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The role of Optical coherence tomography (OCT) and Humphrey automated perimetry in the assessment of optic nerve damage in primary open angle glaucoma

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ABSTRACT

Aim: to compare two techniques used for assessment of optic nerve damage in glaucoma patients and to find whether those methods are complementary or can substitute each other.

Method: this is a prospective study conducted at king Hussein Medical Centre between April 2014 and July 2014. All patients diagnosed to have primary open angle glaucoma were enrolled in this study. Patients with unreliable automated perimetry and patients with past history of retinal or optic nerve diseases were excluded from the study. Optical coherence tomography and Humphrey automated perimetry will be performed to all patients on each visit. The data obtained was analyzed and compared. **Results:** 250 patients (410 eyes) with glaucoma aged between 37 and 75 years. OCT was able to detect glaucomatous damage in 94.6% of glaucoma patients. It detected the damage in 93.6%, 96.1% and 97.6% of eyes with mild, moderate and severe cases respectively. The agreement between the two instruments was 91.9%, 94.2% and 97.6% in mild, moderate and severe cases respectively. **Conclusion:** OCT proved to have a very good agreement with Humphrey automated perimetry and it can be used instead of HAP for assessment the wellness of optic nerve fibers especially when there is any limitation in interpretation of HAP images.

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1. Introduction

Glaucoma is defined as characteristic optic disc damage and subsequent visual field loss usually caused by elevated intra ocular pressure (IOP). (1) This damage is caused by progressive loss of retinal ganglion cells and their fibers. (2) Glaucoma is considered as a silent disease because it is usually a symptomatic until advanced damage takes place. (3) Therefore, early detection of the disease is essential to prevent irreversible deterioration of vision. (4) Optical coherence tomography (OCT) and Humphrey automated perimetry (HAP) are the most common techniques used to assess the wellness of optic nerve fibers. (5) Evaluation of the optic nerve fibers is essential not only for the diagnosis of the disease and assessing its severity, it provides an evaluation regarding the progression of the disease and effectiveness of treatment as well. (6) OCT works in a similar way to ultrasound, using near-infrared light instead of sound waves to produce high resolution, cross-sectional images. while HAP presents light stimuli in a random fashion and the patient have to record receiving that stimuli, therefore patient's cooperativeness is essential to achieve optimum evaluation of the disease. The aim of this study is to compare those two methods to find whether those methods are complementary or can substitute each other for assessment of optic nerve wellness.

2. Methods

This is a prospective study conducted at king Hussein Medical Centre in Amman-Jordan. All patients diagnosed to have primary open angle glaucoma will be enrolled in this study. Patients highly false positive or negative results in HAP, patients with dense media that prevent optic nerve fibers imaging and causing low vision like dense cataract and corneal opacity and patients with past history of retinal or optic nerve diseases were excluded from the study. OCT and HAP were performed to all patients on each visit. The data obtained was analyzed and compared.

3. Results

250 patients (410 eyes) aged between 37 and 75 years (median 52±8 years) were included in the study. 110 were males (ratio 1.1:1). Table 1 represents the severity of glaucomatous damage as detected by both instruments.

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Table: 1.The severity of glaucomatous damage as detected by both instruments.

Severity of glaucomatous damage	Normal	Mild	moderate	severe	Total
Abnormal result by HAP	0 (0.0%)	267 (65.1%)	102 (24.9%)	41 (10%)	410 (100%)
Abnormal result by OCT	5 (3.7%)	255 (62.2%)	100 (24.4%)	40 (9.8%)	410 (100%)
Abnormal result by both instruments	0 (0.0%)	250 (61.0%)	98 (23.9%)	40 (9.8%)	388 (94.6%)
Abnormal result by at least one instrument	5 (3.4%)	272 (63.0%)	104 (24.1%)	41 (9.5%)	432 (100%)
Agreement*	0 (0.0%)	91.9%	94.2%	97.6%	89.8%

Agreement is the ratio of eyes with abnormal results detected by both instruments to the number of eyes with abnormal results detected by at least one instrument.

Glaucoma is defined as characteristic optic disc damage and subsequent visual field loss usually caused by elevated intra ocular pressure (IOP).(1)This damage is caused by progressive loss of retinal ganglion cells and their fibers.(2) Glaucoma is considered as a silent disease because it is usually a symptomatic until advanced damage takes place.(3) Therefore, early detection of the disease is essential to prevent irreversible deterioration of vision.(4) Optical coherence tomography (OCT) and Humphrey automated perimetry (HAP) are the most common techniques used to assess the wellness of optic nerve fibers.(5)Evaluation of the optic nerve fibers is essential not only for the diagnosis of the disease and assessing its severity, it provides an evaluation regarding the progression of the disease and effectiveness of treatment as well.(6) OCT works in a similar way to ultrasound, using near-infrared light instead of sound waves to produce high resolution, crosssectional images. while HAP presents light stimuli in a random fashion and the patient have to record receiving that stimuli, therefore patient's cooperativeness is essential to achieve optimum evaluation of the disease.The aim of this study is to compare those two methods to find whether those methods are complementary or can substitute each other for assessment of optic nerve wellness.

4. Discussion

Glaucoma is one of the second leading cause of blindness world wide.(7) early effective treatment is essential before irreversible damage occurs.(1,8) HAP and OCT play a major role in the diagnosis of glaucoma and assessing the severity and progression of glaucoma.(9,10)patient's cooperativeness is essential for performing HAP,in OCT much less cooperativeness is needed.

This study demonstrated that about two thirds of glaucoma cases in Jordan were in mild forms, this reflects the effective screening measures adopted for early diagnosis of glaucoma. Although OCT was not able to detect glaucoma damage in 3.4%, most of those cases were having mild damage. OCT was able to detect glaucomatous damage in 96.6%, this means OCT is reliable in the assessment of glaucoma. In mild cases OCT was able to detect glaucomatous damage in 93.6% of eyes in which the damage was documented by HAP. On the other hand, this percentage increased to 96.1% and 97.6% in moderate and severe cases respectively. In all cases this percentage was 94.6%.

The agreement between the two instruments was 91.9%, 94.2% and 97.6% in mild, moderate and severe cases respectively. This means there is a good agreement between the two techniques in mild cases and excellent agreement in moderate and severe cases.

The explanation for those results is that OCT reflects the anatomical integrity of retinal nerve fibers while HAP reflect the physiological and functional aspects, any defect in which usually precedes the structural changes, and that clarify why OCT was not able to detect all abnormal results in mild cases but with the increase in the disease severity OCT became more sensitive.

This study demonstrated that imagings in patients with glaucoma facilitate the glaucoma diagnosis and it may alter treatment strategies. Each of the imaging techniques measures different aspects of the optic nerve fibers and differences may exist between them that may limit their interpretation, but they are still considered as complementary and there is a high agreement between them. This means OCT can replace HAP for assessing glaucomatous damage in uncooperative patients or patients with unreliable HAP.

5. Conclusion

OCT proved to have a very good agreement with Humphrey automated perimetry and it can be used instead of HAP for assessment the wellness of optic nerve fibers especially when there is any limitation in interpretation of HAP images.

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