Research Article

EVALUATION OF THE PATTERN OF CONTRAST SENSITIVITY IN GLAUCOMA PATIENTS

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ABSTRACT

This prospective cross-sectional study was conducted to measure the contrast sensitivity in different types of glaucoma patients. The patients for this study were identified using a non-probability convenient sampling method from 01st February 2020 to 30th August 2020. The diagnosis and sensitivity were tested using lea contrast sensitivity, Snellen visual acuity charts, trial box, and occluder. The data were analyzed using Statistical Package for Social Sciences (SPSS version 20.0). Out of 60 patients, including 37 males and 23 females, between 16-80 years of age. 33 (55 %) patients were diagnosed with Primary Open Angle Glaucoma(POAG), 17 (28.3 %) patients with Primary Close Angle Glaucoma, 7 (11.7%) patients with Acute Closure Glaucoma(PCAG), and 3 (5%) patients with Secondary Glaucoma. Similarly, with glasses, 46 (76.7 %) patients had visual acuity 6/6 to 6/12, 11 (81.3%) patients had 6/18 to 6/36 and 3 (5 %) patients had 6/60. According to contrast sensitivity 30 (50%) patients had 1.25% (80%), 21 had 2.50% (40%) and 9 had 5% (20%). 15 subjects had 1.25% (80%), 13 subjects had 2.5 %(40%) and 5 subjects had 5% contrast sensitivity in POAG. Around 11 subjects had 1.25% (80%), 4 subjects had 2.5 % (40) and 2 subjects had 5% contrast sensitivity in PCAG, 3 subjects had 1.25% (80%), 3 subjects had 2.5 % (40) and 2 subjects had 5% contrast sensitivity in PCAG. There was a reduction in contrast visual acuity with and without refraction. Most of the patients had variation at the level of Contrast Visual Acuity in POAG.

Key Words: Contrast Sensitivity, Close Angle, Glaucoma, Intraocular Pressure, Open Angle,

INTRODUCTION

Glaucoma is an ocular illness that damages the optic nerve and gradually progresses to blindness. Rising pressure inside the eye (i.e. raised intraocular pressure) damages the optic nerve, failing to transmit images to the brain, resulting in blindness (1). Increased intraocular pressure is a significant risk factor (2). The pathogenesis of glaucoma is not yet understood; however, the rising intraocular pressure is thought to cause retinal ganglion cell necrosis. There is an imbalance between aqueous humor secretion from the ciliary body and its drainage. Aqueous humor is normally drained through two independent pathways:

1. The trabecular meshwork,
2. The uveoscleral outflow pathway

The rate of flow through these pathways determines the intraocular pressure. Open-angle glaucoma is related to increased resistance in the trabecular meshwork resulting in reduced outflow (3,4). The significant risk factors for glaucoma include age over 45 years, family history or personal history of

raised intraocular pressure, reduced corneal thickness and rigidity, ocular injury, and diabetes mellitus (5,6).

Glaucoma has been categorized into five major types, including:

1. Open-angle or chronic glaucoma: This is the most common glaucoma presenting with gradual vision loss without any other sign symptoms (7,8).
2. Angle Closure (acute) glaucoma: It is an emergency where the flow of aqueous humor fluid is blocked suddenly, causing a rise of fluid pressure causing pain and visual impairment (9).
3. Congenital glaucoma: It is the embryonic development defect in the angle of the eye, where an abnormally developed angle of the eye shows slow or complete blockage of fluid drainage. This type of glaucoma has a familial predisposition and presents with cloudy eyes, excessive tearing, or sensitivity to light in children(10).
4. Secondary glaucoma: It is not a primary defect in the aqueous humor production or drainage but rather a complication of injury or any other eye condition, i.e., cataracts or even ocular tumors, and certain drugs such as corticosteroids may also cause glaucoma (11,12).
5. Normal-Tension glaucoma: It occurs without increased intraocular pressure. The exact cause is unknown, but extreme sensitivity or a reduced blood flow to the optic nerve could be a possible cause (13,14).

Contrast sensitivity deals with the ability to see fine points at low contrast levels. When a person can see minute details at very low contrast, it suggests their high contrast sensitivity, while otherwise, if a person doesn't see that case. Contrast sensitivity is directly related to three-dimensional (3D) vision or Binocular Single Vision (BSV) (15).

Contrast sensitivity is vital in communication, orientation, and mobility, performing everyday tasks, particularly near vision tasks such as reading and writing. The vision in patients with age-related macular degeneration (ARMD) and glaucoma gets better in bright light (11). There is literature available suggesting variation in contrast sensitivity in different types of glaucoma. However, there is low-level literature available suggesting measures of contrast sensitivity in each type of glaucoma. Thus, this study measured contrast sensitivity in different glaucoma patients using visual acuity and visual field.

METHODS

A prospective cross-sectional study was conducted at Glaucoma clinic at Al- Ibrahim Eye Hospital Malir, Karachi, Pakistan, from 1st February 2020 till 30th August 2020. Sixty patients with various glaucoma types were included using a non-probability convenient sampling technique. These patients were between the ages of 16 to 80 years, with a confirmed diagnosis of glaucoma without any other ocular disease.

