Neuro-Ophthalmic Findings in Strokes Involving the Vision Related Areas of the Brain in A Teaching Hospital in Nigeria

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Short title: Strokes involving the vision related areas of the brain.

ABSTRACT

Purpose: A significant portion of the brain is involved in vision related activities. Strokes involving these areas of the brain do present with diverse neuro-ophthalmic manifestations due to the embryonic relationship between the eye and the brain. This study is aimed at finding out the types and magnitude of neuro-ophthalmic manifestations in these strokes, with a view to improving the diagnostic accuracy and management of these strokes.

Methods: This hospital based cross-sectional study recruited 102 participants with strokes involving the vision related areas of the brain at Lagos State University Teaching Hospital, Nigeria. All the participants had comprehensive ophthalmic, and neurological assessment, as well as a thorough clinical evaluation.

Results: Out of the 102 recruited participants, males were 56 (55%), with majority of participants 60 (58.8%) in the age group 41-65. The commonest anatomical site involved was multi-territorial, followed by the basal ganglia and the frontal lobe of the cerebrum in that order. The most common neuro-ophthalmic finding was nystagmus 69(67.6%), followed by gaze abnormalities 46 (45.1%), abnormalities in saccades 37(36.2%) and smooth pursuit 36(35.2%), among others. Abnormal corneal sensations in 36(35.3%), was the most common anterior segment abnormality and optic disc pallor in 65(63.7%) for the posterior segment. Abnormal depth perception was found in most participants 87(85.3%).

Conclusion: This study shows the diverse neuro-ophthalmic findings in strokes involving the vision related areas of the brain, with effects seen in the anterior segment and posterior segment of the eye, and other visual consequences. This knowledge could help improve diagnostic accuracy for these strokes particularly in the ophthalmic setting.

KEYWORDS: Neuro-ophthalmic, strokes, vision related, brain, teaching hospital, findings.

INTRODUCTION

Stroke is defined as a sudden onset of focal brain, retina or spinal cord (neural tube structures) ischemia or hemorrhage of vascular origin (and not due to trauma) resulting in neurological deficit lasting more than twenty-four hours or leading to death[1].

The ganglion cells which are the first order neurons derived from the retina, connect by their axons to form the optic nerve, which after crossing at the optic chiasm and making a synapse at the lateral geniculate nucleus, send their optic radiations to the visual cortex and visual association areas where visual processing occurs. These areas have their connections to the temporal, parietal, frontal and occipital cortices.[2,3] The efferent visual pathway is the ocular motor pathway that has a role in modifying vision through its effect on ensuring binocular single vision, ocular movements, pupillary reactivity, among others.

The Circle of Willis provides an important connection between the vascular supply of the forebrain and the hindbrain. [4]Although neuronal impulses originate from the eye, the interpretation to the stimulus is conferred via the vision related areas of the brain. Research in the field of neuroscience has shown that more than fifty percent of the brain is involved with vision,[5] either singly or in combination with other stimuli. The role of the central visual pathway is to process the visual information travelling to the brain, while perception and cognition are at the visual cortical areas.[7] Strokes involving the vision related areas of the brain (SVRAB) occur as a result of impairment of vascular supply to the vision related areas of the brain either due to hemorrhage or infarction. Any insult that affects any of the vision related areas of the brain, causes a failure of the function sub served by that part and thus the presentations seen,[9] which could be purely ocular or combined with non-ocular presentations.

Manifestations of stroke varies in the eye [6] and could affect the afferent or the efferent visual pathway[7]. It is crucial to note that subtle or transient ocular manifestations might signify a stroke and rapid detection and management of this, might prevent a stroke recurrence.[19]Because strokes involving the vision related areas of the brain could present with subtle neuro-opthalmic manifestations in the anterior segment, posterior segment or only accidentally noticed on neuro-ophthalmic evaluation, it becomes crucial to understand these numerous presentations to facilitate early detection of these cases in the ophthalmic clinic. This is particularly so if there are no accompany common manifestations of these strokes.

