

Acute Onset Visual Loss: Presentation of Moyamoya Disease in a Girl

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Abstract

Moyamoya disease is a chronic progressive cerebrovascular arteriopathy of unknown origin which is characterized by progressive stenosis internal carotid artery and cerebral arteries with typical angiographic appearance of abnormal basal collateral vessels. Clinical features include early neurological symptoms (eg. dysarthria, aphasia, hemiparesis and seizures) while visual impairment is considered atypical, being generally reported as a later complication of ischemic or hemorrhagic events.

We report a case of a 4-years girl who developed an acute onset of right visual loss with normal eye movements, without any neurological and behavioural alterations. A magnetic resonance angiography showed features suggestive of Moyamoya disease with a typical “puff of smoke” aspect confirmed with an angiography: it was started heparin and antiepileptic medications and after she was subject to two surgical intervention (indirect EDAS revascularization combined with right EDAMPS) with instrumental and clinical improvement.

Moyamoya disease should be included in differential diagnosis of each pediatric patient with acute onset visual loss: delay of diagnosis is one of the most important prognostic factor for impairment ophthalmologic recovery.

Keywords

moyamoya disease; visual impairment; puff of smoke; cerebrovascular disorder

Introduction

Moyamoya disease is a progressive angiogenetic disorder, with an arterial narrowing involving distal portion of internal carotid arteries, at intracranial level. This disorder leads to development of collateral vessels, with a typical “puff of smoke” aspect in angiographic studies [1]. In this condition ultrastructural findings include intimal thickening in the terminal portions of the internal carotid vessels. Proliferation of intima is usually associated to lipid deposition, fibrocellular thickening of the intima, waving of the internal elastic lamina, and thinning of the media [1].

The overall prevalence of Moyamoya disease is highest in the Japanese population, that is 10-fold higher than to the European population. Age distribution is bimodal with a first peak between 5 and 15 years, and a second peak during the fourth decade [3]. While 10% of cases is hereditary, with autosomal

dominant inheritance pattern involving mutations in chromosome 3,6,8,12,17 [1], most cases are secondary to other clinical conditions or idiopathic.

This disease may be asymptomatic for long time or be rapidly evident with headache, epileptic seizures, speech impairment, focal signs and progressive cognitive defects. Clinical features are various in different ages: adults generally present more frequently hemorrhagic manifestations, children commonly have ischemic stroke [2].

Classification includes two distinct conditions: Moyamoya disease (MMD), with no clear underlying causes, and Moyamoya syndrome, secondary to other conditions as sickle-cell disease, neurofibromatosis type I and trisomy 21 [4,5]. Usually early symptoms of MMD include dysarthria, aphasia, hemiparesis and seizures. Syncope, paraparesis, involuntary movement and visual impairment are less frequent and considered atypical [4]. Visual impairment is generally reported as a possible later complication of ischemic or hemorrhagic events [7].

Diagnosis may be performed with CT scan or NMR imaging, and confirmed with magnetic resonance angiography, which is still the gold-standard diagnostic survey, as stated in the last guidelines [6] (table 1).

Case Report

A 4-years old Caucasian female was admitted to Paediatric Department for right eye blindness. Clinical history revealed the presence of a progressive right eye visual loss in the previous 2 weeks, with exotropia at the mid-position and at upper and lateral gaze. Left eye movements were normal without behavioural alterations. A funduscopy evaluation performed before admission showed bilateral optic nerve edema. In the previous year, the child presented episodes of mild headache, well controlled with an acetaminophen therapy. Familiar and perinatal history was normal. In the previous two weeks ophthalmic findings with funduscopy evidenced severe right visual loss, normal left visual acuity, normal crystalline, mild peripapillary edema. A 16-slides brain CT scan without contrast resulted negative, laboratory results and electrocardiogram were normal. At admission the child was in good clinical conditions, except for a complete right blindness without any other alterations at neurologic evaluation. A second ophthalmologic evaluation confirmed complete visual loss, right peripapillary edema with normal retina.

