Study of Visual Field Defects in Neuro-Ophthalmology Cases at SVRRGG Hospital, Tirupathi - A Cross-Sectional Study

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ABSTRACT

BACKGROUND
Visual field defects are caused by different lesions affecting different sites of visual pathway. Most common causes include stroke and intracranial space occupying lesions. Assessment of visual field defect helps in localization of the lesion along with measurement of the defect. The purpose of this study was to record different types of visual field defects in neuro-opthalmic diseases.

METHODS
This cross-sectional observational study was conducted between February 2016 and March 2018 at Department of Ophthalmology, SVRRGG Hospital. Visual field testing was done by confrontation method and Humphreys field analyser with best corrected visual acuity. Patient satisfying inclusion and exclusion criteria are included in the study.

RESULTS
Among the 58 participants, 37 (64 %) were males and 21 (36%) were females. Cerebrovascular accident was seen in 25 cases which was the most common aetiology followed by pituitary adenomas in 14 cases. Complete homonymous hemianopia was observed in 16 cases which was the most common field defect followed by bi-temporal hemianopia in 12 cases, enlargement of blind spot in 11 cases, incomplete homonymous hemianopia in 7 cases, superior and inferior quadrantanopia in 4 cases each, inferior altitudinal field defects in 2 cases, central scotomas in two cases and superior altitudinal field defect in one case.

CONCLUSIONS
Visual field defects are used to monitor the progression, recurrence of disease and as a guide for treatment. It is mandatory to record the fields in the neuro-opthalmic diseases.

KEY WORDS
Visual Field Defects, Neuro-Ophthalmic Diseases

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Visual field defects are caused by different lesions affecting different parts of the visual pathway. Vascular lesions form a part of cerebrovascular accidents which are on rise due to more number of patients with hypertension, diabetes mellitus and hyperlipidaemia. Intracranial aneurysms, intracranial space occupying lesions also contribute significantly to lesions causing visual field defects. Visual field testing can be useful in localizing the site of lesion before higher investigations like computed tomography/magnetic resonance imaging (CT/MRI) are taken. Early diagnosis may reverse or prevent some visual loss. Visual field defects are very important because they measure the functional visual loss.

The perimetry is a subjective method of assessing visual damage. Automated perimeters are objective, accurate and supported by useful software packages to assist in assessment of visual fields, with statistical level of confidence. Visual field assessment is important in the evaluation of lesions involving the visual pathways and should be performed at baseline and periodically during follow-up. Standard automated perimetry has been shown to be adequate in neuro-ophthalmic practise and is now the technique of choice for a majority of practitioners. Humphrey visual fields are useful for patients with severe visual and neurologic deficits and patients with peripheral visual field defects.

Visual fields are useful in monitoring progression or recurrence of disease. Visual field defects can adversely affect activities of daily living such as personal hygiene, reading, and driving and should be taken into consideration when planning rehabilitation strategies. Visual field testing must be performed in all patients with lesions of the visual pathway.

The current study was aimed at recording different types of visual field defects in neuro-ophthalmic diseases with Humphrey’s field analyser which is today considered gold standard perimeter.

**Aims and Objectives**

To determine the different types of visual field defects in neuro-ophthalmic disease.

**METHODS**

This is a cross-sectional observational study conducted between February 2016 and March 2018 at Department of Ophthalmology, S. V. Medical College, Tirupati.

**Inclusion Criteria**

Patients with neuro-ophthalmic diseases that produce visual field defects and patients who had visual acuity better than or equal to 6/60 in at least one eye were included in the study.

**Exclusion Criteria**

Patients with ocular pathologies, glaucoma, onco-operative patients, and patients refused to give consent for the participation were excluded.

A detailed history was taken regarding chief complaints, duration of the disease, treatment taken, and relevant comorbidities. Clinical examination of the patients included a detailed general physical examination and systemic examination. Ophthalmic examination included best corrected visual acuity, colour vision, slit lamp examination with direct ophthalmoscopy, fundus photograph and visual field testing. Visual field testing was done by confrontation and with the Humphrey’s field analyser with best corrected visual acuity.

**Field Protocol**

The 30-2 programme on Humphrey’s field analyser with a white on white Goldmann size III target was used for visual field examination. All patients underwent full threshold strategy for visual field examination. The reliability criteria used were fixation losses < 20 %, false positive and false negative errors < 33 %. Only fields reliably performed were included in the analysis.

