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Metrizamide Sagittal Tomography: Adjunct to CT Cisternography of the Sellar Region

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A total of 30 patients with pituitary adenoma was studied by sagittal polytomography en route to coronal and axial computed tomography (CT) cisternography after a low FDA-approved dose of 6 ml of 170 mg I/ml metrizamide via lumbar injection. The requirement for defining the relation of the optic nerves and chiasm to the intrasellar contents or suprasellar mass before proton beam irradiation or certain surgical approaches was satisfied. Pneumoencephalography as a supplemental procedure to CT and CT cisternography was replaced. The concomitant elimination of conventional sellar polytomography and pneumoencephalography results in decreased total radiation exposure and a more comfortable, expeditious workup.

Cranial computed tomography (CT) using intravenous contrast material and CT metrizamide cisternography with axial and coronal sections provide information concerning the presence, position, and extension of pituitary adenomas [1-4]. However, the use of stereotactic, necrotizing, proton beam irradiation for pituitary adenomas at Massachusetts General Hospital necessitates detailed visualization of the optic chiasm and suprasellar optic nerves for localization. CT and CT cisternography have not provided the necessary detail in axial, coronal, or reconstructed sagittal views using the EMI-1005 and EMI-5005 scanners. Consequently, until recently this group of patients underwent pneumoencephalography with polytomography of the sella-suprasellar region.

To eliminate the discomforts of pneumoencephalography, a 6 ml 170 mg I/ml metrizamide dose injected by the lumbar route, which is approved by the FDA for CT cisternography was used for sagittal polytomography [5] of the sellasuprasellar region en route to the CT cisternography images. This provided clear visualization of the relation of the optic chiasm and nerves to the sella, the negative defect of the third ventricle, and the outline of an intra- or suprasellar mass. It was received enthusiastically by the physicians managing the patient, and due to good patient tolerance is almost always the procedure of choice. As a result, pneumoencephalography has been essentially replaced in the evaluation of this region. We report the technique and results of the procedure in 30 patients.

Subjects and Methods

A total of 30 patients was examined by metrizamide Polytome cisternography while en route to CT cisternography (figs. 1 and 2). The study was performed in anticipation of possible proton beam therapy for suspected pituitary adenoma. The technique is outlined as follows.

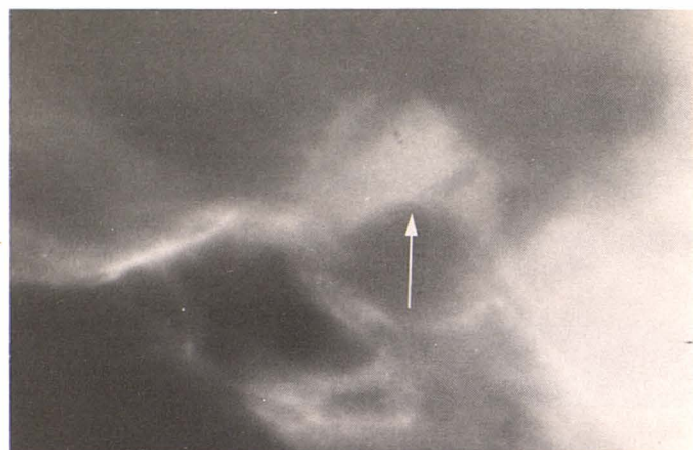
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A



