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AJNR Am J Neuroradiol 1995, 16 (4) 971-974

<http://www.ajnr.org/content/16/4/971>

This information is current as
of April 19, 2024.

MR of Pituitary Metastasis in a Patient with Diabetes Insipidus

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Summary: We present a case of acute-onset diabetes insipidus in a 69-year-old man who had been treated for lung cancer. T1-weighted MR images showed a thickened pituitary stalk and absence of the normal high intensity of the posterior pituitary lobe. Dynamic imaging demonstrated poor enhancement in the posterior lobe, whereas the anterior lobe was strongly enhanced. Autopsy revealed that metastatic tumor from lung cancer had infiltrated the posterior lobe as well as the pituitary stalk.

Index terms: Diabetes insipidus; Pituitary gland, neoplasms

Metastasis to the pituitary gland is a recognized event in some forms of systemic cancer, usually discovered incidentally at autopsy. With the advent of magnetic resonance (MR), pituitary metastasis recently has been detected when some patients were investigated for diabetes insipidus (1). We present the MR images in a case of pituitary metastasis from lung cancer, which was subsequently confirmed at autopsy.

Case Report

In a 69-year-old man with a 7-month history of small-cell carcinoma of the lung, polyuria and persistent thirst suddenly developed. Endocrinologic examinations revealed central diabetes insipidus. Computed tomography (CT) scan demonstrated that the thickness of the pituitary stalk had increased compared with a scan obtained 6 months before. No other abnormalities were found by CT. MR was performed focusing on the pituitary lesion. T1-weighted images showed a symmetrically thickened pituitary stalk that was 4.6 mm wide in the sagittal plane and 6.3 mm wide in the coronal plane (Fig 1A, B). The posterior lobe showed absence of the expected high signal intensity and slightly lower signal intensity than the anterior lobe (Fig 1A). The pituitary gland was not enlarged. T2-weighted images did not show any abnormal high signal intensity in the infundibulum or the pituitary gland (Fig 2). Dynamic MR images in the sagittal plane were obtained every 24 seconds after the rapid manual injection of gadopentetate dimeglumine (0.1 mmol/kg) (Fig 3). The first dynamic image at 35 seconds after the injection of gado-

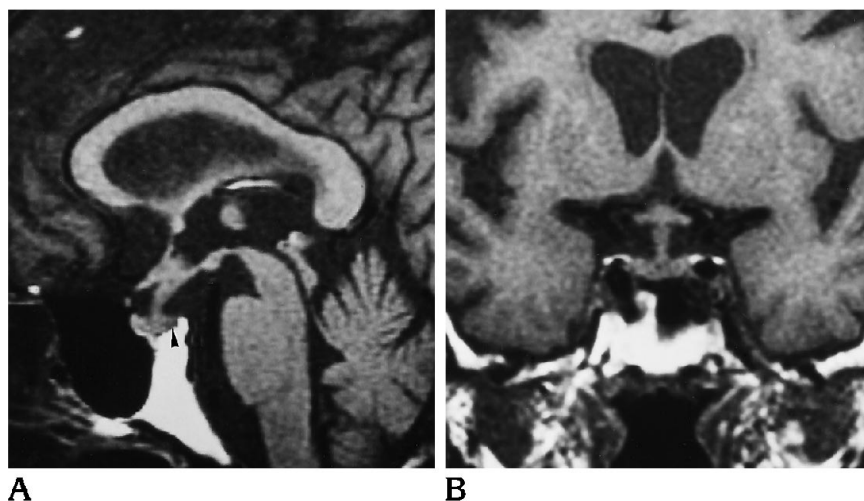


Fig 1. T1-weighted (350/20/4 [repetition time/echo time/excitations]) sagittal (A) and coronal (B) images show a symmetric thickened pituitary stalk. The posterior lobe shows absence of the normal high signal intensity and slightly lower signal intensity than the anterior lobe (arrowhead).

Received April 27, 1993; accepted after revision July 12.

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AJNR 16:971-974, Apr 1995 0195-6108/95/1604-0971 © American Society of Neuroradiology



Fig 2. A T2-weighted (3000/100/1) sagittal image shows no abnormal high signal intensity in the infundibulum and posterior lobe.

pentetate dimeglumine demonstrated inhomogeneous enhancement of the thickened pituitary stalk. The anterior lobe was homogeneously and intensely enhanced on the second dynamic image at 59 seconds, whereas the posterior lobe of the pituitary gland was poorly enhanced on all of the dynamic images. The postcontrast T1-weighted image also showed less enhancement in the posterior pituitary gland (Fig 4), but the contrast between the anterior and posterior lobes was less evident than in the dynamic images. Coronal postcontrast image showed small enhancing areas of the hypothalamus extending from the pituitary infundibular lesions.

