

Diagnostic Workup and Considerations in Angle-closure Glaucoma

A systematic approach can help you discriminate between forms of this disease.

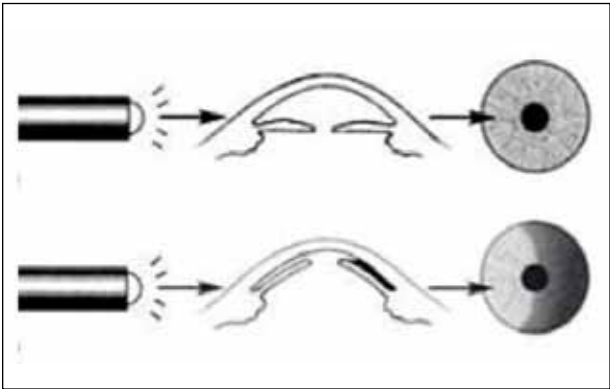
BY DOUGLAS J. RHEE, MD

Angle-closure glaucomas (ACGs) are situations of elevated IOP caused by the physical obstruction of the anterior chamber angle (trabecular meshwork and ciliary body face). When presented with a case of suspected ACG, it is critical to differentiate the various conditions, because their treatment differs. While considering the differential diagnosis (Table 1), you may find it helpful to stratify the various conditions by underlying mechanism and the presence of symptoms.

DIAGNOSTIC WORKUP

History

Symptoms such as pain, seeing halos around lights, and the rapid occurrence of conjunctival hyperemia/



(Courtesy of Janet Hunter, BS, COMT)

Figure 1. Flashlight test.

TABLE 1. GENERAL CATEGORIZATION OF ANGLE-CLOSURE GLAUCOMAS				
Classification	Primary ^a		Secondary ^a	
Onset	Acute	Chronic	Acute to Subacute	Chronic
Conditions	Acute ACG (pupillary block)	Chronic ACG (pupillary block)	Neovascular glaucoma	Iridocorneal endothelial syndrome
		Plateau iris syndrome	Inflammatory glaucomas	Inflammatory glaucomas
			Drug induced	Posterior polymorphous corneal dystrophy
			Aqueous misdirection syndrome	Miscellaneous: tumor associated, anterior segment dysgenesis, Axenfeld-Reiger syndrome, etc.
			Phacomorphic glaucoma	
Abbreviation: ACG, angle-closure glaucoma.				
^a Primary ACG results from unknown factors. Secondary forms are the result of a distinct and otherwise understood pathophysiology.				



Figure 2. In indentation gonioscopy, a Zeiss or Zeiss style (where the radius of curvature of the gonioprism is flatter than the curvature of the cornea [eg, Posner, Sussman, etc.]) lens is used. First, an examination of the angle is performed without pressure on the cornea (A). Under direct observation, gentle pressure is placed on the cornea to indent it (B). This causes a sudden increase in the pressure within the anterior chamber (ie, true anterior chamber that is anterior to the iris) that pushes the iris posteriorly. Reprinted with permission from Rhee DJ, ed. *Color Atlas and Synopsis of Clinical Ophthalmology*. Wills Eye Institute. *Glaucoma*. Philadelphia, PA: Lippincott, Williams & Wilkins; 2012.

injection suggest a rapid change in IOP resulting in corneal edema. In contrast, a gradual elevation of IOP allows the cornea to compensate and not become edematous. Eyes with chronic-onset ACGs can have a surprisingly high IOP but a clear cornea and no symptoms save vision loss due to significant optic nerve and visual field damage.

Question patients regarding pertinent risk factors for the secondary ACGs such as a past medical history of diabetes or uveitis, recent changes in medication, recent ophthalmic surgery, etc.

Office Examination

The presence of a shallow anterior chamber can be inferred from the shadow cast on the nasal iris from a light held temporal and roughly parallel to the plane of the limbus—otherwise known as the *flashlight test* (Figure 1). On slit-lamp examination, many diagnostic aspects for the various etiologies of both primary and secondary forms of angle closure are visible (Table 2).

Gonioscopy is diagnostic for ACGs. With pupillary block acute ACG or its precursor condition (or anatomic configuration), the angle structures may not be visible except with indentation gonioscopy (Figure 2). Gonioscopy is the only way to clinically diagnose plateau iris syndrome. A prominent last iris roll is visible that moves poorly during indentation gonioscopy (Figure 3).

