Jpn J Ophthalmol 2005;49:294–296
DOI 10.1007/s10384-005-0195-y

LABORATORY INVESTIGATION

Retinal Nerve Fiber Layer Thickness in Optic Tract Syndrome

Yasuko Tatsumi, Akiyasu Kanamori, Azusa Kusuhara, Yoriko Nakanishi, Sentaro Kusuhara, and Makoto Nakamura

Department of Organ Therapeutics, Division of Ophthalmology, Kobe University Graduate School of Medicine, Kobe, Japan

Abstract

Background: Optic tract syndrome (OTS) is characterized by incongruous homonymous hemianopia and a perpendicular pattern of bilateral optic atrophy due to the optic tract lesion. However, loss of retinal nerve fiber layer thickness (RNFLT) associated with OTS has not been quantitatively assessed.

Case: A 20-year-old woman with blunt head trauma showed normal visual acuity, color vision, ocular motility, and intraocular pressure. Because of a relative afferent pupillary defect in her left eye and left-sided homonymous hemianopia, we suspected right-sided optic tract damage, although magnetic resonance imaging detected no intracranial lesion.

Observations: Using optical coherence tomography (OCT), the RNFLT of this case was measured at 31 months after the trauma and compared with age-matched normal controls (n = 41). Nasal, temporal, superior, and inferior quadrant RNFLT was reduced by 22%, 21%, 5%, and 46% in the right eye and 76%, 64%, 25%, and 27% in the left eye, respectively. The reduction was > 3 × the standard deviation of the normal mean values in the nasal and temporal quadrants of the left eye and in the inferior quadrant of the right eye.

Conclusions: OCT can determine the RNFLT reduction corresponding to the characteristic patterns of optic atrophy of OTS. **Jpn J Ophthalmol** 2005;49:294–296 © Japanese Ophthalmological Society 2005

Key Words: band atrophy, optical coherence tomograhy, optic tract syndrome, retinal nerve fiber layer

Introduction

Optic tract syndrome (OTS) is the designation for optic tract lesion characterized by incongruous homonymous hemianopia and a relative afferent pupillary defect (RAPD) contralateral to the lesion, leading to the eventual development of optic atrophy in both eyes.[1] In the eye ipsilateral to the lesion, the superior and inferior parts of the disc preferentially become atrophic owing to damage to the uncrossed, temporal projection of the nerve fiber. In the eye contralateral to the lesion, the temporal and nasal parts of the disc preferentially become pale in color owing to damage to the crossed, nasal projection of the nerve fiber, so-called band-atrophy. The perpendicular pattern of optic atrophy in the two eyes is a hallmark of the chronic phase of OTS. The diagnosis of OTS is made essentially from clinical findings because the lesion is usually too small to be radiologically detected. Despite this well-known nomenclature, however, the characteristic reduction of the retinal nerve fiber layer thickness (RNFLT) in OTS has never been quantitatively assessed. Here, we report a case of OTS in which optical coherence tomography (OCT) clearly demonstrated the unique pattern of RNFLT.

Received: April 8, 2004 / Accepted: March 3, 2005
Correspondence and reprint requests to: Makoto Nakamura, Department of Organ Therapeutics, Division of Ophthalmology, Kobe University Graduate School of Medicine, 7-5-2 Kusunoki-cho, Chuo-ku, Kobe 650-0017, Japan
e-mail: manakamu@med.kobe-u.ac.jp

