

Macular ganglion cell complex measurement in bilateral retrobulbar optic neuropathy without a relative afferent pupillary defect

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Purpose: This study aimed to demonstrate the clinical usefulness of measuring the macular ganglion cell complex (GCC) for the early detection of axonal loss in eyes with bilateral retrobulbar optic neuropathies.

Patients and methods: We retrospectively reviewed the medical records of three patients with bilateral toxic, ischemic, or infiltrative retrobulbar optic neuropathy.

Results: No relative afferent pupillary defect was detected in any patients. The results of the fundus examinations were unremarkable at the initial presentation except for slight optic disk pallor in the right eye of Case 3. Magnetic resonance imaging showed no abnormal findings in Cases 1 and 2. Measurement of the macular GCC clarified the presence of axonal loss in all three cases with diagnostic uncertainty. Although reduction in the macular GCC thickness was not observed initially in Case 2, it became evident later when both optic disks still appeared normal.

Conclusion: A reduction in the macular GCC thickness seemed to precede the appearance of optic disk pallor and occurs regardless of toxic, ischemic, or infiltrative retrobulbar optic neuropathy. The current case series suggested that measurement of the macular GCC facilitated early differentiation between bilateral retrobulbar optic neuropathy and nonorganic visual loss, which can otherwise be challenging in some cases.

Keywords: infiltrative optic neuropathy, ischemic optic neuropathy, magnetic resonance imaging, optic disk pallor, optical coherence tomography, toxic optic neuropathy

Introduction

Patients with retrobulbar optic neuropathy can present with medically unexplained visual loss requiring differentiation from nonorganic visual loss.¹ The only objective sign of this organic disorder might be a relative afferent pupillary defect (RAPD) in the affected eye; however, an RAPD might not be detected when the optic neuropathy is bilateral and symmetric. In the current case series, we retrospectively reviewed three patients with bilateral retrobulbar optic neuropathies, including toxic, ischemic, and infiltrative optic neuropathies.²⁻⁵ We showed the clinical usefulness of measuring the macular ganglion cell complex (GCC) for the early detection of axonal loss in eyes with bilateral retrobulbar optic neuropathies.

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Case series

Case 1

A 72-year-old man presented with gradual bilateral visual loss during the previous 1 month. He presented with best-corrected visual acuities (BCVAs) of 0.2 and 0.08 in the right and left eyes (OD and OS, respectively), with no RAPD. The results of a fundus examination were unremarkable in both eyes (“oculus uterque” or OU) (Figure 1A and B). When the GCC thickness was measured by optical coherence tomography (OCT) (RS-3000 Advance OCT; Nidek, Gamagori, Japan), there was a slight reduction in the papillomacular bundles OU (Figure 1C and D). The reduction in the papillomacular bundles worsened during the follow-up period (Figure 1E and F), but no changes in circumpapillary retinal nerve fiber layer (cpRNFL) parameters were observed (Figure 1G and H). Goldmann perimetry showed central scotomas and temporal depressions OU. The results of contrast-enhanced magnetic resonance imaging (MRI) of the brain and orbits with fat suppression were normal. The medical history included nontuberculous mycobacterial pulmonary infections, which had been treated daily with 750 mg of ethambutol for 16 months. When bilateral toxic optic neuropathy was diagnosed, the ethambutol was discontinued to minimize any additional toxic effects. Sixteen months after the initial presentation, his BCVAs were 0.8 OD and 0.5 OS.

Case 2

An 83-year-old man presented with sudden bilateral visual loss 2 weeks previously. He presented with BCVAs of 0.03 OU and no RAPD. The results of a fundus examination were unremarkable OU, except for retinal arteriolosclerosis OU (Figure 2A and B). OCT showed that the reduction in the macular GCC thickness was not apparent at the initial presentation (Figure 2C and D). It became evident 1 month later when both optic disks still appeared normal (Figure 2E and F), but no changes in cpRNFL parameters were observed (Figure 2G and H). Goldmann perimetry showed central scotomas OU. The results of MRI of the brain and orbits with fat suppression were normal. The medical history included end-stage renal disease, anemia, and hypertension, and he had been undergoing hemodialysis. Posterior ischemic optic neuropathy was diagnosed OU. Four months after the initial presentation, his BCVAs were 0.01 OU.

