Case Records of the Massachusetts General Hospital



Weekly Clinicopathological Exercises

FOUNDED BY RICHARD C. CABOT

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Case 35-2002

PRESENTATION OF CASE

A nine-year-old right-handed girl was admitted to the hospital because of a suprasellar mass.

The girl had been well, with normal development, until about six months earlier, when her mother observed that she reported "feeling cold" with increasing frequency. During the four months before admission, she reported having impaired vision. Several optometric and ophthalmologic examinations failed to reveal a cause, in great part because the girl was frightened and unable to cooperate fully. At about the same time, her performance at school began to deteriorate dramatically; she reported having severe fatigue and was noted to sleep for 10 to 12 hours daily. Her appetite increased, but her weight did not. In the days leading up to admission, she began to have headaches. She had not sustained head trauma and did not have excessive thirst or polyuria.

Nineteen days before admission, the girl was examined by a neuroophthalmologist, who observed that she was frightened and withdrawn. With considerable effort, he found that the visual acuity in the right eye was 20/80 and in the left eye was 20/400. There was an afferent pupillary defect in the left eye and optic-nerve pallor bilaterally, and there was marked bilateral constriction of the visual fields, especially in the right homonymous fields.

A contrast-enhanced magnetic resonance imaging (MRI) study (Fig. 1, 2, and 3), performed five days later, showed an expansile mass, 5.0 by 3.5 by 3.5 cm, that arose from the suprasellar region and contained fluid–fluid levels. Several smaller, cystic spaces in a rim

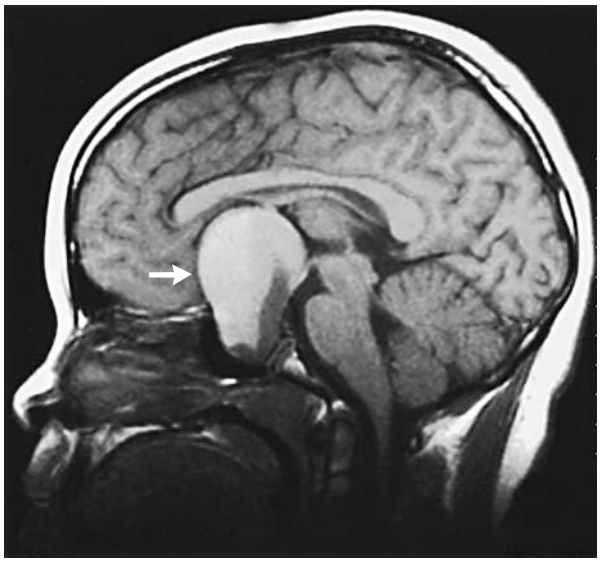


Figure 1. Sagittal T_1-Weighted MRI Scan of the Head Showing a Large, Heterogeneous Lesion (Arrow) Arising from the Sella Turcica and Extending Upward into the Suprasellar Cistern.

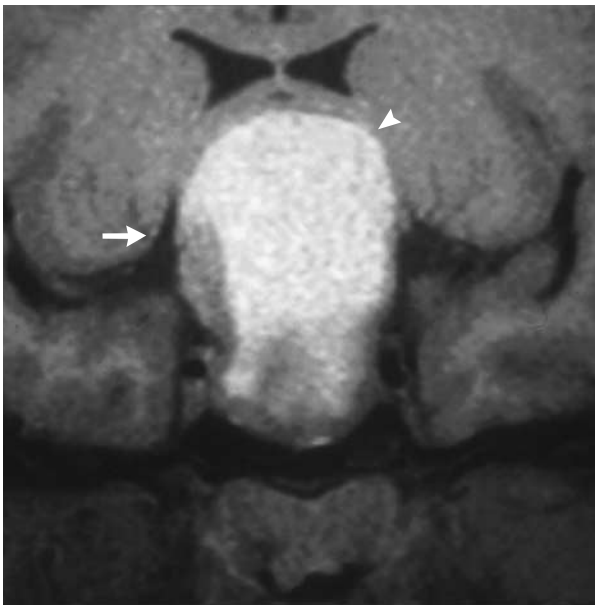


Figure 2. Coronal T_1-Weighted MRI Scan Showing Upward Displacement of the Optic Chiasm (Arrowhead) by the Lesion (Arrow).

This finding indicates that the lesion does not arise from the hypothalamus.

