CONTRAST SENSITIVITY FUNCTION AND PHOTOSTRESS RECOVERY TIME IN GLAUCOMA SUSPECTS

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ABSTRACT

OBJECTIVE: *The aim of this study was to assess contrast sensitivity function and photostress recovery time in Glaucoma suspects and to find the association of raised IOP with Contrast sensitivity function (CSF) and Photostress recovery time (PSRT).*

METHODS: *In this cross sectional observational study, 97 glaucoma suspects were included. The suspects were selected from regular visitors of the outpatient department of Ophthalmology Mayo Hospital Lahore. The ethics board of the University approved the study protocol. The principles of Declaration of Helsinki were followed in the study. All the subjects provided written informed consent. CS was measured monocularly using the Pelli-Robson chart at distance of 1 m with standard room illumination and scores were noted for at least two letters identified by the suspects with least contrast. PSRT was tested using distant direct ophthalmoscope. One sample t-test was used to analyze the data and compare means of CSF and PSRT with normal values mentioned in literature. Pearson correlation was applied to find the relation of variables.*

RESULTS: *The analysis included 97 glaucoma suspects. Mean age was 49.98 ± 7.12 years, and 41% were men. Mean CSF was 0.92 ±0.10 (p<0.000). Similarly, PSRT was 59.32seconds (p<0.000). The correlation of IOP with CSF was r= -0.435(p<0.000) and IOP with PSRT was r = 0.224 (p=0.028).*

CONCLUSION: *The study results showed that Contrast sensitivity is reduced and Photostress recovery time is delayed in glaucoma suspects. The raised IOP also showed significant association with CSF and PSRT. This result is a useful psychophysical indicator and could give an important clinical understanding of the early changes before glaucomatous optic disc and defected visual field are appeared.*

KEY WORDS: *Glaucoma, Glaucoma suspects, Contrast sensitivity.*

INTRODUCTION

Glaucoma is a neuro-degenerative disease of the ganglion cells of retina with typical features of increased intraocular pressure (IOP), glaucomatous optic disc and usually visual field defects. According to WHO it is the second leading cause of irreversible and preventable blindness worldwide.[1] The global prevalence of glaucoma is estimated to be 3.5% and it represents a main public health challenge in the aged population particularly in people aged above 40 years.[2] It is expected to affect 76 million population in 2020 and more than 111 million individuals by the year 2040.[3]

Glaucoma can be classified into various types e.g. primary open angle glaucoma, normal-tension glaucoma, angle closure glaucoma, secondary glaucoma, and congenital glaucoma based on the underlying anatomy and pathophysiology. The predominant subtype is primary open-angle glaucoma (POAG), which is an inherited disorder defined by visual field defects and ONH excavation.[4]

The prevalence of glaucoma in Pakistan is about 1.8 million and almost half of the patients have permanently lost their eyesight, due to delay in diagnosis and treatment. About 90% of the population even don't have awareness about the disease.[5] To reduce the risk of permanent vision loss an early diagnosis is necessary, nearly half the glaucoma

patients remain undiagnosed until a late stage because the disease is slowly progressive and asymptomatic in early stages.[6]So, it is important to timely diagnose and start treatment, that can be done by screening glaucoma suspects. Glaucoma suspects are the individuals who are at risk of developing glaucomatous optic nerve degeneration (GOND) and vision loss in the future. A person can be declared as a glaucoma suspect if he or she has one or more of the following clinical features like: elevated Intraocular pressure, abnormal angles, strong family history of Glaucoma, High Myopia and Systemic diseases like diabetes and hypertension.[7]

This vision loss adversely affects function in daily life like mobility, reading, driving and causes bumping into objects and falls. The progression of glaucoma affects VA, color vision, contrast sensitivity (CS) and visual field. Assessment of these vision parameters is very important for everyday function and quality of life.[8]

Glaucoma patients can have decreased contrast sensitivity despite normal VA. Changes in CS of the patients have been noticed before any reduction of visual acuity, visible structural changes on the retinal nerve fiber layer and manifest defects on visual fields. It has been revealed that around 30% of the optic nerve axons are lost before visual field defects become apparent. The inadequacy of visual fields to spot early glaucomatous changes led attempts to detect the early changes with contrast sensitivity.[9]

Apart from contrast sensitivity testing, photostress test for glare sensitivity also plays a key role in detection of Glaucoma. Several studies reported PSRT as a potential test to screen retinal diseases like glaucoma and diabetic retinopathy.[10]Photostress is a simple test that is used in differentiating the cause of decreased VA arising from any disorder occurring either in the optic nerve or in the macula.[11] According to age of patient the recovery time changes. The PSRT of 50 to 60 seconds correspond to people with age of 40 years or more and for healthy young people with no macular disorders, it is less than 50-60 seconds. Recovery time of 1.5-3 minutes or longer is recorded in patients with macular problems and other posterior segment diseases. Recent studies on photostress test have shown a delayed dark adaptation or increased recovery time in glaucoma (an inner retinal disease)[12] which mainly affects retinal ganglion cells. This suggested that the delayed recovery time is due to abnormality of ganglion cells.[13]

This study was conducted to assess CSF and PSRT in glaucoma suspects and determine whether raised IOP in glaucoma suspects has any influence on CS and PSRT or not.

