Metrizamide-Enhanced CT for Evaluation of Brainstem Tumors

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Computed tomography (CT) of the brain has been used extensively to evaluate both supratentorial and infratentorial mass lesions. However, even with the use of intravenous contrast enhancement, visualization of small brainstem lesions has not been totally satisfactory. The differentiation of intratumoral lesions has also at times proved difficult and frustrating. Computed tomography combined with intrathecal enhancement using metrizamide provides excellent delineation of the normal anatomy of the basal cisterns and brainstem [1-4]. Small aberrations of the normal architecture can be easily seen allowing early diagnosis and accurate localization of small mass lesions.

Technique

Routine lumbar puncture with a 22 gauge needle is performed with the patient prone on a myelographic table. Then, 7 ml of metrizamide (concentration of 170-190 mg iodine/ml) is introduced intrathecally under intermittent fluoroscopic control. The table is tilted to the 45° Trendelenburg position, and the patient left in the head-down position for 1-2 min. After returning the table to the 15° Trendelenburg position, the patient is transferred to a slightly inclined stretcher in the prone position to prevent pooling of contrast in the cisterna magna [4]. If lumbar puncture cannot be performed, 5 ml of metrizamide is introduced via C1-C2 puncture, and the same maneuvers are then performed. The patient is immediately transferred for CT scan. The gantry is angled at 0° to the orbitomeatal line, as compared with 20° for routine scans or at -20° to the orbitomeatal line in order to obtain sections perpendicular to the brainstem.

Normal Anatomy

Excellent visualization of the basal cisterns is appreciated. The midbrain, pons, and medulla are well delineated by contrast in the cisterns [3-5] (fig. 1). These structures are analyzed for symmetry, size, and position. The fourth ventricle and its lateral recesses are filled in most studies and should be evaluated for compression or displacement (fig 1A) [4]. The negative shadow of the basilar artery may often be appreciated in the interpeduncular cistern (fig. 1B).

Case Reports

Case 1

A 43-year-old white man had a history of progressive headache, nausea, difficulty swallowing, nystagmus, and dysequilibrium. Routine CT scan and bilateral carotid and vertebral arteriograms were normal. Posterior fossa opaque cisternogram demonstrated a mass filling the right cerebellopontine angle. The differential diagnosis included an extraaxial cerebellopontine angle tumor versus an intraaxial pontine mass that had expanded into the cerebellopontine angle.

A metrizamide-enhanced CT scan demonstrated asymmetrical enlargement of the right pons extending up to involve the right cerebral peduncle (fig. 2). This was consistent with the diagnosis of an infiltrating pontine glioma.

A suboccipital craniotomy and biopsy of an intraaxial right pontine lesion were performed. Pathology demonstrated a grade II astrocytoma. The patient tolerated the procedure well and subsequently began radiation therapy.

Case 2

A 63-year-old white woman was transferred from another hospital with a 2 month history of vertigo and dysequilibrium. Physical examination revealed a lethargic female with spontaneous nystagmus, a central seventh nerve deficit on the left, and profound left hemiparesis and left hemisensory loss. Cerebellar examination could not be performed. A CT scan with and without intravenous contrast material demonstrated a contrast-enhancing mass lesion in the region of the pons adjacent to tentorial calcification (figs. 3A and 3B). This lesion enhanced homogenously and displaced the fourth ventricle to the left. Because of its proximity to the tentorial incisura, the differential diagnoses considered were an intraaxial pontine tumor versus an extraaxial lesion such as a meningioma.

A metrizamide-enhanced CT scan demonstrated asymmetric enlargement of the right pons with compression of the right cerebellopontine angle cistern and displacement to the left of the metrizamide-filled fourth ventricle (fig. 3C). Slightly more cephalad sections

Received May 23, 1979; accepted after revision August 22, 1979.
This manuscript appears in January/February AJNR and April AJR.
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AJNR 1:31–34, January/February 1980 0195-6108/80/0011-0031 $00.00 © American Roentgen Ray Society
CASE REPORTS

A posterior fossa exploration was performed and the pons was found to be enlarged and hypovascular. Necrotic-appearing tissue was obtained from a pontine biopsy and sent for permanent section. Pathology revealed evidence of old and new hemorrhage. The presumptive diagnosis was hemorrhage and necrosis into a pontine tumor. Postoperatively the patient's neurologic and respiratory status deteriorated, and she died several weeks after surgery. No autopsy was performed.

Discussion

Before the advent of CT, pneumoencephalography and cerebral angiography were the traditional methods for evaluating brainstem lesions. These procedures required a great deal of time and certain amount of risk and discomfort to the patient. Small lesions were often difficult to detect and localize accurately.

Computed tomography with intravenous contrast enhancement has aided considerably in the early detection and localization of these lesions [6]. However, masses in this region are sometimes not identified. The basal cisterns around the pons and midbrain are 1–10 mm wide with little difference in attenuation coefficient between cerebrospinal fluid and brain. Metrizamide in the basal cisterns markedly increases their attenuation so that high contrast is provided between the cisterns and brainstem. This markedly improves resolution and decreases artifact [4].

When lesions are identified with conventional CT, localization and differentiation between intra- and extraxial lesions is often difficult. Because of the excellent visualization of the cisterns and architecture of the brainstem with metrizamide enhanced CT, differentiation between intra- and extraxial lesions can be made more reliably. Further, the exact localization and extent of lesions can be defined.

Adverse reactions to intrathecal metrizamide used for
intracranial CT scanning are the same as those observed with metrizamide used for routine lumbar myelography. These include headache, nausea, and vomiting, with usually a 3–6 hr delay time [4, 6]. These side effects are usually mild and last no longer than 24 hr. The total metrizamide dose is less than in lumbar myelography. Numerous animal experiments have demonstrated the low epileptogenic effect of metrizamide in the intracranial subarachnoid space [6]. The results of recent studies in the literature using intracranial metrizamide in humans also shows no significant difference in side effects between intracranial metrizamide and routine metrizamide lumbar myelography [4, 6].

Metrizamide-enhanced CT scanning offers a rapid, safe method of evaluating the brainstem. In the evaluation of a patient suspected of a mass lesion in the brainstem, routine CT with intravenous contrast material should be performed. Demonstration of a mass lesion can provide valuable diagnostic information. However, metrizamide CT may clarify the exact site and extent of the lesion. A normal CT scan does not exclude a brainstem lesion, and if clinical signs warrant further investigation metrizamide-enhanced CT should be the next step in diagnostic evaluation. With the advent of more sophisticated CT scanners and multiplanar reconstruction, the information obtained with metrizamide CT scanning may be sufficient to eliminate the necessity for further studies in many cases.

REFERENCES

