Ischaemic optic neuropathy: the Singapore scene

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ABSTRACT

The commonest cause of an optic neuropathy in Singapore is ischaemia, and ischaemic optic neuropathy (ION) is one of the commonest causes of permanent loss of vision in elderly patients, especially in those with diabetes mellitus, hypertension and hyperlipidaemia. ION in our practice is almost invariably of the anterior variety and non-arteritic in origin, i.e. NA-AION. Posterior ION comprises less than two percent of our cases. Three patients with different patterns of NA-AION are described, and in the discussion, how the condition can be distinguished clinically from optic neuritis. With respect to posterior ION, the necessity of excluding a compressive cause before this diagnosis can be made is emphasised.

Keywords: anterior ischaemic optic neuropathy, Goldmann perimetry, ischaemic optic neuropathy, optic disc swelling, visual field defect

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INTRODUCTION

In a survey of 902 new patients attending our neuro-ophthalmology clinics over an 18-month period between 2002 and 2004, there were 200 patients with optic neuropathies. Of these, the commonest underlying causes were ischaemia (38%), followed by optic neuritis (34%), and compressive lesions (23%). Ischaemic optic neuropathy (ION) is almost invariably anterior ION (AION), involving the ophthalmoscopically-visible optic nerve head with optic disc swelling. It is associated with diabetes mellitus, hypertension and hyperlipidaemia. The condition is classified as (a) non-arteritic, designated AION (NA-AION [best] or NAION), and (b) arteritic, designated AION (AAION), and caused by giant cell or temporal arteritis (GCA). Rarely, other vasculitides, such as systemic lupus erythematosus and Takayasu's disease, may also cause ION.[1] As already reported in this journal, GCA is extremely uncommon in Singapore and no further proven case has been seen by us since 2003.[2] Posterior ischaemic optic neuropathy (PION) is a rare condition, even in Caucasians, and is only diagnosed by exclusion of other causes, especially a compressive lesion. Reported cases have nearly all been associated with proven GCA i.e. arteritic cases (APION), but non-arteritic cases (NAPION) have also been reported.[3]

METHODS AND RESULTS

During the 18-month period mentioned in the introduction, we carried out a survey of all cases attending the reorganised neuro-ophthalmology clinics at the Singapore National Eye Centre (SNEC) and in the other three main Singapore hospitals. A total of 1,506 patients were examined.[4] The two most common single conditions encountered were, in almost equal numbers, a sixth nerve palsy and ION. It was soon apparent to us that the clinical picture and other aspects of ION were quite different to that encountered in the Western world and to that described in the common ophthalmic textbooks, so we felt it was important to bring these facts to the attention of not only ophthalmologists but also physicians, general practitioners and others who are likely to encounter patients presenting with this condition in Southeast Asia. For example, because we are dealing with a known ischaemic pathological process in the optic nerve, a pale or atrophic disc might logically be expected to be present. However, this is not always the case. We have found here that many ION patients were misdiagnosed as optic neuritis, papilloedema or other rarer optic disc abnormalities, resulting in their inappropriate management. In order to emphasise these points, three case histories with individual comments are first given below and all aspects of ION are dealt with in the subsequent discussion.

CASE 1

A 56-year-old Singaporean Chinese woman presented with "blurred" left vision of one week duration. She was hypertensive and was being treated medically. Visual acuity was reduced to 6/45 and on examination, she had a left relative afferent pupillary defect (RAPD). A left infero-nasal visual field defect on confrontation testing was confirmed with Goldmann perimetry (Fig. 1a). Only nine of 15 Ishihara plates were read, compared to normal colour vision in the right eye. The left optic disc

