

Principles of Pituitary Surgery



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KEYWORDS

- Pituitary tumors • Pituitary surgery • Transnasal • Transsphenoidal
- Endoscopy versus microscopy

KEY POINTS

- The principles of pituitary surgery involve extensive surgical planning and decision making.
- Various technical nuances distinguish the endoscopic from the microscopic transsphenoidal approach.
- Strategies can be used during the nasal, sphenoidal, and sellar stages of surgery to maximize tumor resection, minimize complications, and preserve sinonasal anatomy/function.

INTRODUCTION

Evolution of Transsphenoidal Surgery

Since the initial description of a transnasal approach for the treatment of pituitary tumors in 1907, transsphenoidal surgery has undergone continuous evolution marked by close collaboration between neurosurgeons and otolaryngologists. Oskar Hirsch developed a lateral endonasal approach in 1910 that he initially performed as a 5-step procedure over a period of several weeks before simplifying the procedure to a single-step submucosal transeptal approach.¹ Contemporaneously, Harvey Cushing began approaching pituitary tumors using a transsphenoidal approach but transitioned to the transcranial route because of his concern that an endonasal approach provided restricted access and poor illumination, compromising adequate decompression of the optic apparatus.² Most neurosurgeons followed Cushing's lead and transsphenoidal surgery was not "rediscovered" until Jules Hardy introduced the surgical microscope in the 1960s.³

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The first completely endoscopic transsphenoidal approach for pituitary tumors was reported in 1992 by Jankowski, and further advanced by the collaborative teams of Jho and Carrau in Pittsburgh and Sethi and Pillay in Singapore.^{4,5} Over the last 20 years, the endoscopic technique has been adopted by a multitude of surgeons who have favored the dynamic panoramic view afforded by the endoscope, allowing for improved visualization and better resection of tumors extending into the suprasellar area and cavernous sinuses. In addition, the advent of extended endoscopic endonasal approaches, such as the transplanum and lateral transcavernous approaches, has facilitated resection of large, invasive pituitary tumors that were previously deemed unresectable or requiring transcranial surgery.

Critics of the endoscopic approach have rightfully focused on the loss of stereoscopic vision as a major limitation, with mastery of the procedure demanding a steep learning curve. Prospective studies directly comparing the microscopic and endoscopic approaches for pituitary tumors have not been performed; however, an increasing body of literature has established the safety and noninferiority of endoscopic endonasal techniques, and several studies have demonstrated improvement in the extent of tumor resection. McLaughlin and colleagues⁶ reported that, after microsurgical resection of pituitary adenomas, endoscopy revealed residual tumor leading to further resection in 36% of cases. Messerer and colleagues⁷ found their gross total resection rate increased from 50% using the microscope to 76% on initial conversion to the endoscopic approach. In this review, we describe the principles of pituitary surgery, including the key elements of surgical decision making, and discuss the technical nuances distinguishing the endoscopic from the microscopic approach.

PRINCIPLES OF SURGERY

Indications for Surgery

Pituitary adenomas are most frequently categorized as functional or nonfunctional depending on their hormonal secretory pattern. Prolactinomas represent the most common functional adenoma, and the mainstay of treatment is dopamine-agonist medical therapy, with surgical treatment reserved for patients who fail to respond despite dose escalation or are intolerant to the medications. Transsphenoidal surgery remains the primary treatment for adenomas secreting adrenocorticotropic hormone (ACTH, Cushing disease) and growth hormone (acromegaly) with biochemical remission rates significantly correlated with tumor size and invasiveness.⁷

Nonfunctional pituitary adenomas (NFPA) are extremely common. Autopsy and radiographic studies reveal the presence of NFPA in 11% to 27% of the population.^{8,9} Although most NFPA are microadenomas (<1 cm) and clinically asymptomatic, macroadenomas may present with compressive symptoms including headache, visual impairment, hormonal insufficiency, and cranial nerve palsies caused by cavernous sinus extension. Surgery is generally indicated for patients with macroadenomas causing visual compromise or exhibiting growth on serial imaging studies. Approximately 5% of patients with pituitary adenomas present with apoplexy caused by intratumoral hemorrhage or infarction.¹⁰

Preoperative Surgical Planning

The main goal in endoscopic pituitary surgery is to maximize tumor resection while avoiding complications such as visual deterioration, cerebrospinal fluid (CSF) leakage, endocrinopathy, vascular injury, and sinonasal morbidity. Although pituitary adenomas are typically benign lesions, recurrences are common after incomplete surgical removal, and thorough preoperative surgical planning is essential to achieve optimal outcomes.

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