CT of Extraarachnoid Metrizamide Instillation

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Because CT of spinal extraarachnoid metrizamide collections may be misleading, we reviewed the postmetrizamide CT scans of 425 patients in order to characterize the appearance of subdural or epidural metrizamide. Eight patients were found to have extraarachnoid metrizamide contrast collections. In all patients, both the subarachnoid space and the extraarachnoid collection were opacified with metrizamide. In seven patients, a subdural collection of metrizamide created a mass upon the opacified subarachnoid space. Three of these subdural collections were less dense than the opacified subarachnoid compartment and simulated soft-tissue disease, including tumor and an arteriovenous malformation. The hypodense collections are probably a result of leakage of metrizamide and cerebrospinal fluid through the spinal needle defect. CT clues for diagnosing these potentially misleading subdural collections include preservation of the normal dural and epidural interface, identification of small islands of metrizamide within a suspected soft-tissue "mass," the presence of concomitant epidural contrast material collections, and the absence of adjacent vertebral-body destruction.

The plain-film appearance of extraarachnoid collections of contrast material occurring during myelography are well known [1, 2]; however, the CT appearance of extraarachnoid collections of metrizamide has received little attention. It is our experience that such collections may result in confusing images. This article examines the potential error caused by the CT appearance of subdural metrizamide, which may simulate extradural spinal disease.

Materials and Methods

We reviewed 425 postmetrizamide CT scans, done over a 2-year period (1982–1984), for evidence of extraarachnoid contrast material. Eight patients with extraarachnoid collections on postmetrizamide CT were identified. Conventional lumbar myelographic techniques were used in all cases. In all eight patients, the spinal puncture was performed in the prone position using a 22-gauge spinal needle placed at the L2 to L3 level. Ten to 12 ml of metrizamide (190 mg of iodine/ml) were then instilled. No complications were encountered in the myelographic procedure. Routine anteroposterior, lateral, and oblique spot radiographs were obtained of the lumbar spine. The patient was then placed in a supine position for 3 to 4 hours. Prior to the CT study, all patients were rotated 360° about the spinal axis to mix the cerebrospinal fluid with the metrizamide. Supine CT scanning (GE CT/T 8800) of the lumbar spine was performed 2 to 4 hours after myelography. Scans were obtained through suspected areas of disease, usually from the L3 to the S1 vertebral body, using 5.0-mm-thick slices, spaced every 3 mm. CT studies were not routinely performed at the L2–L3 site of needle puncture.

Results

Subdural collections of contrast material were visualized by postmetrizamide CT in seven patients. One other patient had a partial epidural metrizamide collection.

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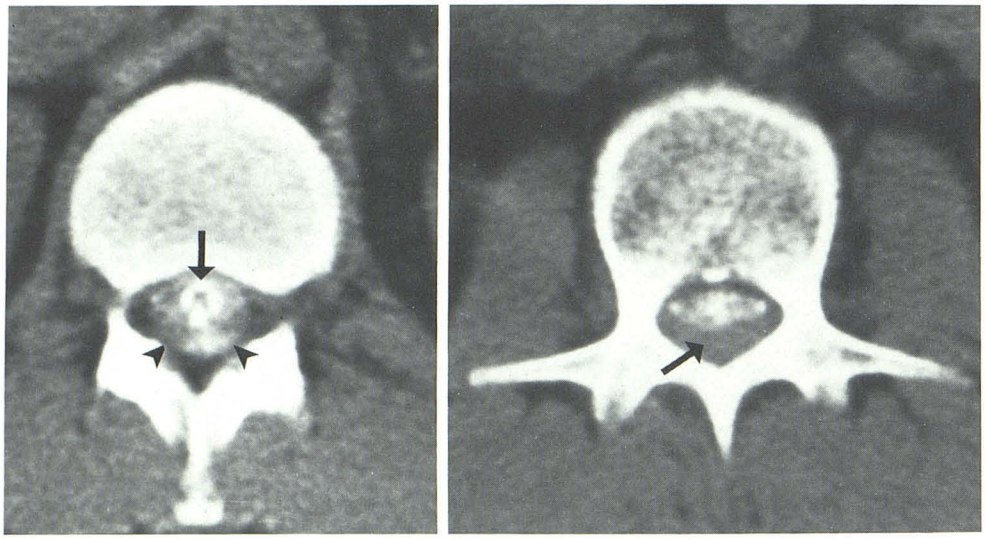

Fig. 1.—**A**, Case 1: partial subdural injection of conus medullares level postmetrizamide myelography. The densely opacified subarachnoid space (*arrow*) has been concentrically narrowed by partial subdural injection of metrizamide. The lower density of the subdural compartment is probably a result of cerebrospinal fluid mixing with metrizamide. The outer dural margin and epidural fat are both normal. **B**, Postmetrizamide CT section at the L1 level shows opacified subarachnoid space displaced anteriorly by "soft-tissue mass" (*arrow*), which is actually an extension of subdural mixture of cerebrospinal fluid and metrizamide.

