

MEASUREMENTS THAT MATTER



Evaluating the utility of different tonometry methods and corneal hysteresis in glaucoma management.

BY EILEEN L. CHANG, MD, AND CHRISTOPHER C. TENG, MD

AGREEMENT OF INTRAOCULAR PRESSURE MEASUREMENT OF ICARE IC200 WITH GOLDMANN APPLANATION TONOMETER IN ADULT EYES WITH NORMAL CORNEA

Badakere SV, Chary R, Choudhari NS, Rao HL, Garudadri C, Senthil S¹

ABSTRACT SUMMARY

This cross-sectional study compared the IOP measurements obtained with an iCare ic200 tonometer (iCare USA) to those obtained with a Goldmann applanation tonometer (GAT) in patients who did or did not have glaucoma. One hundred fifty-six eyes of 156 patients (51 women and 105 men) were evaluated; 96 of the eyes were glaucomatous, and 60 were not. Eyes with significant corneal pathology and other factors that limited the use of GAT were excluded. First, readings with the ic200 device were taken by one clinician who used the consecutive measurement mode. Next, another clinician, masked to the ic200 readings, measured the IOP using a GAT within 5 minutes of the ic200 measurement.

The ic200 measured a higher IOP than the GAT by an average of 1.27 mm Hg. There was a higher correlation in IOP measurement between the ic200 and GAT when the measurement with the latter device was 21 mm Hg or less; in this situation, the difference was 1 mm Hg on average. When the IOP measured by GAT was above 21 mm Hg, the average difference in the devices' readings was 1.8 mm Hg. For every 1 mm Hg increase in GAT IOP, the overestimation of the ic200

STUDY IN BRIEF

- ▶ A cross-sectional study found that the IOP readings taken with an iCare ic200 (iCare USA) were slight overestimations but correlated relatively well with IOP measured by a Goldmann applanation tonometer. The investigators found that, at higher-than-normal IOPs, the degree of overestimation by the ic200 increased.

WHY IT MATTERS

The iCare ic200 is a mobile, user-friendly, handheld device. Various other models of the device have been used for community health screenings, home monitoring, and telehealth. Given the ic200's wide range of potential uses, including for individuals with positional difficulties, data on this model's reliability provide guidance on its use.

increased by 0.04 mm Hg. Age, sex, axial length, and central corneal thickness (CCT) were also measured, and none of these factors was found to change the measurements obtained with the ic200 significantly compared with those obtained with the GAT.

DISCUSSION

Is the iCare ic200 an appropriate substitute for the GAT?

Based on this study, readings taken with an iCare ic200 are within 1 mm Hg of those obtained with a GAT when the IOP is 21 mm Hg or less. This suggests that the ic200 may be used for tonometry in routine patients, community screenings, teleophthalmology, and home visits. A potential advantage of this device is that it uses disposable tips, which may help reduce disease transmission. Moreover, because the ic200 can be used on individuals in a supine position, it can be used for patients who have positioning difficulties.

The initial cost of a GAT is higher than that of an ic200, and the former requires a slit lamp and reusable probes. The ic200's disposable probes, however, are an additional purchase.

How does the ic200 compare with older models of the iCare (eg, ic100 and TA01i)?

Badakere et al reported a higher correlation between IOP readings obtained with the iCare ic200 and the GAT compared to those obtained with previous models of the iCare device. They suggest that software modifications in the ic200 that detect errors in positioning of the device may play a role in its improved agreement with the GAT. Nakakura et al² showed that the iCare ic100 and TA01i models tended to underestimate the IOP compared with a GAT. Other studies have demonstrated that higher IOPs were even less accurate with older models of the iCare device.

THE RELATIONSHIP BETWEEN ASYMMETRIES OF CORNEAL PROPERTIES AND RATES OF VISUAL FIELD PROGRESSION IN GLAUCOMA PATIENTS

Estrela T, Jammal AA, Mariottoni EB, et al³

ABSTRACT SUMMARY

This prospective study correlated asymmetries in corneal hysteresis (CH) with asymmetries in visual field progression in the eyes of patients with glaucoma. Two hundred fifty-two eyes of 126 binocular patients with primary open-angle glaucoma were evaluated. Standard automated perimetry (SAP) was performed using the Swedish Interactive Thresholding Algorithm Standard with a 24-2 testing strategy. CH was measured with an Ocular Response Analyzer (Reichert), and visual field progression was assessed using trend-based analysis of mean deviation (MD) rates of change. Mean follow-up time was 4.3 ± 0.8 years, with an average of 11 visits.

Eyes were defined as better and worse based on the rates of SAP MD change; worse eyes had a more negative slope. The median rate of MD change in better eyes was -0.08 dB/y, whereas the MD change in worse eyes was -0.38 dB/y. There was no statistically significant difference in mean IOP, peak IOP, baseline MD, CH, or CCT between the better and worse eyes. The log of the asymmetry in SAP MD rates of change was significantly positively correlated with CH asymmetry only. In a multivariable model, CH asymmetry remained significantly associated with an asymmetry in the rates of MD change when all other variables were adjusted for.

Estrela et al concluded that CH assessment was more closely related to ocular biomechanics than CCT and that CH assessment provided valuable information for the management of glaucoma. They stated that this study supports CH as a risk factor for glaucoma progression.

STUDY IN BRIEF

- This prospective study indicates that asymmetry in the corneal hysteresis (CH) of the two eyes of the same patient correlates with asymmetric glaucoma progression on standard automated perimetry using the Swedish Interactive Thresholding Algorithm and a 24-2 testing strategy over the course of 4.3 ± 0.8 years.

WHY IT MATTERS

CH is of growing interest in the field of glaucoma because this parameter may provide information on the potential of the optic nerve to withstand elevated IOP. Glaucoma progression in the two eyes of the same patient tends to be asymmetric. This study suggests that CH differences may play a bigger role in this asymmetry than differences in corneal thickness. If further research bears out this idea, then eye care providers should take CH into consideration more frequently when evaluating patients with glaucoma.

DISCUSSION

How is CH related to the risk of glaucoma progression?

CH may serve as an indirect indicator of the viscoelastic properties of the entire eye, including the lamina cribrosa and peripapillary sclera. Higher CH may allow the optic nerve and surrounding structures to withstand a higher IOP and IOP fluctuations, thereby decreasing the rate of optic nerve damage and glaucoma progression. This concept is supported by both the current study³ and previous studies showing that lower CH corresponds with more advanced visual field loss and faster visual field progression.^{4,5}

In which patients should CH be checked?

This study and many others demonstrate the value of measuring CH in patients with various forms of glaucoma, including primary open-angle, normal-tension, and pseudoexfoliation. CH may eventually become a part of the comprehensive glaucoma workup and may become an important factor to consider in the medical and surgical management of the disease. The more important question may be how CH should be used during clinical decision-making. It most likely will be one of many parameters (including age, CCT, visual field indices, IOP, peak IOP, etc.) used to gain a

better understanding of the nature of the disease process. ■

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