48 hours home intraocular pressure and blood pressure monitoring in patients with normal tension glaucoma (NTG)

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Introduction

Pathogenesis of glaucoma is not completely understood despite advancement in glaucoma research. One of the major risk factors of glaucoma is an increase in intraocular pressure (IOP) but a high proportion of patients have glaucoma without a raised IOP. In Japan, NTG accounted for 92% of open angle glaucoma cases and the proportion of patients with NTG is 4 times higher than those with high pressure glaucoma.[1] One of the current major limitation in management of glaucoma is the infrequent number of IOP readings taken which are mainly within clinic hours only. This limited the ability to determine the cause of glaucoma and to formulate the most effective treatment. Using home tonometry, patients are now able to measure their own IOP outside of clinic and thus opened up the possibility of studying IOP fluctuations. [2]

Objectives

There are three objectives to this research.

1. To explore the pattern of intraocular pressure and blood pressure fluctuation in patients with presumed NTG.
2. To determine the proportion of patients with NTG but have increased intraocular pressure above 21mmHg when measured for 48 hours.
3. To determine the timing of peak and trough IOP and ocular perfusion pressure (OPP).

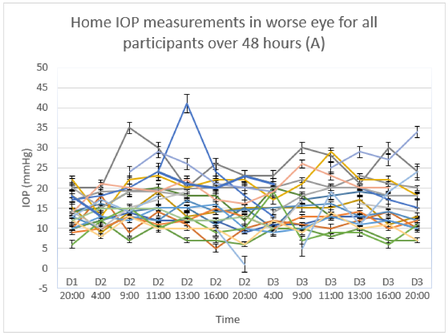
Methods

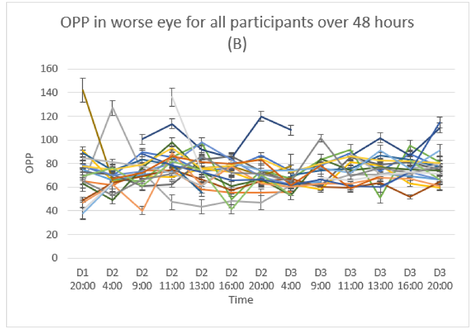
Total of 22 patients with NTG who attended clinics at Princess Alexandra Eye Pavilion (NHS Lothian, Edinburgh) were selected as participants for this research. All participants had measurements of central corneal thickness (CCT), standard automated perimetry, baseline IOP and optical coherence tomography angiography (OCTA) imaging performed. Their ocular medications were also stopped. After a 4-week ocular medications washout period, they attended clinic and the ORA was also used to obtain measurements of corneal hysteresis (CH). They were then taught how to use the IcareHOME, fitted with Ambulatory Blood Pressure monitor programmed and instructed to measure their own IOP at 4am, 9am, 11am, 1pm, 4pm, and 8pm for 2 days. First reading was taken at 8pm making the total IOP readings 13 in 48 hours. Results were collected, separated into worse and better eye and analyzed. Ocular perfusion pressure was also calculated for each patient.

Results

	Worse eye	Better eye	P-value
Gender (female)	12 (54.5%)		NA
Age (years)	65.6 +/- 8.4 (range 50 to 76)		NA
Treated hypertension	9 (41%)		NA
Standard automated perimetry MD (dB)	-6.04 +/- 1.24	-1.90 +/- 0.44	0.002
CCT (um)	557 +/- 7.7	555 +/- 7.6	0.600
CH (mmHg)	9.75 +/- 1.13	9.73 +/- 1.13	0.516
Number of IOP readings	11.3 +/- 1.7		NA
Mean (+/- SD, range) IOP (mmHg)	15.7 +/- 1.0 (range 8.6 to 25.4)	15.4 +/- 0.9 (range 9.8 to 26.1)	0.854
Mean (+/ SD, range) MAP (mmHg)	87.2 +/- 7.6 (range 74.4 to 110.2)		NA
Mean (+/-SD, range) OPP (mmHg)	71.1 +/- 2.6 (range 25.4 to 98.5)	71.3 +/- 12.8 (range 26.1 to 93.0)	0.526
OPP peak (+/- SD, range)	97.6 +/- 18.3 (range 74.3 to 142.0)	96.5 +/- 18.0 (range 73.7 to 142.0)	1
OPP trough (+/- SD, range)	55.9 +/- 11.1 (range 37.7 to 79)	55.0 +/- 11.6 (range 33.3 to 75.0)	1
OPP SD	2.6	12.8	N/A

Table 1. Demographic and clinical characteristics of participants (both eyes of 22 subjects). All measurements were obtained after ocular medication washout.





