

OPHTHALMIC CARE OUTSIDE OF THE CLINIC



Telemedicine and home-based methods of identifying patients at risk of glaucoma and disease progression.

BY KRISTEN ANN V. MENDOZA, MD, AND NISHA CHADHA, MD

PHILADELPHIA TELEMEDICINE GLAUCOMA DETECTION AND FOLLOW-UP STUDY: INTRAOCULAR PRESSURE MEASUREMENTS FOUND IN A POPULATION AT HIGH RISK FOR GLAUCOMA

Hark LA, Myers JS, Pasquale LR, et al¹
Industry support: No

ABSTRACT SUMMARY

This 5-year prospective randomized controlled trial was part of the Philadelphia Telemedicine Glaucoma Detection and Follow-up Study targeting diverse, high-risk populations. A total of 902 individuals were enrolled. They included people older than 40 years of age who identified as African American, Hispanic, or Asian; people older than 65 years of age; and people older than 40 years of age with diabetes or a family history of glaucoma.

Participants were evaluated at visit 1 by an ocular technician and two health educators during an appointment with the participants' primary care physician. Visual acuity was tested, tonometry readings using an iCare Home (Icare USA) were obtained, and fundus photography was performed. Systemic blood pressure was also measured, and participants' medical, ocular, and family history was obtained.

Glaucoma and retina specialists reviewed visit metrics and photographs to determine the presence

STUDY IN BRIEF

- A prospective controlled trial screened patients at high risk of glaucoma at their primary care physician's office. Fundus photography was used to assess the appearance of the optic nerve, and an iCare Home (Icare USA) was used to measure the IOP. At subsequent follow-up visits where a comprehensive examination, Goldmann applanation tonometry, and visual field testing were performed, 10.9% of patients were diagnosed with glaucoma. The inclusion of IOP data increased the odds ratio of glaucoma diagnosis by 4.48 for individuals with an IOP greater than 21 mm Hg and an optic nerve that had a suspicious appearance.

WHY IT MATTERS

The study highlights the ability of telemedicine and portable devices to aid glaucoma screening and diagnosis in at-risk populations. Whereas Goldmann applanation tonometry is not practical in a screening setting, the study demonstrated the utility of rebound tonometry for improving glaucoma detection.

of suspected optic nerve pathology. Participants with an abnormal or unreadable image or an IOP greater than 21 mm Hg were invited to return for a second visit. At that visit, they received a comprehensive examination by a glaucoma specialist or glaucoma fellow that included Snellen visual acuity, Goldmann applanation tonometry (GAT), corneal pachymetry, slit-lamp biomicroscopy, and visual field testing with an Octopus 300 (Haag-Streit) using a 24-2 Swedish interactive thresholding algorithm-standard.

Of the 902 participants, 536 (59.4%) were invited for a second visit, which 347 of them attended. Fifteen participants were fast-tracked to seeing a

community ophthalmologist outside of the study because their IOP was 30 mm Hg or higher at visit 1. After the second visit and using AAO Practice Pattern Guidelines, 38 participants were ultimately diagnosed with glaucoma (14 had an IOP > 21 mm Hg at visit 1), 159 participants were categorized as glaucoma suspects (38 had an IOP > 21 mm Hg at visit 1), and 25 participants were diagnosed with ocular hypertension (22 had an IOP > 21 mm Hg at visit 1).

Elevated IOP at the first visit was significantly associated with a history of diabetes ($P = .011$) but not with age, sex, ethnicity, or a history of glaucoma, hypertension, or smoking. Family

history was not associated with a diagnosis of glaucoma at the second visit.

The odds ratio for being diagnosed with glaucoma at visit 2 was 4.48 for participants whose optic nerve had a suspicious appearance and whose IOP was greater than 21 mm Hg at visit 1. The odds ratio was 2.04 for participants whose optic nerve had a suspicious appearance and whose IOP was 21 mm Hg or less.

DISCUSSION

Did IOP measurement by rebound tonometry improve the detection of glaucoma?

Diagnosing glaucoma can be challenging because the disease course is often asymptomatic, variable, and slowly progressive. Social determinants of health frequently create additional barriers. The study focused on the accessibility of screening and demonstrated the utility of telemedicine for detecting optic nerve abnormalities, along with IOP measurement, as a means of

identifying patients at risk of glaucoma. Of the participants who completed a second visit, 10.9% were diagnosed with glaucoma, and 7.2% were diagnosed with ocular hypertension. When IOP data were included, the odds ratio of being diagnosed with glaucoma was 4.48 among individuals found to have an IOP greater than 21 mm Hg.

Can home tonometry be used in place of GAT?

Although GAT is widely considered to be the gold standard for IOP measurement, home tonometry with the iCare Home can be an effective substitute, and the device's portability facilitates disease screening outside of a clinical setting. In a previous study, IOP readings obtained with home tonometry and GAT were highly correlated with one another, with coefficient r greater than 0.9 and differences measuring only 0.4 mm Hg OD and 0.8 mm Hg OS.² In the study by Hark et al,¹ incorporating IOP

data obtained with home tonometry increased the detection of patients at risk of glaucoma.