Although many ocular manifestations may be seen in stroke patients,[9,19] the neuro-ophthalmic findings directly due to strokes involving the vision related areas of the brain are worth exploring to ensure a better understanding of these strokes and consequently a better management and prognosis for the individuals concerned. This study sought out to find out the different neuro-ophthalmic manifestations in patients with strokes involving the vision related areas of the brain in other to reduce cases of missed diagnosis and misdiagnosis among these patients particularly if there are no accompany non ocular manifestation.

PURPOSE

To determine the types and magnitude of neuro-ophthalmic findings in the anterior segment, posterior segment as well as in general neuro-ophthalmic evaluation in Strokes involving the Vision Related Areas of the Brain among stroke patients in Lagos State University Teaching Hospital (LASUTH) Ikeja, with a view to improve the diagnostic accuracy and management of the stroke condition.

PATIENTS AND METHODS.

STUDY DESIGN AND POPULATION

This hospital based cross-sectional descriptive study was carried out at the Lagos State University Teaching Hospital, Lagos, Nigeria. The study was conducted among all eligible male and female patients with strokes involving the vision related areas of the brain visiting the neurology clinic, eye clinic or on admission on the stroke ward within six months from the onset of the study.

A total of 102 patients were recruited using a consecutive sampling technique. The recruited patients had the time between the ocular signs and symptoms within a year of the onset of stroke. The study was carried out between September 2019 and March 2020 after obtaining an ethical approval. The study was conducted in line with the Helsinki Declaration on research

ethics. After duly explaining the nature of the study to the participants, the compliance with law, confidentiality and health standards, a written informed consent was obtained from the participants by signature or thumb printing.

The inclusion criteria for their selection included: patients 18 years and above, first incidence stroke patients, patients with strokes involving the vision related areas of the brain with ocular complaints, with or without non ocular manifestations, patients within one year of diagnosis of stroke and patients giving consent for study. Those excluded from the study included: repeat stroke patients, patients unwilling to participate in the study, patients with other neurological comorbidity, stroke patients of over one-year, unconscious patients, aphasic patients that cannot communicate in writing, patients with an ocular pathology preceding the stroke and patients diagnosed with other ocular pathologies.

ETHICAL CONSIDERATION: Ethical approval was sought and obtained from the Health Research and Ethics Committee of Lagos State University Teaching Hospital (LREC), with ethical reference number LREC/06/10/1125.

STUDY PROCEDURE

Patients with Strokes involving the vision related areas of the brain as identified by imaging, and with ocular complaints were identified among patients with a clinical diagnosis of stroke. Those eligible and willing to participate in the study were recruited. A written informed consent was obtained and thereafter, history taking and ocular findings were noted with the use of a questionnaire.

GENERAL EXAMINATION: The following were noted and recorded:

Weakness of any part (limb or facial weakness) and speech pattern.

NEUROLOGICAL EXAMINATION

Gait to determine type. Assessment for gait was done by telling the patient to walk and examining for the gait pattern.

Orientation in time, place and person, this was done by asking he patient questions to ascertain the time of the day, place the patient was at that time and the identity of the person asking the question or a nearby relative.

Muscle bulk, power, tone and reflexes. This was done by observing for the muscle bulk from the flexor muscles of the arm to assess if it is reduced, normal or increased

Cranial nerve examination of the second, third, fourth, fifth, sixth and seventh cranial nerve.

OCULAR EXAMINATION: this was done in this order

VISUAL ACUITY: for distance and near was done using Snellen's acuity chart or illiterate E chart with and without pin hole.

IOP: this was done using perkins tonometer.

ANTERIOR SEGMENT EXAMINATION

The following tests were performed.

Examination of the lids with pen torch to look for ptosis and other abnormalities present.

Ptosis evaluation was done using a ruler used to measure the distance from the corneal light reflex to the upper lid margin. The severity was graded into mild, moderate and severe.

Assessment of the globe alignment using hirschberg test to detect presence of strabismus. Presence of esodeviations or exodeviations were noted.

