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Manish K. Aghi and Lewis S. Blevins Jr

Imaging the Pituitary and Parasellar Region**529**

Christopher P. Hess and William P. Dillon

Magnetic resonance imaging is the fundamental imaging tool for the evaluation of tumors and other lesions of the pituitary gland and infundibulum. Abnormalities may arise within the pituitary itself, from vestigial embryologic remnants, or from surrounding tissues. Correct diagnosis rests on accurate assessment of lesion location, imaging appearance, and clinical presentation. This article reviews the radiologic evaluation of lesions within the sella and suprasellar cistern, focusing on common masses and pseudomasses of the pituitary and sellar region that neurosurgeons are most likely to encounter in clinical practice.

Management of Incidentally Found Nonfunctional Pituitary Tumors**543**

Mark E. Molitch

Clinically nonfunctioning pituitary adenomas range from those causing significant hypothalamic/pituitary dysfunction and visual field compromise to those being completely asymptomatic, detected either at autopsy or as incidental findings on imaging scans performed for other reasons (often referred to as pituitary incidentalomas). Growth of nonfunctioning pituitary adenomas without treatment occurs in about 10% of microadenomas and 24% of macroadenomas. In the absence of hypersecretion, hypopituitarism, or visual-field defects, periodic screening by magnetic resonance imaging may detect enlargement. Potential indications for surgery are growth of a pituitary incidentaloma, the development of visual-field defects, or the development of hypopituitarism.

Endoscopic Surgery for Pituitary Tumors**555**

Joshua W. Lucas and Gabriel Zada

The endoscopic transsphenoidal approach to the sella turcica has been developed and refined for the treatment of pituitary lesions. Studies comparing endoscopic transsphenoidal surgery with the traditional microscopic transsphenoidal technique have found equivalent or improved rates of tumor resection and hormonal remission, and equal or lower rates of complications. This procedure affords improved panoramic visualization, illumination, surgical freedom, and mobility. This approach facilitates two-handed microdissection and the ability to look around corners using angled lenses, promoting maximal tumor resection and preservation of the pituitary gland. Experience, technologic advancements, and improved instrumentation are likely to contribute to improved surgical outcomes.

External Beam Radiation Therapy and Stereotactic Radiosurgery for Pituitary Adenomas **571**

Jason P. Sheehan, Zhiyuan Xu, and Mark J. Lobo

This article discusses contemporary use of external beam radiotherapy and stereotactic radiosurgery for pituitary adenoma patients. Specific techniques are discussed. In addition, indications and outcomes, including complications, are detailed.

Management of Large Aggressive Nonfunctional Pituitary Tumors: Experimental Medical Options When Surgery and Radiation Fail **587**

Brandon A. Miller, W. Caleb Rutledge, Adriana G. Ioachimescu, and Nelson M. Oyesiku

Pituitary adenomas are generally considered benign tumors; however, a subset of these tumors displays aggressive behavior and are not easily cured. The protocol for nonsurgical treatment of aggressive pituitary lesions is less standardized than that of other central nervous system tumors. Aggressive surgical treatment, radiation, dopamine agonists, antiangiogenic drugs, and other chemotherapeutics all have roles in the treatment of aggressive pituitary tumors. More studies are needed to improve outcomes for patients with aggressive pituitary tumors.

Clinical Management of Pituitary Carcinomas **595**

Michael C. Oh, Tarik Tihan, Sandeep Kunwar, Lewis Blevins Jr, and Manish K. Aghi

Pituitary carcinomas are defined as malignant primary neoplasms of the adenohypophysis with either systemic or craniospinal metastases. Although pituitary adenomas are common, pituitary carcinomas only make up 0.1% to 0.2% of all pituitary tumors. Prognosis is very poor with approximately 66% mortality in the first year of diagnosis. Although effective medical and surgical treatments are available for pituitary adenomas, pituitary carcinomas require a multimodality treatment including surgery, hormonal therapy, cytotoxic chemotherapy, and radiation with limited success. Here we review the clinical behavior and pathologic characteristics of pituitary carcinomas and the recent advances in potential therapies for this malignant disease.

Visual Outcomes After Treatment of Pituitary Adenomas **607**

Clare Louise Fraser, Valérie Biousse, and Nancy J. Newman

Pituitary adenomas frequently manifest with neuro-ophthalmic symptoms and signs. The location of the pituitary gland makes involvement of both the visual pathways and the ocular motor cranial nerves likely when there is adenomatous expansion. A sudden expression of visual loss or diplopia commonly accompanies pituitary apoplexy. Several preoperative neuro-ophthalmic indicators help predict posttreatment outcomes and help determine the best intervention. Treatments themselves may also cause neuro-ophthalmic complications. The current literature and avenues of future research are reviewed.

Management Options for Persistent Postoperative Acromegaly **621**

Nestoras Mathioudakis and Roberto Salvatori

This article presents management options for the patient with acromegaly after non-curative surgery. The current evidence for repeat surgery, adjuvant medical therapy with somatostatin analogues, dopamine agonists, the growth hormone receptor antagonist pegvisomant, combination medical therapy, and radiotherapy in the context of persistent postoperative disease are summarized. The relative advantages and disadvantages of each of these treatment modalities are explored, and a general treatment algorithm that integrates these modalities is proposed.

Neurosurgical Treatment of Cushing Disease **639**

Sameer A. Sheth, Sarah K. Bourne, Nicholas A. Tritos, and Brooke Swearingen

Cushing disease (CD) is caused by overproduction of adrenocorticotropin by a pituitary adenoma (or, rarely, carcinoma). The diagnosis of CD requires distinguishing it

from other hypercortisolemic states with a thorough endocrine workup. CD remains a primarily surgical disease, with remission rates of 70% to 95% following microscopic or endoscopic transsphenoidal surgery.

Medical Management of Persistent and Recurrent Cushing Disease

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Maria Fleseriu

Recent evidence supports the notion that the incidence of Cushing disease is higher than previously thought. Transsphenoidal surgery, in the hands of experienced neurosurgeons, is currently considered the first-line treatment of choice. However, an examination of remission and recurrence rates in long-term follow-up studies reveals that potentially up to 40% to 50% of patients could require additional treatment. If left untreated, the resultant morbidity and mortality are high. Successful clinical management of patients with Cushing disease remains a challenge. The development of new therapeutic agents has been eagerly anticipated. This article discusses the results of currently available and promising new therapeutic agents used to treat this challenging disease.

Medical Versus Surgical Management of Prolactinomas

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Michael C. Oh, Sandeep Kunwar, Lewis Blevins Jr, and Manish K. Aghi

Prolactinomas are the most common hormone-secreting pituitary adenomas, comprising 40% of all pituitary tumors. Prolactinomas present a unique challenge for clinicians, as these tumors are amenable to either medical or surgical treatments based on patients' comorbidities, tolerance to medical treatment, and the response of tumors to medical treatment. Rare prolactinomas that are unresponsive to either medical or surgical treatment modalities may be responsive to radiation therapy. This article reviews the recent advancements in the management of prolactinomas.

Hypopituitarism and Central Diabetes Insipidus: Perioperative Diagnosis and Management

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Jessica K. Devin

Pituitary tumors are a unique class of intracranial neoplasms with the potential to disrupt hormone function and water metabolism. Preoperative and postoperative endocrine assessment is mandatory to recognize and promptly treat new deficiencies and identify those that have resolved. Close collaboration among neurosurgical, endocrine, and anesthetic teams is equally vital during the perioperative period. Appropriate patient education at the time of discharge regarding the symptoms of diabetes insipidus, hyponatremia, and adrenal insufficiency is increasingly important.

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