How can the study findings advance the care of patients who have glaucoma and glaucoma suspects?

Glaucoma involves multiple risk factors. The study uniquely captured a relatively comprehensive examination without an ophthalmologist at visit 1 by combining fundus photography and IOP readings to triage the participant's acuity of need for examination by an ophthalmologist. The subjectivity in interpretation of optic nerve photographs notwithstanding, individuals with high IOPs or an optic nerve that had a suspicious appearance received the gold-standard GAT and visual field testing required for diagnosis. The study demonstrated an effective use of telemedicine and portable, rebound tonometry to streamline patient access to ophthalmic care and improve the detection of individuals at risk of glaucoma.

HOME SELF-TONOMETRY TRIALS COMPARED WITH CLINIC TONOMETRY IN PATIENTS WITH GLAUCOMA

McGlumphy EJ, Mihailovic A, Ramulu PY, Johnson TV³

Industry support: No

ABSTRACT SUMMARY

A retrospective review compared IOP characteristics obtained with home tonometry versus clinic tonometry in 107 eyes of 61 patients with glaucoma. After demonstrating their ability to use an iCare Home tonometer, patients obtained four mandatory daytime and an optional nighttime measurement over the course of 7 days at home. The IOP measurements were categorized into four time periods: early morning (4:30–8:00 AM), office hours (8:00 AM–5:00 PM), evening (5:00–10:30 PM), and overnight (10:30 PM–4:30 AM).

STUDY IN BRIEF

- ▶ A retrospective study compared IOP measurements obtained by patients with home tonometry to IOP measurements obtained in the clinic with Goldmann applanation tonometry. The maximum IOP reading and IOP range were significantly greater with home tonometry. Based on data obtained during the trials of home tonometry, glaucoma treatment was escalated (ie, additional medication, laser trabeculoplasty, or incisional surgery) for more than half of the participants.

WHY IT MATTERS

Measuring IOP during normal office hours can miss clinically significant IOP fluctuations and new maximum values. The absence of these data may explain why some patients experience glaucomatous progression even though their IOP is on target when measured in the office. Home tonometry can fill this data gap and may reveal IOP variability and peaks, which could provide insight into a patient's clinical stability and guide management. The study findings are even more significant during the COVID-19 pandemic, which has necessitated an exploration of viable tools for telemedicine.

The mean IOP obtained in the clinic, usually measured with GAT,

was slightly higher than the mean IOP obtained at home with an iCare

Home (14.5 vs 13.6 mm Hg, $P = .02$). Maximum IOP in the clinic was significantly lower than at home (17.6 vs 20.8 mm Hg, $P < .001$). The IOP range in the clinic was significantly smaller than at home (6.1 vs 12.9 mm Hg, $P < .001$). In addition, 45 eyes (61%) in the clinic and 55 eyes (74%) at home had at least one IOP measurement that exceeded the target IOP ($P < .001$). The highest mean IOP occurred early in the morning. The mean daily maximum (MDM) home IOP exceeded the mean clinic IOP by 30% in 32 eyes (29.9%).

Male sex, younger age, and a lack of previous glaucoma surgery were more likely to produce significant differences between the MDM home IOP and clinic IOP. In 55 of 95 eyes (58%), escalation of glaucoma therapy in the form of increased medication, laser trabeculoplasty, or surgery followed the home tonometry trials.

DISCUSSION

How were patients selected for home tonometry?

Ophthalmologists ordered home tonometry for several reasons, including the following:

- Concern about occult IOP elevation, a worsening visual field, or retinal nerve fiber layer thinning even though the IOP reading in the clinic met the target;
- The presence of a disc hemorrhage;
- Symptoms of IOP elevation; and
- A desire to quantify the IOP range.

The findings of the study therefore cannot be generalized to all glaucoma patients and may be limited by selection bias.

Were there certain patient characteristics associated with significant differences in clinic versus home tonometry?

Interestingly, male sex, younger age, and an absence of previous glaucoma surgery were more likely to produce significant differences between MDM home and clinic IOP. The retrospective nature of the study, however, precludes the ability to conclude that home monitoring should be focused on this cohort of patients.

How was the accuracy of home measurements addressed?

Home tonometry offers advantages such as allowing patients to measure their own IOP, eliminating the need for a topical anesthetic, and portability. Accurate use of the device, however, is important. The study is unique in that all patients were certified in the use of an iCare Home tonometer. Certification included successfully obtaining three measurements that were within 5 mm Hg of a GAT measurement taken at the same time. Additionally, two novel metrics, MDM and mean daily range, were used in the analysis to keep spurious measurements from artifactually influencing the data.

Did the findings lead to changes in management?

In the study, peak IOP tended to occur early in the morning. Home tonometry had a significantly greater maximum IOP, range of IOP, and frequency at which IOP exceeded the target compared to measurements obtained in the clinic, although mean IOP was slightly but not significantly

lower. More than half the time, in 58% of eyes, these data triggered a change in glaucoma management: additional medication (38%), laser trabeculoplasty (20%), and surgery (42%). Because it has been suggested that diurnal IOP fluctuation decreases after trabeculectomy,⁴ study participants who received incisional surgery might have experienced a cessation of glaucomatous progression. ■

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