Modified CT techniques in the evaluation of temporal lobe epilepsy prior to lobectomy.

T el Gammal, R J Adams, D W King, E L So and B B Gallagher

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Modified CT Techniques in the Evaluation of Temporal Lobe Epilepsy Prior to Lobectomy

Taher El Gammal[1]
Robert J. Adams[2]
Don W. King[2]
Elson L. So[3]
Brian B. Gallagher[2]

The outcome of temporal lobectomy performed for seizure control is improved by preoperative identification of structural lesions. We used cranial CT, modified to improve visualization of mesial temporal structures, as a means of preoperative evaluation in 48 patients with partial complex seizures. The axial views, parallel to the temporal fossa, improved visualization of five lesions, including two that were not diagnosed by routine cranial CT. In 12 patients, intrathecal metrizamide was used; the rest received intravenous contrast. These modified techniques could not reliably predict mesial temporal herniation; however, modified axial CT with intravenous contrast is recommended for evaluation of suspected temporal lobe pathology.

The outcome of temporal lobe resection for partial complex seizures is better in patients with structural abnormalities of the temporal lobe than in patients without evidence of a pathologic lesion [1, 2]. Specifically, mesial temporal sclerosis and transtentorial herniation at surgery have been correlated with good postoperative seizure control [3]. Preoperative identification of mass lesions or mesial temporal sclerosis is therefore desirable, especially when EEG patterns do not clearly localize a seizure focus. Recently, Bolender and Wyler [4, 5] reported a quantitative technique using intrathecal metrizamide and cranial CT to detect chronic mesial temporal herniation preoperatively. The present investigation was designed to determine if nonquantitative CT techniques, modified to visualize anterior temporal structures, could improve visualization of temporal lobe mass lesions and predict the presence of transtentorial herniation.

Materials and Methods

Forty-eight consecutive temporal lobectomy candidates underwent a preoperative protocol that included history and examination, neuropsychological testing, video and EEG monitoring (often with depth electrodes), arteriogram with Wada testing, and routine and modified cranial CT. All patients were admitted to the epilepsy unit of the Medical College of Georgia Hospital. Twenty-eight of these cases have undergone surgery.

All patients received routine cranial CT with and without intravenous contrast. All patients underwent temporal lobe CT (TLCT) in planes parallel to the temporal fossa after intravenous contrast. Intrathecal contrast (metrizamide) was used in 12 patients, four of whom had additional coronal tomography. The CT examinations were performed on a GE 9800 scanner.

TLCT views involved 10 transaxial sections of 3-mm thickness at 3-mm intervals in the temporal lobe region parallel to the temporal horns. The rest of the brain was studied in 1-cm slices at 1-cm intervals. The plane of TLCT was determined as follows: a digital scout was obtained with the patient supine and the neck in moderate extension; gantry angulation was used to adjust the scan plane to pass from the top of the dorsum sella through a point 3 mm inferior to the posterior border of the planum sphenoidale (Fig. 1).

TLCT images from the first 33 patients were evaluated by grading the definition of seven anatomic structures: the tentorium, aqueduct of Sylvius, contour of the brainstem, unci, posterior temporal lobes, temporal horns, and temporal choroid plexi of the lateral ventricles. A score of 3 represented excellent visualization, while 0 represented no visualization. To be

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[1] Department of Radiology, Medical College of Georgia, Augusta, GA 30912-2366. Address reprint requests to T. El Gammal.

[2] Department of Neurology, Medical College of Georgia, Augusta, GA 30912-2366.

[3] Department of Neurology, Marshfield Clinic, Marshfield, WI 54449.

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graded a 3, paired structures had to be well visualized bilaterally. Averaged visualization scores provided an approximate measure of the consistency with which each of these anatomic structures was seen.