Extra-ocular motility testing by following a pen in all directions of gaze to determine extra-ocular muscle palsy due to involvement of the third, fourth or sixth cranial nerve

Assessment for presence of conjugate gaze palsies was assessed by telling the patient to look at a pen placed in front of the patient's eye and observing for the ability of both eyes to move together in the same direction of gaze.

Assessment for presence of Skew deviation in which there is vertical misalignment was done by assessing the alignment of both eyes in the vertical direction and noting for any asymmetry in alignment.

Horizontal eye movement was tested by examining the ability to slowly track a finger from side to side (with only the eye without moving the head) to detect abnormalities with smooth pursuit movement. Saccades were tested by asking the patient to look back and forth between the examiners thumb in one hand and index finger in the other.

Assessment of globe for nystagmus or any abnormal eye movement was done using a pen torch. The direction, amplitude and frequency of the nystagmus was observed and noted.

Diplopia chart using clinical assessment for the purpose of this study was done for those with the history of double vision.

Bells phenomenon was assessed by observing the eye rolled up on attempted opening of the eye by the examiner following a forced lid closure.

The cornea was examined for the presence of exposure keratopathy due to facial nerve involvement and stained with fluorescein to detect any epithelial defect. The corneal sensation was checked with a wisp of cotton wool to assess trigeminal nerve function.

The pupil was examined with pen torch for symmetry, size and reactivity to light by shining the light, observing for the size and symmetry, followed by assessment for direct and consensual light papillary light reactions.

ADJUNCTIVE TESTS

Light brightness test was done by shining a bright light into the eye, one eye at a time to determine the percentage of light brightness sensitivity in each eye and comparing the brightness in both eyes.

Colour desaturation test was done using the red cover of a mydriacyl bottle one eye at a time by stating the shade of colour seen by the patient.

Colour vision test was done using the ishihara chart.

Depth perception was assessed using TNO test for stereoscopic vision.

Test for dry eye using Schirmer strips. Schirmer 1 with anesthetic was done to minimize discomfort for these patients.

POSTERIOR SEGMENT EXAMINATION

This was done after dilation of the two eyes using 1% tropicamide

Binocular Indirect Ophthalmoscopy (BIO) was done for the posterior segment, noting the cup disc ratio, disc margins, neuro retinal rim, caliber of the vessels, macula, and other areas of the retina.

INVESTIGATIONS: these includes radiological investigations such as magnetic resonance imaging and computerized tomographic scan, as well as laboratory tests including fasting blood sugar, erythrocyte segmentation rate, lipid profile, genotype and full blood count. Automated perimetry was requested if fit and a confrontational perimetry for those unable to undergo the automated perimetry where possible.

DATA COLLATION AND ANALYSIS

Data was entered and analyzed using IBM SPSS version 25.0 software. Data obtained was shown in frequencies and percentages and represented in tables.

RESULTS

One hundred and two participants were recruited and fully studied. The demographics showed that the age range of the study participants were 18-40 in 15 (14.7%), 41-65 in 60 (58.8%), which was the predominant age range in this study and over 65 years in 27 (26.5%). The mean age in this study is 52.7 with a standard deviation (SD) of 11.1. In terms of sex distribution, males were the preponderant group with a prevalence of 56 (55%) as against females with a prevalence of 46 (45%). The male to female ratio was 1.2:1.

Regarding the ocular symptoms complained by the study participants, majority (62.7%) noticed change in their eye function since the stroke started. Abnormal depth perception was the most noticeable abnormality in 68.8%, followed by blurring of vision in 60.8%, field defect in 47% and grittiness in 35.3%. In terms of ocular motility abnormalities, difficulty in eye movement was noticed in 22.5%, deviation of the eye 19.6%, droopy lids and abnormal eye movement in 9.7% each. The visual perceptual abnormalities complained were visual neglect in 21.6%, difficulty in recognizing faces in 17.6%, left to right disorientation in 14.7% and seeing what others do not see in 9.8%.

