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Research Article

POST-STROKE VISUAL FIELD DEFECTS AND OTHER OPHTHALMOLOGICAL ABNORMALITIES: A RETROSPECTIVE STUDY

ROOPA ROKHADE[1]*, PRADEEP KUMAR JAIN[2]

[1]Department of Ophthalmology, [2]Department of Neurosurgery, SDM College of Medical Sciences & Hospital, Shri Dharmasthala Manjunatheshwara University, Dharwad, Karnataka, India.
*Corresponding author: Roopa Rokhade; Email: rooparokhade2111@gmail.com

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ABSTRACT

Objective: The study aimed to estimate prevalence of visual field defects (VFDs) and other ophthalmological abnormalities in post-stroke patients.

Methods: This retrospective study, conducted in department of ophthalmology in collaboration of department of neurology of a tertiary care medical institute, analyzed data from 80 adult patients undergoing ophthalmological examination including perimetry for presence of VFDs. Demographic data, including age and gender were extracted. Medical records were reviewed to assess visual disturbances, systemic illnesses, and medications. Gender distribution and presence of risk factors such as diabetes and hypertension were analyzed. Ophthalmological findings and the type and severity of VFDs were noted from perimetry reports. Magnetic resonance imaging and computed tomography scans were analyzed to identify brain lesions causing VFDs.

Results: In a study of 80 stroke patients, males were more prevalent (58.8%) than females (41.2%), with the most affected age group being 31–40 years (33.8%). Hypertension was the most common risk factor (35.0%), and ischemic stroke was the most frequent type (66.3%). The anterior circulation was the predominant site of lesions (85.0%). The most frequent VFDs was complete homonymous hemianopia, observed in 20 patients (25.0%), followed by partial homonymous hemianopia in 6 patients (7.5%). Constriction and inferior quadrantanopia were each noted in 3 patients (3.75%), while superior quadrantanopia was seen in 2 patients (2.5%). Hemianopia combined with quadrantanopia and scotoma were the least common (1.25% each). The other common ophthalmological finding was gaze palsy which was seen in 13 (16.25%) patients.

Conclusion: Visual filed defects and other ophthalmological manifestations such as gaze palsies are common in post-stroke patients. Early detection and targeted rehabilitation of these abnormalities enhance recovery, reduce disability and optimize outcomes for stroke survivors.

Keywords: Stroke, Ophthalmological abnormalities, Visual field defects, Gaze palsy.

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INTRODUCTION

Stroke is a leading cause of morbidity and mortality worldwide and results from an acute disruption of cerebral blood flow that leads to focal or global neurological deficits [1]. The pathophysiology of stroke involves either ischemic or hemorrhagic processes that impair blood supply to specific brain regions. This disruption to blood supply leads to neuronal death, infarction, and a cascade of metabolic disturbances [2]. Ischemic strokes are primarily caused by arterial occlusion due to thrombosis or embolism whereas hemorrhagic strokes result from the rupture of a cerebral vessel, leading to intracerebral or subarachnoid hemorrhage (SAH). The global burden of stroke is significant, with an estimated 12.2 million incident cases and 6.55 million deaths annually. The prevalence of stroke is increasing due to the growing burden of risk factors such as hypertension, diabetes, and smoking [3].

Risk factors for stroke include both modifiable and non-modifiable elements. Modifiable risk factors encompass hypertension, diabetes mellitus, dyslipidemia, smoking, atrial fibrillation, and sedentary lifestyle, which significantly increase the likelihood of cerebrovascular events. Non-modifiable risk factors include age, gender, race, and genetic predisposition. Strokes are broadly classified into two types: Ischemic and hemorrhagic [4]. Thrombotic strokes are seen secondary to disruption of blood supply to brain secondary to thrombus within an artery and usually occurs at the sites of atherosclerotic plaque. Embolic strokes result from a clot that forms elsewhere in the body such as in the heart or major arteries and subsequently travels to the brain. Hemorrhagic strokes are categorized into intracerebral hemorrhage (ICH) and SAH. ICH is usually caused by hypertensive arteriopathy or cerebral amyloid angiopathy while SAH is most commonly due to ruptured cerebral aneurysms or arteriovenous malformations [5].

The immediate complications of stroke can range from transient ischemic attacks to severe neurological deficits, depending on the location and extent of the brain injury [6]. In the acute phase, complications may include cerebral edema, increased intracranial pressure, and herniation, which require urgent medical intervention. Long-term complications are diverse and encompass motor and sensory deficits, cognitive impairment, speech difficulties, and neuropsychiatric disorders, such as depression and anxiety [7].

