Case Report

Taiwan J Ophthalmol 2024;14:137-139

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DOI:
10.4103/tjo.TJO-D-22-00166

Infrared images help to identify retinal emboli in hemodynamic retinal artery occlusion

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Abstract:

To report a case of stroke with internal carotid artery (ICA) occlusion and retinal artery occlusion (RAO) with multiple emboli identified by infrared images. The patient presented with acute blurred vision and slurred speech since woke up in the morning. Carotid Doppler ultrasonography showed severe left ICA stenosis with the decreased flow. Computed tomography angiography demonstrated left ICA critical stenosis with compensatory flows from the right ICA. There was coexistent RAO with multiple emboli, silver-wiring, and segmentation of the retinal artery. More hyperreflective emboli were uncovered by infrared images of spectral-domain optical coherence tomography. Embolism may accompany with the compensatory flow for ICA occlusion. RAO patients should have thorough carotid evaluations, especially those with multiple retinal emboli.

Keywords:

Carotid occlusion, emboli, infrared images, retinal artery occlusion, stroke

Introduction

Retinal artery occlusion (RAO) associated with decreased carotid/cerebral blood flow due to severe ipsilateral carotid artery occlusion is considered hemodynamic RAO.[1] Compensatory flow often happens in response so that most hemodynamic RAOs have no or only minor neurologic deficits.[1] However, multiple retinal emboli are often associated with hemodynamic RAO as they may origin from compensatory flow and act as a specific sign of hemodynamic RAO.[1] Infrared reflectance image of spectral-domain optical coherence tomography (SD-OCT) is helpful to identify these retinal emboli more clearly and definitively than color fundus photography.

Case Report

A 72-year-old male presented at the emergency room with acute blurred vision in his left eye and slurred speech since waked up in the morning. He was fully ambulatory with a history of hypertension. Immediate carotid Doppler ultrasonography showed atherosclerosis and severe stenosis (77%) of the left internal carotid artery (ICA) with high systolic velocity (304 cm/s). There were decreased blood flow (76 cc/min) at the left proximal ICA and increased flow (301 cc/min) at the right ICA. Computed tomography angiography demonstrated critical stenosis at the left ICA with compensatory flows from the right ICA and vertebral arteries [Figure 1]. Under the diagnosis of stroke, he received intense medical care at the neurologic department and became well and stable after 1 month. On ophthalmic consultation, fundus examination showed retinal whitening and emboli, ruling in the diagnosis of coexistent RAO in the left eye. Ocular massage was applied immediately.

A few weeks later, he underwent carotid arteriography but a stent to the left ICA

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Submission: 28-11-2022
Accepted: 12-01-2023
Publsihed: 21-03-2023

How to cite this article: Chen Y, Tung HF, Hwang JF. Infrared images help to identify retinal emboli in hemodynamic retinal artery occlusion. Taiwan J Ophthalmol 2024;14:137-9.

was not indicated because long segmental stenosis from proximal to the distal ICA was found [Figure 2]. After the procedure, decreased muscle power of the right limb and slurred speech were noted again. Magnetic resonance imaging revealed a recurrent stroke.

On ophthalmic examination at 2-month follow-up, his visual acuity was 2/10 in the left eye. Fundus examination revealed diminished retinal whitening. There was silver-wiring and segmentation of the retinal artery with multiple emboli [Figure 3A]. SD-OCT revealed residual high reflectivity of the inner retina but the macula became thinning. Noticeably, more retinal emboli in different sizes and shapes were uncovered by infrared images of SD-OCT [Figure 3B]. Under proper medical treatment, he maintained neurological stable and there was no recurrent stroke attack during the 5-year follow-up.

Discussion and Conclusions

Cases of RAO with multiple retinal emboli are rare but highly associated with ipsilateral carotid artery occlusive disease.[1,2] In case of severe ICA stenosis, nocturnal hypotension below the critical level may trigger hemodynamic changes including decreased ipsilateral ICA flow, responsive compensatory flow from the contralateral ICA, multiple embolism formation, and RAO attack.[3] This explains why stroke and RAO often occurred while waking up in the morning. Embolism may arise from the turbulence of the stenotic artery or accompany with the compensatory flow in response for ICA occlusion.[1,2] During hemodynamic changes, flow direction changes of the compensatory flow and collapse/reopen of collaterals may facilitate debris scaling off the vessel wall and become microemboli in the fundus.[1,2] Most microemboli will migrate, disappear, and cause no harm at all.[4] However, some microemboli may accumulate to be visible on the disc, at the bifurcation, and lead to symptomatic retinal infarctions.[5]

RAO signs including box-carrying, segmentation, and silver-wiring of retinal artery have similar whitish colors that may obscure the presence of emboli and confuse us in color fundus photography [Figure 3A]. Clinically, OCT helps soon to establish the diagnosis of RAO and is useful to verify changes in macular ischemia during the course of the disease.[6] In this case, an infrared image of SD-OCT is helpful to identify retinal emboli that more hyperreflective emboli have been recognized at the bifurcations and macular terminals [Figure 3B]. The difference in size and shape of the embolism is probably the result of aggregation of microemboli which come with compensatory flow through collaterals during hemodynamic changes of ICA occlusion.