B

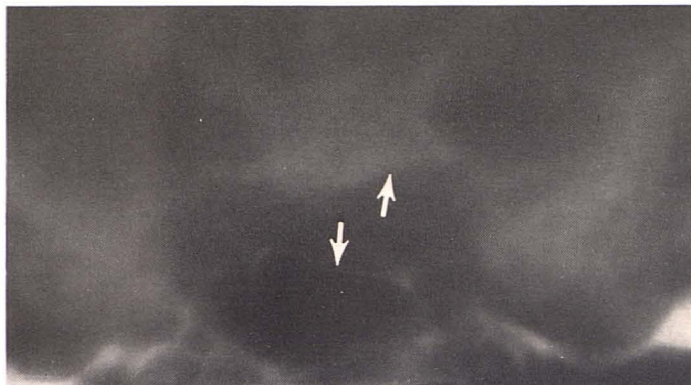


C

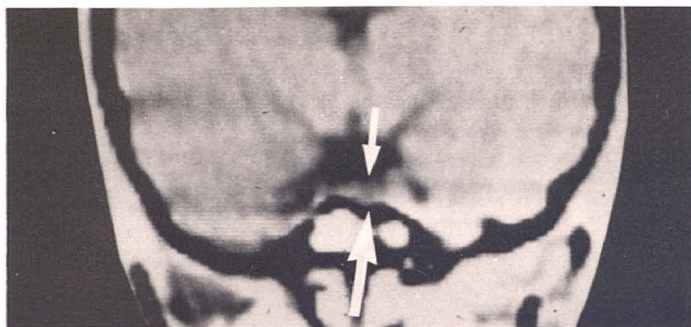
Fig. 1.—Sagittal metrizamide polytomography. A, Left side of sella shows slight upward bulging and focal enlargement of sella. B, Normal midline section. C, Normal right side section.

Preparation. There are no premedications. The patient is kept well hydrated, which is very important to prevent nausea, vomiting, and other potential complications.

Preliminary films for technique and position of sella-suprasellar



A



B

Fig. 2.—Same patient as in fig. 1. A, Coronal metrizamide polytomography. Left side of sella shows chiasmatic cistern displaced upward with focal depression of sella floor. B, Coronal CT cisternography. Findings similar to A.

region are a sagittal midline hypocycloidal tomographic section (Polytome) and a posteroanterior tomographic section at right angles to the orbitomeatal or anthropologic baseline. (This view is optional and used if subsequent coronal CT sections are not of diagnostic quality.)

Introduction of metrizamide. A 170 mg I/ml metrizamide (small vial) solution is prepared and 6 ml is withdrawn into a disposable plastic syringe (this avoids potential chemical reactions from re-sterilized glass syringes). A 22 gauge spinal needle is used for L3-L4 or L4-L5 puncture in the right lateral decubitus flexed position on the Polytome table. No fluoroscopy is necessary. Straps are secured to keep the patient from slipping forward. The table is tilted in the 15° Trendelenburg position. An assistant holds the chin up toward the ceiling with the vertex tilted upward to its limit. Over 15–20 sec, 6 ml of 170 mg I/ml metrizamide is evenly injected, and the needle is removed. The table is tilted 40° head down for the next 10 sec with the patient in the same position (the assistant continues to support the patient's head and shoulders). The patient is quickly turned into the prone position with the chin flexed onto the chest. Meanwhile, the table is tilted to 60° head down for about 35 sec. The assistant braces the shoulders. At the end of the 35 sec, the table is returned to 0°. The patient is smoothly turned into the left lateral decubitus position while the table is returned and supporting straps are quickly removed. (Moving the patient from the initial right lateral decubitus position to a left lateral decubitus position permits a smoother dispersion of the metrizamide in the suprasellar cistern.

Then the patient is pulled down for centering on the sella-suprasellar region. Two sagittal Polytome sections are obtained and processed (usually small field without grid). Immediately thereafter,

sagittal sections are taken at 2 mm intervals. The two original sagittal sections are reviewed, and a change in technique or position is made if necessary on a second set of alternating 2 mm sagittal sections. Sagittal sections should be completed within 5 min. If no additional sagittal sections are necessary, or after obtaining alternating 2 mm sagittal sections but before waiting for processing, the patient is turned prone if optional coronal sections (orbitomeatal or anthropologic line perpendicular to table) are to be obtained. Two preliminary films are then obtained to confirm the technique, immediately followed by sections at 2 mm intervals as for the sagittal sections.