Ten days after MR imaging, the patient died and autopsy was performed. The pituitary stalk was grossly thickened, and histopathological examination revealed that the pituitary infundibulum was entirely infiltrated by tumor and the hypothalamus was partially involved (Fig 5). The entire posterior lobe of the pituitary was infiltrated by the tumor. Extension into the anterior lobe was found microscopically at the border between the two lobes, although there was only minimal invasion (Fig 6). No other metastatic lesions of the brain were found. There was no invasion of the subarachnoid space, indicating that this metastasis was probably derived from hematogenous spread.

Discussion

The incidence of pituitary metastases varies from 0.14% to 28.1% of all brain metastases and is higher in autopsy series (2). They most frequently originate in lung carcinoma in men and breast carcinoma in women. Pituitary metastases more commonly affect the posterior lobe and the infundibulum than the anterior lobe. A review of 201 reported cases (2) showed that the frequency of involvement within the pituitary gland was 50.8% in the posterior lobe alone, 33.8% in both lobes, and 15.4% in the anterior lobe alone. The predilection of metastases for the neurohypophysis may reflect the fact that the posterior lobe receives its blood supply directly from the inferior hypophyseal arteries, whereas the anterior lobe is nourished indirectly by portal vessels. This predilection for

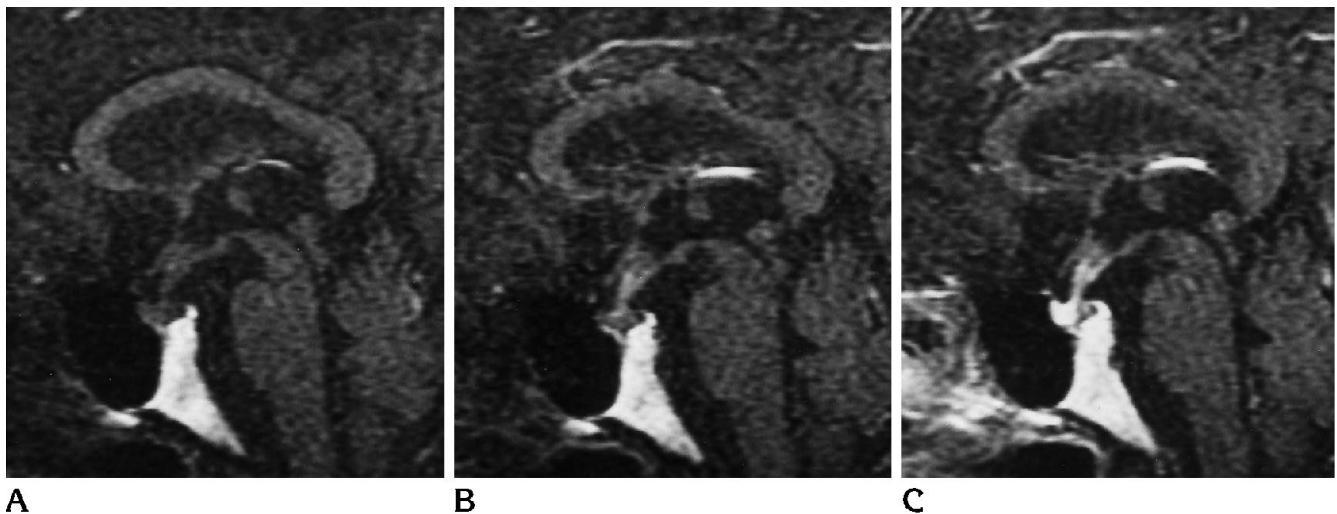


Fig 3. Dynamic images (150/20/1) of the pituitary gland at the midsagittal level.

A, The precontrast image shows no characteristic high intensity in the posterior lobe.

B, The first dynamic image at 35 seconds shows inhomogeneous enhancement of the thickened pituitary stalk.

C, The second dynamic image at 59 seconds shows homogeneous enhancement of the anterior lobe. The posterior lobe of the pituitary shows poor enhancement during all dynamic phases.

