Ophthalmology

A CORRELATIVE STUDY OF PUPILLARY RESPONSE AS MEASURED BY AUTOMATED MONOCULAR PIPILLOMETER (NEUROPTICS PLR™-3000) WITH RETINAL NERVE FIBER LAYRE THICKNESS AND VISUAL FIELD IN VARYING SEVERITIES OF GLAUCOMA

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ABSTRACT

OBJECTIVES To assess the efficacy of monocular pupillometry as a clinical RAPD test to detect asymmetrical as well as symmetrical glaucoma and to correlate this with visual fields and retinal nerve fiber layer thickness.

MATERIALS AND METHODS

1) Study area: The study is conducted at Aravind Eye Hospital and PG Institute of ophthalmology at Madurai, Tamil Nadu.

2)Study population: We would enroll patients with glaucoma of any cause (as per our inclusion criteria) in at least one eye, defined by having both optic disc and/or retinal nerve fiber layer structural abnormalities consistent with glaucomatous damage.

3)Sample Size: 125 cases

4)Study design: Hospital based prospective study.

5)Study duration: December 2017 to July 2018.

6)Method of measurement of outcome of interest: Quantification of pupillary response could help in assessing the varying severities of glaucoma. NeurOptics® PLR™-3000 monocular pupillometer could be a probable screening tool to assess asymmetric glaucoma. RAPD (or the swinging flash light test) detects only differences between the two eyes, but when the severity of glaucoma is the same in both eyes, could paradoxically generates a RAPD =0. Thus the use of the monocular device is intended to quantify the severity of one eye independently of the contralateral eye and detects symmetrical glaucoma also.

KEYWORDS :

Data collection methods:

All patients will be examined and findings recorded as per the proforma designed for the study (Annexure 1) after obtaining a Written Detailed Informed Consent for inclusion in the proposed Study (Annexure 2).

Selection criteria of patients:

Inclusion Criteria for cases: Adult population >35,BCVA better than 6/36 in both eyes ,Primary Open Angle Glaucoma (POAG),Primary angle closure glaucoma (PACG) post LPI, Pseudoexfoliation Glaucoma, Pigmentary Glaucoma

Exclusion Criteria for cases:

Cloudy corneas, Any retinal pathologies like vessel occlusions, retinal detachments, Severe NPDR, PDR with extensive PRP,H/O blunt ocular injury, Past H/o ocular surgeries, Severe Uveitis, Primary and secondary optic atrophies, On miotic or mydriatic medications,On systemic medications, On topical alpha agonists Dense cataracts. More than NS II, Congenital pupil abnormalities/ Anterior segment dysgenesis.VA less than 6/36, Refractive error: Refractive error: refractive error higher than +3.00 or lower than - 6 diopters, Patient not willing for the study

METHODOLOGY

All enrolled patients would undergo a detailed ocular and systemic examination including: Best corrected visual acuity (BCVA) measured by Snellen charts.Retinoscopy with subjective and automated refraction (Auto-Ref-Keratometer, RK-5; Canon, Tokyo, Japan).Slit lamp examination.Intraocular pressure (IOP) measurement using Goldmann applanation tonometry (GAT).Gonioscopy using a Zeiss four mirror prism.Pupillary responses would be assessed using an automated pupillometer (NeurOptics® PLR™-3000 Pupillometer).The test duration is 25-45sec.Two readings would be taken by the same examiner to assess intra observer variability. The neurological pupil index and pupillary dynamics is captured from the machine.Corneal thickness measured using a pachymeter (Pacscan 300 AP).Visual field testing by an automated Perimeter would be done by a Humphrey Field Analyzer- SITA standard (24-2) (zeiss 750 i) algorithm.The pupils would be dilated with tropicamide for an Optical Coherence Tomography- RNFL study (Heidelberg engineering) and the superior and inferior RNFL thickness would be captured from the data, followed by Fundus Photograph (Topcon TRC 50EX).+++++QA final detailed examination of the patient would be done by the study examiner noting down the posterior segment findings and correlating all the investigations.

STATISTICAL METHODS:

A sample of 125 cases are needed to find the sensitivity of the automated pupillometer (NeurOptics® PLR™-3000 Pupillometer) with 80% specificity, 7% precision and 95% Confidence Interval. Mean (SD) or Frequency (Percentage) will be used to describe summary information. Chi-square test or Fisher's exact test will be used to assess the association between categorical variables. Pearson correlation or spearman rank order correlation will be used to find out the correlation between variables. P-value is less than 0.05 considered as statistically significant. All statistical analysis will be done by STATA 11.1 (Texas, USA

RESULTS: A total of 120(240 eyes) subjects were recruited for study. The subject was aged ranging from 42-78 years and the mean age among the cases were (60.53+/- 7.71). The history laser peripheral iridotomy (PI) done in 72 cases and 168 cases laser PI not done.

