

Compliance to Gonioscopy in Patients with Glaucoma Risk Factors: A Clinical Audit from a Tertiary Care Centre

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ABSTRACT

Background: Gonioscopy is the gold standard for anterior chamber angle assessment and is essential for glaucoma screening, diagnosis, and classification. However, it remains underutilized in routine practice, potentially delaying glaucoma diagnosis and treatment. The study aimed to evaluate the proportion of glaucoma suspect patients undergoing gonioscopy for glaucoma screening and diagnosis and to assess the impact of corrective interventions on adherence to gonioscopy examination.

Methods: This prospective observational clinical audit was conducted in the Ophthalmology Outpatient Department of a tertiary care centre over two audit cycles (April-May and August 2025). Adults (>18 years) with glaucoma risk factors were included. Gonioscopy performance and reasons for non-performance were recorded. Between audit cycles, corrective measures comprising staff education, protocol reinforcement, regular reminders, and enhanced patient counselling were implemented. Data were analysed using descriptive statistics and the Chi-square test.

Results: Gonioscopy was performed in 18/85 (21.2%) patients during the first audit cycle and increased to 37/51 (72.5%) following corrective interventions. Clinician-related non-performance decreased from 95.5% to 28.6%. The improvement in gonioscopy adherence between the two audit cycles was statistically significant ($\chi^2 = 32.83$, $p < 0.001$).

Conclusion: Gonioscopy is underutilized in glaucoma suspects, mainly due to clinician-related factors. Staff training, protocol reinforcement, patient counselling, and periodic clinical audits significantly improve adherence and support early glaucoma diagnosis and treatment.

Keywords: Gonioscopy, Glaucoma, Clinical Audit, Compliance, Anterior Chamber Angle, Quality Improvement

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INTRODUCTION

Glaucoma is one of the leading causes of irreversible blindness worldwide and remains a major public health challenge because the disease is often asymptomatic until advanced stages. Recent global estimates indicate that glaucoma is responsible for vision impairment or blindness in millions of individuals, emphasizing the importance of timely detection and treatment.[1-3] In India, glaucoma affects approximately 12 million people, with over 75% of cases remaining undiagnosed, resulting in delayed presentation and avoidable visual disability.[4]

Diagnosis of glaucoma requires comprehensive assessment of the optic nerve head, intraocular pressure, visual fields, retinal nerve fibre layer, and anterior chamber angle. Gonioscopy remains the gold standard for anterior chamber angle evaluation and is essential for differentiating open-angle from angle-closure glaucoma, identifying secondary glaucomas, and guiding appropriate management.[5-7] Since angle anatomy may change over time, gonioscopy should also be repeated during follow-up when clinically indicated.[7,8]

Despite its established clinical importance, gonioscopy continues to be underutilized in routine ophthalmic practice. Factors contributing to its underuse include inadequate clinician training, perceived technical difficulty, time constraints in busy outpatient clinics, and increasing reliance on non-contact imaging modalities such as anterior segment optical coherence tomography (AS-OCT). Although AS-OCT and Van Herick grading are valuable adjuncts, they cannot replace gonioscopy for comprehensive dynamic assessment of the anterior chamber angle.[6,9-12]

Published data on gonioscopy utilization in Indian tertiary care centres are scarce. Most available evidence originates from international studies, which demonstrate that gonioscopy is performed in only a minority of patients during initial glaucoma evaluation despite guideline recommendations.[13] This lack of Indian audit data highlights the need to evaluate adherence to recommended clinical practice, identify barriers to gonioscopy performance, and implement quality improvement strategies.

The present clinical audit was undertaken at our tertiary care teaching hospital as part of the National Accreditation Board for Hospitals (NABH) quality assurance programme to evaluate adherence to gonioscopy among patients with glaucoma risk factors. By identifying deficiencies in routine practice and assessing the impact of targeted corrective interventions through repeated audit cycles, this study aimed to improve compliance with established glaucoma screening protocols and enhance the quality of patient care.

