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Influence of visual field results in the glaucoma diagnosis

Influência dos resultados do campo visual no diagnóstico de glaucoma

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ABSTRACT

Objective: *To determine the influence of visual field results in the diagnosis of glaucoma.* ***Methods:*** *A questionnaire with ophthalmologists was conducted where slides of a digital photograph of the optic disc and computerized visual field exam were presented. (Physicians were instructed to answer whether glaucoma was observed in each of the slides). No other information was given to those examiners. Half of the patients had glaucoma with corresponding visual field, and the other half had physiological cupping and normal visual field. The slides were equally divided between retinography and corresponding visual field (same patient) and exams randomly exchanged, where an optic disc of glaucoma with a normal visual field was placed, and vice-versa. The order in which the slides were presented was also randomized.* ***Results:*** *Forty slides were evaluated by 29 ophthalmologists. No glaucoma specialist was included. The overall agreement among the examiners (Kappa) was 0.270 ± 0.281, and 0.261 ± 0.238 for the exams of the same eye and was 0.274 ± 0.217 from the slides with the exams changed (p=0.4). The diagnosis was made correctly in glaucoma patients with corresponding visual field exam in 66.89% of the cases, and in 66.20% of patients with physiological cupping. When the exams were exchanged, the results dropped to 34.13% and 35.86%, respectively (p<0.001 for both).* ***Conclusion:*** *Visual field results may influence the diagnosis of glaucoma by non-glaucoma specialists.*

Keywords: *Glaucoma/diagnosis; Visual field tests; Optic disk; Observer variation; False negative reactions.*

RESUMO

Objetivo: Avaliar a influência da campimetria computadorizada no diagnóstico do glaucoma. **Métodos:** Foi realizado questionário com oftalmologistas apresentando slides com uma fotografia digital de disco óptico e campo visual computadorizado. Os médicos deveriam assinalar se o exames apresentados eram de glaucoma ou não. Nenhuma outra informação foi passada para os examinadores. Metade dos pacientes apresentavam glaucoma com dano correspondente de campo visual, e a outra metade aumento fisiológico da escavação e campo visual normal. Os slides foram igualmente divididos em: retinografia e campo visual correspondentes (mesmo paciente) e exames invertidos de forma aleatória, colocando um disco óptico de glaucoma com um campo visual normal e vice-versa. A ordem de apresentação dos slides foi randomizada previamente. **Resultados:** Foram incluídos 40 slides, avaliados por 29 oftalmologistas. Nenhum especialista em glaucoma foi incluído. A concordância entre os examinadores (Kappa) foi de 0,270 ± 0,281, sendo de 0,261 ± 0,238 para os exames correspondentes e 0,274 ± 0,217 para os slides com os exames trocados (p=0,4). O diagnóstico foi realizado corretamente nos pacientes com glaucoma com o campo visual correspondente em 66,89% dos casos, e em 66,20% nos pacientes com aumento da escavação (normais). Quando houve a troca da correspondência dos exames, os valores caíram para 34,13% e 35,86%, respectivamente (p<0,001 para ambos). **Conclusão:** O conhecimento prévio dos resultados do campo visual pode influenciar o diagnóstico do glaucoma.

Descritores: Glaucoma/diagnóstico; Testes de campo visual; Disco óptico; Variações dependentes do observador; Reações falso-negativas.

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Introduction

Glaucoma is a multifactorial disease characterized by damage to the optic disc and/or retinal nerve fiber layer (RNFL) with typical damage to the visual field. The functional damage assessed by the visual field, although late in the pathogenesis of glaucoma,[1] generally occurs in correspondence with the structural damage.[2,3]

The clinical judgment is the core of the medical profession. Physicians, however, tend to use complementary information to increase their ability to diagnose. A widely used exam to help ophthalmologists to evaluate glaucoma, the visual field, has an element of subjectivity, which includes the physician's own learning curve[4-6] and multiple sources of variability[7] such as individual errors, fixation loss, false-positive and false-negative results. [2] Therefore, an initial visual field assessment may not indicate the real condition of the patient, and could have a modified result if retested,[8] resulting in errors of interpretation and subsequent evaluation of the patient's condition. A glaucomatous visual field may, therefore, only be a result of a learning experience with the exam. On the other hand, initial glaucomatous optic disc damage may not have a correspondent visual field defect. Typical glaucomatous damage to the optic disc and/or RNFL,[9] however, is an absolute indication of glaucoma, and diagnosis is established regardless of the results obtained with the visual field assessments.

The result of a given exam may influence the clinical judgment by examiners. It has been shown that knowledge of chronology of optic disc stereophotographs influences the determination of glaucomatous progression.[10] Similarly, it is possible to hypothesize that the evaluation of complementary exams, especially those that may be affected by physician and/or patient subjectivity such as the visual field exam, before examining the patient, could alter the clinical judgment of the physician. This study aims to determine whether the visual field may influence the diagnosis of glaucoma.

