Original Research Article

A study of ocular movements and pupillary changes in acute stroke patients

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Abstract

Background: Cerebrovascular disease or stroke rank first in frequency and importance, among all the neurological diseases of adult life. It is the third most common cause of death in the world. Different neuroanatomical pathways are involved in the control of pupil, the integrity and the functionality of these neurological pathways can be often be ascertained through the analysis and interpretation of pupillary behavior. This makes the pupil size and the pupillary light reflex an important factor to be considered in many clinical conditions.

Aim and objective: To study the ocular movements and pupils in acute stroke patients with its clinical correlation and imaging.

Materials and methods: The study sample included was 50 patients with acute stroke confirmed by CT/MRI findings of both sexes and who belonged to the age group of 20 to 80 years from RMMCH. A detailed clinical history was taken for these patients who were included in this study. All these patients were examined thoroughly with particular importance to ocular movements and pupils.

Results: Of the 50 patients, 16 patients were having an altered level of consciousness(32%), 30 patients were having speech disturbances(72%), 18 patients were having gaze paresis(36%), all the patients who were included in the study were having facial palsy (100%), Of the 18 patients with abnormal pupillary findings, there were 9 patients (18%) with dilated pupils which were not reacting to light during the first 12 hours, i.e. from the time of admission, 9 patients (18%) with round, constricted pupils, sluggishly reacting to light and 32 patients (64%) did not show any changes in the pupils. Of the 20 patients (40%) with abnormal ocular movements, the commonly observed ocular changes in the study sample were 3rd nerve palsy, 6th nerve palsy, multiple cranial nerve palsies, conjugate eye deviation to the side of the lesion, nystagmus on left lateral gaze, horizontal nystagmus on lateral gaze to the side of lesion.

Conclusion: The Anterior circulation stroke (78%) was more common than the Posterior circulation stroke (22%) in our study group. Although the abnormal pupillary changes and ocular movements were very common in posterior cerebral artery territory infarcts, the incidence of abnormal pupillary changes and ocular movements was more common in posterior cerebral artery territory (50%) and also in middle cerebral artery territory (45%) in our study group.

Key words

Cerebral Ischemia, Abnormal Pupillary Changes, Ocular Movements, Cranial Nerves Lesion.

Introduction

Every year there are approximately 700,000 cases of stroke-roughly 600,000 ischemic lesions and 100,000 hemorrhages, intracerebral or subarachnoid with 1,75,000 fatalities from these causes combined. Just as the "Face is the index of the mind" to a neurologist "the eyes are the index of the brain" the abnormalities of eye movement are frequent manifestations of the cerebrovascular disease [1]. The eye is an important organ which most of us take it for granted. It's a highly specialized sense organ which unlike most organ of the body, is available for external examination [2]. About 20% of the population have pupils that are slightly unequal in size that respond equally to light. Different neuroanatomical pathways are involved in the control of pupil, the integrity and the functionality of these neurological pathways can be often be ascertained through the analysis and interpretation of pupillary behaviour [3]. This makes the pupil size and the pupillary light reflex an important factor to be considered in many clinical conditions [4]. More specifically, the location of the pupillomotor nuclei and the efferent oculomotor nerve is important for assessing the onset of descending transtentorial herniation and brainstem compression, it has also been shown through blood flow imaging the pupillary changes in neurological patients in ICU are highly correlated with brainstem oxygenated and perfusion or ischemia [5]. Abnormal ocular movements may occur after injury at several levels of the neuraxis. Unilateral supranuclear disorders of gaze tend to be transient; bilateral disorders more enduring. Nuclear disorders of gaze also tend to be enduring and are frequently present in association with long tract signs and cranial nerve palsies on opposite sides of the body [6]. Nystagmus is a reliable sign of posterior fossa or peripheral eighth nerve pathology. Several of these signs have characteristics which enable the clinician to localize the site as well as the probable nature of the underlying pathology. One may determine whether the motility disturbance is due to cerebral hemispheric or brainstem disease. Localization is aided by knowledge of central ocular motor anatomy and physiology which is extensively reviewed elsewhere [7].

