Metrizamide cisternography in the evaluation of pituitary adenomas and the empty sella syndrome

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Selected cases are presented demonstrating evaluation of sellar and juxtasellar pathology with metrizamide cisternography. The compatibility of metrizamide with the current generation of computerized tomography scanners has provided complementary data to metrizamide-enhanced hypocycloidal tomographic studies of the sellar and juxtasellar areas. The ease and low morbidity of metrizamide cisternography relative to pneumography is outlined.

KEY WORDS • metrizamide • cisternography • pituitary tumor • empty sella

This paper discusses the use of metrizamide cisternography coupled with hypocycloidal polytomography and computerized tomography (CT) utilizing both axial and coronal planes in the diagnoses of pituitary adenomas and the empty sella syndrome.

Materials and Methods

Metrizamide is a water-soluble, non-ionic contrast medium developed in Scandinavia and recently introduced to North America. It has been used in more than 4000 myelographic procedures in Western Europe. The reported incidence of side effects is quite low. Kieffer, et al., stated that 41% of their group of 117 patients who underwent metrizamide myelograms had no adverse side effects from the examination. Headache occurred in 38%, which typically began 3 to 6 hours after the procedure but ended within 24 hours. Nausea (37%) and vomiting (29%) are common complaints with metrizamide myelography, beginning 2 to 4 hours after the myelogram and lasting less than 1 day. Chronic alcoholism, a previous history of seizures, or use of neuroleptic drugs constitute contraindications to metrizamide examinations.

In this study 15 to 20 cc of metrizamide in concentrations of 190 to 290 mg/cc of iodine was instilled into the subarachnoid space via lumbar puncture. The patients were then placed in Trendelenburg's position at 20° for 5 minutes to allow the contrast medium to ascend through the spinal subarachnoid space into the basilar cisterns. Anteroposterior and lateral polytomography of the sella was then performed. This was followed by axial and coronal CT in selected cases.

Case Reports

Case 1

This 25-year-old woman presented with physical features suggestive of mild acromegaly. She complained of right-sided headaches but was neurologically intact including visual field testing. Laboratory examinations showed normal prolactin, follicle-stimulating hormone and growth hormone levels, although the 17-hydroxysteroid and 17-ketosteroid levels were elevated. Plain radiographs of the skull demonstrated thinning of the dorsum sellae and posterior clinoid processes. Carotid arteriography and CT scanning both before and after intravenous contrast enhancement were normal. A metrizamide cisternogram using 15 cc of contrast material at a concentration of 200 mg/cc of iodine demonstrated mild upward bulging of the diaphragma sellae by an intrasellar mass lesion (Fig. 1). No suprasellar extension was present. A transsphenoidal hypophysectomy with complete removal of the tumor was performed without incident.

Case 2

This 55-year-old man gave a 20-year history suggestive of pituitary dysfunction, namely, thinning and loss of body hair, loss of libido, and progressive slowing of mentation. He was myxedematous and had body features and habitus compatible with panhypoplastic features.
Metrizamide enhancement of sellar lesions

Fig. 1. Case 1. Chromophobe adenoma without suprasellar extension. Left: Metrizamide-enhanced lateral midline polytomogram showing upward bulging of the diaphragma sellae by an intrasellar tumor (small arrowheads). Large arrowheads are in the suprachiasmatic cistern outlining the chiasm. Right: Metrizamide cisternogram, anteroposterior polytomogram. The tumor mass (small arrowheads) is outlined by a thin rim of contrast medium separating it from the optic chiasm superiorly (large arrowheads). The supraclinoid carotids are outlined laterally (arrows).

Pituitarism. Recently he had noted progressive visual loss. On neurological examination he was blind to confrontation in the left eye and had a temporal field defect with macular sparing in the right eye. Plain skull radiographs showed marked enlargement of the sella turcica. Bilateral carotid arteriograms demonstrated lateral displacement of the parasellar portion of both carotid arteries and upward displacement of both anterior cerebral arteries, indicating both parasellar and suprasellar extension of the tumor mass (Fig. 2 upper). A metrizamide cisternogram using 15 cc of contrast material at a concentration of 190 mg/cc of iodine in conjunction with CT showed the extent of the suprasellar spread of the neoplasm (Fig. 2 lower). At surgery, a large chromophobe adenoma was subtotally resected via a left subfrontal approach.

Case 3

This 35-year-old man had received a course of radiotherapy elsewhere for a presumed pituitary tumor some 4 years previously. He presented at this time with complaints of headaches and decreasing vision. Visual field testing demonstrated superior altitudinal field defects in both eyes. Plain skull radiographs showed a ballooned pituitary fossa. A metrizamide cisternogram using 10 cc of contrast material at a concentration of 250 mg/cc of iodine in conjunction with polytomography and CT scanning showed filling of an immense intrasellar cistern by the contrast medium (Fig. 3). The optic chiasm was displaced downward into the empty sella. At surgery, the sellar dura was elevated with a methyl methacrylate plug via a transethmoidal approach. Postoperatively, the patient's visual fields were normal.

