Diagnosis of an “isodense” pituitary microadenoma by dynamic CT scanning

Case report

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A case of Nelson's syndrome with an adrenocorticotropic hormone-secreting pituitary chromophobe microadenoma is presented to demonstrate the potential capability of rapid sequential (dynamic) computerized tomography (CT) scanning for the diagnosis of a pituitary microadenoma that was isodense with the adjacent pituitary gland on conventional enhanced CT scanning. The dynamic CT scans showed transient high density in this microadenoma contrasting with the pituitary gland in the early-enhancement phase, and thereafter the contrast density was indistinguishable from that of the pituitary gland in the delayed-enhancement phase. For the detection of pituitary microadenoma, dynamic CT combined with subsequent delayed CT scanning can provide diagnostic and localizing information.

KEY WORDS • pituitary tumor • computerized tomography • contrast enhancement • dynamic computerized tomography • Nelson's syndrome

The diagnosis of intrasellar pituitary microadenoma, less than 1.0 cm in diameter, has recently been made by computerized tomography (CT) scanning. It is now established that CT images obtained by high-resolution direct coronal scanning with contrast enhancement can provide accurate delineation of microadenomas. Some microadenomas, however, show enhancement indistinguishable from the surrounding normal pituitary gland.

The purpose of this paper is to demonstrate the diagnostic capability of rapid sequential (dynamic) CT scanning after an intravenous bolus injection of contrast medium for detection of these microadenomas that are isodense with the surrounding tissue on conventional enhanced (delayed) CT scans.

Case Report

This 27-year-old woman presented with a 10-year history of cutaneous and buccal pigmentation. She had had bilateral total adrenalectomy for Cushing's disease 12 years before admission. She was referred to our clinic in January, 1983, by her physician, with a presumed diagnosis of Nelson's syndrome.

Examination. Physical examination was normal except for the cutaneous and buccal pigmentation. There was no neurological deficit. Serum adrenocorticotropic hormone (ACTH) level was 341.5 pg/ml (normal 15 to 85 pg/ml). Plain skull x-ray films and polytomography showed focal erosion of the inferior mid and right lateral floor of a normal-sized sella. Bilateral carotid arteriography revealed no abnormal findings in and around the sella turcica.

The CT examinations were performed on 1.5-mm direct coronal sections with a GE CT/T 8800 scanner.* The focal erosion of the sellar floor was shown on plain CT scans. On conventional enhanced CT scanning, heterogeneous contrast enhancement was demonstrated within the whole sella except for the right upper portion, where slight extension of the subarachnoid space was shown (Fig. 1). The presence of a tumor could not be established.

For the dynamic study, bolus intravenous administration of warmed meglumine diatrizoate (40 ml in 12.2 gm iodine) was delivered in a large antecubital vein

* GE CT/T Model 8800 scanner manufactured by General Electric Co., Medical Systems Division, Milwaukee, Wisconsin.
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Fig. 1. Conventional enhanced computerized tomography scan in direct coronal section. Heterogeneous contrast enhancement (white arrows) is demonstrated within the whole sella except for the right upper portion, where slight extension of the subarachnoid space (black arrow) is shown. The presence of a tumor cannot be identified. Focal erosion of the sellar floor (arrowhead) is also shown.

Fig. 2. Coronal dynamic computerized tomography scan demonstrating focal homogeneous contrast enhancement (black arrows) immediately above the focal erosion of the sellar floor in the early enhancement phase. Internal carotid arteries (white arrows) are also intensely enhanced.

Discussion

The pituitary gland is devoid of a blood-brain barrier and normally exhibits contrast enhancement. Pituitary microadenomas are also frequently enhanced with contrast medium. Therefore, microadenomas may be hyperdense, isodense, or hypodense within the adjacent pituitary gland depending on the relative difference of enhancement between them.

When a microadenoma is isodense with the pituitary gland, the diagnosis must be made from other findings, including an eroded sellar floor, abnormal height and upward convexity of the gland, and a displaced pituitary stalk seen on the CT images. These are suggestive signs, and are not always identified consistently. Polytomography, carotid angiography, and cavernous sinography have also been proposed to elucidate the radiological changes associated with microadenoma. Thin-section hypocycloidal tomography has been recommended as the best method for detecting subtle sellar changes secondary to microadenoma.

On the other hand, some authors have recently pointed out incidental developmental variations of the sellar floor simulating the changes of microadenoma, without any relationship to the location of the tumor itself. At present, polytomography is considered not to be as effective as CT, because of its absolute reliance upon the radiological diagnostic protocols.

This report illustrates a case of Nelson's syndrome with an ACTH-secreting pituitary chromophobe microadenoma proven at operation, which was indistinguishable from the adjacent pituitary gland on conventional enhanced CT. Dynamic CT has the ability to demonstrate rapid change in contrast density over
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In the last scan the tumor exhibits a density from that of the adjacent pituitary gland. At operation, a pituitary microadenoma was found.

FIG. 3. Sequential dynamic computerized tomography scans showing an enhancing lesion (white arrows). In the last scan the tumor exhibits a density from that of the adjacent pituitary gland. At operation, a pituitary microadenoma was found.

time. In our case, the use of dynamic CT allowed delineation of the microadenoma in the early-enhancement phase between 12.4 and 48.2 seconds from the beginning of the intravenous bolus injection of contrast medium. Time-density curves revealed that the microadenoma was enhanced more rapidly and intensely than the pituitary tissue in the early-enhancement phase. This feature probably reflects a difference in their vascular structures: that is, in leakage of contrast medium into their extravascular spaces.

In the region of the sella turcica, the pituitary gland, the cavernous sinus, and the internal carotid artery lie close together. Since these structures have similar contrast densities, it is difficult to distinguish them from one another on conventional enhanced CT scans. Cohen, et al., recently reported good visualization of the paraseellar vascular structures on dynamic CT scans, which was also considered to be useful for confirming tumor extension, showing vascular encasement by tumor, and eliminating the possibility of a vascular lesion.

Gardeur, et al., reported CT analysis of 85 intrasellar pituitary microadenomas; eight of the adenomas were isodense with normal pituitary tissue after contrast enhancement, including five of 63 microadenomas secreting prolactin, one of four secreting growth hormone (GH), and two of four secreting ACTH. Similarly, Sakoda, et al., reported that one of 17 nonfunctioning adenomas, seven of 25 adenomas secreting prolactin, and one of 14 secreting GH were isodense on contrast-enhanced CT scans. Our case suggests that dynamic CT scans can offer direct visualization of microadenomas that appear isodense on conventional enhanced CT. In
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![Dynamic CT image](image)

Fig. 4. Dynamic computerized tomography (CT) scan with time-density analysis of the regions of interest, including the pituitary microadenoma (1), pituitary tissue (2), the left internal carotid artery (3), and brain tissue (4). The microadenoma shows a density higher by 19 to 36 Hounsfield units than the pituitary tissue during dynamic CT.

In the evaluation of pituitary microadenomas, the use of the dynamic CT scan, combined with subsequent delayed CT, can provide more accurate diagnostic and localizing information.

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References


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