Results

Visualization scores based on the above criteria were averaged for the 33 patients and are shown in Table 1. The improved delineation of anterior mesial temporal structures and visualization of the temporal horns provided by TLCT is demonstrated in Figure 2A. In approximately 30% of the cases, paired vessels, arising from the proximal posterior cerebral arteries, were seen lateral to the posterior communicating arteries (Fig. 2B). These arteries, termed the uncal arteries, curve anteriorly over the surfaces of the unci and, to our knowledge, have not previously been described. Displacement of one of them may be helpful in identifying lesions in the area of the uncus.

In this series of 48 cases, eight lesions were identified by all methods. There were four tumors, of which three were temporal lobe astrocytomas and one was a small posterior temporal oligodendroglioma. Two of the temporal lobe lesions were detected by TLCT after negative conventional CT (Figs. 3 and 4). TLCT improved visualization of the other temporal lobe lesion discovered by routine CT, but made no contribution to the localization of the posterior temporal lesion.

Two of the lesions were arachnoid cysts. TLCT improved definition and localization of one of these, which was anterior temporal in location and associated with calcification of uncus overriding the tentorium. In the other case, visualization of a suprasellar cyst was not significantly enhanced by TLCT.

The other two lesions included an infarction in the occipital lobe, which was well outlined by routine CT, and a calcified temporal lesion not yet subjected to surgery. In the latter case, conventional CT showed an area of high attenuation that could not be clearly distinguished from artifact created by the petrous bone. Using TLCT, we verified the anterior temporal location of the abnormality by separating it from the petrous ridge anteriorly.

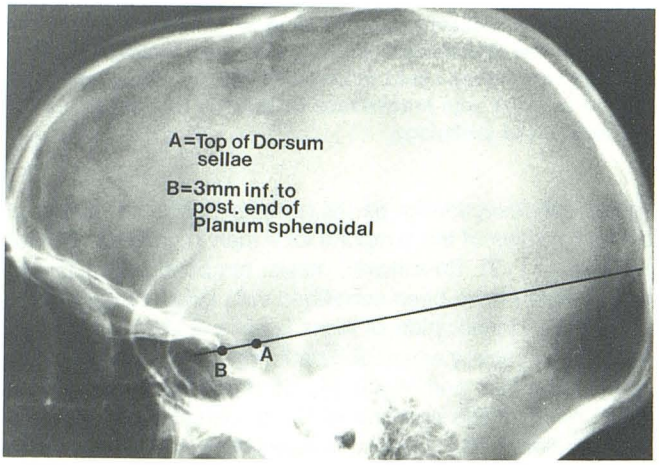

Fig. 1.—Selected plane for axial imaging.

TABLE 1: **Anatomic Visualization with Temporal Lobe CT**

Anatomic Structure	Visualization Score*
Tentorium	2.96
Aqueduct of Sylvius	2.79
Brainstem	2.96
Uncus	2.39
Temporal horns	2.01
Temporal choroid plexus	2.64

* Visualization scores represent the averages over 33 cases of the rating score (0 = no, 3 = excellent visualization) given to each anatomic structure based on how well it was seen on temporal lobe CT.