The study aimed to evaluate the proportion of glaucoma suspect patients undergoing gonioscopy for glaucoma screening and diagnosis and to assess the impact of corrective interventions on adherence to gonioscopy examination. The objectives were to determine the proportion of glaucoma suspect patients undergoing goniosco-

py as recommended by standard clinical guidelines, identify the reasons for non-performance of gonioscopy, including clinician-related factors and patient refusal, and compare adherence to gonioscopy examination before and after the implementation of corrective measures across two audit cycles.

MATERIALS AND METHODS

This prospective observational clinical audit was conducted in the Outpatient Department of Ophthalmology at a tertiary care hospital as part of the National Accreditation Board for Hospitals (NABH) quality assurance programme. The audit was approved by the Hospital Clinical Audit Committee (Ref. No. DMC&H/Q&S/2025/366). As the study was conducted as a clinical audit to evaluate adherence to established standards of routine clinical practice without introducing any intervention beyond standard patient care, formal Institutional Ethics Committee approval was not obtained. Written informed consent was obtained from all participants before inclusion in the audit.

The study was carried out in two audit cycles with an interval for implementation of corrective measures between the two cycles. The first audit cycle was conducted from 21st April 2025 to 20th May 2025, and the second audit cycle was conducted from 1st August 2025 to 31st August 2025.

Study Population: All adult patients attending the ophthalmology outpatient department who fulfilled the criteria for glaucoma suspicion were included in the study. Both new and follow-up patients were considered.

Inclusion Criteria include adult patients (>18 years) with glaucoma risk factors were included. These comprised patients with consistently elevated intraocular pressure (IOP >21 mmHg), defined as two or more Goldmann applanation tonometry measurements obtained on separate outpatient visits prior to enrolment, glaucomatous optic disc changes, visual field abnormalities suggestive of glaucoma, a positive family history of glaucoma among first-degree relatives, optic disc haemorrhages, or retinal nerve fibre layer defects.

Exclusion Criteria are those patients with congenital glaucoma, any ocular infections and a history of recent ocular surgery

Sample Size: As this was a prospective clinical audit undertaken as part of the hospital quality improvement programme, no formal sample size calculation was performed. Instead, all consecutive adult patients fulfilling the predefined inclusion criteria during each audit period were included. Accordingly, the sample size was determined by the number of eligible patients attending the ophthalmology outpatient department during the respective audit cycles. The first audit cycle (21 April-20 May 2025) included 85 eligible patients, whereas the second audit cycle (1-31 August 2025) included 51 eligible patients. The lower number of patients in the second cycle

reflected the actual number of eligible glaucoma suspect patients presenting during the audit period, with no changes to the inclusion criteria, audit duration, or sampling methodology between the two cycles.

Method of Gonioscopy: Gonioscopy was performed using indirect gonioscopy with a Goldmann single-mirror goniolens at the slit lamp under topical anesthesia. A coupling agent was applied between the cornea and the lens to eliminate the cornea-air interface and allow visualization of the anterior chamber angle. The patient was seated comfortably at the slit lamp, and the examination was carried out in a dimly lit room using a short slit-lamp beam to minimize pupillary constriction and make iridotrabecular contact more apparent. [5,8]

After instillation of topical anesthetic drops, the inferior aspect of the goniolens was first placed on the inferior sclera, and the lens was gently tilted forward to make contact with the cornea while the patient was instructed to look straight ahead. The examiner visualized the inferior angle through the superior mirror and similarly assessed the superior, nasal, and temporal angles by rotating the lens appropriately. Care was taken to keep the lens as perpendicular as possible to the angle being examined for optimal visualization. All gonioscopic examinations in both audit cycles were performed by the same ophthalmologist using the same standardized examination technique, thereby minimizing inter-examiner variability. Gonioscopy was performed in both eyes for all patients meeting the inclusion criteria, and the findings were used for screening, diagnosis, and classification of glaucoma as open-angle or angle-closure glaucoma. Gonioscopy should be repeated during follow-up when clinically indicated. [5,8]