Materials and methods

This prospective study was conducted in Rajah Muthiah Medical College and Hospital (RMMCH) during the period from February 2017 to December 2017. The study sample included was 50 patients with acute stroke confirmed by CT/MRI findings of both sexes and who belonged to the age group of 20 to 80 years from RMMCH. A detailed clinical history was taken for these patients who were included in this study. All these patients were examined thoroughly with particular importance to ocular movements and pupils. All these patients were undergone a CT brain or MRI brain.

Inclusion criteria

- Patients in the age group of 20-80 years of both sexes.
- Patients who admitted within 48 hours of stroke onset.
- All the patients were examined thoroughly with particular importance to ocular movements and pupils.
- All the patients were undergone a CT Brain or MRI Brain.

- All the patients were re-examined every 12 hours for 72 hours.

Exclusion criteria

- Patients admitted after 48 hours of stroke onset.
- Patients who were in the age group less than 20 years and more than 80years.
- Patients with a previous history of stroke.
- Patients who came with an acute neurological syndrome other than stroke
- Patients with previous or present ophthalmological lesions.

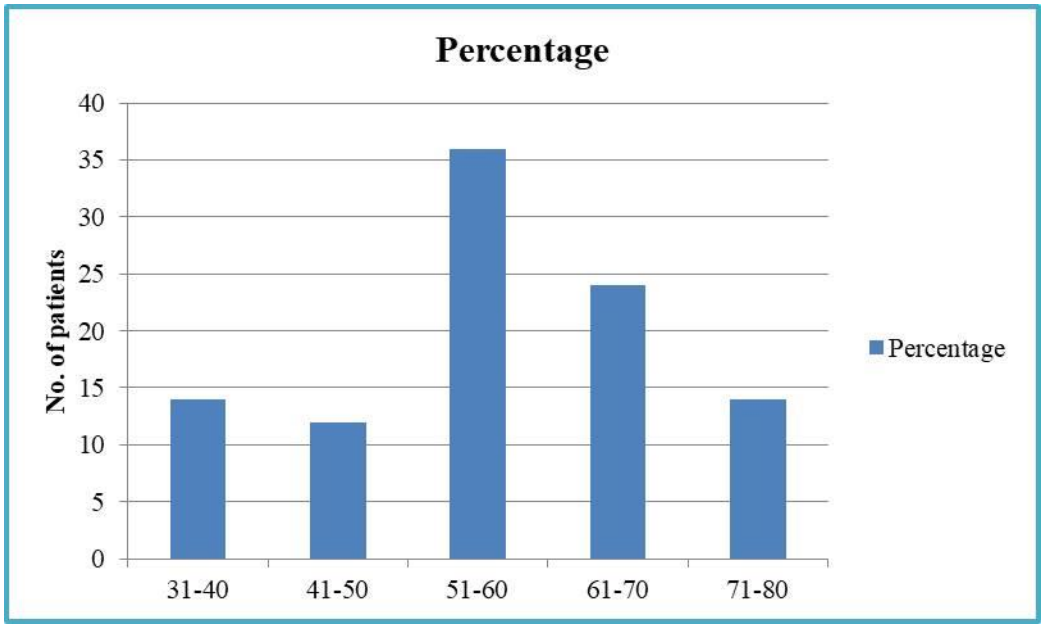
Statistical analysis

All the data were evaluated using a statistical package for social science (SPSS 17.0). Chi-square test with Yate' s adjustment was performed to determine associations between ocular movements and papillary changes and other neurological findings and CT Brain reports (hemisphere involvement, type of stroke, the area of involvement, age, and gender). The confidential interval was considered at 95% level. When the p value was equal to or less than 0.05, the finding was considered significant.

Results

Of the 50 patients taken into our study, the majority of the patients were in the 5th decade (**Graph – 1**). The youngest was 31 and the eldest was 80 years of age with a median age of 5l-60 years. 36 were males and 14 were females. Stroke was common among males (72%) compared to females (28%).

Graph – 1: Age wise distribution among cases (n=50).