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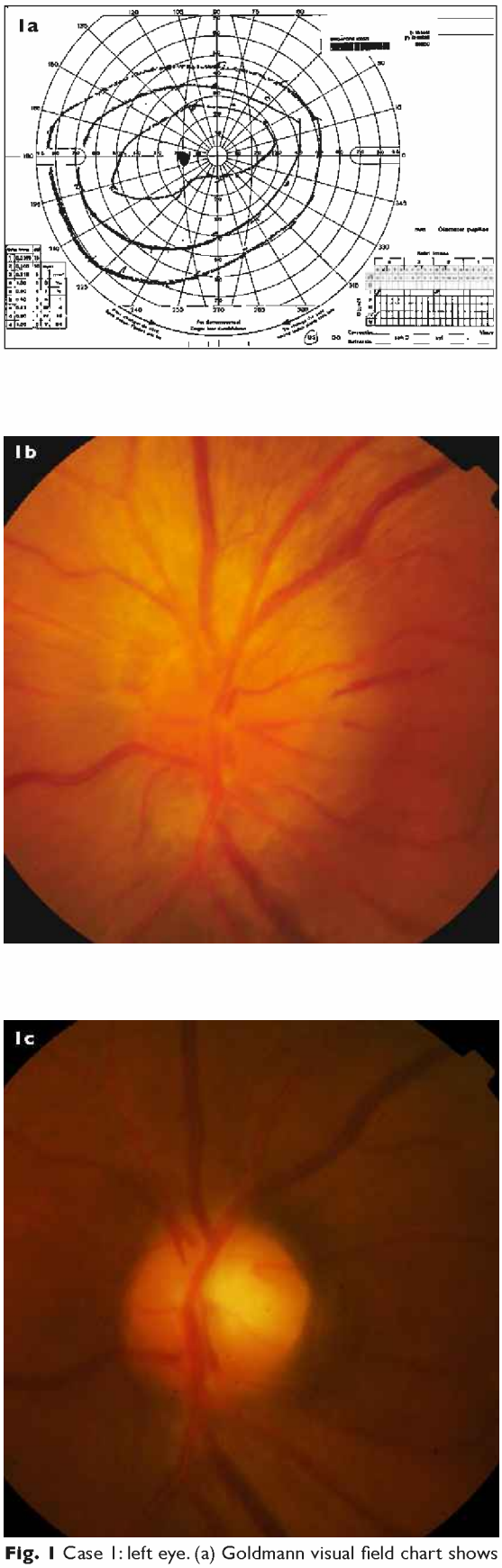


Fig. 1 Case 1: left eye. (a) Goldmann visual field chart shows an infero-nasal defect. (b) Photograph taken one week from the onset of symptoms shows a hyperaemic swollen optic disc with splinter haemorrhage at the temporal margin. (c) Photograph of the optic disc taken at six weeks from onset shows resolution of swelling with pallor developing.

was swollen and distinctly hyperaemic (Fig. 1b). The right eye appeared unremarkable. Blood pressure (BP) was 166/90 mmHg, and the erythrocyte sedimentation rate (ESR) was 22 mm/hr. At follow-up six weeks later, the left optic disc had developed superior pallor with resolving oedema (Fig. 1c). At three months follow-up, there was complete resolution of the disc swelling with definite superior pallor.

Comment: This is a straightforward example of a patient with NA-AION having one risk factor and the commonest visual field defect found in this condition involving the infero-nasal area. It should be noted that the optic disc was hyperaemic and swollen at the outset. It was not pale and still showed some swelling, but only developed pallor six weeks later.

