

Reversible Changes of Posterior Cerebral Artery after Angioplasty for Moyamoya Disease: Report of a Case

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Abstract

Background: The changes of posterior cerebral arteries (PCAs) in Moyamoya disease (MMD) are often involved in the clinical setting. However, the changes of PCAs after recovering the hemodynamics of anterior circulation in MMD are not reported.

Case Description: A 14-year-old patient was diagnosed as MMD with symptomatic stenosis in the right middle cerebral artery (MCA), asymptomatic stenosis in the left terminal internal carotid artery, and moyamoya-like vessels, stenotic lesion and an aneurysm were found in the right PCA, who was treated with balloon angioplasty in the right MCA. One month later, the patient suffered from transient ischemic attack in the right. DSA showed deteriorated severe stenosis in the left terminal portion of ICA and the proximal segment of MCA. The patient was performed angioplasty in the left ICA and MCA again. The follow-up angiography did not show any evidence of restenosis at the previous sites of stenosis after 18 months. Interestingly, the aneurysm and collateral vessels were disappeared as well as the stenotic vessel in the right PCA was recovered completely.

Conclusion: Our findings indicated that the pathologic changes of PCA are reversible after recovering the hemodynamic of the anterior circulation in MMD. It is important to understand the pathophysiological changes of posterior circulation in MMD.

Keywords: Moyamoya disease; Endovascular; Angioplasty; Ischemic stroke

Introduction

Moyamoya disease (MMD) is a cerebrovascular disease characterized by chronic steno-occlusive on the circle of Willis and its principal branches, along with the development of an aberrant network of collateral circulation that leads to ischemic and/or hemorrhagic stroke. In the guidelines of the research committee on MMD announced by the Japanese Ministry of Health and Welfare, the development of moyamoya vessels are necessary for a definitive diagnosis of MMD [1]. The presence and appearance of steno-occlusive posterior cerebral artery (PCA) lesions are not included in the diagnostic criteria of MMD. However, the PCAs are usually involved in the progress and long-term follow-up in MMD patients [2,3]. The frequency and location of cerebral infarction has been positively correlated to the progress of PCA steno-occlusive lesions [4,5].

Although several studies indicated that surgical revascularization improves cerebral hemodynamic and reduces the incidence of subsequent ischemic events, there are few studies focusing on the changes of posterior circulation in the patients [3,6-8]. Most patients (47.4%) were found progressive changes in the PCA after superficial temporal-middle cerebral artery (STA-MCA) anastomosis. The changes of posterior circulation in the patients with moyamoya disease recovered hemodynamic of the anterior circulation completely were not presented in the literatures. In the present study, we reported a

patient with moyamoya disease showing ischemic cerebrovascular events was performed angioplasty successively in bilateral anterior circulation. The pathologic changes of posterior cerebral artery were reversible completely in the follow-up digital subtraction angiography (DSA).

Case Report

A 14-year-old male patient came to our hospital on May 14th, 2012, with hemiparesis and hemianesthesia on left side for three days. The patient has no history of congenital and genetically disease. On arrival to our hospital, neurologic examination yielded a left facial droop, weak muscle strength of 4/5 (on the Muscle Strength Grading System from the Medical Research Council) on left side. A complete work-up for stroke was performed. Compute axial tomography scan showed several low-density lesions located in the basal region and deep border zones, implying a hemodynamic origin (not show). Computed tomography angiography demonstrated nearly occlusions in the distal portion of internal carotid artery (ICA), the proximal segment of MCA, and anterior cerebral artery (ACA), and moderate narrow in the left ICA bifurcation (no show). Laboratory tests yielded a normal platelet count and coagulation profile. C-response protein (CRP), erythrocyte sedimentation rate (ESR) and immunoglobulin E (IgE) were not elevated. The markers of autoimmune diseases such as antinuclear antibodies (ANA), perinuclear anti-neutrophil cytoplasmic antibodies (p-ANCA), and cytoplasmic ANCA (c-ANCA) were not increased. Other inflammatory markers including rheumatoid factor (RF), and anti-phospholipid antibodies were negative. DSA examination demonstrated severe stenosis in the right terminal portion of ICA,

