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Indications and outcome of carotid Doppler ultrasound: An ophthalmic perspective

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PURPOSE. *The purpose of this study was to assess indications and outcome of carotid Doppler ultrasound requested by ophthalmologists from an eye hospital over a period of three years.*
METHODS. *This retrospective study was designed to analyse data for all patients referred to have carotid Doppler ultrasound from 1999 to 2001. Colour fundus photograph was used to ascertain diagnosis of ocular condition. Detailed case note analysis was done to correlate patient details, indication, results of carotid Doppler, and status of anti-platelet treatment as well as presence of other risk factors.*
RESULTS. *107 patients were included in the study. 46.7% had normal internal carotid on Doppler while 53.3% patients had stenosis, 22.8% of which were significant. 15 out of 24 patients with retinal artery occlusion had internal carotid artery (ICA) stenosis. 2 out of 6 patients with migraine had significant stenosis. 12 patients had retinal vein occlusion (5 were bilateral), 9 of whom showed ICA stenosis. 14 of 15 patients with retinal emboli had stenosis of ICA. Other diagnoses included anterior ischaemic optic neuropathy, cranial nerve palsy, etc. 42 patients had 1 to 3 risk factors, and 11 patients had more than 3 risk factors. Ophthalmologists started anti-platelet management in 24 patients (42.1%) with some degree of ICA stenosis.*
CONCLUSIONS. *Approximately 55% of our patients referred for carotid Doppler were positive for ICA stenosis with nearly a fifth of such referrals having more than 70% stenosis, which is considered to be clinically significant. Our results highlight the importance of such referrals for carotid Doppler for various ophthalmic conditions by the ophthalmologists.*
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KEY WORDS. *Amaurosis fugax, Carotid Doppler ultrasound, Transient monocular blindness*

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INTRODUCTION

Transient monocular blindness (TMB), also known as amaurosis fugax, accounts for approximately 25% of transient ischaemic attacks involving the anterior cerebral circulation (1). TMB, when caused by ischaemia of the retina, is considered to be evidence of an attack in the vascular territory of the internal carotid artery (ICA) and a risk factor for ischaemic stroke (2, 3). TMB secondary to ICA disease is either from dislodged emboli occluding the retinal artery branches, or from retinal artery spasm caused by the impedance in blood flow, in order to maintain auto-regulation of blood pressure (4). However, TMB could also be caused by other causes such as migraine, optic neuropathy (5), or intrinsic eye disease, where blood

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supply to photoreceptors is compromised in the presence of bright light (6), possibly secondary to vasospasm or retinal claudication (4).

Patients with history of TMB often present to ophthalmologists and undergo carotid Doppler ultrasonography to detect atheroma and turbulence in the ICA. Donders et al (4) analysed several features in patients presenting with TMB to correlate high and low risk groups for the likelihood of severe atherosclerosis of the ICA. Their study was limited to patients with TMB only and was designed to facilitate the clinicians' decision to perform further investigations in those patients. However, in the ophthalmic outpatients, carotid Doppler ultrasonography is carried out often for various other indications including amaurosis fugax or arterial emboli, and the purpose of our study was to assess the outcome of such a practice and also to correlate the results with various ophthalmic conditions diagnosed in such patients.

METHODS

Retrospective case note analysis of data was performed to cover a total period of three years from 1999 to 2001. All the patients referred to have carotid Doppler ultrasound for various ophthalmic indications were consecutively included in the study. Colour fundus photograph was used to diagnose the ocular condition in these patients. Detailed case note analysis was undertaken to correlate patient's details, indications and results of carotid Doppler ultrasonography along with the record of any risk factors including diabetes, hypertension, hypercholesterolemia, smoking, as well as any history of cerebrovascular accident, ischaemic heart disease, deep vein thrombosis and pulmonary embolism. It was also noted if the patient was on any anti-platelet treatment prior to the ophthalmic consultation, or was started on such a treatment by the ophthalmologists. As per our practice, fundus fluorescein angiography was performed only in patients with macular oedema initiated by vascular compromise. Neurology opinion and investigations such as CT scan and MRI were arranged in limited patients in whom a neurological lesion was suspected clinically. The patients who had detectable carotid artery stenosis were referred to the vascular surgeons; the details of their management are beyond the scope of this study.