**Criteria Used to Diagnose Field Defects**

- Depression of thresholds 5DB or more in 3 or more contiguous points adjacent to the vertical midline.
- Pattern deviation probability plot showing 3 or more contiguous points adjacent to the vertical midline in the involved quadrant depressed to 1 % probability level with normal mirror image points across midline.

All cases were assessed radiologically by CT/MRI with or without contrast.

**Statistical Analysis**

The software Microsoft Excel was used to structure the data for statistical analysis with software Statistical Package for Social Sciences (SPSS 18.0).

**RESULTS**

In the present study, 58 patients were diagnosed to have neuro-ophthalmic diseases with field defects during the one year period.

| Sl. No. | Age   | Percentage |
|--------|-------|------------|
| 1      | 41 - 50 | 25.86 %    |
| 2      | 31 - 40 | 22.41 %    |
| 3      | 21 - 30 | 22.42 %    |

**Table 1. Distribution of Cases According to Age**

Majority of the cases were reported in the age group of 41 – 50 years (25.86 %), followed by 31 - 40 years (22.41 %), 21 - 30 years (22.41 %). Mean age of males and females were $33.33 \pm 13.5$ and $39.18 \pm 13.1$ years respectively.
Among the study participants, 37 (64%) were males and 21 (36%) were females. The mean age of the study population was 37.06 ± 13.4 years.

### Table 2. Distribution of Cases According to Sex

| Sl. No. | Sex       | No. of Cases | Percentage |
|---------|-----------|--------------|------------|
| 1       | Male      | 37           | 64%        |
| 2       | Female    | 21           | 36%        |

One eye blind and hemianopia in another eye was observed in one case. (Figure 2)

### Table 3. Category of Cases According to Fundus Presentation

| Fundus                          | Cases (%) |
|---------------------------------|-----------|
| Normal                          | 32 (55.3%)|
| Papilloedema                    | 11 (19%)  |
| Temporal pallor of disc         | 8 (13.7%) |
| Pale disc/edema                 | 3 (5.2%)  |
| Hyperemia with blurred disc margins | 2 (3.4%) |
| Optic atrophy                   | 2 (3.4%)  |
| Total                           | 58 (100%) |

### Table 4. Distribution of Visual Field Defects in Various Neuro-Ophthalmic Disease

- Complete homonymous hemianopia was observed in 16 cases which was the most common presentation followed by pituitary adenomas in 14 cases, idiopathic intracranial hypertension in 6 cases, CP angle tumours in 5 cases, craniopharyngiomas and non-articrteric anterior ischemic optic neuropathy (NA-AION) in 3 cases each, and multiple sclerosis was observed in 2 cases. (Figure 1)

- Complete homonymous hemianopia was observed in 16 cases which was the most common field defect followed by bi temporal hemianopia in 12 cases, enlargement of blind spot in 11 cases, incomplete homonymous hemianopia in 7 cases, superior and inferior quadrantanopia in 4 cases each, inferior altitudinal field defects in 2 cases, central scotomas in 2 cases and superior altitudinal field defect in one case. Field defects of both enlargement of blind spot and isopter constriction was observed in 2 cases. Bi temporal superior quadrantanopia was seen in one case, hemianopia in one eye and quadrantanopia in another eye was seen in one case.

- Normal fundus was observed in 32 cases followed by papilloedema in 11 cases, temporal pallor of the disc in 8 cases, pale disc/edema in 3 cases, hyperaemia with blurred disc margins and optoc atrophy in two cases each. (Table 3)

- In the present study, visual field defects observed in cerebrovascular accident were complete homonymous hemianopia 14 (24.1%) cases followed by incomplete homonymous hemianopia 7 (12%) cases, superior quadrantanopia two (3.4 %) cases and inferior quadrantanopia two (3.4 %) cases.

- In the present study, visual field defect observed in pituitary adenomas was bi temporal hemianopia in 9 (16 %) cases followed by homonymous hemianopia in two (3.44 %) cases. Bi temporal superior quadrantanopia, hemianopia in one eye and quadrantanopia in another eye was seen in one case each. Unilateral temporal hemianopia was observed in one case.

- In the present study, enlargement of blind spot was seen in all cases of idiopathic intracranial hypertension. Enlargement of blind spot and isopter constriction was seen in two cases.

- In all cases of CP angle tumours, enlargement of blind spot was observed. Bi temporal hemianopia was seen in all three cases of craniopharyngiomas. Inferior altitudinal field defects were seen in two cases and superior altitudinal field defect in one case of NA-AION. In multiple sclerosis, visual field defect of central scotoma was observed in two cases (Table 4).

