Relationship Between Preferred Sleeping Position and Asymmetric Visual Field Loss in Open-Angle Glaucoma Patients

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• PURPOSE: To investigate the relationship between preferred sleeping position and asymmetric visual field (VF) loss in open-angle glaucoma (OAG) patients.
• DESIGN: Retrospective, cross-sectional study.
• METHODS: Six hundred and ninety-two (692) patients with bilateral normal-tension glaucoma (NTG) or high-tension glaucoma were consecutively enrolled. A questionnaire to determine the preferred sleeping position was administered to each patient. Asymmetric VF loss was defined as a difference in mean deviation between the 2 eyes of at least 2 dB. According to these values, the better eye and worse eye were defined. Among the patients with asymmetric VF loss, the numbers preferring the worse eye–dependent lateral decubitus position and the better eye–dependent lateral decubitus position were compared.
• RESULTS: Among the enrolled patients, 309 (60.6%) with NTG and 121 (66.5%) with high-tension glaucoma had asymmetric VF between the 2 eyes. Among the 309 NTG patients, 100 (32.4%) preferred the lateral decubitus position. Of these, 66 (66.0%) preferred the worse eye–dependent lateral decubitus position ($P = .001$). Among the 121 high-tension glaucoma patients, 32 (26.4%) preferred the lateral decubitus position, and of these, 23 (71.9%) preferred the worse eye–dependent lateral decubitus position ($P = .013$).
• CONCLUSION: Our results suggest that the sleep position habitually preferred by glaucoma patients may be associated with greater VF loss. (Am J Ophthalmol 2014;157:739–745. © 2014 by Elsevier Inc. All rights reserved.)

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INTRAOCULAR PRESSURE (IOP) REDUCTION CAN SLOW the progression of visual field (VF) damage in glaucoma patients; however, despite apparently effective IOP control, some patients continue to progress.[1] It is well known that IOP is higher in the supine position than when sitting.[2–6] Moreover, the extent of IOP elevation from the sitting to the supine position is greater in primary open-angle glaucoma (OAG), ocular hypertension, and normal-tension glaucoma (NTG) than in normal subjects.[6–8]

In prospective studies of the effect of the lateral decubitus position on IOP in healthy volunteers, IOP in the lateral decubitus position was consistently higher in the dependent eye (the lower-positioned eye; eg, the right eye in the right lateral decubitus position) than in the nondependent eye (the upper-positioned eye; eg, the left eye in the right lateral decubitus position).[9–11] Further, IOP in the dependent eye in the lateral decubitus position was consistently higher than that in the sitting or supine position.[9–12] In 2 recent studies on OAG patients, IOP in the lateral decubitus position was consistently higher in the dependent eye than in the fellow eye, and dependent-eye IOP was consistently higher in the lateral decubitus position than in the sitting or supine position.[13,14]

People generally spend between one-quarter and one-third of their lives sleeping. During sleep, body position varies between the supine position and the lateral decubitus position, often more on 1 side than the other. Thus IOP elevation related to the lateral decubitus position might play a role in glaucoma progression.[13,15,16]

On the basis of questionnaire data, we previously suggested that the lateral decubitus position habitually preferred by glaucoma patients might be associated with asymmetric VF damage; however, the number of respondents was relatively small.[13] In the present study, examining a large subject group, we verified our hypothesis on the association between the preferred sleeping position and asymmetric VF loss between eyes.

METHODS

THIS RETROSPECTIVE CROSS-SECTIONAL STUDY WAS approved by the Institutional Review Board of Seoul National

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University Hospital and was conducted in accordance with the relevant Declaration of Helsinki specifications. Patients with treated bilateral OAG and IOPs in the teens during office hours were consecutively enrolled from the Glaucoma Clinic of Seoul National University Hospital from September 1, 2012 to December 31, 2012. The criteria for a diagnosis of OAG were typical glaucomatous optic disc change, reproducible glaucomatous VF defect, and open angles on gonioscopy. Glaucomatous optic disc changes were characterized as focal or diffuse neuroretinal rim thinning or as localized notching with correlating VF changes. Glaucomatous VF defects were confirmed if 2 of the following 3 criteria were met: the presence of a cluster of 3 points on a pattern deviation probability plot with $P < 5\%$, 1 of which had $P < 1\%$; a pattern standard deviation (PSD) with $P < 5\%$; or a glaucoma hemifield test result outside normal limits.