After obtaining written consent, all patients were assessed in standardized room illumination with Snellen's chart. Contrast sensitivity was evaluated with lea symbols contrast sensitivity chart (low contrast flip Chart), visual acuity was checked using Occluder and Snellen visual acuity chart. The findings of the examination were recorded on a pre-designed proforma.

Statistical analysis

Statistical package for social sciences (SPSS) version 20.0 was used for data analysis. All continuous variables are presented as terms of mean± and Standard Deviation (±SD), and categorical variables are presented as frequency and percentages in graphs and tables.

RESULTS

Total 60 patients with a confirmed diagnosis of glaucoma consented to be part of this study, including 37 males and 23 females (Figure 1). The mean onset age was 38.4 years, ranging from 16 to 80 years. Out of 60 patients, 33 (55 %) patients were diagnosed with Primary Open Angle Glaucoma (POAG), and 17 (28.3 %) patients were Primary Close Angle Glaucoma (PCAG), 7 (11.7%) patients were Acute Closure Glaucoma (ACG), and 3 (5%) patients were Secondary Glaucoma (SG) (Figure: 02). Visual Acuity with glasses 46 (76.7 %) patients had 6/6 to 6/12, 11 (81.3%) patients had 6/18 to 6/36 and 3 (5 %) patients had 6/60 (Table: I). Contrast Sensitivity with glasses 30 (50%) patients had 1.25% (80%).21 patients had 2.50% (40%), 9 patients had 5% (20). (Table: I)

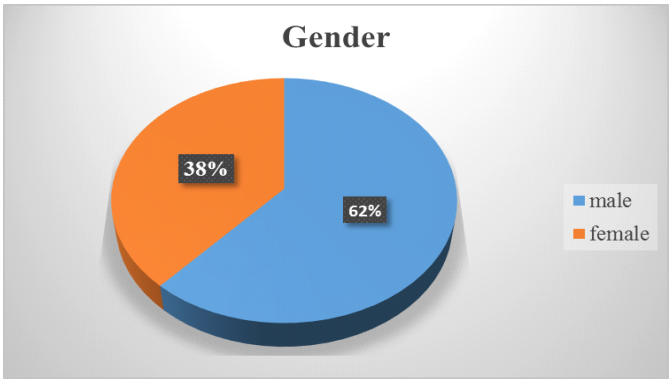

Figure 1. Gender distribution of the patients presenting with glaucoma

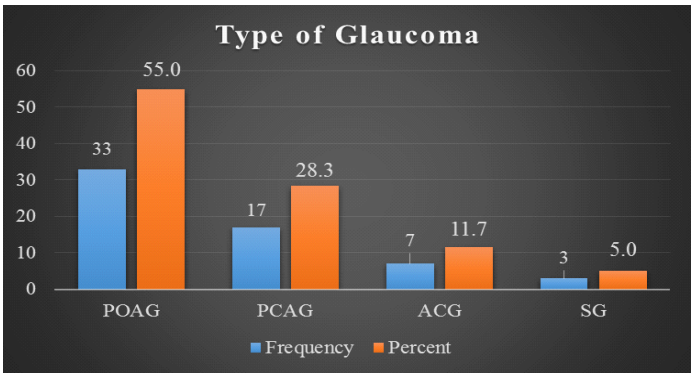

Figure 2: Distribution of the types of glaucoma

Contrast Sensitivity of 15 patients was 1.25% (80%), 13 patients had 2.5% (40) and 5 patients had 5% in POAG. 11 patients had 1.25% (80%), 4 patients had 2.5% (40), and 2 patients had 5% in PCAG. 3 patients had 1.25% (80%), 3 patients had 2.5% (40) and 2 patients had 5% in ACG. 1 patient had 1.25% (80%), 1 patient had 2.5% (40), and 1 patient had 5% in SG (Figure: 03)

Visual Acuity with Glasses	Frequency	Percent
6/6-6/12	46	76.7
6/18-6/60	11	18.3
6/60	3	5
Total	60	100
Contrast Sensitivity with Glasses	Frequency	Percent
5%	9	15.0
2.5%	21	35.0
1.25%	30	50.0
Total	60	100.0

Table 1: Visual Acuity with glass in patients with confirmed diagnosis of glaucoma

