



EYE THE WINDOW TO THE BRAIN: OCULAR MANIFESTATIONS OF CEREBROVASCULAR ACCIDENT.

Ophthalmology

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ABSTRACT

Aim: to study the various ocular manifestations of stroke and accentuate the importance of early ocular examination.

Method: a descriptive cross sectional study was carried out on 50 diagnosed patients of stroke with Glasgow Coma Scale (GCS) > 8. A preformed questionnaire specifically designed for the study and detailed ophthalmic examination including visual acuity, slit lamp examination, ocular movements, visual fields, etc. were performed on all the patients. Radiological reports were noted.

Results: In our study population, 39(78%) were males. 46 patients (92%) had arterial stroke and 4 patients (8%) had venous stroke. Mean age of occurrence was 56.5 years. Venous stroke was found to be more common in the younger age group (31-40 years) with all 4 patients presenting with papilledema. In Patients with arterial strokes, middle cerebral artery (MCA) territory involvement was most commonly seen. Overall 92% patients had some or the other ocular finding. 28%(n-14) had contralateral homonymous hemianopia, vertical gaze palsy in 12% (n- 6), horizontal gaze palsy in 4% (n-2), ptosis and restriction of extra ocular movements in 4%(n-2), 8%(n- 4) had papilledema. MRI reports were found to be more accurate than CT scan for localizing the site of lesion.

Conclusion: This study concludes that a significant number of patients of stroke have ocular findings. Ocular examination should not be neglected, as it has a great localization value and aids in early intervention which can help in better visual rehabilitation.

KEYWORDS

cerebrovascular accident, homonymous hemianopia, papilledema, visual field defects.

Eye is an extension of the brain and contains nervous tissue in the light sensitive layer, the retina. Eye acts as the window to the brain as it derives its blood supply mainly from the brain vasculature. Therefore, any accident in the brain will affect the eye in all possible manners.

Stroke or cerebrovascular accident (CVA) refers to a clinical syndrome of presumed vascular origin, characterized by rapidly developing focal or global disturbances of cerebral function, lasting more than 24 hours, or leading to death. It is a medical emergency and can cause permanent neurological damage and death.^[1] CVA are of two types: Ischemic or Hemorrhagic ⁽²⁾. Ischemic stroke occurs due to decrease of blood supply to the brain while hemorrhagic occurs when blood vessel in the brain bursts, spilling blood into the spaces surrounding the brain cells or when a cerebral aneurysm ruptures.

The major risk factors for stroke are hypertension, tobacco use, smoking, low hemoglobin levels (<10 g%), lower HDL cholesterol as important risk factors ⁽³⁾.

If a certain part of the brain loses its blood supply it correspondingly tends to lose its function (like speech, vision, motor, sensory). Vascular occlusion along the afferent or efferent visual pathways can produce myriad effects, including transient monocular vision loss (TMVL), visual field deficits or ocular dysmotility.⁽⁴⁾ It is reported in the literature that severity of retinopathy, retinal microvascular abnormality,⁽⁵⁾ hypertensive retinopathy,⁽⁶⁾ retinal vein occlusion⁽⁷⁾ and retinal emboli are related to an increased risk and predictive of stroke. Thus, analysis of fundus findings is useful for predicting an atherothrombotic ischemic stroke and planning follow-up examinations. Vision loss can be the most disabling residual effect after a cerebral infarction, it also impacts quality of life and leads to loss of independence and depression.⁽⁸⁾ The lesion in the brain will reflect through various signs and symptoms in the eye, such as: Ptosis, Pupillary signs, Ocular muscle palsy, Visual field defects, Optic nerve head changes, Fundus - Retinal vascular changes, Cortical blindness.

All these manifestations have a great localizing value of the stroke, so it will also provide assistance in roughly localizing the brain lesion during stroke. Identifying and addressing these ocular manifestations as early as possible will be beneficial and may help in preventing the irreversible vision loss.

MATERIALS AND METHODS:

Study type: descriptive cross sectional study

Place: carried out at Pravara rural medical college and hospital, Loni, Maharashtra.

Study population: diagnosed cases of CVA.

Sample size: 50

Sampling method: Non random purposive sampling method

INCLUSION CRITERIA:

- Patients diagnosed with cerebrovascular accidents admitted in the general Medicine ward or referred to the ophthalmic OPD.
- Patient/ Relative giving written informed consent
- Patients who have undergone CT/MRI brain.

