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CASE REPORT

Binasal Hemianopia Due to Bilateral Internal Carotid Arteries Dolichoectasia: A Case Report and Literature Review

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ABSTRACT

Binasal hemianopia is rare. It is more commonly associated with ocular diseases than intracranial pathologies. Nevertheless, the proximity of internal carotid arteries (ICA) to the visual pathway may cause a variety of neurologic effects which may lead to visual loss. Although visual loss is uncommon, ICA aneurysm may compress the optic nerve causing visual field defect and reduced visual acuity. We report a 66-year-old male presented with asymptomatic binasal hemianopia detected during routine glaucoma screening. Computed tomography (CT) and magnetic resonance imaging (MRI) of the brain and orbit showed dolichoectasia in the cavernous segment of both ICA, which compressed the pre-chiasmatic optic nerve bilaterally. Humphrey's visual field test confirmed the diagnostic of binasal hemianopia respecting the vertical midline. This was the first reported case of binasal hemianopia without visual disturbances. This case highlights the importance of using CT and MRI as additional diagnostic tools to identify the true cause of binasal hemianopia (ICA dolichoectasia) in patients with glaucoma. A thorough assessment of any visual field defect helps to detect life-threatening intracranial pathologies effectively and is managed accordingly.

INTRODUCTION

Binasal hemianopia is a rare visual field defect with only a few reported cases (Hamann et al., 2015). Ocular and intracranial causes for binasal hemianopia have been reported with the ocular causes contributing a more substantial portion than the intracranial origin (Ashwin & Quinlan, 2006; Hamann et al., 2015). Documented reports of binasal visual field defects from the intracranial vascular disease are even rarer (Ashwin & Quinlan, 2006; Hamann et al., 2015; Salinas-Garcia & Smith, 1978). Despite its lower incidence, binasal hemianopia due to intracranial causes poses a more life and sight-threatening condition such as a cerebral aneurysm. The current report presents a complex case of asymptomatic binasal hemianopia which was discovered by confrontational visual field testing during glaucoma screening.

CASE PRESENTATION

A 66-year-old man, a high myope was detected to have mildly elevated intraocular pressure during a routine glaucoma screening. He was also found to have binasal visual field defect by confrontation visual field testing. He was then referred to our ophthalmology centre for further management. He denied any visual symptoms. Apart from high myopia, he was also pseudophakic following cataract surgery a few years prior. There was no family history of glaucoma. His systemic comorbidities include hypertension, hyperlipidaemia, and hypothyroidism.

Ocular examination showed his best corrected visual acuity was 6/7.5 in the right eye and 6/6 in the left eye. Pupillary reactions were normal. Intraocular pressures were 23 mm Hg and 24 mm Hg in the right and left eye respectively. Fundus examination showed bilateral tilted optic discs with prominent peripapillary atrophy. The right optic disc was diffusely pale. There was no obvious glaucomatous cupping (Figure 1).

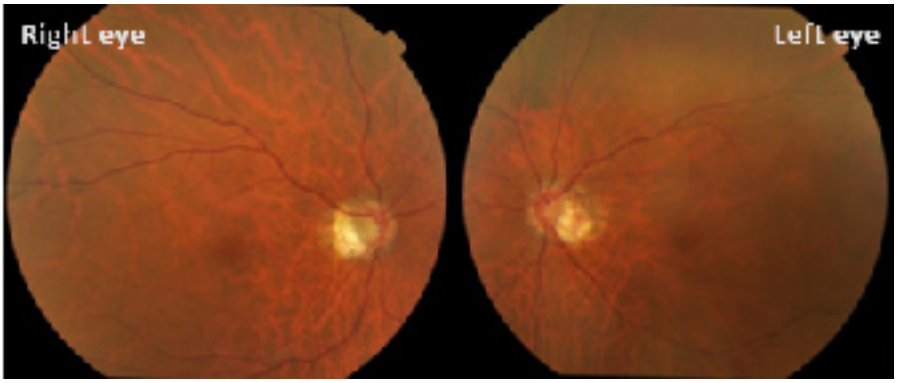

Figure 1 Fundus photographs showed a cup/ disc ratio of 0.7 (right eye) and 0.6 (left eye) with a bilateral tilted, mild pallor optic disc with thinning of the right inferotemporal rim