In five of these eight patients, extraarachnoid collections were of equal or higher density than that of the opacified thecal sac. The diagnosis of extraarachnoid contrast material in these patients was obvious.

In the other three patients, the subdural collection had a CT density lower than that of the opacified thecal sac. The resulting "soft-tissue" appearance can be particularly confusing and is probably due to the dilution of metrizamide with cerebrospinal fluid. The subdural collections of metrizamide and cerebrospinal fluid simulated potentially serious extradural mass lesions in two of these three patients (Figs. 1 and 2).

In the other patient, a subdural fluid collection extended with fingerlike projections from the lumbar puncture site to the upper thoracic region. This appearance was consistent with the tubular filling defects typical of a spinal arteriovenous malformation, the suspected clinical diagnosis (Fig. 3A). A follow-up postmetrizamide CT study performed 2 weeks later demonstrated complete resolution of the abnormal extraarachnoid collection (Fig. 3B). In all seven patients who had subdural collections, the subarachnoid compartment was deformed; however, the interface between the dura and surrounding epidural fat appeared normal (Figs. 1–3).

A review of the plain films taken directly after metrizamide instillation failed to identify extraarachnoid collections of metrizamide in those patients having a subdural collection less dense than the opacified thecal sac. In the five patients with collections that were isodense or hyperdense relative to the thecal sac, only three were identified on plain-film metrizamide myelography.

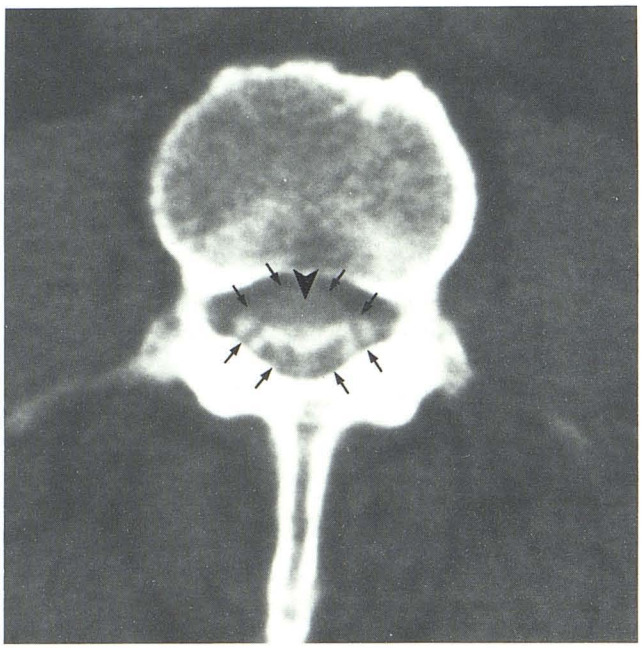

Fig. 2.—Case 2: partial subdural injection. Anterior subdural fluid collection (*arrowhead*) displaces opacified subarachnoid space posteriorly. Convex margin suggests a soft-tissue mass; however, the intact circular dural margin and epidural fat (*arrows*) suggest a subdural collection. Metrizamide myelography revealed only displacement of opacified subarachnoid space from vertebral body.

Discussion

Subdural and epidural metrizamide collections may occur during metrizamide instillation as a result of either direct injection of contrast material through a malpositioned spinal needle or leakage of metrizamide and cerebrospinal fluid through the arachnoid defect left by the spinal needle. Contrast material may also leak into the extraarachnoid compartments through surgical or traumatic dural tears [3].

The conventional radiographic appearance of extraarachnoid contrast material is well recognized. One series reviewed Pantopaque myelography using 18-gauge spinal needles and

