

**A STUDY OF OCULAR MOVEMENTS AND PUPILS IN ACUTE STROKE WITH ITS  
CLINICAL CORRELATION AND IMAGING**

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*Article History: Received 12<sup>th</sup> October,2015, Accepted 23<sup>rd</sup> October, 2015, Published 24<sup>th</sup> October,2015*

**ABSTRACT**

Stroke is the third leading cause of mortality in India. 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 cerebrovascular disease. Recent research has shown that, the eye movement and pupil examination is more accurate than MRI in predicting stroke and was able to identify all patients in the study who had a stroke, whereas an MRI conducted in the first day or two after hospital admission missed more than one in ten strokes. Hence this study to observe the ocular movements and pupils in acute stroke patients with its clinical correlation and imaging.

**Keywords:** Pupils, ocular movements, stroke

**1.INTRODUCTION**

Stroke is the third leading cause of mortality in India. 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.<sup>(1,2)</sup> 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 cerebrovascular disease. Eyes is an important organ which most of us take it for granted. It's a highly specialized sense organ which unlike most organ of body, is available to external examination. About 20% of 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 behavior. This makes the pupil size and the pupillary light reflex an important factor to be considered in many clinical conditions. More specifically, the location of the

pupillomotor nuclei and efferent oculomotor nerve is important for assessing the onset of descending transtentorial herniation and brainstem compression, its 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.<sup>(3)</sup>

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. Nystagmus is a reliable sign of posterior fossa or peripheral eighth nerve pathology.<sup>(4)</sup> 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. Recent research has shown that, the eye movement and pupil examination is more accurate than MRI in predicting stroke and was able to identify all patients in the study who had a stroke, whereas an MRI conducted in the first day or two after hospital admission missed more than one in ten strokes. Hence this study to observe the

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ocular movements and pupils in acute stroke patients with its clinical correlation and imaging.<sup>(5)</sup>

**2.METHODOLOGY**

This prospective study was conducted in Rajah Muthiah Medical College and Hospital (RMMCH) during the period from October 2013 to October 2015.

The study sample included 50 patients with acute stroke confirmed by CT/MRI findings of both sexes and who belong to age group of 20 to 80 years, who got admitted within 48 hours of stroke onset. Patients who got admitted after 48 hours of stroke onset and who were in age group less than 20years and more than 80years, who had previous history of stroke, who had recent history of infection, trauma(head injury), surgery within a month who came with any acute neurological syndrome other than stroke and patients with previous or present ophthalmological lesions were excluded from the study. A detailed clinical history was taken for these patients who are included in this study. All these patients were examined thoroughly with particular importance to ocular movements and pupils every 12 hours for 72 hours . All these patients have undergone a CT brain or an MRI brain.

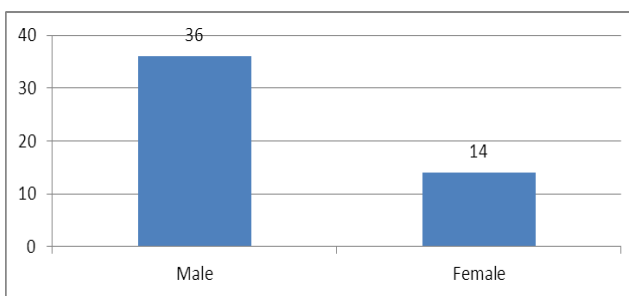
**3.STATISTICAL ANALYSIS**

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 pupillary changes and other neurological findings and CT Brain reports (hemisphere involvement, type of stroke, area of involvement, age and gender). The confidential interval was considered at 95% level. When *p* value was equal to or less than 0.05, the finding was considered significant.

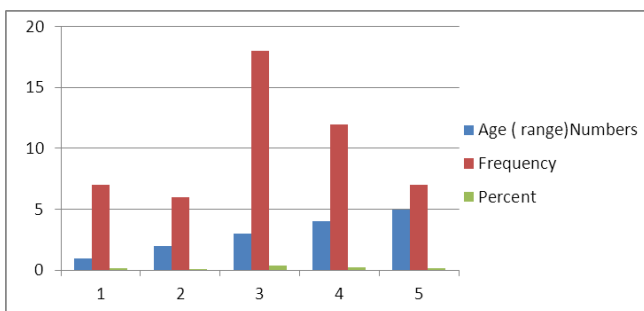
**4.RESULTS**

Of the 50 patients in our study, the maximum number of cases were between the age group 51-79 years (28 patients).The percentage of male patients was 72 % to that of female patients which was 28 %. In our study almost all ages were in their fifth and sixth decade, with youngest at 31 and oldest at 79 years of age with a mean age of 55years . Of the 50 acute ischemic stroke patients, neurological findings included a clinical presentation of hemiplegia (13 subjects) and hemiparesis in (37 subjects), involvement of left hemisphere of brain in 33 subjects (70%), right hemisphere in 17 cases (30%) and involvement of cortical area in 26 subjects (65%). Cortical areas included frontal, parietal, temporal, and occipital lobes; internal capsule; thalamus and basal ganglion. The abnormal ocular movements were found in 20 cases. The involvement of 3rd cranial nerve was found in 9subjects, involvement of 6th cranial nerve in 3 subjects, 7th cranial nerve is involved in almost all the cases, multiple cranial nerve involvement in 3 subjects, conjugate eye deviation towards lesion side found in 3, nystagmus in lateral gaze was observed in 6 cases, significant pupillary changes were observed in 18 cases.