In chronic angle closure, angle structures will not be visible for the majority of the angle, and there will be peripheral anterior synechial adhesion from the chronic apposition of the peripheral iris to the trabecular meshwork. In

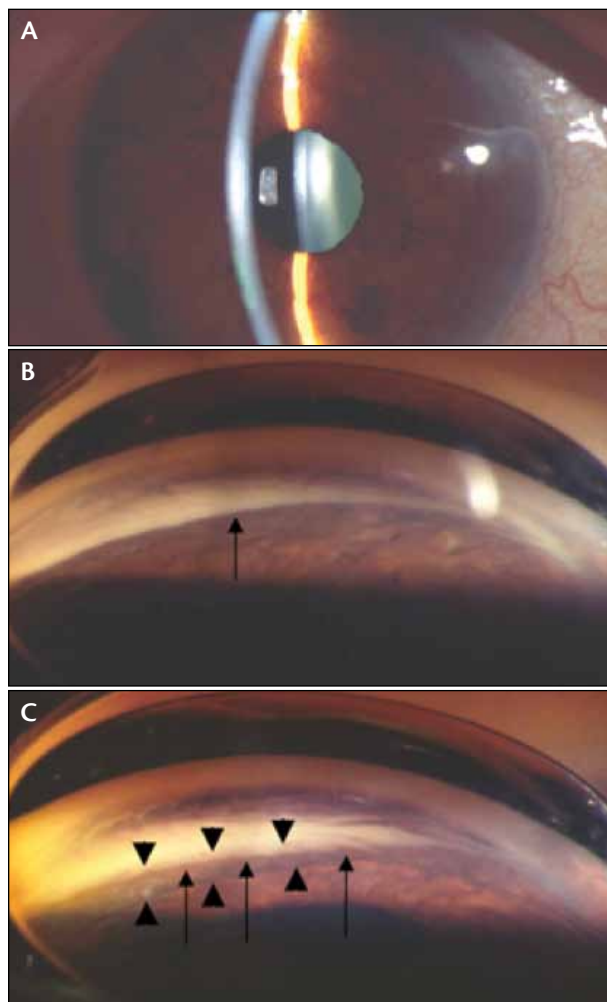


Figure 3. Clinical example of indentation gonioscopy in a patient with plateau iris syndrome. Anterior segment view of a slit lamp shows a deep central anterior chamber and patent peripheral iridotomy at 12 o'clock (A). Absence of visible angle structures. Arrow indicates the last iris roll (B). Indentation gonioscopy reveals angle structures. View is distorted due to corneal striae from the indentation of the goniolens. The downward-pointing arrowheads show Schwalbe line. The arrows indicate the trabecular meshwork, while the upward-pointing arrowheads show the last iris roll (C). Reprinted with permission from Rhee DJ, ed. *Color Atlas and Synopsis of Clinical Ophthalmology*. Wills Eye Institute. *Glaucoma*. Philadelphia, PA: Lippincott, Williams & Wilkins; 2012.

secondary cases, peripheral anterior synechial adhesion will be significant, either from the contraction of a membrane that has grown over the angle (eg, neovascular, iridocorneal endothelial syndrome) or iridocorneal adhesions to areas

TABLE 2. COMMON FINDINGS AT THE SLIT LAMP

Condition	Common Slit-lamp Findings
Neovascular glaucoma	• Neovascularization (ie, fine noncircumferential vessels) of the iris may only be present at the pupillary border in early cases • Circulating red blood cells and proteinaceous aqueous humor in more severe cases • Deep anterior chamber
Inflammatory or uveitic glaucoma	• Circulating white blood cells and proteinaceous aqueous humor (a.k.a. cell and flare, respectively) in the aqueous humor • Posterior synechiae, keratic precipitates • Busacca nodules • Neovascularization of the iris in chronic or severe cases • Typically a deep anterior chamber but can have an acute presentation of a secondary mechanism (ie, nonpupillary block angle closure) where there is complete adhesion of the pupillary border to the lens (ie, complete posterior synechial closure) or, more rarely, if there are uveal effusions or choroidal effusions causing rotation of the ciliary body
Iridocorneal endothelial syndrome	• Irregularities of the iris such as stretch tears (essential iris atrophy), loss of normal iris crypts with appearance of protruding iris through the endothelial membrane (eg, mushroom appearance of iris nevus), "beaten metal" appearance of the corneal endothelium (most prominent with Chandler syndrome) • Typically unilateral, but very rare bilateral cases have been described • Deep anterior chamber
Posterior polymorphous corneal dystrophy	• Coalescent posterior corneal vesicles • Multilayered Descemet membrane thickening with sharp margins, usually bilateral and asymmetric • Islands of abnormal, multilayered endothelial cells surrounded by normal endothelium • Occasional iridocorneal adhesions • Typically autosomal dominant • Deep anterior chamber
Acute angle closure (pupillary block)	• Most prominent diagnostic finding is iris bombé in which the anterior chamber depth is deeper at the pupillary border and shallower in the near midperiphery of the iris • Corneal edema • Conjunctival injection • Middilated and nonreactive pupil • Typically a hyperopic refractive error • Shallow anterior chamber

of abnormality (posterior polymorphous dystrophy, adhesions to defects in endothelial or Descemet membrane thickening, uveitis, adhesions to keratic precipitates on the cornea or trabecular meshwork).