Case 3

A 58-year-old man presented with gradual bilateral visual loss over the previous 2 months. He presented with BCVAs of 0.15 OD and 0.5 OS with no RAPD. The results of a fundus examination were unremarkable OU, except for slight optic disk pallor OD (Figure 3A and B). OCT showed decreased papillomacular bundles OU (Figure 3C and D), but no changes in cpRNFL parameters were observed (Figure 3E and F). Goldmann perimetry showed a paracentral scotoma OD. Contrast-enhanced MRI of the brain and orbits with fat suppression showed enlargement and gadolinium enhancement of the bilateral optic nerves. Analysis of the cerebrospinal fluid led to the diagnosis of lymphoplasmacytic lymphoma, which was treated with intrathecal and systemic chemotherapy. Infiltrative optic neuropathy was diagnosed. Four months after the initial presentation, his BCVAs were 0.15 OD and 0.4 OS.

Ethics statement

Written informed consent has been provided by the patients to have the case details and any accompanying images published.

Discussion

Retrobulbar optic neuropathy OU can be challenging to diagnose. First, RAPD might not be detected in cases with retrobulbar optic neuropathy OU. Second, although optic disk pallor usually develops over time, the optic disk might appear normal initially. Third, the presence of normal optic nerves on MRI images does not rule out a diagnosis of retrobulbar optic neuropathy.^{2-4,6} In the current case series, an RAPD was not detected in any patient. The fundus examinations were unremarkable at initial presentation, and no abnormalities were seen on the MRI images in Cases 1 and 2.

The patterns of macular GCC loss might provide an objective measure of optic nerve damage in patients with chiasmal compression.^{7,8} In the current case series, measurements of the macular GCC were useful to clarify the presence of axonal loss in cases with diagnostic uncertainty. Although reduction in the macular GCC was not observed 2 weeks after the onset in Case 2, it became evident 6 weeks after the onset when both optic disks still appeared normal. The reduction in the macular GCC thickness seemed to precede the appearance of optic disk pallor and occurred regardless of the type of optic neuropathy.

