NUCLEAR AND INFRANUCLEAR LESIONS OF 3,4,6 CRANIAL NERVE LESIONS AND THEIR CLINICORADIOLOGICAL CORRELATION

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RAJIV GANDHI GOVERNMENT GENERAL HOSPITAL
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CERTIFICATE

This is to certify that the dissertation entitled **"NUCLEAR AND INFRANUCLEAR LESIONS OF 3,4,6 CRANIAL NERVE LESIONS AND THEIR CLINICORADIOLOGICAL CORRELATION"** is a bonafide original work of **DR.R.VIVEKA SARAVANAN,** in partial fulfillment of the requirements for D.M. Branch– I (NEUROLOGY) Examination of the Tamil Nadu Dr.M.G.R Medical University to be held in August 2013, under our guidance and supervision.

Dr.R.Lakshmi Narasimhan, D.M.,
Professor of Neurology,
Institute of Neurology,
Madras Medical College,
Chennai – 3.

Dr.C.Mutharasu, DM,
Professor of Neurology,
Institute of Neurology,
Madras Medical College,
Chennai – 3.

Dr.K.Deiveegan, M.Ch.,
Professor and Head,
Institute of Neurology,
Madras Medical College,
Chennai – 3.

Dr.V. Kanagasabai, MD.,
Dean,
Madras Medical College,
Chennai – 3.

DECLARATION

I hereby solemnly declare that this dissertation titled **"NUCLEAR AND INFRANUCLEAR LESIONS OF 3, 4, 6 CRANIAL NERVE LESIONS AND THEIR CLINICORADIOLOGICAL CORRELATION"** was done by me in Institute of Neurology, Madras Medical college and Rajiv Gandhi Government General Hospital, Chennai -3, under the guidance and supervision of **Prof.R.LAKSHMINARASIMHAN, MD, D.M,** Professor of Neurology, Institute of Neurology, Madras Medical College & Rajiv Gandhi Government General Hospital, Chennai. This dissertation is submitted to the Tamil Nadu Dr. M.G.R. Medical University towards the partial fulfillment of requirement for the award of D.M Degree Branch I (Neurology).

Place: Chennai
Date:

Dr.R.Viveka saravanan,
DM, Post Graduate,
Institute of Neurology,
Madras Medical College,
Chennai – 3.

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CONTENTS

INTRODUCTION

Palsies of any of the three cranial nerves supplying the extra ocular muscles have their presentations, disturbing ocular motility. Abnormalities of ocular motility help in the localization of lesions of the cerebral hemispheres, brain stem, cranial nerves (CNs), and even the striated muscle. Only one nerve may be involved or there may be a combination of the three nerves. The palsies are usually acquired.

Sometimes palsies can be congenital due to the developmental defect of the nucleus or motor nerve fibers. Oculo motor fibers can be interrupted intraaxially or extraaxially. Lesions can be in the foramens or extra cranial e.g. Intraorbital.

All these Oculomotor nerves can be affected in the brainstem (nucleus or fascicular portion)[1], in the subarachnoid space, in the cavernous sinus, at the superior orbital fissure, or in the orbit.

MRI has become the most useful diagnostic tool in the localization, diagnosis and management of the nuclear and infranuclear lesions of 3, 4, 6 cranial nerves.

In conditions like vasculitis and prothrombotic states, laboratory investigations add on to radiological findings and histopathological evaluation is useful when there are therapeutic difficulties.

Cranial nerves 3, 4, and 6th palsies can be due to head injury[2,26]. In many studies head injury is very well correlated with imaging. In this study, we have excluded the head injury patients presenting with 3, 4&6 cranial nerve palsies.

This study is about the clinicoradiological correlation in nuclear, infranuclear lesions of 3, 4, 6th cranial nerves.

AIM OF THE STUDY

1) To study the demography in patients with nuclear and infranuclear lesions of 3, 4, 6 cranial nerves

2) To study the clinical localizations in patients with nuclear and infranuclear lesions of 3, 4, 6 cranial nerves

3) To analyze the radiological findings in patients with nuclear and infranuclear lesions of 3, 4, 6 cranial nerves.

4) To analyze the various etiological factors of nuclear and infranuclear lesions of 3, 4, 6 cranial nerves

5) To study clinicoradiological correlation in patients with nuclear and infranuclear lesions of 3, 4, 6 cranial nerves

REVIEW OF LITERATURE

The oculomotor nerve emerges from the supero-ventral aspect of the pons near the midline and courses in the interpeduncular cisterns. It passes in between the posterior cerebral arteries and the superior cerebellar arteries with a slight angulation in the distal course. Then it passes through the basilar cisterns inferior to the posterior-communicating arteries and the uncus of the temporal lobes, after which it enters the cavernous sinuses superiorolaterlly. The pore for these nerves is lateral, posterior, and superior to the internal carotid arteries. A small sheath of cerebrospinal fluid may be present around these nerves on entering the cavernous sinuses. The third cranial nerve comes out through the superior orbital fissures. Then it divides into inferior and superior divisions and innervates the superior, inferior, and medical recti, the inferior oblique and levator palpebrae muscles, and the pupillary sphincters. The component controlling the extra ocular muscles is called somatic component. It's nucleus is located in the midbrain at the level of the superior colliculi, anterior to the sylvian aqueduct near the midline. These oblong shaped nuclei have three components: lateral (subdivided into dorsal, intermediate, and ventral parts), medial, and central sub nuclei. The Edinger-Westphal (EW)

nucleus, which controls visceral innervation (mainly constriction of the pupillary muscles), is behind these nuclei.

The third cranial nerve is formed when the somatic portion joins the parasympathetic portion from the EW nucleus. Cisternal portions of the third cranial nerve are better visualized on sagittal, axial, and coronal MR images. Within the cavernous sinuses, the third nerves lie supero lateral to the upper portion of the ICA siphon[3]. It does not enhance after contrast administration.

The fissures can be easily identified but the structures in the fissure cannot be differentiated. The 3,4,5,6 cranial nerves are seen as a group inferior to the anterior clinoid process before exiting through the superior orbital fissures. Micro vascular disease caused by diabetes mellitus is the most common cause of third cranial nerve palsy[33]. Other causes like age-related micro vascular changes and syphilis may also cause third cranial nerve palsy[7]. Here the end arteries are affected and the involvement of the nerve is global, which causes a complete palsy (muscular and pupillary).

Posterior-communicating artery aneurysms compress the outer portion of the nerve. Pupillary constrictor fibers travel in this portion, and hence these patients present with an incomplete palsy

(blown pupil, same as in herniation of the temporal lobe). Tumors and trauma are other causes of cranial nerve III palsy[8]. Approximately, one third of cranial nerve III palsies are idiopathic[9].

Midbrain infarctions may result in complex syndromes with accompanying third cranial nerve palsies. When the nuclei of the oculomotor nerves and the ipsilateral cortical spinal tract are affected, it results in Weber syndrome[10] (ipsilateral ophthalmoplegia and contralateral hemiplegia). If an infarct affects the nuclei of the oculomotor nerve and adjacent red nucleus, it results in Benedikt syndrome (Ipsilateral ophthalmoplegia and contralateral intention tremor). Characteristics of a third cranial nerve ophthalmoplegia are a wrinkled forehead, raised eyebrow, eyelid droop, dilated pupil, and a downward and laterally displaced eye. Infections such as meningitis, particularly tuberculosis, may result in a third cranial nerve palsy[33]. Herniation of a temporal lobe displaces the brainstem towards the opposite side and this results in stretching of the oculomotor nerve and results in palsy.

The third cranial nerves are affected by

1) Aneurysm

2) Vascular disease (infarction in the brainstem and/or the nerve)

3) Tumor

4) Trauma

Diseases affecting the cavernous sinus may also result in third cranial nerve palsy (Foix syndrome). Third cranial nerve palsy in combination with a superior orbital fissure syndrome is called Rochon-Duvigneaud syndrome[11].

A lesion at the level of the orbital apex results in Rollet syndrome[12]. A lesion at the petrosphenoidal junction affecting also the second, fourth, and sixth cranial nerves is called Garcin syndrome[13]. Osteitis of the petrous apex (Gradenigo syndrome)[14] results in palsies of the third, fifth, and sixth cranial nerves. Fractures affecting the sphenoid bone can occasionally result in palsies of the oculomotor nerves.

Third nerve palsy

Third nerve palsy can be diagnosed by abnormalities in the function of the superior rectus, inferior rectus, inferior oblique and medial rectus muscles. As the third nerve innervates levator palpebrae superioris and pupil, involvement of the eyelid with induced ptosis is seen and the eye is deviated out and slightly down. Isolated extrtraocular muscle palsies are unlikely to

represent a third nerve palsy, especially in the following cases :an apparent superior rectus weakness without ptosis; an inferior oblique weakness without medial and inferior rectus weakness, which is possibly Brown syndrome; or an isolated medal rectus weakness, most likely an INO. Myasthenia can involve the extra ocular muscles and levator but it spares the pupil and is not associated with pain.

Abnormalities of the pupil such as mydriasis and failure to react may be signs of third nerve involvement. However, because of the peripheral location of the pupillary fibers in the extra axial portion of the third nerve, it is possible for sparing of the pupil to coexist with even complete involvement of the extra ocular muscles and levator. Rarely an acute third nerve palsy to be caused by a mass lesion when the pupil is completely spared, which is not true for progressive oculomotor dysfunction. 50% of slowly progressive third nerve palsies resulting from a slowly expanding parasellar lesion (carotid cavernous aneurysm, meningioma, pituitary adenoma, etc. may be unassociated with pupillary compromise. In addition, sympathetic dysfunction, which is common with cavernous sinus lesions, may partially mask pupillary involvement by reducing mydriasis.

Acute onset of third nerve palsy associated with a dilated, and reactive pupil is presumed to represent an aneurysm, usually of the posterior communicating artery. When associated with headache and stiff neck, it may represent an aneurysmal subarachnoid hemorrhage.

Neoplastic, inflammatory and even micro vascular causes may result in a pupil- involving third nerve palsy. Pain is almost a constant finding with aneurysmal third nerve palsy, but it is also frequent with micro vascular paresis[15]. Third nerve dysfunction associated with opthalmoplegic migraine can mimic that caused by an aneurysm. This rare syndrome is usually preceded by a headache and initial onset essentially always occurs in childhood.

Congenital third nerve palsies often represent perinatal trauma, involvement of the nerve is variable[39], aberrant regeneration is common and divisional palsies may occur. Slowly progressive oculomotor palsies are an indication for repeat MRI in spite of previous negative studies, as neurlemmomas can remain cryptic. One rare congenital syndrome is cyclic oculomotor palsy[16].an eye with an underlying palsy develops intermittent spasms during which the paretic eye turns from its exotropic position towards midline, the ptotic eyelid elevates and the dilated

pupil constricts.

Acute isolated pupil-sparing third nerve palsy in a vasculopathic patient over 40 does not require work-up other than blood pressure and fasting blood sugar tests. It is important to follow these patients as the expected recovery is within 3 months[33]. In a third nerve palsy associated with trauma a careful check for carotid cavernous fistula is essential.

