Unilateral Thalamic Infarction Associated with Rupture of Dissecting Posterior Cerebral Artery in Childhood-Onset Systemic Lupus Erythematosus: A Case Report

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Case Report

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Abstract

Background

Cerebrovascular diseases are well-known complications of systemic lupus erythematosus (SLE). Among them, cerebral arterial dissection is a rare vascular complication, in which an intimal tear of the blood vessel leads to an intramural hematoma. Cerebral arterial dissection leads to arterial stenosis, thrombosis, and aneurysm, resulting in cerebral infarction or subarachnoid hemorrhage (SAH). Herein, we report a case of posterior cerebral artery (PCA) dissection in SLE that presented as unilateral thalamic infarction followed by SAH and intraventricular hemorrhage (IVH).

Case Presentation

A 16-year-old boy hospitalized with prolonged fever, hair loss, and skin eruption was newly diagnosed with SLE based on the 2019 EULAR/ACR SLE classification criteria. He suddenly complained of headache, diplopia, and impairment of lateral gaze during hospitalization. Brain magnetic resonance imaging revealed left thalamic infarction, although cerebral vessel inflammation or thrombosis was not observed. Antiphospholipid antibodies such as lupus anticoagulant, anti-cardiolipin antibody, and anti- β 2-glycoprotein antibody were not detected. His symptoms improved with high-dose steroid, low-dose aspirin, and mannitol therapy. Five days later, he experienced severe headache and generalized tonic-clonic seizures. Brain computed tomography revealed SAH and IVH with hydrocephalus. Even though emergent external ventricular drainage was performed, the ventricle size did not decrease. Transfemoral cerebral angiography revealed a ruptured dissecting PCA pseudoaneurysm, and immediate coil embolization was successfully performed. The patient fully recovered without any neurologic sequelae, although he underwent ventriculoperitoneal shunting for hydrocephalus following SAH.

Conclusions

To the best of our knowledge, this is the first reported case of PCA dissection in a patient with childhood-onset SLE. Moreover, the subsequent progression from cerebral infarction to SAH caused by PCA dissection makes this case unique. In SLE patients presenting with cerebral infarction and hemorrhage, cerebral arterial dissection and pseudoaneurysm should be considered to achieve favorable outcomes.

Background

Systemic lupus erythematosus (SLE) is a heterogeneous systemic autoimmune disease with multiple organ involvement. Childhood-onset systemic lupus erythematosus (cSLE) is defined as SLE developing before 18 years of age [1]. Patients with cSLE generally have a more severe clinical course with a higher incidence of lupus nephritis, neuropsychiatric manifestations, and hematologic abnormalities. In contrast, adult-onset SLE patients have more cutaneous and musculoskeletal involvement [2, 3].

Neuropsychiatric systemic lupus erythematosus (NPSLE) is highly prevalent in SLE patients, affecting 22 to 95% of cSLE patients. It can occur at any time during the course of SLE, regardless of systemic SLE disease activity. Clinical manifestations of NPSLE vary, depending on whether the central or peripheral nervous system is involved, and can manifest as a focal or diffuse subtype [4]. Common central nervous system disorders include headache, seizures, and cognitive disorders such as delirium and dementia. Cerebrovascular diseases such as transient ischemic attack and cerebral venous thrombosis are relatively rare and occur in less than 10% of patients with SLE.

However, cerebral arterial dissection has seldom been reported. Arterial dissection is caused by disruption of the arterial intima, causing intramural hematoma. It can lead to subsequent cerebral infarction, intraventricular hemorrhage (IVH), or subarachnoid hemorrhage (SAH) through arterial stenosis, thrombosis, and aneurysm [5-7]. Herein, we describe a cSLE patient with posterior cerebral artery (PCA) dissection leading to PCA pseudoaneurysm, unilateral thalamic infarction, and intracranial hemorrhage.

Case Presentation

A 16-year-old boy complaining of prolonged fever for 6 months, hair loss, and skin eruptions was hospitalized. Physical examination showed generalized edema and non-scarring alopecia. Skin eruption included vasculitis on the face, both palms and soles; gangrene on the extension surface of the left knee, and oral ulcers with erythema. Multiple joints with arthritis were noted, including both knees (Fig. 1). However, he did not show any neurological or cognitive abnormalities. Initial laboratory evaluation revealed leukopenia, thrombocytopenia, hemolytic anemia, and proteinuria. The antinuclear antibody test was positive at 1:320 dilution with a speckled pattern. Anti-double stranded-DNA levels were elevated while C3 and C4 complement levels were decreased (Table 1).

