The diagnosis and treatment of central retinal artery occlusion with severe cardio-cerebrovascular disease: a case report

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Background: Central retinal artery occlusion (CRAO) is an acute eye disease that seriously damages vision. Patients with CRAO often have a combination of various cardio-cerebrovascular diseases (CCVDs), and CRAO patients often ignore their cardio-cerebrovascular disorders because of their ocular symptoms. In addition, there are few reports about CRAO patients with CCVDs received effective interventions implemented. We report the diagnosis and treatment of a Chinese CRAO patient with CCVD who received timely multidisciplinary interventional therapy to provide ideas for clinical ophthalmologists in the diagnosis and treatment of similar diseases.

Case Description: A 76-year-old male patient, who had previously been diagnosed with hypertension, was admitted to hospital due to a sudden decrease in vision in his right eye for >2 days with a severe headache. After fundus photography, he was diagnosed with CRAO in the right eye. His cerebral angiography revealed multiple stenoses at arteries of his neck and brain included the right ophthalmic artery. Neurosurgery was attempted to perform a thrombolysis of the right ophthalmic artery while performing the angiography, but failed to find the opening of the right ophthalmic artery. However, through electrocardiogram (ECG) monitoring during the operation, we found that the patient had frequent ventricular premature beats, so the Department of Cardiology performed coronary arteriography for him which revealed severe stenosis of the left anterior descending (LAD) artery. The cardiologists performed a percutaneous coronary intervention (PCI) at the same time as the coronary angiography. Some 2 months later, the patient was admitted to the Neurosurgery Department to implant stent at the left vertebral artery. After stent implantation, his headache symptom improved significantly and his right eye vision improved.

Conclusions: Through timely cerebral angiography and ophthalmic examinations, the patient was diagnosed with CRAO combined with CCVD, and after received multidisciplinary interventional therapy, the patient's right eye vision and headache symptom improved and more severe cardio-cerebrovascular adverse events were avoided. In treating CRAO patients, in addition to aggressive eye treatment, the systemic cardio-cerebrovascular situation of each patient should also be assessed, a timely diagnosis made, and effective interventions implemented to reduce morbidity- and mortality-related cardio-cerebrovascular events.

Keywords: Central retinal artery occlusion (CRAO); cardio-cerebrovascular disease (CCVD); vertebral artery stenosis; case report

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Introduction

Central retinal artery occlusion (CRAO) is an acute ischemic stroke that can lead to severe vision loss and is a harbinger of further cerebrovascular and cardiovascular events (1). Occlusion at any site from the common carotid artery to the intraretinal arterioles causes a corresponding retinal ischemia. The etiology of CRAO includes atherosclerosis, arterial spasm, periarteritis, coagulation abnormalities, thromboembolism, and external compression, among which the sources of thromboembolism include the heart, aortic arch, and large vessels (2). Patients with CRAO often have a combination of various cardio-cerebrovascular diseases (CCVDs), and patients with CRAO often only come to medical attention because of ocular symptoms. Ophthalmologists easily ignore systemic cardio-cerebrovascular factors when treating such patients. However, the occurrence of serious cardio-cerebrovascular adverse events would be life-threatening and there are few reports about CRAO patients with CCVDs receiving effective interventions implemented. We report the intervention management of a Chinese CRAO patient with severe CCVD to provide additional clinical ideas for our ophthalmic peers treating the disease. We present the following case in accordance with the CARE reporting checklist (available at https://atm.amegroups.com/article/view/10.21037/atm-22-6453/rc).

Highlight box

Key findings

- A series of multidisciplinary interventions is beneficial to the health of patients.

What is known and what is new?

- Patients with CRAO often have a combination of various CCVDs, and CRAO patients often only receive medical attention because of their ocular symptoms.
- We report on the intervention management of a Chinese CRAO patient with severe CCVD to provide additional clinical ideas for our ophthalmic peers treating the disease.

What is the implication, and what should change now?

- In treating CRAO patients, in addition to aggressive eye treatment, the systemic cardio-cerebrovascular situation of each patient should also be assessed, a timely diagnosis made, and effective interventions implemented to reduce morbidity- and mortality-related cardio-cerebrovascular events, protect the patient's visual function, and prolong the patient's life.

