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Evaluation of Visual Field Changes in Patients with Cerebral Stroke at the Time of Diagnosis and in the Post-Recovery Phase

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ABSTRACT

Background Visual dysfunction is a frequent but often under-recognized consequence of cerebral stroke. Visual field defects, particularly homonymous hemianopia and quadrantanopia, may substantially affect mobility, reading, activities of daily living, independence and quality of life. This study evaluated visual field changes in patients with acute ischemic stroke at the time of diagnosis and after three months of recovery, and examined their relationship with the anatomical site and vascular territory of stroke.

Methods This prospective analytical hospital-based study was conducted in the Departments of Ophthalmology and Neurology at Indira Gandhi Government General Hospital and Postgraduate Institute, Puducherry, between July 2022 and July 2023. Thirty-eight patients with newly diagnosed ischemic stroke presenting within two weeks of diagnosis were included. Patients underwent neuroimaging and comprehensive ophthalmic assessment, including best-corrected visual acuity, contrast sensitivity, slit-lamp examination, fundus examination, automated visual field testing using Humphrey Field Analyzer 24-2 SITA Standard perimetry, and visual evoked potential (VEP) testing. The same ophthalmic evaluation was repeated after three months.

Results The study included 38 patients, of whom 23 (61%) were male and 15 (39%) were female. The mean age was 59.3±13.6 years. Thirty-one patients (82%) had anterior circulation stroke and seven (18%) had posterior circulation stroke. Visual field defects were present in 21 patients (55.26%) at the time of diagnosis. Complete and partial homonymous hemianopia were the most frequent defects, followed by superior and inferior quadrantanopia. All patients with posterior circulation stroke had visual field defects, compared with 45% of patients with anterior circulation stroke. Visual field abnormalities correlated with the anatomical site of cerebral infarction. Visual field defects did not show significant improvement after three months, whereas visual acuity and contrast sensitivity improved significantly.

Conclusion Visual field impairment was common among patients with acute ischemic stroke, affecting more than half of the study population. Posterior circulation stroke was particularly strongly associated with visual field abnormalities, and the type of field defect demonstrated a relationship with the anatomical site of infarction. Visual field defects persisted at three months despite improvement in visual acuity and contrast sensitivity. These findings emphasize the importance of routine ophthalmic and visual field assessment in stroke patients and early referral for visual rehabilitation.

Keywords*: cerebral stroke; ischemic stroke; visual field defect; homonymous hemianopia; quadrantanopia; automated perimetry; visual rehabilitation; visual evoked potential*

INTRODUCTION:

Stroke is a major cause of mortality and long-term disability. In addition to motor, sensory, speech and cognitive deficits, cerebral stroke can produce a broad spectrum of visual abnormalities. Visual dysfunction may involve visual acuity, contrast sensitivity, ocular motility, visual attention and visual fields. Among these, post-stroke visual field defects are particularly important because they can interfere with mobility, reading, orientation, driving and independent functioning. The visual consequences of stroke depend largely on the location and vascular territory of the cerebral lesion. Lesions involving the retrochiasmal visual pathway produce characteristic patterns of visual field loss. Homonymous hemianopia and quadrantanopia are among the most frequently encountered visual field abnormalities following stroke.

Although visual field loss after stroke is well recognized, there is comparatively limited information regarding its persistence or recovery over time, particularly in relation to the site and vascular territory of cerebral infarction. The present study was therefore undertaken to evaluate visual field changes in patients with cerebral stroke at the time of diagnosis and in the post-recovery phase, with particular emphasis on the relationship between visual field defects and cerebral lesion location.

Aim

To compare visual field changes and their functional correlation with visual parameters in patients with cerebral stroke at the time of diagnosis and in the post-recovery phase.

Objectives

- To estimate the prevalence of visual field defects in patients with acute cerebral stroke.
- To correlate visual field defects with the intracranial site of infarction.
- To compare visual field defects between anterior and posterior circulation stroke.
- To compare visual field defects during the acute phase and at three months after stroke.
- To assess visual parameters, including visual acuity and contrast sensitivity, at diagnosis and after three months.
- To study VEP patterns at diagnosis and during the post-recovery period.