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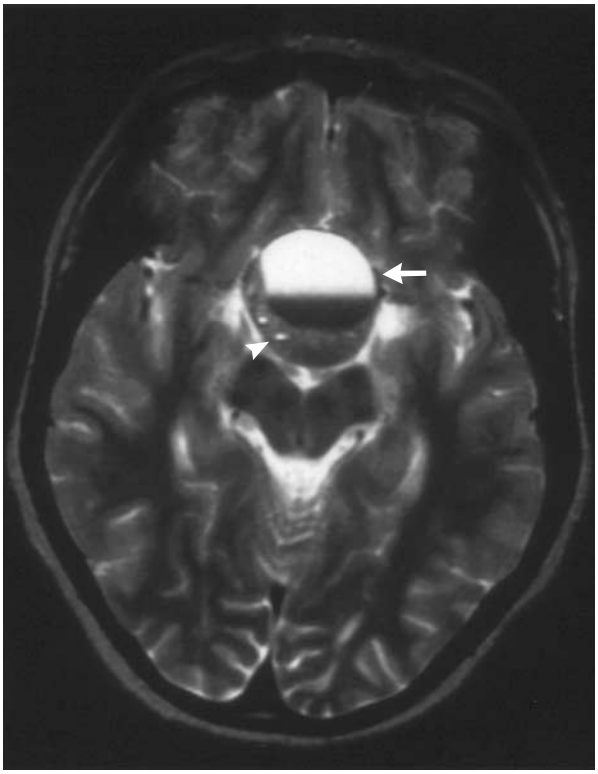


Figure 3. Axial T_2-Weighted MRI Scan Showing a Fluid–Fluid Level within the Anterior Component (Arrow).

The bright area probably represents serum, and the dark area represents the cellular components of blood. These findings suggest the presence of hemorrhage. There is a rim of soft tissue posteriorly. Smaller collections of fluid are visible as bright areas (arrowhead) in the solid portion of the lesion.

of soft tissue posteriorly also contained tiny fluid–fluid levels. No marked enhancement of the spaces was observed, but only a limited bolus (5 ml) of gadolinium had been injected. The mass splayed the optic nerves and in part obscured them and the optic chiasm. There was no prolongation on T_2-weighted images or enhancement of the brain structures that surrounded the mass. The flow voids of the internal carotid arteries were also splayed. A single anterior cerebral artery was identified. No other midline anomalies or defects were seen. A high-intensity signal in the right petrous apex was thought to represent marrow. A magnetic resonance angiographic study, performed the same day, also revealed splaying of the intracavernous carotid arteries. Flow-related enhancement was otherwise normal in the anterior and posterior circulation, and there was no evidence of stenosis. There was mild ventricular prominence.

Table 1. Laboratory Data Obtained Four Days before Admission.*

Variable	Result
Hematocrit (%)	34.3
White-cell count (per mm³)	7,400
Platelet count (per mm³)	301,000
Mean corpuscular volume (μm³)	80
Sodium (mmol/liter)	132
Potassium (mmol/liter)	4.2
Chloride (mmol/liter)	99
Carbon dioxide (mmol/liter)	22.1
Thyroxine (μg/dl)	3.5
Thyroid hormone–binding index	0.70
Free thyroxine index	2.5
Thyrotropin (μU/ml)	3.45
Cortisol (μg/dl)	3.3
Prolactin (ng/ml)	1,918
Somatomedin C (ng/ml)	167

*To convert the value for thyroxine to nanomoles per liter, multiply by 12.87. To convert the value for cortisol to nanomoles per liter, multiply by 27.59.

Laboratory studies were performed four days before admission. The urine was normal, as were the levels of urea nitrogen, creatinine, and glucose. Other data are summarized in Table 1. The girl was referred to this hospital.

The patient was an only child and lived at home with her mother. She was allergic to amoxicillin. Her father was said to have peptic ulcer disease. The temperature was 36.6°C, the pulse was 142, and the respirations were 20. The blood pressure was 165/75 mm Hg. On physical examination, the head and neck were normal. No rash, dry skin, lymphadenopathy, thyromegaly, or nuchal rigidity was detected. The lungs and heart were normal. There was no palpable breast tissue or axillary hair. The abdomen, arms, and legs were normal.

