



THE IMPACT OF NOCTURNAL IOP VARIATION ON GLAUCOMA PROGRESSION IN CURRENTLY UNDERGOING GLAUCOMA TREATMENT PATIENTS

Ophthalmology

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KEYWORDS

INTRODUCTION

- Glaucoma is defined as a group of progressive optic neuropathies characterized by the degeneration of retinal ganglion cells which results in optic nerve head changes and subsequent visual field loss. It is the leading cause of irreversible blindness worldwide.
- The global prevalence of glaucoma in the population aged 40 to 80 years is 3.54%, and the number of people suffering from glaucoma is estimated to increase to 111.8 million till 2040.
- Intraocular Pressure (IOP) fluctuation, especially nocturnal peaks, may contribute to disease progression, and maybe missed during daytime visits.
- Continuous 24-hour monitoring provides better insights compared to single clinic measurements.
- Supine positioning during sleeping hours is associated with decreased BP and increased IOP which results in decreased perfusion to eye, including the optic nerve. Reduced ocular perfusion pressure increases optic nerve damage and associated vision loss.

OBJECTIVE

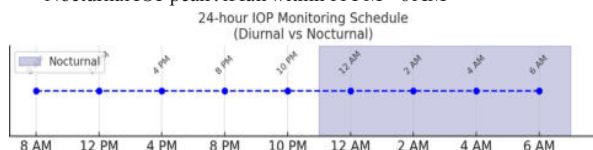
- To measure 24-hour IOP variations using a handheld perkins applanation tonometer.
- To identify nocturnal IOP-related peaks which can be missed during diurnal IOP monitoring.
- To correlate nocturnal IOP peaks with glaucoma progression in ongoing treatment patients.
- To evaluate if there is any gender co-relation in nocturnal IOP peaks in glaucoma patients.
- To evaluate clinical implications for patient management.

MATERIALS AND METHODS

- Inclusion criteria – Treatment ongoing glaucoma patients aged 18 years or older with well controlled IOP during their daytime clinical visits.
- 40 Glaucoma patients (23 male, 17 female), informed written consent were obtained for all patients.

Two group of patients were recruited-

- Progressors** (progressive visual field loss on perimetry, currently on antiglaucoma medications despite controlled daytime IOP)
 - Non – progressors** (clinically stable showing no progression)
- Both eyes: 24-hour IOP monitoring with perkins applanation tonometry done every 4 hourly in daytime and every 2 hourly in night time.
 - Measurements: 8 AM, 12, 4, 8, 10 PM on current (**Diurnal**) and 12, 2, 4, 6 AM (**Nocturnal**)
 - Nocturnal IOP peak : if fall within 11 PM – 6 AM



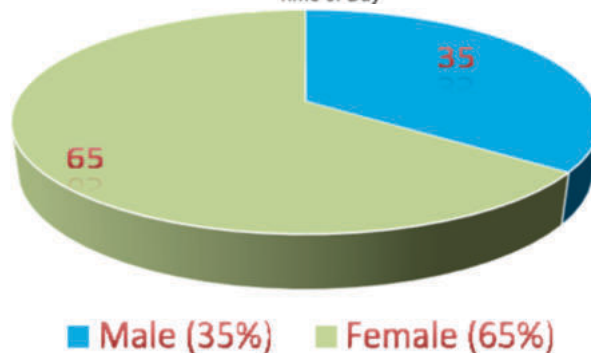
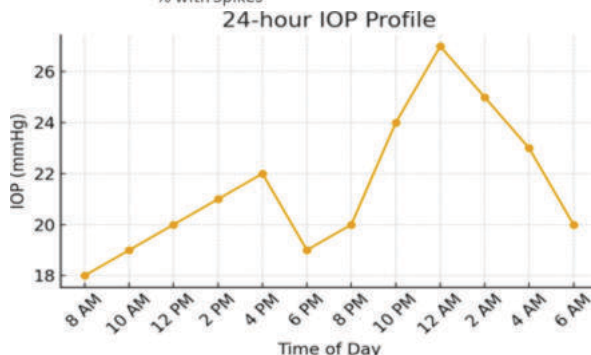
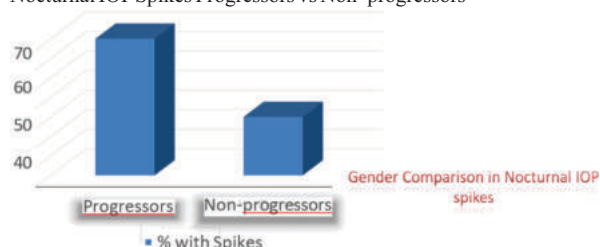
RESULTS

