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Clinical Evaluation of Optic Nerve Head Parameters In A Rural and Urban Population in West Bengal

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Abstract:

Aim: To clinically analyse the various optic nerve head parameters in a rural and urban population in West Bengal aged over 40 years and with open angles.

Materials and Methods: This research work has two arms, the rural arm is an eye care centre in Hooghly District of West Bengal (Village: Kuliapara, P.O. Dhobapara, P.S. Balagarh) and the urban arm is a tertiary eye hospital in Kolkata, West Bengal. People aged 40 years and above or those turning 40 in the calendar year and not on any topical or systemic medications underwent complete ophthalmological examination including clinical evaluation of optic nerve head with slit lamp biomicroscopy. Patients with history of intraocular surgery, ocular trauma, and corneal opacities preventing accurate applanation tonometry and media haze dense enough to preclude adequate fundal view were not enumerated.

Results: The sample size analysed is 1641, making it one of the largest study of its kind in India. There is a positive correlation of VCDR with age in both the rural ($r = 0.24$) and urban ($r = 0.44$) groups, though the correlation is much stronger in the urban group. The average VCDR for the urban group is 0.414 and there is a statistically significant difference between the values of the right and left eyes ($p = 0.027871$). The average VCDR in the rural group is 0.42 and there is no statistically significant difference between the right and left eye values in this group ($p = 0.709461497$).

Conclusions: This study not only helps to establish a large database of optic nerve head parameters for both rural and urban populations, but also highlights the significance of accurate evaluation of ONH parameters in the diagnosis and progression of glaucoma.

1. Introduction

Glaucoma is a progressive optic neuropathy in which morphological changes that occur at the optic nerve head (ONH) and retinal nerve fibre layer (RNFL) are associated with functional deficit, measurable as visual field (VF) loss. Examining and monitoring the optic nerve head, structurally and functionally, is important for diagnosis and treatment.¹ Glaucomatous optic nerve damage leads to a multitude of morphological changes of the optic nerve head and to a great variety of functional deficits. Most of the morphological alterations of the optic nerve head have been described semi quantitatively or qualitatively using the cup/disc diameter ratio and qualitative variables such as the occurrence of disc haemorrhages and neuroretinal rim notches.² Structural damage is still largely dependent on clinical assessment with an ophthalmoscope and the detection of change relies on professional judgment.¹

Limited data exist on the morphology of the optic disc in East Asian and South-East Asian populations, which may differ from that of whites. Knowledge of the normal structure of the optic disc and the associations with demographic and biometric variables, and systemic disease in these populations would provide an important reference and may assist in the identification of glaucoma.³

This study aims to clinically analyse the various optic nerve head parameters in a rural and urban population in West Bengal aged over 40 years and with open angles.

2. Materials and Methods

Institutional Ethics Committee clearance was obtained for conducting this population based cross sectional study. This research work has two arms, the rural arm is an eye care centre in Hooghly District of West Bengal (Village: Kuliapara, P.O. Dhobapara, P.S. Balagarh) and the urban arm is a tertiary eye hospital in Kolkata, West Bengal.

People aged 40 years and above or those turning 40 in the calendar year and not on any topic or systemic medications were examined. Patients with history of intraocular surgery, ocular trauma, corneal opacities preventing accurate applanation tonometry and media haze dense enough to preclude the adequate fundal view was not enumerated.

All patients were examined as follows :

- Ocular and medical history -- A detailed history pertaining to medical and ophthalmic problems was elicited. Data collected includes use of glasses and its duration, history of previous trauma or surgery or laser in the eyes, history of ocular and oral medication, significant systemic illness with special reference to diabetes or hypertension, significant family history and addiction history.
- Refraction and recording of uncorrected and best-corrected visual acuity
- Torch light external ocular examination including ocular movements and any other obvious strabismus / eyelid pathology.
- Pupillary evaluation – Carried out in dim light conditions. The patient is asked to focus on a distant object and the strength and the direct and indirect reaction of each pupil noted. The presence or absence of an afferent pupillary defect is also checked for.
- Slit lamp biomicroscopy, including Van Herick grading of the angle of the anterior chamber angle.
- Applanation tonometry using the Goldmann Applanation Tonometer .
- Corneal pachymetry – Central corneal thickness using ultrasound pachymetry (Ocuscan RxP, Alcon labs, USA).Average of three readings, rounded off to the nearest whole number, was taken.
- Gonioscopy – Done in dim illumination using a narrow slit beam not extending onto the pupillary area. The Goldmann single mirror lens is used for the purpose. The angle is graded using Shaffer's grading system.
- Grading of lens opacities – using the LOCS II Classification after pupillary dilatation.
- Evaluation of optic disc using +78D lens. The vertical cup-disc ratio (VCDR) was recorded and any other significant findings like presence of pure papillary atrophy, optic disc/ peripapillary haemorrhage, bayoneting sign, baring of circumferential vessels, laminar dot sign, etc. were recorded.
- Frequency Doubling Perimetry (Humphrey FDT, Carl Zeiss, and Dublin, USA) was performed in all patients.