Visual field defects (VFDs) are among the most common visual impairments observed in stroke patients, with an estimated incidence of 20–57%. The types of VFDs can vary, including homonymous hemianopia, quadrantanopia, and scotomas, depending on the location and extent of the brain lesion [8]. VFDs in stroke patients typically result from damage to the optic tract, optic radiations, or occipital cortex, which are responsible for visual processing. Lesions in the posterior cerebral artery territory are frequently implicated in VFDs due to their role in supplying blood to the visual cortex. Moreover, stroke-related visual impairments can have a profound impact on a patient's daily functioning, limiting their ability to perform tasks that require visual scanning, such as reading, driving, and recognizing faces.

These impairments can also increase the risk of falls and contribute to social isolation and decreased quality of life [9].

Evaluation and management of stroke patients for VFDs and other associated ophthalmological abnormalities involve a multidisciplinary approach that includes comprehensive neuro-ophthalmological assessment and tailored rehabilitation strategies. Initial evaluation should include a detailed history and neurological examination, followed by specific visual field testing, such as perimetry, to map the extent and pattern of visual loss [10].

Despite the growing recognition of VFDs in stroke patients, there remains a significant knowledge gap regarding the optimal diagnostic and management strategies for these impairments. Therefore, we undertook this retrospective study to estimate prevalence of VFDs and other ophthalmological abnormalities in post-stroke patients.

METHODS

This was a retrospective study in which 80 patients with stroke were included based on predefined inclusion and exclusion criteria. The study was conducted in the department of ophthalmology in collaboration with department of neurology of a tertiary care medical college. Data was retrieved from the hospital's electronic medical records (EMRs) and patient charts and in inpatient department (IPD) papers. The sample size was calculated based on a pilot study conducted on the topic of VFDs in stroke patients. Assuming 90% power and a 95% confidence interval, the required sample size was 72 patients; therefore, we included 80 patients in our study. Stroke was diagnosed based on clinical evaluation and neuroimaging findings documented in the medical records. VFDs were identified through data retrieved from neuro-ophthalmological examinations and visual field testing, specifically perimetry, as recorded in the patient files.

Demographic information such as age and gender were extracted from the medical records. A detailed review of the medical records was performed to gather information on symptoms related to visual disturbances, difficulty with visual scanning tasks, and other relevant neurological symptoms. Presence of systemic illness such as diabetes mellitus, hypertension and any other significant illness was also noted. History of medication if available was also recorded. The presence and severity of VFDs were specifically noted with the help of reports of perimetry test results documented in the EMRs. The perimetry data provided a detailed assessment of the type and location of VFDs, including homonymous hemianopia, quadrantanopia, and scotomas.

Imaging studies, such as magnetic resonance imaging and computed tomography scans, were also reviewed to determine the location and extent of brain lesions responsible for the VFDs. The prevalence of VFDs in stroke patients was assessed, and the severity of these defects was further evaluated based on the extent of visual field loss documented in the perimetry results. Statistical analysis was performed using Statistical Package for the Social Sciences version 24.0. Mean and standard deviations were calculated for various parameters. The correlation between the presence of stroke and the severity of VFDs was assessed using Pearson's correlation. A $p<0.05$ was considered statistically significant.

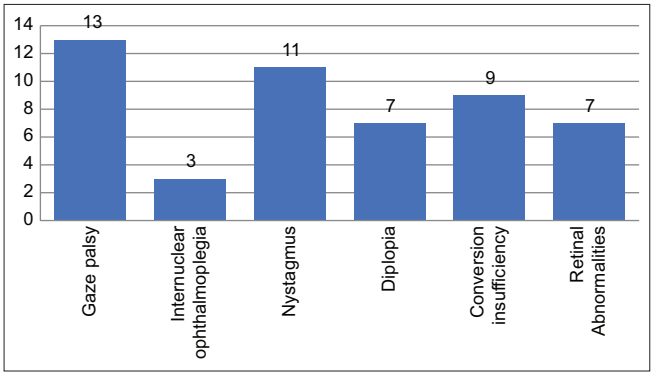

Fig. 1: Ophthalmological manifestations in post-stroke patients

Inclusion criteria

The following criteria were included in the study:

1. Patients having history of stroke in whom assessment of VFDs was done by perimetry
2. Age above 18 years
3. Complete record with respect to past history, imaging reports and details about type of stroke available in EMRs or IPD papers.

Exclusion criteria

The following criteria were excluded from the study:

1. Age <18 years
2. Complete record with respect to history, perimetry and imaging not available in EMRs or from IPD papers.