- 80 eyes (40 patients) included in the study
- In patients who are labelled as progressors, 55-60% shows significant nocturnal IOP peaks where in non-progressors only 18-20% shows nocturnal IOP peaks.
- So, we can suggest that there is significant association between nocturnal IOP peaks and progression of glaucoma. Though larger sample size and broad level of research is still required to implement these results in general population
- Also a positive correlation was established between female gender and Nocturnal IOP related spike with a significantly higher

proportion of females (65%) showing night spike than their male (35%) counterparts.

- Early screening and prognosis of glaucoma patients can be improved with monitoring of nocturnal IOP along with diurnal IOP.

Nocturnal IOP Spikes Progressors vs Non-progressors



DISCUSSION

- Fluctuation in IOP over a 24 hour period is a well established phenomenon. Many explanations have been proposed for IOP fluctuations, including autonomic or humoral control, changes in vascular tone, bodily postural changes.
- Supine positioning during sleeping hours is associated with decreased blood pressure and increased IOP, which results in decreased ocular perfusion pressure (OPP). Previous studies theorized that this phenomena might increase optic nerve damage and progressive vision loss.
- It is necessary to use perkins applanation tonometry as a substitute for slit lamp mounted goldsman tonometer or non contact tonometer, as IOP was measured as patients were supine.
- In view of IOP monitoring and assessment of glaucomatous progression, interestingly there are individuals with normal IOP readings or satisfactory IOP control developing visual field deterioration and even irreversible blindness.

Study	Design / Method	Key Findings	Link / DOI / PubMed
Higashide et al., 2024	Prospective, 24-h contact lens sensor (CLS) in NTG	Nighttime variability (SD of IOP signals) predicted faster glaucoma progression	Prediction of glaucoma progression by 24-h contact lens sensor profile in NTG (Scientific Reports) https://pmc.ncbi.nlm.nih.gov/articles/PMC11405842/
Yang et al., 2021	CLS 24 h, nocturnal acrophase analysis	Larger nocturnal variability correlated with faster visual field loss in POAG	Nocturnal Variability of Intraocular Pressure Monitored with Contact Lens Sensor is associated with Visual Field Loss in Glaucoma - PMC
Mansouri et al., 2012 (and follow-on)	Continuous 24 h CLS monitoring in glaucoma	Many glaucoma eyes have nocturnal IOP peaks not captured during office hours	Continuous 24 hour intraocular pressure monitoring for glaucoma with a contact lens sensor: time for a paradigm change Swiss Medical Weekly
Dubey et al., 2020	Treated glaucoma, nocturnal IOP spike analysis	Nocturnal IOP peaks ("night spikes") were more frequent in eyes that progressed despite controlled daytime IOP	
Moon et al., 2015 (IOVS)	Supine nocturnal IOP measurement / posture studies	Elevated nocturnal IOP and acrophase linked with optic nerve damage / VF loss	(This was more of a review / foundational posture work — specific link not retrieved here)

CONCLUSION

- 24-hour IOP monitoring might potentially be a valuable adjunct to spot office IOP measurements as it offers clinicians information on the overall circadian IOP rhythm, timing of IOP peaks, and magnitude of IOP fluctuations in different glaucoma subtypes and in different patients
- 24-hour IOP monitoring detects nocturnal peaks missed in routine visits
- Positive association between nocturnal IOP peaks and glaucoma progression
- Female gender more prone to nocturnal spikes
- Early detection enables targeted treatment to slow disease progression
- Large-scale standardized prospective trials would be essential to better correlate the 24-hour IOP patterns with glaucoma progression

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