Optic Nerve Head Morphologic Characteristics in High-Tension and Normal-Tension Glaucoma

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Objectives: To determine the morphometric parameters in high-tension glaucoma (HTG) and normal-tension glaucoma (NTG) with a confocal scanning laser ophthalmoscope, and to determine the relationship to disc size.

Methods: One hundred eighty-six patients with glaucoma were recruited for this study. For each patient, only one eye was randomly chosen. Patients with NTG and HTG were classified using untreated intraocular pressure (IOP) as the variable; the NTG group had IOP less than 22 mm Hg during a diurnal tension curve, while patients with HTG had IOP greater than 21 mm Hg in at least 3 measurements. All the patients were examined with Humphrey perimeter program 30-2 and a Heidelberg Retina Tomograph. Findings were assessed by t test. Patients were then divided by disc area size into 3 subgroups: small discs with an area less than 2 mm², mid-sized discs with an area of 2 to 3 mm², and large discs with an area greater than 3 mm².

Results: One hundred thirty-two HTG eyes and 50 NTG eyes were assessed. Four eyes were excluded because they were classified as having secondary glaucoma. No significant differences were found between HTG and NTG eyes for any Heidelberg Retina Tomograph morphometric parameters, even when patients were divided into subgroups.

Conclusion: No differences were apparent between HTG and NTG in morphometric parameters as measured by scanning laser ophthalmoscopy.


Normal-tension glaucoma (NTG) has long been recognized as a clinical entity characterized by typical glaucomatous optic nerve head (ONH) damage and visual field defects. Greve and Geijssen found that NTG was characterized by larger optic discs, a thinner inferotemporal rim area, more pallor than cupping, and a pale, sloping, moth-eaten disc appearance. Others have also noted optic disc and visual field differences between patients with high-tension glaucoma (HTG) and NTG. Some authors believe that the appearance of the optic disc and visual field in patients with NTG is similar to that found in HTG. It is important to determine if there are differences in optic disc topography between these 2 entities since this may provide clues as to the possible different factors responsible for the damage to these patients’ eyes. We evaluated the optic disc topography using a Heidelberg Retina Tomograph (HRT) (Heidelberg Engineering, Heidelberg, Germany) in patients with NTG and HTG to address this question.

RESULTS

Four eyes were excluded because they were classified as having secondary glaucoma. The 182 eyes were classified in 2 different groups: 132 subjects had HTG and 50 had NTG. The distribution of the data was normal, so the t test was used to compare data between groups.

The mean ± SD age of patients with HTG was 63.89 ± 12.06 years; patients with NTG, 63.74 ± 11.4 years. This difference was not statistically significant.

No significant difference was found between HTG and NTG for refraction (mean ± SD, −0.76 ± 2.84 D and −1.04 ± 3.18 D, respectively) or for visual field indices (Table 1).

The t test revealed no significant differences between HTG and NTG for the following HRT parameters: disc area, cup area, cup-disc area ratio, rim area, cup volume, rim volume, mean cup depth, maximum cup depth, cup shape measure, high-variation contour, mean RNFL thickness, and RNFL cross-section area (Table 2).

No significant difference between HTG and NTG was found for the HRT parameters, even when the cohort was divided on the basis of optic disc size.

A power calculation on cup shape measure revealed that there was less than a 5% chance that we were incorrect in accepting that there was no difference between the HTG and NTG groups for this parameter. We calculated the power assuming an effect size of .05.
There remains considerable disagreement within the glaucoma community as to the possible differences in optic disc appearance and visual field damage present in patients with HTG and NTG. Some authors believe that the optic disc is significantly different in these 2 patient groups and that the visual fields of patients with NTG exhibit visual field defects that are deeper and closer to fixation than in patients with HTG. Others believe that the disc...
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between the 2 groups. This parameter has already been the changes in any of the measured parameters of optic disc groups. We were unable to find any significant differ-

ences in the disc damage found in these 2 patient both cases.

These different findings may relate to selection bias, since NTG is usually detected only when significant disc dam-

age has already occurred.

Our study looked at optic disc morphometry as re-
corded by the HRT to determine if there are apparent dif-
fferences in the disc damage found in these 2 patient groups. We were unable to find any significant differ-

ences in any of the measured parameters of optic disc structure. Perhaps most interesting is the finding that even the parameter cup shape measure was not different be-

tween the 2 groups. This parameter has already been shown to be very precise in differentiating the normal disc from the disc from patients with glaucomatous visual field loss.24,25 Since this parameter is sensitive to small variations in the topography of the optic disc, the lack of significant difference in this parameter between the 2 groups suggest that the disc changes are similar in appear-

ance.

All of the patients in this study were part of a university-based practice. This may be a source of potential bias. Another potential source of bias could be a mismatch in the amount of visual field damage present in the 2 patient groups. We do not believe that this is a prob-

lem in our study, since the mean values of the visual field indices were almost identical in the HTG and NTG groups. If a mismatch was present, this would have biased the study toward detecting a selection-induced difference in optic disc morphologic characteristics between the 2 groups. Since no significant difference in optic disc morphologic characteristics was detected, this potential bias is not relevant.

These results suggest that the separation of HTG and NTG on the basis of an arbitrary pressure differ-

ence threshold is probably not useful. Pressure remains an important controllable factor in the pathogenesis of both of these disease entities.23,27 Other factors remain to be determined that will probably be important at both ends of the spectrum in this disease. The fact that the optic disc topographical appearance is the same at both the HTG and NTG ends of the spectrum suggests that the final damage to the optic nerve is similar in both cases.

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Table 1. Demographic Analysis of Patients With Glaucoma*