When the pupil is enlarged or the third nerve involvement is progress, a work up is indicated. MRI with gadolinium is the primary diagnostic study. When combined with MRA, it can show aneurysms larger than4mm. Inflammatory lesions and even some infiltrates (lymphoma) may not show up on MRI.CSF analysis for cells and protein may be helpful. Often serial MRIs over a period of years are required to uncover the etiology in cryptogenic third nerve palsies.

Following viral infections [33]or vaccination, children may have transient opthalmoplegia. In older patients, an erythrocyte sedimentation rate may be used to screen for giant cell arteritis. Since giant cell arteritis is an important cause of opthalmoplegia[17] in elderly, it is worthwhile to consider giant cell arteritis as a cause

even though diplopia that results from giant cell arteritis is a result of orbital hypoperfusion that leads to extraocular muscle ischemia.

Diagnosis is more difficult in cases of incomplete third nerve palsy. It was previously thought that divisional palsies (superior rectus and levator, or medial rectus, inferior rectus and inferior oblique) indicate pathology within the cavernous sinus or orbital apex. Now it is known that divisional palsies can also occur with pathology more proximally situated including within the midbrain. Although microvascular diseases can cause divisional involvement, these patients should be carefully worked up with MRI with contrast. Ophthalmic artery aneurysms can cause superior division palsies.

Relative pupil sparing also presents diagnostic difficulties. In the presence of significant mobility impairment, slight dilatation of the pupil may occur with microvascular disease. Progressive pupillary enlargement is always an indication for work –up.

As a damaged third nerve recovers misdirection of fibre growth can result in aberrant regeneration. The classical findings in aberrant regeneration are

1) Eyelid elevation or hang up with adduction and depress

2) Miosis with elevation

The causes of acquired third nerve palsy are

1) Brain stem lesions

2) Inflammatory conditions like meningitis, encephalitis, toxin exposure causing polyneuritis, Echo virus infection, Herpes infection

3) Vascular causes like ICA dissection, aneurysms and carotico cavernous fistula

4) Tumors like Glioblastoma multiforme

5) Demyelinating disorders

6) Trauma

7) Miscellaneous causes are

   a. Anterior communicating artery aneurysm

   b. Bilateral chronic subdural hematoma

   c. Congenital toxoplasmosis

   d. “Crack” cocaine

   e. Diagnostic angiography

   f. Eosinophilic granuloma of the optic nerve

g. Frontal sinus mucocele

h. Infectious mononucleosis

i. Leukemia

j. Measles immunization

k. Myasthenia gravis

l. Ophthalmoplegic migraine

m. Polyarteritis nodosa

n. Porphyria

o. Sarcoidosis

p. Schwannoma

q. Temporal arteritis

r. Viagra therapy (sildenafil citrate)

s. HIV20

TROCHLEAR NERVE (IV)

The trochlear nerve is the only cranial nerve arising from the dorsal brainstem and has the longest intracranial course (especially in their cisternal portion). The fourth cranial nerve is 7.5 cm long

approximately. At the level of the inferior colliculi these nerves decussate before emerging from the dorsal midbrain and they are the most slender of all cranial nerves coursing parallel to the free edge of the tentorium between the posterior and superior cerebellar arteries. They enter the cavernous sinuses inferior to the oculomotor nerves and usually cannot be individually discriminated within the lateral wall of the cavernous sinus.

It travels in the outer dural wall of the cavernous sinuses. They innervate only the superior oblique muscles after exiting through the superior orbital fissures.

These nerves cannot be seen by routine MR imaging generally because of their small size, but it is possible to identify their cisternal portions in approximately 20% of all coronal examinations[4]. They are never affected in an isolated fashion.

Fourth cranial nerve palsies are commonly caused by trauma (because of their long course), tumor, brainstem infarction, and aneurysm[19,22]. About 50% of fourth cranial nerve palsies are idiopathic. Diseases involving the superior orbital fissure and the orbital apex can affect fourth cranial nerves. Patients with fourth cranial nerve palsy typically have difficulty going downstairs.

Patients turn their head and may present with torticollis to compensate for the weakness of downward and lateral gaze.

FOURTH NERVE PALSY

A fourth nerve palsy is the presumptive diagnosis in a patient presenting with vertical double vision and when there is no history s/o restrictive phenomena. Finding a hyperdeviation also raises suspicion of a fourth nerve palsy. Hyperdeviation increases on contralateral gaze and with ipsilateral head tilt.

The lines of the maddox rod are tilted with the patient and the testing must be done with the patient upright. Subtle restrictive problems or a skew deviation must be reconsidered if the deviation does not follow the expected pattern. Double maddox rod testing should show evidence of excyclotorsion between 3 –10 degrees. Results that show greater than 10 degrees of excyclotorsion raise the possibility of a bilateral fourth nerve palsy.

Fourth nerve palsies are either congenital or acquired. Head tilt in old photographs or vertical fusional range of greater than 3 D is strongly suggestive of a long standing or congenital fourth nerve paresis. Often patients are unaware of a previous head tilt until old photographs including driver's licenses are examined. Head trauma

is the most common cause of an acquired fourth nerve palsy which may have been so trivial the patient had forgotten it. Microvascular causes are the leading diagnosis of fourth nerve palsies in older patients.

It is extremely uncommon for nuclear involvement of the fourth nerve although it has been reported with vascular disease (including arteriovenous malformation), trauma and demyelination. The fourth nerve may be involved as it exits the brain stem, crossing in the superior medullary velum. Pineal gland lesions (pinealoma, pineoblastoma, teratoma, dysgerminoma or choriocarcinoma) may all affect the fourth nerve, usually bilaterally and frequently with other signs of the dorsal mid brain syndrome. Other inflammatory pathology (including meningitis) and vascular phenomenon (including carotico cavernous fistula) can impair trochlear function within the area of cavernous sinus. In the subarachnoid space the fourth nerve may be affected by microvascular abnormalities quite often[24]. Following a neurosurgical procedure iatrogenic fourth nerve paresis is not rare, occurring most frequently when the tentorial edge is cut.

To make sure, the fourth nerve palsy is clearing older patients should be followed up. Restrictive syndromes such as thyroid

ophthalmopathy or old trauma and myasthenia gravis should be considered.

ABDUCENT NERVE

The sixth cranial nerves emerge at the Ponto medullary junction. The cisternal portions are inconsistently identified on sagittal and coronal MR images. They appear as thin lines of intermediate signal intensity coursing parallel to the clivus[5]. They can be easily mistaken for the anterior wall of the basilar artery or for pulsation artifacts within the prepontine cistern. The sixth cranial nerves enter the medial petrous bones via the Dorello's canal[6]. Then they enter cavernous sinuses medial to the gasserian ganglia. They are prone to injuries as they are the only cranial nerves coursing inside of the cavernous sinuses.

These cranial nerves travel inferior to the ophthalmic division of cranial nerve V. Via the superior orbital fissure they exit the skull. They innervate the lateral recti muscles. Common pathologies affecting them are tumors, trauma, infarction, demyelinating diseases, and vascular pathology of the cavernous sinuses (e.g., ICA– cavernous sinus fistula). More than 40% of cranial nerve VI palsies are idiopathic.

The nuclei for the sixth cranial nerves are located close to the midline (most motor cranial nerve nuclei are nearly midline in position) at the level of the floor of the fourth ventricle. The nuclei are located medially because the fibers for facial nerves wrap around them creating slight bulges on the floor of the fourth ventricle (facial colliculi).

The nuclei for the abducens nerves communicate via the medial longitudinal fasiculi, with the third cranial nerve nuclei and coordinate eye movements.

SIXTH NERVE PALSY

In the finding of an isolated abduction deficit a sixth nerve palsy is suspected. The deficit need not be complete and may, be indicated only as an esodeviation increasing on ipsilateral gaze. Slowed ipsilateral saccades strongly suggest a sixth nerve etiology.

Inflammatory lesions (post viral, demyelinating etc.) may affect the sixth nerve within the brainstem, particularly in the young patient, and by vascular lesions, especially in the older patients. Metabolic disease such as vitamin B Wernicke-Korasakoff syndrome can also affect the sixth nerve. A pontine glioma may present as unilateral or bilateral sixth nerve palsy in children.

Intra axial lesions usually result in other neurologic findings, including involvement of the seventh cranial nerve and facial sensation. If the ventral brain stem is involved, associated abnormalities of the corticospinal tract lead to contralateral hemiparesis (Millard Gubler syndrome)[18]. Nuclear involvement of the sixth nerve means the patient will show gaze palsy, usually without associated diplopia. When the gaze palsy begins to clear, additional involvement of the fascicle will lead to more rapid improvement in the adducting eye, causing the appearance of a relative ipsilateral sixth nerve palsy and possibly diplopia.

Following types of pathology can affect the sixth nerve within the subarachnoid space:

- ❖ Inflammatory (sarcoid)
- ❖ Infiltrative(including lymphoproliferative abnormalities)
- ❖ Infectious (especially basilar meningitis such as tuberculosis or fungus)
- ❖ Compressive (usually arising from the clivus, meningioma, chordoma,chondrosarcoma, metastatic disease)

In addition, lesions of the cerebellar pontine angle may get large enough to affect the sixth nerve (neurlemmomas of eight

nerve, the auditory nerve or meningiomas). These lesions are generally associated with decreased hearing and vestibular findings as well as seventh nerve dysfunction and facial sensory loss). Finally the subarachnoid sixth nerve may be affected by shifts in the positions of the brain stem that cause the tugging on the nerve itself. Changes in the intracranial pressure as with acute hydrocephalous, following lumbar puncture, and associated with pseudotumor cerebri are particularly likely to affect the sixth nerve[21].

As the sixth cranial nerve passes over the petrous pyramid, it may be affected by trauma, enlargement of the inferior petrous pyramid (Gradenigo syndrome), or neoplastic processes. Meningiomas or neurlemmomas may affect the sixth nerve within the posterior cavernous sinus or as it crosses the petrous pyramid. In addition, nasopharyngeal carcinoma invading the skull base through the foramen lacerum may produce sixth nerve palsy as well as pain and decreased hearing. Aneurysms of the intracavernous carotid artery often present with sixth nerve palsy but may also have sensory changes and a Horner's syndrome.

In isolation congenital sixth nerve palsies almost never occur.[25] Congenital absence of the sixth nerve is seen in Duane

syndrome. The lateral rectus muscle in these patients is innervated by various branches from the third nerve, which results in narrowing of the palpebral fissure with attempted adduction. Co-contraction commonly causes upshoot and downshoot. Patients are frequently unaware of the abnormality and usually do not have trouble with double vision. In Mobius syndrome, bilateral involvement of the sixth and seventh nerves is seen. Other lower cranial nerves may also be involved. Using their intact adduction patients with both Duane and Mobius syndromes cross fixate,.