The defined standard for this audit was gonioscopy examination in both eyes for every patient meeting the inclusion criteria. [7,8,14]

Data Collection: Patients fulfilling the inclusion criteria were recorded daily, and documentation was made regarding whether gonioscopy was performed in both eyes. For patients in whom gonioscopy was not performed, the reason was noted and categorized as either clinician-related (doctor did not perform) or patient-related (patient refusal). All patients who underwent gonioscopy were further evaluated with fundus examination for optic disc analysis, visual field testing (perimetry), and retinal nerve fibre layer optical coherence tomography (RNFL-OCT) for confirmation of glaucoma diagnosis. Patients diagnosed with glaucoma were subsequently initiated on appropriate treatment.

Intervention Between Audit Cycles: Based on findings from the first audit cycle, remedial measures were implemented, including: a) Education and training of medical personnel responsible for performing gonioscopy, b) Reinforcement of the importance of gonioscopy in all glaucoma suspect patients, c) Repeated reminders every alternate day for 4 weeks regarding adherence to gonioscopy protocols, and d) Improved patient counselling

and reassurance regarding the importance and routine nature of the procedure to reduce refusal rates

Statistical Analysis: Data were entered into Microsoft Excel and analysed using IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize the data and are presented as frequencies, percentages, mean, and standard deviation, as appropriate. The Chi-square test was used to compare the proportion of patients undergoing gonioscopy between the two audit cycles. Prior to analysis, the assumptions of the Chi-square test, including adequate expected cell frequencies, were verified. Where these assumptions were not met, Fisher's exact test was considered appropriate. A two-sided p value of <0.05 was considered statistically significant.

RESULTS

During the first audit cycle (21 April-20 May 2025), 85 eligible glaucoma suspect patients were screened. Gonioscopy was performed in a minority of patients, with most eligible patients not undergoing the examination (Table 1). Clinician-related factors were the predominant reason for non-performance, whereas patient refusal was uncommon (Table 2).

Table 1: Gonioscopy performed in the first and in the second audit cycle

Gonioscopy performed	First audit cycle (n = 85) (%)	Second audit cycle (n=51) (%)
Performed	18 (21.2)	37 (72.6)
Not performed	67 (78.8)	14 (27.5)

Table 2: Factors for not performing gonioscopy during the first and second audit cycle

Factors	First audit cycle (n= 67) (%)	Second audit cycle (n= 14) (%)
Doctor didn't perform	64 (95.5)	4 (28.6)
Patient refused	3 (4.5)	10 (71.4)

Table 3: Factors for not performing gonioscopy in 4 patients

Factors	Number of patients
Incapable to sit on slit lamp	2
Bilateral Conjunctivitis	1
Planned cataract surgery	1

Table 4: Factors for patient refusal in 10

Factors	Patients
Wanted gonioscopy on next visit	6
Wanted to bring relative along	2
Gonioscopy examination already done previous month	1
Refused gonioscopic examination at all	1

Table 5: Percentage of patients undergoing gonioscopy examination

Gonioscopy	Cycle 1 (n = 85)	Cycle 2 (n = 51)
Performed	21.2%	72.6%
Not performed	78.8%	27.5%
Chi-square value $\chi^2(df=1)$	32.83	
P value	< 0.001	

Following implementation of corrective measures, including staff education, reinforcement of standard glaucoma evaluation protocols, regular reminders, and enhanced patient counselling, the second audit cycle (1-31 August 2025) included 51 eligible patients. A substantial improvement in gonioscopy adherence was observed, with most patients undergoing the examination (Table 1). Among patients in whom gonioscopy was not performed, patient-related factors became more common than clinician-related factors (Table 2). The remaining clinician-related reasons included inability to sit at the slit lamp, bilateral conjunctivitis, and planned cataract surgery (Table 3), while patient refusal was mainly due to preference for undergoing gonioscopy at a subsequent visit or other personal reasons (Table 4).