A magnetic resonance angiography (MRA) showed: a severe narrowing in intracranial portion of both internal carotid arteries; the presence of a collateral circulation from vertebro-basilar vessels through posterior communicating arteries that supplied vascular flow in anterior and middle cerebral arteries. Such findings were suggestive of Moyamoya disease (Fig. 1). Therefore, after neurosurgical consultation, the patient was subjected to selective angiography that evidenced a clear "puff of smoke" without other vascular malformations or intracranial aneurisms and confirmed the diagnostic hypothesis (Fig. 2). An epiaortic echocolordoppler evaluation, performed to evaluate proximal vessels, showed narrowed common carotid arteries, "stump-flow" aspect of right internal carotid artery, normal external carotid artery flow. The other investigations necessary for the characterization of the disease (echocardiography, abdominal echography and electroencephalography) were normal. Laboratory findings including blood cell count, haemoglobin level, C-reactive protein, hepatic and renal function,

immunoglobulins, folic acid, ammonium, coagulation and thrombophilia screening were normal; autoimmunity screening (ANA, ANCA) and serological tests (Toxoplasma, EBV, HSV1, Borrelia, Bartonella, VZV) were negative.

Clinical features, vascular imaging and specific findings of angiography, were suggestive of a Moyamoya disease. Considering the high risk of ischemic episodes in infancy associated to such condition was started an antiplatelet therapy (acetylsalicylic acid: 3.5 mg/kg). The girl was rapidly transferred to a neurosurgery unit where low molecular weight heparin and antiepileptic medications were started before two surgical intervention: indirect EDAS (encephalo-duro-arterio-synangiosis) revascularization combined with right EDAMPS (encephalo-duro-arterio-myo-periostealsynangiosis). Headache resolved a few days after intervention while right visual loss persisted and post-surgery MRN showed a progressive improvement of the radiological signs. The girl is continuing antiepileptic therapy with valproic acid (150 mg twice a day) and did not present any sign or symptoms of ischemic events. She is subject to follow-up with EEG, MRA, and neurological visit: the oculistic follow-up visits showed a clinical visual improvement.

Discussion

Moyamoya disease is the third most common cause of paediatric cerebrovascular disorders which should be considered in differential diagnosis of any children with cerebral ischemic features. Diagnosis should be rapid as early treatment is mandatory to prevent the development of cognitive impairment.

The presence of acute visual loss at the beginning of the disease in pediatric patients, as in our girl, is rare and atypical as confirmed by a recent review of literature [12]; it is generally described in patients with Moyamoya syndrome [9,10]. These manifestations are usually related to stenosis of posterior cerebral circulation and include blindness, scotomata, blurred vision and amaurosis, with a more likely occurrence in children [11].

Therapeutic options include surgical treatment with early revascularization and supportive pharmacological medications. Surgery may be performed with direct, indirect and combined procedures, in order to reverse neurological deficits, prevent further ischemic events, allow a normal cognitive development and contain seizures and involuntary movements. Supportive therapy includes antiepileptic, calcium channel blockers and antiplatelet drugs, and is important to minimize the risk of thrombotic events and seizures and to maintain intravascular volume. A periodic follow-up of children with Moyamoya disease is necessary as most cases can be recurrent. In each case of Moyamoya disease a MRA screening should be routinely performed in first-degree relatives, to identify asymptomatic parents and siblings. An MRA should also be considered in patients with high risk of Moyamoya syndrome with cerebral ischemia findings and elevated TCD velocity [8].

Conclusion

The Moyamoya disease can present itself in an extremely heterogeneous also with soft or unusual clinical patterns: from this stems the difficulty for the doctor to arrive at the diagnosis. It's important to know this disease to bring a strong clinical suspicion and to reach the diagnostic confirmation in the shortest possible time. The speed with which the diagnosis is made and launched specific therapy is essential to prevent the emergence of further brain damage especially in the pediatric patient where an

ischemic stroke or hemorrhagic can dramatically affect cognitive development, thus affecting the normal intellectual development and autonomy in the years to come. The key issue is the multidisciplinary approach that increases, given the lack of experience in this field, the ability to frame and identify the disease.

