

## CASE REPORT

# Moyamoya syndrome associated with systemic lupus erythematosus

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Moyamoya disease is a rare, progressive cerebrovascular disorder that is characterized by a stenosis or occlusion of the bilateral internal carotid arteries and the development of collateral vessels. Transient ischemic attacks or seizures are the usual presentation of moyamoya disease in children, whereas cerebral hemorrhage is the most common symptom in adults. We report an 18-year-old female patient with active lupus nephritis who presented with the sudden onset of left hemiparesis. Brain magnetic resonance imaging showed acute infarctions in the right basal ganglia and subcortical white matter of the right frontal lobe. Cerebral angiography showed the stenosis of the bilateral internal carotid arteries with rich basal collateral vessels (moyamoya vessels). There was no evidence of atherosclerosis or antiphospholipid syndrome. Glucocorticoid therapy was used to control the systemic lupus erythematosus. Prophylactic bypass surgery was performed to prevent recurrent ischemic attacks. This case report shows that an underlying cerebrovascular lesion of moyamoya vessels in a patient with systemic lupus erythematosus is susceptible to cerebrovascular accidents. *Lupus* (2008) 17, 679–682.

**Key words:** angiography; cerebral infarction; ischemic attack; moyamoya syndrome; systemic lupus erythematosus

## Introduction

Moyamoya disease is a rare cerebrovascular disorder that is characterized by bilateral progressive supraclinoidal stenosis or occlusion of the internal carotid artery and the development of collateral vessels (moyamoya vessels) around the basal ganglion region.<sup>1</sup> It occurs mainly in Asian children or young adults.<sup>2,3</sup> Most children present with symptoms of transient ischemic attacks (TIA) or cerebral infarction, whereas adults generally present with a cerebral hemorrhage.<sup>4</sup> Moyamoya syndrome (MS) is a term applied to moyamoya vessels associated with underlying diseases. Several reports have described an association between moyamoya disease and autoimmune diseases.<sup>5–11</sup> We report an unusual case of MS, which

was associated with systemic lupus erythematosus (SLE); the patient developed multiple cerebral infarctions and presented with left hemiparesis.

## Case report

An 18-year-old woman was admitted to our hospital with a two-week history of generalized edema. Fourteen months ago she was diagnosed with SLE based on the presence of oral ulcers, typical malar rash, lupus nephritis, pleural effusion, positive antinuclear antibody (ANA), and a high-titer anti-double stranded DNA (anti-dsDNA). The lupus nephritis had been well controlled by mycophenolate mofetil (MMF), prednisolone, and angiotensin receptor blocker. However, she withdrew her medication 1 month ago.

The physical examination showed body temperature, pulse, and blood pressure of 37.4 °C, 96 beats/min, and 150/100 mmHg, respectively. The laboratory test showed the following: a white blood