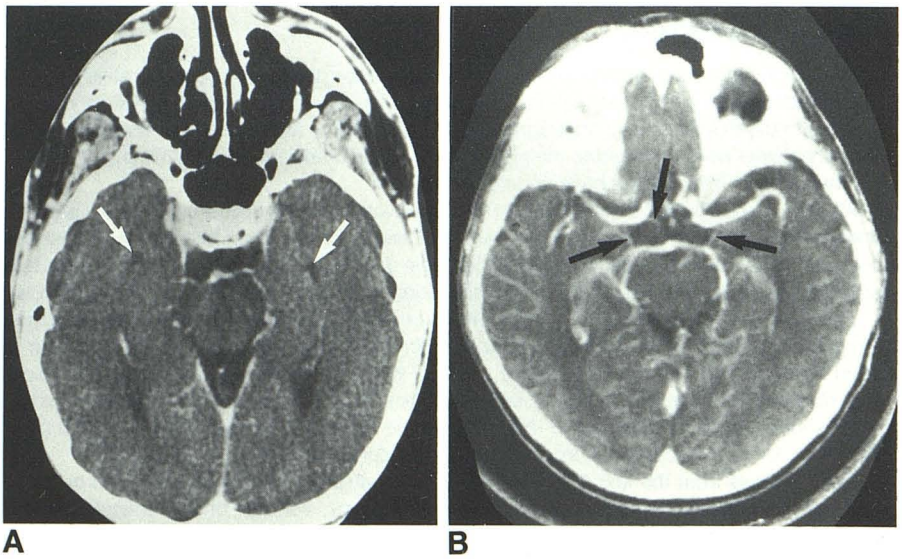

Fig. 2.—Normal anatomy of temporal lobe structures.

***A*, Anterior temporal horns (*arrows*).**

***B*, Medial border of unci are outlined by uncal arteries (*posterior arrows*), branches of posterior cerebral arteries. Right posterior communicating artery is seen more medially (*anterior arrow*).**

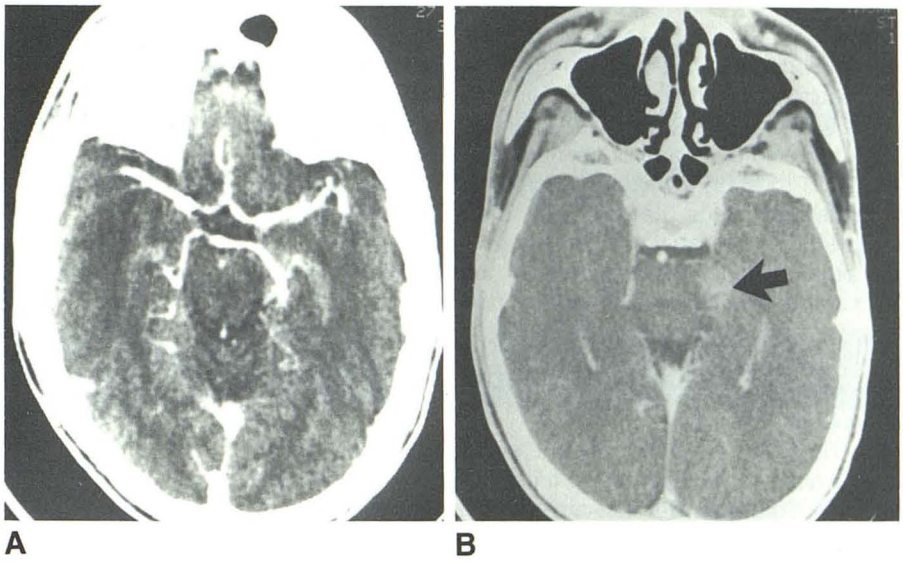

Fig. 3. Early left temporal glioma.
A, Enhanced conventional CT shows no abnormality.
B, Temporal lobe CT shows tumor enhancement in left uncus (*arrow*).

