LANDMARK REPRINT

Clinical Recognition of Glaucomatous Cupping

RALPH E. KIRSCH, M.D., AND DOUGLAS R. ANDERSON, M.D.

IN CLINICAL PRACTICE IT IS A FREQUENT AND MOST DIFFICULT task to decide whether an optic nerve head is cupped because of glaucoma or whether the cupping is simply a physiologic excavation. The present study of the optic nerve head in normal and glaucomatous eyes was designed to determine if there are indeed anatomic features that would reliably distinguish acquired glaucomatous cupping from physiologic cupping.

Our interest in this differentiation was furthered by the obvious variation in susceptibility of individual eyes to damage from elevation of intraocular pressure. Not all individuals with abnormal tonograms, positive provocative tests (water drinking, corticosteroid), or even frank elevation of intraocular pressure ("ocular hypertensives") are in danger of developing visual loss. On the other hand, some eyes suffer typical glaucomatous cupping and visual field loss with little or no elevation of intraocular pressure (low-tension glaucoma).

This variation in susceptibility has important therapeutic implications. The real aim of treatment, after all, is not simply to control the intraocular pressure, but to prevent ocular damage (disk cupping and visual field loss). Measurements that deal only with intraocular pressure or aqueous humor outflow may suggest that an individual is statistically at higher risk (for example, a pressure of 35 mm Hg will damage more eyes than a pressure of 25), but when decisions to initiate or intensify treatment are made it is clearly preferable to take into account whether intraocular pressure is causing ocular damage in that particular individual. Herein lies the importance of evaluation of the disk and visual field. Our goal in this study was to improve our ability to detect and evaluate glaucomatous damage of the disk in a single inspection—without comparison to the appearance of that disk on a previous occasion.

MATERIALS AND METHODS

IN OUR FORMAL STUDY, TWO GROUPS OF PATIENTS WERE selected: those with definitely normal eyes, and those with definitely glaucomatous eyes. We excluded all equivocal or borderline cases—for example, those with ocular hypertension without field loss. The patients were drawn from our private practices and from the Dade County outpatient clinic of Jackson Memorial Hospital at the Bascom Palmer Eye Institute.

The first group consisted of 70 normal patients selected because they had a moderate or marked degree of disk cupping. All were determined to have normal intraocular pressure (Goldmann applanation tonometry), normal values for facility of outflow by Schiøtz tonography, and normal visual fields. Normality of these parameters should insure that few, if any, patients with undetected glaucoma were included in the normal group.

The second group consisted of 80 glaucomatous patients with unequivocal glaucoma, having elevation of intraocular pressure and characteristic field loss. The field loss varied from subtle defects to severe glaucomatous loss.

All disks were examined at the slit lamp with a diagnostic contact lens (Goldmann), except for a few cases examined with a Hruby lens. Most were also examined by direct or indirect ophthalmoscopy, or both. Stereoscopic color fundus photographs were obtained of all disks, and these were studied in detail as the main method for review and comparison of disks. On occasions when a question arose during examination of photographs, patients were re-examined with the slit lamp, which proved the only method of examination that was superior to stereoscopic fundus photography. Also available were the patients' clinical records, which contained narrative descriptions and disk diagrams.

Since completing the formal study more than a year ago, we have of course made informal observations on all patients that came under our examination, including patients with other optic nerve diseases and with ocular hypertension. These observations have served to extend the original findings andhave given us additional confidence in the concepts developed.

RESULTS

IN NORMAL EYES (FIGURE 1), THE PHYSIOLOGIC CUPS, ARE usually round, or occasionally horizontally oval. The exceptions are disks that are clearly atypical in shape and appearance, obviously related to congenital abnormalities (high myopia, inferior conus, optic pits, etc.). The physiologic

From the Department of Ophthalmology, Bascom Palmer Eye Institute, University of Miami School of Medicine, Miami, Florida.