CONCLUSION: Measuring pupillary reflex with automated monocular pupillometer can detect optic neuropathy in glaucoma. The method is fast and objective, measured by trained technician.This study shows, that automated monocular pupillometer reading positively correlated with OCT and visual field finding. Automated monocular pupillometer can become part of the routing examination of glaucoma especially for screening, but still we required detailed examination of optic nerve appearance and visual field testing. The pupillometer also help to asses the severity of glaucoma with the help of NPI value.

TABLE 1: Mann Whitney U test Mann Whitney U test

Parameters	NPI Mean (SD)	MD Median (IQR)	PSD Median (IQR)	OCT INF * Mean (SD)	OCT SUP * Mean (SD)
Gender Female Male P-value	4.6(0.4) 4.3(0.7) 0.002	-6.3(-9.9 to -2.8) -6.2(-11.6 to -3.1) 0.667	5.0(2.3-7.5) 5.2(2.5-8.4) 0.274	106.6(24.4) 97.3(29.3) 0.012	106.9(25.8) 102.6(28.0) 0.288
Laser history No Yes P-value	4.4(0.6) 4.6(0.4) 0.004	-6.7(-10.3 to -3.5) -4.9(-10.2 to -2.1) 0.074	5.2(2.5-8.3) 4.7(2.0-8.4) 0.129	98.2(26.4) 107.2(30.2) 0.009	101.5(26.5) 110.6(27.9) 0.005

YAG No Yes P-value	4.4(0.6) 4.6(0.4) 0.004	-6.7(-10.3 to -3.5) -4.9(-10.2 to -2.1) 0.074	5.2(2.5-8.3) 4.7(2.0-8.4) 0.129	98.2(26.4) 107.2(30.2) 0.009	101.5(26.5) 110.6(27.9) 0.005
Gonioscopy Close Open P-value	4.7(0.2) 4.4(0.6) 0.391	-9.5(-11.3 to -6.1) -6.2(-10.3 to -3.0) 0.389	8.4(6.8-9.0) 5.2(2.4-8.3) 0.146	115.5(26.1) 100.6(27.9) 0.181	109.0(16.0) 104.2(27.2) 0.905
RAPD Absent Present P-value	4.4(0.6) 4.0(0.04) 0.069	-6.2(-10.2 to -3.0) -22.5(-24.3 to -20.7) 0.024	5.2(2.4-8.3) 11.4(10.3-12.4) 0.05	101.3(27.6) 51.0(12.7) 0.036	104.8(26.7) 40.5(7.8) 0.022

In the above table Mann Whitney U test was used to find the significant difference between the two groups in assessing the clinical parameters. The p-value (<0.05) shows that there is a significant difference between the two groups.

TABLE 2. SPEARMAN RANK ORDER CORRELATION.

| Correlations & P-value □	NPI	MD	PSD	OCT INF Average
MD (n=240)	0.2666 <0.001			
PSD (n=240)	-0.1295 0.0451	-0.7600 <0.001		
OCT INF Average (n=240)	0.2935 <0.001	0.5980 <0.001	-0.5090 <0.001	
OCT SUP Average (n=240)	0.1638 0.011	0.5488 <0.001	-0.4961 <0.001	0.6131 <0.001

p- Spearman Rank Order correlation

In the above-mentioned table, Spearman rank order correlation was used to find the correlation between two independent variables. The P value (<0.05) shows that there exists a correlation between the variables. NPI is positively correlated with MD (rho =0.27, p<0.001), positively correlated to OCT INF average (rho = 0.29, p<0.001), positively correlated to OCT SUP average (rho = 0.16, p=0.011).
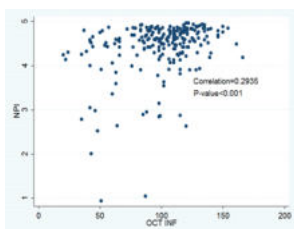
NPI is positively correlated with MD
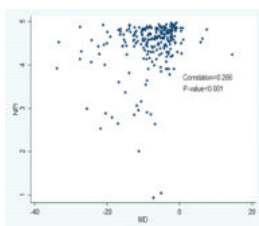
NPI is positively correlated with OCT SUPERIOR
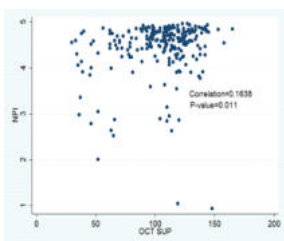
NPI is positively correlated with OCT INFERIOR

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