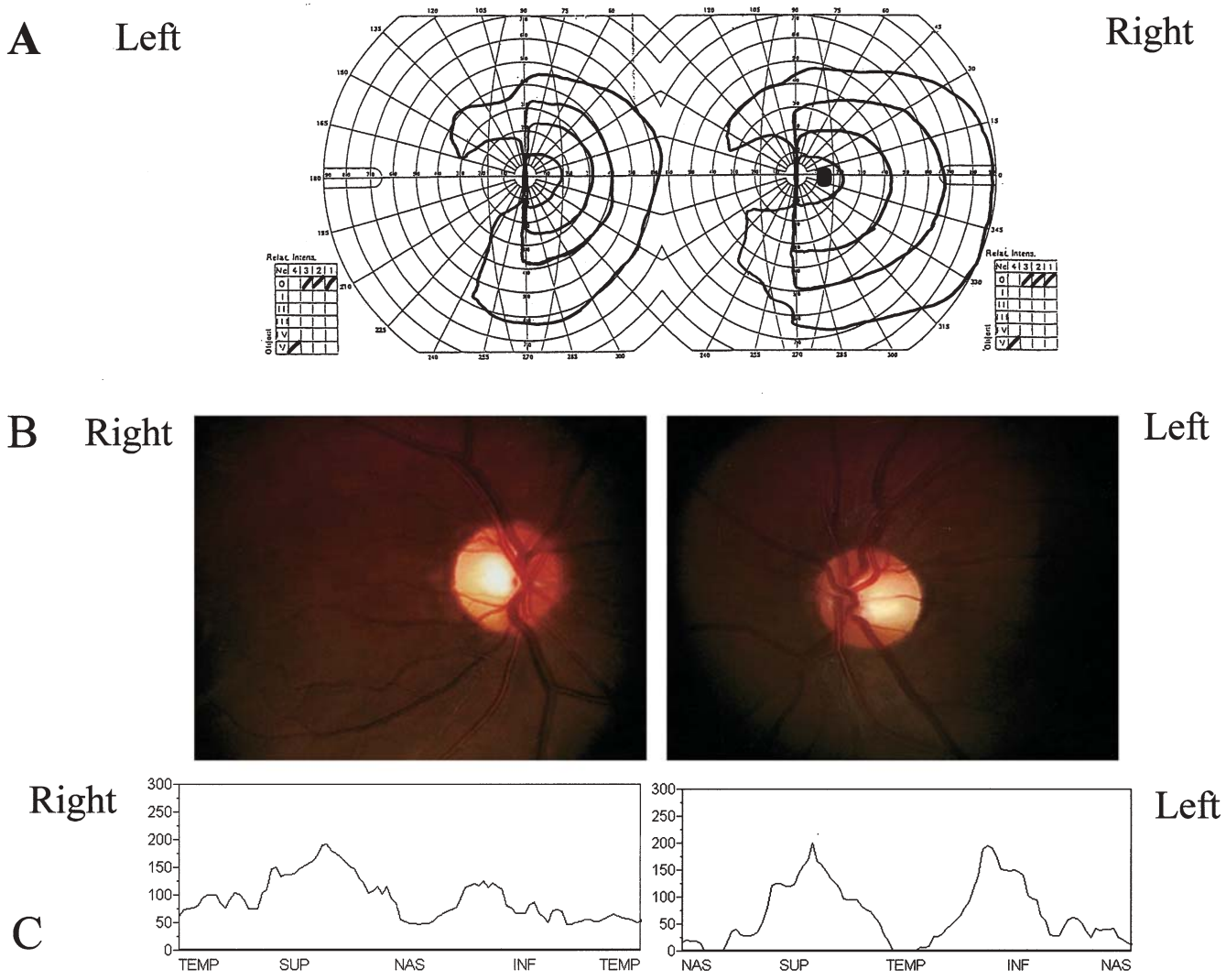

Figure 1A–C. Visual field, disc change, and retinal nerve fiber layer thickness (RNFLT) profile from an optical coherence tomography analysis of the present case. **A** Goldmann perimetry on November 1, 2000. Left-sided incongruous homonymous hemianopia is noted. **B** Optic disc findings at 31 months after injury show inferior to temporal pallor of the right optic disc and horizontal pallor of the left optic disc. **C** RNFLT profile of the OCT analysis on July 9, 2003. RNFLT of the inferior segment in the right eye and the temporal and nasal segments in the left eye are reduced corresponding to the optic atrophy.

