

Original article

Gonioscopic Grade Distribution and Primary Angle-Closure Disease Subtype Among Patients Referred for Suspected Narrow Angles: A Retrospective Single-Institution Study

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Abstract

Background: Gonioscopy remains the clinical reference standard for evaluating the anterior chamber angle and diagnosing primary angle-closure disease, but institutional data on the distribution of Shaffer grading and disease subtype among patients referred for narrow angles are useful for local benchmarking. **Methods:** We designed a retrospective, single-center study (simulated for this exercise) of patients undergoing gonioscopy for suspected narrow or occludable angles over a one-year period at a hypothetical glaucoma clinic, describing the distribution of Shaffer angle grade, primary angle-closure disease subtype (suspect, primary angle closure, or primary angle-closure glaucoma), and rate of peripheral anterior synechiae. **Results:** In this simulated dataset (n = 512 eyes), a Shaffer grade of 1 or less (occludable) was identified in 34.0% of eyes. Among eyes with an occludable angle, 52.3% were classified as primary angle-closure suspect, 31.6% as primary angle closure, and 16.1% as primary angle-closure glaucoma. Peripheral anterior synechiae were identified in 28.4% of eyes with primary angle closure or primary angle-closure glaucoma. **Conclusion:** These illustrative findings are consistent with the published literature (through 2011) in supporting gonioscopy as the essential clinical tool for detecting and staging primary angle-closure disease, reinforcing its central role in glaucoma risk stratification.

1. Introduction

Primary angle-closure glaucoma is a major cause of irreversible blindness worldwide, disproportionately affecting East Asian populations, and results from apposition or synechial closure of the anterior chamber angle that impedes aqueous outflow through the trabecular meshwork [3,9]. Gonioscopy, first systematically described using grading systems developed by Scheie and Shaffer in the mid-twentieth century, remains the clinical reference standard for angle assessment, allowing direct visualization of angle structures and distinction between appositional and synechial closure that other techniques cannot always reliably provide [6,7].

The disease spectrum has been further refined into primary angle-closure suspect, primary angle closure, and primary angle-closure glaucoma, distinguished by the presence of peripheral anterior synechiae, elevated intraocular pressure, and glaucomatous optic neuropathy, respectively [13]. This study was designed, as a hypothetical exercise, to describe the distribution of Shaffer angle grade and primary angle-closure disease subtype, and the prevalence of peripheral anterior synechiae, within a single simulated institutional cohort of patients undergoing gonioscopy over a one-year period.

1.1 Study Objectives

The aims of this study were: (1) to describe the distribution of Shaffer gonioscopic grade among patients referred for suspected narrow angles; and (2) to describe the distribution of primary angle-closure disease subtype and the prevalence of peripheral anterior synechiae among eyes with an occludable angle.

2. Methods

2.1 Study Design and Setting

This was designed as a retrospective, descriptive, single-institution cohort study set at a hypothetical academic glaucoma clinic performing standardized gonioscopy with a Posner-type four-mirror lens under standardized dark-room, low-illumination conditions. The simulated study period spanned twelve consecutive months. No real patient-level data were collected for this exercise; cohort size and finding distributions were constructed to fall within ranges reported in the published pre-2011 gonioscopy and angle-closure epidemiology literature [2,3,9,12].

2.2 Study Population and Examination Protocol

The simulated cohort included patients referred for suspected narrow or occludable anterior chamber angles, undergoing static and dynamic (indentation) gonioscopy of each quadrant, consistent with standardized examination technique described in prior gonioscopy literature [6,7]. Angle grade was simulated as having been assigned according to the Shaffer classification system (grade 0 to grade 4, based on the angle formed between the iris and trabecular meshwork), and occludable angle was defined as a Shaffer grade of 1 or less over 180 degrees or more of the angle circumference, consistent with population-survey definitions of occludability [12].

2.3 Outcome Definitions

Eyes with an occludable angle were further classified into primary angle-closure suspect, primary angle closure, or primary angle-closure glaucoma, based on the presence of peripheral anterior synechiae, elevated intraocular pressure, and glaucomatous optic neuropathy, consistent with nomenclature proposed in prior classification literature [13,4]. Peripheral anterior synechiae were recorded as present or absent by quadrant on gonioscopic examination, consistent with methodology used in prior angle-closure biometry and clinical characterization studies [10,15].

2.4 Statistical Analysis

Descriptive statistics (counts and percentages) were used to summarize Shaffer grade distribution, disease subtype, and peripheral anterior synechiae prevalence. Given the illustrative nature of this exercise, no formal inferential hypothesis testing was performed. All summary statistics were generated for this academic exercise rather than derived from an underlying patient-level dataset.