Humphrey visual field (24-2) test confirmed the binasal hemianopia respecting the vertical midline (Figure 2). Spectral-domain optical coherence tomography (OCT) scan showed the thinning of the retinal nerve fibre layer of the right eye, as compared to the left eye (Figure 3). Computed tomography (CT) scan of the brain and orbit revealed dolichoectasia of the supraclinoid portion of both internal carotid arteries with atherosclerotic calcifications closely related to the intracranial segments of both optic nerves. Magnetic resonance imaging (MRI) of the brain and orbit showed dolichoectasia

of the cavernous segment of both internal carotid arteries compressing onto the pre-chiasmatic optic nerve bilaterally (Figure 4 and Figure 5). He was counselled for microvascular decompression of both optic nerves. However, the patient opted for conservative management and was placed on regular neurosurgery follow-up. He was counselled on the risk of aneurysmal haemorrhage, its complications, and the potential sequelae of stroke and vision loss.

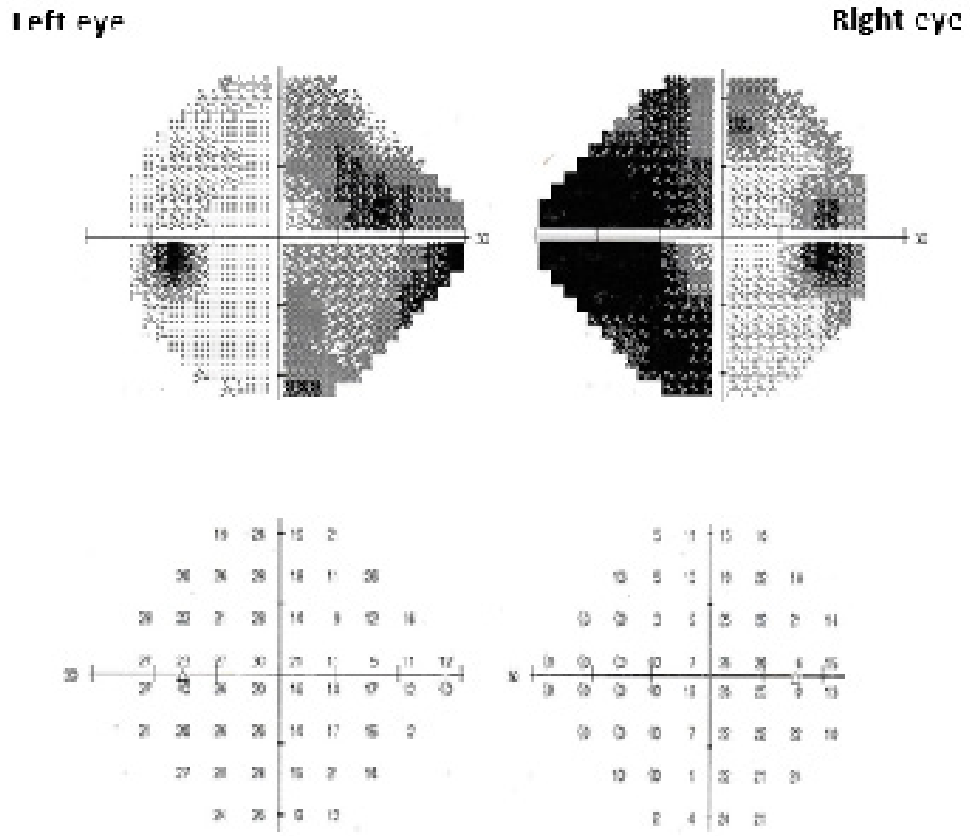

Figure 2 Humphrey's visual field showed binasal hemianopia respecting the vertical line

