Pathologic Quiz Case

Sphenoid Sinus Mass in a 12-Year-Old Girl

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A 12-year-old girl was admitted to an outside institution with a 1-week history of fever, headaches, symptoms suggestive of sinus congestion, and progressive deterioration of visual acuity in the left eye. A day before the admission, she experienced a sudden and marked reduction of vision in her left eye. Imaging studies were performed, steroid treatment was started, and she was referred to our institution for definitive treatment. Ophthalmologic examination revealed visual acuity of 20/400 in the left eye and 20/20 in the right eye. The remainder of the neurologic examination results were within normal limits. Imaging studies of the head revealed a large, low-density mass that filled and expanded the sphenoid sinus (Figure 1, magnetic resonance image, thick arrows point to the mass and thin arrow to the unaffected pituitary gland; inset, computed tomogram, arrow points to the mass). There was erosion of the sell turcica, clivus, and left lateral wall of the sphenoid sinus, leading to displacement of the left optic nerve. The mass extended into the right ethmoid sinus and eroded its roof. The lesion was excised and sent for histopathologic examination. The specimen included multiple fragments of brown to black soft tissue with an aggregate measurement of 2.2 × 1.4 × 0.5 cm. Histologically, there were nests, cysts, and anastomosing trabeculae of epithelial cells (Figure 2, hematoxylin-eosin, original magnification ×10). The epithelial cells at the periphery were cuboidal to short columnar, showed nuclear palisading, and rested on well-developed basement membranes. The cells in the center of the nests were more loosely knit and showed foci of cystic degeneration, squamous differentiation with abundant “wet” keratin, and focal calcification (Figure 3, hematoxylin-eosin, original magnification ×10). There were foci of necrosis, mixed inflammatory infiltrates, and needle-shaped spaces consistent with cholesterol clefts (Figure 4, hematoxylin-eosin, original magnification ×20). The stroma between the epithelial islands was variably fibromyxoid to collagenous. Fragments of normal respiratory mucosa were seen. No brain or pituitary glandular tissue was identified.

What is your diagnosis?
Craniopharyngiomas are benign epithelial neoplasms that usually occur in the sellar region and comprise approximately 1.5% to 11.6% of all intracranial neoplasms. They are the most common of all nonepithelial intracranial neoplasms. Histologically, craniopharyngiomas are of 2 types: adamantinomatous and papillary. Adamantinomatous craniopharyngioma is a relatively poorly circumscribed lesion composed of nests and trabeculae of epithelial cells embedded in a fibrocollagenous stroma. The peripheral layer of epithelial cells shows nuclear palisading. The epithelial cells in the center are loosely knit and are termed the stellate reticulum. These may undergo cystic degeneration, which may be extensive in some cases. The central epithelial cells usually show abundant keratinization. Unlike the keratin seen in an epidermoid cyst, the keratin of adamantinomatous craniopharyngiomas is not flaky and has a diagnostic “wet” appearance. In addition, adamantinomatous craniopharyngiomas do not show an orderly squamous maturation and lack the keratohyaline granule-containing squamous cells and the anucleate squames. The “wet” keratin may undergo calcification and, occasionally, ossification. There may be focal necrosis with inflammatory and fibrohistiocytic reaction. Abundant xanthogranulomatous reaction with numerous cholesterol clefts is typical. The presence of sparkling cholesterol crystals in the turbid-brown cyst fluid gives it the “machinery oil” appearance. The histopathologic appearance of the less common papillary craniopharyngiomas is different. Papillary craniopharyngioma is a well-circumscribed lesion composed of cores of fibrovascular stroma lined by well-differentiated squamous epithelium that mimics squamous papilloma. Unlike adamantinomatous craniopharyngiomas, papillary craniopharyngiomas lack the stellate reticulum, “wet” keratinization, calcification, and xanthogranulomatous inflammation with cholesterol clefts. Cystic change is less frequent and less extensive, and the cyst fluid does not have the “machinery oil” character.

Adamantinomatous craniopharyngiomas occur predominantly in the pediatric population, although some cases occur in early adulthood. On the other hand, papillary craniopharyngiomas invariably occur in older adults. This explains the bimodal age distribution of craniopharyngiomas with one peak in childhood (age, 5–14 years) and the other peak in the sixth to eighth decades of life. Biologically, adamantinomatous craniopharyngiomas are associated with abnormalities of Wnt signaling due to mutations in the gene for β-catenin. Immunohistochemically, this can be demonstrated by the abnormal nuclear/cytoplasmic localization of β-catenin in adamantinomatous craniopharyngiomas. In contrast, papillary craniopharyngiomas show membranous staining pattern for β-catenin and do not show β-catenin gene mutations.

The striking similarity of adamantinomatous craniopharyngiomas to odontogenic tumors and occasional examples of papillary craniopharyngiomas with ciliated epithelium suggest that both these lesions arise from the remnants of the Rathke pouch. Consistent with this hypothesis, the Rathke cleft between the anterior and the intermediate lobes of the pituitary gland in the suprasellar region is the most common site of origin of these tumors. During the fourth week of human gestation, an outpouching of the ectoderm (the Rathke pouch) arises from the oral stomodeum under the inductive influence of the diencephalon. The Rathke pouch grows dorsally toward the future pituitary fossa and forms the anterior and intermediate lobes of the pituitary gland (the infundibular process from the ventral portion of the diencephalon forms the posterior lobe). Craniopharyngeal canal, the cord of cells joining the stromodeal ectoderm to the Rathke pouch, normally disappears by the 6th to 12th week of gestation, but persistent craniopharyngeal canals have been described. Although craniopharyngiomas usually arise from the Rathke cleft, they may occur anywhere along the path of migration of the Rathke pouch (ie, in craniopharyngeal canal rests). Rare examples have occurred in the pharynx, paranasal sinuses, sphenoid bone, cerebellopontine angle, optic chiasm, and pineal gland. Indeed, ectopic anterior pituitary gland and pituitary adenomas can occur anywhere along this path, and pharyngeal pituitary is a constant finding in humans.

Although usually benign, craniopharyngiomas often recur due to incomplete surgical removal. There are rare examples of squamous cell carcinomas developing in craniopharyngiomas. In both cases, the patients underwent surgical resection and radiotherapy for craniopharyngioma and multiple recurrences of craniopharyngioma occurred before the development of squamous cell carcinoma 16 to 35 years after the initial diagnosis.

References