The non-ocular complaints by the study participants were weakness of one side of the body in 73(71.6%), deviation of the mouth in 68(66.7%), speech problems in 48(47.1%), headache in 46(45.1%), change in behavior in 44(43.1%), balance problems in 26(25.5%), convulsion in 20(19.6%), abnormal sensation in 15(14.7%) and others including loss of hearing,

vomiting, loss of voice, tinnitus, total paralysis and vertigo in 35(34.3%).

The warning symptoms for strokes involving the vision related areas of the brain noted in this study were history of sudden black out in the two eyes in 22(21.6%) and sudden deterioration of vision in one eye in 8(7.8%).

In terms of the neuro-ophthalmic findings in the study participants, the findings were noted from the general neuro-ophthalmic assessment, the anterior and posterior segment examinations, as well as the adjuvant ocular tests and are revealed in tables 1 to 5. Overall the neuro-ophthalmic manifestations seen were noted in the anterior segment of the eye including abnormal corneal sensations in 36(35.3%), pupillary abnormalities in 35(34.3%), which were the most common anterior segment findings overall.

In the posterior segment, optic disc pallor in 60(58.8%), which is a neuro-ophthalmic finding was the most common ocular manifestation. Regarding the neuro-ophthalmic findings on neuro-ophthalmic evaluation, the commonest finding was nystagmus in 69(67.6%), followed by gaze abnormalities in 46 (45.1), then abnormalities in saccades and smooth pursuit in 37(36.3%) and 36(35.3%) respectively.

Diplopia in 19(18.6%) and skew deviation was seen in 9 (8.8%) participants. The adjuvant tests done revealed majority had abnormalities in depth perception, light brightness sensitivity, colour vision, and almost half 46(45.1%) for schirmer test. Colour vision and light brightness abnormalities are due to abnormalities in the optic nerve, abnormal schirmer test are due to abnormalities in the facial and/or trigeminal nerves, while abnormalities of depth perception due to the brain areas involved in visuospacial processing . These results shows the diversity of neuro-ophthalmic findings in these strokes.

TABLE 1: Ophthalmic findings among the study participants (Anterior segment)

VARIABLES	**RIGHT EYE. N (%)**	**LEFT EYE N (%)**
Visual Acuity (best corrected)		
Distance		
6/4-6/18	63(61.8)	50(49.0)
6/24-2/60	29(28.4)	33(32.4)
1/60-NPL	10(9.8)	19(18.6)
Near		
Normal	43(42.2)	
Impaired	59(57.8)	
Exposure keratopathy		
Present	1(1.0)	2(2.0)
Absent	101(99.0)	100(98.0)
Corneal sensation		
Normal	66(64.7)	66(64.7)
Reduced	36(35.3)	35(34.3)
Absent	0(0.0)	1(1.0)
Pupil symmetrical		
Yes	88(86.3%)	
No	14(13.7%)	
Pupil size		
Normal	85(83.3%)	
Dilated	12(11.8%)	
Miosed	5(4.9%)	
Pupil reactivity		
Reactive	67(65.7%)	
Sluggishly reactive	15(14.7%)	
RAPD	10(9.8%)	
Unreactive	10(9.8%)	

Note. Data collected by author. The most common anterior segment abnormality was abnormalities in corneal sensations is 36(35.3) and 35(34.3%).

TABLE 2: Ophthalmic findings among study participants (posterior segment)

VARIABLES	RIGHT EYE. N (%)	LEFTEYE N (%)
Optic disc pallor		
Present	60 (58.8)	60 (58.8)
Absent	42 (41.2)	42 (41.2)
Margin		
Intact	88 (86.3)	88 (86.3)
Blurred	14 (13.7)	14 (13.7)
Caliber		
Normal	31 (30.4)	31 (30.4)
Attenuated	57 (55.8)	57 (55.8)
Dilated	11 (10.8)	11 (10.8)
Others	3 (2.9)	3 (2.9)
Macula		
Exudates	8(7.8)	8(7.8)
Edema	0(0.0)	0(0.0)
Atrophy	2(2.0)	2(2.0)
Retina		
Hemorrhage	10 (9.8)	11 (10.8)
Vessel occlusion	2 (2.0)	1 (1.0)
Pallor	8 (7.8)	6 (5.9)

Note. Data collected by Author. The most common posterior segment abnormality was optic disc pallor in 60 (58.8%).