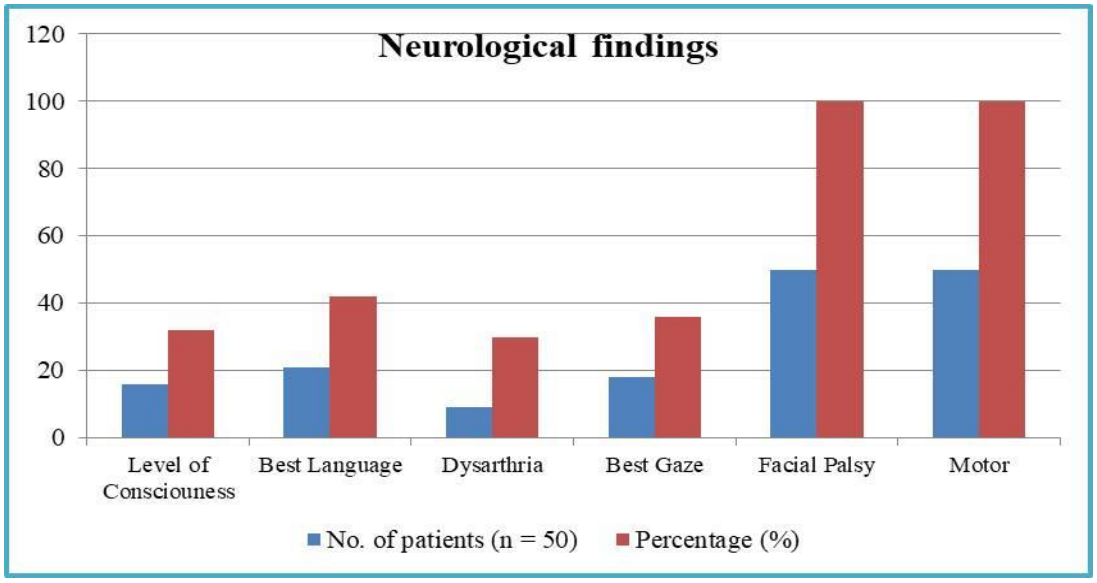


All the 50 patients with acute stroke were assessed with the National Institutes of Health Stroke Scale (NIHSS). Of the 50 patients, 16 patients were having an altered level of consciousness (32%), 30 patients were having speech disturbances (72%), 18 patients were having gaze paresis(36%), all the patients who were included in the study were having facial palsy (100%), all the patients presented with motor deficits (100%) as per **Graph - 2**.

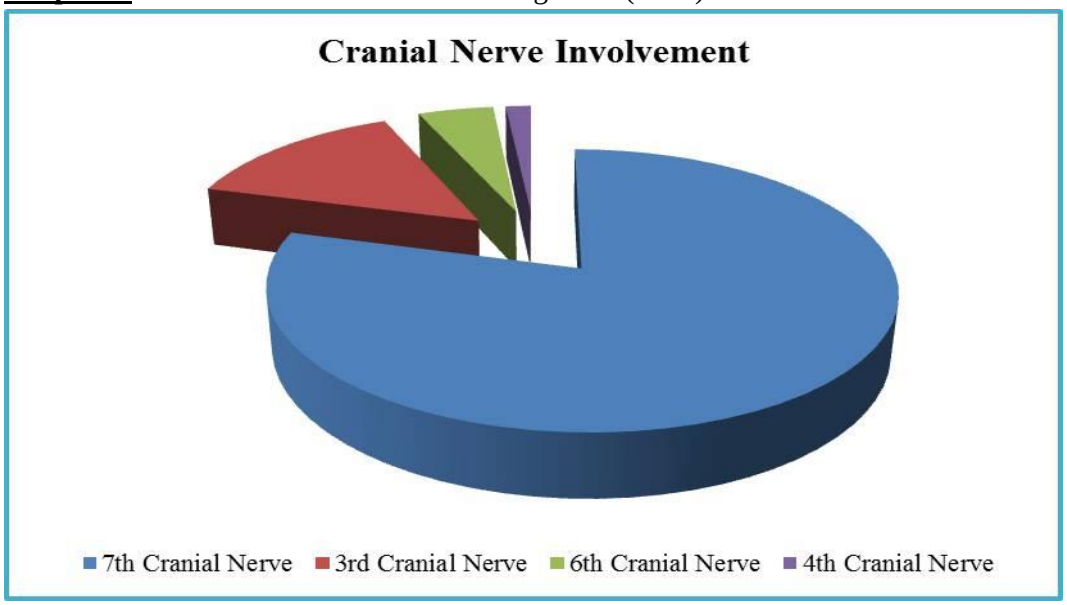
Of the 50 stroke patients, the cranial nerve involvement was observed in almost all the cases especially the 7th cranial nerve, also observed 3rd cranial involvement in 9 patients, 6th cranial nerve involvement in 3 patients, multiple cranial nerve involvement in 2 patients (**Graph – 3**).

