Clinical Case Report

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Usefulness of multiphase computed tomography angiography in a patient with transient ischemic attack in the hyperacute phase

A case report

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Abstract

Rationale: Patients with transient ischemic attack (TIA) have the possibility of developing stroke in the future. To prevent recurrent TIA or future stroke, identifying the cause of TIA is important. However, about two-third of patients with TIA have negative findings on diffusion-weighted imaging (DWI).We present a case of TIA, the cause of which was identified using multiphase computed tomography angiography (MCTA) in the hyperacute phase of the disease.

Patient Concerns: The patient was a 57-year-old man who was admitted to the emergency department for right-side weakness persisting for 1 hour.

Diagnoses: Occlusion of the proximal M3 segment of the left middle cerebral artery territory was found on the initial MCTA.

Outcomes: The weakness completely resolved at 2 hours after symptom onset, and there was no acute infarction on the initial diffusion-weighted magnetic resonance imaging (MRI) on the same day. Follow-up MCTA on the next day showed recanalization of the left M3 segment. Follow-up diffusion-weighted MRI showed focal acute infarction in the left middle cerebral artery territory.

Lessons: MCTA could identify distal occlusion of the anterior circulation in patients with cardioembolic TIA in the hyperacute phase with negative DWI findings.

Abbreviations: DWI = diffusion-weighted imaging, MCA = middle cerebral artery, MCTA = multiphase computed tomography angiography, MRI = magnetic resonance imaging, SVS = susceptibility vessel sign, SWI = susceptibility-weighted imaging, TIA = transient ischemic attack.

Keywords: computed tomography angiography, transient ischemic attack

1. Introduction

Nearly 7.5 million transient ischemic attack (TIA) events occur worldwide per year.[1] Approximately 20% of ischemic strokes are preceded by one or several TIAs, and 10% to 15% of patients with TIA experience a stroke within 3 months, with half occurring within 48 hours.[2] The occurrence of TIA offers the unique opportunity to initiate treatment before the onset of permanent disability.[3,4] Cardioembolism is one of the most common causes of TIA,[5] and was reported to account for 6% to 31% of cases.[5,6] Rapid detection of the etiology of TIA in a patient and rapid treatment are essential to prevent future stroke; however, about two-third of patients with TIA have negative findings on diffusion-weighted imaging (DWI).[7]We report the case of a patient with cardioembolic TIA who showed distal middle cerebral artery (MCA) occlusion on multiphase computed tomography angiography (MCTA), and demonstrated spontaneous recanalization on follow-up MCTA.

2. Case report

The patient consented to publication of this case report, and the study was approved by the Institutional Review Board of Chung-Ang University Hospital. A 57-year-old man was admitted to the emergency department for dizziness and right-side weakness persisting for 1 hour. He has been experiencing atrial fibrillation for 20 years and had a history of embolic cerebral infarction 3 years ago. He decided to stop taking anticoagulant medication 1 month ago. His initial mental status was alert; however, the motor function of his right lower limb was evaluated as grade III. The initial MCTA revealed occlusion of the left proximal M3 segment of the MCA. Retrograde contrast delay caused by collaterals at the M3 segment was noted on the third phase of

