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Comparison of Baseline Ocular Demographic Characteristics between Primary Open-Angle Glaucoma Subjects and Controls

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ABSTRACT

Background: Primary Open-angle Glaucoma (POAG) is a prevalent eye disorder affecting masses. The general ocular characteristics routinely done in all patients are not paid special consideration which can add valuable ophthalmological information, and to enlighten about its efficacy is the main focus of the study. **Objective:** To determine and compare general ocular demographic attributes in cases of POAG and age-matched controls. **Study Design:** Case-control study. **Settings:** This case-control study was conducted at Al-Ain Eye Institute, Karachi Pakistan. **Duration:** 4 months from November 2018 till February 2019. **Methods:** After approval from Ethical Review Committee (ERC) of Bahria University Health Sciences (BUHS), 57 patients of POAG and 46 age-matched healthy controls, stratified into age-groups contributed as samples for the study. The ophthalmoscopic parameters were calibrated using slit-lamp bio-microscopy, tonometry and axial-length (AXL) electronic measurements. Independent sample T-test, along with Fischer exact and Mann Whitney-U tests were used for statistical analysis. **Results:** The baseline characteristics of AXL in cases was (24.23 ± 1.99mm) as opposed to (23.27 ± 1.99mm) in controls, Intraocular pressure (IOP) (p-value 0.000); with range in cases analyzed (20.05 ± 2.47 mmHg) as compared to (15.59 ± 3.46 mmHg) in controls. Vertical cup-to-disc ratio (VCDR) also exhibited statistically significant results (p-value 0.000). **Conclusion:** Careful analysis of AXL, IOP and VCDR can provide beneficial knowledge in subjects. Deranged values can provide clue in undiagnosed cases of POAG and specific ocular tests should be employed in such cases.

Keywords: *Primary Open-angle glaucoma, AXL, IOP, VCDR.*

INTRODUCTION

Glaucoma ranks tall among the causes of blindness.[1] Increased IOP, myopia, increased corneal thickness and optic disc hemorrhages are some factors that have been implicated in the pathogenesis.[2] Glaucomatous optic neuropathy (GON) occurs as a result, sufferers realize about POAG late after its onset, till then progressive ocular loss already had occurred.[3] Hence its early detection merits heavy. When the advanced techniques are being employed for POAG detection and treatment worldwide, Pakistan; facing many socio-economic challenges also face one problem, ignorance of simple medical knowledge that may aid great to the overall prognosis of the ailment.[4] In Pakistan, ophthalmological investigatory appliances are present in public and private sector hospitals that routinely measure the AXL, IOP and VCDR. AXL is one of the major causes for refractive ocular errors,[5] and its increase occurs mostly in POAG.[6] IOP enhancements occur in ubiquity in POAG cases. Its calculation and appropriate cause of its fluctuations is important in POAG management.[7] IOP has also been associated with other optic nerve head morphological disorders.[8] The anatomical appearance of optic nerve head is imperative and its clinical evaluation is commonly employed in eye examinations.[9] Its diversities have impact over the progression of GON. Since these ocular findings are inexpensive and may add a magnitude of evidence in the overall diagnosis, we are determining and comparing these attributes among the POAG cases and healthy controls in our study.

METHODS

This case-control study was conducted at Al-Ain Eye Institute, Karachi Pakistan with the duration of 4 months from November 2018 till February 2019. For cases- POAG cases were recruited who had an IOP of >22mmHg 22mmHg measured by Goldmann tonometry (At-900, Haag Striet, Switzerland), with open-angle glaucoma ascertained by gonioscopy and examination through slit-lamp (Topcon SL-D 7, Topcon Corporation, Tokyo, Japan) and stereoscopic ophthalmology (WelchAllyn, USA). For controls, IOP of < 21 mmHg, with no optic disc defects.

All other types of glaucoma and any ocular disease, autoimmune disorders, diabetic and hypertensive retinopathies and patients of neurological disorders and head traumas were excluded from the study.

The study included 103 total participants with 57 cases of POAG and 46 age-matched healthy controls by using non probability purposive sampling technique. Both eyes of the participants were examined. The study was ethically approved by ERC of BUHS (ERC 60/2018). IOP of > 22 mmHg (Goldmann Applanation tonometry) was considered to be having POAG. Open angle of the anterior chamber was examined by gonioscopy and Slit-lamp biomicroscope and stereoscopic ophthalmoscopy was ascertained. AXL of up to 30 mm (Optical Biometer Al Scan I) were included in the study. Optic disc and cup-to-disc ratio (Slit-lamp biomicroscope and stereoscopic ophthalmoscopy) were also calculated. Participants had least visual acuity of >20/40.

The Visual field assessment accepted protocol for visual field defects for cases was taken as external normal limits on glaucoma hemifeild test, with three nonstandard points with P <5% probability of being normal, 1 with P<1% by pattern deviation, pattern standard deviation of <5% on automated Humphry 50-2 VF analysis [(Medmont M 700 Automated Perimeter, fast threshold, Vermont, Australia) for visual field analysis].[10]

ALCD, LCT and RNFLT were measured using SD-OCT with enhanced depth imaging (REVO nx/SOCT Copernicus REVO OPTOPOL Technology, Wavelength 830nm, Axial resolution 2µm, scan speed 1,10,000 scans/sec, scan time 1.37seconds, OPTOPOL Technology Sp. Z o.o, ul. Zabia 42, 42-400 Zawiercie, Poland) on standard guidelines.[6] "ALCD was drawn as a link between the ends of Bruch's membrane and anterior border of LC 10", whereas LCT was estimated by "measuring the zone between the anterior and posterior borders of LC".[6]

RESULTS

The recent study included 57 cases of POAG and 46 age-matched controls. 9 participants were excluded due to inability to follow the standard guidelines. As shown in table 1, males insignificantly predominate in the cases as well in controls, with maximum preponderance in the 61-70 years age group.