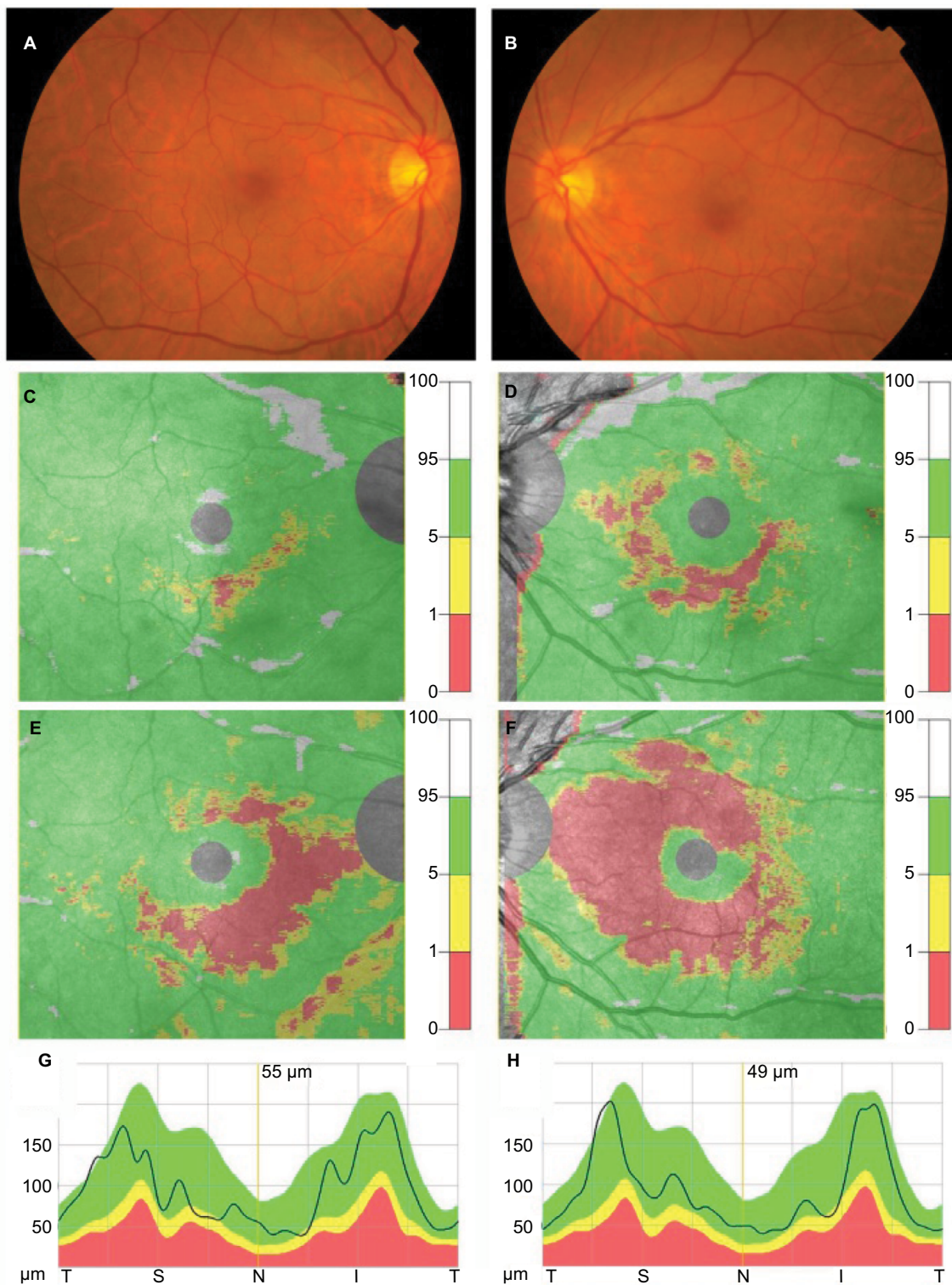


Figure 1 Fundus photographs and results of measurement of the macular GCC and cpRNFL obtained from Case 1.

Notes: Fundus photographs of the right (A) and left (B) eyes at initial presentation. Macular GCC maps of the right (C) and left (D) eyes at initial presentation and of the right (E) and left (F) eyes 5 months later. Spectral domain optical coherence tomography was used to measure the thicknesses of the internal limiting membrane, retinal nerve fiber layer, ganglion cell layer, and inner plexiform layer, as well as provide macular GCC maps based on the normative database. On the macular GCC maps, green indicates that the thicknesses are within the normal range, yellow – abnormal below the 5% level, and red – abnormal below the 1% level. Temporal, superior, nasal, inferior, temporal graphs of the thickness of the cpRNFL in the right (G) and left (H) eyes 5 months after the initial presentation.

Abbreviations: GCC, ganglion cell complex; cpRNFL, circumpapillary retinal nerve fiber layer; T, temporal; S, superior; N, nasal; I, inferior.

