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Multiplanar computed tomography reconstruction to aid in recognition of the middle cerebral artery "Dot" sign: The sagittal string sign

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Abstract

While non-contrast head computed tomography is effective in detecting blood, it is not sensitive in diagnosing hyperacute ischemic stroke. One neuroradiologic marker for early thromboembolic occlusion of the distal middle cerebral artery is the middle cerebral artery "dot" sign. The "dot" seen on the typical axial plane represents a hyperdensity of the middle cerebral artery in the Sylvian fissure. A review of medical literature was conducted via PubMed utilizing search phrases "MCA," "dot," and "sign." The review was limited to the intravenous tissue-type plasminogen activator era, 1996 and on. Articles were analyzed to determine the use of the sagittal plane of non-contrast head computed tomography to locate the middle cerebral artery "dot" sign. The search terms yielded 11 results which revealed that computed tomography reconstruction and sagittal planes were not used for detection of the middle cerebral artery "dot" signs. Our patient had no known past medical history. The initial non-contrast head computed tomography was read as having a hypodensity in the right insular region and a middle cerebral artery "dot" sign. Multiplanar reconstruction of the computed tomography demonstrated a hyperdense sagittal string-like appearance of the middle cerebral artery along the Sylvian fissure. Computed tomography angiography confirmed the M2 occlusion. This is the first report of using the head computed tomography sagittal plane for diagnosis of the middle cerebral artery "dot" sign. Incorporating multiplanar reconstruction and producing the sagittal plane may lead to a higher sensitivity of the middle cerebral artery "dot" sign. Further studies incorporating a patient cohort will be needed to determine how much the sagittal plane view augments predictive value of the middle cerebral artery "dot" sign.

Keywords

Neurology, radiology, middle cerebral artery dot sign, sagittal, multiplanar

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Background

While non-contrast head computed tomography (CT) is effective in detecting blood, it is not sensitive in diagnosing hyperacute ischemic stroke. One neuroradiologic marker for early thromboembolic occlusion of the distal middle cerebral artery (MCA) is the MCA "dot" sign which was first described in 2001.[1] The "dot" seen on the typical CT axial plane represents a hyperdensity of an MCA branch (either M2 or M3) in the Sylvian fissure. This is comparable to the better known hyperdense MCA (HMCA) sign which is indicative of an M1 occlusion.

Objective and methods

The primary purpose of this study was to review the literature regarding the use of the sagittal plane from a non-contrast head CT to improve detection rate of the MCA "dot" sign. A review of the literature was conducted via PubMed utilizing the search phrases "MCA," "dot," and "sign." The review was limited to the intravenous (IV) tissue-type plasminogen activator (tPA) era, 1996 and on. Articles were analyzed to

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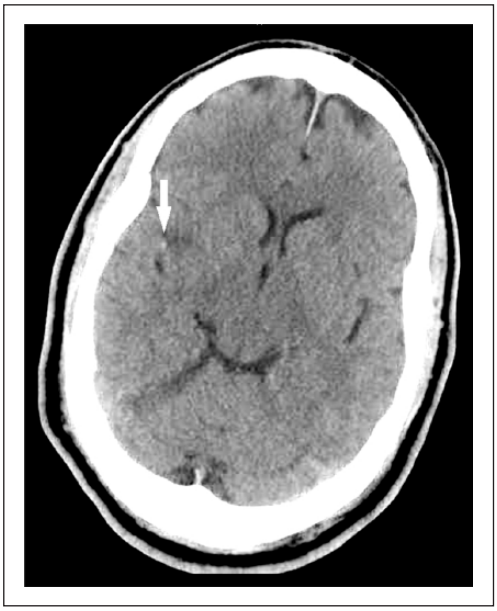

Figure 1. Non-contrast head CT, axial plane, 5 mm thickness, showing hyperdense MCA "dot" sign in the right Sylvian fissure (arrow).

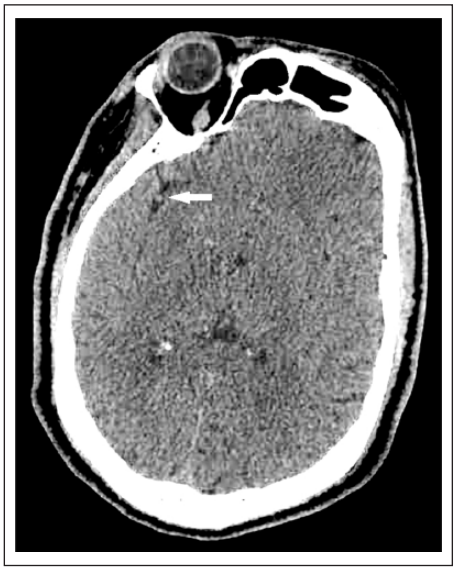

Figure 2. Non-contrast head CT, axial plane, 0.67 mm thickness, showing hyperdense MCA "dot" sign in the right Sylvian fissure.

determine the use of the sagittal plane of non-contrast head CT to locate the MCA "dot" sign.