Case Report

A 20-year-old unconscious woman with a brain contusion caused by a motor vehicle crash on October 1, 2000, was admitted to the emergency room of our hospital. Computed tomography revealed a slight subarachnoidal hemorrhage in the right-side sylvian fissure. Ten days after the accident, best-corrected visual acuity was 20/20 in both eyes. Pupillary responses disclosed RAPD in the left eye. The ocular motility, intraocular pressure, critical flicker fusion frequency, anterior segments, media, and optic discs were all normal in both eyes. Her systemic condition did not allow us to evaluate her visual field until 1 month after the accident, when Goldmann perimetry revealed left-sided incongruous homonymous hemianopia (Fig. 1A). Twelve months later, pallor in the temporal and nasal parts of the left optic disc and in the superior and inferior parts of the right optic disc became prominent. The diagnosis of OTS was made based on these clinical findings, although magnetic resonance imaging taken at 1 month after the accident did not detect any abnormal lesion. RNFLT was measured by OCT using version A6X1 software (Humphrey Instruments, San Leandro, CA, USA). We took the average of three circular scans (3.4 mm in diameter) centered on the optic disc, as previously reported.[2] The reduction rate of each quadrant RNFLT was measured and compared with the corresponding value in 41 age-matched normal controls. The absolute value of the RNFLT and its reduction rate at 12 and 31 months after the accident are shown by quadrant in Table 1. RNFLT was significantly decreased in the nasal quadrant

Table 1. Retinal nerve fiber layer thickness and reduction rate in each quadrant in normal subjects and at 12 and 31 months after the accident in the current patient

	Retinal nerve fiber layer thickness (reduction rate) μm (%)				
Retinal quadrant	Normal	Right 12M	Right 31M	Left 12M	Left 31M
Nasal	100 ± 21	80 (25)	83 (22)	29[a] (73)	24[a] (76)
Temporal	107 ± 18	66 (24)	74 (21)	68 (32)	36[a] (66)
Superior	150 ± 19	121 (19)	142 (5)	116 (23)	113 (25)
Inferior	151 ± 20	95 (37)	81[a] (46)	122 (19)	110 (27)

M, months.
[a] Values lower than normal mean (3 × SD).

of the left eye at 12 months after the accident, and in the inferior quadrant of the right eye and in the temporal and nasal quadrants of the left eye at 31 months, as judged by the reduction of RNFLT, > 3 × the standard deviation for normal values.

Discussion

The present case study clearly demonstrated that OCT can successfully quantitate the RNFLT reduction corresponding to the characteristic ophthalmoscopic findings of optic atrophy in OTS. The perpendicular pattern of RNFLT reduction contrasts distinctly with the RNFLT reduction seen in glaucomatous eyes, in which inferior and superior temporal RNFLT is preferentially reduced at early stages.[3] Further, as shown by us[4] and another group,[5] compression in the chiasmal region, which causes bitemporal hemianopia and bilateral band atrophy of the discs, leads to significant reduction of the superior and inferior RNFLT. These lines of evidence clearly indicate that OCT can detect RNFLT reduction corresponding to disease- or site-dependent optic nerve damage.

Acknowledgments. The authors are grateful to Professor Akira Negi for his critical reading of this manuscript.

References

1. Miller NR, Newman NJ. Chapter 8. Topical diagnosis of lesions in the visual sensory pathway: In: Miller NR, Newman NJ, editors. Clinical neuro-ophthalmology, 5th edition. Baltimore: William & Wilkins; 1998. P. 237–386.
2. Kanamori A, Escano MF, Eno A, et al. Evaluation of the effect of aging on retinal nerve fiber layer thickness measured by optical coherence tomography. Ophthalmologica 2003;217:273–278.
3. Kanamori A, Nakamura M, Escano MF, et al. Evaluation of the glaucomatous damage on retinal nerve fiber layer thickness measured by optical coherence tomography. Am J Ophthalmol 2003;135:513–520.
4. Kanamori A, Nakamura M, Matsui N, et al. Optical coherence tomography detects characteristic retinal nerve fiber layer thickness corresponding to band atrophy of the optic discs. Ophthalmology 2004;111:2278–2283.
5. Monteiro MLR, Leal BC, Rosa AAM, et al. Optical coherence tomography analysis of axonal loss in band atrophy of the optic nerve. Br J Ophthalmol 2004;88:896–899.