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Case Report

Central retinal vein occlusion with moyamoya disease: a case report

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Abstract: Moyamoya disease is mainly caused by stenosis or occlusion of the terminal internal carotid artery, anterior cerebral artery, and proximal middle cerebral artery, and an abnormal vascular network is formed near the stenosis or occlusion of vascular lesions. Moyamoya disease can lead to a series of complications such as transient cerebral ischemia, cerebral infarction, and cerebral hemorrhage, which have been reported in the literature. Eye involvement with moyamoya disease is relatively rare in the literature. This article introduces a case of central retinal vein occlusion in a teenager related to moyamoya disease. The patient was only 16 years old and suddenly suffered from vision loss in the left eye. After detailed ophthalmological examination, she was diagnosed with central retinal vein occlusion in the left eye. In order to find the exact cause, we conducted head and neck CTA and brain DSA examinations on the patient, and finally found that the main cause of central retinal vein occlusion in this patient was moyamoya disease, which indicated that central retinal vein occlusion in young people may be caused by moyamoya disease in the early stage. This discovery has great clinical significance, for characteristic manifestations of the eye, suggesting that examination of moyamoya disease is a routine item for such patients, so as to achieve early detection, early diagnosis and early treatment, in order to avoid cerebral infarction, cerebral palsy, and serious or even life-threatening complications such as bleeding.

Keywords: Central retinal vein occlusion (CRVO), moyamoya disease (MMD), contraceptives, case-report

Introduction

Moyamoya disease was first described [1] in 1969, by Suzuki J et al who officially named it MMD [2]. Moyamoya disease is mainly characterized by stenosis or occlusion at the end of internal carotid artery, the proximal end of anterior cerebral artery and middle cerebral artery, and an abnormal vascular network is formed near the stenosis or occlusion of vascular lesions. The cause of moyamoya disease is still unclear. Moyamoya disease is a partial reflection of systemic diseases, and its pathogenesis is complex. The main pathological change is the proliferation of elastic fibers in the intima of internal carotid artery, which gradually narrows the lumen of internal carotid artery and eventually leads to occlusion. Moyamoya disease can lead to a series of complications such as transient cerebral ischemia, cerebral infarction and cerebral hemorrhage, which have been reported in the literature [3]. Eye involvement in moyamoya disease is rarely seen in the literature. This may be because ophthalmologists have little knowledge of moyamoya disease and have not carried out corresponding examinations, and miss the diagnosis. Yet it does exist, including anterior ischemic optic neuropathy and retinal movement [4], pulse obstruction, optic disc dysplasia, and choroidal defect [5]. Recently, we encountered a patient with central retinal vein occlusion and moyamoya disease. According to us, this patient is the youngest patient with central retinal vein occlusion related to moyamoya disease reported so far, and it was first diagnosed in the ophthalmology department. This case is of great clinical significance.

Case report

We present a case of central retinal vein occlusion with moyamoya disease. This study was performed in accordance with the Declaration of Helsinki. An informed oral consent for publication of the clinical and laboratory data was