Discussion

Computerized tomography has been shown to be superior to plain skull x-ray films and nuclear brain scans as a screening method for the detection of juxtasellar masses. Although Naidich, et al., found CT scans completely reliable in assessing the presence or absence of suprasellar masses, Citrin and Davis1 and Reich, et al., believed that pneumography is necessary in addition to CT scanning in evaluating the smaller lesions or where more accurate determination of suprasellar extension is needed. Grepe, et al., first described metrizamide cisternography in 1975, pointing out that detailed examination of intracisternal anatomy requires a contrast medium with a steeper absorption gradient than can be achieved with air. Because of the miscibility of metrizamide with cerebrospinal fluid (CSF), surface tension problems disappear and the smaller recesses of the CSF-brain interface can be delineated with hypocycloidal...
Fig. 2. Case 2. Chromophobe adenoma with suprasellar extension. Upper: Recombined subtraction print of bilateral selective carotid injections demonstrating lateral displacement of the parasellar segment of both internal carotid arteries by an intrasellar mass (small arrowheads). The supraclinoid portions of the carotid arteries are stretched (arrows) and the A-1 segments elevated bilaterally (large arrowheads). Lower Left: Metrizamide-enhanced horizontal computerized tomography (CT) scan. The suprasellar extension of the tumor is seen as a negative density displacing contrast in the suprasellar cistern. Contrast is also seen in the interhemispheric fissure, ambient cistern, and quadrigeminal cistern. Lower Right: Metrizamide-enhanced coronal CT scan. The suprasellar extension of the tumor mass is well delineated by the metrizamide in the suprasellar cistern. Faint transient opacification of the third and lateral ventricles by metrizamide is normal.
FIG. 3. Case 3. Empty sella. **Upper Left:** Metrizamide-enhanced lateral midline polytomogram. The floor of the sella is excavated (large arrowheads). The contrast medium filled the empty sella (small arrowheads). The optic chiasm is seen as a linear radiolucency coursing obliquely through the sella. The fourth ventricle is also filled with metrizamide (4). **Upper Right:** Metrizamide-enhanced anteroposterior polytomogram. The floor of the sella turcica is ballooned downward (large arrowheads). The contrast medium fills the empty sella (small arrowheads). The supracallosal portion of the carotid arteries is outlined by metrizamide in the carotid cistern (arrows). **Lower Left:** Metrizamide-enhanced horizontal computerized tomography (CT) scan. The contrast medium fills the empty sella and surrounds the rectangularly-shaped optic chiasm. **Lower Right:** Metrizamide-enhanced coronal CT scan. The contrast medium fills the empty sella and outlines the optic chiasm. The inferior recesses of the third ventricle are also seen. The middle cerebral arteries are seen entering the median Sylvian fissure bilaterally. The lateral ventricles are seen enhanced at the level of the foramen of Monro. The corpus callosum can be seen by virtue of dye in the pericallosal cistern.
tomography. This same miscibility allows even diffusion of the contrast material throughout the cisterns, obviating the need for cumbersome maneuvers required to position and hold gas in areas of interest. These advantages, plus the compatibility of the watersoluble contrast medium with the current generation of CT scanners, make metrizamide superior to air for cisternography.

Our experience with nine patients (seven tumors and two empty sellas) supports that of others who reported adequate cisternal concentrations of metrizamide after instillation in the lumbar theca. Following instillation, the cisternal concentration of metrizamide remained adequate for conventional tomography for about an hour and for enhanced CT scans for about 3 to 4 hours, which dictated the sequence of our radiological studies. If the need arises for greater cisternal concentration, the suboccipital instillation of 3 to 4.5 ml of metrizamide in concentrations of 300 mg of iodine per ml has provided higher cisternal concentrations with no significant side effects. On the other hand, Roberson, et al., pointed out that most seizure complications were seen with the higher intracranial concentration produced with cervical injections. They advocated prophylactically premedicating patients undergoing metrizamide cisternography with phenobarbital. Continuous dilution and absorption of the contrast medium reduces the hyperosmolality of the enhanced CSF and therefore the epileptogenic potential; 90% of the contrast is cleared from the CSF in 24 hours, so prolonged anticonvulsant therapy is unnecessary.

As seen in our selected cases, metrizamide-enhanced hypocycloidal tomography and CT are complementary studies. The definition of the bulging diaphragma sellae seen on the polytomogram was not appreciated on the coronal CT scan in Case 1, whereas in Case 3 it was the increased sensitivity of the CT scan that allowed a true appreciation of the extension of the anterior third ventricle into the empty sella. Because of the diminished suprasellar cisternal volume in Case 2, only the CT scan was sensitive enough to delineate the suprasellar extension of the chromophobe adenoma. It becomes obvious, then, that the compatibility of metrizamide with the CT scanner becomes an important feature in metrizamide cisternography.

While intravenous contrast-enhanced CT studies are the procedure of choice to exclude the presence of a suprasellar mass lesion, once that lesion has been identified, metrizamide cisternography with polytomography and CT scanning should be performed to precisely delineate the relationship between the tumor and the adjacent brain.

References


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