It is important to determine whether the non-traumatic sixth nerve palsy is isolated. Evidence of associated dysfunction of the third, fourth, fifth, seventh or eighth cranial nerves or of sympathetic abnormalities is an indication for a work up including at least an MRI with and without gadolinium. Increased intracranial pressure such as history of headaches or findings of papilledema and obesity might indicate that the sixth nerve palsy is non-localizing. An acute inflammatory or microvascular sixth nerve palsy may cause pain and significant pain is an indication for a work up. In the older patients, the diagnosis of a microvascular sixth nerve palsy anticipates that it should clear within a period of 2-3 months. Any evidence of progression or failure to resolve is an

indication for MRI. In children post viral inflammatory lesions may be seen.

In adolescents and young adults demyelinating disease may be an under-recognized cause of sixth nerve palsy. Yield of neuroimaging (MRI) is low in the absence of other findings. Failure to resolve or development of any other long tract signs of brain stem findings suggests the presence of pontine or cerebellar glioma, ependymoma or medulloblastoma. Patients must be followed up and persistence of sixth nerve dysfunction is always an indication for MRI. Metabolic syndromes causing sixth nerve palsies are rare. In the setting of negative MRI cerebrospinal fluid analysis may be indicated.

Persistent limitation of vertical gaze can be caused by co-contraction of the superior and inferior recti.

MULTIPLE CRANIAL NERVE PALSIES

Diagnosis of involvement of more than a single ocular motor nerve paresis is critical. It is difficult to detect involvement of the fourth nerve in the presence of a third nerve palsy. In this condition there is failure of intorsion with attempted downgaze with the eye in abduction. Microvascular diseases rarely cause simultaneous

involvement of more than one cranial nerve. Paresis of extraocularmuscles innervated by two or more ocular nerve requires work up. Pain or facial sensory loss suggests pathology in the area of cavernous sinus that may be neoplastic (meningioma, neurilemoma, pituitary adenoma, metastatic disease), vascular (caraticocavernous fistula or aneurysm) or inflammatory (sarcoid, Tolosa Hunt syndrome). In MRI we can visualize the pathology in majority of cases. Evidence of neoplastic and inflammatory cells in cerebrospinal fluid should be considered if the MRI is negative.

Elevated proteins and pleocytosis may appear in the CSF in the setting of post infectious polyradiculoneuropathy (Fisher syndrome). Botulism can cause multiple cranial nerve palsies associated with diffuse weakness, particularly respiratory. Painful ophthalmoplegia of Tolosa Hunt syndrome responds to corticosteroid therapy. This response has been suggested as a diagnostic criterion. Mass lesions (particularly lymphoproliferative) may also respond to a course of corticosteroids and Tolosa Hunt syndrome should be considered a diagnosis of exclusion following MRI with gadolinium. Failure to fit the pattern of single cranial nerve palsy should always stimulate reconsideration of myasthenia, skew deviation or restrictive strabismus.

Bilateral cranial nerve involvement is always an indication for work up. Bilateral sixth nerve palsies rarely caused by microvascular disease. In this setting MRI should be the first step in approaching diagnosis.

CAVERNOUS SINUS

Cavernous sinuses are

1) Paired venous structures located lateral and inferior to sphenoid sinus/hypophysis, anterior and medial to the petrous apex, and posterior to the optic canal and inferior and superior orbital fissures.

2) These are endothelial-lined structures containing multiple septations.

3) They are the only veins in the body to be traversed by arteries (ICAs).

4) They form the lateral sellar compartment of the extradural neuroaxis, which is a system of veins extending from the orbits via the spinal epidural space to the coccyx.

The dural walls of the cavernous sinuses are characterized as follows:

1) The outer layer extends to the clinoids and laterally to the middle cranial fossae where it continues as the dura matter. The outer dural layer may contain a separate venous compartment called the lateral sinus.

2) The inner layer follows the bone margins of the sinus and has secondary septations, including those forming the Meckels cave.

3) The petroclinoid ligaments separate the cavernous sinuses into an oculomotor trigone (containing most cranial nerves) and a vascular trigone (located medially).

There are vascular communications between the cavernous sinuses located as follows:

1) Basilar venous sinus or plexus communications are located dorsal to the clivus.

2) Anterior intercavernous communications are located ventral to the hypophysis.

3) Posterior intercavernous communications are located dorsal to the hypophysis.

4) Intrasellar intercavernous communications are located between the anterior and posterior lobes of the pituitary gland.

5) All of these communications may be normally seen in children (particularly in babies) but are not easy to see in adults. They are enlarged in cavernous sinus-carotid artery fistulas (direct and indirect) and unilateral processes obstructing the drainage of one cavernous sinus.

The porous trigeminus is the dorsal opening of the cavernous sinuses through which the main trunk of the fifth cranial nerves courses. The Meckel cave is a dural reflection containing the semilunar ganglion, which is surrounded by the trigeminal cistern.

The mandibular branch of the third division of the trigeminal nerve exits from the Meckel cave via the foramen ovale. It does not enter the venous portion of the cavernous sinus. The walls of the cavernous sinus enhance normally.

The features of gasserian (semilunar) ganglion are:

1. Its trunk separates in three bundles immediately.

2. It is not a true ganglion.

3. The inferolateral aspect of a gasserian ganglion

may enhance normally after gadolinium is given, possibly because of a combination of perineural vascular plexus and presence of ganglion cells

The oculomotor trigone comprises the cranial nerves III, IV, V1, and V2 located between the inner and the outer dural layers forming the lateral walls of the cavernous sinuses, in which the ICA is located between the lateral wall of the sphenoid sinus and inner dural layer of the cavernous sinus. The carotid artery lies mostly outside the sinus but becomes intracavernous in some portions. This region comprises the vascular trigone. Here the cavernous sinus contains venous blood and multiple septations.

Sixth cranial nerves may be surrounded by the inner dural layer or be within the cavernous sinus.

Before exiting the superior orbital fissure the Cranial nerves III, IV, VI and V1 are grouped inferolateral to anterior clinoid. The ophthalmic vein and artery are contained in the middle of the anterior region of the fissure. The anteroinferior portion of the fissure contains the maxillary division of the trigeminal nerve before it exits via foramen rotundum.

The superior dural ring surrounding the ICA marks the superior-most aspect of the cavernous sinuses. It comprises the outer dural layer. It is inseparable from the arterial adventia. The inner dural layer forms the inner dural ring. The space between both rings is called the carotid cave. The ophthalmic and superior hypophyseal arteries lie outside the cavernous sinus in most individuals.

Structures that drain into and out of the cavernous sinus are

1) Into the cavernous sinuses: the superior and inferior ophthalmic veins, the pterygoid plexus, the superficial sylvian vein, and the uncal (temporal) vein.

The pterygoid plexus drains into the cavernous sinus via the inferior ophthalmic vein, the vein of the foramen ovale, the vein of the foramen spinosum, the vein of foramen lacerum, and the veins of the carotid canal.

2) Out of the cavernous sinus: the inferior and superior petrosal sinuses

In patients with cranial nerve palsies MRI is the imaging method of choice. The oculomotor cranial nerves can be visualized by standard MR sequences. In MR images of normal subjects, it is

demonstrated that the oculomotor nerve, the trochlear nerve and the abducens nerve can be identified not only in the subarachnoid space and cavernous sinus, but also in the orbit. However, a precondition is the use of appropriate imaging sequences and planes (e.g., subarachnoid cisterns: T2-weighted fast spin-echo or T2-weighted three-dimensional sequences in oblique-axial and sagittal planes; cavernous sinus: contrast-enhanced T1-weighted coronal images; orbit: T1-weighted images without contrast agent in the coronal plane obtained using surface coils). Imaging the cranial nerves is clinically important not only for diagnostic purposes in eye muscle palsies but also for planning surgical procedures at the cranio-orbital junction.

Discussing about one of the etiologies, opthalmoplegic migraine is a rare condition that almost always has its onset in childhood. Recurrent attacks are stereotypical. Every episode begins with a unilateral orbital and retro-orbital headache, accompanied by vomiting, that may last for 1 to 4 days. During the migrainous attack, ipsilateral ptosis occurs and within a few hours progresses to a complete paralysis of cranial nerve III. Cranial nerves IV or VI may be rarely involved. The neurological deficit can last from hours to several months. In the past, the focal nature

of the deficit often led to major investigations including angiography to rule out the presence of an internal carotid or posterior communicating artery aneurysm. Usually, no abnormality is found. MRI scans have shown thickening and contrast enhancement of the nerve as it exits the midbrain, which may persist after the third nerve palsy has disappeared and this represents a recurrent demyelinating/inflammatory neuropathy. It is to be determined whether cases with no identifiable cause (or cranial nerve enhancement on MRI) and spontaneously remitting episodes represent a form of migraine. The prognosis is favorable for recovery unless attacks occur very frequently.

MATERIALS AND METHODS

In this study, we analyzed data of patients with nuclear and infranuclear lesions of 3, 4, 6 cranial nerves, who were inpatients in Rajiv Gandhi Government General Hospital, Chennai between February 2011 to February 2013.Data pertaining to patient demographics,signs,investigations and radiological findings were analyzed . Informed consent was taken for enrolment in the study and for the investigations. X-ray skull, CT brain plain and contrast (if necessary) and MRI brain plain and contrast study (if necessary) were done in all the patients, in the department of radiology in Rajiv Gandhi Government General Hospital, Chennai.

INCLUSION CRITERIA

Patients with Nuclear and infranuclear lesions of 3, 4, 6 cranial nerves, who were inpatients in Rajiv Gandhi Government General Hospital, Chennai, between February 2011 to February 2013.

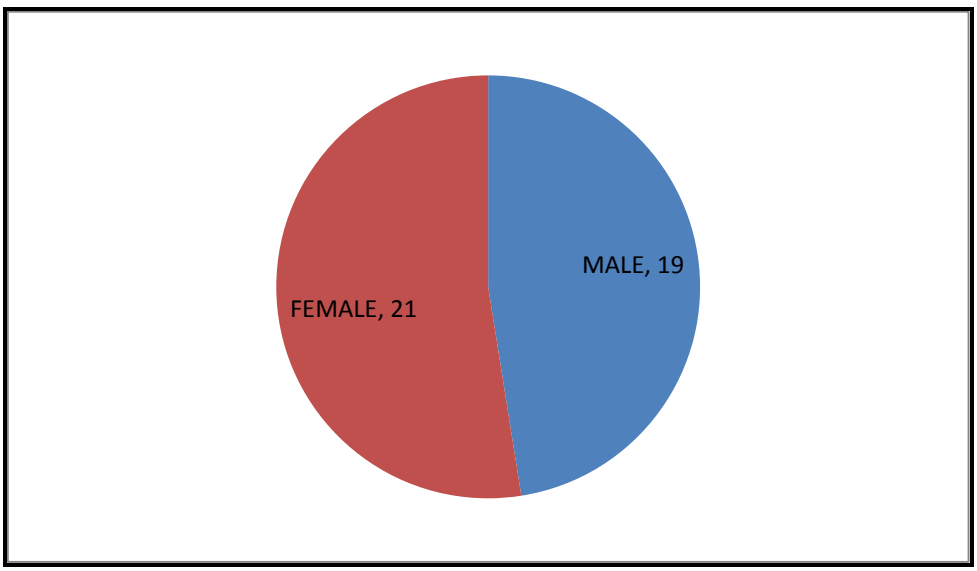
EXCLUSION CRITERIA

Patients with lesions of 3, 4, 6 cranial nerves following head trauma were excluded from this study