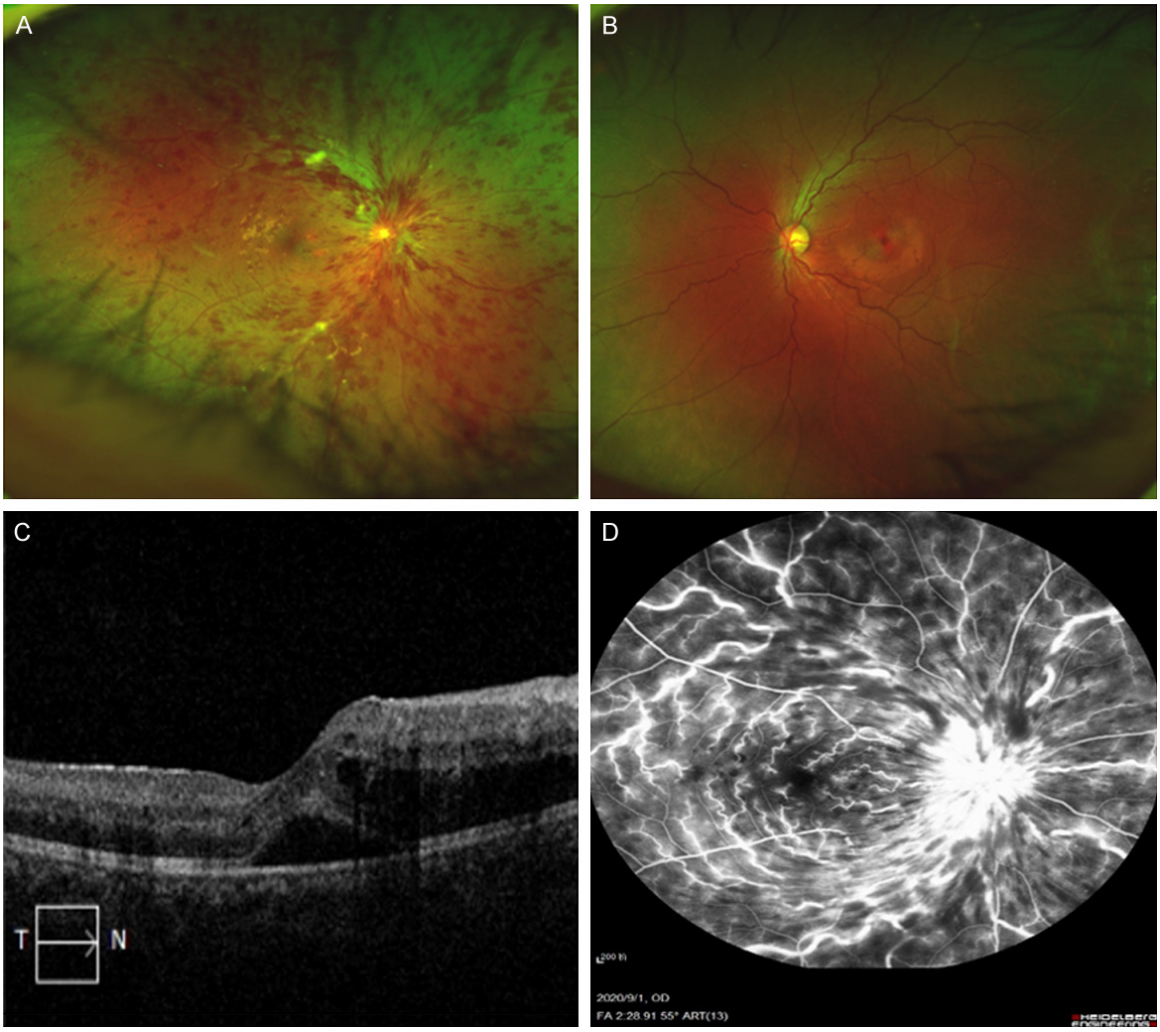

Figure 1. Fundus, OCT and fundus contrast examination results of both eyes. A. Fundus examination results of the right eye. B. Fundus examination results of the left eye. C. Results of binocular OCT examination. D. Results of fundus contrast examination.

obtained from the patient. The 16-year-old female patient, whose right eye vision decreased for one month, had no redness, pain, nausea, vomiting, headache or dizziness. She went to the ophthalmology clinic of Shengli Oilfield Central Hospital in Dongying City on August 29th, 2020. Ophthalmology examination: the visual acuity of right eye is 0.5 (corrected), the visual acuity of the left eye is 1.0 (corrected), and the intraocular pressure of the right eye and left eye are 15 and 17 mmHg (1 mmHg = 0.133 kPa) respectively. No obvious abnormality was found in the anterior segment of both eyes, and fundus examination: the boundary of the optic disc in the right eye is unclear, and there is flaming hemorrhage, tortuous veins and macular edema in the retina (**Figure 1A**). The boundary of the optic disc in the left eye is clear and normal in color, and The retinal vein in the posterior pole is tortuous, without obvious hemorrhage and edema (**Figure 1B**). OCT examination of both eyes: macular edema in the right eye (**Figure 1C**). Outpatient service: the patient was admitted to hospital for treatment with right eye central retinal vein occlusion and right eye macular edema.

After admission, the patient was asked about her medical history in detail. The patient had full-term natural delivery and no history of oxygen inhalation. In february 2020, the patient visited the gynecology clinic of our hospital and was diagnosed with “polycystic ovary syn-