In eyes with narrow angles and suspected intermittent angle closure, you may wish to consider provocative testing in a dark room (to induce pupillary dilation) and

with the patient in a head-down (ie, prone) position so that gravity pulls the iris-lens diaphragm forward to further crowd the angle.

Imaging

Although most forms of ACG can be detected through history and clinical examination, imaging

TABLE 2. COMMON FINDINGS AT THE SLIT LAMP (CONTINUED)

ACUTE ANGLE CLOSURE (NONPUPILLARY BLOCK MECHANISM)	
Condition	Common Slit-lamp Findings
Drug induced	• Shallow anterior chamber but the absence of iris bombé • Typically bilateral
Aqueous misdirection	• Shallow anterior chamber • Typically unilateral with recent history of ipsilateral ophthalmic surgical intervention
Uveitic glaucoma	• Shallow anterior chamber, but can have the appearance of iris bombé
Phacomorphic glaucoma	• Shallow anterior chamber • Typically without iris bombé, but in some cases, there is a component of pupillary block. If pupillary block is present, then iris bombé can be seen. Hallmark is the presence of a very mature cataract
Chronic angle-closure glaucoma	• Shallow anterior chamber, typically bilateral and with a hyperopic refractive error
Plateau iris syndrome	• Deep central anterior chamber but prominent last iris roll with shallow crowding of peripheral angle, typically only seen on gonioscopy • Autosomal dominant in half of cases

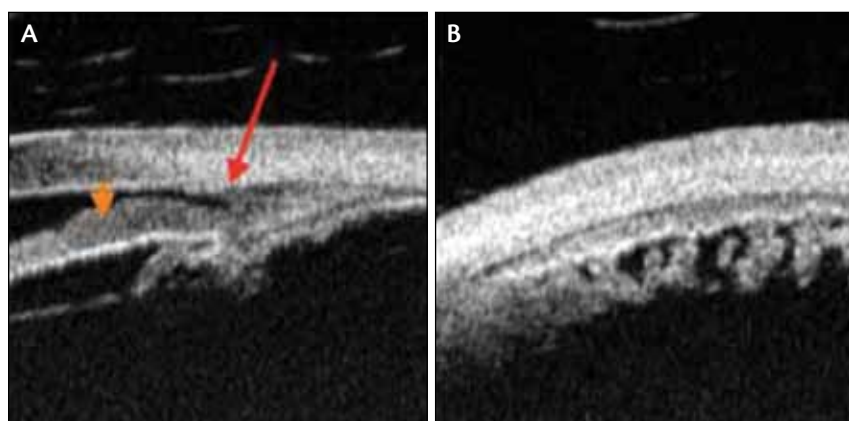


Figure 4. UBM reveals a plateau iris configuration. Moving peripherally from the pupil, the iris (orange arrow) is planar, then angles sharply downward, creating a narrow approach and a slit-like space between the trabecular meshwork and the peripheral iris. The red arrow shows the approximate location of the scleral spur (A). A cross-section of the same eye with ciliary processes of normal width and distribution (B).

can facilitate the diagnosis and your monitoring of some patients. Ultrasound biomicroscopy (UBM) uses 50-MHz ultrasound to provide a tissue resolution of approximately 50 μm and a tissue penetration of 4 to 5 mm. In contrast, typical B-mode ultrasound uses between 8 and 15 MHz with a rough resolution of 100 to 120 μm . During UBM, the sound waves pen-

etrate through the iris to permit visualization of angle structures, the ciliary body, and the anterior pars plana. This is particularly advantageous for the detection of pathology of the ciliary body (eg, swelling, anterior rotation, anterior positioning, subtle uveal effusion, etc.; Figure 4) and structures located in the posterior chamber (eg, ciliary sulcus).

Anterior segment optical coherence tomography uses coaxial light to provide very high-resolution images of the topography of the anterior segment structures. The technology's main disadvantage is that it does not image structures posterior to the iris well. ■

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