Rapid homonymous hemi-macular atrophy of the optical coherence tomography ganglion cell complex after stroke

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DESCRIPTION

A 44-year-old man developed sudden-onset right-sided weakness, aphasia and blurred vision after a cardiac valvuloplasty. Initial CT and CT angiography of the head showed early ischaemic changes involving the left medial temporal lobe, occipital lobe and thalamus with a left P2 occlusion. He was not a candidate for hyperacute therapy given his recent surgery and was already on dual antiplatelet therapy. He had improvement in his weakness and aphasia and was seen in ophthalmology consultation 1 month after the onset of stroke. He was found to have a visual acuity of 20/20 in both eyes, a complete right homonymous hemianopia and optical coherence tomography (OCT) of the macular ganglion cell–inner plexiform layer (GCIPL) showed left homonymous hemi-macular atrophy. OCT of the retinal nerve fibre layer (RNFL) showed early inferonasal thinning, but the overall thickness was within the normal range (figure 1).

The cell bodies of the retinal ganglion cells are located in the ganglion cell layer of the retina. Their axons first travel in the RNFL, then in the optic nerve, optic chiasm and optic tract before they synapse in the lateral geniculate nucleus, after which information is conveyed to the visual cortex.[1] Disruption of the post-geniculate visual pathway will manifest as hemi-macular atrophy of the OCT GCIPL, but this takes at least several

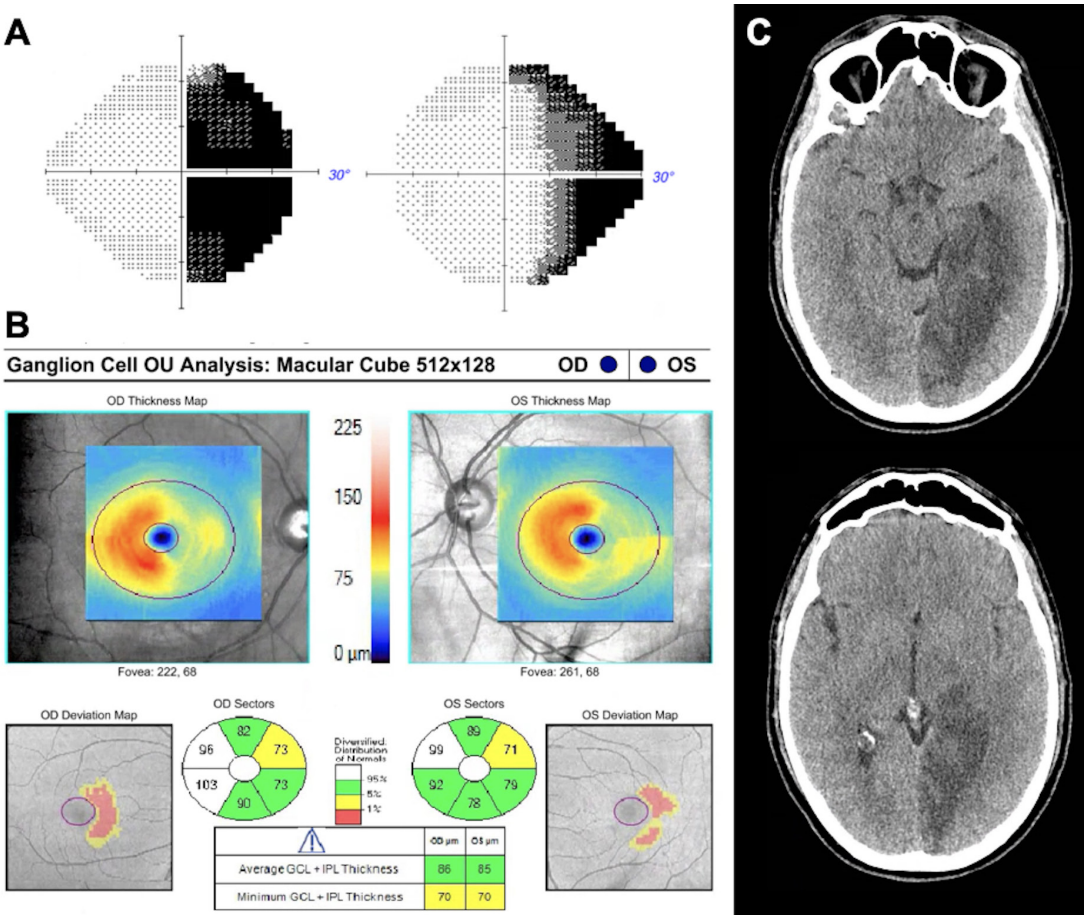

Figure 1 (A) Humphrey 24-2 SITA-FAST visual field testing revealed right homonymous hemianopia. (B) Optical coherence tomography demonstrates left homonymous hemi-macular atrophy of the ganglion cell–inner plexiform layer. (C) CT of the head showed early ischaemic changes involving the left medial temporal lobe, occipital lobe and thalamus.

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months to develop as retrograde trans-synaptic degeneration must occur. On the contrary, disruption of the pre-geniculate visual pathway results in much quicker hemi-macular atrophy of the OCT GCIPL, through a process known as direct retrograde degeneration. A recent study by Mühlemann *et al* compared rates of atrophy between these two processes in patients with pre-geniculate and post-geniculate lesions.[2] They defined significant hemi-atrophy as an ipsilesional:contralesional GCIPL thickness ratio <0.9. Using this cut-off, they found that patients with post-geniculate lesions developed significant GCIPL hemi-atrophy 5 months after onset of their lesion, compared with only 1 month for patients with pre-geniculate lesions. This finding is consistent with our patient, given the stroke affecting his pre-geniculate visual pathway and his rapid development of GCIPL hemi-atrophy. Moreover, the calculated hemi-atrophy ratio of our patient was 0.72 in the left eye and 0.76 in the right eye, suggesting that pre-geniculate lesions can cause a higher degree of degeneration by 1 month than previously anticipated by Mühlemann *et al*. Taken together, these findings suggest that the timing of GCIPL atrophy on OCT can be a useful diagnostic tool in localising lesions to the pre-geniculate or post-geniculate visual pathway.

In contrast to GCIPL analysis, RNFL analysis in our patient revealed an overall thickness within the normal range. In approximately 20% of patients with retrochiasmal lesions, peripapillary RNFL thickness is normal despite reduced macular GCIPL thickness, suggesting that macular GCIPL analysis is more sensitive.[2] This is because our visual field is centred over the macula and not the optic nerve and relating optic nerve changes to specific visual field defects can be difficult. A dense homonymous hemianopia would be expected to give bow-tie atrophy in the eye contralateral to the lesion.[3]

Learning points

- Hemi-macular atrophy of the ganglion cell–inner plexiform layer (GCIPL) on optical coherence tomography (OCT) is observed much earlier in patients with pre-geniculate lesions compared with those with post-geniculate lesions.
- The timing of OCT macular GCIPL atrophy can be useful in localising lesions in the visual pathway.
- Macular GCIPL analysis is more sensitive than peripapillary retinal nerve fibre layer analysis in detecting homonymous hemianopia associated with retrochiasmal lesions.

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