Methods

This study was conducted at the glaucoma sector of the ophthalmology department at the Federal University of Goias, Goiania, Brazil (CEROF-UFG) after approval by the Ethics Committee of that institution. Patients with glaucoma (criteria below), and patients with physiological cupping,[11] but without characteristic signs of glaucomatous optic disc (described below) were included in the study. At least two reliable and normal SITA Standard 24-2 visual field (Humphrey Systems, Dublin, CA)[12] and intraocular pressure less than 18mmHg were eligibility criteria required for inclusion in the last group.

Only glaucoma patients with equal number of glaucomatous visual fieldand optic disc showing typical glaucomatous change, such as notching, global or localized (Hoyt) RNFL loss, vascular changes and/ or optic disc hemorrhagewere included in this study. [9,12] Furthermore, patients had to be in the initial or moderated visual field lossstages to be considered. [12] If eligible, both eyes were included.

For both groups, exclusion criteria were recent intraocular surgery (less than 3 months), unreliable visual field,[12] inability to perform visual field assessments, aphakia or other change on biomicroscopy or ocular fundus that could alter the results of the visual field (except for glaucoma in its respective group), such as age-related macular degeneration or retinal detachment, miosis (pupil < 3mm), drug-induced mydriasis, as well as recent inclusion in another research protocol (6 months) and the patient's refusal to participate. Every patient in either group had best corrected visual acuity greater than or equal to 20/40; diagnosis was previously confirmed by at least two glaucoma specialists.

In order to be included, all patients had to have 24-2 SITA Standard visual field and digital fundus photography (Visucam Lite, Carl Zeiss Meditec, Jena,Germany), presenting the optic disc and RNFL, both done in the same day. Patients were selected during 3 consecutive months. Each patient's visual field and retinography were displayed into one slide and then sent to prospective evaluation by 29 ophthalmologists, none of whom were glaucoma specialists. Each ophthalmologist received 40 pair of tests (40 slides), half of which with a corresponding exam of the eye (visual field and retinography). In the other half, the exams were randomly exchanged, and only the position of the eye (right or left) was observed. This means, physiological cupping retinography with glaucomatous visual field, and glaucomatous optic disc with normal visual field. Consequently, ten slides of each of the four groups - glaucomatous retinography and visual field, normal retinography and visual field, glaucomatous retinography and normal visual field and normal retinography with glaucomatous visual field - were sent to the examiners.

Neither the patients's names nor their initials were disclosed to the ophthalmologists; slides were marked with numbers instead. Actual distribution of the exams in each slide was only known to the study's authors and the order of the slides presented was randomized. All randomization done in the study was through the website www.randomization.com.

One of the authors of the study presented the slides to each of the examiners individually on a 14-inch screen laptop. Completion of the questionnaire was not timed. The identity of each ophthalmologist remains confidential. Examiners were initially informed that this was a study to assess the ability of diagnosing glaucoma through exams without direct examination of the patient, especially designed to serve remote areas, without the presence of an expert on-site. They were also informed that all patients had glaucoma or suspicion of having glaucoma. No other information was given to those examiners. All physicians made conclusions as to whether each patient had glaucoma after evaluating each such patient's slide. Only after data collection, the examiners were informed of the real purpose of the study. Subsequently, they provided consent for analysis and possible publication.

Statistical analysis was performed using SPSS software, version 15.0 (SPSS Inc, Chicago, IL). Normality of the samples was performed using the Kolmogorov- Smirnov test. The independent Student test was used to compare the groups' assessments. Categorical data were compared using the chi-square test, and the agreement between examiners by cross tabulation and Kappa index (correct tests vs. exchanged). In the present study, p values < 0.05 were considered statistically significant.

Results

A total of 290 evaluations per group were performed: 40 eyes, 10 in each group, were assessed by 29 ophthalmologists. The mean MD of glaucoma eyes was -3.76 ± 2.38 dB and 0.18 dB ± 0.96 in the normal ones ($p<0.001$).

The average kappa value between examiners was 0.270 ± 0.281 (range -0.316 to 0.725). When visual field and corresponding retinography were considered in each patient, the average kappa value was 0.261 ± 0.238 (range -0.443 to 0.798), similar to the results achieved when only the eyes with exchanged exams was

considered (mean : 0.274 ± 0.217 , ranging from -0.354 to 0.900, p = 0.4, (figure 1).

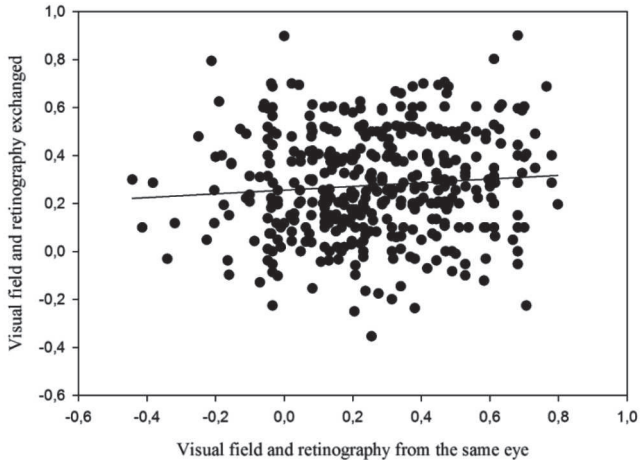

Figure 1: Comparison between when analyzed visual field and corresponding retinography were considered in each patient, and similar to the results achieved when only the eyes with exchanged exams was considered.

