CLINICAL VIGNETTE

Moyamoya Disease and Syndrome

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Introduction

Moyomoya is a chronic, bilateral vasculopathy of undetermined etiology, often characterized by progressive narrowing of the intracranial portion of the internal carotid artery. An abundance of collateral vessels often develop but place patients at very high risk for stroke. Moyamoya disease must be considered as a cause of stroke in otherwise healthy young adults. It is a relatively rare disease worldwide, with a larger prevalence in Asia.

We present a 32-year-old female without significant vascular risk factors who presented with new onset cerebrovascular accident. She was ultimately diagnosed with Moyamoya disease. We review the etiology, epidemiology, pathophysiology, and treatment of this disease.

Case Report

A 32-year-old right-handed female with a history of migraine disorder, asthma, white coat hypertension, and severe needle phobia presented to the Emergency department with right upper extremity paresthesia and clumsiness. She noted right hand and forearm numbness that began 3 days prior to presentation. She had no focal motor weakness, but some subtle coordination difficulty and decreased sensation.

Her home medications included oral contraceptives as well as over-the-counter non-steroidal anti-inflammatory drugs and acetaminophen. She did not take any other prescribed medications, including anti-hypertensive medications. She had no family history of stroke or cardiovascular disease.

Magnetic resonance imaging of the brain without contrast demonstrated multiple left frontal and parietal infarcts as well as right-sided frontal-parietal infarcts. The left sided infarcts were diffusion restricted, whereas the right side was seen on T2 Flair imaging. Magnetic resonance angiography of the head demonstrated multi-vessel asymmetric flow or absent signal, concerning for at least partial versus occlusive thrombus most notably within the left supraclinoid segment of the internal carotid artery and proximal left M1 segment.

The patient was initiated on aspirin and clopidogrel and admitted to the intensive care unit. Her oral contraceptive was held. Blood pressure was managed with a strategy of permissive hypertension, although her pressures were only slightly above the normal range throughout the admission.

A cerebral angiogram showed severe stenosis of the left distal internal carotid artery and left middle cerebral artery in the proximal M1 segment and left anterior cerebral artery proximal A1 segments with delay in late arterial phase, capillary phase and venous phase of the left MCA territory. No definite occlusion was noted. There was luminal irregularity in all M4 segments. These findings, in conjunction with the MRI and MRA findings, were consistent with Moyamoya disease.

The patient underwent extensive rheumatologic and hematologic evaluations, and all studies were unrevealing, other than a mildly elevated IgM antiphospholipid antibody which did not have any clinical significance. Lumbar puncture was considered, but was not performed due to low suspicion for CNS vasculitis or infection.

The patient was discharged on aspirin and atorvastatin. Her oral contraceptives were discontinued, and IUD was recommended. By the time of discharge, her symptoms had mostly resolved, with some residual coordination difficulty. Her blood pressure remained slightly elevated, but this was thought to be secondary to her known white-coat hypertension, and anti-hypertensive medications were deferred.

The patient had outpatient follow-up with neurology, neurosurgery, and her primary care team. Due to the diagnosis of probable Moyamoya, she underwent a left encephaloduroarteriosynangiosis (EDAS) for revascularization of the left hemisphere. She was maintained thereafter on aspirin, with plan for lifelong dosing, in conjunction with close outpatient follow-up, to include risk-factor modification and intensive blood pressure control. During her subsequent primary care visits, the patient had persistent hypertension, and was started on amlodipine for tighter blood pressure control. Her initial symptoms have now completely resolved without any further strokes.

Discussion

Moyamoya is a rare progressive cerebrovascular disorder characterized by stenosis of the internal carotid artery inside the skull and subsequent development of collateral circulation. The collateral vessels appear “smoky” on angiography, which led the disease to be called Moyamoya, which means “Puff of Smoke” in Japanese.[1,2]

Patients with no known associated risk factors are said to have Moyamoya Disease (MMD). Moyamoya Disease is thought to have a significant genetic component and is not related alternative diagnoses. There is a higher incidence among the Japanese population, supporting the hypothesis for genetic determinance. Recently, multiple genes have been suggested as possibly predisposing to the development of MMD, with suggestion of possible autosomal dominant inheritance pattern. This is largely based on studies of a small group of Japanese families with an isolated abnormality on telomeric region 17q25.[1-3]

Patients with similar angiographic findings but with another associated underlying pathogenesis are categorized as having Moyamoya syndrome (MMS). Some associated predisposing conditions include atherosclerosis, sickle cell, history of cranial irradiation, and vasculitis.[1,2]

Moyamoya disease has a bimodal distribution. It often presents in children between 5-10 years old and in adults 30-50 years old. The most common presentation of MMD is ischemic stroke, followed by hemorrhagic stroke and seizures. Ischemic stroke is the more common presentation in the adult population.[1,2,4] In one small retrospective series (31 adults) in the United States, 61% of patients with Moyamoya disease or syndrome presented with ischemic symptoms.[5] While ischemic symptoms are more common, hemorrhagic complications may represent a more significant clinical burden. Seizures are thought to be related to the underlying ischemic insult.[6]

Initial testing usually includes neuroimaging as patients present with TIA-like symptoms. Diagnosis is made by identifying characteristic angiographic findings, with the appearance of stenosis affecting the internal carotids and the presence of collateral vessels.[1,6]

The treatment of MMD and MMS is similar, though in MMS the underlying cause needs control. There is no curative treatment for Moyamoya. Management is supportive, which may reduce the risk of complications. This typically includes anti-platelet treatment with aspirin, though this can be a complex proposition in patients who present with intracerebral hemorrhage. Management also involves aggressive control of blood pressure and cholesterol. Treatment also includes surveillance imaging. This can identify patients who are at highest risk for future ischemic and hemorrhagic complications and would benefit from surgical revascularization.[2,4,7]

Moyamoya disease is a progressive disorder, and with best medical therapy has high likelihood of additional ischemic events.[1]

Surgical revascularization is considered for patients with imaging findings suggestive of severely restricted blood flow. These patients are at high risk for future complications and morbidity.[8] Additionally, all patients who present with ischemic stroke or intracerebral hemorrhage warrant consideration for surgical revascularization in absence of specific contraindication.[9] However, revascularization surgery is typically delayed until after recovery both to reduce the risk of surgical complications and to permit optimal recovery from the cerebrovascular event. Medical management with surveillance imaging is used for lower risk patients.[4,7]

Surgical techniques are either direct or indirect. The direct technique involves a direct connection of the superficial temporal artery (from the external carotid) to a cortical artery within the ischemic hemisphere. This technique is technically more difficult, especially in children. The indirect technique involves one of several procedures where a tissue perfused by a branch of the external carotid artery is applied to the surface of the ischemic hemisphere to encourage revascularization. Our patient underwent an indirect procedure.[7]

Conclusion

Our patient was 32 years old at presentation and thus in the second peak for Moyamoya. She presented with TIA symptoms and other causes of her TIA were ruled out, thus she was given the diagnosis of Moyamoya. Given the concern for occlusive findings on her MRA, she was referred for revascularization. Following her surgical revascularization, she has done well thus far, without further stroke or TIA.

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