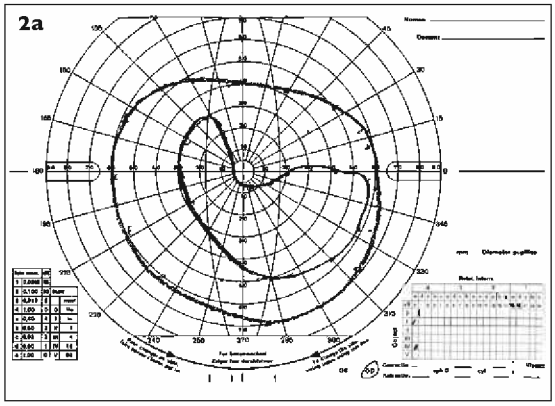
CASE 2

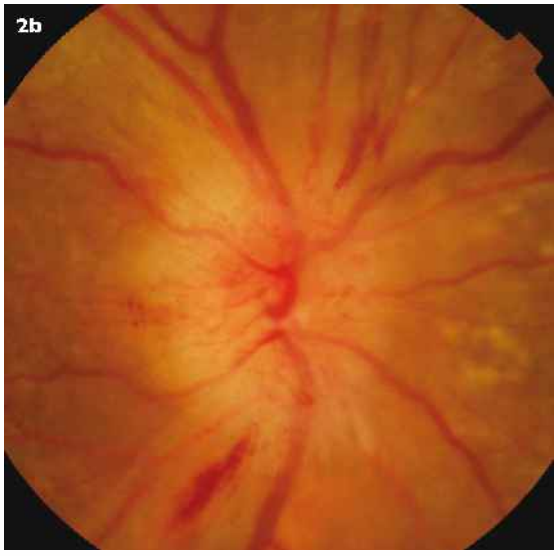
A 71-year-old Chinese woman was referred one month following right uncomplicated phacoemulsification cataract surgery with a complaint of sudden loss of vision in the operated eye one week previously. She had no prior known vascular risk factors. On examination, visual acuity was count fingers at 1 m in the right eye and 6/9 in the left eye. A right RAPD was present and confrontation visual field examination revealed a superior defect. On Goldmann perimetry, there was a central and superior temporal defect (Fig. 2a). The optic disc was swollen and hyperaemic, with a few haemorrhages at its upper and lower poles (Fig. 2b). BP was 154/84 mmHg, blood glucose 5.4 mmol/L and the ESR 32 mm/hr, with otherwise normal blood investigation. Plasma homocysteine was also normal. When seen again one month later (five weeks from the onset of symptoms), the disc swelling was subsiding with early pallor (Fig. 2c), and visual acuity had improved to 6/60. On final review at six months, diffuse disc pallor was present with other findings unchanged.

Comment: Many cases of NA-AION have been reported occurring usually one to two months following cataract surgery, with the unresolved question of whether there is a direct relation between these events.[5] Again in this patient, the optic disc was hyperaemic when seen one week from the onset, and it was still swollen one month later only, then became pale. The absence of any vascular or other disease, and the relatively early onset of the event following cataract surgery supports the suspicion that the development of NA-AION may be a risk in elderly patients following a cataract operation.

CASE 3

A 64-year-old Indonesian Chinese woman presented complaining of painless blurred vision in the right eye, especially in the supero-nasal area. This had





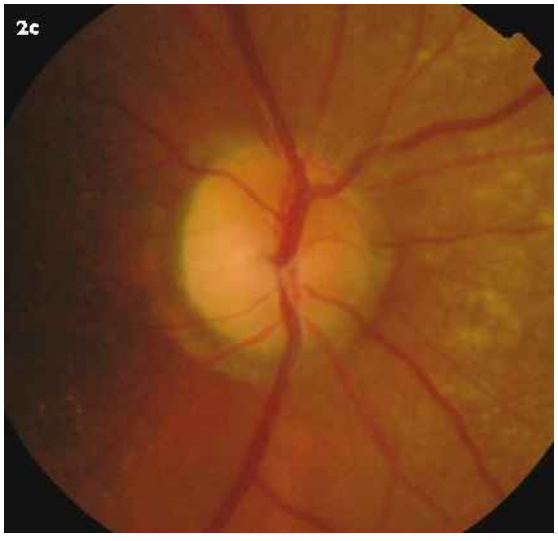


Fig. 2 Case 2: right eye. (a) Goldmann visual field chart shows a supero-temporal defect with fixation involvement. (b) Photograph taken one week from the onset of symptoms shows a hyperaemic swollen optic disc with haemorrhages at the superior and inferior disc margins. (c) Photograph taken five weeks from onset shows that the optic disc is now pale, especially temporally, with swelling resolved.