Of the 50 acute ischemic stroke patients taken into the study, 18 patients were having abnormal pupillary changes (36%) as per **Graph - 4**.

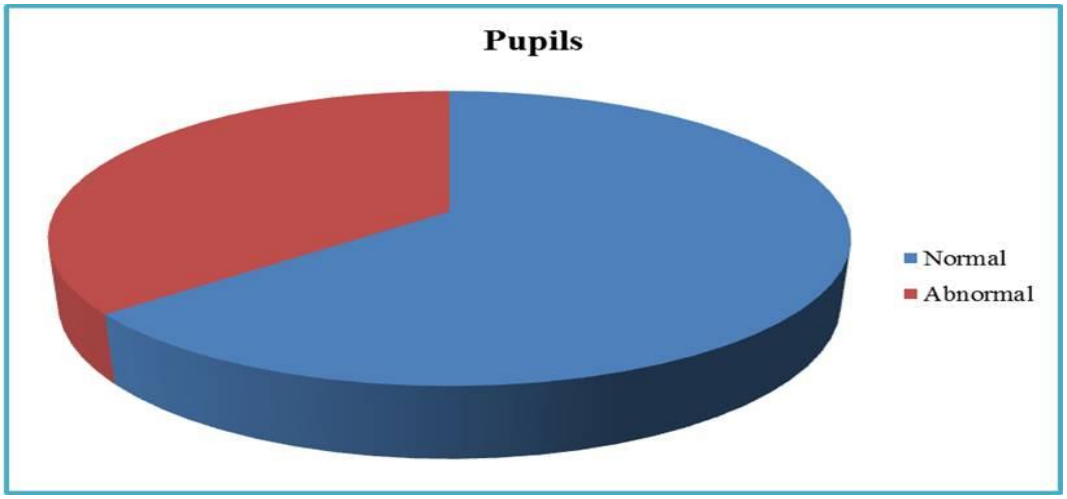
Graph – 2: Neurological findings among cases (n=50).



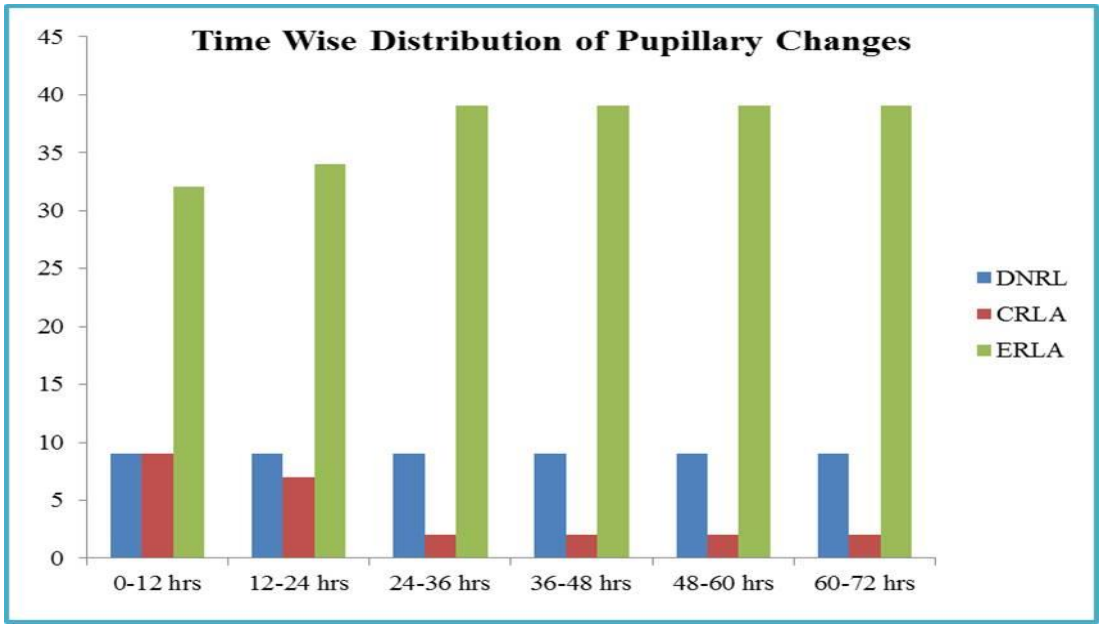
Graph – 3: Cranial nerve involvement among cases (n=50).