RESULTS AND OBSERVATIONS

In this study 40 patients were studied. Out of which 21 were female patients, 19 were male patients. (Fig.1)

Figure-1:

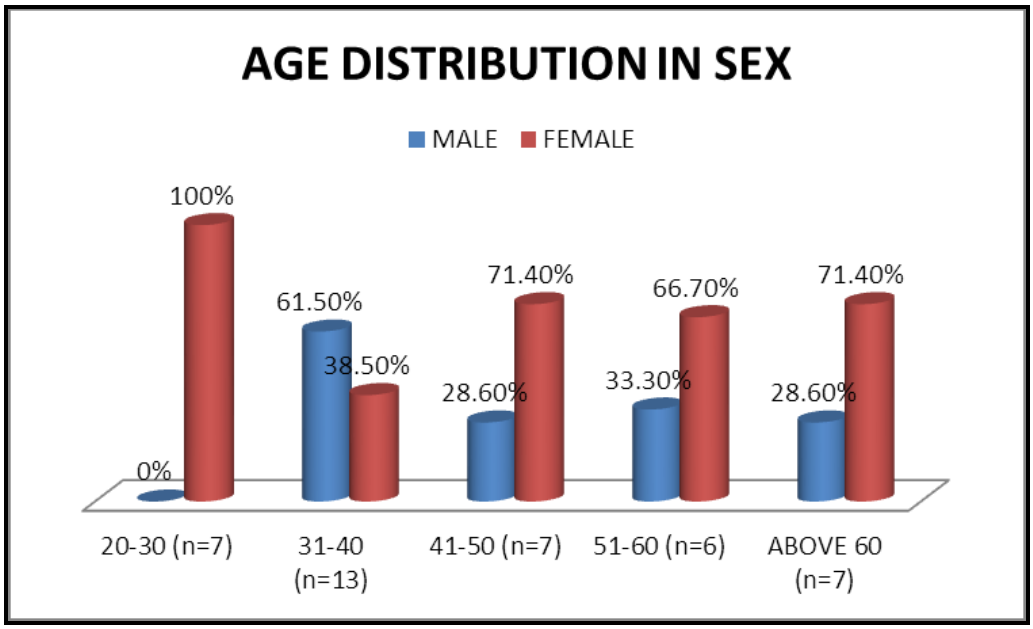


The average age of presentation in this study was 44.05 years. Out of 40 patients studied, 13 patients were in the age group of 30 to 40 years of age. (Table .1, Figure.2)

Table-1

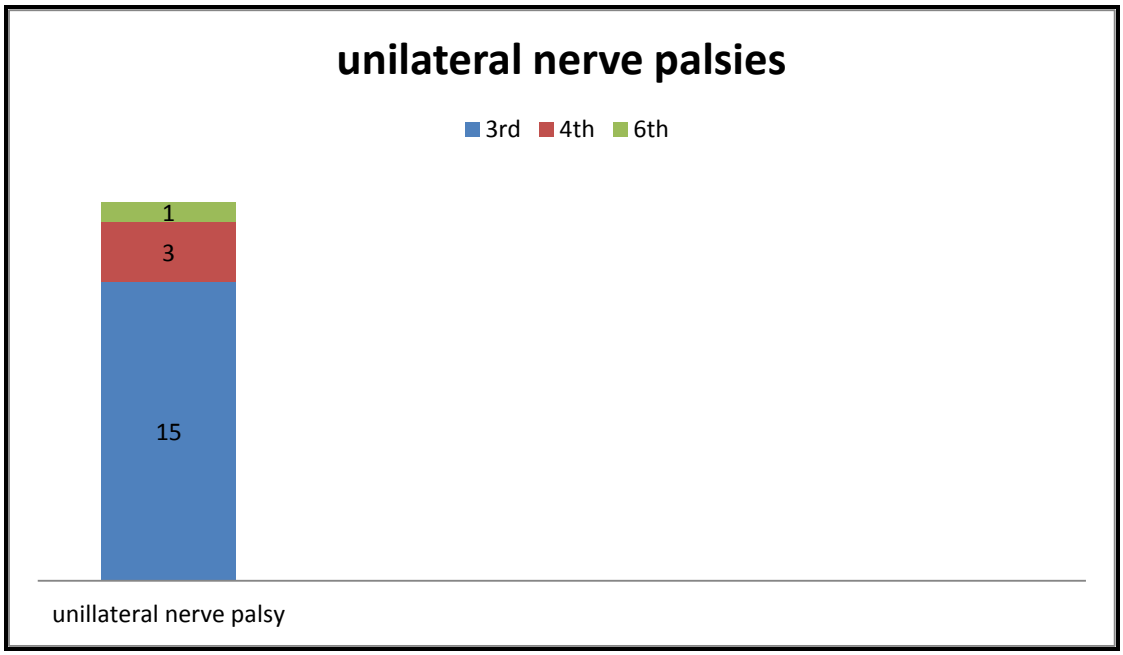
		GENDER		
		FEMALE	**MALE**	**Total**
AGE INTERVAL	20-30	7	0	7
	31-40	8	5	13
	41-50	2	5	7
	51-60	2	4	6
	ABOVE 60	2	5	7
	Total Count	21	19	40

Figure-2



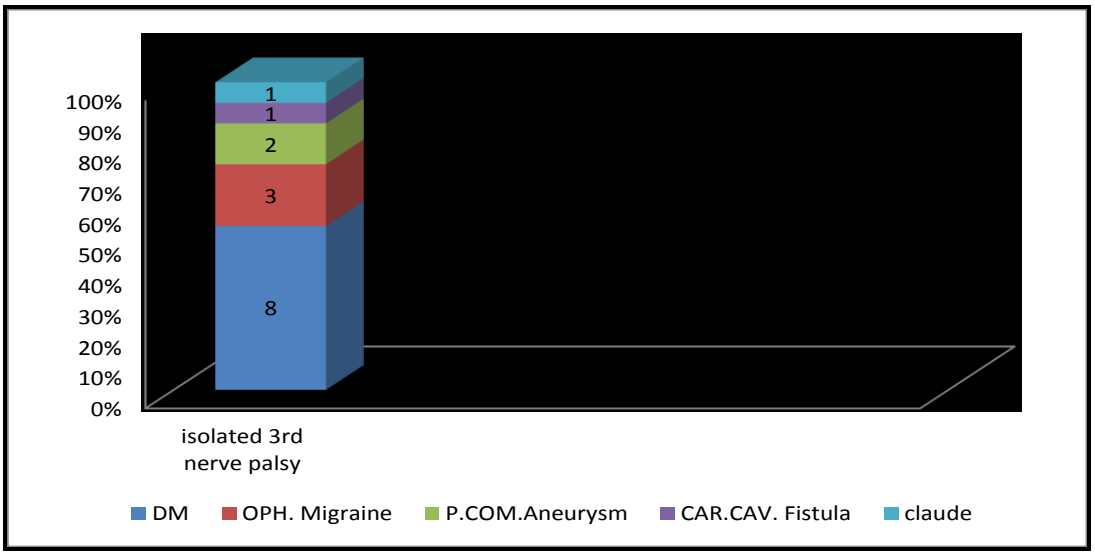
In this study, 15 patients had unilateral 3rd nerve palsy, 3 patients had unilateral 4th nerve palsy and one patient had unilateral 6th nerve palsy. (Figure 3)

Figure-3



Out of the 40 patients 15 patients had isolated unilateral 3rd cranial nerve palsy. Out of the 15 patients only one had incomplete 3rd nerve palsy and rest of the 14 patients had complete 3rd nerve palsy including pupillary fibers. In the 15 patients, 8 had Diabetes, 3 had opthalmoplegic Migraine, 2 had PCOM artery aneurysm, one patient had carotico cavernous fistula and one patient had Claude's syndrome. (Figure. 4)

Figure-4



Only three patients had isolated 4th nerve palsy. Among them various etiologies were Midbrain stroke (1 patient), Multiple sclerosis (1patients), and opthalmoplegic migraine (1patient).

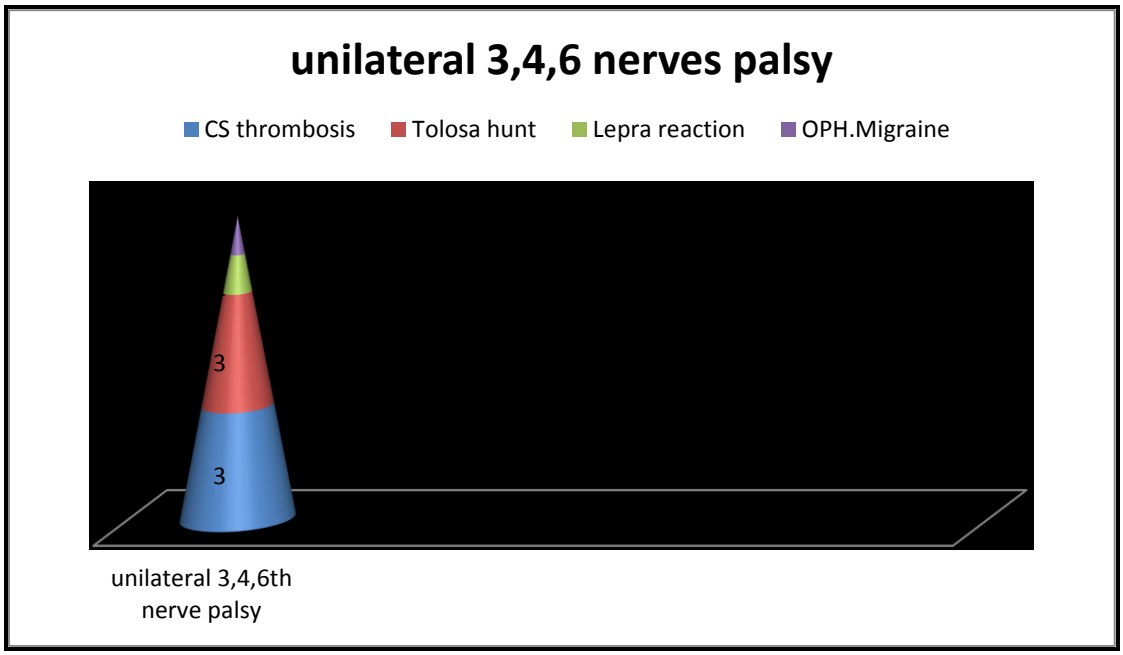
Only one patient had unilateral 6th nerve palsy, who was found to have tuberculous meningitis as etiology.

8 patients had combinations of cranial nerve palsy in the form of unilateral 3, 4, 6 nerves involvement. Among those, 3 patients had cavernous sinus thrombosis and 3 patients had Tolosa Hunt syndrome. Lepra reaction was found in one patient and opthalmoplegic migraine was found in one patient. (Figure 5)

Bilateral 3, 4, 6 cranial nerves were found in 2 patients (Squamous cell carcinoma of the nasopharynx in one patient and aspergilloma in one patient).

