

Racial Differences in the Optic Nerve

Efforts to detect early glaucoma.

BY CHRISTOPHER A. GIRKIN, MD

The management of glaucoma represents one of the most important public health problems facing the delivery of eye care, both in the US and worldwide, and the disease represents the third most common reason to visit an ophthalmologist in this country.¹ According to recent estimates, approximately 68 million people worldwide have glaucoma in some form, with 6.7 million people bilaterally blind from the disease.² Approximately half of these individuals have primary open-angle glaucoma, making it a leading cause of blindness worldwide. In the US alone, almost 2.5 million people are afflicted with open-angle glaucoma, and approximately half of these individuals are unaware that they have the disease.

Glaucoma disproportionately affects blacks, who are at much greater risk of developing the disease³⁻⁶ as well as of going blind from glaucoma.⁷ The disease remains the leading cause of irreversible blindness among blacks, while it is the third leading cause among whites. This article focuses on racial differences in the optic nerve that may play a role in blacks' greater level of risk for glaucoma.

HOW OPTIC DISCS DIFFER

Several clinical and histological studies have characterized racial differences in optic disc structure between blacks and whites. A quantitative evaluation of conventional optic disc photography from the Baltimore Eye Survey demonstrated that mean optic disc area was 12% larger in the black population.⁸ Cup area was greater as well. Although global rim area was similar in both racial groups, due to the relatively larger optic disc in blacks, there was a decrease in rim/disc area; this finding indicates a potential decrease in rim thickness and nerve fibers relative to disc size in this population. In a smaller study including 200 normal subjects that also used disc photography, Beck et al⁹ demonstrated an increased cup-to-disc ratio in blacks relative to whites. Finally, a postmortem histological study of 30

whites and 30 blacks demonstrated an increase in the vertical but not in the horizontal diameter of the optic disc in the black population.¹⁰

IMAGING TECHNOLOGIES

Imaging techniques aimed at the optic disc and nerve fiber layer have evolved to acquire quantitative topographic information on optic disc structure and in vivo measurements of retinal nerve fiber layer (RNFL) thickness to improve physicians' ability to detect glaucoma and progressive glaucomatous damage. Studies evaluating these technologies have been performed in predominantly white subjects; they have not included adequate numbers of black subjects to evaluate the role of quanti-

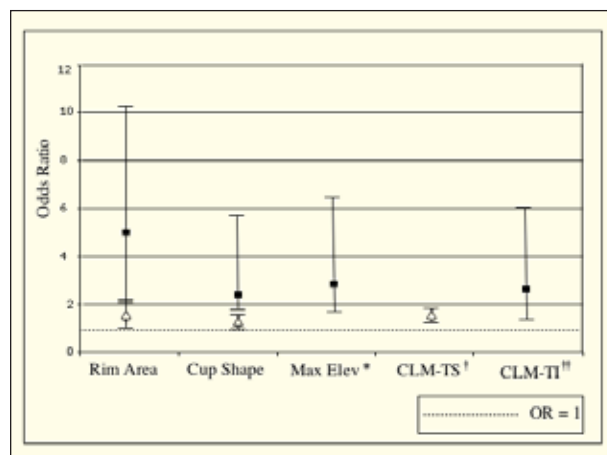


Figure 1. For comparison, the author's group used these odds ratios and 95% confidence intervals for the significant parameters in the final race-specific models for blacks (△) and whites (■).

*Max Elev = maximum elevation along the contour line.

†CLM-TS = contour line modulation ratio-temporal-to-superior.

††CLM-TI = contour line modulation ratio-temporal-to-inferior.

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tative optic disc analysis, the parameters that are most predictive of glaucoma, and the optimal analytical strategies for detecting glaucoma in this at-risk population.¹¹⁻¹⁸

The differences in optic disc structure between blacks and whites found in studies using conventional photographic and histologic methods may affect the ability of these imaging techniques to detect glaucoma. For example, Broadway et al¹⁹ demonstrated that the discriminating ability of confocal scanning laser ophthalmoscopy varied depending on the phenotype of optic disc damage present. In addition, Lester et al²⁰ demonstrated that optic disc area has an effect on the diagnostic precision of confocal scanning laser ophthalmoscopy, an important finding considering reported differences in the optic disc area between blacks and whites.⁸

“We discovered racial differences in the optic-disc structural parameters that are independently predictive of early glaucoma between blacks and whites, even after accounting for differences in optic disc area.”