MATERIALS AND METHODS

A cross-sectional observational study was carried out in college of ophthalmology and allied Vision Sciences, King Edward Medical University from September to December 2022. The study included 97 glaucoma suspects. The suspects were selected from regular visitors of the outpatient department of Ophthalmology Mayo Hospital Lahore. The ethics board of the University approved the study protocol. The principles of Declaration of Helsinki were followed in the study. All the subjects provided written informed consent. IOP of the participants was measured by applanation tonometry. Contrast Sensitivity was measured monocularly using the Pelli-Robson chart at a distance of 1 m with standard room illumination and scores were noted for atleast two letters identified by the suspects with least contrast. PSRT was tested using distant direct ophthalmoscope.

Data was entered and analyzed using Statistical Package for Social Science (SPSS version 25). Qualitative variables were presented as frequency and percentages, and quantitative variables were measured as Mean ±SD. One sample T test was used to analyze the data and compare means of CSF and PSRT with normal values mentioned in literature. Pearson correlation was applied to find the relation of variables. P-values ≤0.05 was considered significant.

RESULTS

Of the 97 participants enrolled in the study 41(42%) were males and 56(57%) were females. Data for PSRT and CSF were analyzed for 97 suspects with mean age 49.98±7.12 years (40 to 65 years)mean IOP value is 27.40±5.604, mean CSF value is 0.928±0.265 and mean PSRT value was 59.32±7.47 seconds.

Table - 1: PSRT of Glaucoma suspects

	Test Value = 44.7						95% confidence interval of the difference	
	mean	Standard deviation	T	df	Significance (2-tailed)	Mean difference	lower	upper
PSRT	59.329	7.47840	19.267	96	0.000	14.6299	13.1227	16.1371

This table shows that mean PSRT of participants in this

study differ significantly with the test value (p<0.05). One sample T test was applied to compare the means of PSRT in glaucoma suspects and those of normal individuals present in literature. This indicates that recovery time in glaucoma suspects is delayed like that occurring in glaucoma patients.

Table - 2: CSF of Glaucoma suspects

Test Value = 1.71							95% confidence interval of the difference	
	mean	Standard deviation	T	df	Significance (2-tailed)	Mean difference	lower	upper
CSF	0.9286	0.26548	-28.988	96	0.000	-0.78139	-0.8349	-0.7279

The table shows that mean CSF of participants in this study differ significantly with the test value (p<0.05). One sample T test was applied to compare the means of CSF in glaucoma suspects and those of normal individuals present in literature It shows CSF is reduced in glaucoma suspects compared to normal individuals.

Table - 3: Correlation of IOP with CSF, PSRT and Age.

		IOP	CSF	PSRT	Age
IOP	Pearson Correlation	1	-0.435	0.224	-0.039
	Sig (p-Value) 2-tailed		0.000	0.028	0.707
	N	97	97	97	97

Pearson correlation test was applied to find the correlation among the variables. IOP showed significant correlation with CSF (p<0.05) and PSRT (p<0.05) while age of patient was not related with IOP (p>0.05).

DISCUSSION

Glaucoma is a heterogeneous group of diseases,cause irreversible blindnessand has high prevalence in elderly population.[1,3] It disturbs visual functions,affects daily life activities, independent living and quality of life.[8]

CS is a measure of central visual function and it can be used as evaluation of glaucomatous damage because more than 50% of retinal nerve fiber layer originates from the macula. Several studies have revealed that CSF is significantly decreased in glaucoma patients compared to the control group, the pathophysiology behind this is death of retinal ganglion cells.[14] The visual function loss in glaucoma patients with decrease in VA or without decrease has been comprehensively described in the literature.[8,9]

Theresults of this study explained that the glaucoma suspects had impaired CSF compared to normative values of controls in different studies. The normative data for contrast sensitivity for less than fifty years is 1.71log units in Pelli–Robson chart.[15]In this study, value of CSF was 0.923 log units in the suspects. One sample T test was used to compare the means of CSF in glaucoma suspects and that of normative values in the literature and the test results were significant with (p=0.000). Some studies also suggested reduced CSF in glaucoma suspects too using different contrast charts and methods.[14]

Many studies reported PSRT to be a reliable macular function test and is a potential tool for screening some of retinal diseases.[13,15]Several studies showed the normative data for PSRT of age <50 years to be 44.7s, 41.97s, 45.0s,35 s and 46.98s. [11,12,13,16,]Studies also suggested delayed recovery time in glaucoma patients with average 70.47 seconds recovery time and the prolonged PSRT found in primary open angle glaucoma is characterized by progressive death RGCs.[13]

In this study mean recovery time for glaucoma suspects was 59.1 seconds. Using One sample T test mean recovery time of 44.7seconds (from literature) was compared to 59.32 seconds of glaucoma suspects and the results were significant (p=0.000).

In the present study correlation of IOP with CSF and PSRT was evaluated and a significant correlation of p=0.000 and p=0.000 was found respectively.

In summary, this study was able to verify that CSF is decreased in glaucoma suspects and PSRT is increased in suspects. These both tests are very easy, simple, cost effective and less time taking and very effective in glaucoma screening. IOP is significantly correlated to CS function and PSRT in glaucoma suspects.If we integrate CSF and PSRT into routine screening and examination of eye, people in the suspects stage can be easily identified and well counseled. In addition, early treatment can be planned and vision loss can be prevented.

CONCLUSION

The study results showed that Contrast sensitivity is reduced and Photostress recovery time is delayed in glaucoma suspects. The raised IOP also showed significant association with CSF and PSRT. This result is a useful psychophysical indicator and could give an important clinical understanding of the early changes before glaucomatous optic disc and defected visual field are appeared.

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