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Brief communication (Original)

Eye diseases associated with obstructive sleep apnea syndrome in an Asian population

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Background: Sleep apnea syndrome is one of the leading causes of excessive daytime sleepiness. There is no literature exploring the prevalence of sleep-associated disorders in the eye of Asians with obstructive sleep apnea syndrome (OSA).

Objective: Study the prevalence of eye abnormalities in Asian patients with OSA.

Material and method: Asian patients with definite OSA diagnosis via the polysomnography were recruited into the study. Complete eye examination and special investigations were performed to define eye diseases: floppy eyelids, dry eyes, keratoconus, Fuchs' endothelial dystrophy, recurrent corneal erosions, open-angle glaucoma, ophthalmoplegia, papilledema and optic neuropathy.

Results: One-hundred Asian OSA patients were examined. We found that floppy eyelids, dry eyes, and normal tension glaucoma were more prevalent compared to the normal population. Abnormal endothelial change and papilledema were detected. Optic neuropathy and ophthalmoplegia were not found in this study, although some patients did have subnormal contrast sensitivity.

Conclusion: There is a higher prevalence of floppy eyelids, dry eyes, and glaucoma in OSA patients. Complete eye examination is recommended in OSA patients to detect early eye abnormalities.

Keywords: Dry eye, floppy eyelids, obtructive sleep apnea, normal tension glaucoma, papilledema

Sleep apnea syndrome (SAS) refers to a clinical disorder that arises from recurrent apneas during sleep and is one of the leading causes of excessive daytime sleepiness. In obstructive sleep apnea syndrome (OSA), airflow ceases despite continuing respiratory drive because of occlusion of the oropharyngeal airway. These mechanisms induce hypoxic changes in various tissues and have been implicated to be a risk factor for the development of neuropsychiatric, behavioral disturbances and cardiovascular sequelae.[1] There are several modalities[2, 3] for OSA treatment including behavioral modification, oral appliance, medicine, or surgery. It was shown that hypoxia in various tissues will induce several diseases and are associated with OSA: floppy eyelid syndrome (FES) [4-8], primary open-angle glaucoma (POAG) [8-10], normal-tension glaucoma (NTG) [11-13], optic neuropathy [14, 15], ptosis, lower lid ectropion, blepharochalasis, trichiasis [5], punctate epithelial keratopathy, keratoconus, progressive endotheliopathy [5], and papilledema [16-18].

Even though OSA is very common yet, there is no literature exploring the prevalence of sleep-associated disorders in the eye among Asians with OSA. In this study, we examined whether the findings in Caucasians were similar to the Asian population.

Material and method

This study was approved by the Ethics Committee of Chulalongkorn University. Informed consent was obtained from every patient. We contacted patients with OSA who have never received any treatments between 1997 and 2002 and new cases between

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January and July 2002 at the department of Otolaryngology, King Chulalongkorn Memorial Hospital. Suspected OSA cases were further investigated by utilizing polysomnography. The test results were calculated in Respiratory Disturbance Index (RDI), which was used to diagnose OSA and grade its severity [1]. All patients with an RDI score ≥5 were included in the study. Patients who previously received any forms of OSA treatment and had a history of pre-existing ocular disease(s) were excluded from the study. A hundred patients agreed to participate in the study.

Data collection

Demographic data, medical information, onset of sleep apnea symptoms, and detailed ocular history were obtained. Additional questions included: experience dryness, burning, foreign body sensation, light sensitivity, blurred vision that improved with blinking, recurrent corneal erosion syndrome, corneal ulcer, and changing of visual quality.

Ophthalmologic examinations

Ophthalmologic examinations and test interpretations were performed by two ophthalmologists specializing in cornea and neuro-ophthalmology. If glaucoma was suspected, it would be confirmed by the glaucoma specialist. The Snellen visual acuity, complete eye examinations, and detailed slit-lamp biomicroscopic examination were administered to both eyes. Intraocular pressure was measured by Goldmann applanation tonometry. The optic nerve was examined via direct ophthalmoscopy and + 90-diopter lens to detect optic nerve abnormality. Automated refractometer and keratometer (Nidek) was used to detect refractive changes.

Computed corneal topography and orbscan topography/pachymetry

Corneal topography was performed using a computed corneal topography analysis system-ALCON EyeMap EH-290 (Alcon laboratories, Forth Worth, USA). The maps were evaluated by a corneal specialist. Patients suspected to have keratoconus were re-examined and re-evaluated using Orbscan II (Bausch & Lomb, Claremont, USA).