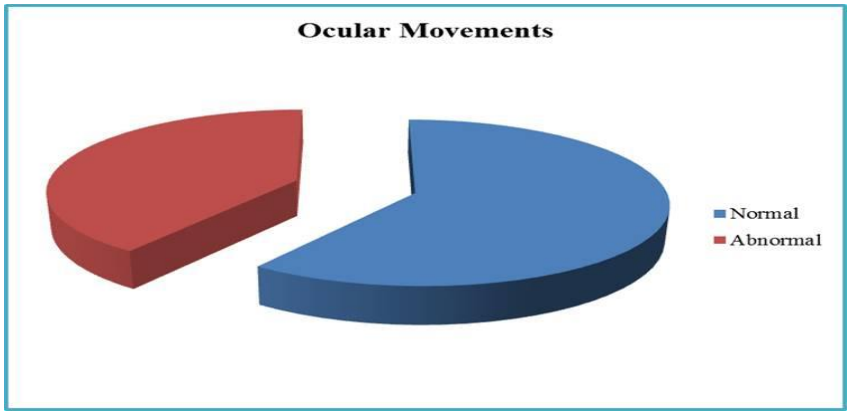
Graph – 4: Pupillary changes involvement among cases (n=50).



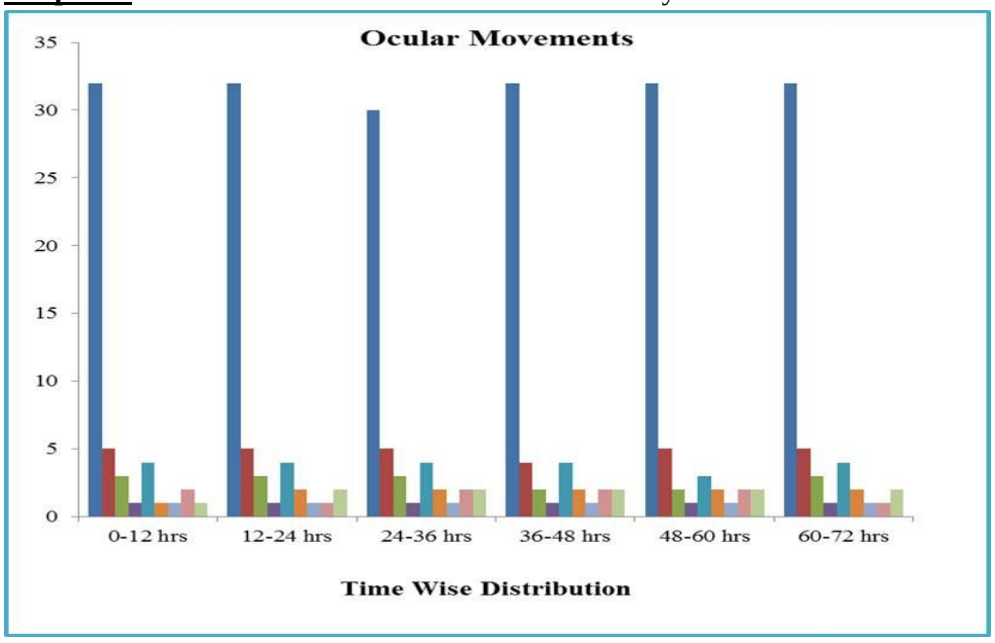
Graph – 5: Pupillary changes pupillary changes observed every 12 hours for 72 hours (n=50).