RESULTS

One hundred and seven patients were included in the study. Mean age was 78 years (range: 45-92 years). 70 (65.4%) of those included were males. 50 (46.7%) patients had normal ICA on carotid Doppler ultrasound testing. Out of the remaining 57 (53.3%) patients having carotid artery atheroma, 44 (77.2%) had 1-69% stenosis, 11 (19.3%) had 70-99% internal carotid artery stenosis, and 2 (3.5%) patients had 100% stenosis (Fig. 1).

Of the 24 patients who were diagnosed to have retinal artery occlusion, 15 patients had demonstrable ICA stenosis on carotid Doppler, 2 of them being significant (Tab. I). 12 patients had retinal vein occlusions with 5 of them having had bilateral vein occlusions. Of these, 9 patients were reported to have stenosis in the ICA, and 4 of those patients had bilateral retinal vein occlusions. None of those patients had significant stenosis of the ICA. Additionally, the contralateral ICA in those 9 patients showed to have insignificant stenosis. Unfortunately, based on the clinical records, it was not possible to comment on whether the vein occlusions were ischaemic or non-ischaemic.

Of the 38 patients who were clinically diagnosed to have TMB, 24 patients (63.2%) had ICA stenosis. 15 of those 38 patients had retinal emboli on clinical examination. 14 of those 15 patients with symptomatic retinal emboli were detected to have different degrees of stenosis on carotid Doppler ultrasound (Tab. I). Of the 6 patients with the clinical diagnosis

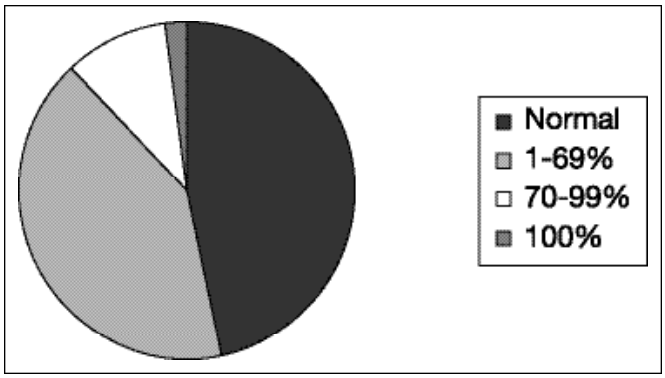

Fig. 1 - *Doppler findings. Pie diagram illustrating the final outcome of all the patients referred for carotid Doppler ultrasonography, including the percentage of ICA obstruction.*

TABLE I - COMPARISON OF FINDINGS BETWEEN INSIGNIFICANT AND SIGNIFICANT CAROTID ARTERY STENOSIS

Factors	Insignificant stenosis n = 44	Significant stenosis n = 13
Age range in years	45 - 92	60 - 81
Male : Female	2 : 1	10 : 3
Risk factors > 3	10	1
Anti-platelet therapy	27	12
Artery occlusion	13	2
Vein occlusion	9	0
Emboli	9	5
Migraine	0	2
Amaurosis fugax	6	4

of migraine, 2 were noted to have significant stenosis on carotid Doppler testing. The remaining 27 patients who had the carotid Doppler test, had been diagnosed to have various other conditions such as isolated cranial nerve palsies, anterior ischaemic optic neuropathy, and advanced primary open angle glaucoma. 7 of them had evidence of ICA stenosis, none of them being significant.

One to 3 risk factors were found to be present in 31 patients (n=44) with insignificant ICA stenosis, while 11 patients (n=13) with significant stenosis (70% or more) had 1-3 risk factors. 10 patients with non-significant ICA stenosis had more than 3 risk factors, while only 1 patient with significant ICA stenosis had more than 3 risk factors.

Eighty-five (79.43%) patients included in the study were on aspirin and other anti-platelet agents to reduce the risk of stroke. Ophthalmologists initiated such treatment measures in 32 (29.9%) patients presenting with amaurosis fugax, retinal emboli, arterial or vein occlusions during the outpatients visit. 38 patients out of the group with normal ICA findings (n=50) were already on some anti-platelet therapy, prior to the ophthalmic consultation while 8 others in that group were advised such prophylaxis by the ophthalmologists, based on risk factors. Of all the 57 patients with some degree of ICA stenosis, 24 patients were prescribed anti-platelet therapy by the ophthalmologists. Anti-platelet therapy was initiated only when clinically a thromboembolic phenomenon was suspected as the cause for visual symptoms or based on risk factors.

