

Diagnostic Utility of Contrast-enhanced 3D T1-weighted Imaging in Acute Cerebral Infarction Associated with Graves Disease

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Graves disease is rarely complicated with cerebrovascular steno-occlusive diseases. Previous studies have suggested several hypotheses for this occurrence, including excess thyroid hormone, which stimulates the sympathetic nervous system, which in turn causes an abnormal hemodynamic response with consequent atherosclerotic changes, and antithyroid antibodies cause local vascular inflammation in patients with Graves disease. However, radiological findings of vasculitis in patients with Graves disease and cerebral infarction remain less known. We report the case of a 30-year-old Japanese woman with acute cerebral infarction due to vasculitis associated with Graves disease. She was admitted to our hospital with a 4-day history of intermittent transient dysarthria and limb shaking of the left leg when standing. Three weeks before admission, she went to a local hospital because of general malaise and was diagnosed with Graves disease. Neurological examination revealed paralytic dysarthria, left central facial nerve palsy, and left hemiparesis (manual muscle testing, 4 of 5). Blood examinations showed hyperthyroidism (thyroid-stimulating hormone ≤ 0.10 $\mu\text{U}/\text{mL}$; free T3 ≥ 25.0 pg/mL ; free T4 ≥ 8.0 ng/dL) and elevation of antithyroid antibody levels (thyroid peroxidase antibody, 87 IU/mL). The vessel wall of the right internal carotid artery was markedly enhanced on contrast-enhanced three-dimensional T1-weighted magnetic resonance imaging, suggesting vasculitis. Magnetic resonance angiography revealed right internal carotid artery occlusion after the branching ophthalmic artery. Arterial stenosis due to vasculitis was considered the cause of hemodynamic ischemic stroke. Vessel wall imaging such as high-resolution contrast-enhanced T1-weighted imaging seems useful for assessing the underlying mechanism of stroke in patients with Graves disease. **Key Words:** Graves disease—ischemic stroke—vasculitis—magnetic resonance imaging—vessel wall imaging.

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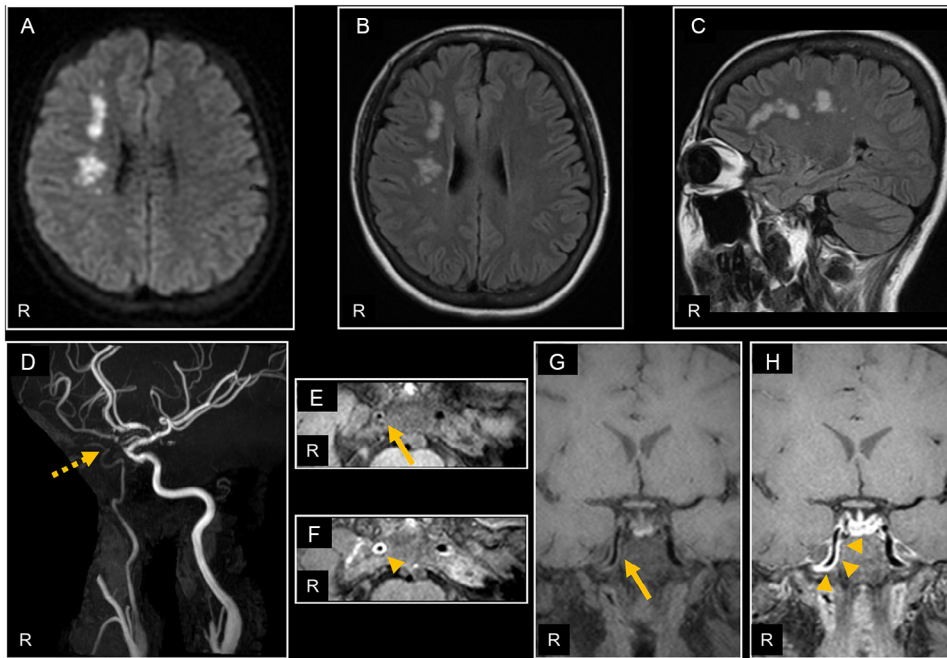