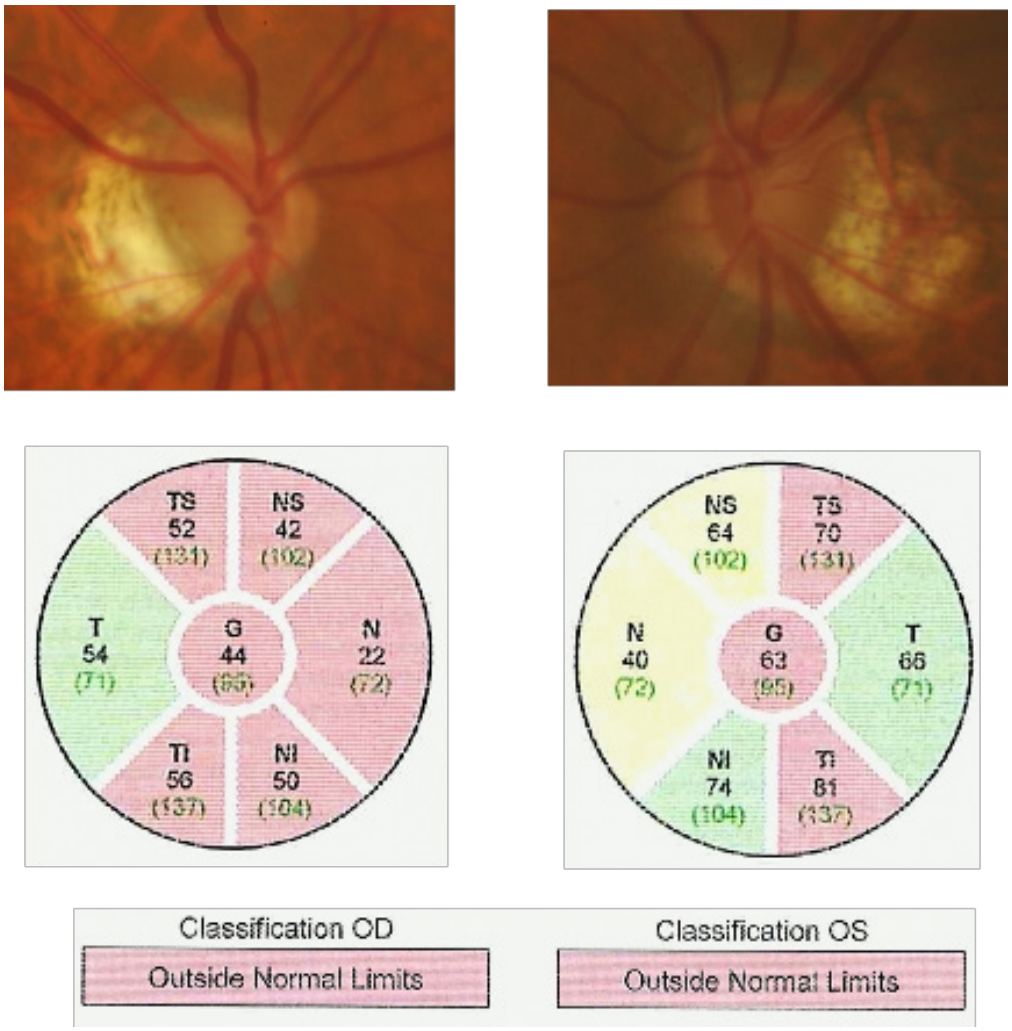

Figure 3 Fundus photographs and peripapillary retinal nerve fibre layer (RNFL) thickness using spectral optical coherence tomography (OCT). Bilateral peripapillary RNFL thinning especially on the right optic disc (upper panel). OCT revealed almost fully thinned RNFL of the right optic disc except for its temporal side with thinning on the superonasal and inferonasal of the left optic disc as denoted in red colour with thickness in μm (lower panel).

