Operative Techniques in Otolaryngology (2006) 17, 31-36

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Operative Techniques in

Otolaryngology

Minimally invasive pituitary surgery

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KEYWORDS
Pituitary adenoma;
Pituitary surgery;
Endoscopic surgery

Since its original description in 1907, surgery of the pituitary gland has undergone a remarkable evolution. While open transsphenoidal approaches gained an early following, they were mostly abandoned in favor of craniotomy because of concern of inadequate tumor resection. However, with widespread use of antibiotics in the 1950s and the introduction of the surgical microscope in the 1960s, the transsphenoidal approach gained popularity as the procedure of choice in the management of pituitary neoplasms. Widespread application of endoscopic surgery for diseases of the sinuses in the 1980s and 1990s, including the management of skull base tumors and cerebrospinal fluid leaks, led to the development of the technique of minimally invasive pituitary surgery (MIPS). MIPS has gained in popularity because of the remarkable visualization provided by the endoscope in addition to the reduced morbidity and rapid recovery afforded by this minimally invasive technique.

The first transsphenoidal resection of a pituitary tumor dates back to 1907, when Schlofer introduced the lateral rhinotomy, transethmoidal approach. The sublabial-transseptal approach, which is still the most commonly used, was first described by Cushing in 1910, and further refined through the years by the introduction of the operating microscope and intraoperative fluoroscopy. In 1987, Griffith and Veeraapen reintroduced the endonasal approach but still used the microscope. The development of the endoscope and advances in endonasal endoscopic surgical techniques encouraged Jankowski to perform the first successful endoscopic resection of a pituitary tumor via the transsphenoidal approach in 1992.[1-5] Over the last decade, this technique has been gaining popularity, with many reports in the literature describing a favorable complication rate as compared with the traditional approach.[1,2,5,6] In our opinion, successful application of this surgical technique requires a close and constant cooperation between the otolaryngology and neurosurgery teams.

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doi:10.1016/j.otot.2006.01.009

Relevant anatomy

The pituitary gland is approximately 1 cm in size and rests in the sella turcica on the dorsal aspect of the sphenoid bone. It is composed of 2 lobes of different embryologic origins and is attached to the brain by the infundibulum or pituitary stalk. The anterior lobe is derived from ectoderm and is composed of epithelial secretory cells surrounded by vascular sinusoids (Table 1). The posterior lobe derives from a ventral evagination of the floor of the third ventricle and is, therefore, composed mostly of unmyelinated axons with cell bodies in the hypothalamic nuclei. These neurons secrete antidiuretic hormone and oxytocin.[7]

As stated previously, the sella turcica is located on the dorsal surface of the body of the sphenoid. It is in close proximity to the optic chiasm anteriorly, clivus posteriorly, cavernous sinus on either side laterally, and hypothalamus superiorly. The cavernous sinus houses the internal carotid artery, as well as the third, fourth, fifth, and sixth cranial nerves (Figure 1).

The sphenoid sinus defines the anterior inferior boundary of the sella. It starts developing at about 5-7 years of age, and is variably pneumatized in adults. The 2 sphenoid sinuses are separated by a septum that is off the midline in 60% to 70% of cases; therefore, the 2 cavities are rarely symmetrical (Figure 2). The lateral walls correspond to the medial walls of the cavernous sinuses; therefore, the different neurovascular structures running in the cavernous si-

Table 1 Different cell types in the anterior pituitary and their products

Cell type	Hormone
Somatotropes	Growth hormone
Lactotropes	Prolactin
Thyrotropes	Thyroid stimulating hormone
Gonadotropes	Luteinizing hormone and follicle stimulating hormone
Corticotropes	Adrenocorticotrophic hormone

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nuses can be seen along the lateral wall of the sphenoid (Figure 3).[8]

Operative technique

Preoperative evaluation and surgical indications

The care of patients with pituitary tumors is best provided by a multidisciplinary team, which includes an otolaryngologist, neurosurgeon, endocrinologist, ophthalmologist, and radiation oncologist. Indications for excision of hormonally inactive adenomas include compressive symptoms, such as hypopituitarism and visual changes, pituitary apoplexy (hemorrhage into the tumor), or severe headaches. Patients with hormonally active prolactinomas are referred for surgery after failure of medical treatment. Patients with acromegaly, hyperthyroidism, or Cushing disease are offered surgery as a primary therapy. The same is true for patients with Rathke cleft cysts, chordomas, and arachnoid cysts. Ideally, the patient's medical condition is optimized by control of such conditions as hyperthyroidism or Cushing disease. Stress doses of steroids are given as necessary.