MATERIALS AND METHODS

Study design and setting

This was a prospective analytical hospital-based study conducted in the Departments of Ophthalmology and Neurology at Indira Gandhi Government General Hospital and Postgraduate Institute, Puducherry. The study period was from July 2022 to July 2023. Thirty-eight patients with acute ischemic stroke were included.

Study population

Patients attending the stroke clinic who had been diagnosed with stroke within the preceding two weeks and who voluntarily consented to participate were recruited.

Inclusion criteria

- Patients with stroke diagnosed within two weeks
- Patients willing to participate

Exclusion criteria

- Corneal opacities
- Esotropia or exotropia in primary gaze
- Recently detected or pre-existing glaucoma
- Nystagmus
- Retinal causes of visual field defects
- High hyperopia or high myopia
- Inability to sit for examination
- Aphasia, disorientation or significant behavioural changes
- Unwillingness to participate

Clinical and radiological assessment

Demographic and systemic risk-factor information was collected, including age, sex, hypertension, hyperlipidaemia, diabetes mellitus, coronary heart disease, alcohol consumption and smoking history. All patients underwent CT or MRI as part of their neurological evaluation. Imaging was used to determine the site and vascular territory of cerebral infarction and was correlated with visual field findings.

Ophthalmic assessment

- Best-corrected visual acuity using Snellen's chart and conversion to logMAR
- Contrast sensitivity using the Pelli-Robson chart
- Slit-lamp examination

- Fundus examination using a +90 D lens
- Automated visual field assessment
- Visual evoked potential recording

All assessments were repeated at three months.

Visual field assessment
Automated perimetry was performed using the Humphrey Field Analyzer with the 24-2 SITA Standard strategy. Mean deviation and pattern/corrected pattern standard deviation were used to characterize the visual field.

Visual evoked potentials
VEP was recorded according to the study protocol using pattern-reversal checkerboard stimulation with monocular stimulation of each eye. P100 latency and amplitude were recorded. Flash VEP was used when pattern VEP could not be obtained.

Statistical analysis
Categorical variables were expressed as frequencies and percentages, while continuous variables were expressed as mean and standard deviation. Paired-sample t-test was used for paired comparisons between diagnosis and three-month follow-up. A p-value <0.05 was considered statistically significant.

RESULTS

Demographic characteristics
Thirty-eight patients with acute ischemic stroke were included. There were 23 males (61%) and 15 females (39%). The mean age was 59.3±13.6 years, with an age range of 27–86 years.

Hypertension was the most common associated comorbidity, present in 47.4% of patients, followed by diabetes mellitus in 32%. Other reported risk factors included smoking, alcohol consumption, hypothyroidism and obesity.
Stroke territory and laterality
Anterior circulation stroke was present in 31 patients (82%), while posterior circulation stroke was present in seven patients (18%). The cerebral lesion was left-sided in 22 patients (57.89%) and right-sided in 16 patients (42.10%).

Prevalence and pattern of visual field defects
At the time of diagnosis, 21 of 38 patients (55.26%) had a visual field defect, whereas 17 patients (44.74%) had normal visual fields. Complete homonymous hemianopia and partial homonymous hemianopia were the most frequent patterns, followed by superior and inferior quadrantanopia. Constricted fields and temporal crescent defects accounted for the remaining abnormalities.

Correlation with site of infarction
Occipital lobe lesions predominantly produced homonymous hemianopia. Temporal lobe lesions were associated with superior quadrantanopia, whereas parietal lobe lesions were associated with inferior quadrantanopia. Constricted fields were observed with multiple infarcts, while temporal crescent defects were associated with occipital lesions.