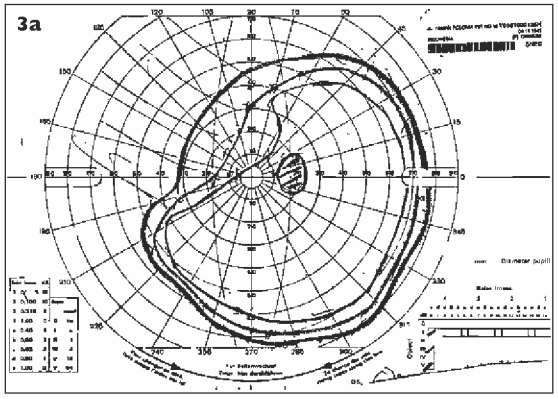
occurred rapidly during the course of a day, two weeks prior to presentation, and had remained unchanged. She had no known medical history. However, her BP was found to be 179/88 mmHg in the clinic. On examination, her visual acuity was 6/6 in both eyes and colour vision was normal. On confrontation testing, there was a right supero-nasal visual field defect, confirmed on Goldmann perimetry (Fig. 3a). There was a right RAPD and the optic disc appeared hyperaemic and swollen (Fig. 3b). Infero-temporally, a small splinter haemorrhage was also present at the disc margin. Full blood count, homocysteine and lipid levels were normal, and the ESR was 7 mm/hr. A provisional diagnosis of NA-AION was made.

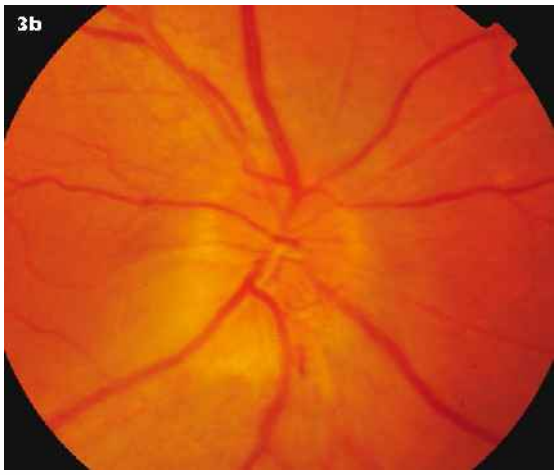
On review three weeks later, she complained of worsening of vision and the right visual acuity was now reduced to 6/12. Colour vision in the right eye was down to 13/15 on the Ishihara plates but was still 15/15 with the left eye. The optic disc swelling had increased in extent and was present diffusely with further haemorrhages (Fig. 3c). Goldmann visual field testing revealed a new infero-nasal defect, in addition to the existing supero-nasal loss (Fig. 3d). In order to exclude the possibility of a compressive optic nerve lesion, computed tomography of the anterior visual pathway was done and this was normal. Seven weeks from the onset of symptoms, she complained of further increased visual field constriction, and Goldmann visual fields confirmed loss of the right nasal visual field. The right visual acuity remained at 6/12 and there was a right RAPD. 13 out of 15 Ishihara plates were read, the right optic disc was still swollen but now became pale. A repeat BP measurement was 137/81 mmHg. As is frequently the case with overseas patients coming to our clinic, a further follow-up appointment was not kept.

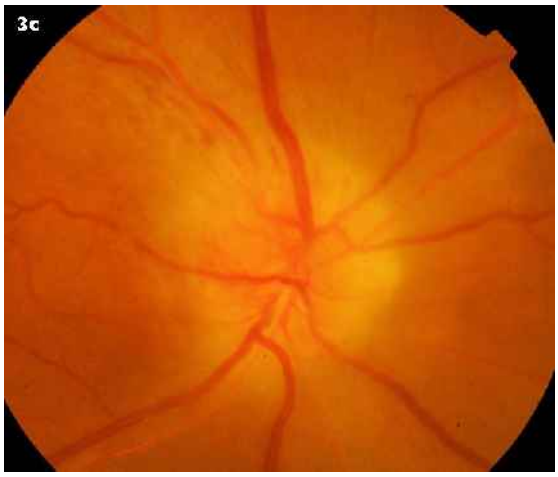
Comment: Progressive loss of vision and/or of the visual field is uncommon in NA-AION. In this patient, a provisional diagnosis was made from the appearance of the optic disc, the visual field findings and the presence of hypertension. In these circumstances, neuroimaging was required in order to exclude a compressive optic neuropathy.