Case presentation

A 76-year-old man presented to the Shenzhen Second People's Hospital in April 2022 due to a sudden decrease in visual acuity in his right eye for >2 days with a severe headache. He had a previous history of hypertension for 15 years and was on regular oral Adalat GITS to control his blood pressure. His visual acuity results were as follows: right eye: hand motions/before eye, left eye: 0.6. Non-contact tonometer: right eye: 9 mmHg, left eye: 13 mmHg. Wide-field fundus photography showed that his right eye had a clear optic disc, and the cup to disk ratio (C/D) was about 0.3. His retinal arteries were thinned, arterial/venous (A/V) was about 1:2. He had some retinal pallor and edema in the posterior pole and cherry red spot (CRS) appeared in the fovea (*Figure 1*). No obvious abnormality was found in his left eye. He was diagnosed with CRAO in the right eye by ophthalmologists and given treatments, such as oxygen inhalation, massage eye drops, sublingual nitroglycerin, and ocular hypotensive eye drops. We contacted the Neurosurgery Department, as the patient urgently needed a cerebral angiogram and interventional thrombolysis.

The patient's intraoperative angiogram showed multiple stenoses at the end of his left carotid artery, the origin of the left internal carotid artery, and Petrous segment. Severe stenoses was found near the carotid bifurcation, of which the narrowest was >80% (*Figure 2A*). The left ophthalmic artery was not visualized, and the left external carotid artery was visualized late. His left subclavian artery showed severe stenosis at the vertebral artery ostium, as did his left vertebral artery ostium. His right internal carotid artery origin and distal Petrous segment and Cavernous segment showed multiple stenoses (*Figure 2B*), and his Siphon segment showed multiple stenoses and dilation changes. The right ophthalmic artery was not visualized. The neurosurgeon intraoperatively looked for the right ophthalmic artery opening with a microcatheter, and the microcatheter reached near the Cavernous segment of the right internal carotid artery but after several attempts, could not find the opening of the ophthalmic artery, and due to the chronic occlusion, his right ophthalmic artery could not be opened.

As the patient was found to have frequent premature ventricular beats on electrical monitoring at the operation center, and his postoperative blood pressure fluctuated at 190/90 mmHg, the Cardiology Department was invited to consult. His cardiotocography report was as follows:

Figure 1 Wide-field fundus photography of the patient's right eye. His right eye had a clear optic disc, and his C/D was about 0.3. His retinal arteries were thinned, A:V was about 1:2. He had some retinal pallor and edema in the posterior pole and CRS was observed in the fovea. C/D, cup to disk ratio; A:V, arterial/venous; CRS, cherry red spot.

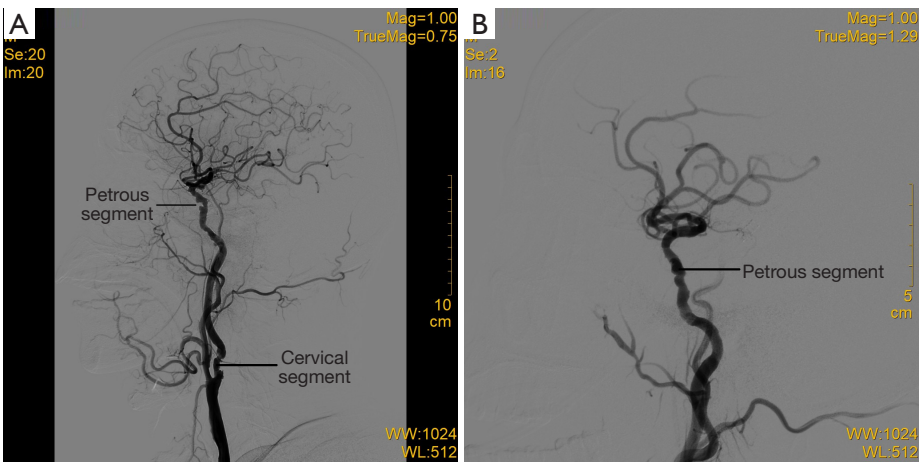

Figure 2 Cerebral angiography of the patient. (A) Multiple stenoses were observed at the end of his left carotid artery, the cervical segment, and Petrous segment of the left internal carotid artery. Severe stenoses were found near the carotid bifurcation, the narrowest of which was >80%. (B) The cervical segment, distal Petrous segment, and Cavernous segment showed multiple stenoses of the right internal carotid artery. M, male; Se, series; Im, image; WW, width; WL, length.

ejection fraction (EF): 68% with ascending aorta reduced elasticity. He also had reduced left ventricular diastolic function and normal systolic function. A 24-h Holter electrocardiogram (ECG) showed frequent multiple premature ventricular contractions (22,645 episodes), 2 of which were present in pairs, and some of which were in bigeminy (17,038 episodes). Partial ST-T in ECG changes were also observed. The consulting doctor suggested that the patient be transferred to the Department of Cardiology to continue treatment, and he continued his eye treatment as before.

