Section: Ophthalmology

JAMP

Original Research Article

AN ANALYTICAL STUDY ON VARIOUS FIELD DEFECTS IN PATIENTS WITH PRIMARY OPEN-ANGLE GLAUCOMA

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Received : 26/12/2023
Received in revised form : 12/02/2024
Accepted : 28/02/2024

Keywords:
Open-angle glaucoma, Glaucoma, Humphrey's Automated Perimetry, Octopus perimeter.

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DOI: 10.47009/jamp.2024.6.1.360

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2024; 6 (1); 1822-1825

Abstract

Background: Glaucoma is one of the leading causes of avoidable blindness in developing nations. Proper screening of high-risk groups at an appropriate time can prevent disease progression. Aim: This study aimed to determine the various types of field defects in patients with primary open-angle glaucoma and to correlate the nature of field defects with intraocular pressure (IOP), age, sex, and refractive error. **Materials and Methods:** This observational and analytical study included 100 patients with primary open-angle glaucoma who underwent visual field testing in the ophthalmology outpatient department. All cases were screened for vision using Snellen's chart, and intraocular pressure measurement was performed using Goldmann's Applanation Tonometry. The results were analysed based on various factors such as age, sex, laterality, presentation of the disease, intraocular pressure, and refractive error. **Results:** Field defects were observed in 58 eyes, with advanced defects being more prevalent in the 41–50-year age group. Myopic individuals had a higher prevalence of all defects, with advanced defects being more prevalent among myopic individuals. IOP is common in most types of defects, with advanced defects in the 26-30 range. Field defects were more frequently observed in new patients, except for superior arcuate scotomas and Bjerrum scotomas. Advanced field defects were more common in the right eye, whereas superior and inferior arcuate defects were more common in the left eye. **Conclusion:** The most common field defect was paracentral scotoma, followed by isolated nasal steps. Advanced defects are more common in females, myopes, and those with high intraocular pressure. Adequate IOP control prevents the progression of visual field defects.

INTRODUCTION

Glaucoma is becoming one of the leading causes of avoidable blindness in developing countries. Proper screening of high-risk groups at an appropriate time can prevent disease progression. Glaucoma is a group of disorders characterised by progressive optic neuropathy which is reflected as scotomas in the patient's visual field and field defects in automated perimetry tests, in which intraocular pressure is the key modifiable risk factor. With the widespread growth in the field of ophthalmological practice with various advancements in ophthalmic instruments, the screening of glaucoma is carried out at various levels from field-level camps to tertiary centres by simple measurement of IOP from a range of devices from Schiotz tonometry to iCare tonometry and ton open at field-level testing and precise non-contact tonometry and accurate Applanation Tonometry at institutional levels.

Visual field testing can also be performed at field levels using a basic Bjerrum screen, which is the most sensitive testing algorithm for primary screening to precise perimetry testing with instruments such as Humphrey's perimeter and octopus perimeter. Thus, screening patients with IOP measurement and field testing with a Bjerrum screen can identify cases at the preliminary level. In a tertiary care Institution with Humphreys Automated Perimeter, diagnosed primary open-angle cases undergo very precise field testing, thus enabling the detection of minor field defects and for induction of earlier therapy which would make the field change static and non-progressive.

Aim

This study aimed to determine the various types of field defects in patients with primary open-angle glaucoma and to correlate the nature of field defects for intraocular pressure, age, sex, and refractive error.

MATERIALS AND METHODS

This observational and analytical study included 199 eyes from 100 patients with primary open-angle glaucoma who underwent visual field testing in the ophthalmology outpatient department. The study was approved by the institutional ethics committee before initiation, and informed consent was obtained from all patients.

Inclusion Criteria

All patients presenting with primary open-angle glaucoma, including newly diagnosed cases and those already on treatment (medical, surgical, or laser) were included.

Exclusion Criteria

Secondary glaucoma, glaucoma cases with closed angles, and field defects due to non-glaucoma causes were excluded.

