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Endoscopic management of craniopharyngiomas

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Craniopharyngiomas are deep-seated anterior skull base lesions that are challenging to treat because of their location and locally aggressive behavior. In recent years, the endoscopic, endonasal technique has been developed for craniopharyngioma surgery to overcome the limitations of previously established microscope-based transcranial and transsphenoidal approaches. The endoscopic, endonasal technique provides a direct path to the tumor with panoramic visualization. Through the transsphenoidal surgical corridor, the endoscopic skull base surgeon can target the craniopharyngioma tumor located within the sella, suprasellar cistern, third ventricle, and prepontine cistern. The initial outcome data from endoscopic, endonasal case series in terms of extent of resection, vision improvement, and hypothalamic-pituitary dysfunction have been encouraging, although further follow-up of treated patients and analysis of outcomes are needed. We describe our technique for treating craniopharyngiomas via a fully endoscopic, endonasal, extended transsphenoidal approach.

Craniopharyngiomas are histologically benign epithelial tumors that arise from embryonic squamous cell rests of Rathke's pouch. Adamantinomatous craniopharyngiomas, often found in children, generally contain cysts that show rim enhancement with magnetic resonance (MR) imaging and calcifications on computed tomography (CT) (Figure 1A, B). Squamopapillary craniopharyngiomas, which are more common in adults, are both cystic and solid. Despite their benign nature, craniopharyngiomas have historically been challenging to treat given their deep-seated skull base location and aggressive local behavior. Craniopharyngiomas most often extend from a suprasellar location, frequently behind a prefixed chiasm, and either abut or strongly adhere to vital structures such as the optic apparatus, pituitary stalk, hypothalamus, anterior cerebral artery complex, and various perforating vessels that supply these structures. In the past, the treatment algorithm for craniopharyngioma centered on gross total resection (GTR). However, there has been recent evidence to suggest that subtotal resection complemented with adjuvant therapy may provide comparable tumor control.[1] The current management therapy that we employ involves maximally safe resection combined with as needed adjuvant therapy such as conformal radiotherapy, endoscopic intraventricular cyst fenestration, and intracystic infusion of antiproliferating agents. Surgical resection for craniopharyngioma was often more commonly pursued through a transcranial approach, particularly if the sella was not enlarged and the tumor had not invaded into the sella.[2-7] However, transcranial surgery typically requires some degree of brain retraction and manipulation of neurovascular structures en route to the targeted lesion. The application of the transsphenoidal approach to craniopharyngioma surgery provides a more direct trajectory to the tumor. Microscope-based transsphenoidal approaches were first applied to intrasellar, infradiaphragmatic lesions but

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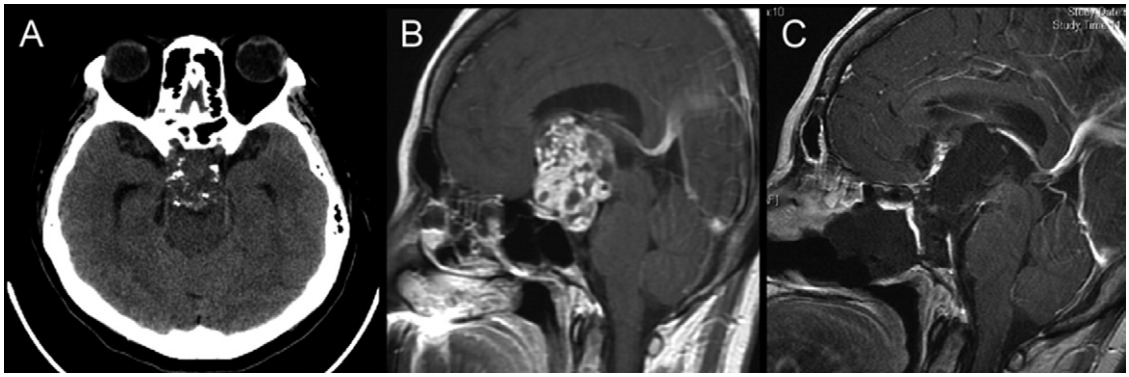