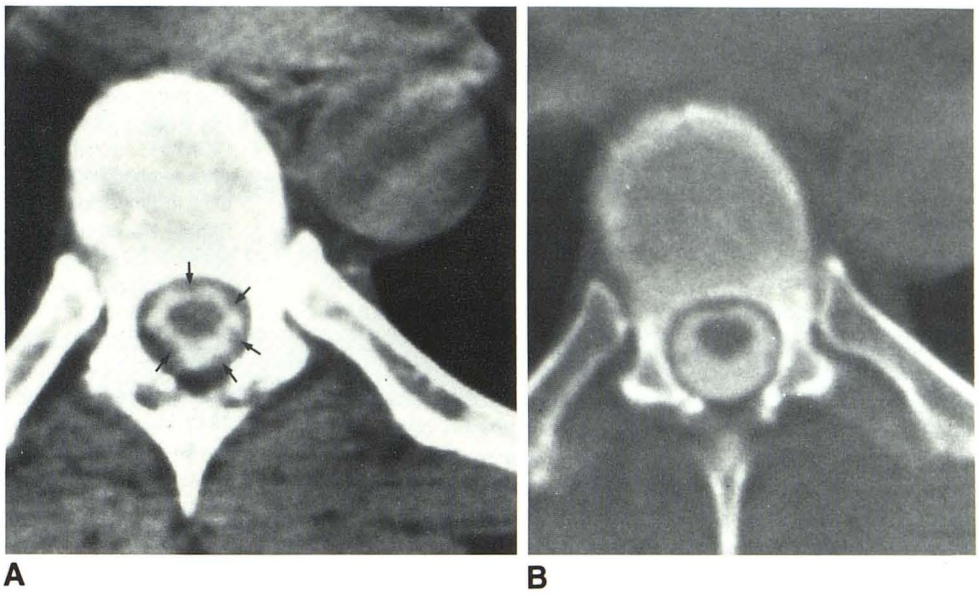

Fig. 3.—**A**, Case 3: partial subdural injection. CT scan of thoracic spine of 58-year-old man with history of progressive bilateral lower extremity weakness and clinically suspected thoracic spinal cord arteriovenous malformation. Initial routine myelography was normal. Postmetrizamide CT revealed long eccentric filling defects (*arrows*) inside margin of opacified thecal sac. **B**, Repeat metrizamide CT scan, 2 weeks after initial study, was normal. Linear filling defects were no longer present and they probably represented small tubular collections of subdural fluid loculated by dural-arachnoid membranous attachments. A spinal arteriogram was thereby avoided.

reported a 10% incidence of extraarachnoid contrast material [2]. In our experience with metrizamide myelography and postmetrizamide CT, extraarachnoid collections are much more uncommon. Perhaps the use of metrizamide and 22-gauge spinal needles accounts for the relatively few extraarachnoid collections we detected.

In comparison to plain-film metrizamide myelography, postmetrizamide CT of the spine provides better delineation of the thecal sac contents from intradural and extradural structures [4–10] and visualizes small collections of relatively low-density metrizamide undetected by plain films [3]. The CT appearance of extraarachnoid collections, however, is less familiar to radiologists and, in our experience, may simulate a serious pathology. While no direct chemical side effects of extraarachnoid instillation are known, differentiation of these collections from other pathologic lesions is important so that further diagnostic studies or surgical intervention can be avoided.

Partial subdural collections of metrizamide may be either hypodense, isodense, or hyperdense relative to the opacified subarachnoid compartment. The density difference probably depends not only on the amount and concentration of contrast that is directly injected into the subarachnoid and extraarachnoid compartments, but also on the amount and concentration of opacified cerebrospinal fluid that leaks into the subdural compartment during the interval between myelography and postmetrizamide CT. Other contributing factors may include the exact needle position, compliance of the subdural space, bleeding within the subdural space, and the relative subdural and subarachnoid pressures.

A hypodense or isodense subdural collection may result in a soft-tissue density that simulates an extradural mass lesion on postmetrizamide CT. In six of our seven patients with subdural collections, the subdural metrizamide collection appeared as a mass that deformed the arachnoid membrane and the opacified subarachnoid space. Three of these mass-like collections had a soft-tissue density suggesting serious pathology, such as epidural tumor or arteriovenous malformation (Figs. 1–3).

In one case in which the subdural collection had a soft-tissue attenuation, small islands of higher-density metrizamide were identified within the collection, documenting the presence of subdural metrizamide (Fig. 1A). Recognition of this intracompartmental density difference on metrizamide CT is important in diagnosing a subdural collection of metrizamide.

Other radiographic clues may help diagnose a subdural contrast collection on postmetrizamide CT. Subdural collections displace the arachnoid membrane away from the dura, and as a result deform only structures within the subarachnoid space. Therefore, normal epidural fat planes around the perimeter of the thecal sac are always observed in the presence of a subdural collection. This preservation of epidural fat may be a clue in differentiating a subdural collection from extradural mass lesions, such as epidural metastases, which usually obliterate the normal dural fat planes surrounding the thecal sac. Another clue to the presence of a subdural metrizamide collection is the absence of distortion of the normal, round dural margin (Fig. 1). Epidural disease will often distort this dural margin, resulting in both epidural fat infiltration as well as distortion of the round perimeter of the thecal sac.

In summary, a mixture of metrizamide and cerebrospinal fluid may collect within the subdural space after metrizamide myelography and form a soft-tissue density on postmetrizamide CT scans of the lumbar spine. This collection can deform the opacified thecal sac and simulate intrathecal or epidural mass lesions. If we ecounter a soft-tissue density mass on

postmetrizamide CT that could represent either an extradural mass or a subdural collection of contrast material, we search for the associated findings that are diagnostic of a collection of subdural contrast material. These include: (1) preservation of the normal dural and epidural interface despite the distortion of the subarachnoid space (Figs. 1B and 2); (2) high-density islands of metrizamide layering within the suspected "mass" of soft-tissue attenuation (Fig. 1A); (3) the presence of epidural contrast material in addition to the suspicious soft-tissue mass; and (4) absence of adjacent vertebral body destruction, a finding usually present in cases of true epidural masses.

Given the above criteria, it is possible to reliably differentiate a soft-tissue mass from a subdural collection of metrizamide. In the unusual case in which this differentiation cannot be accomplished, a repeat CT study may show resolution of the extraarachnoid collection. The ability to recognize benign collections of contrast material can prevent misinterpretation of CT scans and the resultant unnecessary diagnostic and surgical procedures.

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