In this study, combination of either 3&4, 3&6 or 4&6 was not found.

Figure-5



In this study 8 patients had bilateral 6th nerve palsy. Among them, 6 patients had IIH and 2 patients had tuberculous meningitis. (Figure 6,Table 2)

Figure-6

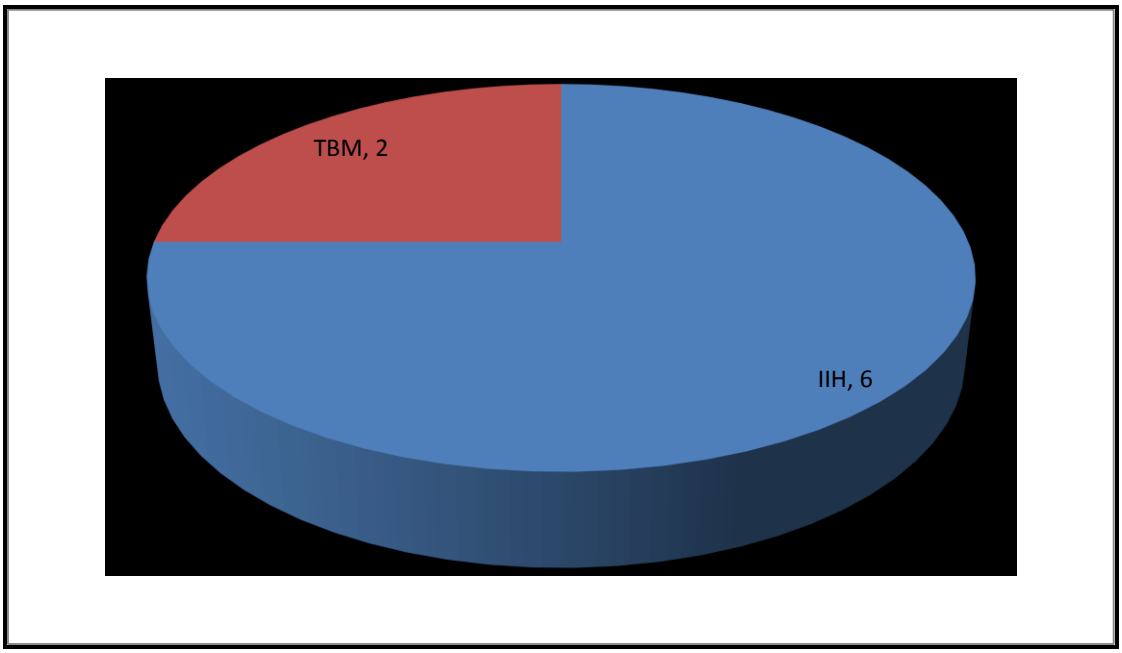
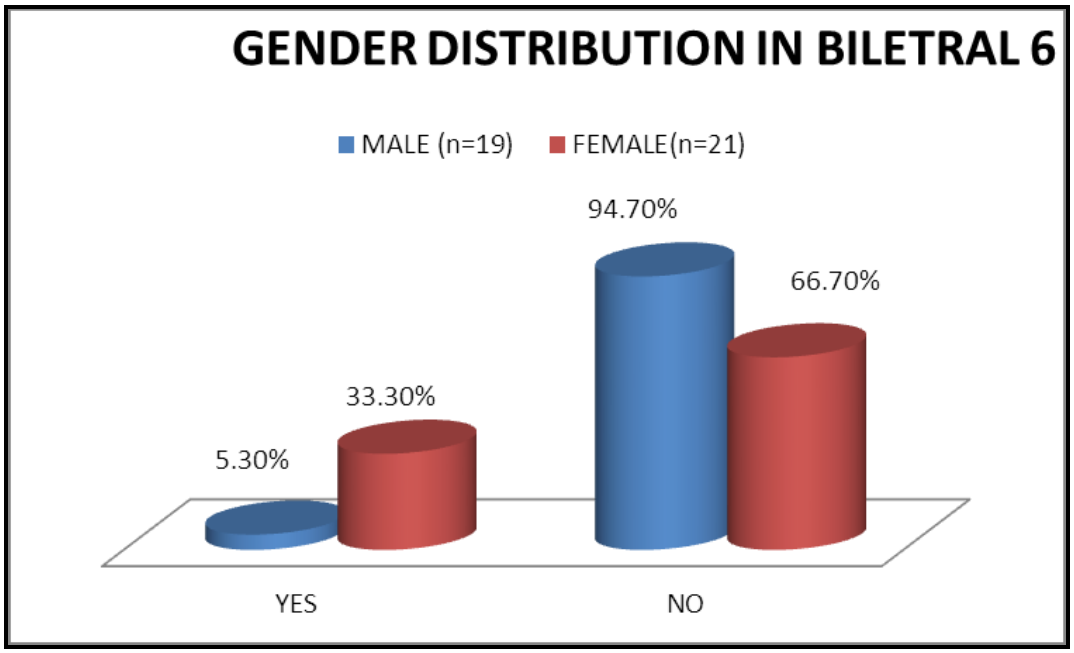


Table-2

DIGNOSIS	NO OF PATIENTS
Idiopathic intracranial hypertension	6
TB meningitis	2

In all these patients clinical localizations was done. In 4 patients the clinical localizations were done at the level of cavernous sinus. Among them one patient had Tolosa Hunt syndrome rather than cavernous sinus involvement (confirmed by MRI)

Figure-7



Various common presentations in this study were isolated 3rd nerve palsy (15 patients), bilateral 6th nerve palsy (8 patients) and unilateral 3,4,6 nerves palsy(8 patients). (Figure. 8).

Figure-8

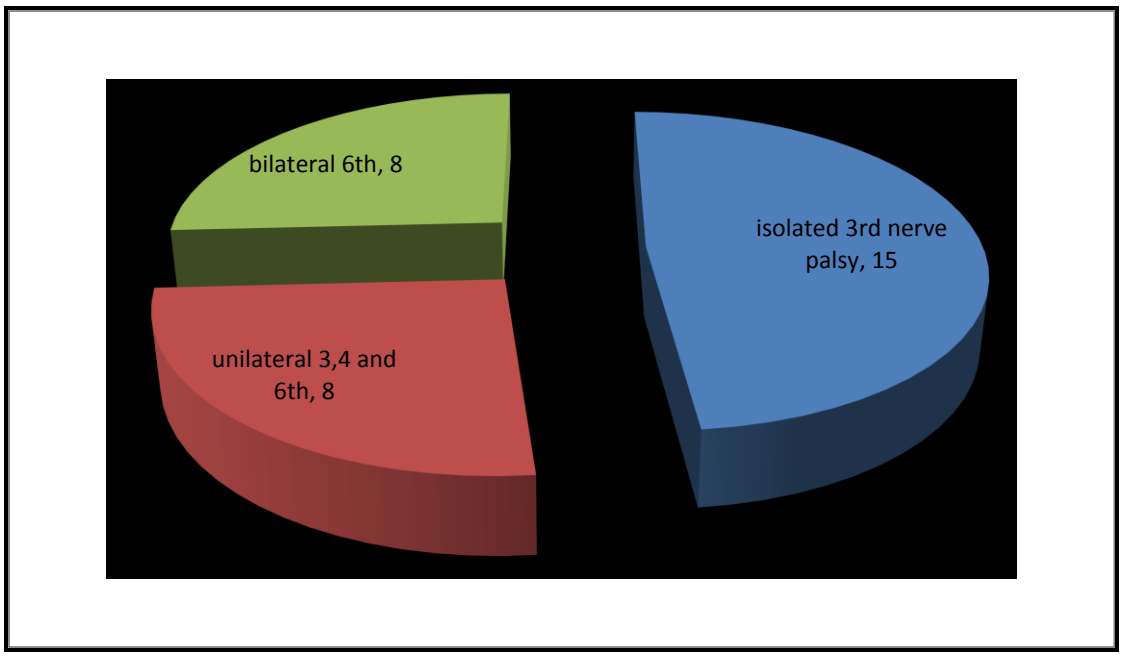
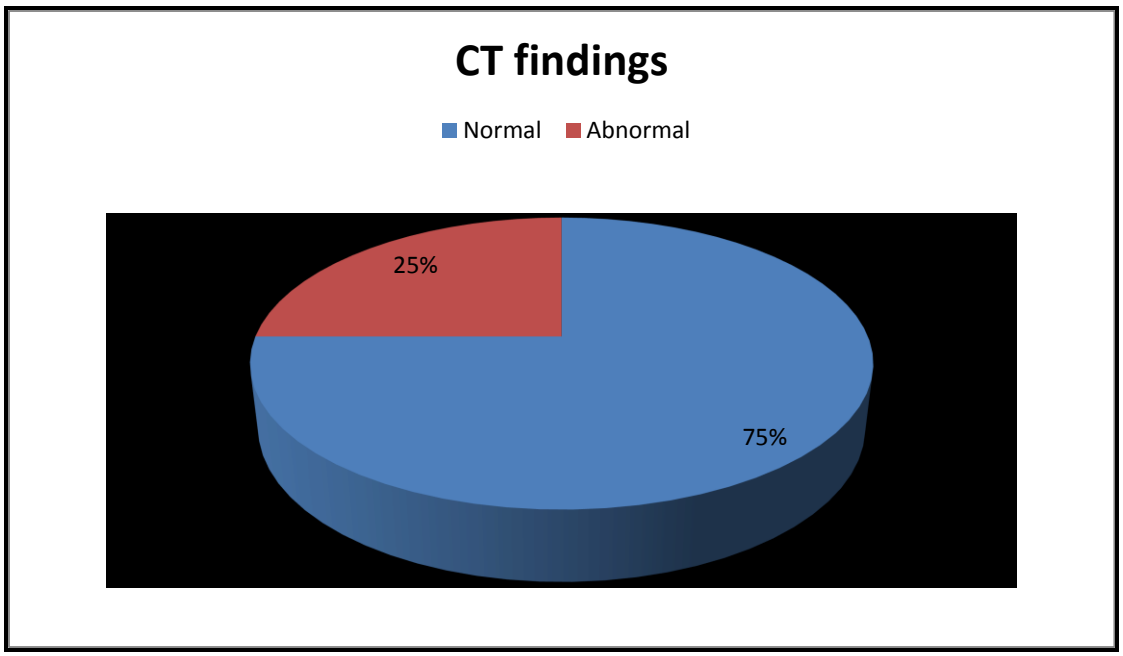


Table-3: Bilateral Multiple Cranial Nerve Palsies

DIGNOSIS	NO.OF PATIENTS
Squamous cell carcnoma	1
Bilateral cavernous sinus thrombosis due aspergillosis	1