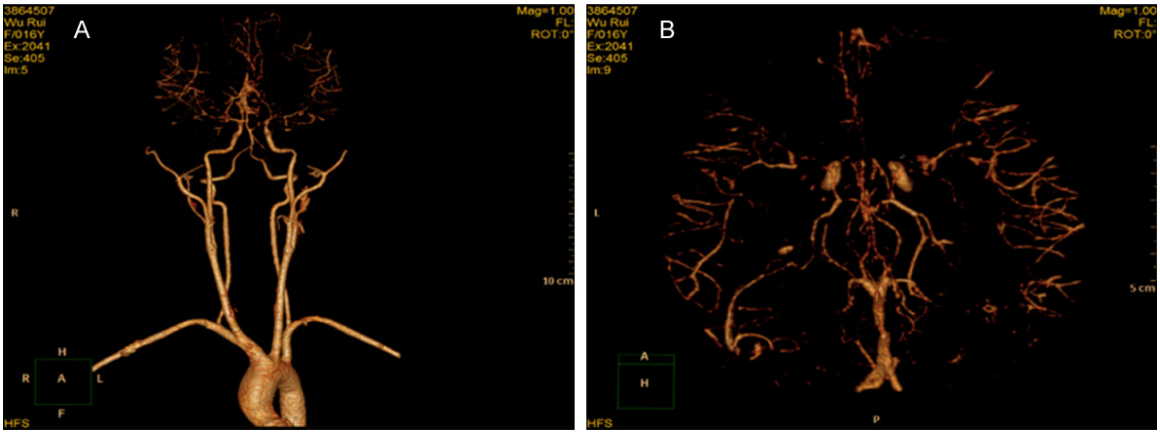

Figure 2. The diagnostic result. A. Central retinal vein occlusion with macular edema in the right eye. B. Diagnosis of moyamoya disease.

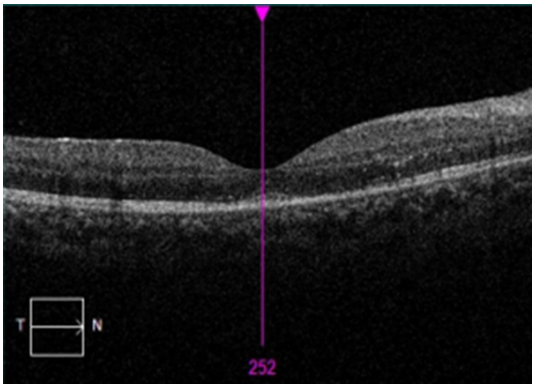

Figure 3. OCT showed macular edema resolved.

drome". She took the contraceptive "drospirenone ethinyl estradiol tablets (II)" for 4 months. Improve related examinations after admission, fasting blood glucose, blood lipid, whole blood cell count, easy thrombus combination, inflammation combination, antinuclear antibody 14 items, anticardiolipin antibody, tuberculosis antibody 8 items and carotid artery color Doppler ultrasound showed no obvious abnormality. The patient was further examined by fundus angiography (**Figure 1D**), and the results showed that the filling of retinal vein in the right eye was delayed and the optic disc leaked in the late stage. Diagnosis: Right eye central retinal vein occlusion with macular edema. Head CTA examination showed that the ends of bilateral internal carotid arteries were occluded. In conclusion, the anterior and middle cerebral arteries were not visualized, and collateral circulation could be seen. The diagnosis was moyamoya disease (**Figure 2A**, **2B**).

On September 4th, 2020, the patient underwent the first injection of ranibizumab in the vitreous cavity of the right eye. After 17 days' follow-up, the patient's right eye vision improved to 1.0 (corrected), and macular edema subsided by OCT (**Figure 3**). Then, the patient went to the vascular intervention department and underwent digital subtraction angiography (DSA). The results showed that the ends of bilateral internal carotid arteries were included, and the anterior and middle cerebral arteries were not developed. It also confirmed the diagnosis of moyamoya disease (**Figure 4A**, **4B**).

Due to the patient's surgical treatment of moyamoya disease in the superior hospital, the eye reexamination and treatment were not timely, and macular edema recurred many times. On October 26th, 2020 and February 5th, 2021, two more vitreal cavity drug injections were performed. The patient was followed for 12 months. There was no retinal vascular occlusion in the left eye and no retinal and iris neovascularization in both eyes.

Discussion

Retinal vein occlusion (RVO), which is divided into central retinal vein occlusion and branch retinal vein occlusion, is the second most common retinal vascular disease in the world with a high blindness rate [6]. RVO mostly occurs in the elderly, especially in patients with systemic diseases such as hypertension, diabetes and heart disease. Most young and middle-aged RVO patients do not have the above-mentioned risk factors, and have unique causes. Studies