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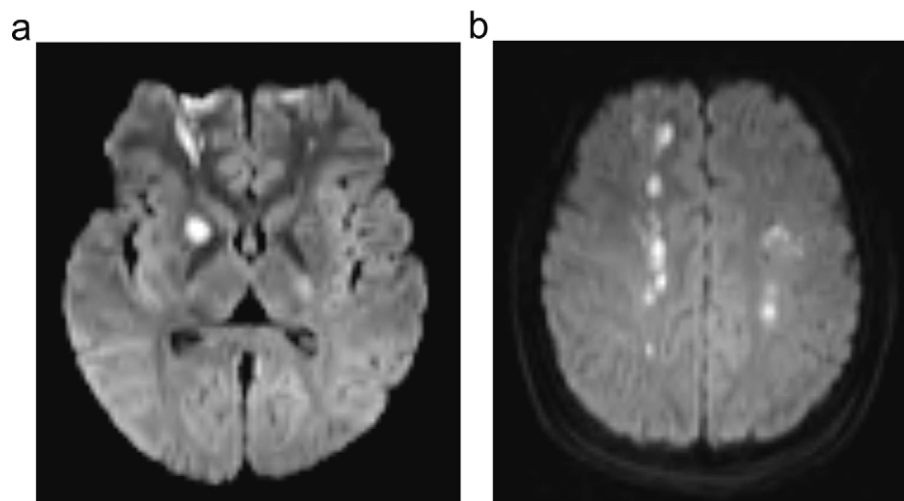
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cell count of 4300 cells/mm<sup>3</sup> (4800–10,800), a hemoglobin level of 9.6 g/dL (12–18), a platelet count of 231,000 cells/mm<sup>3</sup> (130,000–450,000), an erythrocyte sedimentation rate (ESR) of 43 mm/h (0–20), a C-reactive protein (CRP) level of 0.313 mg/dL (0–0.5), a serum protein level of 4.0 g/dL (6.4–8.3), a serum albumin level of 2.2 g/dL (3.5–5.2), a blood urea nitrogen level of 22.9 mg/dL (8–20), a serum creatinine level of 1.1 mg/dL (0.5–1.3), a C3 level of 37.6 mg/dL (90–180), a C4 level of 8.7 mg/dL (10–40), and a CH50 level of 14.3 U/mL (23–46). The lipid profile showed a total cholesterol level of 244 mg/dL (150–200), a triglyceride level of 143 mg/dL (50–150), a HDL-cholesterol level of 45 mg/dL (40–80), and a LDL-cholesterol level of 181 mg/dL (0–120). Urinalysis showed 3+ proteinuria, microscopic hematuria (50 red blood cells/high-power field), and microscopic pyuria (20 white blood cells/high-power field). The protein level of the 24-h urine was 4.98 g/day. An immunologic study showed ANA 1:320 (speckled pattern), anti-dsDNA 85.7 IU/mL (0–7), anti-Sm (–), anti-ribonucleoprotein (RNP) (–), anti-Ro/anti-La (–/–), VDRL (–), lupus anticoagulant (LAC) (–), anti-cardiolipin (aCL) IgG/IgM (–/–), and anti-β2 glycoprotein (GP) I antibody (–). The anti-thrombin III level, prothrombin time (PT), and activated partial thromboplastin time (PTT) were within the normal limits. The increased anti-dsDNA level, decreased level of complement, nephrotic range of proteinuria, and the generalized edema were suggestive of the flare-up of the lupus nephritis. Prednisolone (0.5 mg/kg), diuretics, and antihypertensive drugs were administered to control the proteinuria and gen-

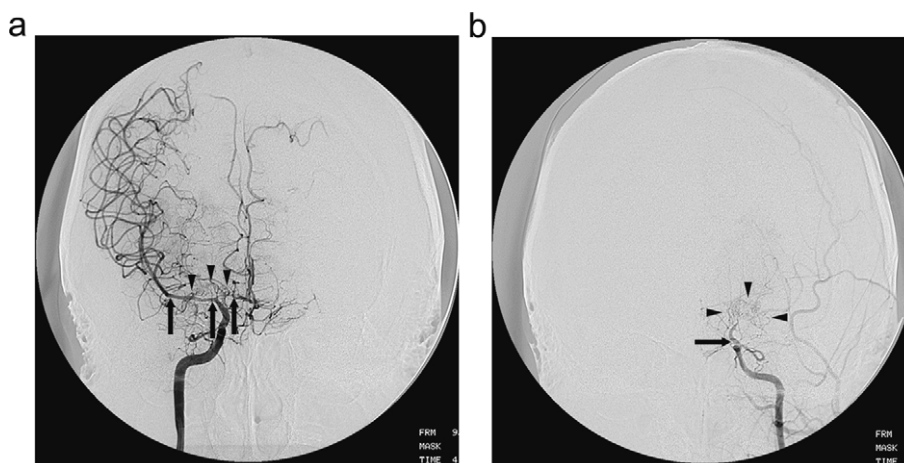
eralized edema associated with aggravated hypertension.

