

Understanding the Problem of Angle-Closure Glaucoma

An overview of some major issues.

BY HARRY QUIGLEY, MD

By 2040, 32 million individuals will have angle-closure glaucoma (ACG),¹ and half of those blind from glaucoma will have angle closure. Family members of patients with angle closure have a one-in-three chance of having angle closure themselves.² Because this vision loss can be avoided through treatment with laser iridotomy, why are these people still suffering blindness from angle closure?

WHO NEEDS AN IRIDOTOMY?

We ophthalmologists must determine which eyes with shallow anterior chambers and narrow gonioscopic angles need iridotomy. Which in-office tests will help us decide? If most narrow-looking eyes needed an iridotomy, the answer would be simple, but it is not. At this time, the best estimate is that fewer than one in 20 gonioscopically narrow eyes will develop angle closure. The outcome of treating all narrow eyes would be 38 (out of 40) needless iridotomies. Because two-thirds of people with angle closure live in Asia, where care is less accessible, millions of unnecessary iridotomies would be performed in countries with limited health care resources and personnel. Unfortunately, chart review studies and Medicare billing data suggest that ophthalmologists are not performing gonioscopy enough and that many eyes with angle closure are missed or miscoded as open-angle glaucoma.³ The currently accepted categories for angle-closure disease are (1) primary angle-closure suspect, (2) primary angle closure, and (3) ACG⁴:

- An angle-closure suspect has an angle where the trabecular meshwork cannot be seen for half or more of the angle gonioscopically.
- In angle closure, the individual's narrow angle has caused the IOP to rise above normal, the formation of peripheral anterior synechiae, or an overt acute attack.

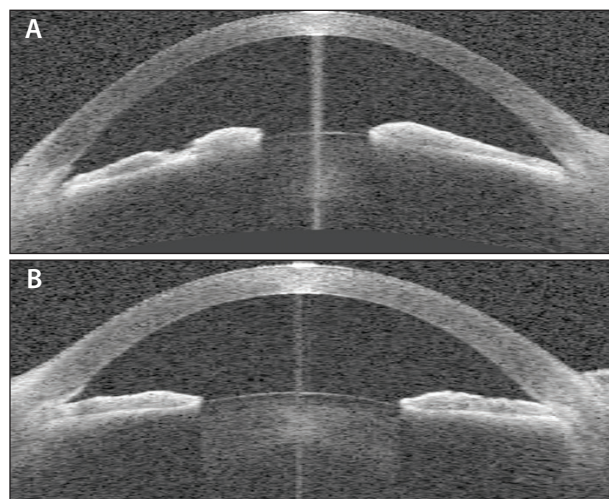


Figure. Anterior segment OCT images of the anterior segment. An eye with a small pupil in bright light (A) and with a large pupil in the dark (B). Quantification of iris area from such pictures shows that the iris normally loses 50% of its area on pupillary dilation from 3 to 8 mm. In eyes that lose very little iris area, the angle is more likely to close, and this feature of poor iris sponginess is found in people with angle closure.

- Patients with ACG have angle closure with actual damage to the nerve (disc or field abnormality).

THE IRIS IS A SPONGE

A better understanding of angle closure rests in recognizing that it is a disease caused by dynamic—not static—features of the eye. Single measurements at one point in time and at one state of illumination cannot separate eyes with angle closure from those without it. Recent evidence suggests that one anatomic

feature that somewhat identifies angle closure along with gonioscopic narrowness is anterior lens position, a high “relative lens vault” by anterior segment optical coherence tomography (OCT).⁵ No static images from ultrasound biomicroscopy (UBM) or OCT, however, have shown a high predictive value. We know the angle is open much wider in bright light (small pupil) than in dim light. When the iris is monitored by video imaging, the angle changes from open to closed in 10 seconds, as the pupil dilates. This transformation tells us that the features that lead to angle closure involve the dynamic behavior of the iris and the choroid.

The iris acts like a sponge, squeezing out extracellular aqueous humor from its stroma when the pupil dilates and taking it up again when the pupil constricts. We can measure a real loss of iris area in cross-sections taken in OCT (Figure). Iris “sponginess” varies, and patients whose irides hold water on dilation are the most likely to develop acute angle-closure attacks, because the iris remains too large and blocks the angle.⁶ Further, Chinese individuals with fluid retention in their irises are more likely to have angle closure than persons of other origins. This is not because all Chinese persons have smaller eyes or abnormal irises but rather that those with small eyes that lack iris sponginess have more angle closure.⁷ Their risk is a combination of physiology and anatomy.

