

The Literature

BY RAJENDRA K. BANSAL, MD

DIURNAL AND NOCTURNAL VARIATIONS IN AQUEOUS HUMOR DYNAMICS OF PATIENTS WITH OCULAR HYPERTENSION UNDERGOING MEDICAL THERAPY

Gulati V, Fan S, Zhao M, et al¹

ABSTRACT SUMMARY

Gulati et al¹ evaluated the interaction of IOP-lowering medications with physiologic changes during the day and night in aqueous humor dynamics in participants with ocular hypertension. Thirty patients were included in the double-masked, randomized, crossover study. Each participant underwent aqueous humor dynamics measurements at baseline and at 2 weeks of dosing in a random order, which included placebo in the morning and latanoprost 0.004% in the evening, timolol maleate, 0.5% (Falcon Pharmaceuticals) twice daily, or dorzolamide HCL 2% (Falcon Pharmaceuticals) twice daily. Patients administered the eye drops at 9 am and 9 pm each day. The investigators assessed seated and habitual IOP by pneumotonometry, episcleral venous pressure by venomanometry, and aqueous flow by fluorophotometry. The researchers evaluated outflow facility by fluorophotometry and by tonography, and they calculated uveoscleral flow mathematically using the Goldman equation. Other measurements included central corneal thickness by ultrasound pachymetry, anterior chamber depth by A-scan, and blood pressure by sphygmomanometry.

According to the investigators, latanoprost and timolol significantly lowered IOP during the morning; dorzolamide did not. All three medications decreased patients' IOP in the afternoon. During the nighttime, latanoprost significantly lowered seated and supine patients' IOP but was less efficacious than during the daytime. Timolol and dorzolamide had no effect on seated or supine IOP at nighttime.

At baseline, aqueous flow was 47% less at nighttime compared with daytime. Latanoprost had no effect on daytime or nighttime flow, whereas timolol and dorzolamide reduced daytime flow by 25% and 16%, respectively. The investigators did not observe further aqueous humor suppression at nighttime by either timolol or dorzolamide.

The daytime to nighttime differences in outflow facility were not significant at baseline or with any of the drugs, the investigators said. The calculated uveoscleral outflow facility was significantly increased by latanoprost but not

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by timolol and dorzolamide. The nighttime values were significantly lower than daytime values in all three groups.

Central corneal thickness measurements were higher at night compared with daytime. At 2 weeks, none of the drugs affected central corneal thickness, episcleral venous pressure, anterior chamber volume, or seated systolic or diastolic blood pressure.

DISCUSSION

How do these findings compare with the results of similar studies?

Liu et al² were the first to report significantly higher IOP at night in patients in a supine position versus a sitting position during the daytime. More than 60% of glaucoma patients' IOPs peak after office hours.³ This may mean a lower perfusion pressure at the optic nerve head due to a fall in systemic blood pressure at night. It is therefore important that glaucoma specialists be aware of the efficacy of various drugs at night.

The study by Gulati et al provides insight into the daytime and nighttime variations in IOP and aqueous humor dynamics in patients with ocular hypertension. Each of the drugs was used in a masked, crossover manner in the same individuals to derive a direct comparison and minimize variability due to sampling differences. In terms of the daytime reduction in IOP and the effects on aqueous humor dynamics, the results of this study were similar to those of others in the literature. There is a lack of consensus regarding the efficacy of these IOP-lowering drugs at night. Some studies have reported that timolol lowers IOP at night when it is used alone or in a fixed combination with a carbonic anhydrase inhibitor^{4,5} or a prostaglandin analogue.⁶ Other studies, including the present one, did not find any IOP-lowering effects with a β -blocker during the night.⁷ One study found that all medications lowered IOP at all measurement times, but it reported that the IOP-lowering effect of timolol was lower at night and that of dorzol-

amide was lower during the day.⁸ In the present study, the investigators found a mean reduction in IOP (13% seated and 10% supine) at night with latanoprost but not with the other two drugs when compared with baseline. Also, none of the medications affected aqueous flow or outflow facility during the nighttime when compared to baseline.

CONTINUOUS INTRAOCULAR PRESSURE MONITORING WITH A WIRELESS OCULAR TELEMETRY SENSOR: INITIAL CLINICAL EXPERIENCE IN PATIENTS WITH OPEN-ANGLE GLAUCOMA

Mansouri K, Shaarawy T⁹

ABSTRACT SUMMARY

Mansouri and Shaarawy reported their initial clinical results with a wireless ocular telemetry sensor (OTS; Sensimed AG) for continuous IOP monitoring in eyes with open-angle glaucoma (OAG). The OTS is a disposable silicone contact lens with an embedded microelectromechanical system that measures changes in corneal curvature induced by variations in IOP. An antenna, mounted around the eye, receives the data, which are then transmitted to a recorder.

Fifteen consecutive patients with OAG showing disease progression despite medical treatment and controlled IOP during office hours chose to undergo a 24-hour IOP monitoring period with the OTS. Measurements were taken every 10 minutes for 1 minute, resulting in a total of 144 measurements over a 24-hour period. The results were obtained in the form of a graph with an arbitrary unit (not mm Hg). Thirteen (87%) patients completed the 24-hour monitoring period.

The investigators found that, in nine out of 13 patients (69%), the highest signals were recorded during the nocturnal period. Prolonged peaks (> 1 hour) were observed in 12 out of 15 (80%) patients; 75% of prolonged peaks occurred exclusively after office hours. On the basis of these findings, the investigators altered glaucoma therapy for 11 (73%) patients.

DISCUSSION

What is the benefit of monitoring IOP for a 24-hour period?

Telemetry is commonly used in medicine to monitor blood pressure, electrocardiograms, and oxygen saturation in arterial blood continuously for 24 hours. Glaucoma patients' treatment regimen is usually based on IOP measurements performed for a fraction of a minute. Apart from poor compliance, undetected IOP fluctuations, especially during the nighttime, can be a handicap in glaucoma

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management. Presently, clinicians do not have a satisfactory method for recording IOP at night without waking up the patient. Self-tonometry has been a subject of much discussion and research. A satisfactory outcome, however, has not been reported.¹⁰

In this study, the investigators used the OTS device introduced by Leonardi et al¹¹ to record IOP continuously for 24 hours in patients with OAG whose disease was progressing. Spikes in pressure occurred at night in 69% of these patients. Based on the information provided by the OTS, the investigators altered the patients' treatment. A device to monitor IOP for a 24-hour period would help glaucoma specialists effectively tailor treatments for their patients, ultimately improving care. ■

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