Neurologic examination showed that the patient was alert and fully oriented, with fluent speech appropriate to her age. The visual acuity was 20/200 in the right eye; with the left eye, she could only count fingers. Bitemporal visual-field defects were detected, and there were bilateral nasal defects that were larger on the left side. Both pupils were mildly reactive; no papilledema was evident, and the extraocular movements were full. The remaining cranial-nerve functions were preserved. Motor power was graded 5/5 throughout, without drift, and the sensation of a light touch, a pinprick, and joint position was intact. Coordination and gait were within normal limits, considering the sub-

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stantial loss of vision. The deep-tendon reflexes were ++ bilaterally, and the plantar responses were flexor.

A surgical procedure was performed. A chest radiograph obtained immediately before surgery was unremarkable, except that it showed endotracheal and nasogastric tubes and a right-sided subclavian line in good position.

DIFFERENTIAL DIAGNOSIS

DR. R. MICHAEL SCOTT*: This nine-year-old girl's clinical presentation (a six-month history of cold intolerance, a four-month history of visual difficulties, and a recent onset of headaches) directs us to the base of the brain, where the hypothalamic–pituitary axis and the visual apparatus are juxtaposed and where the imaging studies showed a large mass.

The differential diagnosis of a suprasellar mass in a child of this age is lengthy. It includes craniopharyngioma; germ-cell tumors; adenomas of the pituitary gland itself; Rathke's cleft cyst; epidermoid and dermoid tumors; Langerhans'-cell histiocytosis; masses resulting from inflammation or infection, such as tuberculoma or lymphocytic hypophysitis; and gliomas of the optic–hypothalamic system. The patient's history and the findings on physical examination will help narrow the differential diagnosis.

Important Elements of the Clinical History and Physical Examination

Sensation of Cold

The most striking aspect of this patient's presentation is her initial report of feeling cold, a symptom that suggests hypothyroidism and that, in this context, may be a manifestation of hypopituitarism. In addition, she had severe fatigue and was sleeping excessively — symptoms reinforcing both possibilities.

Visual Impairment

One of the patient's early problems was impaired vision, although abnormalities were not detected on examination. Shortly before admission, a neuroophthalmologist finally noted a relatively severe visual deficit, which must have come as a surprise to the patient's family. The timing of the discovery is in keeping with children's tendency to remain passive when they have severe disturbances in vision. I have cared for patients with tumors in the suprasellar region who have become completely blind in one or both eyes without reporting it and without any family member noticing a change in the child's behavior until the end stages of the process. In this case, the pallor of the optic nerves, signifying that they are atrophied and scarred, indicates that the process is long-standing. The right homonymous hemianopia suggests that there is compression of the left optic tract or of the junction between the left optic tract and the optic chiasm. The left-sided afferent pupillary defect indicates reduced transmission through the optic nerve on the left, but the exact location of the maximal compression in the optic apparatus is difficult to determine from the findings on physical examination because acuity was reduced in both eyes. The compression of the optic apparatus appears on the scans to be symmetrical.

Absence of Diabetes Insipidus and Developmental Abnormalities

Another striking finding in this patient's history is the absence of symptoms of diabetes insipidus. Children with certain neoplastic and non-neoplastic suprasellar masses, including germ-cell tumors, sarcoidosis, lymphocytic hypophysitis, and Langerhans'-cell histiocytosis, often present with diabetes insipidus.[1,2] Thus, the absence of this disorder makes these diagnoses unlikely. Another salient feature of this child's clinical history is her normal development. Most patients with craniopharyngioma have insufficient production of growth hormone.[3] The patient's appetite increased during the months before surgery, but her weight remained stable. Lesions of the hypothalamus, especially large astrocytomas of the hypothalamic–optic system during the first years of life, can disturb the appetite and cause generalized body wasting — a condition called the diencephalic syndrome. Since this patient's appetite was sustained rather than reduced, it is unlikely that she had this syndrome. In addition, this patient's lesion, as seen on the imaging studies, does not infiltrate the hypothalamus, and her young age argues against this diagnosis.

On the basis of the history alone, germ-cell tumors, craniopharyngioma, glioma of the hypothalamic–optic system, Langerhans'-cell histiocytosis, and inflammatory processes are unlikely causes of the patient's symptoms. The hormonal and visual abnormalities lead me to suspect the presence of an expanding mass involving the parenchyma of the pituitary gland itself.

May we review the imaging studies?