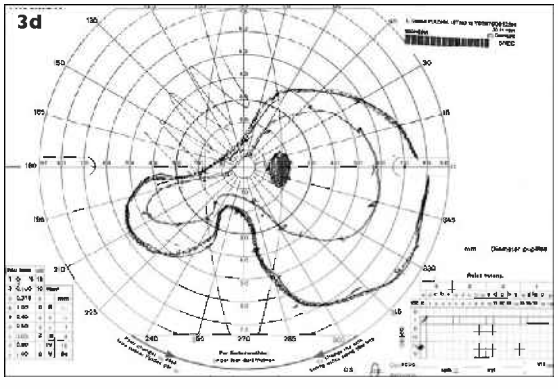
DISCUSSION

The observations and comments in this discussion are based mainly on the senior author's experience over the past six years in the SNEC as a senior consultant neuro-ophthalmologist following more than 30 years in a similar post in Edinburgh, Scotland. As already mentioned, we find many patients with NA-AION referred here, particularly from neighbouring countries, have been misdiagnosed, and subjected to unnecessary investigations and incorrectly treated.









NA-AION presents with visual loss that is often noted on awakening in the morning and sometimes associated with periocular discomfort not worsened with eye movement. Visual loss is usually stable, commonly with a lower altitudinal field defect. Central vision is often normal and colour vision is intact in the non-affected area of the visual field. Rarely, deterioration of visual acuity occurs and less often, progression of the field defect.[6] The optic disc swelling is similar to that in anterior optic neuritis, also hyperaemic at the outset, and generally beginning to subside in two to three weeks. Within six weeks, the characteristic disc atrophy ensues, along with sheathing of the vessels on and around the disc in some cases. In diabetic patients with NA-AION however, the hyperaemic disc swelling may persist for as long as six weeks. NA-AION is therefore not uncommonly mistaken for anterior optic neuritis, and in diabetics for diabetic papillopathy or even proliferative retinopathy.[7] The condition usually occurs in patients who exhibit a "disc at risk", that is, one with a small or no physiological cup and the appearance of a small crowded nerve head. Thus, examination of the fellow eye which will have a similar type of optic disc often facilitates the diagnosis.

Neuroimaging is not required to confirm the diagnosis of AION nor indeed of optic neuritis in patients with a typical history and clinical findings. In both conditions however, except in the event of bilateral involvement, an unequivocal RAPD must be present in order to make the diagnosis. Differentiation of non-arteritic ION from optic neuritis (ON) is not difficult, and contrary to the standard description of the latter indicating that two-thirds of cases are retrobulbar (RBN),[1] 60% of the patients that we see have an anterior type of ON with hyperaemic disc swelling.[8] Pain, especially on eye movement, is a characteristic presenting symptom and initially, there is progressive loss of central vision often spreading to the periphery, and acuity may drop even to no light perception. There is an early disproportionate reduction in colour vision and spontaneous recovery is to be expected.

Fig. 3 Case 3: right eye. (a) Goldmann visual field chart at two weeks from onset shows a supero-nasal defect. (b) Photograph taken at two weeks from onset shows that the optic disc is hyperaemic with localised, mainly infero-temporal, swelling. (c) Photograph taken at five weeks from onset shows that the optic disc is diffusely swollen and still hyperaemic. (d) Goldmann visual field chart at seven weeks shows increased super- and infero-nasal field loss. Optic disc was now becoming pale.

Table I. List of features for differentiating anterior ischaemic optic neuropathy, posterior ischaemic optic neuropathy and optic neuritis.

	Anterior ischaemic optic neuropathy	Posterior ischaemic optic neuropathy	Optic neuritis
Symptoms	Sudden loss of vision, often on awakening.	Sudden loss of vision, often on awakening.	Rapid loss of vision over several days to one week.
Visual acuity	Can be good if central field maintained.	Can be good if central field maintained.	Good to no perception of light.
Colour vision	Normal in unaffected field.	Normal in unaffected field.	Disproportionate loss of colour vision.
Pupils	Relative afferent pupil defect.	Relative afferent pupil defect.	Relative afferent pupil defect.
Visual field loss	Most commonly inferonasal loss, or altitudinal defects, but other patterns possible.	More commonly central scotoma seen.	Central field loss relatively common, nerve fibre bundle defects also possible.
Optic disc appearance	Hyperaemic disc swelling in early phases, pallor developing 3–6 weeks after onset. However arteritic AION usually causes chalky white disc infarction from onset.	Disc appears normal at onset. Pallor develops about 6 weeks after onset.	Hyperaemic disc swelling in early phases, pallor developing from about 6 weeks after onset.