Anterior versus posterior circulation stroke
All seven patients (100%) with posterior circulation stroke had visual field abnormalities. In comparison, 14 of 31 patients (45%) with anterior circulation stroke had visual field defects, while 17 patients (54%) with anterior circulation stroke had normal visual fields.

Visual acuity and contrast sensitivity
Visual acuity and contrast sensitivity improved significantly after three months. The improvement in visual acuity was statistically significant in both eyes, and contrast sensitivity also improved significantly in both eyes.

Visual field recovery
Despite improvement in visual acuity and contrast sensitivity, visual field defects did not demonstrate significant improvement after three months.

VEP findings
The mean P100 latency and amplitude showed no statistically significant differences between the acute and three-month assessments. There was also no statistically significant difference in VEP parameters between anterior and posterior circulation stroke groups.

DISCUSSION

The present study demonstrates that visual field impairment is a frequent manifestation of acute ischemic stroke. More than half of the study population (55.26%) had an identifiable visual field defect at diagnosis. This finding is clinically important because visual field abnormalities can substantially interfere with independent functioning even when patients do not spontaneously report visual symptoms.

The anatomical relationship between cerebral lesion and visual field defect was an important finding. Occipital lesions predominantly resulted in homonymous hemianopia, whereas temporal and parietal lesions were associated with superior and inferior quadrantanopia, respectively.

All patients with posterior circulation stroke had visual field abnormalities, compared with 45% of patients with anterior circulation stroke. This emphasizes the importance of specific visual assessment in posterior circulation stroke.
The study demonstrated significant improvement in visual acuity and contrast sensitivity at three months, suggesting that some aspects of visual function may improve during neurological recovery even when established visual field defects remain persistent.

The absence of significant visual field recovery at three months supports early identification and rehabilitation rather than assuming that field loss will resolve spontaneously. Persistent visual field loss can affect navigation, reading, mobility and driving and may have major implications for independence and quality of life.

VEP parameters did not demonstrate significant changes during follow-up. The findings suggest that conventional full-field VEP may have limited additional clinical value in this particular cohort, although the small sample size and lesion heterogeneity should be considered when interpreting this result.

Clinical Implications

- Visual field assessment should be incorporated into the routine ophthalmic evaluation of patients following stroke.
- Particular attention should be given to patients with posterior circulation stroke.
- Recognition of characteristic field defects can assist anatomical localization and interpretation of neuroimaging.
- Persistent visual field loss should prompt counselling and appropriate visual rehabilitation.

Limitations

- The sample size was small, with only 38 patients.
- The study was hospital-based and may not represent the entire spectrum of stroke severity.
- The three-month follow-up period was relatively short for assessment of long-term visual field recovery.
- Functional neuroimaging such as functional MRI was not performed.
- Ocular motility abnormalities, cranial nerve palsies and supranuclear ocular pathways were not evaluated.
- Cognitive, motor and language limitations may affect visual testing in stroke patients.
- The role of VEP remains uncertain because of the limited sample size.

Recommendations

- Larger studies with longer follow-up should be undertaken to characterize the natural history of post-stroke visual field defects.
- Longitudinal studies should examine the relationship between precisely localized cerebral lesions and visual field patterns.
- Studies incorporating stroke mimics and control groups could help clarify the diagnostic value of VEP.
- Future research should compare conventional VEP with multifocal VEP, EEG, functional MRI and detailed functional visual assessments.

CONCLUSION:

Visual field abnormalities are common in patients with acute ischemic stroke and were identified in 55.26% of patients in this study. Homonymous hemianopia was the predominant visual field defect, followed by quadrantanopia. Posterior circulation stroke showed a particularly strong association with visual field impairment, with all patients in this subgroup demonstrating an abnormal field. The visual field pattern also correlated with the anatomical site of cerebral infarction. Although visual acuity and contrast sensitivity improved significantly during the three-month recovery period, visual field defects did not demonstrate significant recovery. Conventional VEP parameters also showed no significant change during follow-up. These findings support the incorporation of formal ophthalmic and visual field assessment into the evaluation and follow-up of stroke survivors.

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