DR. JAMES D. RABINOV (Neuroradiology): The T_1-weighted sagittal MRI scan of the head (Fig. 1) shows a large lesion, 5.0 by 3.5 by 3.5 cm, arising from the sella turcica and extending upward into the suprasellar cistern. On the coronal MRI scan (Fig. 2), the optic chiasm is splayed and displaced upward around the lesion, probably accounting for the optic-nerve pallor. This image shows that the lesion is separate from the hypothalamic region, as Dr. Scott suggested, although the mass effect extends upward in that location. The lesion itself had a fluid–fluid level that was bright on the T_1-weighted sequence, indicating

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the presence of blood products or proteinaceous fluid. The T_2-weighted sequence (Fig. 3) shows that the fluid has a high-intensity signal anteriorly and a low-intensity signal posteriorly. These findings are consistent with the presence of hemorrhage: serum in the lesion has a high-intensity signal, and cellular components have a low-intensity signal. Posteriorly, the soft-tissue portion of the lesion (which has an intermediate signal) extends into the suprasellar cistern. Smaller hemorrhages (with a high-intensity signal) appear to be present in the solid portion of the mass.

A magnetic resonance angiogram showed no evidence of flow within the lesion, thus ruling out an aneurysm. The solid portion of the lesion did not enhance markedly, perhaps because it was a nonenhancing tumor or because the child received only 5 ml of gadolinium, rather than a full dose.

DR. SCOTT: Could the high-intensity signal represent lipid-containing material rather than blood products?

DR. RABINOV: The bright signal observed both before and after the administration of contrast material on the T_1-weighted and T_2-weighted images may represent lipid. However, when present in conjunction with a fluid–fluid level with a dark signal, the bright signal is most characteristic of a lesion that has hemorrhaged.

DR. SCOTT: What MRI findings help us make a more definitive diagnosis? The pituitary fossa is enlarged by the tumor, which bulges into a sphenoid sinus that is fairly well developed for a child who is only nine years old. The tumor has a striking, multicomponent configuration and extends up to the foramina of Monro. At least a portion of the third ventricle remained patent. If the tumor had grown even slightly larger before the diagnosis was made, the patient would have been much more ill, with hydrocephalus and increased intracranial pressure. Although the massive size and cystic nature of the lesion suggest that it is a giant aneurysm, such aneurysms are rare in children; there is no evidence on the MRI study of a vascular component, and the magnetic resonance angiogram is normal.

I am also struck by the multiple components of this mass. Much of it has high signal intensity on T_1-weighted imaging, suggesting the presence of lipid-containing fluid. On T_2-weighted imaging, the layered components are of mixed signal intensity, and the walls of the lesion itself appear to contain tiny cysts, each with its own fluid level. There are septations throughout the cyst proper, and the walls of the mass vary in thickness.

Important Features of the Imaging Studies

Findings such as those in this case might be seen in epidermoid cysts, which contain the breakdown products of desquamated epithelial cells and layers of cholesterol or other lipid-containing fluids. Rathke's cleft cysts may also be seen in the suprasellar region in children, but they are rare. These cysts form from the cells that are remnants of the outpouching of the primitive gut that develops into the anterior pituitary gland in the embryo.[4] In children, these lesions rarely become colossal, do not cause a marked mass effect, and usually contain fluid of uniformly high signal intensity on both T_1-weighted and T_2-weighted MRI studies.[5] Pituitary adenomas must be considered because they can occur in children and may have a component of cystic hemorrhage on presentation.[6] They can also enlarge the sella turcica. However, the immense size of the lesion in this case, as well as its multicompartmental configuration, would be highly unusual for such a diagnosis.

Another common lesion that the imaging studies suggest is craniopharyngioma. These tumors may be huge, may have large cystic components on presentation, and may enlarge the sella turcica. In children, an almost universal characteristic of craniopharyngiomas is the presence of calcification within the mass,[7] but this finding may be missed on MRI examination, since calcium does not generate a signal on MRI. In cases in which craniopharyngioma is in the differential diagnosis, I obtain a computed tomographic (CT) scan to determine whether calcifications are present. Not only can calcifications strongly suggest the diagnosis of craniopharyngioma, they may also identify areas where surgical dissection of the tumor will be difficult. Bony erosions are perhaps best seen on CT scans rather than on MRI scans, and knowing where bone has been eroded by tumor can help guide the surgeon. Dr. Rabinov, does this patient's mass suggest the presence of calcifications within the tumor?

DR. RABINOV: No.

