tension of air bubbles is inversely correlated with their diameter, smaller air bubbles are more resistant to rupture than larger bubbles. The air bubbles are more likely entrapped in small-sized end arteries (30–60 μm) [8] at the cortical layers than in larger proximal arteries. Flow velocity or pressure gradient is lowest in the cortical borderzone area of the middle and anterior cerebral arteries, the most likely sites of microembolisms [9]. The entrapped air bubbles could thus persistently obstruct local blood flow, break down the blood-brain barrier and activate inflammatory reactions, leading to infarcts [8, 10]. Therefore, the frontal cortical area surrounding the borderzone of the middle and anterior cerebral arteries should be the most common site of ischemic lesions of CAE.

In conclusion, our study suggests that CAE preferentially involves the frontal cortical area with corresponding neurological deficits and that DWI can be used to predict clinical outcomes.

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Sun U. Kwon, MD, PhD
Department of Neurology, Asan Medical Center
University of Ulsan College of Medicine
388-1 Pungnap-2 dong, Songpa-gu
Seoul 138-736 (South Korea)
Tel. +82 2 3010 3960, Fax +82 2 474 4691
E-Mail sukwon@amc.seoul.kr

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Danaparoid in the Prevention of Ischemic Stroke in Paroxysmal Nocturnal Hemoglobinuria

J. Zyss^a, S. Cakmak^a, L. Derex^a, M. Michallet^b, N. Nighoghossian^a

^aCerebrovascular Unit, Hôpital P. Wertheimer, and

^bDepartment of Hematology, Hôpital Edouard-Herriot, UCB Lyon I, Lyon, France

Paroxysmal nocturnal hemoglobinuria (PNH) is an acquired clonal hematologic disorder characterized by complement-mediated hemolysis, venous thrombosis, and bone marrow failure [1]. Systemic venous thrombosis is the main cause of morbidity and mortality. Cerebral arterial occlusion is rare and has been reported in postmortem studies [2, 3].

We describe the case of a PNH patient who experienced posterior cerebral artery infarct. Acute management and further prevention of stroke are still controversial. Danaparoid might be useful in this setting.

Case Report

We describe the case of a 34-year-old female patient, diagnosed with PNH 20 years ago as a complication of idiopathic aplastic anemia. She was initially treated with antilymphocytic serum and ciclosporin (250 mg/ day). No cardiovascular risk factor was evident.

In December 2005, 5 days after a mild sinusitis, she developed left lateral homonymous hemianopia. Multimodal stroke MRI showed a right posterior cerebral artery infarction (fig. 1). Heart

Fig. 1. Diffusion-weighted MRI: left posterior cerebral artery infarction.

auscultation, ECG monitoring, and transesophageal echocardiography ruled out any cardioembolic source of stroke. The search for a thrombophilic state and a systemic inflammatory or autoimmune process was negative.

There was no macroscopic or microscopic hemoglobinuria. The role of PNH was supported by the absence of other vascular risk factors and simultaneous cytopenia and hemolysis markers (leukocyte count: 3,350/ μ l, erythrocytes: 3.08×10^6 / μ l, platelets: 101×10^3 / μ l). Level of hemoglobin was 9.6 g/dl, lactate dehydrogenase 881 IU/l, haptoglobin <0.06 g/l, and bilirubin 28 μ mol/l. Flow cytometry was performed and showed PNH cells (GPI-AP-deficient cells around 2–26% depending on the deficiency marker).

Our patient was initially treated with sodium danaparoid injections 450 IU/day; this treatment has been maintained to date. A residual left visual field defect still persisted. She had no recurrence at 1-year follow-up.

Discussion

PNH is frequently associated with aplastic anemia [1]. The causal role of PNH was supported by the absence of alternative cause-of-stroke vascular risk factors. Moreover, hemolysis and its procoagulant effect could have been triggered by the previous sinusitis.

A number of pathologic mechanisms have been proposed to explain why PNH patients are prone to thrombosis. Tissue factor and platelet-derived microparticles could be involved [4]. Antiplatelets combined with anticoagulant agents (warfarin or low-molecular-weight heparin therapy) are commonly used in therapy. This association may increase the hemorrhagic risk mainly in patients with thrombopenia.

There is strong evidence that PNH patients who have experienced venous thrombosis should receive lifetime anticoagulation therapy [5]. However, recurrent venous thrombosis may occur despite efficient warfarin anticoagulation.

Danaparoid sodium is a low-molecular-weight heparinoid. It has prophylactic and curative use in deep venous thrombosis, which is demonstrated in patients with type-2 heparin-induced

thrombocytopenia, due to its low cross-reactivity with heparin-induced antibodies [6]. Danaparoid is also the mainstay of therapy for disseminated intravascular coagulation.

Danaparoid seems to be of interest in PNH patients who need anticoagulant treatment, as they are already at high risk of thrombopenia. Moreover, this drug may counterbalance procoagulant platelet-derived microparticles. However, secondary prophylactic use of danaparoid in ischemic stroke has never been compared to other anticoagulant treatments. Therefore, further studies are needed.

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Dr. Julie Zyss
Cerebrovascular Unit, Hôpital P. Wertheimer
UCB Lyon I, 59 boulevard Pinel
FR-69394 Lyon Cedex 03 (France)
Tel. +33 4 7235 7806, Fax +33 4 7235 7329
E-Mail juliezyss@hotmail.com