Graph – 6: The ocular movements (n=50).



Graph – 7: Abnormal ocular movements observed every 2 hours for 72 hours.



Of the 18 patients with abnormal pupillary findings, there were 9 patients (18%) with dilated pupils which were not reacting to light during the first 12 hours, i.e. from the time of admission, 9 patients (18%) with round, constricted pupils, sluggishly reacting to light and 32 patients (64%) did not show any changes in the pupils. After 12 hours, 9 patients (18%) were having dilated pupils not reacting to light and 7 patients (14%) with round, constricted pupils, sluggishly reacting to light and 34 patients (68%) were having normal sized round pupils reacting to light. In 24-36 hours, 9 patients (18%) were having dilated pupils not reacting to light and 2 patients (4%) with round, constrict pupils, sluggishly reacting to light and 39 (78%) were having normal sized round pupils reacting to light. In 36-48 hours, 9 patients(18%) were having dilated pupils not reacting to light and 2 (4%) patients with round, constricted pupils, sluggishly reacting to light and 39 (78%) were having normal sized round pupils reacting to light. In 48-60 hours, 9 patients (l8%) were having dilated pupils not reacting to light and 2(4%) patients with round, constricted pupils, sluggishly reacting to light and 39(78%) were having normal sized round pupils reacting to light. In 60-72 hours, 9 patients(1 8%) were having dilated pupils not reacting to light and 2(4%) patients with round, constricted pupils, sluggishly reacting to light and 3 9(78%) were having normal sized round pupils reacting to light (**Graph – 5**).

Of the 50 patients with acute ischemic stroke taken into the study, abnormal ocular movements were observed in 20 patients (40%) as per **Graph - 6**.

Of the 20 patients(40%) with abnormal ocular movements, the commonly observed ocular changes in the study sample were 3rd nerve palsy, 6th nerve palsy, multiple cranial nerve palsies, conjugate eye deviation to the side of the lesion, nystagmus on left lateral gaze, horizontal nystagmus on lateral gaze to the side of lesion (**Graph – 7**).

Discussion

Of the 50 patients in our study, the maximum number of cases was between the age group 51-79 years (28 patients). The percentage of male patients was 72 % to that of female patients which were 28%. All the 50 patients with acute stroke are assessed with the National Institutes of Health Stroke Scale (NIHSS). Of the 50 patients, 16 patients were having an altered level of consciousness (32%), 18 patients were having gaze paresis (36%), all the patients who are included in the study were having facial palsy (100%), all the patients presented with motor deficits (100%), 30 patients were having speech disturbances (72%). Of the 50 patients in our study group, 34 patients were alert, keenly responsive (68%) and 12 patients were not alert, arousable to minor stimulation (24%), patients were not alert, arousable to repeated or painful stimulation (8%) [8]. We had no patients who were totally unresponsive in our study group. Of the 18 patients with abnormal papillary findings, there were 9 patients (18%) with dilated pupils which were not reacting to light during the first 12 hours, i.e. from the time of admission, 9 patients (18%) with round, constricted pupils, sluggishly reacting to light and 32 patients (64%) did not show any changes in the pupils. After 12 hours, 9 patients (l8%) were having dilated pupils not reacting to light and 7 patients (14%) with round, constricted pupils, sluggishly reacting to light and 34 patients (68%) were having normal sized round pupils reacting to light. In 24-3 6 hours, 9 patients (18%) were having dilated pupils not reacting to light and 2 patients (4%) with round, constricted pupils, sluggishly reacting to light and 39 (78%) were having normal sized round pupils reacting to light [9]. In 36-48 hours, 9 patients (18%) were having dilated pupils not reacting to light and 2 (4%) patients with round, constricted pupils, sluggishly reacting to light and 39 (78%) were having normal sized round pupils reacting to light. In 48-60 hours, 9 patients (18%) were having dilated pupils not reacting to light and 2 (4%) patients with round, constricted pupils, sluggishly reacting to light and 39 (78%) were