DR. SCOTT: Because a CT scan was not obtained, we cannot be certain whether calcifications were present within the lesion; thus, craniopharyngioma cannot be ruled out. A tumor of the optic–hypothalamic system can be ruled out: both optic nerves are visible on the sagittal MRI scans and appear to be normal, and the coronal studies show that the caliber of the optic nerves, up to the mass itself, is normal. A cystic astrocytoma of the optic nerves and hypothalamus, with extension into the sella turcica to this extent, is virtually impossible.

Implications of the Laboratory Data

Can the laboratory data help us make a definitive preoperative diagnosis in this case? I believe that the answer is a qualified yes. The most remarkable laboratory finding is the prolactin level, which is 1918 ng per milliliter. Such an extremely high level suggests that the patient has a prolactinoma. Many tumors in

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the pituitary and in the suprasellar region can cause an elevation in prolactin as a result of the so-called stalk effect (in which a mass disrupts the pituitary stalk and interrupts the normal dopamine-mediated secretion of prolactin from the anterior gland). Prolactin levels can thus rise without the presence of a prolactin-producing neoplasm. With the stalk effect, serum prolactin levels are usually no higher than 150 ng per milliliter, but occasionally they have been reported to be in the 600s.[8,9] A level of 1918 ng per milliliter almost certainly indicates a prolactin-secreting neoplasm. There is no mention that this patient was lactating, a finding that would be unanticipated in a prepubertal girl without palpable breast tissue.

Other laboratory studies that support the clinical diagnosis of central hypothyroidism include the low level of serum thyroxine, the low thyroid hormone–binding index, the low free thyroxine index, and the normal level of thyrotropin. Why this neoplasm selectively produced this clinical effect is unclear. The level of somatomedin C, an indirect measurement of growth hormone levels, was normal; the single reported cortisol level, 3.3 μg per deciliter, could be normal, depending on the time of day the specimen was obtained. Some potentially helpful laboratory studies — in particular, tests for hormonal markers elaborated by germ-cell tumors, including human chorionic gonadotropin and alpha-fetoprotein — are not reported.

This bizarre sellar and suprasellar tumor could be of germ-cell origin — perhaps teratomatous, since its appearance on MRI suggests multiple components — and may produce prolactin. In my experience, germ-cell tumors have masqueraded and been mistaken for such lesions as craniopharyngiomas and tumors of the hypothalamic–optic system. Other types of tumors associated with prolactin secretion have been reported; one was an intrasellar gangliocytoma associated with a serum prolactin level of 1440 ng per milliliter.[10] Occasionally, two tumors are present simultaneously in the sella turcica; combinations of various adenomas and Rathke's cleft cysts have also been described.[11]

Diagnosis

I expect that a prolactinoma that had undergone cystic or hemorrhagic change was found, although a number of other types or combinations of tumors, such as a combination of Rathke's cleft cyst and prolactinoma, cannot be ruled out.

This patient appears to be an ideal candidate for a transsphenoidal surgical approach to the tumor, since the sphenoid sinus seems to be well developed for a nine-year-old child and since it appears that the cystic component of the tumor may be easily decompressed by this route. However, the transsphenoidal approach is not usually recommended in children with cystic tumors in this region. The lesions that are typical in this area — in particular, craniopharyngiomas — commonly adhere to vessels in the circle of Willis, the optic apparatus, and the undersurface of the hypothalamus, making attempts to remove them from below without direct visualization hazardous. A transfrontal craniotomy (removal of the orbital rim, roof, and frontal bone to reduce upward retraction of the frontal lobes) or combined frontal–temporal craniotomy would be the preferred approach in most patients with tumors of this size. A combined approach to the tumor — from below, to decompress the tumor fluid (the transsphenoidal route), and from above (frontal craniotomy) — could also be considered.

CLINICAL DIAGNOSIS

Craniopharyngioma or prolactinoma.

DR. R. MICHAEL SCOTT'S DIAGNOSIS

Prolactinoma.

PATHOLOGICAL DISCUSSION

DR. PAUL H. CHAPMAN (Neurosurgery): We approached this lesion by bifrontal craniotomy, with removal of the orbital rims to avoid unnecessary retraction of the frontal lobes. The olfactory nerves were dissected free of the undersurface of the frontal lobes to maintain their integrity during the exposure. The encapsulated tumor extended anteriorly to the tuberculum sellae. Neither optic nerve was evident. We removed a large amount of yellow fluid to decompress the mass. There was no evidence of hemorrhage. We then dissected the tumor capsule away from the adjacent structures, including the optic nerves and optic chiasm, the carotid and posterior communicating arteries with their branching vessels, the anterior aspect and floor of the third ventricle, and the anterior pituitary stalk. We removed the tumor completely from the sella turcica. The solid component of the tumor was yellow, friable, and not very vascular. The remainder of the pituitary gland was flattened against the floor of the sella.

