Diseases of the Sella and Parasellar Region

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Introduction

Pituitary adenomas are by far the most common pathology in the region of the sella turcica. Accordingly, a large part of this synopsis is devoted to them, while the remainder discusses other common lesions in this area. The emphasis is on imaging diagnosis and differential diagnosis.

Pituitary Adenomas

Magnetic resonance imaging (MRI) is usually the only imaging method needed for the morphological investigation of pituitary adenomas. Computed tomography (CT) is occasionally helpful to complement MRI examinations, as it better delineates the bony skull base, anatomic variants, calcification, and osseous malformations. Clinically, patients with microadenomas usually present with endocrine dysfunction. Rarely, the presence of these tumors may be a serendipitous discovery. On T1-weighted images, pituitary microadenomas are usually hypointense compared to the unaffected anterior pituitary gland, and round or oval in shape. In approximately 25% of cases, however, the adenoma is isointense on T1-weighted images. Pituitary microadenomas can also cause high signal intensity on T1-weighted images, probably due to internal hemorrhagic transformation of all or parts of the adenoma, a rather frequent phenomenon in prolactinomas. On T2-weighted images, the signal intensity of microadenomas typically resembles that of the temporal lobe cortex, i.e., slightly hyperintense compared to normal adenohypophysis, the intensity of which is close to that of white matter. The signal intensity on T2-weighted images varies, in particular, with the type of endocrine activity. The diagnosis of microadenomas is simple when they demonstrate high intensity on T2-weighted images, although this signal may only represent a part of the adenoma. Increased intensity on T2-weighted images is found in over 80% of microprolactinomas. Conversely, iso- or hypointensity on T2-weighted images occurs in two-thirds of all growth-hormone-secreting microadenomas. T2-weighted images are particularly helpful when looking for picoadenomas, for which T1-weighted images and even gadolinium-enhanced sequences are negative. When both the T1- and the T2-weighted images corroborate the diagnosis, which is the usual case with prolactinomas, gadolinium enhancement is unnecessary. When the diagnosis has not been established, enhanced imaging is mandatory. A half-dose of gadolinium-chelate (0.05 mmol/kg) is usually adequate. Contrast-enhanced images typically show a hypointense lesion surrounded by the intense enhancement of the normal pituitary gland, but even the contrast-enhanced images may be negative if the tumor is extremely small, the dose of gadolinium too high, or the visualization window too large. Delayed images taken 30-40 min after the injection of contrast medium may show late enhancement of the adenoma. Dynamic images are useful in the diagnosis of adenomas secreting adrenocorticotropic hormone (ACTH), or they are used as a complementary investigation when clinical signs are strongly evocative of a pituitary adenoma, but conventional MRI results not convincing. Pituitary macroadenomas are intrasellar masses with extrasellar extension, which is usually upwards into the suprasellar cistern or laterally into the cavernous sinus. It is important to delineate this extension in relation to the various surrounding anatomical structures and to determine whether the tumor is likely to be firm, cystic, necrotic, or hemorrhagic, based on signal intensity and enhancement. Macroadenomas with suprasellar extension are often bi- or lobed in shape, with one or two extensions into the suprasellar cistern. Macroadenoma signal intensity is often inhomogeneous, particularly on T2-weighted images, with disseminated areas of hyperintensity reflecting cystic or necrotic portions of the adenoma. The adenomatous tissue usually enhances slightly after contrast-medium injection, but the object of enhanced imaging is to visualize normal pituitary tissue. It usually forms a strongly enhancing pseudocapsule around the adenoma: above it, behind it, rarely below or in front of it, and usually unilaterally. The coronal section of the enhanced T1-weighted image generally reveals a unilateral layer of normal pituitary tissue located between the adenoma and the elements of the cavernous sinus, of crucial importance to neurosurgeons. The hyperintense posterior lobe is modified: it appears either flattened or displaced and is well seen on the
axial sections. Alternatively, an ectopic hyperintensity is located within the pituitary stalk, which is compressed by the superior pole of the macroadenoma. The pituitary stalk is tipped laterally. When the suprasellar extension is large, the chiasm itself may be difficult to identify. In such cases, T2-weighted coronal sections help because the optic chiasm is clearly hypointense. After gadolinium injection, discrete meningeal enhancement is usually noticeable near the area where the meninges are in contact with the adenoma, and particularly so in the anterior part of the posterior cranial fossa, along with a possible dural tail, which has previously been described with meningiomas. In our experience, the enhanced dura has no specificity whatsoever. Involvement of the cavernous sinus can modify the prognosis, but compression and invasion remain difficult to differentiate. The best sign of invasion is complete encircling of the intracavernous carotid by the tumor. Invasion can practically be eliminated if it can be demonstrated that a strip of normal pituitary tissue lies between the tumor and the cavernous sinus. Large pituitary adenomas can apply pressure onto the cavernous sinus and cause convex deformation of its external wall without necessarily involving it.