Humphrey's automated perimetry is a sensitive modality for assessing visual field defects. Patients were subjected to visual field testing using Humphrey's automated perimetry. All cases were screened for vision using Snellen's chart, and intraocular pressure measurement was performed using Goldmann's Applanation Tonometry. A gonioscopic examination was performed using Goldmann's Three and Mirror Gonio lenses to confirm the diagnosis. Fundus examination by direct ophthalmoscopy was performed to evaluate disc status and other signs of glaucomatous changes.

After arriving at the diagnosis of primary open-angle glaucoma, patients were subjected to visual field examination using Humphrey's Automated Perimetry. The various field defects noted were paracentral scotoma, superior and inferior arcuate scotoma, isolated nasal step scotoma, and Bjerrum scotoma. Double arcuate scotomas and tubular vision were classified as advanced field defects.

The results were analysed based on various factors such as age, sex, laterality, presentation of the disease, intraocular pressure, and refractive error. The results were tabulated to refine and obtain an extensive and in-depth analytical report to arrive at a firm correlation of the factor observed with the disease studied.

RESULTS

The field defects observed were superior arcuate defects, inferior arcuate defects, nasal steps, paracentral scotomas, Bjerrum scotomas, and double arcuate scotomas, whereas patients with tunnel vision were classified as advanced field defects. No defects were observed in 58 (29.1%) eyes.

Age-wise description of field defects observed among subjects, of which advanced field defects were observed in the 41–50 years age group, superior and inferior arcuate defects in the 61–70 years age group, paracentral scotoma, and nasal step in the 51–60 years age group. However, no defects were observed in the 41 50 years age group. The sex distribution of field defects, of which advanced field defects were more prevalent in females, whereas other field defects were observed to be higher in males.

Myopic individuals have more preponderance in all field defects, and advanced field defects are more prevalent among myopic individuals. 78 persons with immature cataracts and pseudophakia were excluded from this plot. IOP observed in almost all types of defects is common in IOP 21 to 25, while advanced defects (Double Arcuate scotoma and tubular vision) are in the IOP range of 26 to 30. Nasal step in 16 the 20 IOP range of 16–20.

Field defects of all types are more frequently observed in new patients, except for superior arcuate scotomas and Bjerrum's scotomas. Field defects, such as advanced field defects, Bjerrum's scotoma, and nasal steps, were observed more frequently in the right eye, while superior and inferior arcuate defects and paracentral scotomas were observed more frequently in the left eye. [Table 1]

Table 1: Comparison of field between various parameters

		Paracentral Scotoma	Superior Arcuate Scotoma	Nasal step	Inferior Arcuate Defect	Advanced Field Defect	Bjerrum's Scotoma	No Defect
Fields		49(24.4%)	34(17.1)	25(12.5%)	15(7.5%)	13(6.5%)	5(2.5%)	58(29.1)
Age	31-40	2(4.1%)	0	0	0	0	0	4(6.9%)
	41-50	3(6.1%)	2(5.9%)	1(4%)	0	5(38.5%)	2(40%)	21(36.2%)
	51-60	21(42.9%)	8(23.5%)	13(52%)	3(20%)	3(23.1%)	0	14(24.1%)
	61-70	19(38.8%)	18(52.9%)	10(40%)	10(66.7%)	4(30.8%)	2(40%)	16(27.6%)
	71-80	4(8.2%)	6(17.6%)	1(4%)	2(13.3%)	1(7.7%)	1(20%)	3(5.2%)
Sex	Male	30(61.2%)	22(64.7%)	13(52%)	9(60%)	5(38.5%)	3(60%)	24(41.4%)