DR. E. TESSA HEDLEY-WHYTE (Neuropathology): We received a large aggregate of hemorrhagic tissue, 8.0 by 2.0 by 2.0 cm, for examination. The tumor presented a diagnostic puzzle, because microscopical examination revealed epithelioid tumor cells growing in sheets and separated into smaller aggregates by a dense fibrovascular stroma, surrounded by a fibrous capsule (Fig. 4). The individual cells, which varied in shape from round to oval to elongated, had distinct borders and a moderate nuclear-to-cytoplasmic ratio. The nuclei had coarse chromatin and distinct nucleoli (Fig. 4, inset). In addition, scattered mitotic figures were present. The typical pituitary adenoma has either sheets or papillary-like chains of small monomorphic

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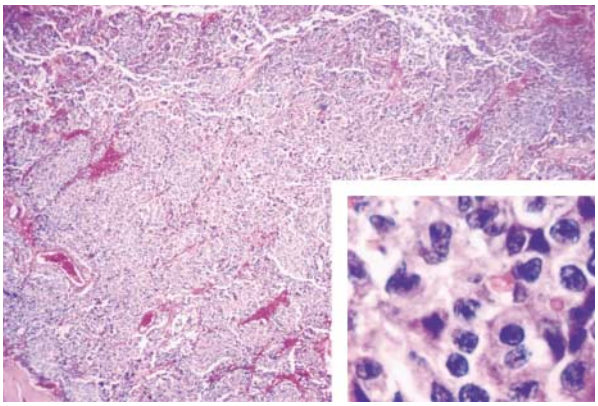


Figure 4. Photomicrograph of the Resected Tumor (Hematoxylin and Eosin, ×35).

The tumor consists of sheets of densely packed cells, with focal hemorrhage. At a higher magnification, mild pleomorphism and prominent nucleoli are visible (inset, ×500).

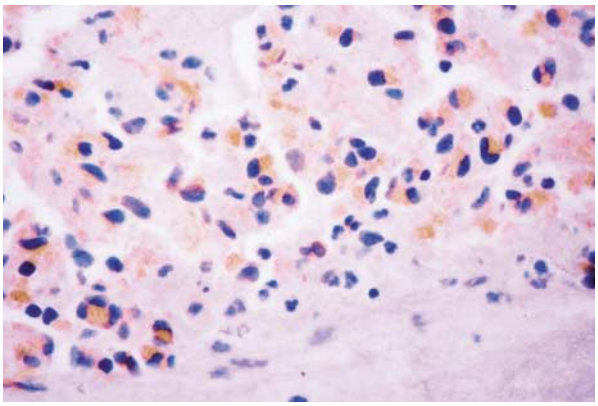


Figure 5. Immunoperoxidase Staining of Tumor Tissue for Prolactin (Diaminobenzidine with Hematoxylin Counterstain, ×500).

The strong staining for prolactin indicates that the tumor is a pituitary adenoma. Most of the tumor cells have cytoplasmic staining with a stippled pattern.

cells with round nuclei, indistinct nucleoli, and no obvious mitoses. Thus, the differential diagnosis included other tumors.

Immunoperoxidase stains were negative for a variety of substances, including cytokeratin, S-100 protein, chromogranin, human chorionic gonadotropin, placental alkaline phosphatase and human placental lactogen, HMB-45 (i.e., melanoma-associated antigen), and epithelial membrane antigen (of meningeal origin), except for a focus of reactivity for human chorionic gonadotropin. On immunoperoxidase staining for pituitary hormones, there was strong staining for prolactin, with a stippled, granular pattern in individual cells (Fig. 5), confirming the presence of a prolactin-secreting pituitary adenoma or prolactinoma. Scattered tumor cells also stained for growth hormone, a common finding in prolactinomas (Fig. 6). There was also some diffuse, faint staining for the beta subunit of follicle-stimulating hormone, but there was no staining for adrenocorticotropic hormone, the beta subunit of luteinizing hormone, the beta subunit of thyrotropin, or the alpha subunit of the glycoprotein hormones. A stain for Ki-67 showed a proliferation fraction of approximately 7 percent. Most pituitary adenomas have Ki-67–labeling indexes between 1 and 3 percent.[12-14] A higher proliferation fraction indicates a higher likelihood of recurrence.