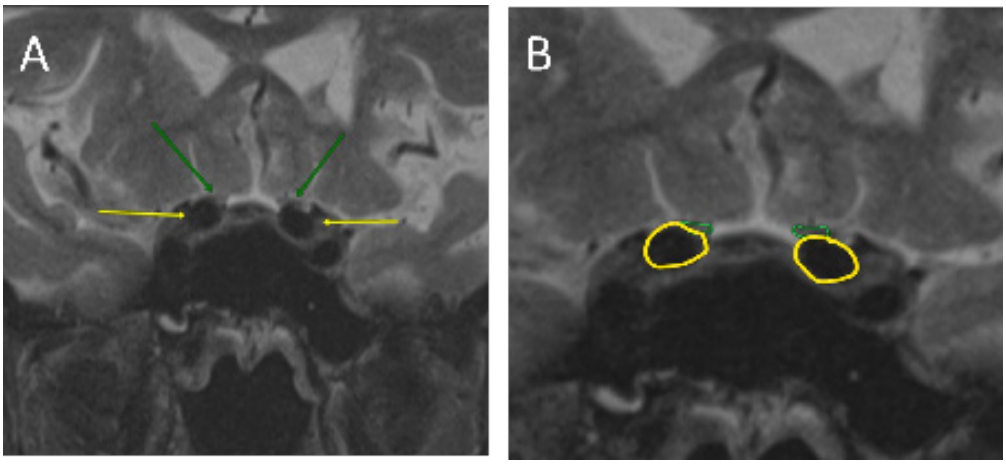

Figure 4 MRI T2WFS in Coronal view (A, B) at the level of prechiasmatic optic nerve. Bilateral prechiasmatic optic nerves (outlined green) are seen abutting the C6 segment of the internal carotid artery (ICA) bilaterally (outlined yellow)

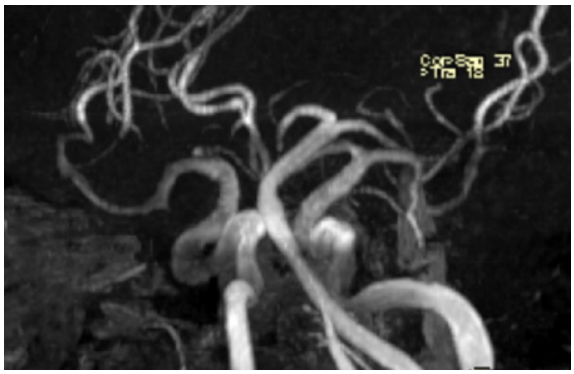

Figure 5 Magnetic Resonance Angiogram in TOF (Time of flight) – Non-contrasted in 3D reconstruction showing tortuous extracranial and intracranial ICA

DISCUSSION

Isolated binasal hemianopia is exceptionally uncommon. Various causes of ocular or neurological conditions have been reported and found to be commonly associated with ocular pathology (Hamann et al., 2015). Ashwin and Quinlan (2006) reported an incidental finding of binasal hemianopia caused by keratoconus. Another study by Salinas-Garcia and Smith (1978) found that 8 out of 100 patients referred for neuro-ophthalmologic examination had binasal visual field defects, six of them had ocular causes while the remaining two were of intracranial origin. Ischaemic optic neuropathy, optic nerve drusen, glaucoma, congenital bilateral optic nerve pits, and retinitis pigmentosa were the ocular pathologies reported. The remaining two cases were caused by congenital hydrocephalus. The mechanism involved is the distended third ventricle compresses the intracranial optic nerves laterally against the supraclinoid portion of the internal carotid arteries, giving rise to binasal visual field defect (Salinas-Garcia & Smith, 1978).

Despite the low incidence of binasal hemianopia associated with intracranial aetiologies, awareness of these neurological causes is essential due to its severe sequelae. The first documented report in 1912 reported that binasal hemianopia was found in a patient with a brain tumour (Cushing & Walker, 1915). Intracranial congenital anomalies, hydrocephalus, intracranial mass lesions, pneumosinus dilatans of sphenoid sinus, neurosyphilis and vascular causes such as pituitary apoplexy and internal carotid artery atherosclerosis were among the reported causes for binasal hemianopia (Bryan et al., 2014; Hamann et al., 2015; Kawahigashi & Nishiguchi, 2018; Kim & Kim, 2019; Lestak et al., 2011; Pringle et al., 2004; Salinas Garcia & Smith, 1978).