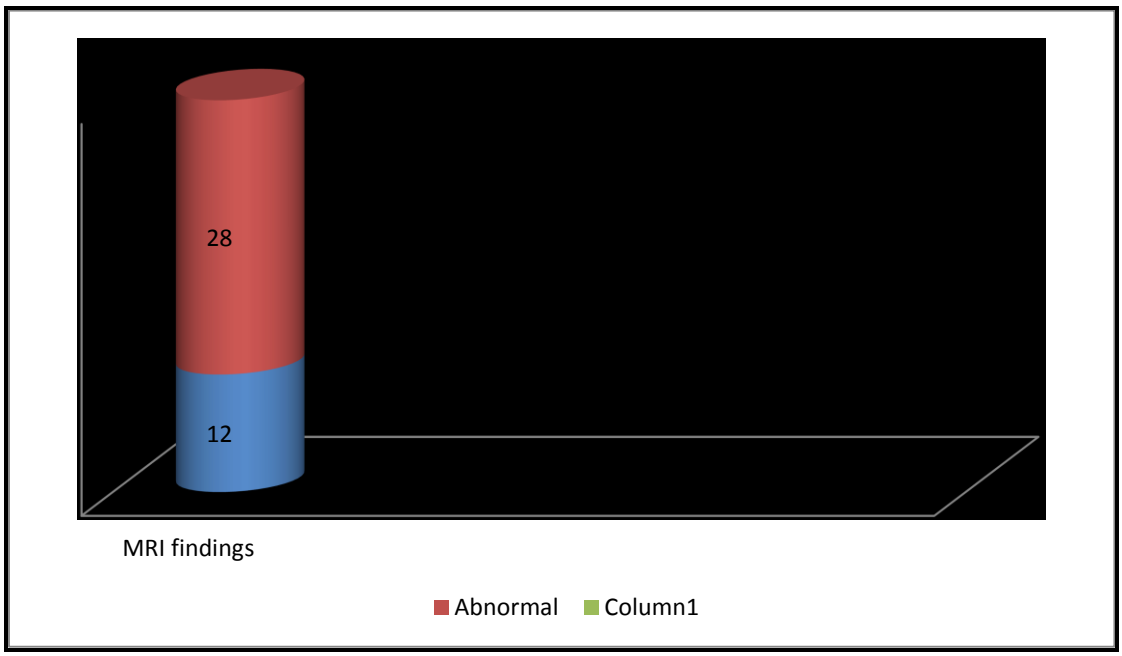
All the 40 patients had undergone CT Brain. In those patients, 30 patients were having normal findings and rests of them were having abnormal findings. (Figure 9)

Figure-9



All the 40 patients had undergone MRI Brain (contrast if necessary). 28 patients had abnormal MRI findings, whereas 12 patients did not have any findings. All the patients who had abnormal CT Brain also had abnormal MRI Brain. (Figure 10)

Figure-10



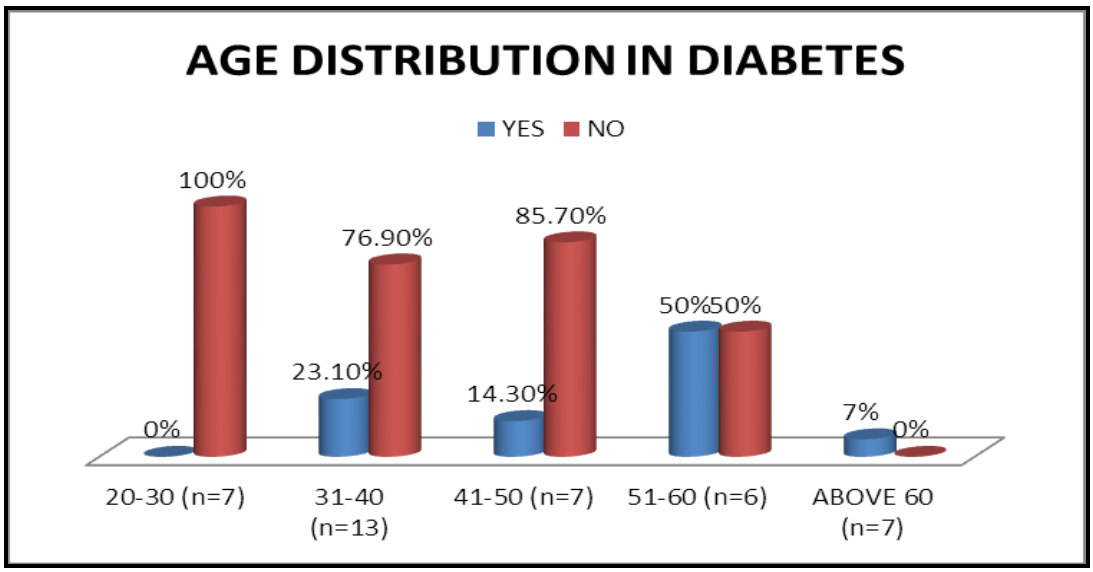
In only one patient x-ray skull was abnormal who had bilateral 3,4,and 6th cranial nerve involvement. (Table.4)

Table-4

	X-Ray Skull		
	Abnormal	**Normal**	**Total**
Bil Multiple Cranial Nerve Palsy	1	2	3
	1	39	40
	2.5%	97.5%	100.0%

In this study 13 patients were already known diabetics. The duration of diabetes was as follows: <10 years- 1, 10 to 15 years- 9 and > 15 years- 3. (**Figure.11**)

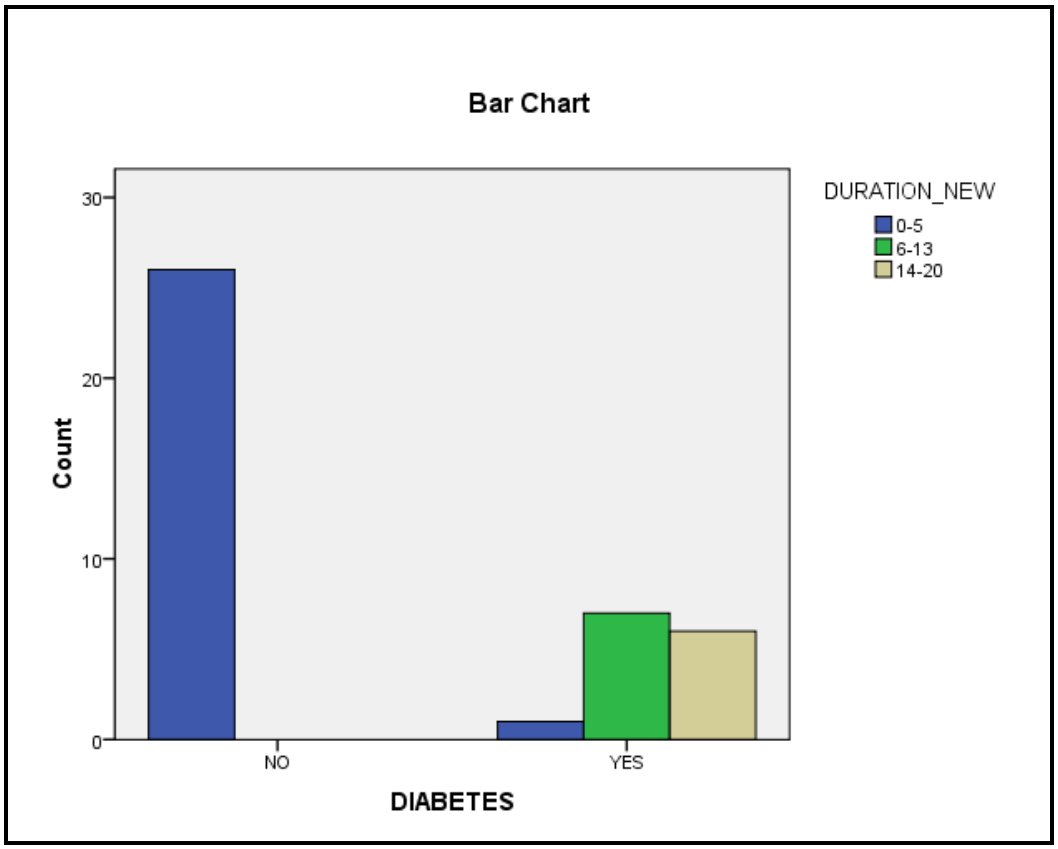
Figure-11



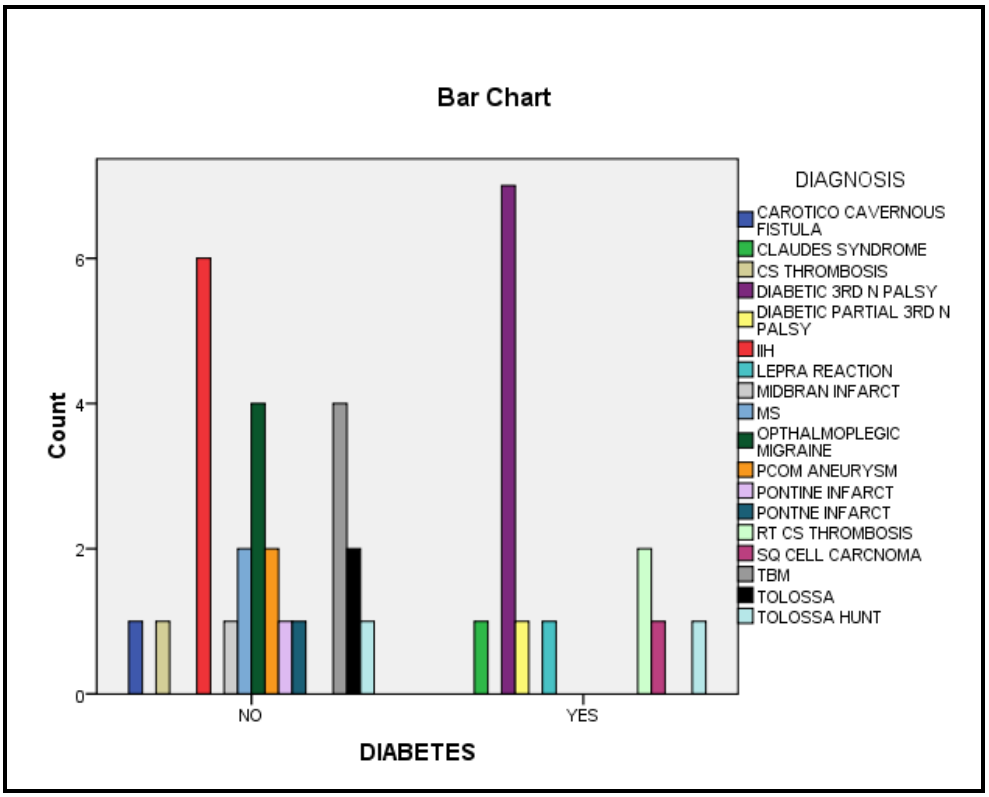
In 8 patients with diabetic third nerve palsy, 4 had duration of diabetes in the range of 6-13 years (in that 1 had partial 3rd nerve palsy) and 4 had the duration in the range of 14 -20 years.(Table.5)

Table-5

Duration of DM	Diabetic 3rd nerve palsy	
	Complete	Partial
0-5 years	0	0
6-13 years	3	1
14-20 years	4	0
Total	7	1