They currently lack the solid and standardized guidelines for the uniform therapeutic approach and follow-up of this disease. This is due to poor understanding of the pathophysiology of this disease, the fragmentation of the data and the results of the various treatment options and the lack of information on the long-term outcome of patients treated with the new surgical techniques.

Our patient presented a rare symptoms (eg. repeated episodes of frontal headache and unilateral visual loss) from the fourth year of life, only with involvement of the internal carotid arteries of brain and savings: these prognostic factors are considered positive to date and associate with a good course and a good prognosis without recurrence or worsening.

On the other hand we have the late diagnosis (admission after 2 weeks from the start of the growing symptoms) which is one of the most important prognostic factor in the visual recovery [13].

Finally there is the need to emphasize the importance of follow-up in the management of patients with Moyamoya especially in pediatric patients: after the surgery is essential to schedule a follow-up plan based on the repetition of neurological examinations, imaging examinations and instrumental tests integrating the pharmacological approach also on the rehabilitation plan to ensure your child the best neuro-cognitive outcomes possible. In conclusion to our report we suggest that Moyamoya disease must be included in the differential diagnosis of any pediatric patient with acute onset of visual loss: in these patients MRA may allow an early diagnosis and treatment by changing positively the prognostic outcome.

Figures

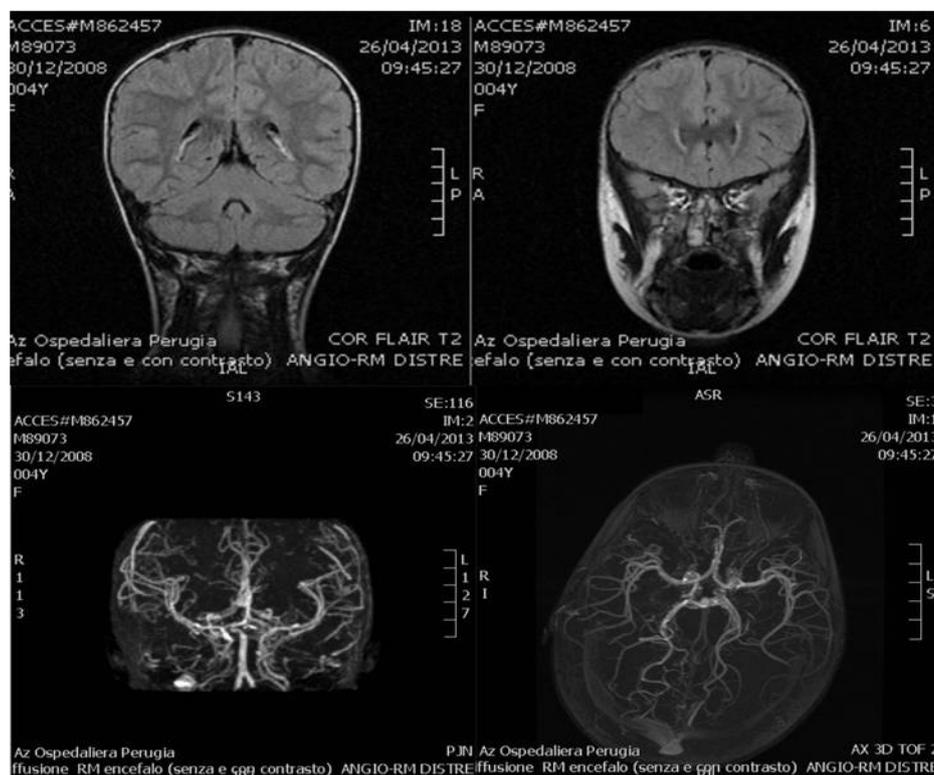


Figure 1: Magnetic resonance angiography (MRA) showing severe narrowing of both internal carotid arteries. Presence of a collateral circulation from vertebro-basilar vessels through posterior communicating arteries.