**GENDER**

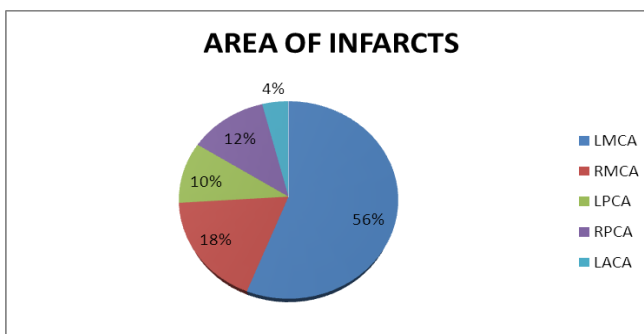


**AGE**



Among the areas of the infarct, anterior circulation stroke was commonest with 39 patients presenting with anterior circulation stroke and 12 patients with posterior circulation stroke. Among anterior circulation stroke, left middle cerebral artery infarct constitutes 56%(28patients), followed by right middle cerebral artery infarct 18%(9patients), followed by left anterior cerebral artery infarcts.

AREA OF INFARCT	NO OF PATIENTS	PERCENTAGE
LMCA	28	56%
RMCA	9	18%
LPCA	5	10%
RPCA	6	12%
LACA	2	4%



**5.DISCUSSION**

This study is mostly comparable to other studies on type of ischemic stroke, hemisphere involved (left, 70%), and area involved (cortical, 65%). Conjugate eye deviation towards the affected hemisphere as well as eye movement disorders due to involvement of the third, fourth and sixth cranial nerves are common.<sup>(6)</sup> The percentage of extra ocular muscle

paresis due to stroke in our study (17.5%) has been observed to be quite similar (18%) to that from the study done by Rowe et al. study.<sup>(7)</sup>

Variety of ocular motility disorders including infranuclear cranial nerve palsies, nystagmus and are well documented with ischemic stroke.<sup>(8)</sup> In our study, the upper motor nucleus of the seventh nerve has been affected in most subjects. and its effect on ocular and visual system has been well observed. According to Behr C Et al, the stimulation of the cerebral hemisphere, prefrontal, parietal and occipital lobe as well as the corona radiata and internal capsule produce pupillary changes. Dilatation is obtained from the above structures with or without horizontal conjugate eye movements. At times, constriction of the pupil occurs with frontal and occipital lobe stimulation. constriction of the pupil is mostly associated with disjunctive movements such as convergence or divergence.<sup>(9)</sup> Evidence for pathways producing dilatation independent of the peripheral sympathetic system was presented as early as 1900 by Parsons, who obtained dilatation of pupils by cortical stimulation after bilateral cervical sympathectomy.<sup>(10)</sup> The persistent associated severe deficit (paralysis, sensory changes, field defect) suggests destruction of cortical and subcortical gray and white matter. The left hemisphere stroke (11 out of 16 cases) has been observed almost to have associated significantly higher level of ocular movement abnormalities than the right hemisphere stroke (5 out of 16 cases) at  $p = 0.001$ . This finding was comparable with other reports. In the Vallar et al. study, 41 35% right brain damaged subjects and 9% left brain damaged subjects had contralateral visual changes. Similarly, Pedersen et al.<sup>(11)</sup> have reported right hemisphere lesions in 42% subjects and left hemisphere lesions in 8% subjects. Ocular defects in lesion confined to the left hemisphere usually gives 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.<sup>(12,14)</sup> This could probably explain the incidence of abnormal ocular movements in the left hemisphere lesions more than right hemisphere lesions.<sup>(13,14)</sup>

## 6.CONCLUSION

The incidence of pupillary changes and ocular movement abnormalities was found to be significant that of the other peer reviewed literature reports. This finding could be expected to rise if maximum study sample have been enrolled. In spite of this, pupillary findings and ocular movements and CT Brain reports were found to be significantly associated with stroke in the study. This study emphasize the importance of examination of pupils and ocular movements in patients with stroke at different period of times, which helps us to localize the lesion prior performing a CT Brain or an MRI imaging studies.

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