RESULTS

The analysis of the gender distribution of the studied cases showed that there were 47 males, accounting for 58.8% of the total, and 33 females, representing 41.2%. There was a male preponderance in cases of stroke with a M:F ratio of 1:0.70 (Table 1).

The most commonly affected age group was found to be between 31 and 40 years (33.8%), followed by the 51–60 years age group (25.0%) and the 41–50 years age group (17.5%). Only 10 (12.5%) patients were found to be in the 18–30 years age group, while 9 (11.2%) patients were in the 61–70 years age group. The mean age of the patients was 43.98 years with a standard deviation of 12.28 years. Mean age of male and female patients was comparable with no statistically significant difference ($p>0.05$) (Table 2).

The most common risk factor among the studied cases was hypertension, affecting 28 patients (35.0%), followed by diabetes mellitus in 15 patients (18.8%) and smoking in 10 patients (12.5%). Atrial fibrillation was present in 5 patients (6.2%), and dyslipidemia was noted in 4 patients (5.0%). There were 8 patients (10.0%) with no known risk factors, while 10 patients (12.5%) had multiple risk factors. Regarding stroke type, ischemic stroke was more prevalent, occurring in 53 patients (66.3%), while haemorrhagic stroke was observed in 27 patients (33.7%). The most common site of the lesion on imaging was the anterior circulation, seen in 68 patients (85.0%), followed by the posterior circulation in 7 patients (8.8%), and both anterior and posterior circulations in 5 patients (6.2%) (Table 3).

The most common type of VFDs among the studied cases was complete homonymous hemianopia, observed in 20 patients (25.0%). This was followed by partial homonymous hemianopia, which affected 6 patients

Table 1: Gender distribution of stroke patients

Gender	Number	Percentage
Male	47	58.8
Female	33	41.2
Total	80	100

Table 2: Age distribution of stroke patients

Age group	Number	Percentage
18–30 years	10	12.5
31–40 years	27	33.8
41–50 years	14	17.5
51–60 years	20	25.0
61–70 years	9	11.2
Total	80	100

Mean age 43.9±12.2 years

(7.5%). Constriction and inferior quadrantanopia were each present in 3 patients (3.75%), while superior quadrantanopia was seen in 2 patients (2.5%). Hemianopia combined with quadrantanopia and scotoma were the least common, each affecting 1 patient (1.25%). Notably, no VFDs was found in 43 patients, accounting for the majority (53.75%) of cases. There was no patient with complete unilateral or bilateral blindness, binasal hemianopia or bilateral homonymous hemianopia (Table 4).

Analysis of additional ophthalmological manifestations observed from the records revealed that gaze palsy was the most common condition, observed in 13 cases (16.25%). This was followed by nystagmus, which was present in 11 cases (13.75%). Convergence insufficiency was identified in 9 cases (11.25%), while both diplopia and retinal abnormalities were each noted in 7 cases (8.75%). Internuclear ophthalmoplegia was the least common manifestation, reported in 3 cases (3.75%) (Figure 1).

DISCUSSION

Stroke is not only one of the common causes of neurological consultations but also it remains the leading cause of deaths as well as disability particularly in old age. Men are more likely to get affected as compared to women. Women are less likely to be affected as compared to men because of presence of estrogen which plays a protective role. In addition to that certain risk factors such as smoking, alcohol consumption and obesity is more prevalent in men which predisposes them for development of another set of pathologies which are again major risk factors for occurrence of stroke. These pathologies include metabolic syndrome, coronary artery disease, hypertension, and diabetes mellitus [11].

Table 3: Risk factors, stroke type and site of lesion in studied cases

Risk factors, stroke type and site of lesions on imaging	Number	Percentage
Risk factors		
Hypertension	28	35.0
Diabetes mellitus	15	18.8
Smoking	10	12.5
Atrial fibrillation	5	6.2
Dyslipidemia	4	5.0
No known risk factors	8	10.0
Multiple risk factors	10	12.5
Total	80	100
Stroke type		
Ischemic stroke	53	66.3
Hemorrhagic stroke	27	33.7
Total	80	100
Site of the lesion		
Anterior circulation	68	85.0
Posterior circulation	7	8.8
Both anterior and posterior circulation	5	6.2
Total	80	100

Table 4: Types of visual field defects on perimetry in post-stroke patients

Type of visual field defects	Number	Percentage
Complete homonymous hemianopia	20	25.00
Partial homonymous hemianopia	6	7.50
Constriction	3	3.75
Inferior quadrantanopia	3	3.75
Superior quadrantanopia	2	2.50
Hemianopia and quadrantanopia	1	1.25
Scotoma	1	1.25
No visual field defect	43	53.75
Total	80	100