Figure 2 Axial computerized tomography illustrating the asymmetric sphenoid sinus.

In addition to a full history and physical examination, the preoperative otolaryngology evaluation must include sinonasal endoscopy to evaluate better the anatomy and exclude concurrent infectious processes. Computerized tomography (CT) of the paranasal sinuses is part of our routine work-up and is used for intraoperative image guidance. A careful review of this study helps reveal the presence of such anatomic variants as Onodi cells, dehiscent carotid arteries (Figure 4), or asymmetric sphenoid sinuses. A preoperative ophthalmology evaluation is strongly recommended in all patients, especially those who present with visual complaints.

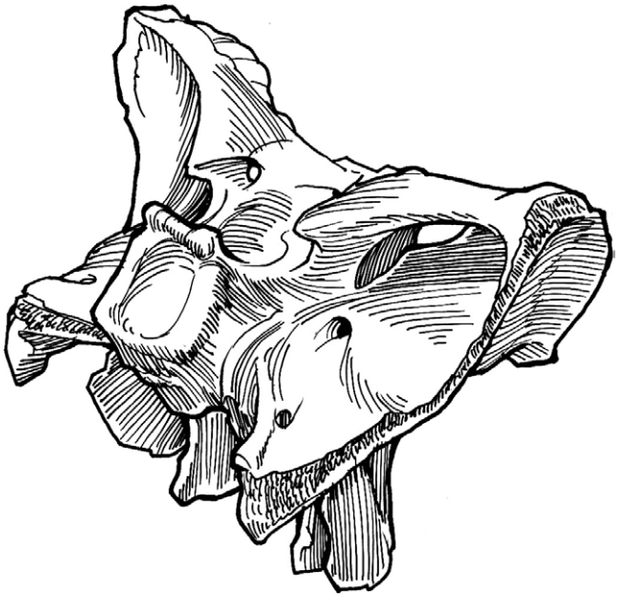

Figure 1 Superior oblique view of the sphenoid bone and the sella turcica.

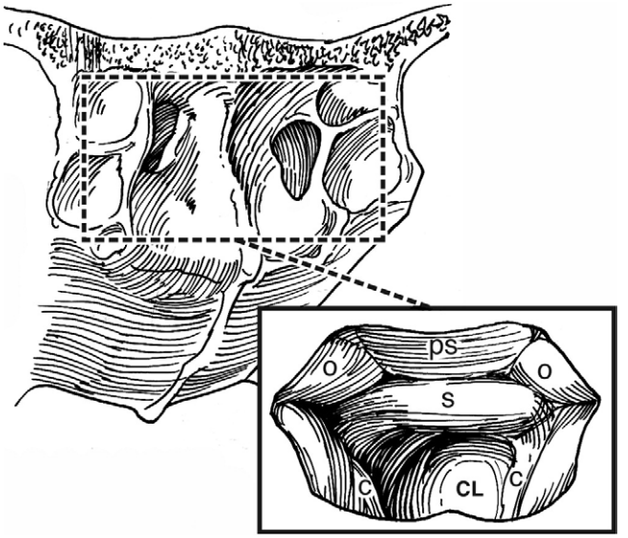

Figure 3 Axial rostrum of the sphenoid. Inset with view of the inside of the sphenoid sinus with the intersinus septum removed, showing osteology of the sphenoid walls. c, internal carotid artery; CL, clivus; o, optic nerve; ps, planum sphenoidale; S, sella turcica.