All subjects over 40 years or turning 40 in the calendar year and gonioscopy revealing Shaffer's Grading 3 or more in more than 180 degrees in both eyes were included for enumeration and analysis.

3. Results

One thousand six hundred and forty one patients were analysed in each of the rural and urban groups. In the urban group, female to male ratio is 0.7:1 and that in the rural group is 0.88:1. The average age of the patients in the urban group is 52.5 years while that in the rural group is 53.85 years ($p < 0.001$). The other findings are listed in the table below:

	RURAL	URBAN
Average Age	53.85 years	52.5 Years
VCDR OD	0.42	0.413
VCDR OS	0.42	0.415
VCDR OU	0.42	0.414

Table 1

4. Discussions and Conclusion

The current study is a population based cross sectional study carried out in a rural and urban population of West Bengal. The sample size analyzed is 1641, making it one of the largest studies of its kind in India. Data from this study will help in establishing normative data base as well as initiate early and prompt treatment in glaucoma suspects.

There is a positive correlation of VCDR with age in both the rural ($r = 0.24$) and urban ($r = 0.44$) groups, though the correlation is much stronger in the urban group. The most common disc findings were laminar dot sign, rim notches (mostly superior), loss of ISNT rule and bayoneting of vessels whereas peripapillary atrophy and disc haemorrhages were less commonly seen. These findings were more associated with higher VCDR values. There also exists a positive correlation between intraocular pressure and VCDR in both the rural ($r = 0.32$) and urban ($r = 0.36$) groups, similar to findings in established studies.

The average VCDR for the urban group is 0.414 and there is a statistically significant difference between the values of the right and left eyes ($p = 0.027871$). The average VCDR in the rural group is 0.42 and there is no statistically significant difference between the right and left eye values in this group ($p = 0.709461497$). However, a statistically significant difference exists between the urban and rural VCDR values ($p = 0.026470808$) with the rural values being higher than the urban ones.

In the rural phase of the Chennai Glaucoma Study, the mean VCDR was found to be 0.39,⁴ which is lower than both our urban and rural values, though only the right eyes were analysed in the Chennai Glaucoma Study. However, in the West Bengal Glaucoma Study, the average VCDR values among the subjects studied, all of whom were from a rural belt, was 0.4,⁵ which is closer to the values obtained in the current study.

The 97.5th percentile of VCDR values in the urban and rural phase were 0.6 and 0.7 respectively whereas that in the Chennai Glaucoma Study⁴ was 0.7 and that in the West Bengal Study⁵ was 0.6. The 99.5th percentile of VCDR values in the urban and rural phase were 0.75 and 0.9 respectively whereas that in the Chennai Glaucoma Study⁴ was 0.8 and that in the West Bengal Study⁵ was

0.6. The 97.5th and 99.5th percentiles for VCDR in a Chinese population of Singapore⁶ were 0.71 and 0.81, respectively, whereas those in urban Thailand⁷ were 0.72 and 0.86, respectively. The investigators in the Rotterdam Study⁸ and a population-based study from South Africa⁹ reported that the 97.5th percentile for VCDR in their populations was 0.7. We suggest that in our population, a VCDR value of >0.7 should be viewed as suspect for glaucoma.

This study not only helps to establish a large database of optic nerve head parameters for both rural and urban populations, but also highlights the significance of accurate evaluation of ONH parameters in the diagnosis and progression of glaucoma.

5. References

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