Diagnosis was accurate in 66.89% of glaucoma eyes with corresponding visual field, and 66.20% in patients with physiological cupping and respective visual field. The values decreased to 34.13% and 35.86%, respectively (p<0.001 for both) when only the slides where there was an exchange of visual field were considered.

Discussion

The normal optic disc can have different dimensions for both the size and cup.[13,14] In the diagnosis of glaucoma, changes that are typical to the condition must be considered,[15] not only cupping, so that false diagnosis (physiological cupping) can be avoided, or at least reduced.

The relationship between the damaged optic disc and the corresponding visual field is generally used in the evaluation of glaucoma. However, visual field examination is subjective, and therefore subject to variability[7] such as the physician's learning curve, becoming more reliable with increased patient testing experience.[4,6] Thus, it is necessary to considerer this important confounding factor to reduce bias when conducting a study protocol involving glaucoma patients, where multiples tests are needed.[4,6] Classification of the visual field is variable and also the agreement between observers,[16,17] those assessments could be weak to moderate if performed by general ophthalmologists, rising from moderate to substantial if performed by glaucoma specialists.[17] In fact, confounding factors for glaucoma diagnosis by analyzing the optic disc and visual field can be substantial, and should be observed. Proper glaucoma diagnosis can be improved when both the optic disc and visual field are analyzed concurrently.

In the present study, the examiners had access to a digital retinography and visual field per eye to perform the diagnosis of glaucoma. All eyes included in the glaucoma group were from patients under treatment for glaucoma, with glaucomatous optic disc and reproducible glaucomatous visual field defects in at least two different visual field tests. Therefore, theoretically, these patients had glaucoma more perceptible than if only patients with pre-perimetric glaucoma had been considered, when diagnosis is suggestive where only optical disc is examined; this could, consequently, bias the results. The mean MD was -3.76 ± 2.38 dB, since only initial or moderated visual fields were included. Patients with physiological cupping had to have their optic disc with minimal confounding factors as possible and had to have a reliable and reproducible normal visual field.

There was poor agreement between the examiners in the diagnosis of glaucoma (Kappa: 0.270 ± 0.281). The Kappa values remained low and similar (p=0.4) even when the analysis was made considering only the slides where the retinography and visual field were from the same patient or only the exchanged ones. Kappa values near one express full agreement, and results near zero indicate no agreement or expected by chance. Negative Kappa values indicate agreement less than expected by chance and suggest disagreement, but its absolute value should not be considered as the intensity of the disagreement.[18] Agreement in the diagnosis of glaucoma in any study does not necessarily indicate accuracy; it indicates that the examiners had evaluated a large number of coincident responses throughout the test, which could however be completely different from the expected. One may anticipate increased agreement in the diagnosis of glaucoma when both tests from the same patient was presented, which however did not happen. Despite the increased rates of correct diagnosis in this subgroup of slides, individual slide evaluation had great variability, as can be noted in the figure, where the distribution cloud of the two groups is well dispersed to both sides of the line from the linear regression.

The diagnosis was correctly made in about 35% of cases when the visual field was exchanged, and slightly over 66% when the visual field and optic disc were from the same eye. These results indirectly reflect the low accuracy of relating the optic disc with a given visual field. It seems that clinicians usually rely on their judgment mainly in the visual field results. In a previous paper, ophthalmologists were asked to match optic discs with their corresponding visual field and of classifying them as healthy or glaucomatous. They correctly matched in 58.7% of cases. In most mismatches, the clinicians overestimated the visual field damage.[19] Apparently, this situation also happened here.

It is possible that the presentation of the optic disc and RNFL through optic disc stereophotographs could increase the diagnostic ability of the observers,[20] a potential weakness of the study. However, a previous paper failed to demonstrate any significant advantage of stereoscopic photographs compared to monoscopic optic disc photographs to estimate glaucoma likelihood.[21] Furthermore, this study was not designed with the aim of assessing the ability to detect glaucoma, but to test the influence of the visual field evaluation in its diagnosis. Furthermore, the presentation of the optic disc and RNFL in a digital retinography and not in a stereoscopic slide affects both groups equivalently, at least reducing this possible bias. However, even with the digital retinography suggesting glaucoma (or normality), the visual field was decisive in this selected sample to characterize an eye as glaucomatous or not.

Although there are no epidemiological data in the majority of countries, including Brazil regarding this subject, a large amount of patients who are being evaluated or who have been diagnosed with glaucoma aren't treated by glaucoma specialists. Additionally, a larger power of the tests is obtained with a greater number of observers. That is the reason why glaucoma specialists were not included as observers, as they could produce different opinions.

In conclusion, it is possible to suggest that the clinical evaluation of patients with glaucoma (or under investigation) should be conducted before the interpretation of the visual field. The knowledge of the results of the visual field can influence the judgment of the diagnosis of glaucoma.

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