Corneal specular microscopy

Corneal endothelial cells were assessed by a contact specular microscope-Konan Sp-5500 (Konan, Tokyo, Japan). Endothelial cell size and variation, density, and shape were measured.

Visual field testing and optic nerve head analysis

Visual field analysis was performed using 30-2 SITA standard program on the HFA II (Humphrey Instrument, Carl Zeiss, Oberkochen, Germany). Clinically suspected glaucomatous optic neuropathy or suspicious visual fields were re-evaluated by the glaucoma specialist: visual field testing, FDT screening test C-20-5 (Frequency Doubling Technology, Humphrey Systems and Welch-Allyn), nonmydriatic fundus photograph (Kowa VK-2), and Heidelberg retinal tomography (HRT II, software version 1.20).

Color vision and contrast sensitivity testing

Ishihara color plate was used for screening color deficiency. Contrast sensitivity was evaluated by Vistech's contrast sensitivity chart (Vistech Consultants, Ohio, USA)

Gonioscopy

If there was an evidence of suspected glaucoma, gonioscopy was done.

Statistical analysis

All data was analyzed by descriptive statistics for prevalence of each disease or abnormality.

Results

Demographic characteristics

Two hundred eyes were examined (n=100). There were 75 (75%) males and 25 (25%) females. The patients' mean age was 45.6±11.2 years (range: 19 to 72). The mean RDI was 26.57±24.65. The body mass index (BMI) was 27.0±4.9. The number of patient and eyes with abnormalities observed in OSA syndrome is shown in **Table 1.**

Table 1. Eye abnormalities in obstructive sleep apnea syndrome.

	Number of patients (number of eyes)
Floppy eyelids	53 (106)
Lacrimal gland prolapse	41 (82)
Trichiasis	3 (6)
Positive ocular irritation symptoms	37
Rapid Tear breakup time	73 (138)
Abnormal fluorescein staining	40 (66)
Glaucoma	9 (12)
Optic disc swelling	1 (2)
Decrease contrast sensitivity	39 (26)

Visualacuity and refraction

Uncorrected Snellen visual acuity was normal (20/20-20/40) in every patient except for three patients (four eyes) who had a visual acuity of 20/70. The average spherical equivalent refractive error was -0.52 (range: -8.75 to +4.82).

Eyelids, conjunctiva, and cornea

Fifty-three patients had floppy eyelids: mild (n=25), moderate (n=26), and severe (n=2). Lacrimal gland prolapse (n=41) was observed in moderate and severe groups. We found superficial punctate keratitis in 21 (39.6%) patients. There were no abnormal corneal findings in the severe group. Three patients had trichiasis of both upper eyelids. No ptosis, blepharochalasis, ectropion or entropion was detected.

Thirty-seven patients complained of ocular irritation symptoms, indicative of dry eyes. Tear film instability was detected in 73 patients (139 eyes). Forty patients (66 eyes) had abnormal conjunctival and corneal fluorescein staining (**Fig.1**). None of the patients had experienced any recurrent corneal erosion symptoms or history of corneal ulcer. Corneal topographies were normal in all (99 of 100) cases except for one patient who had an abnormal corneal curvature.

Four patients had abnormal endothelial cells: three patients (four eyes) resembled guttata and one patient resembled iridocorneal endothelial syndrome (ICE) syndrome.

Glaucoma

The mean intraocular pressure was 14.8±3.05 mmHg (range: 8 to 26.5). There were two ocular hypertensive patients with IOP of 26.5 mmHg OD and 23 mmHg OS, and 22 mmHg OD and 23 mmHg OS. Glaucoma was diagnosed in nine patients (13 eyes).