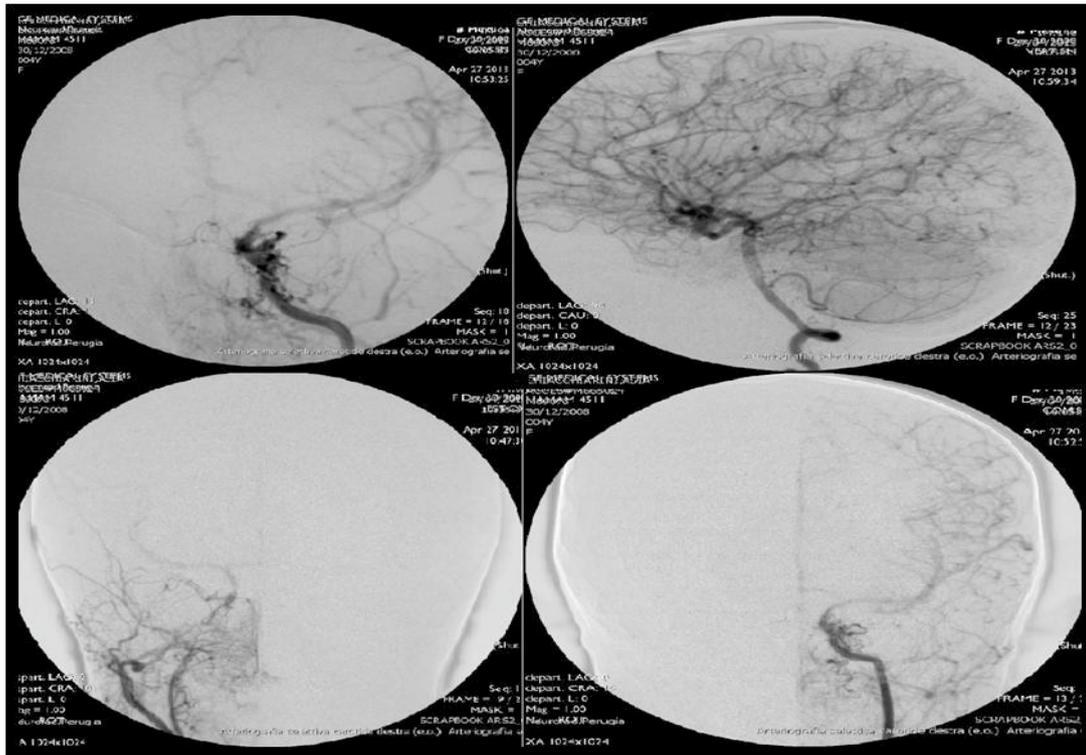


Figure 2: Angiographic evidenced of a “puff of smoke” aspect with complete occlusion of supraclinoid right internal carotid artery and severe narrowing of left internal carotid artery. Presence of a broad collateral circle of vessels from external right carotid artery and from posterior communicating arteries, with widened vertebral arteries. Spare narrowing in the distal portion of right middle cerebral artery.

Table

Table 1: Diagnostic criteria of Moyamoya disease

A	B	C
Cerebral angiography findings:	Magnetic resonance imaging (MRI) and magnetic resonance angiography (MRA) findings:	Cerebrovascular disease with the following basic disease or conditions should thus be eliminated:
<p>1. Stenosis or occlusion at the terminal portion of the internal carotid artery and/or at the proximal portion of the anterior and/or the middle cerebral arteries</p> <p>2. Abnormal vascular networks in the vicinity of the occlusive or stenotic lesions in the arterial phase</p> <p>3. These findings should present bilaterally</p>	<p>1. Stenosis or occlusion at the terminal portion of the internal carotid artery and at the proximal portion of the anterior and middle cerebral arteries on MRA</p> <p>2. An abnormal vascular network in the basal ganglia on MRA. Note: an abnormal vascular network can be diagnosed when more than two apparent flow voids are seen in one side of the basal ganglia on MRI</p> <p>3. (1) and (2) are seen bilaterally. Refer to the Image Diagnostic Guidelines by MRI and MRA</p>	<p>1. Arteriosclerosis</p> <p>2. Autoimmune disease</p> <p>3. Meningitis</p> <p>4. Brain neoplasm</p> <p>5. Down syndrome</p> <p>6. Recklinghausen's disease</p> <p>7. Head trauma</p> <p>8. Irradiation to the head</p> <p>9. Other</p>

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