TABLE 3: Neuro-Ophthalmic findings among the study participants

VARIABLES	RIGHT EYE. N (%)	LEFTEYE N (%)
Ptosis		
Present	10(9.8)	4(3.9)
Absent	92(90.2)	98(96.1)
Cranial nerve 3		
Full	56(54.9)	57(55.9)
Restricted	46(45.1)	45(44.1)
Cranial nerve 4		
Full	78(76.5)	80(78.4)
Restricted	24(23.5)	22(21.6)
Cranial nerve 6		
Full	61(59.8)	62(60.8)
Restricted	41(40.2)	40(39.2)
Bell's phenomenon		
Good	91(89.2)	
Poor	11(10.8)	

Note. Data collected by Author

TABLE 4: Neuro-Ophthalmic findings of study participants

VARIABLES	RIGHT EYE. N (%)	LEFTEYE N (%)
Strabismus		
Present	19 (18.6)	22 (21.6)
Absent	83 (81.4)	80 (78.4)
Gaze abnormalities		
Present	46 (45.1)	
Absent	56 (54.9)	
Skew deviation		
Present	9(8.8)	
Absent	93(91.2)	
Saccades		
Normal	65(63.7)	
Abnormal	37(36.3)	
Smooth pursuit		
Normal	66(64.7)	
Abnormal	36(35.3)	
Nystagmus		
Normal	33(32.4)	
Abnormal	69(67.6)	
Diplopia		
Present	19(18.6)	
Absent	83(81.4)	

Note. Data collected by Author. The most common neuro-ophthalmic abnormality was nystagmus in 69(67.6%), followed by gaze abnormalities in 46(45.1%) among other

TABLE 5: Findings from Adjuvant ocular tests among patients with SVRAB

VARIABLES	RIGHT EYE. N (%)	LEFTEYE N (%)
Light brightness sensitivity		
Normal	48(47.1)	44(43.1)
Abnormal	54(52.9)	58(56.9)
Colour desaturation test		
Normal	51(50.0)	46(45.1)
Abnormal	51(50.0)	56(54.9)
Colour vision test		
Normal	50(49)	48(47.1)
Abnormal	52(50.9)	54(52.9)
Depth perception		
Normal	15(14.7)	15(14.7)
Abnormal	87(85.3)	87(85.3)
Schirmer 1 test		
Normal	56(54.9)	56(54.9)
Abnormal	46(45.1)	46(45.1)

NOTE. Data collected by author. Abnormalities of depth perception was found in most of the study participants 87(85.3%), followed by abnormal light brightness tests in 54(52.9%), colour vision abnormalities in 52(50.9%) among others.

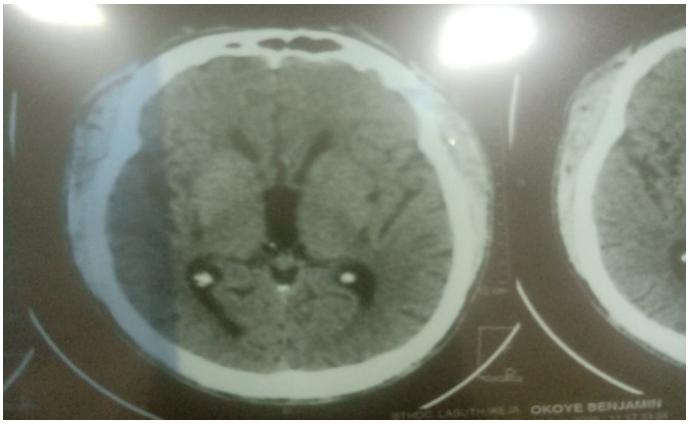
Table 5 shows the findings from the adjuvant tests done by the study participants. Abnormalities in depth perception were the most common, while light brightness and colour vision abnormalities and abnormal schirmer tests were also noted.