In the early descriptions of NA-AION, patients may not have been observed at the outset and because an ischaemic pathology was being considered, pale disc oedema was described as the presenting feature. However, by the time such patients were examined, the initially hyperaemic disc swelling may have resolved.[9] Miller and Newman state that the disc may be "hyperaemic or pale"[1] and Kanski in the latest edition of his classical textbook writes that "the disc is pale".[10]

The pathological process in NA-AION is loss of perfusion affecting the ciliary circulation to the optic nerve head, causing axonal swelling leading to capillary dilatation and fluid leakage. When the axons die some weeks later, pallor becomes evident leading to optic atrophy. This is in contrast to the situation in AAION which is caused by inflammatory occlusion of the posterior ciliary circulation supplying the optic nerve head and the retrolaminar part. It is always associated with a pale "milky-white" swollen and infarcted disc from the outset.[8] Again, the swelling resolves in about six weeks when optic atrophy sometimes associated with disc cupping is present. This disc cupping is never seen with NA-AION and may be mistaken for glaucoma in the arteritic patient.[1]

NA-AION is not a treatable condition and patients should not be given corticosteroids. However, careful investigation for an underlying cause and risk factors must be pursued and these treated. The incidence of sequential involvement of the second eye has been reported to be 14.7% over five years where an underlying cause is not controlled.[11] Recovery in cases of NA-AION is not to be expected, and these patients often end up with an inferior altitudinal or infero-nasal visual field defect.[12] The vexed question of whether there is a connection between cataract surgery and the risk of developing NA-AION is raised in the comments on the second case reported above, but as yet there is no final agreement regarding a possible connection.[5,13]

PION presents a much more difficult diagnostic problem but this is made easier in Singapore because the arteritic variety has never been reported here. Therefore, we need only consider the possibility of NAPION in the differential diagnosis of a retrobulbar optic neuropathy. PION also presents with acute visual loss, with acuity ranging anywhere from no light perception to normal or near normal, but there will always be some visual field defect. The disc is normal, as in RBN, and a RAPD may be the only clinical feature pointing to this diagnosis, but the disc will become atrophic in about six weeks. Visual field findings vary, but generally a central or centro-caecal scotoma with a general constriction of the peripheral field is found at presentation.[14] The presence of vascular risk factors and the age of the patient as in NA-AION is also significant. The differences between AION, PION, and ON are illustrated in Table I.

Neuroimaging, however, is mandatory before a compressive lesion can be excluded and PION diagnosed with any degree of confidence. Because of the different vascular arrangement in the posterior optic nerve as compared to the optic nerve head, a central scotoma is the most common visual field defect encountered in late PION.[14] Again, in contrast to the situation with RBN, recovery is not to be expected. It should be emphasised that recording the full extent of the visual fields out to the periphery is required in all ION patients. These fields are best charted with the Goldmann manual projection or similar perimeter as used in the cases reported above. This is the only

method by which, for instance, an inferior paracentral scotoma often seen in ON can be differentiated from the inferior altitudinal defect characteristic of NA-AION.[12]

In summary, NA-AION is one of the commonest causes of acute permanent visual loss in the elderly population in Singapore. Because the condition itself is untreatable, a search for underlying risk factors is required and treatment of these may prevent second eye involvement. It is not generally appreciated that the disc is initially hyperaemic and may remain so for up to six weeks before pallor develops. This hyperaemic disc can be mistaken for ON or papilloedema, and patients are inappropriately treated as a result. Neuroimaging is not required in order to make a diagnosis of NA-AION. NAPION is rarely seen in Singapore but before making this diagnosis, neuroimaging is mandatory in order to exclude a compressive cause.

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