EXCLUSION CRITERIA:

- History of trauma to eyes and head.
- Unconscious stroke patients, admitted in MICU.
- Presence of ocular conditions like squint, disfigurement of the eyeball, corneal opacity, congenital anomalies of the eye.
- Patients with infective CNS conditions.
- Patients with index stroke of >1 year duration as some features may have resolved over time.

The study was carried out for 1 year from August 2019 to September 2020

METHODOLOGY:

Patients admitted and diagnosed with cerebrovascular accident (CVA) with Glasgow Coma Scale (GCS) > 8 were examined thoroughly. A preformed questionnaire specifically designed for the study. Informed consent was obtained from relatives for patients who were aphasic.

A detailed ophthalmic examination including visual acuity, slit lamp examination, ocular movements, visual fields, dilated fundus examination, cranial nerve assessment, line bisection test etc. were performed on all the patients.

Radiological reports: CT scan or MRI was noted.

Ethical clearance was obtained from the Ethics and Research of Pravara rural medical trust.

RESULTS:

The study was carried out on 50 patients. Out of this 39 (78%) were males and 11 (22%) were females.

Mean age of occurrence was 56.5 years. Venous stroke occurred in the younger age group as all the 4 patients were in the age group of 31-40 years.

As patients were divided according to arterial or venous stroke the

observations were 46 patients (92%) had arterial stroke and 4 patients (8%) had venous stroke. 39(84.78%) patients had ischemic arterial stroke and 7 (15.21%) patients had hemorrhagic arterial stroke.

Mean age of occurrence was 56.5 years. Venous stroke occurred in the younger age group between 31-40 years. Age wise classification was seen as 2 patients in 41- 50 years, 23 patients in 51-60years, 16 in 61-70 years, and 5 patients in 71- 80 years

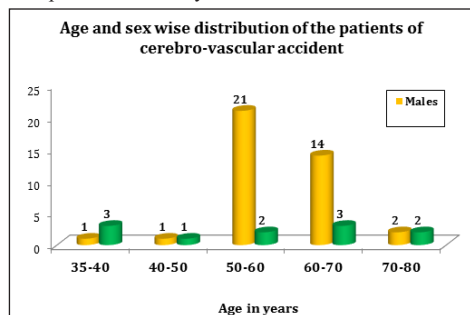


Table No.1: Distribution according to Ischemic arterial stroke and Hemorrhagic arterial stroke patients among Arterial stroke patients:

	Arterial stroke patients (n=46)		
	Males	Females	Total
Ischemic arterial stroke	32(82.05%)	7(17.95%)	39(87.78%)
Hemorrhagic arterial stroke	5(71.43%)	2(28.57%)	7(15.22%)
Total	37(80.43%)	9(19.57%)	46 (92%)

39(87.78%) patients had ischemic arterial stroke and 7 (15.22%) patients had hemorrhagic arterial stroke. 32(82.05%) males and 7(17.95%) female had ischemic arterial stroke. While 5(71.43%) males and 2(28.57%) females had hemorrhagic arterial stroke.

1. ISCHAEMIC STROKE

A. Ischemic arterial stroke

In ischemic arterial stroke, most commonly involved territory is that of middle cerebral artery (64.10%),

Table No.2 Ischemic arterial stroke patients:

	MCA	PCA	MCA+PCA	BASILAR	TOTAL
Ischemic arterial stroke	25 (64.10%)	10 (25.64%)	2 (5.12%)	2 (5.12%)	39 (87.78%)

MCA territory:

Ophthalmic manifestation in MCA ischemic arterial infarction observed as 10 patients (40%) out of the 25 patients with MCA territory ischemic arterial stroke had eyes deviated to the side of the lesion and 15patients(60%) had contralateral homonymous hemianopia.

Table No.3: Area involved in MCA artery stroke

Area involved	No of patients	Ophthalmic manifestations
Gangliocapsular bleed	5	Eyes deviated to the side of lesion (100%) Ipsilateral dilated pupil (40%)
Parieto-temporal Lobar haemorrhage	1	Eyes deviated to the side of lesion (100%)

PCA territory stroke:

Involvement of territories in the PCA stroke were seen as follow:

Table no: 4: Areas involved in PCA stroke

PCA Territory Stroke	Pure occipital	Pure Thalamic	Occipital +Thalamic	Midbrain	Total
No. of patients	4 (40%)	1 (10%)	2 (20%)	3(30%)	10

No 5: lesions noted in PCA territory stroke

Mixed MCA and PCA territory stroke: 2 patients had both involvement of MCA and PCA territory involving the parieto-occipital lobe, which led to contralateral homonymous hemianopia and contralateral visual neglect.

