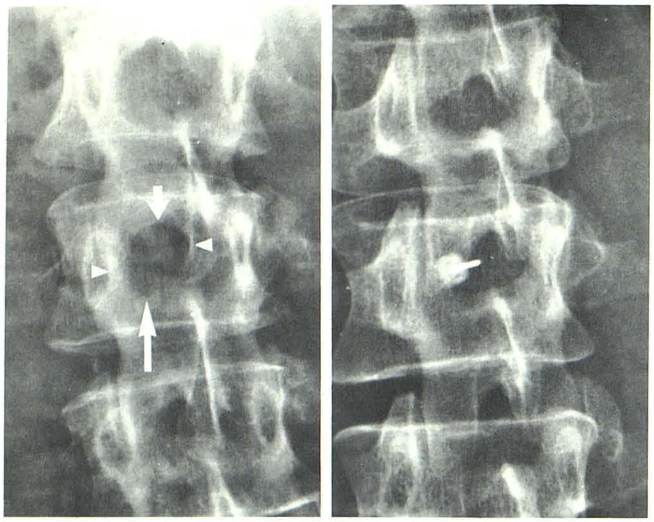

A B

Fig. 1.—**A**, Shallow oblique view of lumbar spine (about 10° of rotation) on anteroposterior fluoroscopy demonstrates borders of "third pedicle": inferior margin of superior lamina (*short arrow*), superior margin of inferior lamina (*long arrow*), and cortical margins of spinous process and pedicle (*arrowheads*). **B**, Using "third pedicle" as target, spinal needle is passed parallel to central fluoroscopic ray.

simply to keep the needle vertical, and any guesswork about the desired versus actual depth of the needle is eliminated.

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CT Signs of Central Descending Transtentorial Herniation

The recognition of computed tomographic (CT) signs of central descending transtentorial herniation (DTH) is important in the evaluation of various diseases of the central nervous system. Although the CT appearance of lateral DTH from supratentorial focal space-occupying lesions has been described [1], the appearance of central DTH from generalized cerebral edema has not been emphasized. We illustrate the signs of central transtentorial herniation by cranial CT.

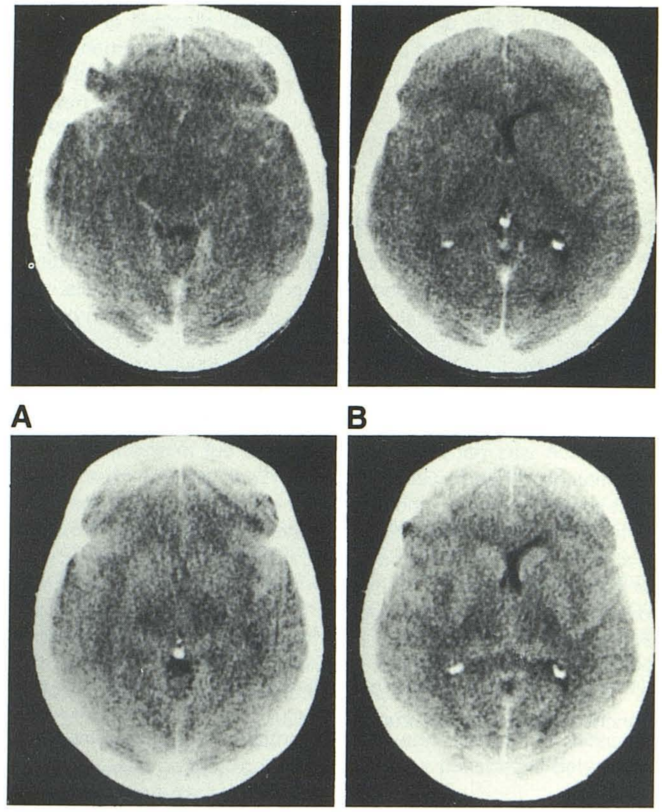

Fig. 1.—**A** and **B**, Cranial CT scans on admission. Small lateral ventricles suggest generalized brain swelling. Pineal gland occupies its normal position in superior part of quadrigeminal cistern, forming a triangle with glomera. **C** and **D**, 3 days after admission. Complete effacement of superior quadrigeminal cistern with widening of both internal capsules and diminished density of both thalami. Pineal gland is now in lower quadrigeminal cistern area, indicating inferior displacement.

Case report.—A 43-year-old woman was admitted with a diagnosis of hepatic coma secondary to postnecrotic cirrhosis. She was unresponsive to deep pain, her pulse was 130, and her blood pressure was 88/50. Her pupils were equal, round, and reactive to light. Extremities were flaccid with only occasional movements of either arm or leg. The electroencephalogram (EEG) showed multifocal status epilepticus. Cranial CT showed small lateral ventricles, suggesting generalized brain swelling. The pineal gland occupied its normal position in the anterior aspect of the superior part of the quadrigeminal cistern, posterior to the thalamic nuclei (figs. 1A and 1B). Three days later, her condition worsened and she developed dilated nonreactive pupils. The ventricles were smaller on repeat CT. Diminished density in both thalami and in the medial aspects of the occipital lobes indicated ischemia from compression of the thalamoperforating and posterior cerebral arteries. The pineal gland was now situated adjacent to the colliculi, indicating its caudal displacement. The superior part of the quadrigeminal cistern (anterior aspect of the diamond) was effaced (figs. 1C and 1D). The patient's EEG at this time showed unequivocal cerebral inactivity, and she was pronounced dead. No autopsy was performed.

With generalized supratentorial processes causing increased intracranial pressure, the unci, hippocampal gyri, hypothalamus, midbrain, brainstem, and basilar artery are forced downward, indicating DTH

[1, 2]. Signs of DTH that have been recognized on CT scans include complete obliteration of the basal subarachnoid cisterns, an increase in sagittal diameter of the brainstem, and inferior displacement of the basilar artery [1]. In most cases of severe cerebral edema due to trauma or central nervous system disease, extremely small lateral ventricles are noted on CT [3, 4]. It is difficult to diagnose DTH using the above signs because it is difficult to separate the basal and midbrain structures on the axial CT scan.

The CT findings of central DTH are based on displacement of the pineal gland. The inferior displacement of the pineal gland on CT has not been described in cases of central DTH. Posterior pineal displacement was reported in a study of pineal calcifications on lateral skull films in patients with supratentorial tumors [5]. Normally, the pineal gland is located in the superior part of the quadrigeminal cistern and is usually seen on the same CT section as both glomera [6]. With central DTH, the quadrigeminal and retrothalamic cisterns are totally effaced owing to displacement and edema of the central brain structures. The pineal gland is displaced inferiorly toward the colliculi, and is noted on a lower CT section.

The appearance of the pineal gland on the CT scan may be influenced by slice thickness and gantry angle. Because the pineal gland lies anterior to the glomera, caudal angulation of the section can cause the gland to appear on a section below that showing the glomera. An increase in caudal gantry angulation or a decrease in slice thickness may cause the pineal gland and glomera to appear at different scanning levels, simulating central DTH. This has not been a problem, in our experience, when using 10-mm slice thickness and no gantry angulation. In addition to displacement of the pineal gland in DTH, other signs of herniation are present for confirmation. Also, both thalami and occipital lobes may show low density due to ischemia from compression of the posterior cerebral and thalamoperforating arteries.

Central DTH in patients with severe generalized cerebral edema due to various central nervous system diseases can be detected by CT. Recognition of the caudal shift of the pineal gland with effacement of the quadrigeminal and retrothalamic cisterns, in association with extremely small ventricles, facilitates this diagnosis.

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