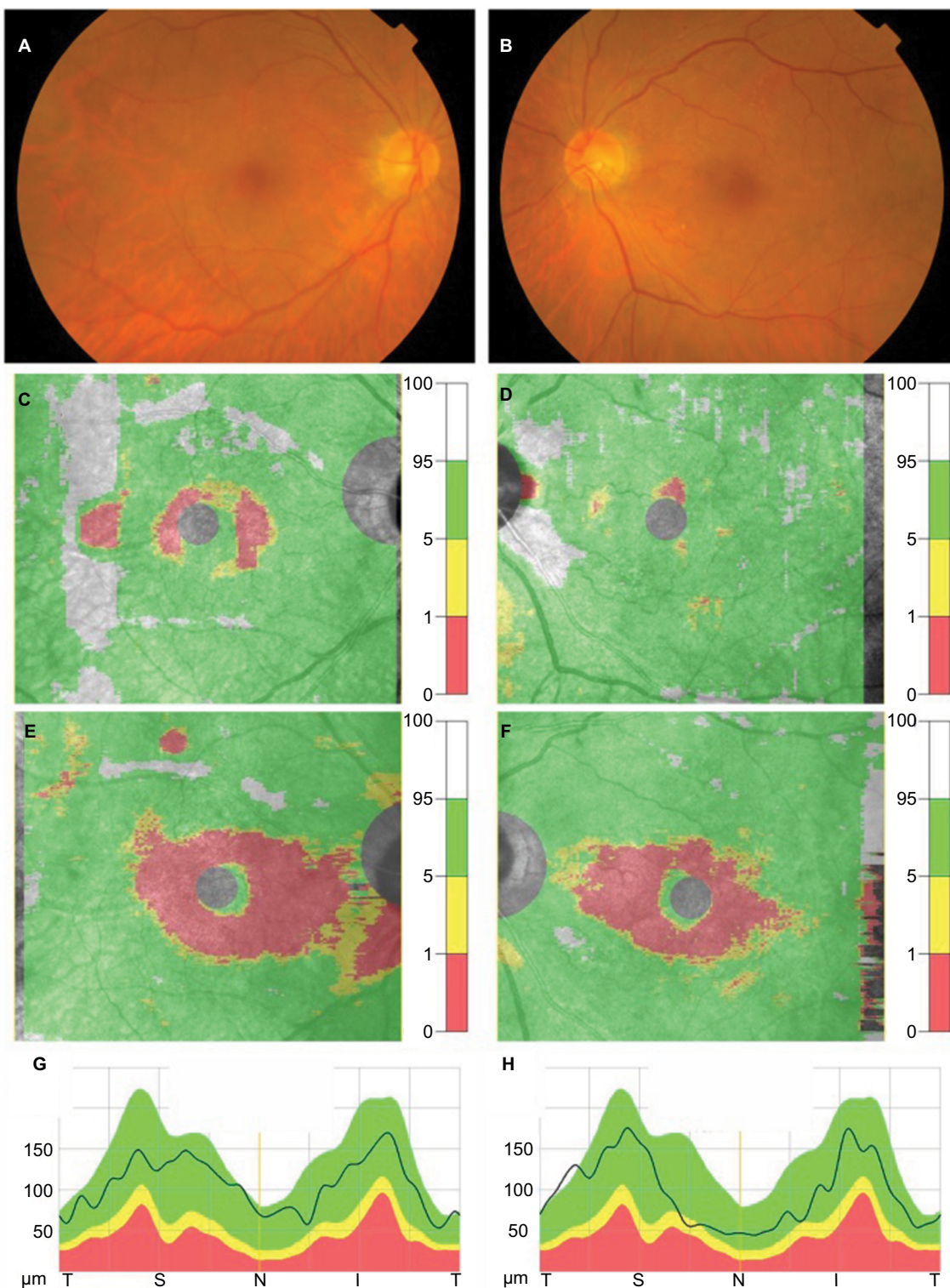


Figure 2 Fundus photographs and results of measurement of the macular GCC and cpRNFL obtained from Case 2.
Notes: Fundus photographs of the right (A) and left (B) eyes at initial presentation. Macular GCC maps of the right (C) and left (D) eyes at the initial presentation and of the right (E) and left (F) eyes 1 month later. Temporal, superior, nasal, inferior, temporal graphs of the thickness of the cpRNFL in the right (G) and left (H) eyes 1 month after the initial presentation.
Abbreviations: GCC, ganglion cell complex; cpRNFL, circumpapillary retinal nerve fiber layer; T, temporal; S, superior, N, nasal; I, inferior.