Case report

Our patient, who had no known past medical history, presented to the Emergency Department after waking up with left-sided weakness, with last known normal being the night before. The examination revealed a left upper motor neuron facial palsy and left-sided hemi-spatial neglect. Left limb strength was 1/5 diffusely in the arm and 4/5 in the left leg.

The initial non-contrast head CT was interpreted as having a hypodensity in the right insular region. On further inspection, an MCA "dot" sign was seen (Figures 1 and 2). Using Visage® 7 enterprise imaging platform, multiplanar reconstruction of 0.67 mm slices from the CT demonstrated a hyperdense sagittal string-like appearance of the MCA along the Sylvian fissure (Figure 3). CT angiography of the head confirmed the distal M2 occlusion. Brain magnetic resonance imaging without gadolinium revealed an acute ischemic stroke (AIS) in the corresponding vascular distribution. CT angiography of the neck showed a proximal right internal carotid artery occlusion suggesting that the patient had an artery-to-artery embolic brain infarction.

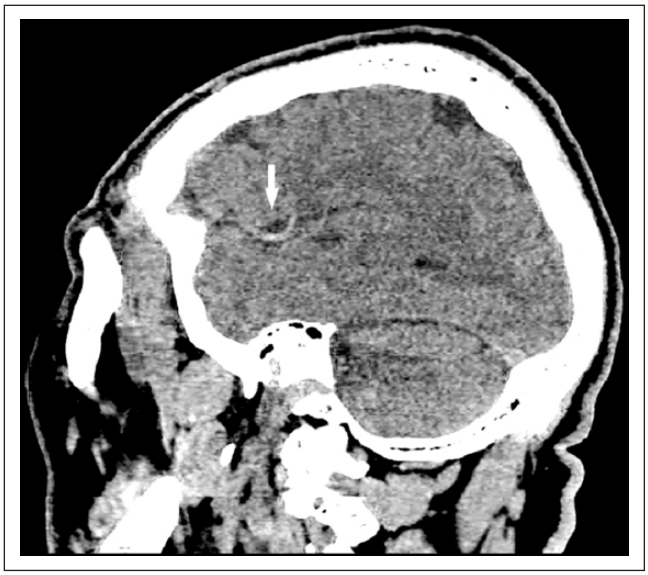

Figure 3. Non-contrast head CT, sagittal plane, 0.67 mm thickness, showing a hyperdense MCA (sagittal string sign) in the right Sylvian fissure (arrow).

Discussion

Of the 11 articles yielded by the search terms, none used CT reconstruction or the sagittal plane for detection of the MCA "dot" sign. Validation studies have demonstrated that the MCA "dot" sign can be associated with patent arteries in some patients with AIS. For example, the positive predictive value and specificity of this sign were 58% and 89%, respectively, in a study incorporating 19 patients with AIS and this finding.[2] Sensitivities of the MCA "dot" sign detected on the axial plane of a CT range from 27% to 38%.[3]

This is the first report of incorporating sagittal plane imaging on baseline non-contrast CT to confirm the presence of an MCA branch occlusion in the presence of an MCA

"dot" sign. By rotating the CT axis, the "dot" in the Sylvian fissure forms an elongated string. Incorporating multiplanar reconstruction and producing the sagittal plane may lead to less false-positive studies, thus a higher specificity and positive predictive value of the MCA "dot" sign. Further studies incorporating a patient cohort are needed to determine how much the sagittal plane view enhances and augments predictive value of the MCA "dot" sign.

The MCA "dot" sign has important diagnostic and therapeutic implications. Its presence can improve clinicians' ability to quickly confirm that a patient is having an MCA distribution ischemic event. Additionally, this sign may help to select patients who are candidates for revascularization with IV thrombolytic therapy.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical approval

Our institution does not require ethical approval for reporting individual cases or case series.

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Informed consent

Written informed consent was obtained from the patient(s) for their anonymized information to be published in this article.

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