On the fifth hospital day, she suddenly complained of motor weakness in her left arm and leg. A neurological examination showed left hemiparesis with a power of 3/5 in the upper and lower extremities. Brain magnetic resonance imaging (MRI) showed acute infarctions in the right basal ganglia and subcortical white matter of the right frontal lobe (Figure 1). MR angiography of the brain showed an occlusion of the supraclinoid portion of both internal carotid arteries with rich basal collaterals from the posterior cerebral artery, which was indicative of moyamoya disease. The intima-media thickness (IMT) of the common carotid arteries, as determined by Doppler ultrasound, was within the normal limit, and no carotid plaque was detected. Conventional angiography of both carotid arteries showed the stenosis of the bilateral internal carotid arteries with rich basal collateral vessels (moyamoya vessels), which is a diagnostic of moyamoya disease (Figure 2).

The above findings were compatible with a MS secondary to active SLE. Therefore, pulse methylprednisolone was administered intravenously for 3 days, which was followed by oral high-dose prednisolone with low-dose aspirin. Ten days later, the patient's condition and motor power in the upper and lower extremities had improved markedly. Two months later, the disease activity of the SLE was well controlled. Prophylactic bilateral extracranial–intracranial artery bypass was performed. She has, since, been in good condition without TIA or other neurological deficits.



**Figure 1** Brain MR images of a 18-year-old female patient presenting with the sudden onset of left hemiparesis. (a) Diffusion weighted image at the level of basal ganglia showed acute infarctions in the right basal ganglia and subcortical white matter of the right frontal lobe. (b) Diffusion weighted image at the level of the centrum semiovale showed bilateral acute internal borderzone infarctions in both centrum semiovale.



**Figure 2** Conventional angiograms of both carotid arteries. (a) Right internal carotid arteriogram showed diffuse stenosis involving the supraclinoid portion of the right internal carotid artery, right anterior cerebral artery, and the M1 portion of the right middle cerebral artery (black arrows) with rich basal collateral vessels (black arrowheads). (b) Left internal carotid arteriogram showed an occlusion of the supraclinoid portion of the left internal carotid artery (black arrows) with rich basal collateral vessels (black arrowheads).

## Discussion

This case report showed a MS associated with SLE. There are few reports of an association between SLE and moyamoya disease.<sup>5,8,9</sup> Two cases developed MS without disease activity of SLE or other risk factors for a cerebral occlusion.<sup>5,8</sup> In the other case, there was a previous history of recurrent right homonymous hemianopsia without major organ involvement of SLE.<sup>9</sup> However, our patient did not have any history of TIA or seizure but the active phase of SLE. The incidence of cerebrovascular accidents (CVAs) in SLE is approximately 15% with most CVAs usually occurring within the first 5 years of SLE and during the disease activity.<sup>12</sup> Our patient suddenly developed left hemiparesis while being treated for aggravated lupus nephritis. Therefore, central nervous system (CNS) involvement of SLE was initially suspected. Unexpectedly, the brain MRI and carotid angiography showed multiple cerebral infarctions and bilateral occlusion of the internal carotid arteries with rich collateral vessels, which was suggestive of the moyamoya disease.

The precise mechanism for MS secondary to autoimmune diseases is unclear. However, MS that is positive for ANA, anti-dsDNA, anti-Ro, LAC, or aCL has been reported, which suggests that immunological factors might play a role in the pathogenesis of MS.<sup>13–17</sup> In our case, the underlying cerebrovascular lesion such as moyamoya vessels together with high lupus activity and dyslipidemia would make the patient more susceptible to CVA. Furthermore, a hemodynamic instability caused by diuretic and antihyperten-

sive drugs may have triggered the ischemia of moyamoya vessels, which resulted in acute cerebral infarctions. Revascularization surgery for moyamoya disease is believed to prevent TIAs by improving the cerebral blood flow, and bypass surgery is actively performed for patients with the disease after an ischemic attack.<sup>18</sup> In this case, an extracranial–intracranial artery bypass rather than supportive care was chosen because the underlying condition, for example SLE or hemodynamic stress, may be vulnerable to recurrent CVAs.

Moyamoya disease is observed more commonly in Asia and in people of non-Caucasian origin.<sup>2</sup> Therefore, when evaluating the CNS manifestation in young patients with SLE, MS should be considered as part of a differential diagnosis and/or as a predisposing cause of CNS lupus, particularly in areas where the disease is prevalent.

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