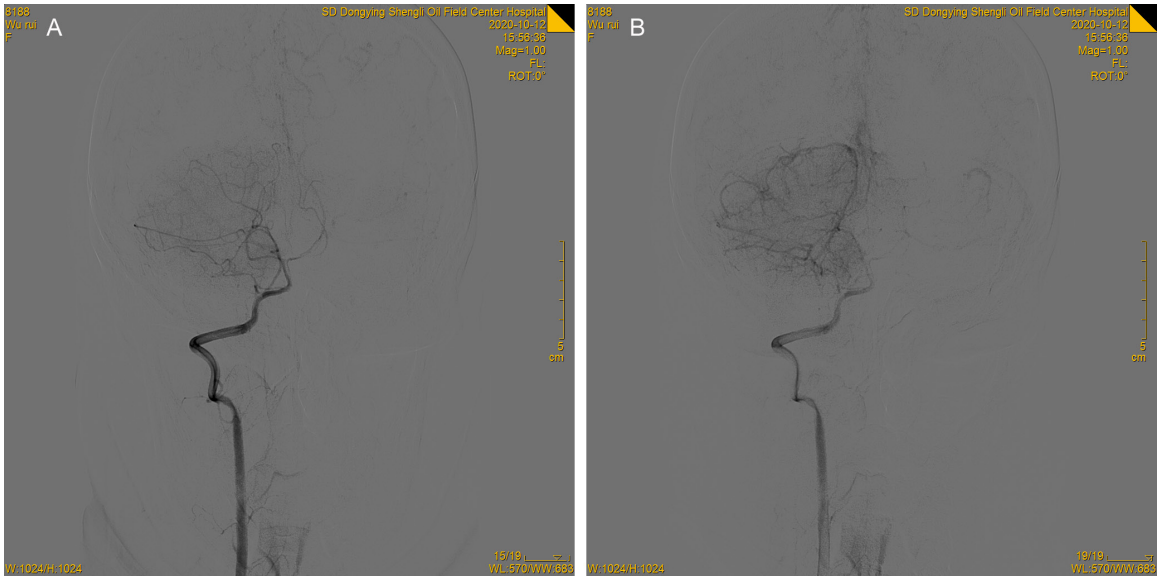

Figure 4. DSA test results. A. Examination of the left internal carotid artery. B. Examination of the right internal carotid artery.

Table 1. Cases of moyamoya disease

No.	Year	Age	Gender	Symptoms
1	2020	48	Female	Central retinal artery occlusion (CARO)
2	2015	51	Female	Ocular ischemic syndrome
3	2016	36	Male	Bilateral continuous branch retinal vein occlusion (BRVO)
4	2007	51	Female	Ischemic optic neuropathy
5	2012	26	Male	Central retinal artery occlusion (CARO)

have shown that 40%-67% of young RVO patients are accompanied by systemic diseases [7]. The patient with moyamoya-related central retinal vein occlusion is a typical example in this article.

Autopsy has confirmed that smooth muscle proliferation, macrophage and T cell infiltration existed in the vascular wall of MMD patients, suggesting that MMD may be related to atherosclerosis [8]. Previous study has shown that there is a certain correlation between arteriosclerosis and RVO, anatomically, when the retinal vascular wall and peripheral tunica vaginalis are hardened, and it can cause retinal vein stagnation or interruption of venous blood flow, and secondary RVO [9]. Another study confirmed that there are extensive retinal vascular abnormalities in moyamoya disease patients, such as artery wall thickening and vein compression, artery stenosis and irregular vein diameter [5]. Therefore, the author speculates that the above mechanism may be an important reason for RVO caused by moyamoya disease in this article.

Previous studies have indicated that central retinal artery occlusion (CARO) was the first symptom of moyamoya disease in a middle-aged patient [10], and ocular ischemic syndrome in patients with moyamoya syndrome is present with retinal vasculitis [11]. In addition, moyamoya patients also suffer from bilateral continuous branch retinal vein occlusion (BRVO) [5], ischemic optic neuropathy due to ocular hypoperfusion [4], and CRAO [12] (**Table 1**).

In this paper, the patient suffered from polycystic ovary syndrome for half a year and took drospirenone ethinyl estradiol tablets (II) orally for 4 months. Studies have shown that estrogen in contraceptives can increase coagulation factors and fibrin, decrease anticoagulation, and aggregate platelets, which further leads to increased blood coagulation and slow blood flow, and easily leads to thrombosis [13]. The

patient took oral drospirenone ethinyl estradiol tablets (II), the estrogen content was reduced to 20 μg, and β-cyclodextrin was used to wrap it, which improved the stability of low-dose ethinyl estradiol. Secondly, drospirenone, as a newly synthesized progestogen, has pharmacological activity very similar to that of progestogen *in vivo*, can also reduce the androgen effect of progestogen, and has little fluctuation on estrogen and progestogen levels *in vivo*. Complications of ocular vascular occlusion are very rare [14].

To sum up, the author thinks that the central retinal vein occlusion in this young female patient is caused by moyamoya disease and contraceptives. Moyamoya disease is the main cause, and oral contraceptives accelerate the progression of moyamoya disease, and promote the occurrence of central retinal vein occlusion.

According to us, this patient is the youngest patient with central retinal vein occlusion related to moyamoya disease reported so far, and it was first diagnosed via ophthalmology. This suggests that retinal vein occlusion in young patients may be the characteristic manifestation of moyamoya disease in the early stage of eye disease, which requires attention, and comprehensive and meticulous systematic examination should be carried out to avoid missed diagnosis and thus delay the treatment opportunity. In addition, when taking drugs that may lead to thrombosis orally, patients should be asked in detail whether there are systemic susceptible factors to avoid serious systemic complications.

Disclosure of conflict of interest

None.

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