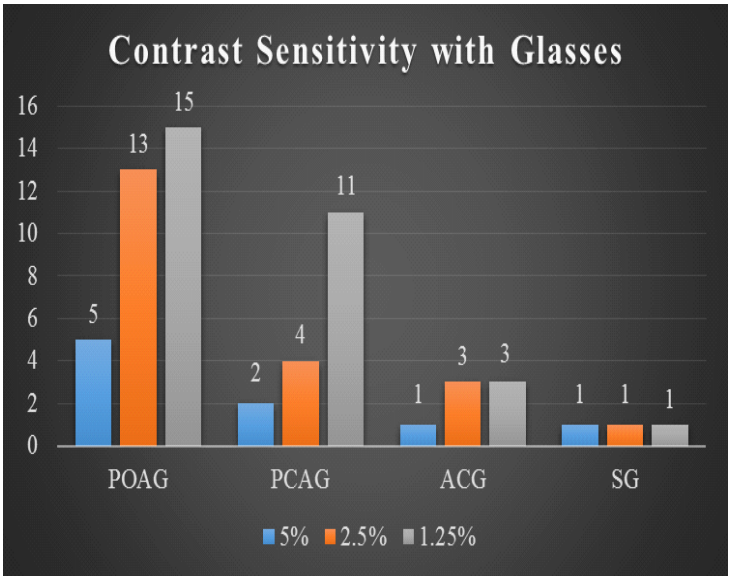

Figure 3. Distribution of Contrast sensitivity in each type of glaucoma

DISCUSSION

In our study, 60 patients were included having confirmed glaucoma diagnosis, their visual acuity was checked, and a contrast sensitivity test of each patient was performed.

The required methods for diagnosing and evaluating glaucoma progression include visual field measurement and optic disc evaluation (3). In addition, psychophysical tests are also helpful to explore each part of the visual pathway's functional status for assessment and monitoring of the disease progression. The deterioration in longitudinal contrast sensitivity in glaucoma patients has been reported in multiple studies.

A test Lea contrast can quickly measure contrast visual acuity by measuring the distance between the eye and clear visibility of the symbols at 25%, 10%, 5%, 2.5%, and 1.25% contrast (10). For the interpretation, the 0.10 visual acuity corresponds to the visibility of 10M symbols at 1 meter, similarly 0.05 at 0.5 meters, and 0.3 at 0.3 meters. Thus, visual acuity values are easy to calculate and interpret, and there is also a table to convert these findings in Snellen equaling VA values (4). There are six pages and response keys available; the contrast to the Peli-Robsin chart test, the obtained results are more reliable and reproducible. The other limitation of the Peli-Robsin chart tests is the measurement of the spatial frequency of 1 cpd at a distance of 1 meter, while patients with ocular hypertension and glaucoma present with contrast sensitivity loss frequencies of 0.25 and 8cpd.

Although in the current study, a decline in the contrast sensitivity with glasses in glaucomatous patients had a maximum of 1.25% contrast sensitivity of high percentage of patients compared to the study conducted by Maria et al. reported in 2016, that contrast sensitivity was affected more in glaucoma patients than high-contrast visual acuity (16). Previously reported studies did not provide such evidence to support contrast sensitivity as a measure for early detection of glaucoma. The contrast sensitivity has been reported to correlate with the perimeter deviation. It is also believed that contrast sensitivity and visual field testing could help identify functional changes in glaucoma patients earlier when they still have good visual acuity.

Onal et al. 2008 investigated spatial-contrast sensitivity (CS) as a measure for diagnosing early glaucoma in patients whose visual acuity was still within normal limits. The study results suggested significantly lower contrast sensitivity at all spatial frequencies in glaucoma patients compared to the controls. The results in our study in terms of Visual Acuity with glasses were 46 (76.7 %) patients had 6/6 to 6/12, 11 (81.3%) patients had 6/18 to 6/36, and 3 (5 %) patients had 6/60. And if we compare contrast sensitivity between both studies, contrast sensitivity measurement was around 50%, while specificity ranged between 68 and 100%. FACT contrast sensitivity scores of less than 22 at 12 cpd spatial frequency provided sensitivity and specificity values concomitantly exceeding 60% to Contrast Sensitivity with glasses 30 (50%) patients had 1.25% (80%).21 patients had 2.50% (40%), 9 patients had 5% (20%).

Contrast Sensitivity has a high percentage in POAG; approximately 33 patients with decreased contrast sensitivity about 15 subjects had 1.25% (80%), 13 subjects had 2.5% (40). Five subjects had 5% than PCAG approximately 11 subjects had 1.25% (80%), four subjects had 2.5% (40), and two subjects had 5% in PCAG after than in ACG approximately three subjects had 1.25% (80%), three subjects had 2.5% (40) and two subjects had 5% in ACG (13). Low percentage in SG approximately 1 subject had 1.25% (80%), 1 subject had 2.5% (40), and 1 subject had 5%. Still, there was no evidence of current previous studies about the types of glaucoma affecting contrast sensitivity.

The study was prospective and conducted in a specialized hospital for eye diseases, having standardized methods and techniques used for the study; however, small sample size is appreciated as a limitation of this study.

CONCLUSION

In this observational study, the result showed a reduction in contrast visual acuity with and without refraction. Most patients had variation at the level of contrast visual acuity in primary open-angle glaucoma. Therefore, it is recommended that contrast sensitivity be performed in patients with refractive errors; in glaucoma patients, visual acuity compared to contrast ability can determine the asymptomatic disorder of eyes.

Routine clinical tests for high and low contrast sensitivity should be done to evaluate patient detail resolving ability and disturbs daily activities, therefore patients must be counseled accordingly.

Conflict of interest:

All the authors declared no conflict of interest.

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