Comparison of the two audit cycles demonstrated a significant improvement in compliance with gonioscopy following the corrective interventions. The proportion of patients undergoing gonioscopy increased from 21.2% to 72.6%, while non-performance decreased from 78.8% to 27.5%. This improvement was statistically significant ($\chi^2(1) = 32.83$, p value < 0.001) (Table 5). Furthermore, clinician-related failure to perform gonioscopy markedly declined, indicating improved adherence to standard glaucoma screening protocols after implementation of the corrective measures.

DISCUSSION

This prospective clinical audit demonstrated substantial underutilization of gonioscopy during the initial audit cycle, with only 21.2% of eligible glaucoma suspect patients undergoing the examination despite established recommendations for routine angle assessment.[7,8,14] The predominant reason for non-performance was clinician-related, indicating that inadequate adherence to standard clinical practice, rather than patient refusal, was the principal barrier to gonioscopy utilization.

Our findings are consistent with those reported by Lee et al., who observed that gonioscopy was documented in only 20.4% of patients at the time of initial glaucoma evaluation and in 29.5% within six months despite guideline recommendations.[13] The similarity between our findings and those from a large international cohort suggests that underutilization of gonioscopy is a widespread challenge rather than an institution-specific issue.

Following implementation of targeted quality improvement measures, including staff education, reinforcement of clinical protocols, regular reminders, and enhanced patient counselling, gonioscopy adherence increased

significantly from 21.2% to 72.6%, while clinician-related non-performance decreased from 78.8% to 27.5%. These findings demonstrate that relatively simple institutional interventions can substantially improve compliance with recommended glaucoma evaluation practices. [7,8,14] Similar improvements in adherence to clinical protocols following audit-based quality improvement initiatives have been reported in other healthcare settings, highlighting the value of periodic clinical audits in promoting evidence-based practice.

An important finding of this audit was the shift in the predominant barrier to gonioscopy performance between the two audit cycles. During the first cycle, clinician-related factors accounted for almost all missed examinations, whereas following implementation of corrective measures, patient-related factors became the principal reason for non-performance. This change suggests that the interventions effectively addressed clinician-related deficiencies, leaving patient-related barriers as the remaining challenge. Most patient refusals were due to a preference for undergoing gonioscopy at a subsequent visit or personal circumstances rather than complete refusal, indicating that further improvements may be achieved through enhanced patient education, counselling, appointment scheduling, and reinforcement of the importance of gonioscopy during glaucoma evaluation.

The present study has important clinical implications. Failure to perform gonioscopy in glaucoma suspect patients may delay recognition of angle-closure disease and secondary glaucomas, potentially affecting diagnosis and subsequent management.[14,15] Routine clinical audits provide an effective mechanism for identifying deficiencies in practice, monitoring adherence to established protocols, and evaluating the effectiveness of corrective interventions. Incorporating regular audit cycles into departmental quality assurance programmes may therefore contribute to sustained improvements in glaucoma care.

Although the second audit cycle included fewer eligible patients than the first (51 vs. 85), both audit cycles were conducted over comparable time periods using identical inclusion criteria and audit methodology. The difference in patient numbers reflected the actual number of eligible glaucoma suspect patients attending the outpatient department during the respective audit periods rather than any change in study design or sampling strategy. Nevertheless, variation in patient volume may have influenced the precision and comparability of the audit findings and should be considered when interpreting the results.

LIMITATIONS

This study has several limitations. As a single-centre clinical audit conducted over two relatively short audit cycles, the findings may not be generalizable to other healthcare settings or reflect long-term adherence to gonioscopy. Baseline demographic and clinical characteristics of patients were not formally compared between

the two audit cycles, and the difference in patient numbers may have influenced comparability. Although all gonioscopic examinations were performed by the same examiner using a standardized technique, inter-observer reliability could not be assessed. In addition, clinicians were aware of the ongoing audit, raising the possibility of a Hawthorne effect, whereby awareness of being observed may have contributed to improved compliance during the second audit cycle.