Table 2 exhibits the general ocular examination findings, with significant results for AXL (24.23 ± 1.99mm) in cases in comparison to (23.27 ± 1.99mm) in controls. IOP also displayed significance, in cases with a range of (20.05 ± 2.47 mmHg) as equated to (15.59 ± 3.46 mmHg) in controls. The VCDR also demonstrated highly significant results, with the ranges of (0.86 ± 0.24) as opposed to controls (0.54 ± 0.19).

Table 1: Comparison of POAG cases and controls according to age

Age, years	Subjects		P-value
	Case (n=57)	Control (n=46)	
<40 Years	4 (7.0%)	3 (6.5%)	0.163ɤ
41-50 Years	12 (21.1%)	4 (8.7%)	
51-60 Years	14 (24.6%)	21 (45.7%)	
61-70 Years	15 (26.3%)	11 (23.9%)	
71-80 Years	11 (19.3%)	5 (10.9%)	
>81 Years	1 (1.8%)	2 (4.3%)	
Male	32 (56.1%)	29 (63.0%)	0.528 ɤ
Female	25 (43.9%)	17 (37.0%)	

P-value ≤0.05 is significant and shown in boldface, ɤ- Fischer exact test, §- Mann Whitney-U test, †- Independent sample T-test

Table 2: General ocular examination characteristics

General ocular characteristics	Subjects		P-value
	Case (n=57)	Control (n=46)	
Axial Length (mm)	24.23 ± 1.99	23.27 ± 1.99	**0.020 §**
Intraocular Pressure (mmHg)	20.05 ± 2.47	15.59 ± 3.46	**0.000 §**
Mean Deviation (dB)	-2.92 ± 2.52	-2.21 ± 2.52	**0.047 §**
Pattern Standard Deviation (dB)	7.54 ± 4.69	3.73 ± 2.12	**0.000 §**
Retina Nerve Fiber Layer Thickness (µm)	73.21 ± 13.63	78.85 ± 9.01	**0.055 §**
Disc Area (mm^2)	2.46 ± 0.93	2.45 ± 0.68	0.647 †
Rim Area(mm^2)	1.00 ± 0.53	1.10 ± 0.50	0.367 †
Vertical Cup to Disc Ratio	0.86 ± 0.24	0.54 ± 0.19	**0.000 §**
Anterior Laminar Depth(µm)	300.87 ± 145.38	334.85 ± 154.96	0.220 §
Lamina Cribrosa Thickness(µm)	218.07 ± 79.80	271.77 ± 64.45	**0.001 †**

P-value ≤0.05 is significant and shown in boldface, ɤ- Fischer exact test, §- Mann Whitney-U test, †- Independent sample T-test

DISCUSSION

The present study is based upon the calibration of general ocular examination findings between the cases of POAG

and age-matched healthy controls. Such findings are not usually paid the attention they deserve[11] though these trivial results can provide a lot of insight and can put a heavy impact over the outcome for the disease.

AXL of the eyes may add ominously in several ophthalmological disorders[12] but this has been linked with a greater frequency in glaucomatous individuals. Many studies have found out the role of greater AXL in POAG subjects[13]. We have also gathered similar and statistically significant results so AXL of the eyes should be paid special consideration especially in POAG.

The rise in IOP had historically been proven to be directly proportional to enhancement in progression of glaucoma as was found in innumerable studies conducted.[14] We in this study explored this relationship and found it to be highly significant as other researchers also did.[15] As lowering of IOP is the only target for the non-invasive correction of glaucoma.[16] We can document through our study that non-contact tonometry is such a simple procedure, its routine analysis can prove beneficial in screening out higher IOP cases at all ages[17] as glaucoma is one big determinant of loss of sight worldwide.

The optic disc anatomical measurements vary greatly with the onset of glaucoma. Our findings of the study are in parallel to the findings world over[18-21] and in all the ages.[22] Such minor alterations of optic disc may aid a lot to the ophthalmologist about the establishment for the diagnosis of POAG and numerous other optical errors and chronic conditions of the eye.

CONCLUSION

The study was conducted over 56 cases and 46 controls, in which the males predominated and that too in the age bar of 61-70 years. General ophthalmoscopic findings which are usually not paid the appropriate attention, were researched in which greater AXL of eyes were significantly found in cases of POAG. The raise in IOP is one determinant characteristic in glaucoma which was also significantly raised in our study. Similar significant results were gathered for VCDR in cases of POAG. So such routine findings may lead to diagnosis of the disease, so they should be given special desired consideration.

LIMITATIONS

Majority of the subjects were not willing for participation in the study and to utilize their data for research. Moreover, this study was conducted at one hospital due to lack of facilities.

SUGGESTIONS / RECOMMENDATIONS

Such type of researches should be conducted at a large scale and should be multi-centric. The general ocular characteristics should be conducted routinely as screening. By doing so the already burdened worrisome state of glaucoma can be detected earlier before the onset of any disability.

CONFLICT OF INTEREST / DISCLOSURE

There was no conflict of interest

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