathke's pouch, this is difficult to reconcile with the observation that these epidermoid nests are very rarely observed before adult life.\textsuperscript{10,11} On the other hand, the alternative view that in many cases these nests result from the metaplasia of adult pituitary cells does not necessarily argue against the embryonic origin of the craniopharyngioma, since such nests have also been observed in the newborn.\textsuperscript{5} At all events, whether the craniopharyngioma is derived from the original Rathke's pouch or is to be aligned from the pathogenetic point of view along other forms of suprasellar epidermoid cysts, its congenital and maldevelopmental origin is not in doubt. An association with other intracranial tumors has occasionally been reported; Carson and Hellwig have recorded its coincidence with a cystic astrocytoma of the left temporal lobe in a child,\textsuperscript{3} and Northfield and Russell have illustrated its chance finding with a massive pontine glioma in a 4-year-old boy.\textsuperscript{16}

Whether chordomas should, like craniopharyngiomas, be regarded as congenital tumors of maldevelopmental origin is an open question, but like the latter they can be considered to be of vestigial nature. Willis is of the opinion that notochordal vestiges constitute the source of most or all chordomas.\textsuperscript{22} The so-called ecchordoses, or ecchordoses physaliformae, originally described by Virchow and said to be found incidentally in 2% of all autopsies\textsuperscript{19} essentially constitute ectopias of the notochord, and should therefore be regarded as distinct from the intra-osseous notochordal vestiges noted above;\textsuperscript{20} according to Russell and Rubinstein, it is doubtful whether they ever give rise to true tumors.\textsuperscript{19} Associated congenital anomalies have been recorded in a few cases of chordoma; Cappell has described a chordoma at the 4th cervical level associated with an independent ecchordosis of the dorsum sellae;\textsuperscript{2} Harvey and Dawson have mentioned the coincidence, in one case, of a cranial chordoma with multiple chordomas of the left arm.\textsuperscript{9} Willis has reported the association of a sacral chordoma with multiple exostoses of many bones since childhood.\textsuperscript{23} He feels, however, that this association indicates no more than just a "possibility that some constitutional tendency to skeletal anomalies may underlie the genesis of chordomas". No coincidence with other intracranial tumors has, as far as we are aware, been reported.

Since the presence of parapituitary epithelial residues over the upper surface of the anterior lobe and especially around the infundibulum has been recorded in one-third of adult subjects, and since notochordal vestiges have been found embedded in the dorsum sellae of 4 to 5% of normal adults,\textsuperscript{22} their simultaneous presence in the same adult subject may well, on statistical grounds, be purely coincidental. However, their concomitant neoplastic transformation poses questions of oncogenesis which cannot be resolved.

**Summary**

I have reported the case of an adult patient with two midline intracranial tumors of vestigial origin, an intrasellar chordoma and a suprasellar craniopharyngioma, and have discussed the case from the diagnostic and oncologic points of view.

**Acknowledgment**

I wish to thank Dr. L. J. Rubinstein for his help in preparing this report, Dr. Lawrence Arinstein for his assistance and permission to use the clinical material,
and Dr. Howard Jones for contributing his opinion and the roentgenograms.

References