Less than 2 percent of intracranial tumors in children are pituitary adenomas, and of all pituitary adenomas, roughly 2 percent occur in children.[15] The true incidence of prolactinomas is difficult to determine from surgical case studies, because many cases

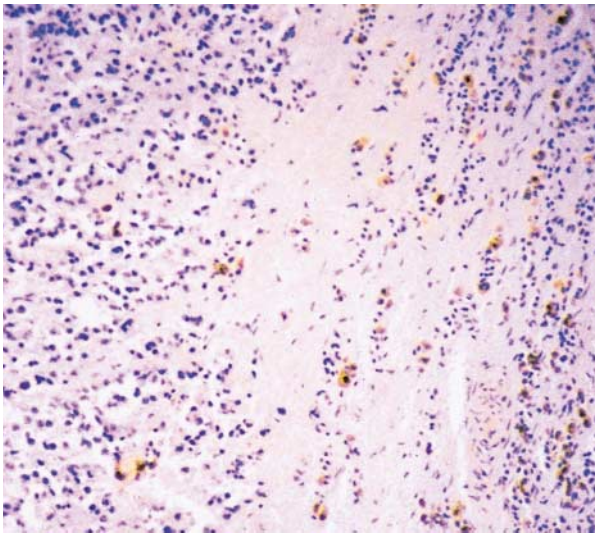


Figure 6. Immunoperoxidase Staining of Tumor Tissue for Human Growth Hormone (Diaminobenzidine with Hematoxylin Counterstain, ×145).

A remnant of normal pituitary tissue is present at the right-hand edge of the figure.

are treated medically. In one series of 150 pituitary adenomas in patients under 19 years of age, 78 (52 percent) were prolactinomas, 50 (33 percent) secreted corticotropin, and only 4 (3 percent) were nonfunctioning.[16] In the same series, prolactinomas were more common in females than in males, and the me-

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dian age of the patients was 14.5 years. Only 18 percent of the patients with prolactinomas presented with neurologic deficits, which were usually visual. Children with Cushing's syndrome due to corticotropin-secreting adenomas are younger than those with other adenomas, and nonfunctioning adenomas are less common in children than in adults.[15,16]

Are pituitary adenomas in children more aggressive than those in adults? The tumor in the current case has a higher proliferative fraction and is more pleomorphic than the usual pituitary adenoma in an adult, and it is very large. All these factors correlate with an increased likelihood of recurrence.[17]

DR. SCOTT: When my colleagues and I evaluated the radiologic characteristics of a series of pituitary adenomas,[6] we found a high incidence of evidence on MRI of hemorrhage in these lesions. Thus, when I see an expansile lesion in the sella and evidence of old or recent hemorrhage, I suspect the presence of a pituitary adenoma. This case is unusual because of the large size of the mass and the presence of large cystic spaces. Dr. Chapman, did you consider a transsphenoidal approach to resection of the tumor?

DR. CHAPMAN: We believed that the likelihood of successfully removing the entire tumor would be greater if we performed a transcranial operation than if we used a transsphenoidal approach.

DR. SCOTT: Another option would have been transsphenoidal decompression of the mass and subsequent treatment with bromocriptine to try to leave some pituitary tissue intact. Did you achieve this objective with the craniotomy?

DR. CHAPMAN: Yes.

DR. JAY LOEFFLER (Radiation Oncology): Is the patient being treated with adjuvant radiation therapy or bromocriptine?

DR. CHAPMAN: Neither. The prolactin level is now at the lower limit of the normal range. Surveillance with measurement of prolactin levels and MRI scanning will allow us to treat the patient in a timely fashion, should the tumor recur. She continues to have low levels of thyrotropin and corticotropin.

DR. RABINOV: Regarding the question of whether the MRI studies showed hemorrhage or lipids within the lesion: the bright T_1-weighted signal anteriorly could have indicated either. When bright signal is present in an area of low signal intensity, with posterior layering in a pituitary lesion, it usually represents hemorrhage. Sometimes, a fat-saturation sequence can be helpful, because lesions such as dermoid tumors can have fluid levels, and we use fat saturation to identify a lipid level. Such a sequence was not obtained in this case because a lipid component is much less common than a hemorrhage with serum and cell layers.

