Celebrating 35 Years of the AJNR: March 1984 edition

AJNR Am J Neuroradiol 2019, 40 (3) 582
doi: https://doi.org/10.3174/ajnr.P0080
http://www.ajnr.org/content/40/3/582

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March 1984 edition

MR Imaging of Pituitary Adenomas Using a Prototype Resistive Magnet: Preliminary Assessment

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Magnetic resonance (MR) images were obtained with a prototype resistive magnet system in 10 patients, all of whom had been shown to have pituitary tumors by enhanced high-resolution computed tomography (CT). Histologic verification was obtained in eight cases. Inversion-recovery (IR) T1-weighted images revealed the tumor in six of nine cases; saturation-recovery (SR) images with less T1 weighting identified seven of nine tumors; Carr-Purcell-Meiboom-Gill (CPMG) spin-echo T2-weighted images revealed two of four tumors. MR images failed to demonstrate three microadenomas: 5 × 5 × 8 mm, 6 × 6 × 6 mm, and one less than 5 mm in estimated size. In the last pretreatment study, CT had demonstrated a 13 mm maximum diameter adenoma. Repeat CT at the time of MR imaging also showed a partially empty sella and did not resolve the residual adenoma. The larger adenomas were identified readily by MR imaging, which, unlike CT, suggested old tumor hemorrhage in two cases, which was confirmed at surgery and histologic examination. MR and CT images were also compared for relative effectiveness in identifying important perisellar structures.

The introduction of computed tomography (CT) has revolutionized the imaging of intracranial neoplasms. High-resolution CT has been shown to have high sensitivity in detecting pituitary tumors and represents the standard against which any new imaging method must be measured. Previous publications dealing with magnetic resonance (MR) imaging of intracranial lesions have generally included examples of a wide variety of pathologic conditions [1–9]. To date, none have dealt exclusively with a series of cases of a single tumor type. Very few MR images of pituitary adenomas or apparently normal pituitary glands have been presented [4, 7, 10–12]. Our study represents an evaluation of MR imaging in a consecutive series of 10 patients with pituitary adenomas, using a prototype resistive magnet MR system. Effectiveness of MR imaging was compared with that of CT.

CT is dependent for image contrast upon variations of x-ray attenuation, produced largely by variations in electron density of tissues. Further, detection and evaluation of pituitary adenomas require the use of intravenous contrast enhancement and, occasionally, intrathecal contrast methods. Proton (^1H) MR imaging exploits the interactions of static and dynamic magnetic fields, radiofrequency (RF) energy, and hydrogen nuclei, yielding information about proton density and the local physicochemical environment of protons, to the extent that this can be inferred from the relaxation time constants T1 (spin-lattice) and T2 (spin-spin). While proton density variations between different soft tissues are rather small, it has been shown that variations in the T1 and T2 relaxation times between normal and abnormal tissues are frequently very large. Suitable choices of RF pulse sequences to optimize these differences result in images with high tissue contrast (up to several hundred percent).

Subjects and Methods

Ten patients with pituitary adenomas were studied (table 1). Before MR imaging, each

Received August 10, 1983; accepted after revision October 18, 1983.

This work was supported in part by Technicare Corp., Solon, OH.

T. J. Brady is supported in part by National Cancer Institute research career development award 5 K04 CA 00848 01.

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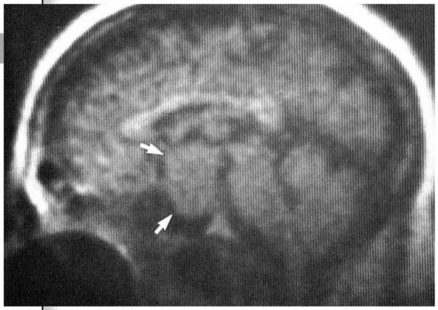
AJNR 5:131–137, March/April 1984
0195–6108/84:0502–0131 $00.00



Correlation of CT Cerebral Vascular Territories with Function: 3. Middle Cerebral Artery

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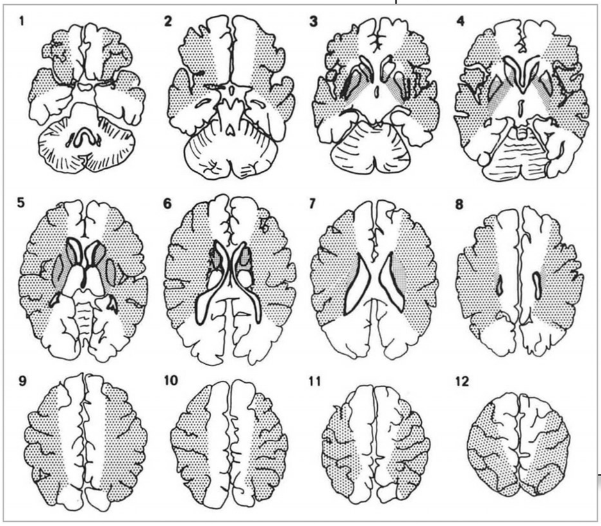
Schematic displays are presented of the cerebral territories supplied by branches of the middle cerebral artery as they would appear on axial and coronal computed tomographic (CT) scan sections. Companion diagrams of regional cortical function and a discussion of the fiber tracts are provided to simplify correlation of clinical deficits with coronal and axial CT abnormalities.



This report is the third in a series designed to correlate cerebral vascular territories and functional anatomy in a form directly applicable to computed tomography (CT). The illustrations are intended to simplify analysis of CT images in terms of clinical signs and symptoms and vascular territories in everyday practice. The anterior and posterior cerebral arteries have been described [1, 2]. This report deals with the middle cerebral arterial territory.

Knowledge of cerebral vascular territories can help in differentiating between infarction and other pathologic processes. For example, if the position and extent of a lesion and the usual position and extent of a vascular territory are incongruous, infarction should receive relatively low diagnostic priority and vice versa. Knowledge of vascular territories can also facilitate correct interpretation of cerebral angiograms by pinpointing specific vessels for particularly close attention.

Knowledge of functional neuroanatomy applied to a patient's clinical findings can improve detection of subtle lesions by pinpointing specific areas for special attention on CT and specific vessels for attention on angiograms.

Discussion

The largest area of the brain that is normally supplied by the vessel(s) of the middle cerebral territory is indicated in figures 1 and 2. An occlusion of the middle cerebral artery will rarely produce a CT lesion larger than that defined in these illustrations. In fact, collateral supply, which often interfaces at the periphery of an infarction, may cause the area of involvement to be smaller than that schematically defined. Furthermore, the area of involvement may have a patchy appearance because only selected branches within the territory are occluded by emboli or fall victim to failure of collateral circulation. Very rarely occlusion may result in infarction of an area that is larger than the territory ascribed to it in figures 1–3. In these cases the territory supplied by the infarcted vessel has "extended" via collateral vessels into adjacent territory(s), the natural supply of which has previously been compromised. Thus when the rescuing vessel is compromised, territory outside the usual vascular limit is also compromised.

The vascular territory generally supplied by the middle cerebral artery and the neurologic functions ascribed thereto are mapped on schematic axial and coronal