Is Management of Central Retinal Artery Occlusion the Next Frontier in Cerebrovascular Diseases?

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Central retinal artery occlusion (CRAO) is a medical emergency that, if not treated, may result in irreversible loss of vision. It continues to be an important cause for acute painless loss of vision. Amaurosis fugax or "transient CRAO" has long been considered an equivalent of transient cerebral ischemic event. Animal models, in addition to data from retrospective and randomized clinical studies, provide valuable insights into the time interval for irreversible retinal ischemia. Subset analyses from 2 large studies of patients with CRAO show benefit from treatment with thrombolysis within 6 hours from symptoms onset. Significant workflow improvements after the intra-arterial therapy trials for acute ischemic stroke have occurred world over in last 5 years.

Patients with CRAO are uniquely suited to receive maximum benefits from the changes in workflow for treatment of patient's acute ischemic stroke. Just as in clinical triage of acute ischemic stroke, correct and timely diagnosis of patients with CRAO may help in preventing visual loss. The approach to acute ocular ischemia should mimic that used for acute brain ischemia. Comprehensive stroke centers would be ideal triage centers for these patients in view of availability of multidisciplinary participation from vascular neurology, neuroendovascular surgery, and ophthalmology.

Time is Retina!

Key Words: Hyperacute stroke—central retinal artery occlusion—intravenous—thrombolysis—intra-arterial therapy

Introduction

The central retinal artery is an end artery that supplies the retina.[1] Occlusion of the central retinal artery (CRAO) with a de-novo thrombus or from an embolus results in ischemia of the retina and hence visual loss. It is considered as an ophthalmic and neurological emergency. It remains an important cause of acute onset visual loss.[1] The visual prognosis of the CRAO is reported to be poor with around two thirds of people having a final visual acuity of 20/400 or worse.[1] "Amaurosis fugax" a Greek/Latin term to denote transient monocular blindness has been suggested as an equivalent to a cerebral transient ischemic attack (TIA).[2-5] Fisher[3] observed fibrin-platelet emboli in the retinal vessels in patients who had amaurosis fugax. Emboli in retinal vessels after carotid angiography or carotid endarterectomy were reported by Hollenhorst.[4] The origin of these plaques and their relationship to carotid disease are well

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reported.[5-7] One study, which followed 80 patients with amaurosis fugax over 6 years, reported that 16% of the patients subsequently developed either monocular blindness or hemiplegia.[8] Most of the trials testing carotid endarterectomy have listed amaurosis fugax or "transient CRAO" as a TIA equivalent and at least 20% of the patients were diagnosed with having "symptomatic" carotid artery disease on this basis.[9-11] Although, carotid artery disease is by far the most common cause for CRAO, the first reported case in literature by von Graefe in 1859 was in a patient with endocarditis.[12] We review the contemporary literature regarding CRAO and outline potential strategies to improve emergency triage and management.

Materials and Methods

For the purpose of making this review – we searched PubMed, Cochrane database with search terms "CRAO", "retinal artery occlusion", "management of central retinal artery occlusion", and "amaurosis fugax". Full articles in English language were reviewed by the authors and references checked for appropriate additional material were included.

Anatomy and Pathogenesis

Anatomy

The central retinal artery (CRA) is the terminal branch of ophthalmic artery, which is the first branch of internal carotid artery.[2,3,13] The surface layer of optic disc is perfused by the CRA after which it divides into superior and inferior branches. The superior and inferior branches further divide into temporal and nasal branches which supply blood to the retina. The outer retina is supplied by the choriocapillaris that branches off the ciliary artery, which also is a branch of the ophthalmic artery. In approximately 20% of people, the cilioretinal artery perfuses the macula and in this circumstance, the macula may be preserved even if the rest of the retina is injured by a CRAO.[13]

The most common cause of CRAO is thromboembolism occluding the central retinal artery when it pierces the dural sheath. At this location, the diameter of the vessel is at its narrowest and hence most vulnerable for occlusion.[13-15]

Pathogenesis

CRAO is clinically divided into four distinct clinical entities:

1) Nonarteritic permanent CRAO:

This is the most common type of CRAO; it occurs in approximately 65% of all patients and causes painless monocular vision loss. Traditionally, the occlusion is considered to be secondary to a fibrin embolus arising from an atherosclerotic plaque most commonly located at the proximal internal carotid artery.[2-4,13,14]

2) Nonarteritic transient CRAO:

This scenario occurs in approximately 15% of patients with CRAO and has the best prognosis. Patients with transient CRAO usually will be asymptomatic at the time of clinical presentation. Based on animal model studies, the cause is considered to be either embolism that breaks up from atherosclerotic plaque of a proximal artery or secondary to transient vasospasm due to serotonin release from platelets on atherosclerotic plaques.[16]

Patients with this condition do have a 1% annual risk of having a subsequent nonarteritic CRAO resulting in permanent visual loss.[17]

3) Nonarteritic CRAO with cilioretinal artery:

In approximately 20% of population the presence of the cilioretinal artery may preserve the perfusion of the macula. The visual loss in this population is unpredictable as the size of the cilioretinal artery and the perfused area are variable.[13] The etiology of the occlusion is similar to nonarteritic CRAO

4) Arteritic CRAO:

Less than 5% of the patients with CRAO have an underlying vasculitis, most commonly due to giant cell arteritis. The clinical presentations are similar to those with the nonarteritic CRAO. While several types of vasculitis can lead to blindness, giant cell arteritis is the most common. Early recognition and prompt treatment with steroids may save vision in these cases.[14-17]

Thus, the majority of patients with CRAO have an embolic event occluding the CRA causing a nonarteritic permanent visual loss. The most common origin of the thrombus is a stenotic proximal internal carotid artery.[2,3]

Because the CRA is a terminal vessel with no collaterals that may forestall the impending ischemia, death of the macula and retina may result.

{Picture of fundus showing CRAO}

1. Nonarteritic– acute changes
2. Complication of CRAO – neovascularization of Iris

Diagnosis of CRAO

The involved physicians should consider CRAO as a stroke of the eye and approach the illness as a medical emergency. Just as time is brain with acute stroke, time also is retina/vision with a CRAO. Just as the specific underlying cause of a stroke is not required to be established prior to