Despite these limitations, the prospective audit design, standardized methodology, implementation of predefined quality improvement interventions, and reassessment through a second audit cycle represent important strengths of the study. The findings demonstrate that periodic clinical audits, combined with targeted educational interventions and protocol reinforcement, can substantially improve adherence to gonioscopy and support quality improvement in glaucoma care.

CONCLUSION

This clinical audit demonstrated that gonioscopy, despite being an essential component of glaucoma evaluation, remains significantly underutilized in routine ophthalmic practice. During the first audit cycle, only 21.2% of eligible glaucoma suspect patients underwent gonioscopy, with clinician-related non-performance being the major contributing factor. Following implementation of corrective measures, including staff education, reinforcement of standard clinical protocols, and improved patient counselling, a substantial improvement in gonioscopy adherence was observed, with a marked increase in compliance and a reduction in clinician-related omissions. These findings highlight that regular training of ophthalmologists, optometrists, and allied ophthalmic personnel, together with continuous reinforcement of clinical protocols, can significantly improve adherence to standard glaucoma screening practices. Periodic clinical audits and re-audits should therefore be incorporated into routine ophthalmic practice to sustain quality improvement, promote timely glaucoma diagnosis, and optimize patient care.

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Availability of data: The data that support the findings of this study are available from the corresponding author on reasonable request.

Declaration of Non-use of generative AI Tools: This article was prepared without the use of generative AI tools for content creation, analysis, or data generation. All findings and interpretations are based solely on the authors' independent work and expertise.

REFERENCES

1. Vision Loss Expert Group of the Global Burden of Disease Study; GBD 2019 Blindness and Vision Impairment Collaborators. Global estimates on the number of people blind or visually impaired by glaucoma: A meta-analysis from 2000 to 2020. *Eye (Lond)*. 2024 Aug;38(11):2036-2046. DOI: <https://doi.org/10.1038/s41433-024-02995-5> PMID: 38565601 PMCID: PMC11269708
2. Barquet-Pizá V, Siegfried CJ. Understanding racial disparities of glaucoma. *Curr Opin Ophthalmol*. 2024 Mar 1;35(2):97-103. DOI: <https://doi.org/10.1097/ICU.0000000000001017> PMID:37922412
3. Quigley HA, Broman AT. The number of people with glaucoma worldwide in 2010 and 2020. *Br J Ophthalmol*. 2006 Mar;90(3):262-267. DOI: <https://doi.org/10.1136/bjo.2005.081224> PMID:16488940 PMCID: PMC1856963
4. Senjam SS. Glaucoma blindness-A rapidly emerging non-communicable ocular disease in India: Addressing the issue with advocacy. *J Family Med Prim Care*. 2020 May 31;9(5):2200-2206. DOI: https://doi.org/10.4103/jfmpc.jfmpc_111_20 PMID:32754474 PMCID:PMC7380776
5. Lopes JG, Guedes RAP, Matsumoto RTN, Francesco T. Diagnostic and surgical gonioscopy. Recent advances and perspective. *Rev. bras. oftalmol*. 2024;83:e0026. DOI: <https://doi.org/10.37039/1982.8551.20240026>
6. Keller MJ, Gast TJ, King BJ. Advancements in high-resolution imaging of the iridocorneal angle. *Front Ophthalmol (Lausanne)*. 2023 Aug 21;3:1229670. DOI: <https://doi.org/10.3389/fopht.2023.1229670> PMID:38983074 PMCID:PMC11182319
7. Murthy GJ, Ariga M, Singh M, George R, Sarma P, Dubey S, et al. A deep dive into the latest European Glaucoma Society and Asia-Pacific Glaucoma Society guidelines and their relevance to India. *Indian J Ophthalmol*. 2022 Jan;70(1):24-35. DOI: https://doi.org/10.4103/ijo.IJO_1762_21. Erratum in: *Indian J Ophthalmol*. 2022 May;70(5):1870. DOI: <https://doi.org/10.4103/0301-4738.343879>. PMID: 34937204 PMCID: PMC8917547
8. Pazos M, Traverso CE, Viswanathan A; European Glaucoma Society; Guidelines Task Force; Guidelines Writers, Authors and Contributors; Guidelines Internal Reviewers; Experts by Experience group (patients' panel); Team of Clinica oculistica of the university of Genoa for medical editing and graphics; External Reviews; EGS Executive Committee; Board of The EGS Foundation. European Glaucoma Society - Terminology and guidelines for glaucoma, 6th Edition. *Br J Ophthalmol*. 2025 Sep 8;109(Suppl 1):1-212. DOI: <https://doi.org/10.1136/bjophthalmol-2025-egsguidelines> PMID:41026937
9. Benitez-Del-Castillo J, Nowrouzi A, Rodriguez-Calzadilla M, Mota-Chozas I, Pinazo-Duran MD. Detection of occludable angle with anterior segment optical coherence tomography and Pentacam as non-contact screening methods. *Int Ophthalmol*. 2022 Jul;42(7):2093-2105. DOI: <https://doi.org/10.1007/s10792-021-02208-y> PMID:35043245 PMCID:PMC8766219
10. Desmond T, Tran V, Maharaj M, Carnt N, White A. Diagnostic accuracy of AS-OCT vs gonioscopy for detecting angle closure: a systematic review and meta-analysis. *Graefes Arch Clin Exp Ophthalmol*. 2022 Jan;260(1):1-23. DOI: <https://doi.org/10.1007/s00417-021-05271-4>. Erratum in: *Graefes Arch Clin Exp Ophthalmol*. 2022 Jan;260(1):385. DOI: <https://doi.org/10.1007/s00417-021-05432-5>. PMID: 34223989 PMCID: PMC8255337