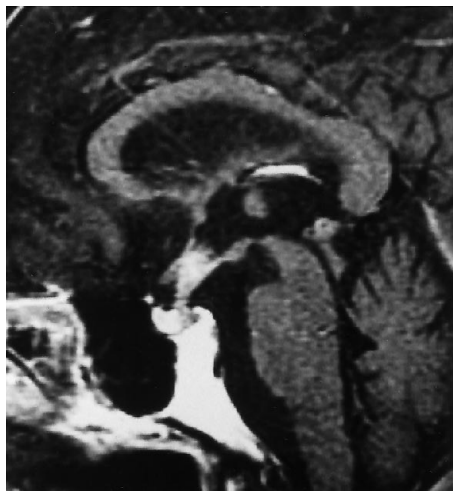


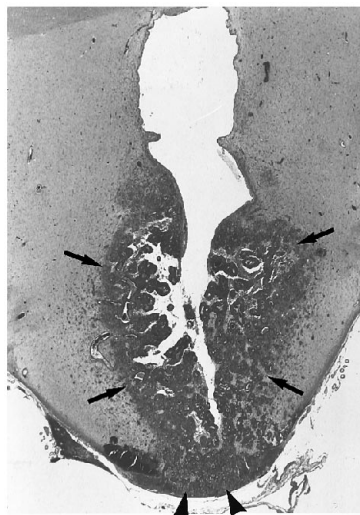
Fig 4. A postcontrast T1-weighted (350/20/4) sagittal image shows reduced enhancement of the posterior lobe and the pituitary stalk.

posterior lobe involvement may explain why patients with pituitary metastases frequently present with diabetes insipidus clinically.

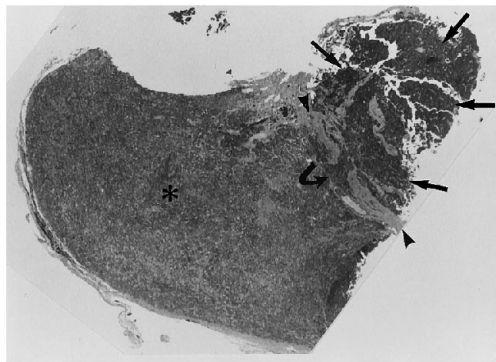
The source of the high signal intensity in the normal posterior pituitary lobe remains unknown at present, although it has been suggested to be caused by phospholipid (3) or neurosecretory granules (4). In patients with diabetes insipidus, it has been reported that the posterior lobe does not show a high signal intensity on T1-weighted MR images (5–9). However, the absence of the high signal intensity in the posterior lobe is not in itself diagnostic, because the same change is occasionally seen in healthy persons (5). Central diabetes insipidus has a wide variety of causes. Tien et al (6, 7)

reported that a symmetrically thickened pituitary stalk as well as the absence of a bright signal was seen in patients with diabetes insipidus attributable to Langerhans cell histiocytosis, tuberculosis, and sarcoidosis. With regard to metastases, it has been reported that MR shows intrasellar and suprasellar dumbbell-shaped masses with a clear indentation at the level of the diaphragma sellae, which may differ morphologically from pituitary adenoma that usually expands the diaphragma (1). In our case, the intrasellar metastasis could have been missed if we had not used gadopentetate dimeglumine. Precontrast T1-weighted image showed slightly low signal intensity in the posterior lobe. However, T2-weighted image did not reveal the high signal intensity of a tumor metastasis. Presumably, the tumor observed in our patient would have grown rapidly and might have become a dumbbell-shaped mass if the patient had survived longer. However, our patient's tumor appears to have been detected at an early stage when the metastasis was just starting to grow.

Dynamic MR imaging has been used recently to evaluate the normal and pathologic pituitary gland (10–12). Sakamoto et al (12) have reported that dynamic imaging can be used to identify pituitary microadenomas by improving contrast. In our case, this method was very useful for delineating a lesion of the posterior lobe. In addition, there was a good correlation between the postmortem pathologic findings and the antemortem MR findings.



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Fig 5. A coronal section through the hypothalamus shows tumor infiltration of the hypothalamus (arrows) and the infundibular recess (arrowheads).

Fig 6. A sagittal section of the pituitary gland shows that the posterior lobe is entirely replaced by tumor (arrows), and only minimal invasion into the anterior lobe (curved arrow) is found at the border between the anterior and posterior lobes (arrowheads). The anterior lobe (asterisk) otherwise is microscopically free of tumor metastasis.

In conclusion, we presented the MR findings of pituitary metastasis from lung cancer in a patient with diabetes insipidus. The lesion was confirmed at autopsy. A thickened pituitary stalk in combination with absence of the normal high signal intensity in the posterior lobe was observed on T1-weighted images. Dynamic imaging proved very useful for identifying tumor infiltration of the posterior pituitary gland.

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