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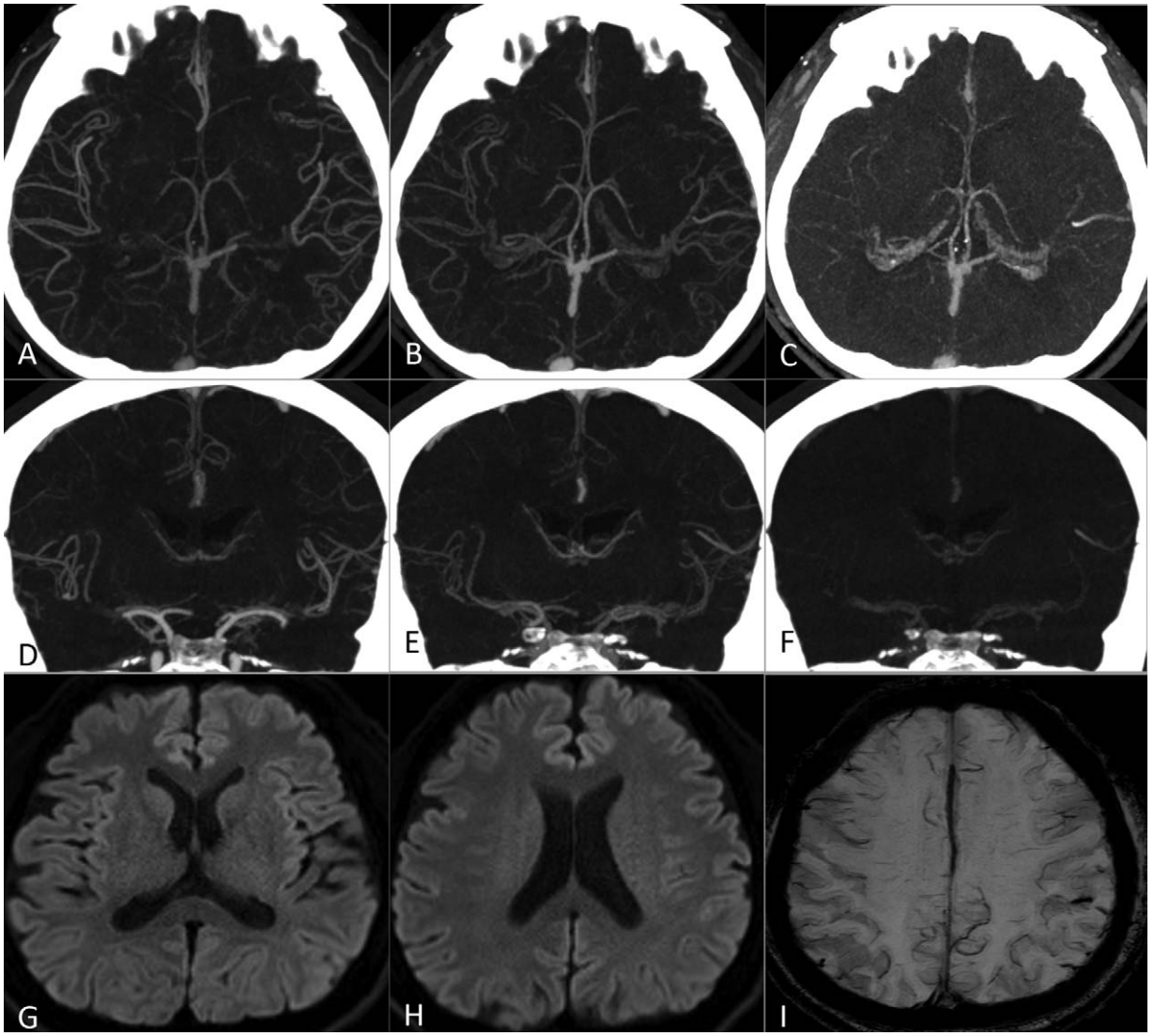

Figure 1. Initial multiphase computed tomography angiography and magnetic resonance imaging (MRI). A–C, Axial images of P1 (late arterial phase), P2 (mid-venous phase), and P3 (late-venous phase). On P3 phase, there is segmental contrast delay at the proximal M3 segment, suggesting proximal M3 occlusion with reversed contrast arrest by collateral flow. D–F, Coronal images of P1, P2, and P3. G–I, Initial MRI. Diffusion-weighted imaging scans (G, H) depict no abnormally high signal intensity; however, migrated embolus is seen at the left far distal middle cerebral artery branch on susceptibility-weighted imaging (I).

MCTA (Brilliance iCT 256; Philips, Best, Netherlands; the full imaging protocol for MCTA was conducted as previously published [8]). One hour later, the patient completely recovered from his right-leg weakness (National Institute of Health stroke scale 0). On diffusion-weighted magnetic resonance imaging (MRI) performed 1.5 hours after MCTA, there was no diffusion restriction in the left MCA territory. Susceptibility-weighted imaging (SWI) showed linear dark signal intensity in the left far distal branch of the MCA, suggesting migration of emboli (Fig. 1). The follow-up MCTA on the next day showed that the occlusion at the M3 segment of the left MCA has resolved. Follow-up MRI showed focal acute infarction near the left insular cortex on DWI, and SWI showed that the linear dark signal intensity at the left far distal MCA branch has resolved (Fig. 2). On the third hospital day, the patient was stable and was discharged according to his own decision (Table 1).

3. Discussion

This article presents a patient with cardioembolic TIA who showed occlusion and contrast delay at the M3 segment of the left MCA on MCTA, although his initial DWI showed no acute or hyperacute infarction in the corresponding region.

MCTA can improve the diagnostic accuracy for cardioembolic occlusion, even when the occlusions are distal; increase the detection of asymmetry of pial vessels in the MCA; and provide information on the leptomeningeal collateral circulation.[8–10] Furthermore, this technique is quick to perform and yields images that are easy to acquire and interpret.[8]

Cardioembolic occlusions could also be depicted using DWI, SWI, and magnetic resonance angiography.[11,12] Al-Khaled et al[13] reported that acute infarction was noted at a rate of from11.1% (<48 h) to 32.2% (<7 ds) on the initial diffusion-