Table 1
Initial laboratory tests on admission

Parameter	Value	Reference range
WBC (/μL)	1,720	4,500-13,000
ALC (/μl)	499	1,000-4,800
Hb (g/dL)	7.8	13.0-16.0
Platelets (x10 ³ /μL)	118	130-400
BUN (mg/dL)	52	10-26
Cr (mg/dL)	1.40	0.6-1.4
AST (IU/L)	138	1-40
ALT (IU/L)	60	1-40
Total bilirubin (mg/dL)	0.4	0.2-1.2
LDH (IU/L)	631	100-225
Haptoglobin (mg/dL)	<7	30-180
Plasma Hb (mg/dL)	122.7	0-5.0
Direct/Indirect Coombs' test	positive/negative	negative/negative
Antinuclear antibody	>1:320	negative
C3 (mg/dL)	18	82-185
C4 (mg/dL)	2	15-53
Anti-dsDNA antibody (IU/mL)	124	0-7
Lupus anticoagulant	negative	negative
Anti-cardiolipin antibody	negative	negative
Anti-β2-glycoprotein antibody	negative	negative
Anti-RNP antibody	positive	negative
Anti-SSA antibody	positive	negative
Anti-SSB antibody	positive	negative
Smith antibody	positive	negative
Urine occult blood	3+	negative
WBC, white blood cell count; ALC, absolute lymphocyte count; Hb, hemoglobin; BUN, blood urea nitrogen; Cr, creatinine; AST, aspartate aminotransferase; ALT, alanine transferase; LDH, lactate dehydrogenase; CRP, c-reactive protein; ESR, erythrocyte sedimentation rate		

Parameter	Value	Reference range
Urine protein/creatinine	2.63	<0.2
WBC, white blood cell count; ALC, absolute lymphocyte count; Hb, hemoglobin; BUN, blood urea nitrogen; Cr, creatinine; AST, aspartate aminotransferase; ALT, alanine transferase; LDH, lactate dehydrogenase; CRP, c-reactive protein; ESR, erythrocyte sedimentation rate		

Pleural effusion was observed on chest radiography. A kidney biopsy revealed WHO class IV mesangioproliferative lupus nephritis. He was diagnosed with SLE based on the EULAR/ACR 2019 SLE classification criteria [8]. He was treated with high-dose steroids, cyclophosphamide, mycophenolate mofetil, and hydroxychloroquine. His symptoms and signs improved with treatment, except for intermittent fever.

On hospital day 46, he suddenly presented with headache, diplopia, and impairment of lateral gaze. Brain magnetic resonance imaging showed left thalamic infarction, but there were no specific findings of cerebral vasculitis or thrombosis (Fig. 2A, 2B). Left PCA thickening was not observed at that time (Fig. 2C, 2D). There was no evidence suggestive of antiphospholipid syndrome, as he was negative for lupus anticoagulant, anti-cardiolipin antibody, and anti- β 2-glycoprotein antibody. His blood was not hypercoagulable, and echocardiography showed no evidence of cardiac embolism. His neurological symptoms and signs temporarily recovered with methylprednisolone pulse therapy (1 g of methylprednisolone for 3 days), low-dose aspirin (100 mg of aspirin once a day), and mannitol infusion therapy.

Five days later, however, he experienced severe headache and generalized tonic-clonic seizures. Brain computed tomography (CT) revealed IVH in the lateral 3rd, and 4th ventricles (Fig. 3A) and SAH in the prepontine cistern (Fig. 3B). Diffuse brain edema and hydrocephalus were also observed on CT. As his consciousness deteriorated within 1 hour of onset, emergent external ventricular drainage (EVD) was performed. Brain CT after EVD insertion showed persistent ventriculomegaly. Transfemoral cerebral angiography was performed to identify other vascular problems, revealing a ruptured dissecting PCA (P1) pseudoaneurysm and blood leakage (Fig. 3C). Immediate coil embolization was performed consecutively (Fig. 3D), and blood leakage was no longer observed. The intratracheal tube was extubated on the day after the operation. Afterwards, he breathed well without any respiratory support, and his mental status was intact. Other neurologic symptoms and signs such as seizure and headache disappeared, and immediate neurological sequelae were not observed. A ventriculoperitoneal shunt was implanted due to post-hemorrhagic hydrocephalus on hospital day 70, and he was able to work with support. He fully recovered without any neurologic sequelae and was discharged with oral medications such as prednisolone and aspirin on hospital day 109.

Discussion And Conclusions

SLE is a representative autoimmune disease involving a multiorgan system with a high risk of cerebrovascular complications, especially in young patients [9]. The risk of both ischemic and

hemorrhagic stroke is higher in patients with SLE than in the general population. Previous studies have shown an increased relative risk of 2.1 for ischemic stroke and 1.82 to 4.84 for hemorrhagic stroke, respectively in patients with SLE [9-11]. However, cerebral arterial dissection is a rare vascular complication in SLE patients.

A few case reports have described cerebral arterial dissection in patients with SLE. Some studies have reported various arterial dissections, including the intracranial internal carotid artery and vertebral arteries [12-14]. Other studies have reported aortic and coronary artery dissections in SLE patients [15-17]. Symptoms and signs related to arterial dissection occurred in patients in their twenties to forties. Although the relationship between arterial dissection and SLE is not completely understood, several etiologies have been proposed. The precipitating factors may include inflammatory reactions leading to extracellular matrix degradation, vessel wall weakening, endothelial damage, atherosclerosis associated with long-term steroid treatment, hypertension, and nephrotic syndrome [16, 18]. However, all of the previous cases of arterial dissection were reported in adult-onset SLE patients and not a cSLE patient, as in this case.