The lack of iris area loss on pupillary enlargement is now being evaluated as a provocative test.

AQUEOUS IS NOT MISDIRECTED

Choroidal expansion is another physiological stimulus for angle closure. It happens like this: the choroid thickens; the IOP immediately rises; aqueous leaves the outflow channels anteriorly; the lens moves forward, increasing pupillary block; and the iris bows forward to close the angle. Sakai et al and Arora et al have published considerable evidence documenting greater choroidal expansion in eyes that have angle closure.^{8,9}

There are many reports of this mechanism caused by topiramate therapy, which produces choroidal expansion and bilateral angle closure. Malignant glaucoma is also initiated by choroidal expansion, with poor fluid transfer through the vitreous gel causing the syndrome to be incorrectly called “misdirected aqueous.” Aqueous cannot be misdirected backward without being able to return forward, so this name should be changed to *vitreous-block glaucoma*.¹⁰

IS IRIDOPLASTY NEEDED?

Will the angles of eyes that look narrow after laser iridotomy creep closed? Is there a role for laser iridoplasty? In 1981, I published an extended follow-up of patients undergoing laser iridotomy. Although a minority of these individuals retained a narrow gonioscopic appearance despite patent iris holes, none of them subsequently developed acute attacks, and few experienced worsening over time. In fact, very few eyes of patients with acute angle-closure attacks, including those that remain narrow after laser iridotomy, will develop glaucoma or detectable progressive disease.¹¹ Although it has been proposed that eyes still narrow after iridotomy have “plateau iris” and need to undergo iridoplasty, there is no evidence that this treatment is needed or that its benefits, if any, outweigh the risks.¹² ■

Harry Quigley, MD, is director of the Glaucoma Center of Excellence and practices at the Wilmer Institute, Johns Hopkins University School of Medicine, Baltimore. Dr. Quigley may be reached at (410) 955-2777; hquigley@jhmi.edu.



Weigh in on
this topic now!



Direct link: <https://www.surveymonkey.com/s/GT30>

How often do you perform gonioscopy?

- ☐ Regularly
- ☐ Sometimes
- ☐ Rarely
- ☐ Never

1. Tham YC, Li X, Wong TY, et al. Global prevalence of glaucoma and projections of glaucoma burden through 2040: a systematic review and meta-analysis. *Ophthalmology*. 2014;121(11):2081-2090.
2. Kavitha S, Zebardast N, Palaniswamy K, et al. Family history is a strong risk factor for prevalent angle closure in a South Indian population. *Ophthalmology*. 2014;121(11):2091-2097.
3. Cassard SD, Quigley HA, Gower EW, et al. Regional variations and trends in the prevalence of diagnosed glaucoma in the Medicare population. *Ophthalmology*. 2012;119(7):1342-1351.
4. Foster PJ, Buhrmann R, Quigley HA, Johnson GJ. The definition and classification of glaucoma in prevalence surveys. *Br J Ophthalmol*. 2002;86(2):238-242.
5. Kim YK, Yoo BW, Kim HC, Aung T, Park KH. Relative lens vault in subjects with angle closure. *BMC Ophthalmol*. 2014;14:93.
6. Quigley HA, Friedman DS, Congdon NG. Possible mechanisms of primary angle-closure and malignant glaucoma. *J Glaucoma*. 2003;12(2):167-180.
7. Seager FE, Jefferys JL, Quigley HA. Comparison of dynamic changes in anterior ocular structures examined with anterior segment optical coherence tomography in a cohort of various origins. *Invest Ophthalmol Vis Sci*. 2014;55(3):1672-1683.
8. Sakai H, Morine-Shinjiro S, Shinzato M, et al. Uveal effusion in primary angle-closure glaucoma. *Ophthalmology*. 2005;112(3):413-419.
9. Arora KS, Jefferys JL, Maul EA, Quigley HA. Choroidal thickness change after water drinking is greater in angle closure than in open angle eyes. *Invest Ophthalmol Vis Sci*. 2012;53(10):6393-6402.
10. Quigley HA. Angle-closure glaucoma—simpler answers to complex mechanisms: LXVI Edward Jackson Memorial Lecture. *Am J Ophthalmol*. 2009;148(5):657-669.
11. Friedman DS, Chew PT, Gazzard G, et al. Long-term outcomes in fellow eyes after acute primary angle closure in the contralateral eye. *Ophthalmology*. 2006;113(7):1087-1091.
12. Ng WS, Ang GS, Azuara-Blanco A. Laser peripheral iridoplasty for angle-closure. *Cochrane Database Syst Rev*. 2012;2:CD006746.