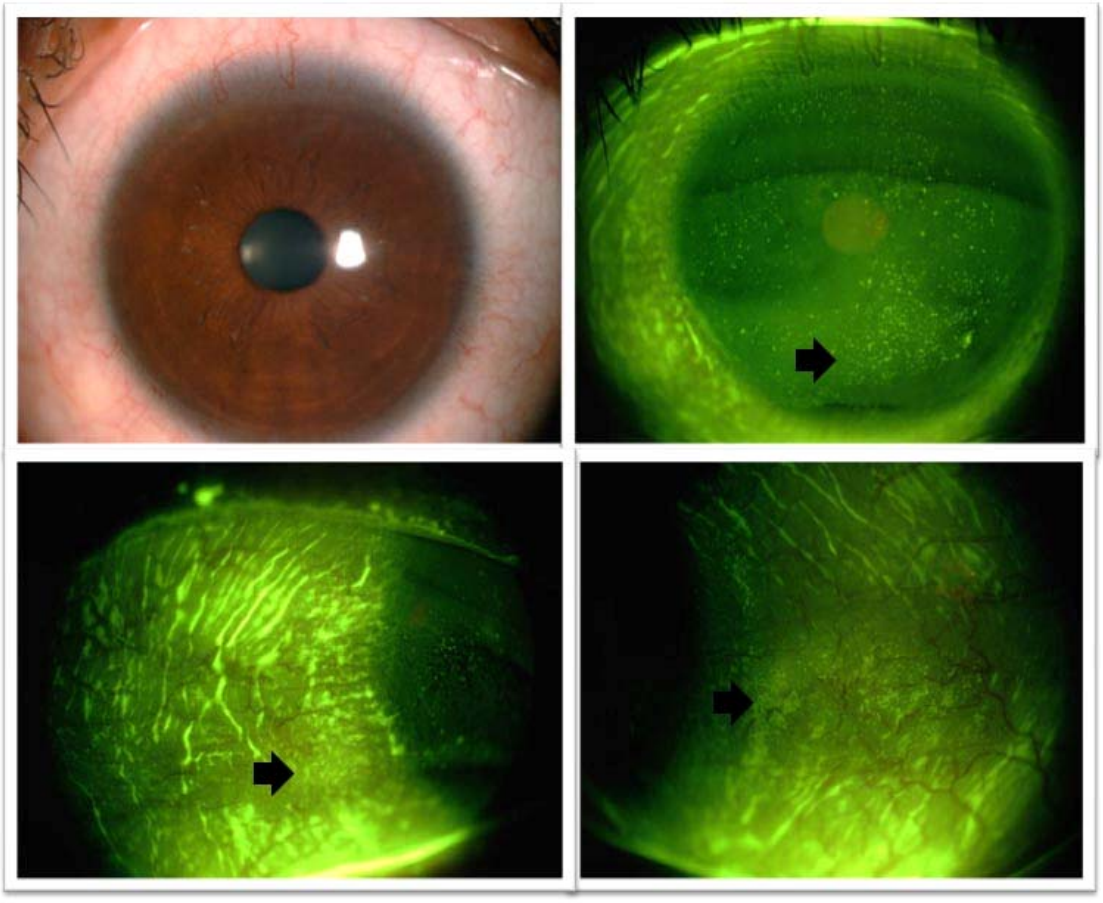

Fig. 1 Fluorescence staining surface epithelium showed as a yellow spot (arrow) on cornea (upper-right) and conjunctiva surface (lower, both) which are evidences of dry eye.

Optic neuropathy and eye movement

Red-green deficiency was found in two patients. Definite non-glaucomatous optic neuropathy was not detected. However, we did find 38 eyes with decreased contrast sensitivity, indicative of some optic nerve disturbance. Twelve patients had a bilateral contrast sensitivity defect.

Bilateral optic disc edema was detected in one patient who had a normal visual acuity and visual field, and no afferent papillary defect. His CT-brain was unremarkable. He was diagnosed to have papilledema (**Fig. 2**)

Discussion

There are numerous eye disorders associated with OSA, which may lead to permanent visual loss. Without proper therapy, the quality of life and life expectancy of these patients is reduced significantly [19]. Various symptoms exhibited by other eye diseases associated with OSA may not be prominent such as obesity [20-23], age [22, 24], and the male gender [22, 25].

For example, OSA may be overlooked in a young and lean person with FES. The patient would be treated only for FES while OSA will contribute to future recurrent FES. This would cause unnecessary inconvenience and expenditure for the patient. If the patient received OSA treatment, both problems would be rectified. Therefore, it would be helpful to know that OSA is associated with FES [6, 7, 26]. Furthermore, OSA treatments can stop the progression of glaucoma and cure it.