Figure 1. (A–H) Brain magnetic resonance imaging. (A) Axial diffusion-weighted image showing rosary-like watershed infarcts in the right cerebral hemisphere. (B, C) Axial and sagittal sections of fluid-attenuated inversion recovery are shown. (D) Magnetic resonance angiography showing right internal carotid artery occlusion after the branching ophthalmic artery (dot arrow). (E–H) Non-contrast-enhanced (E, axial image; G, coronal image) and contrast-enhanced 3D T1-weighted image (F, axial image; H, coronal image). The right internal carotid artery was thickened (arrow) and was markedly enhanced, suggesting vasculitis (arrowhead). Abbreviation: R, right.

Case Report

Graves disease (GD) is rarely complicated with cerebrovascular steno-occlusive diseases. Previous studies have suggested several hypotheses for this occurrence, including excess thyroid hormone, which stimulates the sympathetic nervous system, which in turn causes an abnormal hemodynamic response with consequent atherosclerotic changes, and antithyroid antibodies cause local vascular inflammation in GD.^{1–3} However, little is known about the radiological findings of vasculitis in patients with GD and cerebral infarction (CI).

A 30-year-old Japanese woman was admitted to our hospital with a 4-day history of intermittent transient dysarthria and limb shaking of the left leg (i.e., her knees shake when standing). Three weeks before admission, she went to a local hospital because of general malaise and was diagnosed with GD. She had no medical history of atherogenic disease and no family history of cerebrovascular diseases. She engaged in light smoking (\leq a few cigarettes per day). On admission to our hospital, her blood pressure was 201/101 mm Hg, heart rate was 98 beats per minute, respiratory rate was 15, and had 98% saturation on room air. She had diffuse goiter. Neurological examination revealed paralytic dysarthria, left central facial nerve palsy, and left hemiparesis (manual muscle testing, 4 of 5). Blood examinations showed hyperthyroidism (thyroid-stimulating hormone \leq 0.010 μ U/mL; free T3 \geq 25.0 pg/mL; free T4 \geq 8.0 ng/dL) and the elevation of antithyroid antibodies (thyroid peroxidase antibody,

87 IU/mL; thyroid receptor antibody, 18.5 IU/L). The results of other autoantibody testing including perinuclear anti-neutrophilic cytoplasmic antibodies and proteinase-3-anti-neutrophil cytoplasmic antibody were negative. Electrocardiography was normal. Carotid ultrasonography showed distal occlusion pattern in the right internal carotid artery (ICA). The magnetic resonance (MR) imaging and angiography on admission are shown in Figure 1. The wall of the right ICA was thickened on T1-weighted imaging (T1WI) and was markedly enhanced on contrast-enhanced (CE) three-dimensional T1WI, indicating vasculitis (Fig 1, E–H). N-isopropyl-p-123I iodoamphetamine single photon emission computed tomography showed regional cerebral blood flow hypoperfusion in the right anterior frontal and parietal cortex, right basal ganglia, and right thalamus. She was diagnosed with CI due to vasculitis associated with GD. She was treated with antiplatelet therapy (clopidogrel 75 mg/day); however, she remained resistant to medical treatment, and ultimately underwent a right superficial temporal artery to middle cerebral artery bypass.

Discussion

To the best of our knowledge, this is the first report showing the radiological findings of vasculitis on CE MR imaging in a patient with GD and CI. Local vascular inflammation is considered to be an important risk factor of cerebrovascular steno-occlusive changes in GD^{1–3}; however, the radiological characteristics in GD and vasculitis are still unclear. It is well known that CE MR

imaging can detect changes associated with vasculitis.^{4,5} Consistent with these reports, the right ICA wall was prominently enhanced in our patient with GD and CI. It is unclear why contrast enhancement was seen only in the ICA; we concluded that GD could contribute to local vasculitis and cause severe ICA stenosis. Vessel wall imaging such as high-resolution CE T1WI seems useful for assessing the mechanism of stroke in patients with GD. Further studies are needed to validate our findings.

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