In addition, PCA dissection has been infrequently reported in the pediatric population. In a study of 26 pediatric patients with intracranial dissecting aneurysms, 7 (22.6%) presented with arterial dissecting aneurysms in the PCA [19]. Of the 33 patients with intracranial dissecting aneurysms in children under 15 years old, two patients showed PCA dissecting aneurysms [20]. In an adult study of 133 patients with cerebral arterial dissection over a 7-year period, PCA dissection was diagnosed in four patients (3%) [21]. However, there are no previous reports on PCA dissection in patients with cSLE.

In this paper, we report a case of a SLE patient with unilateral thalamic infarction, IVH, and SAH caused by PCA dissection and pseudoaneurysm. This event suddenly occurred while his other SLE symptoms were improving. He did not have any evidence of antiphospholipid syndrome, cardiac embolism, or coagulation abnormalities, which can cause stroke. While either cerebral infarction or SAH alone following intracranial arterial dissection has been reported [22-24], both types of strokes developed consecutively in this case. We cannot fully explain why the ischemic infarction and hemorrhagic infarction developed from the PCA dissection and pseudoaneurysm. We suggest that uncontrolled inflammation, such as vasculitis related to SLE, hypertension, and/or steroid use, may have aggravated cerebral arterial dissection and blood leakage due to our patient's general condition with intermittent fever. In addition, a possible scenario involves a thrombus originating from the pseudoaneurysm, vessel narrowing due to inflammation causing ischemia, and blood leakage from the ruptured arterial dissection causing SAH and IVH.

In conclusion, to the best of our knowledge, this is the first reported case of PCA dissection leading to unilateral thalamic infarction, IVH, and SAH due to the rupture of a dissecting pseudoaneurysm in a childhood-onset SLE patient. Moreover, the subsequent progression from cerebral infarction to SAH caused by PCA dissection makes this case unique. In SLE patients presenting with cerebral infarction and

hemorrhage, cerebral arterial dissection and pseudoaneurysm should be considered to achieve favorable outcomes.

List Of Abbreviations

cSLE Childhood-onset systemic lupus erythematosus

CT Computed tomography

EVD External ventricular drainage

IVH Intraventricular hemorrhage

MRI Magnetic resonance imaging

NPSLE Neuropsychiatric systemic lupus erythematosus

PCA Posterior cerebral artery

SAH Subarachnoid hemorrhage

SLE Systemic lupus erythematosus

Declarations

Ethics approval and consent to participate

The study protocol was reviewed and approved by the Institutional Review Board of Seoul National University Hospital (IRB no. 2110-095-1263). Exemption of informed consent was approved by IRB.

Consent for publication

The patients' parents provided written informed consent to have the patient's images published.

Availability of data and materials

All data generated or analyzed during this study are included in this published article.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

S Lee and YJ Choi conceptualized and designed the study. HJ Kim and S Kang analyzed and interpreted the patient's data and wrote the first draft of the manuscript. YR Kim and KH Kim analyzed and interpreted the patient's neurosurgical evaluations. S Lee and YJ Choi commented on and critically revised the manuscript. HJ Kim, S Kang, YR Kim, and KH Kim clinically cared for the patient and decided on the treatment course. All authors read and approved the final manuscript.

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Figures

Figure 1

Initial presentation of the patient. (A) skin eruptions on face. (B) oral ulcer with erythema on soft palate. (C) vasculitis -like skin eruption on palm. (D) right knee joint swelling and gangrene on left knee.

Figure 2

Initial findings of brain magnetic resonance imaging (MRI), diffusion-weighted MRI, and magnetic resonance angiography (MRA). (A) Brain MRI shows 1.6cm-sized T2 signal hyperintensity lesion on the thalamus (white arrow). (B) Diffusion restriction in the left thalamic lesion indicating acute infarction (white arrow). (C, D) MRA shows left posterior cerebral artery (PCA) is thicker than right PCA, which revealed left PCA pseudoaneurysm (white arrow).

Figure 3

Intraventricular and subarachnoid hemorrhage caused by aneurysmal rupture. (A) Brain computed tomography (CT) shows ventriculomegaly (white arrow) with intraventricular hemorrhage (*). (B) Brain CT shows subarachnoid hemorrhage (SAH) on pontine cisterna. (C) Transfemoral cerebral angiography (TFCA) reveals ruptured dissecting aneurysm of PCA (*) and continuous bleeding (white arrow). (D) Coil embolization of left P1 was successfully performed and pseudoaneurysm was achieved. Post-procedural angiogram shows complete occlusion of left P1 and pseudoaneurysm.