Nevertheless, association between glaucoma and OSA has been conflicting. POAG is associated with OSA (20%) [8]. Prevalence for OSA in NTG patients is 50% (age 45-64). Patient >64 years old have a prevalence of 63%. This is consistent with other reports [6, 9, 10, 27]. However, other reports showed prevalence of 1.7-3% [28-32]. Geyer O et al. [23] found the prevalence of OSA in patients with open-angle glaucoma to be the same as in the general population (2%). Also, Pearson J [34] showed the incidence of OSA among NTG patients to be the same as in the healthy population. The reason for this difference is due to the sample size. Collectively, it is not possible to draw any definite conclusions regarding the relationship between glaucoma and OSA.

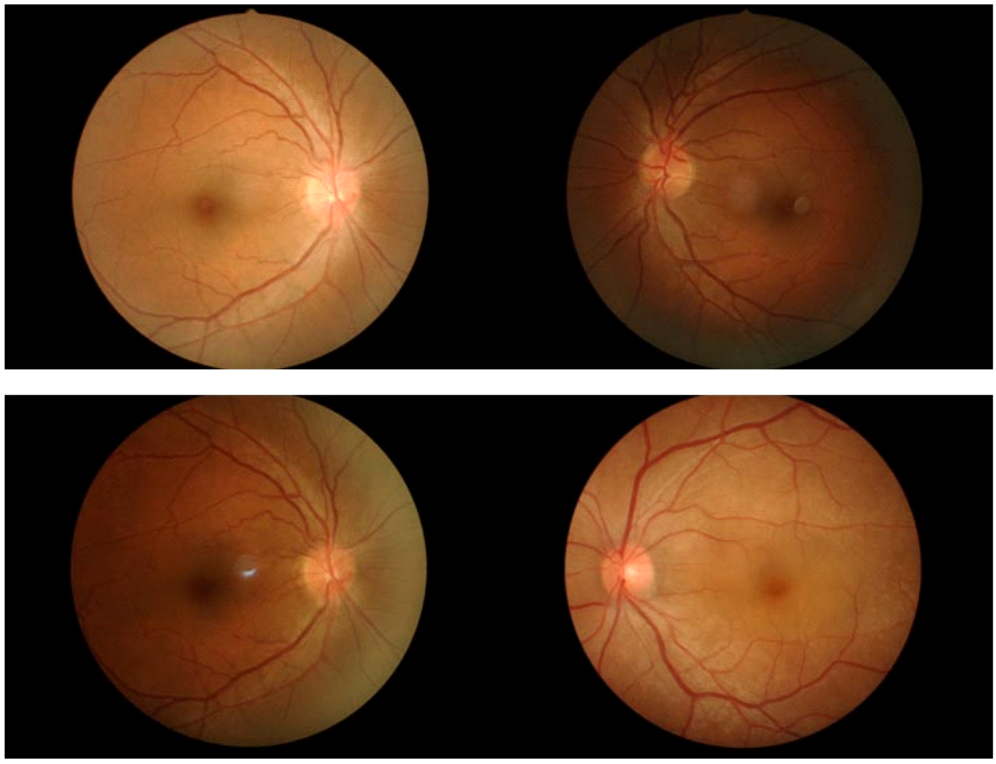

Fig. 2 Fundus photography showed bilateral disc edema and tortuous vessels in OSA patient with papilledema: before (upper) and eight months after treatment of OSA (lower).

Our results for both POAG and normal tension glaucoma were 9%. This value was much higher in patients with OSAS when compared to the normal Thai population but much lower compared to the Caucasian population. Furthermore, we saw a high prevalence of floppy eyelids (53%), dry eye symptoms (37%), rapid tear break-up time (73%) and associated punctuate staining of the cornea (40%). There were no case of clinical and subclinical keratoconus, or non-glaucomatous optic neuropathy. As of note, we found one patient with papilledema. His papilledema was cured when he had OSA treatment. This supports the data that OSA can reverse papilledema.

Our findings should be cautiously interpreted due to some of the limitations encountered within the study. First, our study was an observational cross-sectional study without a control group. Second, we only had hospital-based characteristics for data analysis. Other confounding factors include pre-existing medical diseases that were not on the exclusion criteria. Duration and severity of sleep apnea may influence the results.

In conclusion, there is a higher prevalence of FES, dry eyes, and glaucoma in Thai patients with OSA. Some abnormal endothelial changes and papilledema were detected. All patients with OSAS should be screened for ophthalmologic diseases. Obtaining a sleep history and performing sleep apnea tests may be of importance in patients with floppy eyelids, glaucoma, and those with unexplained optic nerve head changes.

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