

EFFECTIVE GLAUCOMA SCREENING IN A RESOURCE-POOR SETTING



Any contact an individual has with the health care system must be optimized.

BY RONNIE GEORGE, MD; AND NIKHIL S. CHOUDHARI, DNB

Glaucoma is one of the leading causes of irreversible blindness across the globe.¹ In India alone, about 11 million people have glaucoma and another 24 million are at risk of glaucoma.² Angle-closure glaucoma is associated with a greater risk of blindness than open-angle glaucoma, and it accounts for one-third to one-half of the population with the disease.^{1,2} Approximately 90% of patients with glaucoma in India remain undiagnosed.² Therefore, it is necessary to develop efficient screening mechanisms to improve the detection rate and minimize visual morbidity. A large percentage of the Indian population lives in rural areas with poor access to care, whereas urban areas have a higher concentration of medical facilities and ophthalmologists. This problem is compounded by the lack of a single screening test to detect glaucoma.³

OPTIC DISC ASSESSMENT

Of the available diagnostic methods, evaluation of the optic disc is considered to be the most important parameter for detection of glaucoma. The optic disc can be assessed clinically with the use of disc photography and other imaging modalities. Off-site assessment of fundus photography has proven to be a successful model for detection of diabetic retinopathy in resource-poor settings with limited access to care. However, in a teleophthalmology model for detection of glaucoma, the accuracy of optic disc photography was only moderate.⁴

The use of deep learning techniques for automated optic disc classification could improve diagnostic accuracy.⁵ It could also reduce the dependence on a trained reader. However, this approach must be further tested and validated in larger populations.

In various studies conducted in resource-poor areas, a large proportion of clinical images were ungradable due to the presence of media opacities. It is possible to improve the quality of these images by taking dilated optic disc photographs. Dilatation, however, presents the added risk of inducing iatrogenic primary acute angle closure in a population with high rates of angle-closure glaucoma. Therefore, any screening program in these regions should address both forms of the disease.

THE VAN HERICK TECHNIQUE

Detection of primary angle-closure glaucoma is based on assessment of

the anterior chamber angle, and gonioscopy is the reference standard for its evaluation. However, gonioscopy requires high skill and experience. Moreover, the amount of light falling on the pupil and the amount of indentation on the cornea can adversely affect the assessment of narrow angles. The Van Herick grading technique is a practical alternative to gonioscopy in a resource-poor setting. This method involves a slit-lamp based comparison of the peripheral anterior chamber depth and the thickness of the cornea, and it is a quick and simple procedure.

The specificity and positive likelihood ratio of the Van Herick test was considerable in the detection of pre-disease states of primary angle-closure glaucoma using dark room four-mirror indentation gonioscopy as the reference standard (Table).⁶ Van Herick grading can also be performed through teleophthalmology. With this approach, a photograph of the peripheral anterior chamber is captured

TABLE. COMPARISON OF SCREENING METHODS

Parameter (Metric)	Sensitivity (95% CI)	Specificity (95% CI)	LR+	LR-
Goldmann applanation tonometry ³ (IOP >21 mm Hg)	46% (22–71%)	95% (89–97%)	9.20 (NS)	0.56 (NS)
Optic disc photography ³ (Vertical cup to disc ratio ≥0.6)	73% (61–83%)	89% (50–99%)	6.60 (NS)	0.30 (NS)
Van Herick technique ⁶ (Cut-off grade 2)	73.9% (61.9%, 83.7%)	85.7% (71.5%, 94.6%)	5.17 (2.43%, 11%)	0.30 (0.20%, 0.46%)

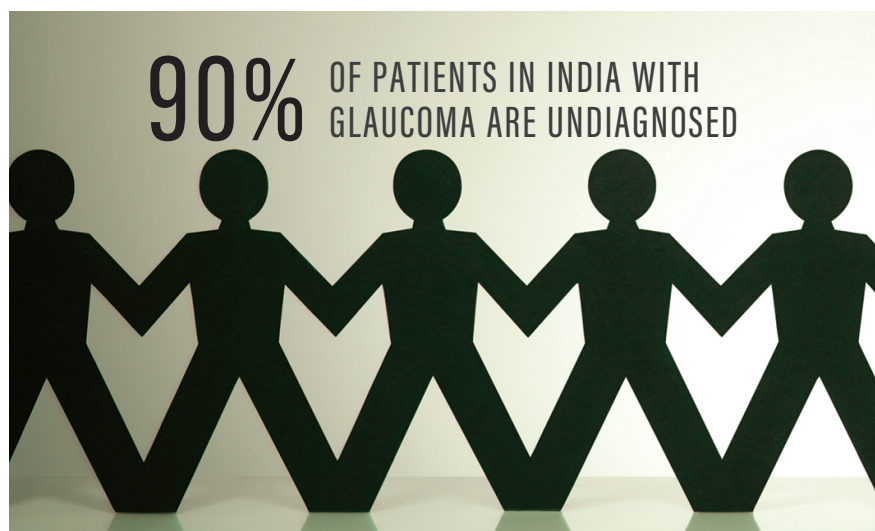
Abbreviations: CI, confidence interval; LR+, positive likelihood ratio; LR-, negative likelihood ratio; NS, not specified

by a slit lamp–mounted camera. A thin slit beam of illumination is focused just within the temporal limbus, offset by 60°, and the patient maintains a straight gaze. The digital photographs are then sent electronically to an ophthalmologist or a glaucoma specialist for evaluation. In one study, the intraobserver and interobserver agreement using weighted kappa in 100 slit-lamp photographs graded with the Van Herick technique was 0.76 and 0.56, respectively.⁷

We have developed a mobile application that can automatically quantify the peripheral anterior chamber depth upon uploading an appropriate clinical image.⁷ However, given the prevalence of primary angle-closure glaucoma, the test is more useful for ruling out the disease (negative predictive value: 97%) than for confirming the disease (positive predictive value: 28%).⁷

A strategy of combining diagnostic tests could be a viable solution. The specificity and positive likelihood ratio of a combined Van Herick test and central anterior chamber depth measurement was 99.3% and 28.25%, respectively, with a positive predictive value of 86%.⁸ A combination testing strategy may work for the detection of open-angle glaucoma as well. For example, combining applanation tonometry (95% specificity)³ and optic disc photography (89% specificity)³ can yield a combined specificity of 99.5%.

Various strategies have been proposed to improve the glaucoma



detection rate. Opportunistic screening is one approach, in which every person who seeks professional eye care undergoes a comprehensive eye examination that includes optic disc evaluation. Because more than 6 million cataract surgeries are performed in India annually and most of these patients are older than 40 years, concentrating on this group could significantly increase the case detection rate. Additionally, targeted screening of family members of patients with primary open-angle glaucoma has been shown to increase the disease detection rate to 13%.⁹

CONCLUSION

In resource-poor settings, it is important that any contact an individual has with the health care system be optimized. This requires multiple strategies

to be employed, including performing opportunistic screening, targeting high-risk groups, combining tests, and advancing technological innovation for disease-specific solutions. ■

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AT A GLANCE

- ▶ In India, glaucoma remains largely undiagnosed, as a majority of the population lives in rural areas with poor access to health care and there is no single screening test to detect glaucoma.
- ▶ With opportunistic screening, every individual who seeks professional eye care undergoes a comprehensive eye examination that includes optic disc evaluation.