having normal sized round pupils reacting to light. In 60-72 hours, 9 patients (18%) were having dilated pupils not reacting to light and 2 (4%) patients with round, constricted pupils, sluggishly reacting to light and 39 (78%) were having normal sized round pupils reacting to light [10]. Motor deficits in all the 50 cases (100%) and Sensory deficits were less commonly observed (10%) [11]. Of the 50 acute stroke patients, neurological findings included a clinical presentation of hemiplegia (14 subjects) and hemiparesis in (36 subjects), involvement of left hemisphere of brain in 36 subjects (60%), right hemisphere in 14 cases (40%) and involvement of cortical area in 26 subjects (65%) [12]. Cortical areas included frontal, parietal, temporal, and occipital lobes; internal capsule; thalamus and basal ganglion. 35% right brain-damaged subjects and 9% left brain-damaged subjects had contralateral visual changes [13]. Ocular defects in lesion confined to the left hemisphere usually give rise to minor and short-lasting spatial impairments in the contralateral side, but bilateral lesions are necessary to produce persistent and severe right visual defects. This could probably explain the incidence of abnormal ocular movements in the left hemisphere lesions more than right hemisphere lesions [14, 15].

Conclusion

The commonly observed ocular changes in the study sample were 3rd nerve palsy, 6th nerve palsy, multiple cranial nerve palsies, conjugate eye deviation to the side of the lesion and nystagmus. All these changes were commonly presented in patients with middle cerebral artery infarct (72%). Although the abnormal pupillary changes and ocular movements were very common in posterior cerebral artery territory infarcts, the incidence of abnormal pupillary changes and ocular movements was more common in posterior cerebral artery territory (50%) and also in middle cerebral artery territory (45%) in our study group.

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References

1. Ropper A, et al. Adams and Victor's Principles of Neurology, 10th Edition, McGraw Hill, 2014.
2. Munjal YP, et al. API Textbook of Medicine, 9th Edition, Jaypee Brothers, 2012.
3. Behr C. Die Lehre von den Pupillen Bewegungen. Berlin, Springer, Vo16, p. 224, 1924.
4. Daroff RB, Troost BT. Supranuclear disorders of eye movements. In Neuro-Ophthalmology, edited by Glaser JS. Hagerstown, Maryland, Harper & Row, 1978, p. 201-218.
5. David Newman Toker "Eye movement exam more accurate than MRI in Stroke Prediction". https://www.dotmed.com/news/story/10309/
6. Fisher CM. Some neuro-ophthalmologic observations. J Neurol Neurosurg Psychiat., 1967; 30: 383.
7. John Leighm David S. Zee. The Neurology of Eye Movements, 4th Edition, Oxford University Press, 2006.
8. Macintosh C. Stroke re-visited: visual problems following stroke and their effect on rehabilitation. Br Orthopt J., 2003; 60: 10-14.
9. Parsons JH. On dilatation of the pupil from stimulation of the cortex cerebri. J Physiol., 1900; 26: 366-379.
10. Pedersen PM, Jorgensen HS, Nakayama H, Raaschou HO Olsen TS. Hemineglect in acute stroke. Incidence and prognostic implications. The Copenhagen stroke study. Am J Phys Med Rehabil., 1997;76: 122-127.

11. Pedersen RA, Abel LA, Troost BT. Anatomy of eye movements. In Biomedical Foundations in Ophthalmology, edited by Jacobiec F. Hagerstown, Maryland, Harper & Row, (in press)
12. Rowe F, VIS group the UK. Prevalence of ocular motor-cranial nerve palsy and associations following Stroke. Eye (Lond), 2011; 25 (July (7)): 881-887.
13. De Renzi E, Colombo A, Faglioni P, Gibertoni M. Conjugate gaze paresis eye deviation in stroke patients. Stroke, 1991; 22: 200-202.
14. Mohr J, Rubinstein LV, Kase C. Gaze palsy in hemispheral stroke: the N1NCDS stroke data bank. Neurology, 1984; 34(suppl 1): 199.
15. Prevost J. De la deviation conjugue'e de Yeux et de la rotation de la Tete, 1868.