TABLE 6: Detailed Description Of Findings In The Brain (Imaging)

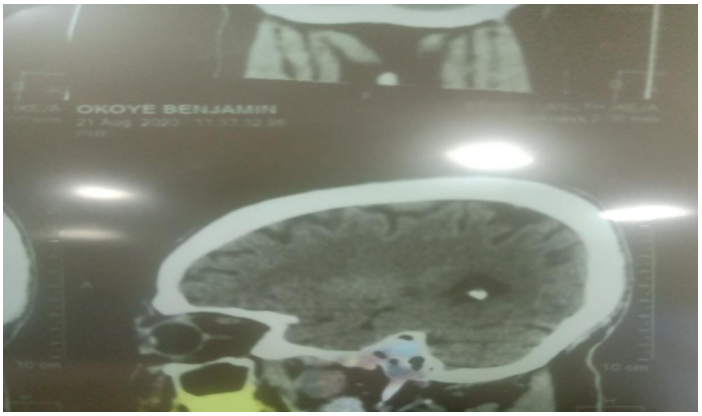
TYPE	LOCATION	FREQUENCY
INFARCTIVE	Parietal lobe	2
	Frontal lobe	10
	Cerebellum	5
	Basal ganglia/ thalamus	10
	Brain stem	3
	Unspecified	3
	Pons	4
	Mixed location	22
	Occipital lobe	4
	Temporal lobe	3
	Ventricle	1
	Circle of willis	1
	Internal capsule	4
HEMORRHAGIC	Frontal lobe	2
	Cerebellum	1
	Internal capsule	3
	Basal ganglia/ thalamus	5
	Pons	3
	Corpus callosum	3
	Ventricle	1
	Mixed location	10
HEMORRHAGIC TRANSFORMATION OF AN INFARCT		
	Frontal lobe	1
	Mixed location	1

Table 6 shows a detailed description of the findings in the brain based on the type, location for each type, the frequency of occurrence, single or multiple infarcts and the laterality of the lesion. Left side of the brain was more commonly involved in terms of laterality.

APPENDIX



CT imaging of a 62 year old man with bilateral basal ganglia infarct



Saggital view on mri showing a large basal ganglia infarct in a 68 year old man

DISCUSSIONS

This study was conducted among patients with Strokes involving the Vision Related Areas of the Brain, to find out the neuro-ophthalmic findings due to these strokes among the study participants. Important findings in these research shows the diverse neuro-ophthalmic manifestations in these strokes.

The demographics in this study showed a preponderance of males with a male to female ratio of 1.2:1, in terms of gender distribution. Foerch et al[10] however in their study, found a varying difference based on age with a female preponderance in

age groups greater than 84 years. The age group most affected in this study is the age group 41-65. Possible explanations might be changing lifestyles and poor health seeking attitude in our environment leading to high rate of undetected and uncontrolled hypertension and the attendant increase in stroke incidence even among the younger age group. This agrees with findings in literature that reveal that most stroke cases in Africa occur in ages less than 60 years, while older ages of 70-75 are usually more affected in developed countries.[11] but different from findings in stroke statistics that states that nearly three quarters of stroke occur after 65 years.[12]

In terms of the types of strokes seen in this study, ischemic stroke was seen in majority 72 (70.6%) while hemorrhagic stroke was seen in 34(29.4). This is in agreement with recent report from Stroke Investigative Research and Educational Network (SIREN) study in Nigeria and Ghana that reported 68% and 32& for ischemic and hemorrhagic stroke respectively.[11]

In terms of the location of these strokes, the most common was multi-territorial. This multi-territorial location involved different vision related areas in the brain. This was followed by the basal ganglia/thalamus, and then the cerebrum .This might be in keeping with findings in literature that showed the middle cerebral artery as the most common artery affected in stroke supplying the large part of the lateral surface of the brain, the internal capsule and part of the basal ganglia via the M1, M2, M3 and M4 segments.[13] The findings that multi-territorial location was the commonest location, shows the diverse inter-connectivity that occurs in different brain areas in giving an interpretation to vision signals that originate from the eye, in terms of the visual process itself as well as other roles to modify the vision.