DISCUSSION

Nguyen et al (7) reported no difference in the prognosis among patients with ICA stenosis due to TMB or hemispheric transient ischaemic attack while Benavente et al (1) noted better prognosis for those presenting with TMB. Both the North American Symptomatic Carotid Endarterectomy Trial Collaborations (1) and the European Carotid Surgery Trialists' Collaborative Group (8) recommend possible beneficial effects with carotid endarterectomy in those presenting with TMB and significant ICA stenosis when other risk factors for stroke were present. Such observations indicate a vital role for the ophthalmologists since they are often the first point of contact for those patients presenting with TMB. Approximately 55% of our patients referred for carotid Doppler were positive for ICA stenosis of varying degree with nearly a fifth of such referrals having more than 70% stenosis, which is considered to be clinically significant. Our results highlight the importance of such referrals for carotid Doppler for TMB from the ophthalmologists.

Gaul et al (9) performed non-invasive carotid artery testing on 500 symptomatic patients and reported 77.2% of them to have an abnormal study. Significant lesions were noted in 16% of such cases. In our study, 53.3% of the 107 patients had an abnormal study with 12.2% of them having hemodynamically significant ICA stenosis. In Gaul et al series (9), 79% of those patients who had definite ocular symptoms like amaurosis fugax had carotid stenosis on carotid Doppler.

In our review, out of 38 patients, 24 (63.2%) had detectable carotid plaque. Similar to our study, Donders et al (4) reported nearly 53% of their patients with TMB to have an abnormal carotid Doppler study. However, their study reported only 10% of their patients with ICA stenosis to have 1-69% stenosis while our report noted a 41% incidence of 1-69% ICA stenosis among the study group. Donders et al (4) speculated vasospasm as the cause of TMB to explain their rather large proportion of patients with TMB and a normal ipsilateral ICA. The significant association of previous migraine attacks supported their speculation with the absence of atherosclerotic lesions in their patients. In our series, we had only 6 patients with migraine in our study group, 2 of whom had significant ICA stenosis while the others had normal ICA study. Our findings, though limited by numbers, did not entirely support such a hypothesis.

Schmidt et al (10) noted none of their 61 patients with retinal vein occlusions to have any degree of ICA obstruction. Similarly, Rauh et al (11) demonstrated no association between atherosclerosis of large arteries and central retinal vein occlusions based on carotid artery duplex scanning and echocardiography. Our findings of 9 out of 12 patients with vein occlusions having any degree of carotid stenosis did not confirm the same. 4 of our 5 patients with bilateral vein occlusions had ICA obstruction on carotid Doppler ultrasonography. Details regarding ischaemic or non-ischaemic nature of our cohort of patients with vein occlusions might have been more useful. Perhaps, this illustrates a need to conduct a large-scale prospective study on the association between retinal vein occlusions, especially bilateral vein occlusions, and atherosclerosis of the large arteries with detailed correlation of associated risk factors.

Retinal arterial emboli can be found in approximately 1% of adults more than 40 years of age (12). Literature is sparse regarding the epidemiology of retinal embolus, its relation to cardiovascular disease risk factors and stroke, and the value of an extensive systemic evaluation (13). Few studies (14, 15) have documented prospective associations between retinal emboli and stroke risk and stroke mortality. Bruno's case-control study (16) revealed significantly increased association between retinal emboli and risk factors such as hypertension and smoking. In our study, 14 of the 15 patients with symptomatic retinal emboli were found to have ICA stenosis, with 26.7% of them being significant. Whether such carotid ultrasound and other vascular imaging should be done routinely for all asymptomatic and minimally symptomatic patients with retinal emboli remains uncertain due to lack of prospective data. It seems appropriate to recommend all ophthalmologists to initiate a complete medical assessment in such patients, for risk stratification, particularly for modifiable risk factors such as hypertension, dyslipidaemia, diabetes, smoking, etc.

Ophthalmologists are often in a position to initiate elaborate clinical assessment of patients presenting with TMB based on carotid Doppler ultrasonography and to note various modifiable risk factors. Besides playing such a pivotal role in the management of this group of patients with TMB, they are also able to initiate anti-platelet therapy as seen in our series, though it might be argued if patients presenting with TMB and normal ICA findings should be started on such treatment.

Our series with its limited numbers illustrates the important role of ophthalmologists in the management of patients with TMB. Our retrospective study also highlights the definite need for a large scale prospective study from an ophthalmic perspective to answer some of the queries regarding presence or absence of associations between certain ophthalmic conditions such as vein occlusions, migraine, etc and ICA stenosis.

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