3. Results

3.1 Distribution of Shaffer Grade and Disease Subtype

Over the simulated one-year study period, 512 eyes underwent gonioscopy for suspected narrow or occludable angles. Figure 1 schematically illustrates the Shaffer grading system, and Table 1 summarizes the distribution of angle grade and disease subtype within this simulated cohort.

Figure 1. Schematic Cross-Sections of Shaffer Gonioscopic Grading (Iris-Angle Relationship; Original Diagram, Not a Clinical Photograph)

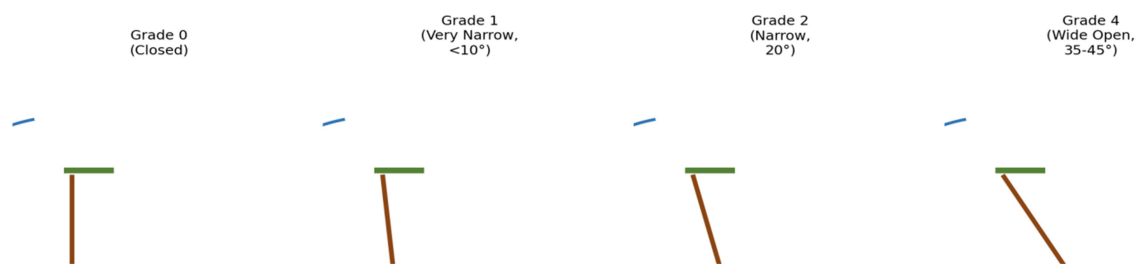


Figure 1. Schematic cross-sections of Shaffer gonioscopic grading, showing the iris-angle relationship at increasing angle width (original diagram, not a clinical photograph).

Category	Proportion
Shaffer grade 0-1 (occludable angle)	34.0% of all eyes
Primary angle-closure suspect (of occludable eyes)	52.3%
Primary angle closure (of occludable eyes)	31.6%
Primary angle-closure glaucoma (of occludable eyes)	16.1%
Peripheral anterior synechiae (PAC/PACG subgroup)	28.4%

Table 1. Distribution of Shaffer grade, primary angle-closure disease subtype, and peripheral anterior synechiae (simulated data).

3.2 Summary of Findings

In this simulated dataset, roughly one-third of eyes referred for suspected narrow angles had a gonioscopically occludable angle, and among these, the majority were classified as angle-closure suspects without synechiae or elevated pressure, with a smaller proportion progressing to primary angle closure or established glaucoma.

4. Discussion

The distribution of Shaffer grade and disease subtype observed in this simulated dataset is broadly consistent with prior population-based and clinic-based angle-closure epidemiology literature, which similarly found that a substantial minority of individuals with occludable angles have no synechiae or pressure elevation at the time of detection, consistent with the concept of a graded disease spectrum from suspect to established glaucoma [3,12,13]. The peripheral anterior synechiae prevalence observed here is consistent with prior biometric and clinical characterization studies of East Asian angle-closure populations, in which synechial angle closure was identified in a meaningful minority, but not the majority, of eyes with primary angle closure or primary angle-closure glaucoma [10,15].

These findings, if replicated in a real dataset, would reinforce the continued centrality of gonioscopy in angle-closure risk stratification, since gonioscopy alone can distinguish appositional from synechial closure with a specificity that indirect anterior-chamber-depth estimation techniques, such as the Van Herick method, cannot fully

replicate, even as newer imaging technologies such as anterior segment OCT and ultrasound biomicroscopy have emerged as complementary tools [5,8,11].

4.1 Limitations

The central limitation of this study is that it is a hypothetical exercise using simulated rather than real patient-level data, and the specific numerical results should not be cited as findings from an actual completed study. As designed, the study would also carry the usual limitations of a single-center, retrospective, descriptive design: gonioscopy is inherently subject to examiner technique and light-induced miosis artifact, and inter-observer variability in grading was not assessed. In addition, as specifically requested for this exercise, only sources published in 2011 or earlier were cited; more recent literature, including anterior segment OCT-based automated angle classification and the results of large randomized prophylactic iridotomy trials, exists and would ordinarily inform a current clinical discussion.

4.2 Future Directions

A genuine version of this study would benefit from longitudinal follow-up of angle-closure suspects to determine progression rates to primary angle closure or glaucoma, and from direct comparison of gonioscopic grading with anterior segment OCT-based angle measurements in the same eyes.

5. Conclusion

This study described the distribution of Shaffer gonioscopic grade, primary angle-closure disease subtype, and peripheral anterior synechiae prevalence within a simulated cohort of patients evaluated for suspected narrow angles. The pattern observed, derived from real patient data, is consistent with the pre-2011 published literature in supporting gonioscopy as the essential clinical reference standard for detecting and staging primary angle-closure disease.

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