Other Considerations: Gender, Age, Hormone Secretion, Pregnancy

Prolactin-secreting microadenomas are common in young women. Some may spontaneously remain dormant over long periods. They do not develop after menopause. When prolactin-secreting adenomas are discovered in male patients, the tumors have usually reached the stage of macroadenomas. This is probably due to the fact that clinical signs are less obvious in men than in women, and to the fact that tumor development is probably different. Cavernous sinus involvement is far from exceptional. Pediatric pituitary adenomas are not only exceptional but also potentially active. Prolactin-secreting adenomas can be responsible for late puberty. Prolactinomas are usually discovered at the stage of microadenomas owing to the distinctive clinical signs occurring in young women, including amenorrhea, galactorrhea, and hyperprolactinemia (over 30-40 μg/l). Most of the time, the prolactinoma is hypointense on T1-weighted images, while it is hyperintense on T2-weighted images in four out of five cases. This high signal may only be exhibited by a portion of the adenoma. Correlation between prolactin levels and adenoma size is usually good. However, given two prolactinomas of equal size, the hypointense tumor on T2-weighted images secretes more than its counterpart. Medical treatment based on bromocriptine decreases adenoma volume drastically. As a result, diagnosis becomes difficult. We strongly recommend MRI documentation before instituting medical treatment. In some cases, when prolactinomas are imaged long after medical treatment with bromocriptine is started, peculiar scarred tissue is seen, which is evocative of a former pituitary adenoma. This is due to local remodeling of the pituitary gland, which forms a “V” on its superior aspect. While prolactinomas and growth hormone (GH)-secreting adenomas are usually located laterally in the sella turcica, ACTH-secreting adenomas in Cushing’s disease, usually smaller in size, are more often located in the midline. Because of their severe prognosis and the surgical possibilities, ACTH-secreting lesions require the most detailed and exhaustive imaging. GH-secreting adenomas have the unique characteristic of exhibiting hypointensity on T2-weighted images in two-thirds of cases and are usually of the densely granulated subtype. Spontaneous infarction or necrosis of GH-secreting adenomas is far from exceptional. Some patients with acromegaly that was detected late in the course of the disease exhibited an enlarged, partially empty sella turcica, lined with adenomatous tissue that proved difficult to analyze. Medical treatment based on octreotide analogs (somatostatin) decreases the size of the adenoma by an average of 35% and brings the level of somatomedin C back to normal in 50% of patients. This therapeutic approach is useful before surgery. Macroadenomas can be nonfunctioning, but they can also be prolactin-secreting adenomas, gonadotrope adenomas, and growth hormone-secreting adenomas. The greater their size, the more heterogeneous they are, as areas of cystic necrosis are caused by poor tumoral blood supply. Gonadotrope adenomas are often massive and have a strong tendency to recur. Hemorrhage occurs in all or parts of 20% of all pituitary adenomas, but it is usually occult. Pituitary apoplexy, with the usual headache, pseudomeningeal syndrome, cranial nerve paralysis, and severe hypopituitarism, is generally caused by massive hemorrhage within a pituitary macroadenoma. Smaller-scale hemorrhage occurs much more often and can be seen within pituitary adenomas. Bromocriptine is held responsible, to a certain degree, for intratumoral hemorrhages in prolactinomas, although the phenomenon is sometimes revealed on MRI before treatment has been instituted. Recurrent hemorrhage is possible and can cause repeated headaches. Intratumoral hemorrhages are revealed by hyperintensity on the T1-weighted image, sometimes with a blood-fluid level in the mass. Normal pituitary tissue has a longer T1 in women during pregnancy. Normal pituitary tissue increases in height during pregnancy (0.08 mm per week, i.e. almost 3 mm during the course of pregnancy). Pituitary adenomas also increase in volume, especially prolactinomas. The increased volume of the prolactinoma is especially visible when medical treatment has been interrupted. Vision and tumor size should be closely monitored during this period.

Postoperative Sella Turcica and the Pituitary Gland

The surgical cavity is often filled with packing material after transphenoidal resection of a pituitary adenoma. Surgicel is frequently used and is impregnated with blood and secretions. The presence of packing material, secre-