Regarding the general ophthalmic findings in these strokes, the visual acuity findings revealed normal to mild visual impairment in majority of cases. For the near vision, majority had near visual impairment 59 (57.8%). The findings may be due to convergence deficits that might affect reading in stroke and may also be compounded by a predominant number with abnormalities in depth perception, saccades and smooth pursuit which may affect hand- eye coordination and in the overall reading ability. This is different from findings by Rowe et al[21] in a prospective observational study on 21 sites with 915 patients, to identify ocular and non ocular causes of reading difficulties after stroke. Results showed 177 of the 915 patients with reading difficulties (19.3%). It was concluded that the reasons for the reading difficulties in these patient was due to visual impairment from eye movement abnormalities, low vision, or visual field loss. The much greater number in our study might be due to the recruitment of patients specifically with strokes involving the vision related areas of the brain.

The neuro-ophthalmic findings were diverse, and effects were found in the anterior segment, posterior segment as well as the findings from general neuro-ophthalmic assessment. The commonest neuro-ophthalmic finding was nystagmus. Nystagmus was particularly noted commonly among those with hemorrhagic stroke and in strokes involving the brain stem and cerebellum. This was followed by gaze abnormalities. This is similar to findings in study by Rowe et al[14] that showed a high incidence of gaze palsies in stroke patients. Other findings include diplopia, ptosis, and poor bells. Skew deviation was the least neuro-ophthalmic finding noted. For ocular motility cranial nerve involvement, the three cranial nerves were affected together in 22 cases, two nerves predominantly 3rd and 6th in 13, with multiple extra-ocular muscle cranial nerve palsies noticed among the participants with ocular motility defects. A possible explanation for this might be due to the reduced vascular supply to the area affected by the stroke affecting all the structures supplied by the vessel unlike in a localized pathology which might be limited to the area involved. Oculomotor nerve (CN 3) was the most affected. Followed by abducens and trochlear nerve in that order. Sixty-three participants in all had extra ocular motility defects. This is higher than the prevalence of extra ocular muscle restriction in the study by Hepworth et al [15] which showed a prevalence of 22 to 54.5% for extra-ocular muscle restriction. The predominance of oculomotor nerve palsy in this study, is different from the findings of many studies that show the sixth nerve as the commonest ocular motility nerve involved. This might possibly be due to the specific recruitment of cases of stroke involving the vision related areas of the brain

as against all stroke cases which might pick abducens nerve palsy as a non-specific sign of neurological involvement. It is however similar to the study by Raj et al [16] which showed 3rd, 6th and multiple cranial nerve palsies as the most commonly observed ocular movement changes. Compared to findings in literature which show that strokes of the posterior circulation involving the brain stem do have features of abnormalities of the ocular sympathetic pathway causing symptoms such as skew deviation, nystagmus or horners syndrome,[22] findings in this study are also in agreement with this.

Regarding the anterior segment findings, exposure keratopathy was seen in 3 cases with poor bells phenomenon seen in 2 of the cases. The underlying poor bell's phenomenon being a neuro-ophthalmic abnormality. The abnormal corneal sensations was the most common neuro-ophthalmic anterior segment finding which shows involvement of the trigeminal nerve in 36(35.3%). Although majority had symmetrical and normal pupillary reactivity, a significant others had abnormality in pupillary reaction ranging from sluggishly reacting pupils, relative afferent pupillary defect(RAPD) and unreactive pupil. Overall, pupillary reaction abnormalities were the second most common anterior segment abnormality noted. Abnormalities in the anterior segment was noted to be more common in the stroke involving the frontal lobe and in multi-territorial strokes. The findings that abnormal corneal sensations followed closely by pupillary abnormalities are the most common anterior segment findings reveals how stroke involving the vision related areas of the brain have an enormous impart even in the anterior segment of the eye. Many of the cases with optic disc pallor however had normally reactive pupil. This is in contrast to findings in compressive optic neuropathies [18]. The cases with the RAPD, were cases predominantly with hemorrhagic lesions involving the frontal lobe.. This is also however comparable to the findings by Raj et al[16] which showed majority of the participants, with normal pupillary reaction.