Additionally, Chi et al²¹ examined 30 whites and 31 blacks without any ocular disease by means of a prototype device for confocal scanning laser ophthalmoscopy and found a relative increase in cup-to-disc ratio among blacks. Tsai et al²² found similar results using the first-generation Heidelberg Retina Tomograph (HRT; Heidelberg Engineering GmbH, Dossenheim, Germany). Their study of 43 black subjects and 44 whites found a significantly larger disc area, cup-to-disc ratio, cup area, and cup volume in blacks but a similar rim area and volume in both groups. In a later review, these researchers noted that the differences were not significant when adjusted for the relationship of these parameters with group differences in optic disc area.¹⁸ They suggested that rim area may be a more robust parameter when using this instrument for determining optic nerve status across different racial groups.

In another study, Poinoosawmy et al²³ examined the peripapillary retinae of 150 healthy volunteers with scanning laser polarimetry. The investigators found a significant decline in RNFL thickness similar to prior histologic studies. They also noted a significantly thinner RNFL measurement—specifically, less retardation—in subjects of Afro-Caribbean descent. Investigators, how-

ever, employed an instrument that used fixed compensation of anterior segment birefringence. The weakness of this technique is well known and may lead to erroneous measurements of RNFL thickness. The current scanning laser polarimeter uses a variable corneal compensator (GDx VCC; Laser Diagnostic Technologies, San Diego, CA) that scans the macular region to estimate and then subtract out the effect of anterior segment birefringence on the retardation measurements.

NERVE STRUCTURE AND EARLY GLAUCOMA

My colleagues and I recently conducted a study (1) to determine the structural characteristics of the optic disc that are associated with early glaucoma in blacks and whites and (2) to ascertain whether these characteristics differ between the two races.²⁴ We discovered racial differences in the optic-disc structural parameters that are independently predictive of early glaucoma between blacks and whites, even after accounting for differences in optic disc area. Although the most predictive parameter (rim area) was the same for each racial group, the magnitude of association was higher in whites (Figure 1). This difference in the relationship between measures of optic disc structure and visual function between blacks and whites indicates that topographic features of the optic disc convey different information with regard to assessing the risk of early glaucoma in blacks.

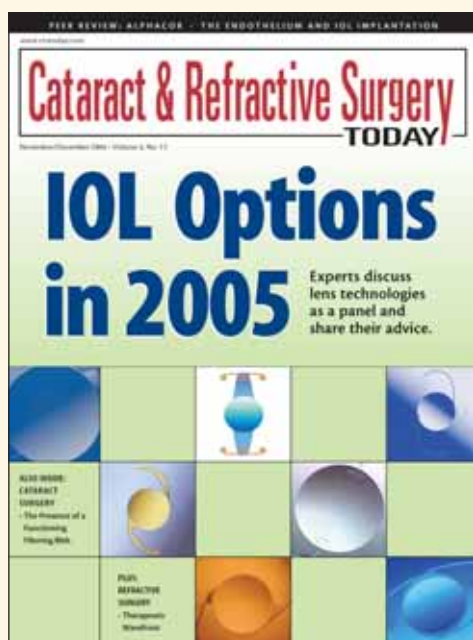
Using a similar dataset, we next compared the best predictive parameters of optic disc topography and subjective optic disc assessments by glaucoma specialists in blacks and whites.²⁵ Despite the subtle differences in the association of structural characteristics and glaucomatous visual dysfunction found in our earlier study, we observed little difference in the ability of the HRT II (Heidelberg Engineering GmbH) or subjective disc assessment to discriminate between glaucomatous and normal eyes in these racial groups. Additionally, the HRT II performed comparably to subjective optic disc assessment.

CONCLUSION

Although differences in socioeconomic, healthcare access, disease awareness, and potential systemic risk factors all contribute to the higher prevalence of glaucoma in blacks, ocular characteristics (primarily in central corneal thickness and in optic disc structure) may also play a part. As practitioners' clinical ability to detect glaucomatous progression improves with the further evolution of ocular imaging and physiologic testing, it will become important to recognize ocular differences between blacks and whites and evaluate them in

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