The Department of Cardiology was of the view that patient was in a poor condition, and immediately commenced ECG monitoring. The cardiologist decided to perform an elective coronary angiogram after the patient's condition became less stable and to evaluate whether to implant a stent. An intraoperative coronary angiography revealed that the patient had a short left main (LM) coronary artery with an irregular wall throughout the left anterior descending (LAD) artery, calcification in the proximal and mid segments, and 85% segmental stenosis. His left circumflex (LCX) coronary artery was thick with irregular canal wall throughout (*Figure 3A*). The patient was angiographically confirmed to have indications for percutaneous coronary intervention (PCI), and the physician decided to perform PCI with an intervention in the LAD artery. Finally, 2 stents were implanted in the patient's LAD artery.

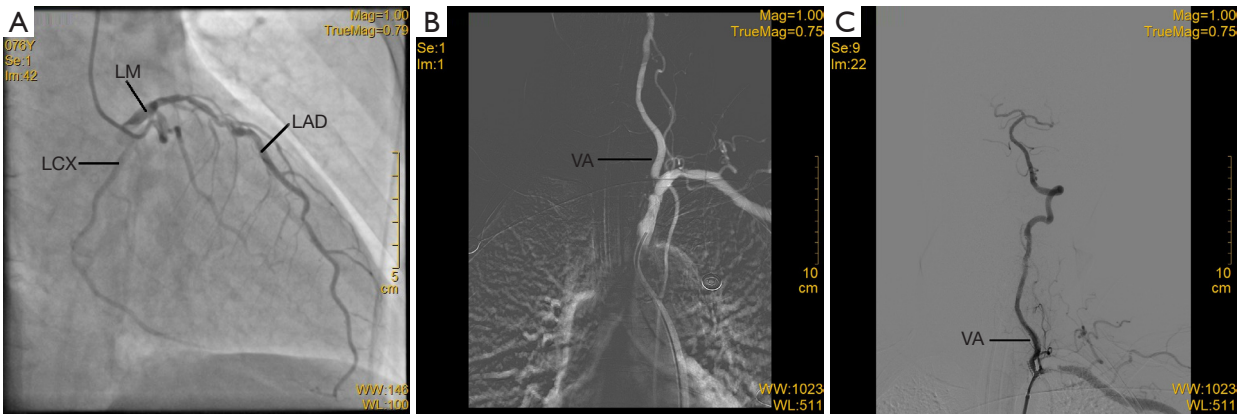

Figure 3 Coronary arteriography and neck angiogram of the patient. (A) His intraoperative coronary angiography: he had a short LM coronary artery an irregular wall throughout the LAD artery, calcification in the proximal and mid segments, and 85% segmental stenosis. His LCX coronary artery was thick with an irregular canal wall throughout. (B) His left VA opening was severely stenotic. (C) After a stent was implanted in the ostium, his left VA was visualized. LCX, left circumflex; LM, left main; LAD, left anterior descending; VA, vertebral artery.

The patient was discharged on postoperative day 3, and his discharge diagnoses were as follows: (I) CRAO in the right eye; (II) coronary atherosclerotic heart disease (frequent premature ventricular contractions, cardiac function I grade); (III) hypertensive disease (grade III, very high risk); (IV) bilateral ophthalmic artery occlusion; (V) severe stenosis of the carotid arteries; (VI) severe stenosis of the bilateral subclavian arteries; and (VII) severe stenosis of the bilateral vertebral artery openings.

In May 2022, the patient was re-admitted to the Department of Neurosurgery of Shenzhen Second People's Hospital to receive an interventional treatment for vertebral artery stenosis. The neurosurgeon implanted a stent for his left vertebral artery.

The patient's intraoperative angiography showed that his left vertebral artery opening was severely stenotic (*Figure 3B*). The neurosurgeon implanted a stent in the ostium of his left vertebral artery, and a postoperative angiography re-examination revealed good stent morphology with patency of flow distal to the left vertebral artery (*Figure 3C*). The patient's postoperative vital signs were stable, and the doctor routinely administered antiplatelet, antihypertensive, and lipid-lowering drugs, which allowed him to be discharged after 3 days. After stent implantation, his headache symptom improved significantly and his right eye vision improved to hand motions/30 cm. And after 3 months, his headache symptom was completely relieved, and his right eye vision improved to hand motions/50 cm. The timeline figure (*Figure 4*) to briefly describe the history, early clinical presentations, laboratory and imaging findings, diagnosis, treatment, progression, and prognosis of this case. He was advised to return for regular ophthalmology, cardiology, and neurosurgery visits. All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Declaration of Helsinki (as revised in 2013). Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the editorial office of this journal.