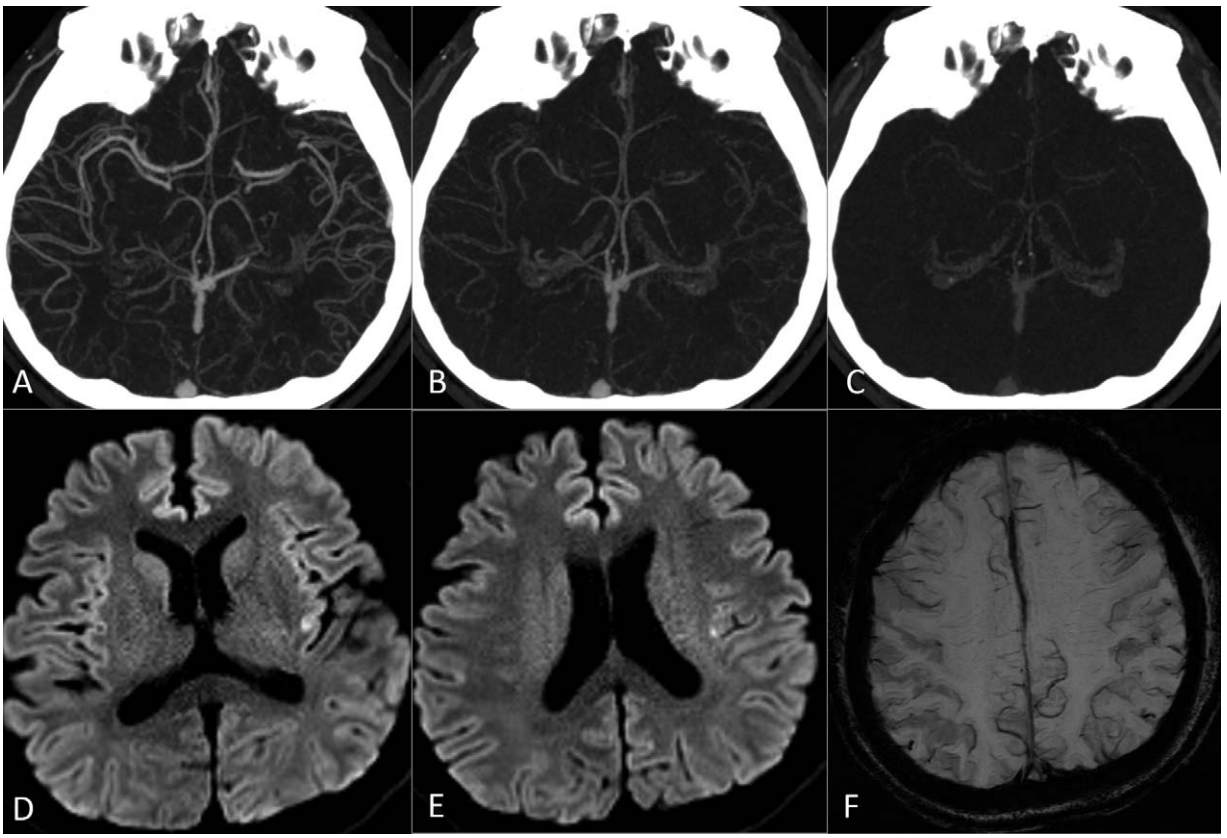

Figure 2. Follow-up multiphase computed tomography angiography and magnetic resonance imaging (MRI). A–C, Axial images of P1, P2, and P3. There is no contrast delay in left the middle cerebral artery territory. D–F, Follow-up MRI. Diffusion-weighted imaging scans (D, E) show focal acute infarction in the left external capsule, and susceptibility-weighted imaging scan (F) depicts that the migrated embolus in the left far distal branch has resolved.

weighted MRI of patients with TIA.[14] Shono et al[15] reported positive findings in 75%, 79%, and 93% of patients on initial DWI at 1, 2, and 3 hours after symptom onset, respectively. A consistent finding was noted in this case report, in that there was no acute infarction on the initial DWI obtained 3 hours after symptom onset but follow-up DWI revealed focal acute infarction in the corresponding region. Therefore, follow-up imaging evaluation is recommendable if the initial DWI was obtained within 3 hour after symptom onset. SWI has also been proposed as a method for detecting acute cardioembolic thrombus based on the susceptibility vessel sign (SVS).[12] A significantly higher number of SVS was noted within 24 hours

Table 1

Timeline.

1st day 07:00	Onset of neurologic deficit
1st day 08:00	ER arrival (contraindication for IV tPA)
1st day 08:32	Multi phase CT angiography (contrast delay at M3 segment of left MCA)
1st day 09:00	Spontaneous symptom resolution
1st day 10:08	MRI (no acute infarction on DWI, migrated thrombus on SWI)
2nd day 23:23	Follow up multiphase CT angiography (resolution of contrast delay at M3 segment)
3rd day 12:34	Follow up MRI (focal acute infarction on DWI, resolved thrombus on SWI)

than at 24 to 72 hours from stroke onset to MRI scan. This implies that thrombus could disappear for 24 to 72 hours from stroke onset, as in this case that showed resolution of SVS at the far distal branch of the left MCA on follow-up SWI. However, when compared with MCTA, MRI takes up to 20 to 30 minutes to screen patients, complete the examination, and interpret the images.[16]

In conclusion, our case report underlines the usefulness of MCTA in patients with TIA in the hyperacute stage. MCTA could rapidly depict distal occlusion of the anterior circulation in patients with cardioembolic TIA in real emergency practice.

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