11. Cutolo CA, Bonzano C, Scotto R, Iester M, Bagnis A, Pizzorno C, et al. Moving beyond the Slit-Lamp Gonioscopy: Challenges and Future Opportunities. *Diagnostics (Basel)*. 2021 Dec 6;11(12):2279. DOI: <https://doi.org/10.3390/diagnostics11122279> PMID:34943516 PMCID:PMC8700682
12. Dhalla A, Evans T, Pilling J, Auger G. Comparison of anterior segment optical coherence tomography versus technician led gonioscopy as a triage tool for anterior chamber angle status. *Eye (Lond)*. 2025 Aug;39(12):2474-2478. DOI: <https://doi.org/10.1038/s41433-025-03906-y> PMID:40624244 PMCID:PMC12325918
13. Lee JH, Yoo K, Lung K, Apolo G, Toy B, Sanvicente C, et al. Patterns and Disparities in Recorded Gonioscopy During Initial Glaucoma Evaluations in the United States. *Am J Ophthalmol*. 2024 Aug;264:90-98. DOI: <https://doi.org/10.1016/j.ajo.2024.02.032> PMID:38423202 PMCID:PMC11257810
14. Gedde SJ, Chopra V, Vinod K, Bowden EC, Kolomeyer NN, Challa P, et al. Primary Angle-Closure Disease Preferred Practice Pattern®. *Ophthalmology*. 2026 Apr;133(4):P153-P201. DOI: <https://doi.org/10.1016/j.ophtha.2025.12.030> PMID:41665581
15. Chansangpetch S, Rojanapongpun P, Lin SC. Anterior Segment Imaging for Angle Closure. *Am J Ophthalmol*. 2018 Apr;188:xvix. DOI: <https://doi.org/10.1016/j.ajo.2018.01.006> PMID:29352976