Discussion

Embolic sources of CRAO can be classified as cardioembolic, carotid, or aortic derived embolic, or other. A single-center study involving 103 patients with CRAO demonstrated that 37% of patients had severe ipsilateral carotid artery disease (3), and the European Academy of Eye Disease Regression Evaluation Group study also demonstrated that 40% of patients with CRAO had carotid artery stenosis ≥70% (4), illustrating that the condition of the neck vasculature is an important factor in the pathogenesis of CRAO. Similarly, regular cardio-cerebrovascular monitoring is beneficial for patients with CRAO. A meta-analysis using a random-effects model suggested that cranial magnetic resonance findings in 30% of acute CRAO and 25% of acute retinal branch artery occlusion patients were suggestive of acute cerebral

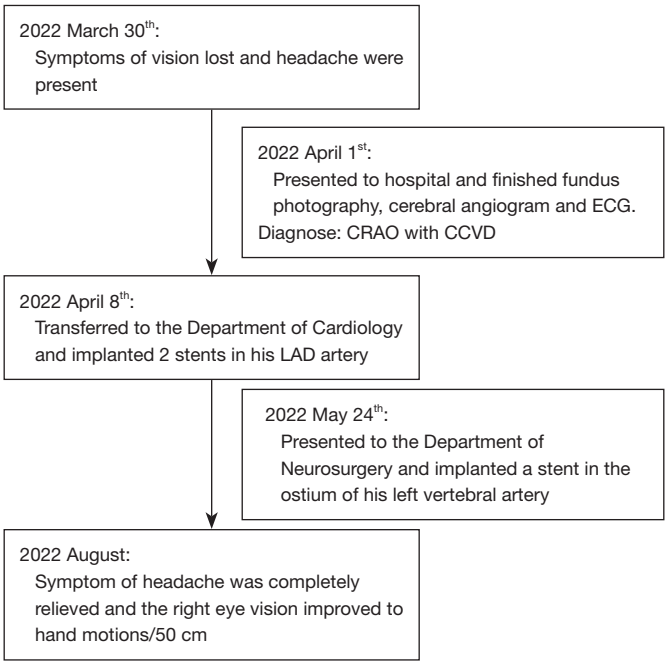

Figure 4 The timeline figure to briefly describe the history, early clinical presentations, laboratory and imaging findings, diagnosis, treatment, progression, and prognosis of this case. ECG, electrocardiogram; CRAO, central retinal artery occlusion; CCVD, cardio-cerebrovascular disease; LAD, left anterior descending.

ischemia (5). Chodnicki *et al.* (6) conducted a region-based population analysis and found that the risk of stroke 15 days before and after a diagnosis of CRAO was 2.2%. Another retrospective observational cohort study reported that the proportion of patients who developed atrial fibrillation within 2 years of the diagnosis of CRAO was 49.6%, which was much higher than that of age-, sex-, and comorbidity-matched controls and comparable to that of patients with ischemic stroke (7), which suggests that patients with CRAO may benefit from long-term cardiac condition monitoring. Thus, regardless of whether CRAO patients are treated in time to receive thrombolysis during the first visit at the ophthalmology department, the factors of CCVD should be considered and screened, and timely multidisciplinary consultations, including cardiology, and neurosurgery consultations, should be performed to prevent misdiagnosis or miss CCVD at the first visit, and thus prevent the occurrence of more serious cardio-cerebrovascular adverse events.

Conclusions

The ophthalmic artery arises from the internal carotid artery, which is the terminal branch of the ophthalmic artery that is the central retinal artery. As the caliber of the central retinal artery is too narrow (160 μm), mechanical embolization cannot be accomplished with existing surgical techniques. Theoretically, thrombolysis of the early thrombus in the central retinal artery via the direct injection of plasminogen activator into the ophthalmic artery for ophthalmic artery thrombolysis has good therapeutic effects (8), and is able to reduce the incidence of intracranial thrombus and the risk of systemic hemorrhage (9). The patient in this case had already missed the optimal thrombolysis time window at presentation and thrombolysis eventually failed. The patient was found to have more severe comorbidities in his cardio-cerebral vasculature by a preoperative examination before thrombolysis, intraoperative cerebral angiograph, and electrocardiographic monitoring. The patient's timely accept intervention after surgery prevented the occurrence of further cardio-cerebral adverse events and improved the quality of his life. In treating CRAO patients, in addition to aggressive eye treatment, the systemic cardio-cerebrovascular situation of each patient should also be assessed, a timely diagnosis made, and effective interventions implemented to reduce morbidity- and mortality-related cardio-cerebrovascular events, protect the patient's visual function, and prolong the

patient's life.

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Footnote

Reporting Checklist: The authors have completed the CARE reporting checklist. Available at https://atm.amegroups.com/article/view/10.21037/atm-22-6453/rc

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://atm.amegroups.com/article/view/10.21037/atm-22-6453/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Declaration of Helsinki (as revised in 2013). Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the editorial office of this journal.

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