The posterior segment findings revealed that majority(65(63,7%) had optic disc pallor, with the margin being blurred in 14 (13.7%). This shows that majority of the patients had posterior segment neuro-ophthalmic involvement, which was an involvement of the optic nerve showing loss of the retinal ganglion cells as evidenced by the disc pallor.. With regards to the caliber of the vessels (arterioles and venules), majority had attenuated vessels. The high number of cases with attenuated vessels may be due to the high number of patients with hypertension in this study. The significant number of cases with attenuated vessels may also reveal the embryological resemblance of the retina and the brain in reflecting the possible ischemic changes happening at the level of the brain reflected through the retina vascular changes. This is also in keeping with the study by Nwachukwu et al[17] in Nigeria that showed that the most common retinal abnormality in stroke was focal arteriolar narrowing. Other posterior segment changes include retinal hemorrhages

The adjuvant ocular tests done revealed abnormalities in light brightness, colour desaturation and colour vision tests in many of the cases . This high prevalence of these colour vision abnormalities, might show involvement of the optic nerve early in strokes involving the vision related areas of the brain. In addition to this the high incidence of colour vision abnormalities in these stroke patients may not be limited to the optic nerve but might be due to associated central achromatopsia that might occur in strokes involving the vision related areas of the brain particularly with involvement of the visual association cortices. It is important to note that abnormalities in depth perception was seen in majority 87 (85.3%) of the participants. This might also explain some of the conditions of visual morbidity among patients with these strokes affecting their quality of life. The Abnormal schirmer test in 46 (45.1%), shows that a high number of patients with strokes do have dry eyes. A possible reason for this might be the involvement of the greater petrosal branch of facial nerve supplying the lacrimal gland which causes impaired tear production, and the zygomatic branch of the facial nerve supply to the orbicularis oculi , which affects the ability to close the eye or blink thus affecting tear distribution. All these shows the diverse neuro-ophthalmic presentations due to strokes involving the vision related areas of the brain.

Many of the participants in this study who had optic disc pallor were being managed as a case of normal tension

glaucoma. While this study has been able to elicit some additional neuro-ophthalmic manifestations asides optic disc pallor that could point in the direction of stroke, future researches should be conducted to find out the pathogenesis of optic disc pallor in stroke as different from that of glaucoma. It is important to note that ophthalmic signs and symptoms occasionally may be the sole manifestation of a stroke.[23]

This study reveals the different neuro-opthalmic manifestations of strokes involving the vision related areas of the brain in the clinical setting, which could help in early identification and consequent management of this pathology.

LIMITATIONS OF STUDY

1. Three out of the 102 study participants were unable to do the imaging test due to cost and clinical diagnosis had to be used in these patients.
2. Magnetic resonance angiography would have been further helpful in identifying precisely the vessels involved in the stroke. Cost was however a barrier to this and this was only done in two patients.

CONCLUSION

This study shows the diverse neuro ophthalmic findings in Strokes involving the Vision Related Areas of the Brain, ranging from findings in the anterior segment, posterior segment as well as from comprehensive neuro ophthalmic evaluation. A knowledge of these findings would improve diagnostic accuracy for strokes, particularly in the ophthalmic setting.

ABBREVIATIONS

SVRAB: Strokes involving the Vision Related Areas of the Brain

LASUTH: Lagos State University Teaching Hospital

RAPD : Relative Afferent Pupillary Defect

SIREN : Stroke Investigative Research and Educational Network

BIO : Binocular Indirect Ophthalmoscope

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DISCLOSURE

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