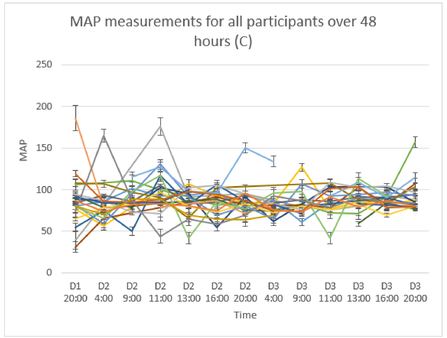


Figure 1. Graphs showing home IOP measurements in worse eye (A), OPP in worse eye (B) and MAP measurements (C) taken over 48 hours for all patients. If either MAP or IOP reading was missing at a particular time, both MAP and IOP will be omitted for that time. OPP readings obtained by using formula [MAP * 2/3 + IOP].

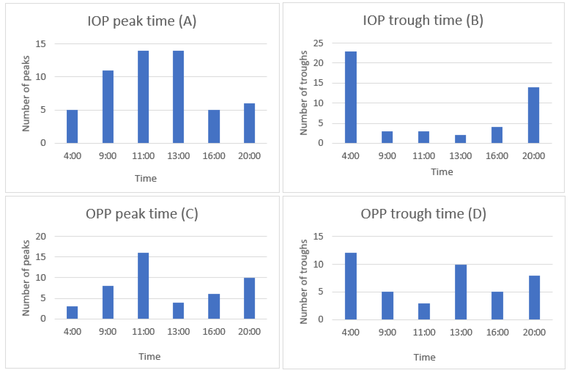


Figure 2. Histograms showing timings of peak IOP measurements (A), trough IOP measurements (B), peak OPP (C) and trough OPP (D). 39/55 (70.1%) of IOP peaks occurs at 9:00, 11:00 and 13:00 whereas 37/49 (75.5%) IOP trough occurs at 4:00 and 20:00.

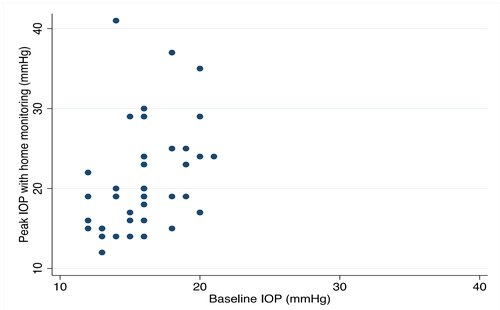


Figure 3. All participants had an IOP of 21mmHg or less at time of diagnosis and their IOP had never exceeded 21 mmHg during follow up. After medication washout and home IOP monitoring, 17 of 44 eyes (38.6%) had a peak IOP >21mmHg. Illustrates the arbitrary nature of defining NTG based on an IOP cut off.

Conclusion

In conclusion, home monitoring is a feasible way to obtain 48 hours intraocular pressure. 38.6% of participants with NTG after washout period had a peak IOP of >21mmHg when monitored for 48 hours. This brings on the question of whether we should be using the term normal tension glaucoma based on a cut off IOP of 21mmHg. The data also shows that peak IOP occurs more frequently at 9:00, 11:00 and 13:00 whereas trough occurs more at 4:00 and 20:00. This tells us that IOP fluctuations also play a role in the diagnosis of NTG as we might not always be measuring patients' peak IOP especially during clinic hours. Further research on IOP monitoring will help us to better understand and manage patients with NTG.

References

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2. Pronin S, Brown L, Megaw R, Tatham A. Measurement of Intraocular Pressure by Patients With Glaucoma. Measurement of Intraocular Pressure by Patients With Glaucoma [Internet]. 2017Aug31 [cited 2019Nov5];135. Available from: https://jamanetwork.com/journals/jamaophthalmology/fullarticle/2650809