Reprint requests to Douglas R. Anderson, M.D., Bascom Palmer Eye Institute, P.O. Box 875, Biscayne Annex, Miami, Florida 33152

0002-9394/$36.00
https://doi.org/10.1016/j.ajo.2018.06.008

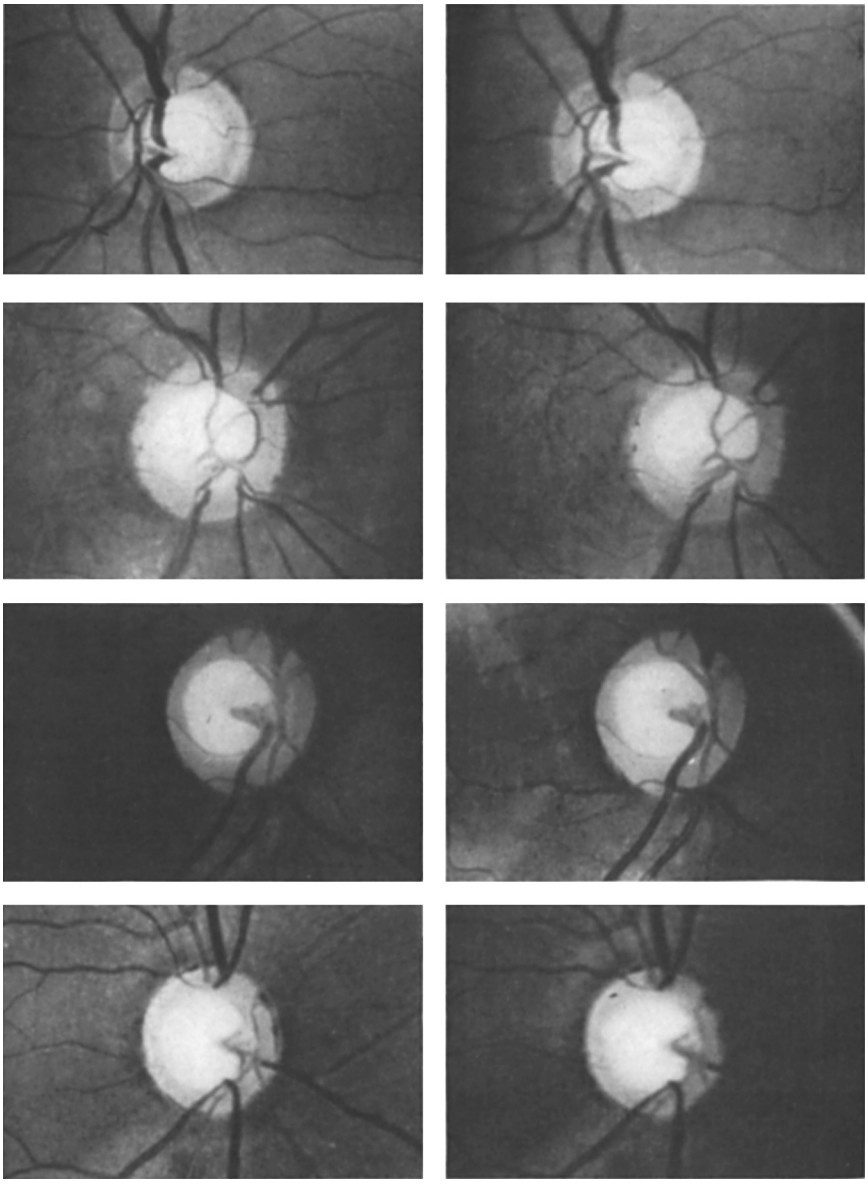

FIGURE 1 (KIRSCH AND ANDERSON). Stereoscopic views. Examples of physiologic cups in disks of patients without glaucoma. These examples are chosen to illustrate that the cups are round, but may be somewhat eccentric in position.

cups are of varying size and are sometimes eccentric in position within the optic nerve head, but of particular note is that even when the cup is large, the entire circumference of the cup is surrounded by a rim of disk tissue.

In the glaucomatous eyes, the disks can be divided according to their cups into three overlapping and loosely defined groups. The obviously abnormal disks have complete glaucomatous cupping (Figure 2) with advanced visual field loss (Figure 3) about which there could be no clinical doubt. The cup occupies all the area of the disk, extending to the disk margin everywhere, with no disk tissue remaining.

In a second, less advanced group (Figures 4 and 5), the cup does not occupy the entire disk, but does extend toward and touch the disk margin near the superior or inferior pole of the disk, often more temporal then nasal. In some instances it seems as if there had been a large physiologic cup prior to the onset of glaucoma, and tissue had been lost from one segment of the rim as an acquired change (Figure 4-A). In other instances, the appearance suggests that the disk originally had a small physiologic cup, and there was preferential segmental loss of tissue between the center of the disk to the upper or lower margin (Figure 4-B). In this latter group, the cup diameter is greater vertically than horizontally, giving the cup a vertically oval shape.

Of particular interest to us was the third group of glaucoma disks, those with relatively small cups (Figures 6 and 7). In these, the cup does not reach the disk margin, and there is