ISSN (O): 2687-5365; ISSN (P): 2753-6556

	Female	19(38.8%)	12(35.3%)	12(48%)	6(40%)	8(61.5%)	2(40%)	34(58.6%)
Refractive error	Hypermetropia	8	5	3	3	1	1	15
	Myopic	23	12	10	5	7	1	27
IOP Range in mm of Hg	11-15	2 (4.1%)	3 (8.8%)	0	0	0	0	4 (6.9%)
	16-20	22 (44.9%)	9 (26.5%)	14 (56%)	6 (40%)	0	2 (40%)	21 (36.2 %)
	21-25	24 (49%)	19 (55.9%)	11(44 %)	8 (53.3%)	1(7.7%)	2 (40%)	31 (53.4 %)
	26-30	1 (2%)	3 (8.8%)	0	1(7.7%)	11 (84.6%)	1 (20%)	2 (3.4%)
	31-35	0	0	0	0	1 (7.7%)	0	0
Field defects (New/old)	New	27(55.1%)	9(26.5%)	14(56 %)	9(60%)	8(61.5%)	2(40%)	33(56.9%)
	Old	22(44.9%)	25(73.5%)	11(44 %)	6(40%)	5(38.5%)	3(60%)	25(43.1%)
Field defects (Right/left)	Right eye	17	15	13	8	7	3	36
	Left eye	32	21	10	8	5	2	22

DISCUSSION

An analytical study was conducted in 199 eyes of 100 diagnosed POAG patients who were subjected to field examination by Humphrey's automated perimetry. The field defects observed were superior arcuate defects, inferior arcuate defects, nasal steps, paracentral scotomas, Bjerrum scotomas, and double arcuate scotomas, whereas patients with tunnel vision were classified as advanced field defects. Hormonal variation observed among males and females affects the incidence and progression of the disease course among the sexes. Despite this, in a developing country, such as our time of presentation to health providers, other factors also contribute to disease presentation. This study showed a slightly higher prevalence of advanced field defects in females. This is similar to the meta-analysis conducted by Alice et al.

The retinal ganglion cells are sensitive to the ageing mechanism. This can be explained by the age-related variation observed. Thus, ageing can be established as a fixed variable in field changes observed in glaucomatous patients. However, age also acts as a variable at the time of presentation in routine follow-up. This also acts as an additive to the analysed variables. This study shows that advanced field defects are distributed as a spectrum between 40 and 70 years of age. Earlier field defects such as paracentral scotoma and nasal step were also observed more in the 41–70 years age group. This finding was also observed in the meta-analysis by Alice et al.

Two sets of patients were included in this study: those with old-diagnosed POAG and those with newly diagnosed POAG. Two things can be discussed in this regard: new cases may be either an early or delayed presentation, while old cases may have adequate medical care and are good responders to therapy. On the other hand, older patients may be poor treatment responders or poor complaint cases to the therapy sought. Almost all field defects were observed more frequently in new cases, and advanced field defects were observed in the earlier five months.

Although one-time measurement of intraocular pressure does not reflect the progression of field changes, new cases presenting with High IOP show advanced or extensive field defects. This can be explained by the effect of High IOP on retinal ganglion cells and the optic nerve head. explains that advanced field defects are observed in the intraocular pressure range of 25 to 30 mmHg. However, cases in the low intraocular pressure range showed either no defects or earlier field defects. The same was observed in a study conducted in the Department of Ophthalmology at the Okayama University, Japan.

This can also be attributed to the type of refractive error involved. Myopes are more prone to POAG than hypermetropes, which can be correlated with disease progression. Refractive correction is either provided or fed while reporting field defects which makes an automated correction. This also applies to lens changes, which were corrected from the observed results and showed a clear correlation between myopia and advanced field defects.

CONCLUSION

Paracentral scotoma was the most common field defect observed, followed by isolated nasal steps. Advanced field defects are observed more in females than males among the refractive errors, myopes present with more advanced field defects, and newly diagnosed cases presenting with high intraocular pressure show advanced field defects; old cases with adequate control of intraocular pressure show nil or earlier defects, and intraocular pressure range of 26 to 30 mmHg shows advanced field defects. Thus, adequate IOP control halts the progression of visual field defects.

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ISSN (O): 2687-5365; ISSN (P): 2753-6556