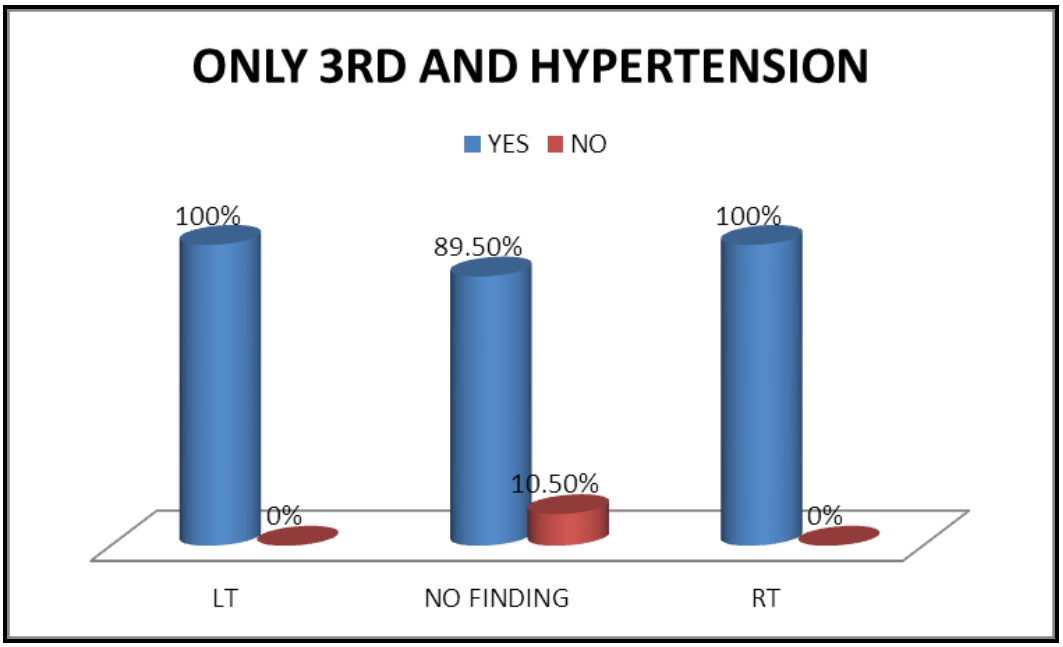
Diagnosis in diabetic patients



6 patients were known hypertensives in this study.

Two patients presenting with isolated third nerve palsy had systemic hypertension - chi square=11.930 with statistically significant p value of 0.003. (Figure-12)

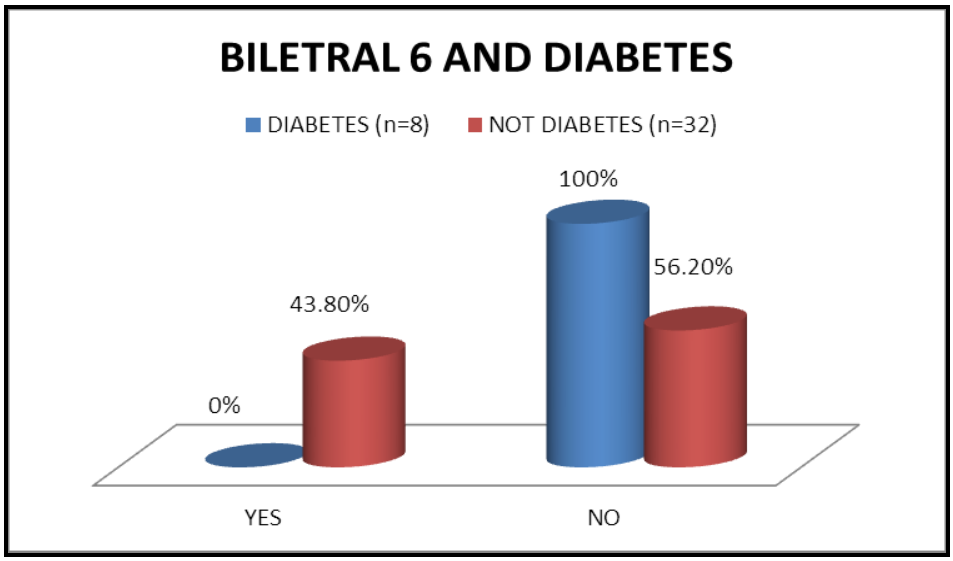
Figure-12



All the 4 patients presented with the combination of 3,4 and 6th cranial nerve palsies showed abnormalities in CT scan brain plain and contrast –chi square=9.231,with stastically significant p value of 0.002

8 patients were with bilateral 6th nerve palsies were diabetic patients, chi square=5.385, with statistically significant p value of 0.020 (Figure-13)

Figure-13



Xray skull abnormality in bilareral multiple cranial nerve palsies

Out of three patients with bilateral multiple cranial nerve palsies, 1 patient showed abnormality in X-ray skull.(Figure.14)

Figure-14

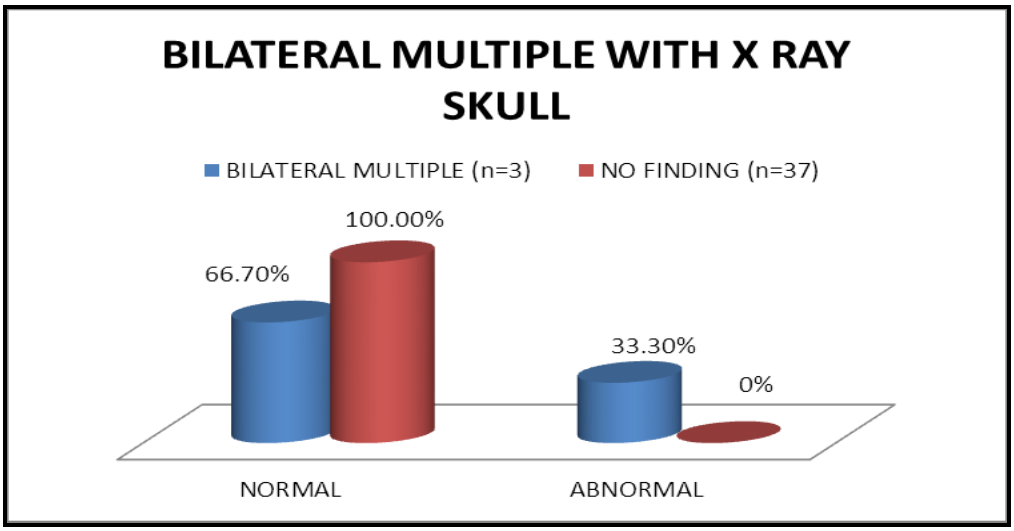
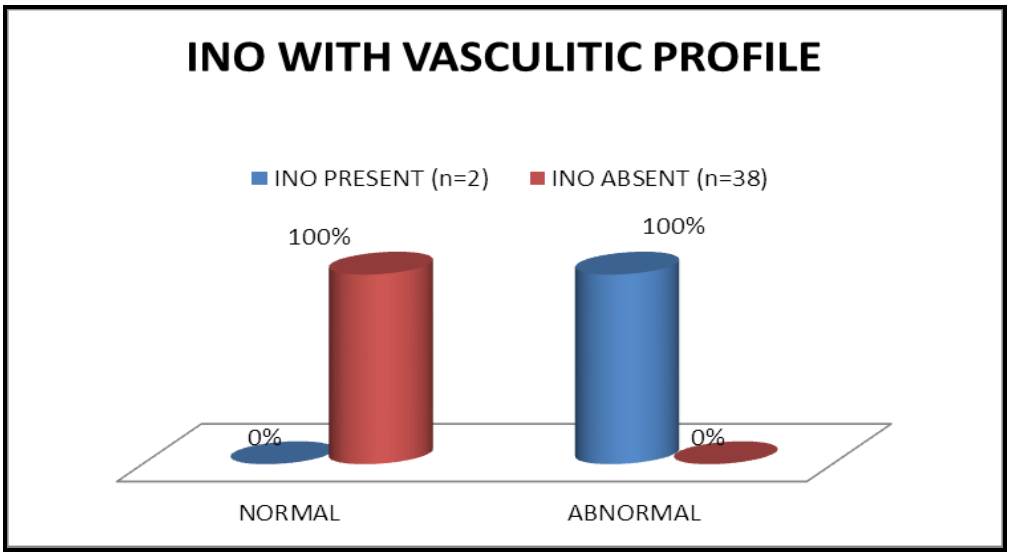
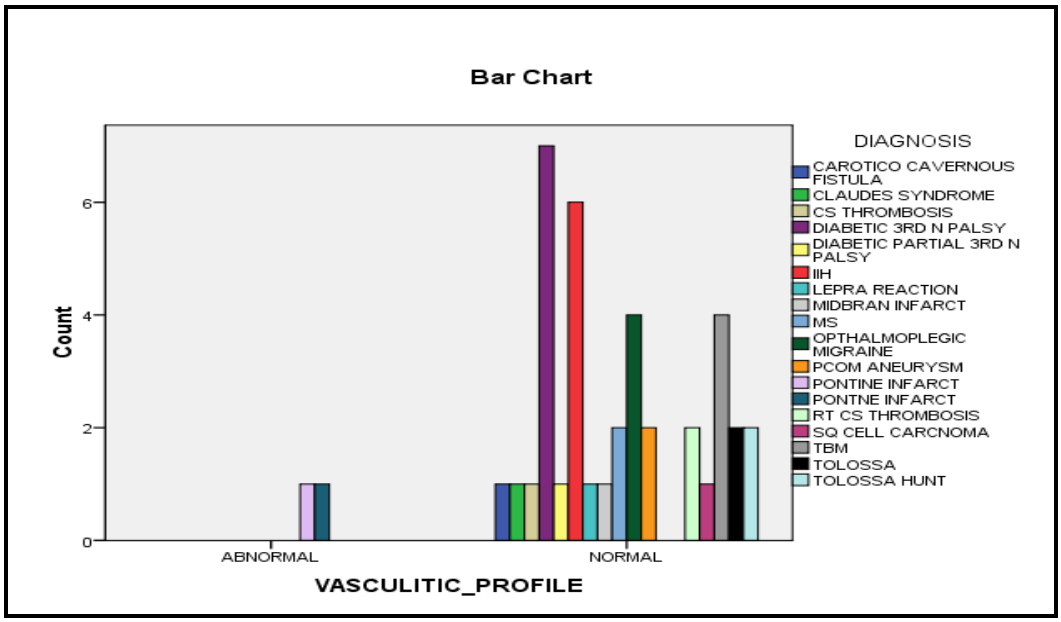


Figure-15



In both the patients with INO the vasculitic profile was abnormal (Figure-15)

Vasculitic profile was abnormal in 2 patients, with pontine infarcts



DISCUSSION

In this study 40 patients were included.21 patients were females (52.5%) and 19 patients were males (47.5%) (Figure-1)

Hence in this study of 3,4,6 cranial nerves, we had slight female preponderance.

Patients were in the age group ranging from 23 to 65 years. The average age is 44.05 years. 7 patients were in the age group of 20 to 30 years, 13 patients were in the age group of 31-40 years, 7 patients were in the age group of 41-50 years, 6 patients were in the age group of 51-60 years and 7 patients were in the age group of above 60 years. So in this study, majority of patients are in the age group of 31-40 years. Out of 13 patients in this age group 8 patients were females. (Table 1).