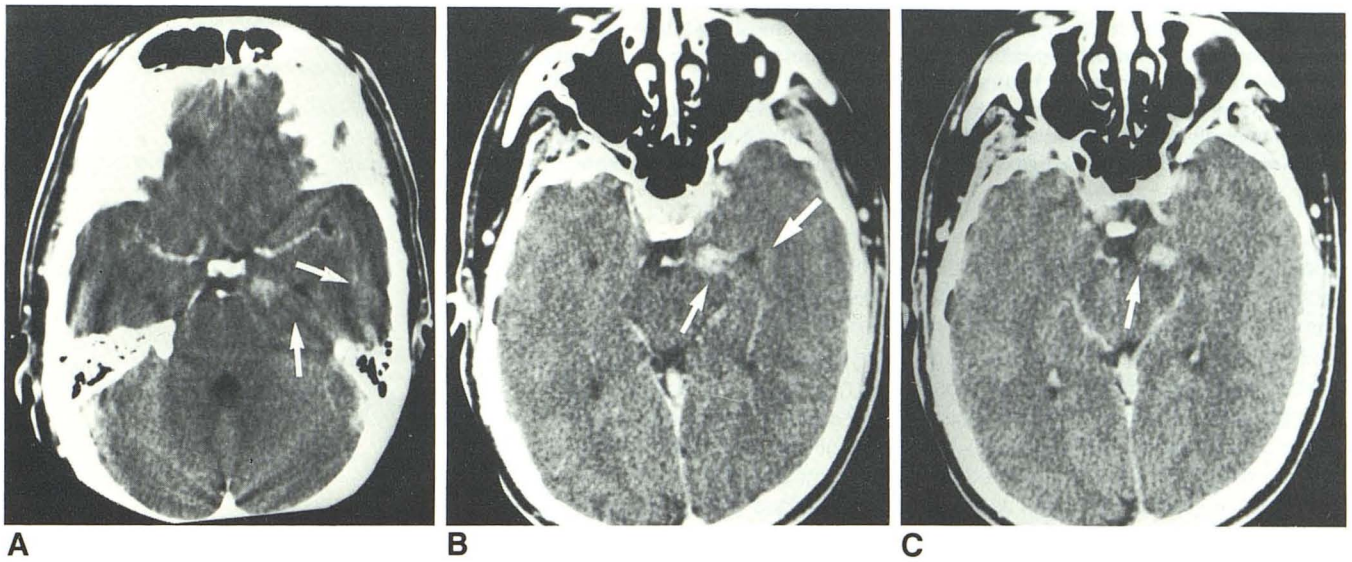

Fig. 4. Early left temporal glioma.
A, Conventional enhanced CT shows artifacts from left petrous bone (*arrows*). Tumor enhancement could be mistaken for artifact.
B, Temporal lobe CT shows tumor enhancement (*short arrow*). *Long arrow* shows temporal horn.
C, Higher section shows overriding left uncus (*arrow*).

Intrathecal metrizamide was used in conjunction with TLCT in three of the eight cases with structural abnormalities and in nine other patients. It provided important additional information in one of the tumor cases by better demonstrating the separation between a mesial temporal mass and the brainstem. In the patient with an anterior temporal cyst, filling of the lesion with metrizamide demonstrated that the abnormality was an arachnoid cyst and not a cystic tumor confined to the mesial temporal lobe. However, metrizamide provided no additional information beyond intravenous contrast in the other 10 cases in which it was used. No complications with intrathecal metrizamide were encountered in this series.

In three cases without definite lesions, TLCT showed evidence of significant asymmetry that was not present on routine CT. One patient's TLCT study showed the left uncus to be closer to the midline than the right uncus. On the basis of other information, right temporal lobectomy was performed in this case and revealed gliosis. The other two, one with dilatation of the temporal horn unilaterally and one with hippocampal asymmetry, have not undergone surgery.

The surgeon reported herniation of the uncus over the free edge of the tentorium in eight cases: in only one of these cases, which involved a tumor, was the herniation predicted preoperatively by TLCT.

Discussion

The modification described in this report as temporal lobe CT resulted in improved preoperative diagnosis in five of 48 cases and suggested abnormality in three others. Two tumors were revealed that had not been diagnosed by conventional CT. TLCT routinely showed anterior mesial temporal anatomy to better advantage than did routine angulation CT, and it revealed important anatomic details obscured by artifact from the petrous ridge. Differentiation of intracranial structures from artifact created by the petrous ridge is a distinct advantage of this technique. In addition, displacement of the temporal horns, rarely seen on routine CT in the absence of hydrocephalus, may help to confirm the pathologic nature of attenuation in this area.

TLCT is accomplished without additional equipment or special quantitative methods. In most cases, intrathecal contrast is not required. Because six to eight additional slices are needed, TLCT adds aproximately 30% more radiation to the ocular lenses than does conventional CT. Although this series was confined to candidates for temporal lobectomy, TLCT may also prove useful in the initial investigation of patients presenting with partial complex seizures or other signs of temporal lobe pathology.

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