Cerebral aneurysms cause variable effects on the eye and visual system depending on their size and location. Bilateral aneurysm or atherosclerosis of the internal carotid arteries compresses adjacent non-crossing fibres of both optic nerves resulting in binasal hemianopia (Smith, 1905). Literature on this cause-effect relationship of binasal hemianopia with evidence of neuroimaging is still scarce. In the past, the anatomical relationship in binasal hemianopia was mostly discovered from post-mortem findings through autopsy reports with corresponding tangent screen perimetry, fundoscopy and X-rays when the patients were still alive. This occur before the advent of advanced radiological imaging such as CT or MRI scans (Knapp, 1932; Smith, 1905). Table 1 summarizes reported cases of binasal hemianopia due to intracranial vascular pathologies, demonstrating the scarcity of reports on binasal hemianopia visual field defects caused by vascular pathologies (Hamann et al., 2015; Kawahigashi & Nishiguchi, 2018; Rebolleda et al., 2015).

The hallmark of visual field defect respecting the midline seen in our patient is the tell-tale sign of a more posterior lesion in the visual pathway. At the same time, the patient demonstrated raised intraocular pressure and disc changes suggestive of glaucoma. Hence, one of the immediate differential diagnoses was primary open angle glaucoma. However, binasal hemianopia respecting the vertical midline is not a characteristic feature

of glaucomatous visual field defect. Thus, vascular abnormalities or space-occupying lesions causing binasal hemianopia became the main concern in this patient.

Peiris and Russell (1980) demonstrated a group of supraclinoid aneurysms presented with bilateral visual field defects alongside other features, especially headaches. This patient did not report any visual or neurologic disturbance suggestive of intracranial abnormalities as reported by previous authors (Table 1).

Table 1 Cases of binasal hemianopia due to intracranial vascular pathologies with neuroimaging described in previous literature

	Case Reports		
Clinical Features	**Kawagihashi et al. (2018)**	**Rebolleda et al. (2015)**	**Hamman et al. (2015)**
Age (years)	67	73	70
Gender	Male	Male	Male
Risk factors	Nil	Nil	Arterial hypertension and on a pacemaker
Symptoms	Headache, retro-orbital pain, diplopia and left ptosis	Progressive vision loss	Reduced night vision with photophobia
Fundus examination	Nil	• OD: temporal optic disc pallor • OS: normal	OU: Diffuse pallor of optic discs
Ocular findings	Left oculomotor nerve palsy evidenced by left blepharoptosis, incomplete ophthalmoplegia, slightly dilated pupil, BNH	BCVA RE 6/24, LE 6/6), positive right relative afferent pupillary defect (RAPD), BNH	Bilateral severe dyschromatopsia, BNH
OCT	Nil	Nil	• OD: Thinning of temporal peripapillary RNFL • OS: Thinning of nasal and superior peripapillary RNFL
Brain CT or MRI and other imaging	MRI findings: Pituitary apoplexy with pituitary adenoma	MRI findings: Elongation of right supraclinoid ICA compressing the right optic nerve and chiasm with right optic disc atrophy	• CT brain findings (MRI was not performed as the patient was on a pacemaker): Dolichoectasia of both ICA to optic nerves, anterior to the optic chiasm • Carotid artery duplex scan findings: 30% calcification of bilateral cervical segment of the left internal carotid artery

Due to the patient's atypical clinical features, determining the diagnosis was challenging, thus CT, MRI and MRA of the brain and orbit greatly facilitated us to identify the ectatic ICA in this patient. Diagnosis could have been different as the raised intraocular pressure suggestive of possible glaucoma could mask a more serious underlying aetiology. This neuroimaging pointed out the dolichoectasia of the cavernous segment of the internal carotid arteries which compressed the pre-chiasmatic optic nerve bilaterally. This finding led towards the true cause of binasal hemianopia which would eventually enable the appropriate management of this case.

CONCLUSION

The current report describes a rare case of binasal hemianopia secondary to bilateral internal carotid arteries dolichoectasia. Clinical features vary from acute visual loss secondary to ischaemic optic neuropathy or chronic visual loss from compressive optic neuropathy with other neurological manifestations. It can also remain silent without any visual disturbance as in the reported case. Diligent assessment of any visual field defect affecting the vertical midline may help to detect life-threatening intracranial pathologies.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest to publish this case report.

CONSENT

Written consent was obtained from the patient to publish this case report. A copy of the written consent is available for review by the Chief Editor.

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