Presences of RAPD in the eye of affected side along with fundus findings of CRAO.

Basilar artery ischemic stroke:

Two patients (5.1%) had basilar artery related ischemic stroke having pontine infarct. One patient had abducens nerve palsy with abduction deficit with facial nerve palsy of the lower motor neuron type with weak orbicularis action. The other patient with basal tegmental Para median pontine infarction had findings of ipsilateral internuclear ophthalmoplegia with restriction of adduction of ipsilateral eye with end gaze nystagmus of contralateral eye on attempted contralateral version.

B. Hemorrhagic arterial stroke:

Out of the total 7 patients, 4 (71.42%) had bleed in the anterior circulation i.e involving the MCA or posterior communicating artery(PCOM), and 3 (29.58%) had bleed in the area of posterior circulation i.e involving PCA or vertebrobasilar artery.

Location of lesion	No. of patients	Ophthalmic manifestation
Bilateral Para median thalamic infarct	1	Vertical gaze palsy
Thalamic +occipital infarct	2	Contralateral homonymous hemianopia with macular sparing
Midbrain	3	Ipsilateral 3 rd nerve palsy Pupil fixed and dilated ptosis

Table no. 6 : features noted in hemorrhagic stroke

Area involved	No of patients	Ophthalmic manifestations
Gangliocapsular bleed	2	- Eyes deviated to the side of lesion (100%) - Ipsilateral dilated pupil (40%)
Parieto-temporal Lobar haemorrhage	1	Eyes deviated to the side of lesion (100%)
Subarachnoid haemorrhage	1	- Cranial nerve III palsy with ptosis and restriction of extraocular movements except abduction and intorsion - Ipsilateral dilated pupil - Papilloedema
Posterolateral thalamic hemorrhage	1	- Skewed ocular deviation with the deviation of eye contralateral to haemorrhage turned downward and medially. - non reacting pupils
Pontine hemorrhage	2	- Pinpoint pupils - Doll's eye absent

Out of 7 patients with hemorrhagic ischemic stroke 6 (85.71%) patients were diagnosed hypertensive, highly suggesting that hemorrhagic strokes are common in hypertensive patients.

2. Venous stroke:

4 (8%) patients out of 50 had venous stroke, all 4 patients were in the age group of 35 – 45 years and out of the 4 patients 3(75%) patients were female and 1 (25%) patient was male, suggesting that venous stroke is common in younger age group especially in female.

Papilledema was found in all 4 (100%) patients while VIth nerve palsy was found in 1(25%) patient.

Patients with hemorrhagic arterial strokes, majority of the patients had middle cerebral artery territory involvement (71.42%) and had gaze preference to ipsilateral side.

Diabetes and Hypertension:

Out of the 50 patients 31(62%) had retinal abnormalities in patients with ischemic arterial stroke, out of 39 patients, 30 patients (76.92%) were hypertensive and out of them 26 out of 30 (83.87%) had hypertensive retinopathy. 8 out of 12diabetic patients (66.66%) had diabetic retinopathy

The following table Summarizes the risk factors for stroke, of both arterial and venous origin.

Table No. 7 Risk factors in the patients of cerebro-vascular accidents:

Risk factors	No. of patients	Percentage (%)
Altered lipid profile	7	14%
On oral contraceptives	2	4%
Smoking	5	10%
Hypertension	30	60%
Diabetes	12	24%
Total	50	100%

Radiological findings: All 50 patients radiological reports were noted. MRI was done by 41(82%) patients and CT scan by 9 (18%) patients. And was seen that MRI scans were more accurate in locating the lesions than CT scans.

Table No. 8: lesions noted in CT

CT SCAN	ARTERIAL	VENOUS	TOTAL	
	ISCHEMIC	HEMORRHAGIC		
Actual	6(66.66%)	2(22.22%)	1(11.12%)	9(100%)
Reported	4(66.66%)	2(100%)	1(100%)	7(77.77%)

Table No. 9: lesions noted in MRI

MRI SCAN	ARTERIAL		VENOUS	TOTAL
	ISCHEMIC	HEMORRHAGIC	S	
Actual	33(80.49%)	5(12.19%)	3(7.32%)	41(100%)
Reported	33(100%)	5(100%)	3(100%)	41(100%)

Summarizing the lesions in various strokes, it was found that, out of the total 50 patients 19 patients had visual complaints (38%), 92%(46) had some or the other ocular finding 28%(n-14) had contralateral homonymous hemianopia, Vertical gaze palsy in 12% (n-6) in patients with thalamic infarct, horizontal gaze palsy in 4% (n-2) in patients with pontine involvement, ptosis and restriction of extra ocular movements in 4%(n-2), 8%(n-4) had papilledema.