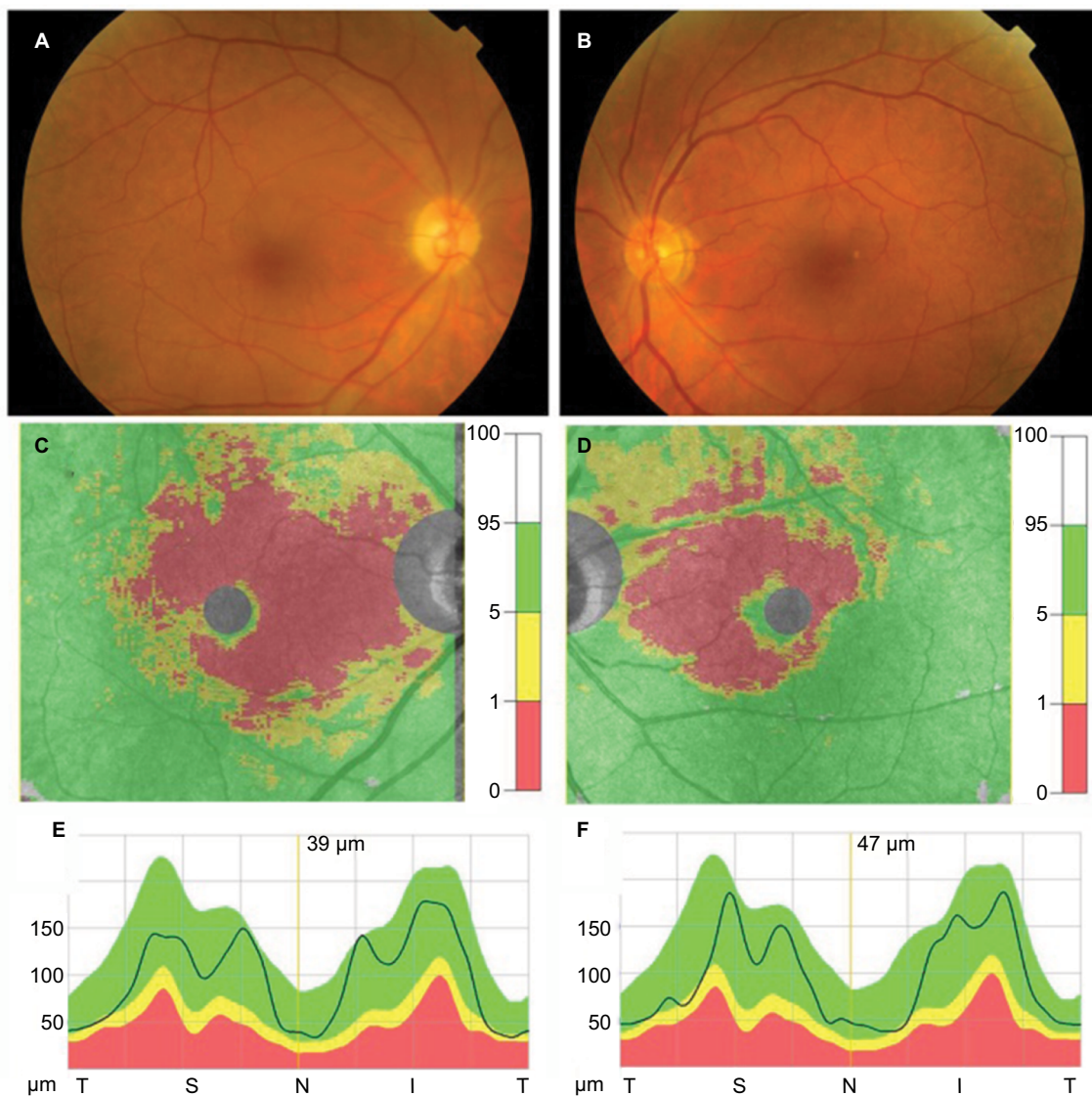


Figure 3 Fundus photographs and results of measurement of the macular GCC and cpRNFL obtained from Case 3.

Notes: Fundus photographs of the right (A) and left (B) eyes at initial presentation. Macular GCC maps of the right (C) and left (D) eyes at initial presentation. Temporal, superior, nasal, inferior, temporal graphs of the thickness of the cpRNFL in the right (E) and left (F) eyes at the initial presentation.

Abbreviations: GCC, ganglion cell complex; cpRNFL, circumpapillary retinal nerve fiber layer; T, temporal; S, superior; N, nasal; I, inferior.

Conclusion

The current case series suggested that measurement of the macular GCC can facilitate early differentiation between retrobulbar optic neuropathy OU and nonorganic visual loss, which can otherwise be challenging in some cases. However, we must always keep in mind that the macular GCC should be evaluated after taking a careful medical history and fundus examination.

Acknowledgment

The authors thank Lynda Charters for her contribution to the manuscript.

Disclosure

The authors report no conflicts of interest in this work.

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