DR. SCOTT: If I had been confident that the contents of the cyst were blood byproducts and not lipid, my differential diagnosis would have been substantially shorter.

ANATOMICAL DIAGNOSIS

Prolactinoma.

ADDENDUM

Eighteen months after the operation, the patient has no evidence of recurrent prolactinoma; her prolactin levels remain normal. She takes levothyroxine (125 μg per day) and cortisol (10 mg per day). Because of failure to grow for one year, she takes growth hormone (0.3 mg per kilogram of body weight per week). She has normal vision in the right eye but remains virtually blind in the left eye. (This information was provided by Dr. John S. Palfrey [Pediatrics] and Dr. Suleiman N. Mustafa-Kutana [Pediatric Endocrinology], both of Boston Medical Center, Boston.)

REFERENCES

1. Willman CL, Busque L, Griffith BB, et al. Langerhans'-cell histiocytosis (histiocytosis X) — a clonal proliferative disease. N Engl J Med 1994;331:154-60.

2. Honegger J, Fahlbusch R, Bornemann A, et al. Lymphocytic and granulomatous hypophysitis: experience with nine cases. Neurosurgery 1997;40:713-22.

3. Sklar CA. Craniopharyngioma: endocrine abnormalities at presentation. Pediatr Neurosurg 1994;21:Suppl 1:18-20.

4. Craniopharyngiomas and suprasellar epidermoid cysts. In: Russell DS, Rubinstein LJ. Pathology of tumours of the nervous system. 5th ed. Baltimore: Williams & Wilkins, 1989:695-702.

5. Asari S, Ito T, Tsuchida S, Tsutsui T. MR appearance and cyst content of Rathke cleft cysts. J Comput Assist Tomogr 1990;14:532-5.

6. Poussaint TY, Barnes PD, Anthony DC, Spack N, Scott RM, Tarbell NJ. Hemorrhagic pituitary adenomas of adolescence. AJNR Am J Neuroradiol 1996;17:1907-12.

7. Harwood-Nash DC. Neuroimaging of childhood craniopharyngioma. Pediatr Neurosurg 1994;21:Suppl 1:2-10.

8. Albuquerque FC, Hinton DR, Weiss MH. Excessively high prolactin level in a patient with a nonprolactin-secreting adenoma: case report. J Neurosurg 1998;89:1043-6.

9. Smith MV, Laws ER Jr. Magnetic resonance imaging measurements of pituitary stalk compression and deviation in patients with nonprolactin-secreting intrasellar and parasellar tumors: lack of correlation with serum prolactin levels. Neurosurgery 1994;34:834-9.

10. McCowen KC, Glickman JN, Black PM, Zervas NT, Lidov HG, Garber JR. Gangliocytoma masquerading as a prolactinoma: case report. J Neurosurg 1999;91:490-5.

11. Nishio S, Fujiwara S, Morioka T, Fukui M. Rathke's cleft cysts within a growth hormone producing pituitary adenoma. Br J Neurosurg 1995;9:51-5.

12. Kawamoto H, Uozumi T, Kawamoto K, Arita K, Yano T, Hirohata T. Analysis of the growth rate and cavernous sinus invasion of pituitary adenomas. Acta Neurochir (Wien) 1995;136:37-43.

13. Mazal PR, Czech T, Sedivy R, et al. Prognostic relevance of intracytoplasmic cytokeratin pattern, hormone expression profile, and cell proliferation in pituitary adenomas of akromegalic patients. Clin Neuropathol 2001;20:163-71.

14. Shibuya M, Saito F, Miwa T, Davis RL, Wilson CB, Hoshino T. Histochemical study of pituitary adenomas with Ki-67 and anti-DNA polymerase alpha monoclonal antibodies, bromodeoxyuridine labeling, and nucleolar organizer region counts. Acta Neuropathol (Berl) 1992;84:178-83.

15. Partington MD, Davis DH, Laws ER Jr, Scheithauer BW. Pituitary ad-

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enomas in childhood and adolescence: results of transsphenoidal surgery. J Neurosurg 1994;80:209-16.
16. Kunwar S, Wilson CB. Pediatric pituitary adenomas. J Clin Endocrinol Metab 1999;84:4385-9.
17. Hsu DW, Hakim F, Biller BM, et al. Significance of proliferating cell nuclear antigen index in predicting pituitary adenoma recurrence. J Neurosurg 1993;78:753-61.

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