Figure 1 (A) Preoperative axial CT image demonstrating calcifications in a craniopharyngioma. (B) Preoperative sagittal, gadolinium-enhanced MR image of the craniopharyngioma in (A) demonstrating tumor extension into the sella, suprasellar cistern, preopontine cistern, and third ventricle. (C) Postoperative sagittal, gadolinium-enhanced MR image of the craniopharyngioma in (A, B) demonstrating a near total resection of the lesion with intentionally unresected residual tumor along the hypothalamus.

later were used for tumors with a predominantly suprasellar location after the development of extended transsphenoidal approaches.[8-10] The introduction of the endoscope to transsphenoidal surgery was the next major step in the advancement of craniopharyngioma surgery. Similar to microscope-based transsphenoidal approaches, with the endoscopic, endonasal approach, the tumor is typically the first structure encountered after the bony and dural opening, eliminating the need for brain retraction and minimizing manipulation of neurovascular structures. The endoscope importantly brings the lens and light source into the operative field, dramatically increasing the field of view and illumination, negating the limitations of a narrow surgical corridor.[11] Although the endoscopic, endonasal skull base experience for craniopharyngioma is still in its early stages, the reported rates of GTR, vision improvement, and postoperative hypothalamic-pituitary dysfunction are comparable, and in some cases better, than older microscope-based transcranial and transsphenoidal case series of craniopharyngioma surgery.[12-18]

Indications

Through the transsphenoidal surgical corridor, the endoscopic, endonasal technique may be used to resect craniopharyngiomas that are in a sellar and suprasellar location.[19] An important aspect of the technique is the incorporation of the transtuberculum and transplanum approaches, which allows the surgeon to resect progressively larger tumors in the suprasellar cistern (Figure 2A). Additionally, tumors that extend into the third ventricle may also be reached through the endoscopic, endonasal, extended transsphenoidal approach (Figure 2B). In cases of tumor extension to the prepontine cistern, the bony opening of the endoscopic, endonasal approach may be enlarged to include the upper portion of the clivus (Figure 2A). For craniopharyngiomas that grow into the frontal horns of the lateral ventricles, the endoscopic transcranial, intraventricular approach may be employed to perform multicompartment cyst fenestration. The major limitation of the endoscopic, endonasal, extended transsphenoidal approach is its lateral reach. As a general rule, the endoscopic, endonasal technique should not be applied to tumors that extend more than a centimeter beyond the lateral limits of the exposure.[19] Craniopharyngiomas with significant lateral extension, such as into the middle cranial fossa, may be better approached via a frontotemporal craniotomy or other lateral transcranial trajectory.

Methods

Given its usual close proximity to the optic chiasm, pituitary stalk, and hypothalamus, common presenting symptoms of craniopharyngioma are visual field deficits and hypothalamic-pituitary dysfunction. Prior to undergoing surgery, patients with optic chiasmal compression should undergo comprehensive neuro-ophthalmologic assessment and all patients should undergo neuro-endocrinologic evaluation. Ophthalmologic assessment should include formal visual field testing (Figure 3). Endocrinologic assessment should include fasting morning cortisol, adrenocorticotropic hormone, thyroid function testing, follicle-stimulating hormone, luteinizing hormone, growth hormone, insulin-like growth factor-1, prolactin, serum sodium, and urine specific gravity.

Surgical procedure

Nasal and sinus portion

After the patient is brought into the operating room and placed under general anesthesia, 0.25 mL of 10% fluorescein (AK-FLUOR; Akorn, Lake Forest, IL) is injected into 10 mL of cerebrospinal fluid (CSF) via a lumbar drain to aid in visualization of intraoperative CSF leaks and closure of the skull base.[20] The drain is placed for temporary postoperative CSF diversion because these intradural tumors will generally have significant postresection CSF leaks that can