DISCUSSION:

In this study the patients were divided into two groups according to the stroke - arterial and venous stroke. The arterial stroke group patients were further divided as- arterial ischemic and arterial hemorrhagic stroke. Venous stroke usually has both ischemic and hemorrhagic component. Out of total 50 patients 92% (46) patients had arterial stroke (84.78%(39) patients had arterial ischemic stroke and 15.21%(7) patients had arterial hemorrhagic stroke), and 8%(4) had venous stroke. The mean age of occurrence was 56.5 years. Venous stroke was seen to occur in younger age group, 31-40 years. A case control study carried out by S F de Bruijn, J Stam et.al found that 85% women with cerebral venous sinus thrombosis used oral contraceptive pills. Thus it stated the impact of hormones, consumption of contraceptive pills and also the effect of pregnancy on cerebral venous sinus thrombosis⁽⁹⁾ Male predilection of stroke was found in the study, 38(76%) were male patients and 12 (24%) were female patients. Similar studies have found that stroke is more common in male population⁽¹⁰⁾ In our study Hypertension, diabetes, dyslipidemia etc. were found as the risk factors for stroke. Out of 50 patients 30 patients were hypertensive and 12 were diabetic. A study conducted by Martin J O'Donnell, et. Al considering the risk factors for stroke reported that the odds ratio of stroke with the risk factors was hypertension- 2.64, diabetes mellitus- 1.36, Alcohol intake- 1.51, smoking- 2.09 and many more.⁽¹¹⁾ Around 64% (n- 32) of patients were found to consume tobacco in any form, It is a major modifiable risk factor for preventing stroke.⁽¹²⁾

MCA was most commonly affected blood vessel in ischemic as well as hemorrhagic stroke. Various studies have the same outcome of MCA being the most commonly affected vessel.⁽¹³⁾ Yee Sien Ng, Joel Stain, et.al conducted a study over 2213 individuals prospectively over 9 years and reported that the most common stroke group was MCA stroke (50.8%) and small vessel stroke(12.8%). Visual impairment was seen in the form of ocular motility disorder (due to affected nerves), visual field loss, and visual perceptual loss. Some amount of pre existing visual impairment due to senile cataract was observed in 44%(22) patients. The visual impairment seen due to stroke was visual field loss, ocular motility disorder, and visual perceptual disorder. The most common from of visual field loss was found to be homonymous hemianopia. In case of ocular dysmotility disorders vertical gaze palsy was most commonly seen. Out of the total 50 patients 19 patients had visual complaints (38%), 92%(46) had some or the other ocular

finding, 28%(n-14) had contralateral homonymous hemianopia in Vertical gaze palsy in 12% (n- 6) in patients with thalamic infarct, horizontal gaze palsy in 4% (n-2) in patients with pontine involvement, ptosis and restriction of extra ocular movements in 4%(n-2), 10% (n-5) had diplopia and 2%(n-1) patient had cortical blindness.

Similar study carried out by Fiona J. Rowe and the VIS writing group reported that of 1345 patients, 92% had confirmed visual impairment, acquired strabismus was noted in 16% and acquired ocular motility disorder in 68%. Peripheral visual field loss was present in 52%, most commonly homonymous hemianopia. Overall 84% patients were visually symptomatic with visual field loss complaint followed by blurred vision, reading difficulty, and diplopia. In venous stroke, all 4 patients (100%) in the study were found to have papilloedema on fundus examination. 1 patient (25%) out of 4 had involvement 6th nerve which lead to bilateral abduction deficit. A prospective study conducted by Hossein Azin and Nahid Ashjazzadeh, over 61 patients with diagnosis of cerebral venous sinus thrombosis reported that 62.3% patients had papilloedema and cranial nerve involvement was noted to be 31.1%.⁽¹⁴⁾ Radiological reports were noted and found that MRI was more accurate than CT scan.

Limitations of the study are small sample size, difficulty in examining unconscious patients. For confirming the files defect all the patients were not willing for perimetry and a few of them were unfit for the procedure.

CONCLUSION:

This study concludes that a significant number of patients of stroke have ocular findings. These findings also have great stroke localizing value. MRI should be done in order to get the perfect site of lesion. Ocular examination should not be neglected, as an early intervention can help in better visual rehabilitation.

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