- In the present study, age matched normal fundus was observed in all cases of cerebrovascular accident and craniopharyngiomas. Out of 14 cases of pituitary adenomas, temporal pallor of disc was seen in 8 cases, age matched normal fundus was seen in 4 cases and optic atrophy was
seen in 2 cases. Papilloedema was seen in all cases of idiopathic intracranial hypertension and CP angle tumours. Palediscocoele was seen in all cases of NA-AION. Blurred margins with hyperaemia of disc were observed in all cases of multiple sclerosis.

### Neuro-Ophthalmic Diseases

| Neuro-Ophthalmic Diseases                  | Fundus      | Cases (%) |
|-------------------------------------------|-------------|-----------|
| Cerebrovascular accident (25)             | Normal study| 25 (45.5%)|
| Pituitary adenomas (14)                   | Normal study| 2 (3.6%)  |
| Temporal pallor of disc                   | Normal study| 9 (16.8%) |
| Idiopathic intracranial hypertension (6)  | Papilloedema| 6 (10.3%) |
| CP angle tumour (5)                       | Papilloedema| 5 (8.6%)  |
| Cranioophyngioma (3)                     | Normal study| 3 (5.1%)  |
| Non-arteritic anterior ischemic optic neuropathy (3) | Normal study | 3 (5.1%) |
| Multiple sclerosis (2)                    | Papillitis  | 2 (3.4%)  |

**Table 5. Distribution of Fundus Presentation in Various Neuro-Ophthalmic Diseases**

### DISCUSSION

Visual field defects are very important because they measure the functional visual loss. In this study, 58 patients having various neuro-ophthalmic diseases were screened for visual field defects. The location of lesions was confirmed by CT/MRI. The findings of CT/MRI were clinically correlated. The field defects were analysed by using Humphrey’s visual field analyser. The location of neuro-ophthalmic diseases was correlated with field defects.

In our study, the visual filled defects caused by neuro-ophthalmic disease noted were homonymous hemianopia, bilateral hemianopia, enlargement of blind spot, enlargement of blind spot and isopter constriction, quadrantanopia, altitudinal field defects, central scotomas. The neuro-ophthalmic disease noted were cerebrovascular accident, pituitary adenomas, CP angle tumours, idiopathic intracranial hypertension, craniopharyngioma, NA-AION and multiple sclerosis.

### Analysis of Visual Field Defects in Various Neuro-Ophthalmic Diseases

| Type of Field Defect                  | Present Study | Rowe, F.J. et al.¹ | Sivacharan K.J.N. et al.² |
|--------------------------------------|---------------|-------------------|--------------------------|
| Complete homonymous hemianopia       | 56 %          | 55 %              | 62 %                     |
| Incomplete homonymous hemianopia     | 28 %          | 17 %              | 32 %                     |
| Superior quadrantanopia              | 8 %           | 7 %               | 6 %                      |
| Inferior quadrantanopia              | 8 %           | 9 %               | 6 %                      |

**Table 6. Comparison of Visual Field Defects in Cerebrovascular Accident**

In this study, in cases of cerebrovascular accident, complete homonymous hemianopia was observed in 56 % of cases and it was similar to Rowe et al.¹ study where it was 55 %. In Sivacharan et al. study complete homonymous hemianopia was observed in 62 % cases of cerebrovascular cases.

Incomplete homonymous hemianopia was observed in 28 % cases of cerebrovascular accident, and it was similar to Sivanchar et al. study where it was 32 %. In Rowe, F.J. et al.¹ study incomplete homonymous hemianopia was observed in 17 % of cases. In cases with cerebrovascular accident, superior quadrantanopia was observed in 8 % of cases and it was similar to Rowe et al.¹ study where it was 7 %. Inferior quadrantanopia was observed in 8 % of cerebrovascular cases and it was similar to Rowe et al.¹ study and Sivacharan et al. study where it was 9 % and 6 % of cases respectively.