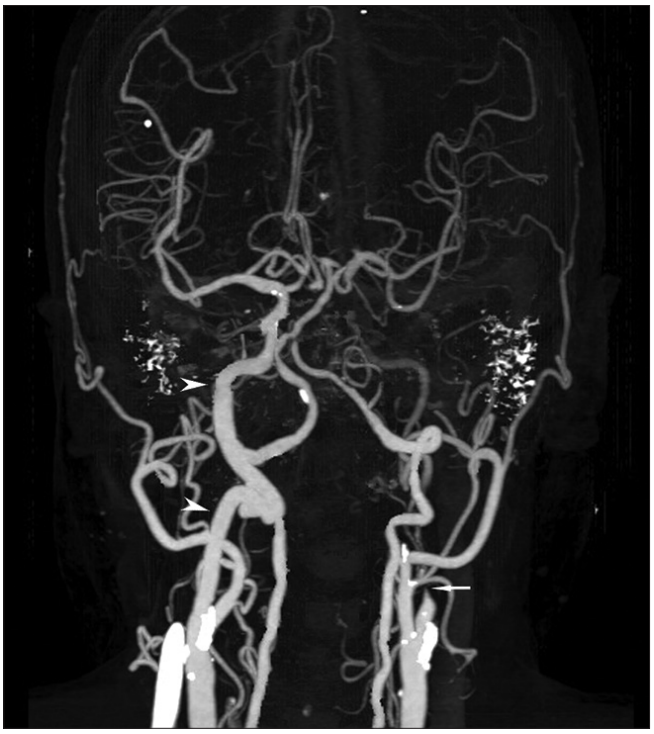

Figure 1: CT angiography demonstrates critical stenosis at left ICA (arrow). There are compensatory flows from right ICA (arrowhead) and bilateral vertebral arteries to maintain an adequate intracranial circulation, but hemodynamic insufficiency is noted in left cerebrum. CT = Computed tomography, ICA = Internal carotid artery

Figure 2: Carotid arteriography reveals long segmental stenosis from proximal ICA (black arrow). ICA = Internal carotid artery

Clinically, infrared imaging modality is used to detect lipid content in coronary plaques.[7] Cholesterol retinal emboli were also reported as more visible on

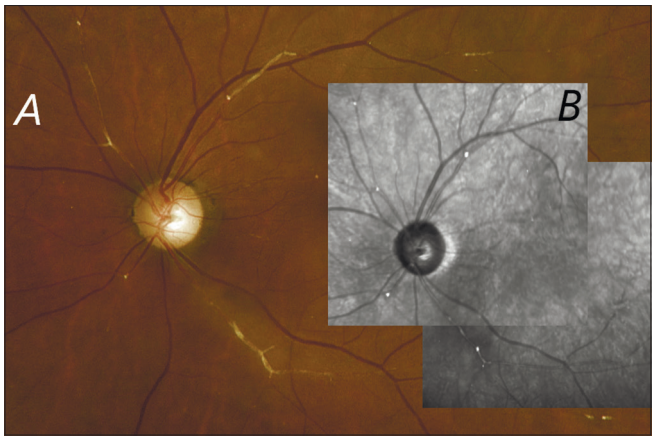

Figure 3: Hemodynamic RAO at 2-month follow-up. (A) Color fundus photography shows diminished macular opacities with multiple retinal emboli. There are coexistent clinical signs of atherosclerosis and RAO, including box-carrying, segmentation, and silver-wire. (B) Composite infrared image of SD-OCT identifies more hyperreflective emboli of different size and shape at the bifurcations and macular terminals. RAO: Retinal artery occlusion. SD-OCT = Spectral-domain optical coherence tomography

infrared imaging and indicated carotid stenosis with atherosclerotic changes.[8] RAO patients should have thorough carotid and cardiac evaluations especially those with the presentation of multiple retinal emboli.

Authorship

All authors attest that they meet the current ICMJE criteria for Authorship.

Declaration of patient consent and Ethical approval

This report does not contain any personal identifying information. The patient consent is waived by CCH IRB (approval number: 170519).

Acknowledgements

We thank Chen-Wei Huang for the color artwork.

Financial support and sponsorship

Nil.

Conflicts of interest

The authors declare that there are no conflicts of interests of this article.

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