The patients were divided into 2 subgroups according to the baseline IOP without medication. Some patients treated when referred to us were removed from all ocular hypotensive therapy. Required washout periods prior to measurement of the baseline IOP were 5 days for carbonic anhydrase inhibitors, 2 weeks for adrenergic agonists, and 4 weeks for beta-adrenergic receptor antagonists and prostaglandin analogues. On the other hand, other referred patients, because of uncontrolled IOP despite maximally tolerable medical therapy with or without oral hypotensive agents, were not removed from hypotensive therapy but were excluded from this study. Untreated baseline IOP was measured by Goldmann applanation tonometry at different times during daylight hours on at least 3 visits: NTG was diagnosed if all of the readings were ≤21 mm Hg, and high-tension glaucoma was diagnosed in cases where any of the readings were >21 mm Hg. The exclusion criteria were as follows: eyes having poor reliability on VF analysis (>20% fixation loss; >15% false-positive or false-negative answers); any media opacities or diseases that could influence the digital optic disc photograph and red-free photograph; 20/40 or worse best-corrected visual acuity; high myopia (>6.0 diopters); or any diseases that might secondarily influence IOP or the VF.

A questionnaire on the preferred sleeping position was administered to each of the subjects and their answers recorded by a single observer masked to the ophthalmic examination results. The following questions were asked: (1) Do you have a preferred lying position when you are sleeping? a) YES, b) NO; (2) If your answer to "Question 1" is a) YES, which body position do you prefer? a) right lateral decubitus position (lying on your right side), b) left lateral decubitus position (lying on your left side), c) supine position (lying on your back), d) prone position (lying on your stomach), e) both lateral decubitus positions (lying on your right and left side, alternately). Because we could not know which lateral decubitus position was the dominant lateral decubitus side, the answer "e) both lateral decubitus positions" to "Question 2" was regarded as "no preference."

The electronic medical records, VF test results, and digital optic disc photographs of the enrolled patients were retrospectively reviewed. All patients were examined regularly at intervals of 3-6 months. IOP was assessed by Goldmann applanation tonometry. Digital optic disc photography (TRCSS2; Topcon, Inc, Tokyo, Japan) and VF analysis using the Swedish interactive thresholding algorithm (SITA) of 30-2 perimetry (Humphrey Field Analyzer II; Carl Zeiss Meditec, Dublin, California, USA) were evaluated also at 3- to 6-month intervals.

The association between the preferred sleeping position and asymmetric VF loss in the OAG patients, NTG and high-tension glaucoma, was analyzed. Asymmetric VF loss was defined as a difference in mean deviation (MD) of at least 2 dB between the eyes.[17,18] For all patients with asymmetric VF loss, the better eye and worse eye were defined based on the MD value determined in the VF test performed within 6 months of the enrollment of each patient.

All statistical analyses were performed using SPSS version 18.0 (SPSS Inc, Chicago, Illinois, USA). The subjects' demographics were compared according to the baseline IOP, mean IOP, spherical equivalent, axial length, central corneal thickness, and result of VF testing using paired t tests and independent t tests. χ^2 t tests and 1-sample χ^2 tests were used to analyze the results of the preferred sleeping position questionnaire. A $P < .05$ value was considered to represent a significant difference.

RESULTS

A TOTAL OF 692 SUBJECTS WITH OAG (367 MEN, 325 WOMEN; mean age: 60.6 ± 13.5 years; range: 19-91 years) met the criteria for inclusion in this study. There were 510 NTG and 182 high-tension glaucoma patients. Table 1 provides a demographic summary. As is apparent, there was a significant mean IOP difference between the right and left eyes of the high-tension glaucoma patients (15.3 ± 3.2 mm Hg and 14.7 ± 3.0 mm Hg, respectively; $P = .009$). The VF test results showed no such difference.

Table 2 summarizes the demographics of the OAG patients with asymmetric VF loss. Of the enrolled 692 patients, 430 (62.1%) had asymmetric VF loss.The baseline IOP of the worse eye was 16.7 ± 5.4 mm Hg and that of the better eye was 16.0 ± 4.4 mm Hg ($P < .001$). There was a significant difference in MD value between the worse eye and better eye (−11.3 ± 7.4 dB and −4.8 ± 5.7 dB, respectively; $P < .001$).

Table 3 summarizes the demographics of the NTG and high-tension glaucoma patients with asymmetric VF loss. The numbers of patients with asymmetric VF defect were 309 (of 510) NTG patients (60.6%) and 121 (of 182) high-tension glaucoma patients (66.5%) ($P = .159$; χ^2 test). The number of NTG patients having the worse VF in the left eye was 175, and in the right eye, 134 ($P = .020$;