The patient is given a glass of water to maintain hydration and is sent to the CT scanner in prone position for direct coronal and axial sections. Supine hanging-head position for coronal sections, rather than prone hyperextended positioning, retains sufficient suprasellar metrizamide concentration and usually eliminates dental artifacts (they achieve true coronal rather than subaxial sections). The patient is sent back to the room semierect in 35° to sitting position, which is maintained for 8 hr. The patient can ambulate after 8 hr, or remain supine for another 16 hr if headache is present. Good hydration is maintained with oral intake for 24 hr after the study.

Results

Patient tolerance was excellent with only transient delayed minor complications. No serious complications were encountered (table 1).

Detail of the optic chiasm and nerves in relation to suprasellar mass or intrasellar contents was of diagnostic quality in all 30 patients on sagittal Polytome sections. However, marked suprasellar extension of tumor resulted in adequate, but not excellent, detail. Posteroanterior Polytome sections were of value in those patients in whom dental fillings produced artifacts in the sellar region on the subsequent CT cisternography coronal sections. The CT cisternography artifacts were more often seen with subaxial prone positioning than with later use of a supine hanging-head position on an incline board possible with the EMI-1005 (240 wedges) as well as the EMI-5005. However, the posteroanterior Polytome sections lacked good sellar region metrizamide concentration and diagnostic quality in 11 of the 30 cases.

The information provided by the sagittal Polytome images in all 30 cases obviated pneumoencephalography.

Discussion

The use of intrathecal metrizamide by lumbar puncture to demonstrate intracranial structures by polytomography is not new [6], but the high doses previously used were sufficiently neurotoxic to require pre- and postmedication with phenobarbital, Dilantin, and Dramamine [7, 8]. Electroencephalographic abnormalities were notable. Counteracting the neurotoxic effects of a high dose of metrizamide with medication was not considered justified [9]. As a result, the FDA limited metrizamide for intracranial imaging to CT in a dose of 4–6 ml of 170–190 mg I/ml via lumbar injection. Since the resulting CT cisternography images in combination with the CT were considered satisfactory to replace pneumoencephalography, additional Polytome metrizamide cisternography was usually not done.

However, certain types of treatment of sellar-suprasellar area abnormalities require more precise definition of the

TABLE 1: Side Effects

| Side Effects | No. Patients (n = 30) |
|--------------------------------|--------------------------|
| Headache | 5 |
| Nausea only | 12 |
| Nausea and vomiting | 7 |
| Nausea, vomiting, and headache | 3 |
| Seizure | 0 |
| Urticaria | 1 |

relation of the optic chiasm and nerves to the suprasellar mass or intrasellar contents than most currently available CT scanners can offer in coronal, axial, or direct sagittal or computer-reconstructed sagittal views. One of these types of treatment is stereotactic, necrotizing, proton beam irradiation of intrasellar pituitary adenomas, which is selectively and frequently used at Massachusetts General Hospital as an alternative to surgery. Pneumoencephalography was often necessary to define the anatomy in the sagittal plane after cranial CT and CT cisternography. Now, however, with the use of preliminary metrizamide Polytome sagittal sections (and occasionally optional coronal sections as well, to substitute for potentially inadequate subsequent coronal CT cisternography sections with dental artifacts) en route to CT cisternography, pneumoencephalography has been almost completely replaced with a notable improvement in cost and patient comfort. Conventional sella polytomography has also been deleted from the workup of patients with high clinical and laboratory suspicion of tumors, thus decreasing total radiation dose. To use as low a dose of metrizamide as possible, special positioning, rapid imaging, and 6 ml of 170 mg I/ml concentration were used rather than 190 mg I/ml, the upper limit approved by the FDA for CT cisternography.

There is an added advantage of this approach. The clinician accustomed to the older diagnostic approach will be introduced to the adequacy and safety of CT and CT cisternography. From this experience, he will be more amenable to accepting the exquisitely detailed information produced by the newest scanners. The relation of normal nearby structures to small intrasellar or sella-suprasellar abnormalities may be seen on 2-mm-thick coronal and axial sections after intravenous contrast injection [10]. It is also possible that computed radiography, which can be carried out with the new scanners, may, in conjunction with metrizamide cisternography, be able to provide similar definition of the suprasellar structures [11].

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