In this study, there were 47 males, accounting for 58.8% of the total, and 33 females, representing 41.2%. There was a male preponderance in cases of stroke with a M:F ratio of 1:0.70. The most commonly affected age group was found to be between 31 and 40 years (33.8%), followed by the 51–60 years age group (25.0%) and the 41–50 years age group (17.5%). The mean age of the patients was 43.98 years with a standard deviation of 12.28 years. Kannan *et al*. conducted a study to review the prevalence of stroke in a tertiary care hospital in southern India [12]. For this purpose, the authors undertook a study comprising 1168 stroke patients admitted to neurology department. The study found that 779 patients (66.7%) were male, and 389 (33.3%) were female. Ischemic strokes were more common, affecting 72.6% of patients, while 27.4% had hemorrhagic strokes. Anterior circulation strokes were more prevalent (88.27%). Notably, 42.63% of patients were aged between 40 and 60 years. On the basis of these findings, the authors concluded that the prevalence of stroke, especially ischemic, is increasing, highlighting the need for updated epidemiological data in India. Similar gender distribution and age group was also reported by the authors such as Bushnell *et al*. [13] and Ospel *et al*. [14].

In this study, most common risk factor for stroke was hypertension, affecting 35% of the patients, followed by diabetes mellitus in 18.8%, and smoking in 12.5%. Atrial fibrillation was present in 6.2%, while dyslipidemia was noted in 5% of the cases. Additionally, 10% of patients had no known risk factors, and 12.5% had multiple risk factors. Abdu and Seyoum conducted a retrospective cross-sectional study to assess sex differences in stroke risk factors, clinical profiles, and outcomes For this purpose, the authors undertook a study comprising 312 stroke patients with confirmed diagnoses from medical records between 2018 and 2021 [15]. The study found that males (54.8%) were more likely to be younger with an average age of 60.05 years and had a higher prevalence of smoking (27.7%), alcohol consumption (17.7%), and khat chewing (11.8%). Females (45.2%) were older with an average age of 65.8 years and more likely to present unconscious (26.8%). Hypertension was the most common risk factor in both sexes (65.7% in males vs. 70.1% in females). In terms of outcomes, 18.6% of patients died during hospitalization, with no significant difference between males (19.8%) and females (17.1%). However, males were more likely to be discharged with improvement (61.6% vs. 55.6%).On the basis of these findings, the authors concluded that although there were no significant gender differences in stroke mortality rates, public education and gender-specific strategies are essential for mitigating stroke risks. Similar risk factors profile was also reported by the authors such as Boehme *et al*. [16] and Allen and Bayraktutan [17].

In this study, the most common VFDs among the studied cases was complete homonymous hemianopia, observed in 20 patients (25%). Partial homonymous hemianopia affected 6 patients (7.5%), while constriction and inferior quadrantanopia were seen in 3 patients each (3.75%). Superior quadrantanopia was present in 2 patients (2.5%). Hemianopia combined with quadrantanopia and scotoma were the least common, each affecting 1 patient (1.25%). The majority of patients (43 or 53.75%) had no VFDs. There were no cases of complete unilateral or bilateral blindness, binasal hemianopia, or bilateral homonymous hemianopia. Other than VFDs gaze palsy was the most common ophthalmological manifestation, observed in 13 cases (16.25%), followed by nystagmus in 11 cases (13.75%) and convergence insufficiency in 9 cases (11.25%). Diplopia and retinal abnormalities were each noted in 7 cases (8.75%), while internuclear ophthalmoplegia was the least common, reported in 3 cases (3.75%). Rowe *et al*. conducted a prospective cohort study to examine the prevalence, type, rehabilitation, and outcome of visual field loss following a stroke [18]. For this purpose, the authors undertook a study involving 915 stroke patients who were assessed using a standardized protocol, including visual field testing. The study found that 52% of patients had visual field loss, with 46% experiencing homonymous hemianopia, 11% quadrantanopia, and 11% other types such as scotomas. On the basis of these findings, the authors concluded that different types of VFDs following stroke require specific rehabilitation

strategies. Similar VFDs after stroke were also reported by the authors such as Shrestha *et al.* [19] and Pollock *et al.* [20].

CONCLUSION

Assessment of VFDs in individuals with stroke is important as these impairments significantly impact quality of life and functional independence of patients. Identifying and categorizing VFDs allows for targeted rehabilitation strategies to improve patient outcomes. Early detection and appropriate rehabilitation of these visual deficits are essential for enhancing recovery, minimizing disability, and improving the overall quality of life for stroke survivors.

CONFLICTS OF INTEREST

None.

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