proximal stenosis and dilated net-like branch vessels in the proximal segment of MCA, ACA (Figure 1A), as well as moderate narrow in the left ICA bifurcation (Figure 1B). In addition, the abnormal phenomena were also involved in the right PCA. An aneurysm was located at the distal portion of the stenosis in the P1 segment of the right PCA, except for the severe stenosis and net-like vessels changes (Figure 1C). Leptomeningeal collateral circulation from right PCA was developed to the anterior circulation. No signs of vasculitis were found. The vascular signs were suggestive of moyamoya changes. Balloon angioplasty procedure was performed initially (Figure 1D). One month later, the patient presented with recurrent transient hemiparesis and hemianesthesia on the right. DSA showed near-occlusion of the supraclinoid segment in the left ICA, occlusion of the proximal segment of the ACA, as well as severe stenosis in the proximal segment of the MCA (Figure 1E). No restenosis was found in the right MCA. Then, the patient was performed angioplasty in the left ICA and MCA (Figure 1F). After the treatment, the cerebral ischemic events did not reoccur. Unexpectedly, the follow-up DSA after 18 months showed no re-stenosis in the procedured arteries (Figures 1G and 1H). The moyamoya vessels, shrink of the aneurysm, and spontaneous improvement of the stenosis in the right PCA was disappeared (Figure 1I).

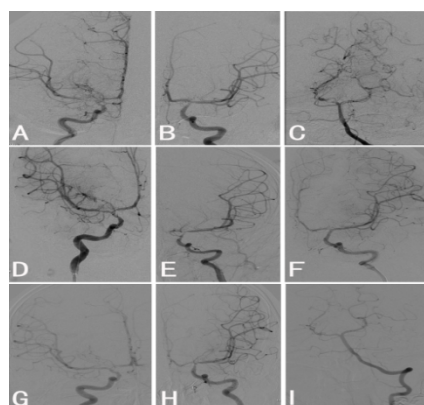


Figure 1: Angiography before and after the initial procedure and follow-up angiography.

Discussion

In this case, we first reported the phenomena of reversible changes in PCA after endovascular treatment for moyamoya disease. Eighteen months after angioplasty successfully for anterior circulation, the stenosis was improved, the aneurysm shrunk markedly, and the net-like vessels disappeared in the PCA. The mechanism of the reversible changes in PCA is related to the restore flow completely in anterior circulation after angioplasty. The procedure may reduce pathologic blood flow by improving blood flow and perfusion pressure in the region of anterior circulation, which would consequently constrict moyamoya arteries and shrink distal aneurysms [9].

In moyamoya disease, the PCAs are often involved following advancement of ICA lesions to compensate for the reduced intracerebral anterior circulation. A recent study shows that steno-occlusive changes involving the PCA only after ICA lesions have advanced in elder children [10]. Mugikura et al. discovered that the prevalence and the severity of steno-occlusive lesions in the PCA were

significantly correlated to the severity of the steno-occlusive changes in the ipsilateral ICA. It was also found that cerebral infarction in the MCA territory, the posterior watershed, or the PCA territory were closely associated with steno-occlusive changes in the PCA [11]. Similar characteristics were showed in the present case, which demonstrated near-occlusive stenosis, net-like vessels in the proximal segment of the right PCA, and progressive severe stenotic lesions, as well as moyamoya vessels in the bilateral terminal portion of ICA, and the proximal segment of MCA and ACA. The possible reason is that the gradually reduced perfusion in the internal carotid system results from the chronic stenosis and occlusion in the anterior circulation. To compensate for the reduced flow in the anterior circulation, the blood flow and hemodynamic stress on vascular endothelium are increased in the vertebrobasilar system, which are involved in the steno-occlusion, the development of moyamoya vessels and aneurysms [12,13].

However, there are few studies focusing on the changes of posterior circulation in the patients after treatment [3,6-8]. Revascularization by surgery by-pass might accelerate a process similar to disease progression and induced recurrent cerebral ischemia in PCAs despite successful cerebral revascularization. Most patients (47.4%) were found progressive changes in the PCA after superficial temporal-middle cerebral artery (STA-MCA) anastomosis, which was associated with decreased leptomeningeal collateral blood flow to the anterior circulation. The cerebral hemodynamic changes after revascularization by by-pass procedure are very complicated in moyamoya disease, and the improved blood flow is partially and incompletely. Some patients caused the observed neurological deficits after bypass procedure, which were hypothesized that a combination of competing blood flows from the collateral circulation, new blood flow from the STA, and impaired cerebral autoregulation led to focal decreases in regional CBF [14]. Percutaneous angioplasty may be beneficial early in the disease, reducing the deleterious effect of hypoperfusion to the brain and associated ischemic events. It could also reduce the progression of collateralization resulting in a decreased chance of hemorrhage [15]. However, the current limited data demonstrates that endovascular treatment of symptomatic moyamoya is fraught with relatively high complication and recurrence rates [16]. In conclusion, the present case provided indirect evident indicating that the changes of PCA in moyamoya disease are contributed to the hemodynamics disturbance in the anterior circulation in moyamoya disease. And the pathologic changes in posterior circulation are reversible completely after the hemodynamics in anterior circulation is recovered.

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