### Original Research Article

**Bi temporal hemianopia was observed in 64 % of pituitary adenomas and it was similar to Sivacharan et al. study where it was 68 %. In Vallabha et al.¹⁰ study, Lee et al.¹⁹ study and Astorga-Carballo et al.¹⁸ study bi temporal hemianopia was observed in 50 %, 41.3 % and 40 % of cases respectively. In Meenakshi Dhar et al.¹¹ study it was observed in 24.3 % of cases. In cases with pituitary adenomas, homonymous hemianopia was observed in 14.2 %. This was similar to Lee et al.¹⁹ study and Sivacharan et al.¹⁵ study where it was 10.3 % and 10.7 % of cases respectively. In Astorga-Carballo et al.¹⁸ study it was observed in 3.1 % of cases. Bi temporal superior quadrantanopia was observed in 7.1 % cases of pituitary adenomas. This was in concordance with Astorga-Carballo et al.¹⁸ Lee et al.¹⁹ Sivacharan et al. And Meenakshi Dhar et al.¹¹ studies.**

**In the present study, enlargement of blind spot was seen in all cases of idiopathic intracranial hypertension. This was similar to Wall M et al.¹² study. In Lim et al.¹³ and Pai et al.¹⁴ studies enlargement of blind spot was observed in 55 % and 39 % of cases respectively. Both enlargement of blind spot and isopter constriction was observed in 33.3 % of cases and was similar to Pai et al.¹⁴ study. Enlargement of blind spot was seen in cases of established papilledema. Whereas, enlargement of blind spot and isopter constriction was seen in cases of chronic papilledema.**

| Type of Field Defect                  | Present Study | Wall M et al.¹² | Pai, et al.¹³ | Lim, Kurian, Penn, et al.¹³ |
|--------------------------------------|---------------|-----------------|--------------|----------------------------|
| Enlargement of blind spot            | 100 %         | 100 %           | 39 %         | 55 %                       |
| Isopter constriction                 | 33 %          | 75 %            | 90 %         | 50 %                       |

**Table 8. Comparison of Visual Field Defects in Idiopathic Intracranial Hypertension**

In cases of craniopharyngioma, bi temporal hemianopia was observed in 100 % of the cases. This was in concordance with Raju KV et al.¹⁵ study where it was 100 %.
et al. study bi temporal hemianopia and homonymous hemianopia was observed in 27 % and 11 % of cases respectively.

| Type of Field Defect | Superior Altitudinal Field Defect | Inferior Altitudinal Field Defect |
|----------------------|-----------------------------------|----------------------------------|
| Present study        | 33 %                              | 67 %                             |
| S Han, et al.         | 18 %                              | 82 %                             |
| Hayreh, SS et al.     | 8 %                               | 92 %                             |
| Transtason, et al.    | -                                 | 55 %                             |

Table 10. Comparison of visual field defects in non-arteritic anterior ischemic optic neuropathy

In cases of NA-AION, superior altitudinal field defect was observed in 33 % of cases. In Han et al. study and Hayreh SS et al. study it was 18 % and 8 % of cases respectively. Inferior altitudinal field defect was observed in 67 % of NA-AION cases these findings are in agreement with Hayreh SS et al.

| Type of Field Defect | Central Scotoma |
|----------------------|-----------------|
| Present study        | 100 %           |
| Nakajima et al.      | 94 %            |

Table 11. Comparative Study of Visual Field Defects in Multiple Sclerosis

In cases of multiple sclerosis, central scotoma was observed in 100 % of cases and it was similar to Nakajima et al. study where it was 94 % of cases.

**Fundus Analysis**

In the present study, papilloedema was seen in 100 % cases of idiopathic intracranial hypertension and it was similar to Pai et al. study and Lim et al. study as 94 % and 90 % respectively.

Papilloedema was seen in 100 % cases of CP angle tumours and it was in concordance with Raju K.V. et al. study which showed 100 % presentation of papilloedema in CP angle tumours.

Temporal pallor of the disc was observed in 57 % cases of pituitary adenomas. It was in concordance with Astorga-Carballeiro et al. study which showed 56 % presentation of pallor of disc in pituitary adenomas. Pale disc oedema was seen in all cases of NA-AION. It was in concordance with Han et al. study which showed 100 % presentation of pale disc oedema in NA-AION. Blurring of optic disc margins and hyperaemia was seen in all cases of multiple sclerosis which was similar to Nakajima et al. study where it was 100 %.

In the present study, optic atrophy was seen in 2 cases of pituitary adenoma which showed field defect of homonymous hemianopia.

**CONCLUSIONS**

Visual field defects are used to monitor the progression, recurrence of disease and as a guide for treatment. It is mandatory to record the fields in the neuro-ophthalmic diseases. Standard automated perimetry is a procedure of choice and is easy, reproducible, accurate and has replaced most of the conventional ways of assessing visual fields.

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