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Letters

Practical Errors in Measurement of the Pituitary at CT

Direct visualization of the pituitary gland is now possible with computed tomography (CT). It is hoped that this method will enable earlier detection and/or accurate localization of pituitary microadenomas. After contrast administration, it appears that microadenomas can be of the density of intravascular blood, or of higher or lower density [1]. Other criteria have been proposed to evaluate the pituitary gland for microadenomas. On the basis of CT scans on normal patients, a frontal or lateral height greater than 5 mm in males and 7 mm in females is considered abnormal [1]. A gland that exhibits a convex upper margin is also considered abnormal. However, no reference has been made to the possible effect on these criteria of intrasellar vascular channels.

Intercavernous vascular connections occur frequently within the sella. They are named for their position, either anterior, inferior, or posterior, relative to the pituitary gland. Their presence and size are variable. The anterior intercavernous sinus was present in 76% of an autopsy series, and the posterior intercavernous sinus in 32% [2]. On CT, enhancement within these sinuses is indistinguishable from enhancement of the pituitary gland [1]. Consequently, error in the measurement of true pituitary gland height would occur if it is measured from the bony floor of the pituitary fossa to the superior surface of the pituitary gland, since an isodense inferior intercavernous sinus would increase the apparent height of the pituitary gland. This could yield a falsely large value for the height of the gland, possibly raising the suspicion of the presence of a microadenoma. Perhaps a bolus injection with dynamic scanning would enable a more accurate measurement of pituitary height.

The width of the pituitary gland is usually equal to or greater than either the depth or length. In 14% of cases, the intracavernous parts of the carotid arteries are medial. This can cause lateral compression of the pituitary gland [2]. The gland could compensate for this loss in lateral dimension by increasing its height and even possibly forming a convex upward configuration. The superior surface may become triangular as a result of being compressed laterally and posteriorly by the carotid arteries [2]. Since the carotid arteries are isodense with the pituitary gland after infusion, these variations can cause a false measurement of the width and height of the gland.

The use of high resolution scanners with 1.5-mm-thick sections enables visualization of small, low or high density lesions within the pituitary gland. However, if a part of a pixel contains both a low density microadenoma and an isodense-to-pituitary gland intercavernous sinus, volume averaging could cause an artifactual loss of visualization of the abnormality, leading to a false-negative examination. A bolus injection with dynamic scanning might define the magnitude of these errors. In a similar fashion, volume averaging can cause the bony sella (volume) to be apparently smaller in size.

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Reply

Dr. Lipman speculates that intrasellar venous channels, partial volume artifacts, and anomalous carotid arteries may cause errors in the CT diagnosis of pituitary microadenoma. The effect of partial volume artifacts [1, 2], the normal variations of the sella [3–9], and vascular anomalies [10] have been discussed at length. Practically speaking, when the CT criteria of microadenoma are met in a patient with endocrine evidence of hypersecretion of a pituitary hormone, the diagnosis of microadenoma can be made confidently. The three important criteria for diagnosing a pituitary microadenoma are height of the gland exceeding 9 mm, a convex upper surface of the gland, and a region of diminished density within the enhanced gland.

The diminished density may be the weakest of the three criteria. Citing Syvertsen et al., Dr. Lipman states that the microadenoma may appear in CT as a hyper-, hypo-, or isodense region (compared with enhanced blood) in the pituitary gland. In fact, the experience that Syvertsen et al. described suggests all microadenomas are hypodense, but the experience of others [10, 11] suggests some microadenomas may be iso- or hyperdense. The appearance of microadenomas in CT images depends very much on the CT technique used. Microadenomas are more likely to appear hypodense if the scanning is done immediately after contrast medium is injected and if coronal slices are scanned. They are much more likely to appear hyperdense if scanning is delayed and if axial slices are scanned. In reporting CT studies of microadenomas, the techniques should be very carefully described.

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