In this study 15 patients were found to have isolated third nerve palsy (37.5 %).Compared with the study by Rucker et al[27], which showed 30% of patients with third nerve palsy, this study has a higher incidence (37.5%). The commonest etiology of isolated third nerve palsies is diabetes mellitus.8 patients had diabetic third nerve palsy, followed by opthalmoplegic migraine in 3 patients. 2 patients were having PCOM aneurysm, one patient had carotico

cavernous fistula and one had Claude's syndrome[31]. (Figure 3) Among these, one patient of diabetic third nerve palsy had presented with partial 3rd nerve involvement (pupillary sparing).

None of these patients had a nuclear lesion.

In patients with diabetic third nerve palsy 9 patients were males and six patients were females.

The study conducted by al Saleh et al in Arabic populations[30], showed a male preponderance in patients with diabetic third nerve palsies and our study also has a similar picture.

In 8 patients with diabetic third nerve palsy, the duration of diabetes in 8 patients was within the range of 6-13 years and in the remaining 4 patients the duration of diabetes was within the range of 14-20 years.(Table.5)

In this study, 3 patients had isolated fourth nerve palsy (7.5%) Compared with the study by Rucker et al which showed 11% of patients with isolated 4th nerve palsy, this study has a lower incidence (7.5%). None of this patient had diabetes as risk factor.

One patient had a midbrain infarct[40], one was a known case of relapsing remitting form of multiple sclerosis (In the previous

episodes, she had only optic nerve involvement) and one was a case of opthalmoplegic migraine.

In a study conducted by Amy Gelfand et al[32,28] in patients with opthalmoplegic migraine, the involvement of isolated third cranial nerve was common (83%) and involvement of isolated fourth cranial nerve was rare (2%). In our study, out of 4 patients with opthalmoplegic migraine, 3 had isolated 3rd nerve palsy (75%) and 1 had isolated 4th nerve palsy (25%)

In this study, 9 patients had isolated sixth nerve palsy (22.5%). Compared with the study by Rucker et al which showed 45% of patients with isolated 6th nerve palsy, this study has a lower incidence. Out of these one patient had unilateral sixth nerve palsy with TB meningitis as the etiology.

In the remaining 8 patients with bilateral 6th nerve palsy, 7 patients were females and 1 patient was male, with a statistically significant p value of 0.027.

In the 8 patients with bilateral sixth nerve palsy, 6 patients had idiopathic intracranial hypertension and 2 patients had TB meningitis. (Figure 6). The diagnosis of IIH was made with the clinical signs and after measurement of the CSF opening pressure.

In this study, 27.5% patients had multiple cranial nerve palsy. Compared with the study by Rucker et al, which showed 14% of patients in this group, this study has a higher incidence. In this group 8 patients, had unilateral 3,4&6 th cranial nerve involvement.

3 patients had cavernous sinus thrombosis, 3 patients had Tolosa Hunt syndrome, 1 patient had a lepra reaction and 1 patient had opthalmoplegic migraine.

Diabetes was the commonest etiological factor in these patients (62.5%)[27] with unilateral 3,4,&6th cranial nerve lesions.

2 patients presented with bilateral 3,4& 6th cranial nerve palsies .In those patients, one had squamous cell carcinoma of the naso pharynx with extension into the bilateral cavernous sinus [33]and one patient with aspergillosis causing cavernous sinus thrombosis, ,who was diabetic.(Table .3)

2 patients presented with internuclear opthalmoplegia.In both these patients vasculitic profiles were abnormal.

Summarizing, the common presentations in this study were

1) Isolated third nervepalsy in 15 patients

2) Bilateral sixth nerve palsy in 8 patients

3) Unilateral 3,4and 6th nerve palsy in 8 patients.

In this study we did not have any patients with combination of 3&4, 4&6 or 3&6

In this study, 13 patients were diabetics. The duration of diabetes was as follows: < 10 years -1 patient, 10-15 years-9 patients and > 15 years -3 patients. (Figure.11)

6 patients had systemic hypertension.

Vasculitic profile was abnormal in 2 patients.

X-ray skull was abnormal in 1 patient with squamous cell carcinoma.

All the 40 patients were evaluated with CT scan brain plain and contrast. CT brain was abnormal in only 10 patients. 4 patients with cavernous sinus thrombosis, 2 patients with Tolosa hunt syndrome, 3 patients with TB meningitis and 1 patient with lepra reaction had abnormal CT findings.

All the 40 patients were evaluated with MRI brain plain and contrast (if necessary). 28 patients had abnormal MRI findings, whereas 12 patients did not have any findings.

All the patients with abnormal CT brain also had abnormal MRI brain.

CT brain was normal in 6 patients with IIH, 4 cases with opthalmoplegic migraine, 2 cases with Tolosa Hunt syndrome, 2 patients with pontine infarct, 2 patients with multiple sclerosis, 2 patients with INO[37]and in 1 patient with Claude's syndrome, but their MRI showed abnormalities

In this study, MRI was found to be superior to CT scan brain in all patients with nuclear, brain stem, fascicular lesions and some patients with lesions in cavernous sinus and nerve lesions[36].

In all the 8 patients with diabetic third nerve palsy, in 2 patients with PCOM aneurysm and in 2 patients with IIH, MRI was normal.

There was a correlation between the clinical findings, clinical localization and imaging in 28 patients with MRI findings and in 2 patients with PCOM aneurysm, with CT angiogram findings.

In a study by Pamela y.blake et al [34]with 50 patients of isolated third nerve palsy , 18 patients were with diabetic third nerve palsy and none of them showed MR changes and in among those who showed MRI changes , 2 had brainstem infarct,2 had carotico cavernous aneurysm,1 had opthalmoplegic migraine and 1 had aneurysm.

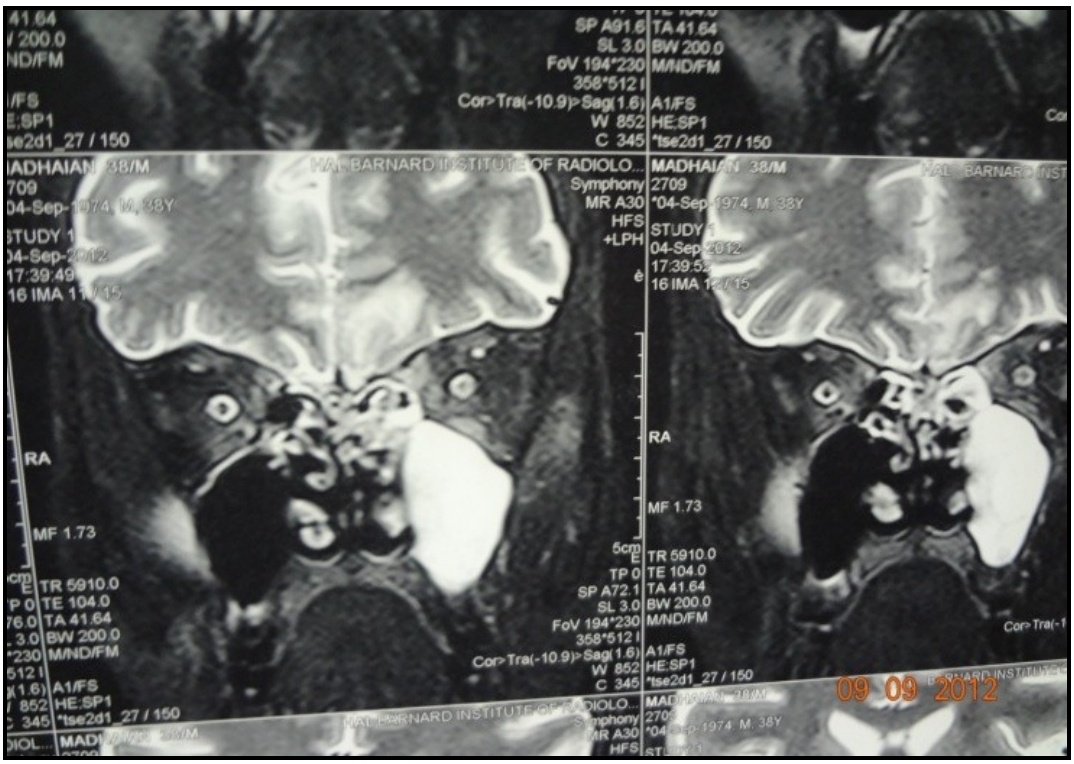
CT angiogram was done for 2 patients, in whom PCOM aneurysm was suspected, based on the clinical signs (head ache with pupillary involvement) [38], and both of them had aneurysm of PCOM.

Histopathological examination was done in 3 patients who had extensive lesion in MRI and not responding to therapy. 1 patient had mucormycosis, 1 patient had aspergillosis and 1 patient had squamous cell carcinoma. Patients with mucormycosis and aspergillosis were diabetics[35].

Though INO is a common presentation in multiple sclerosis[29,23], in the two patients included in our study one had only isolated 3rd and the other had isolated 4th nerve palsy.

Chi SL et al [38] suggested that diabetes mellitus or a combination of diabetes and hypertension, but not hypertension

alone, is a risk factor for micro vascular ischemic ocular motor cranial neuropathies. In this study we had 2 patients with both hypertension and diabetes as risk factor who developed 3rd nerve palsies.



MRI of a patient with lepra reaction showing hyperintensities in left cavernous sinus

CONCLUSION

1) In this study, there was no sex preponderance.

2) Commonest age group of presentation was 30-40 years.

3) Among the 3,4 and 6 cranial nerves,commonly affected was the 3rd cranial nerve followed by 4th cranial nerve and 6thcranial nerve

4) Among the combinations of cranial nerves, Bilateral 6th nerve involvement and unilateral 3,4,6 cranial nerve involvement were the commonest presentations, followed by bilateral 3,4,6 th cranial nerve involvement.

5) The combinations of 3&4, 3&6 and 4&6 cranial nerve involvement were not found in our series.

6) MRI showed abnormal findings in 70% of the patients, whereas CT showed abnormal findings only in 25% of patients.

7) The commonest cause of nuclear and infranuclear 3.4.6 cranial nerve lesion was Diabetes Mellitus in this study.

8) The commonest cause of imaging negative etiology in this study was Diabetes Mellitus.

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ABBREVIATIONS

CSF	:	Cerebro spinal fluid
ICA	:	Internal carotid artery
IIH	:	Idiopathic intracranial hypertension.
INO	:	Internuclear opthalmoplegia
MS	:	Multiple sclerosis.
PCOM	:	Posterior communicating artery
TBM	:	Tuberculous meningitis

PROFORMA

Name :

Serial No :

Age :

IP No :

Sex :

Address :

DOA :

DOD:

Phone No :

Diagnosis :

History :

Clinical Findings :

Investigations ; Basic investigations

CSF Analysis and opening pressure(in selected cases)

OTHERS

1) Diabetic profile

2) Hypertensive profile

3) Thyroid profile

4) Vasculitic profile

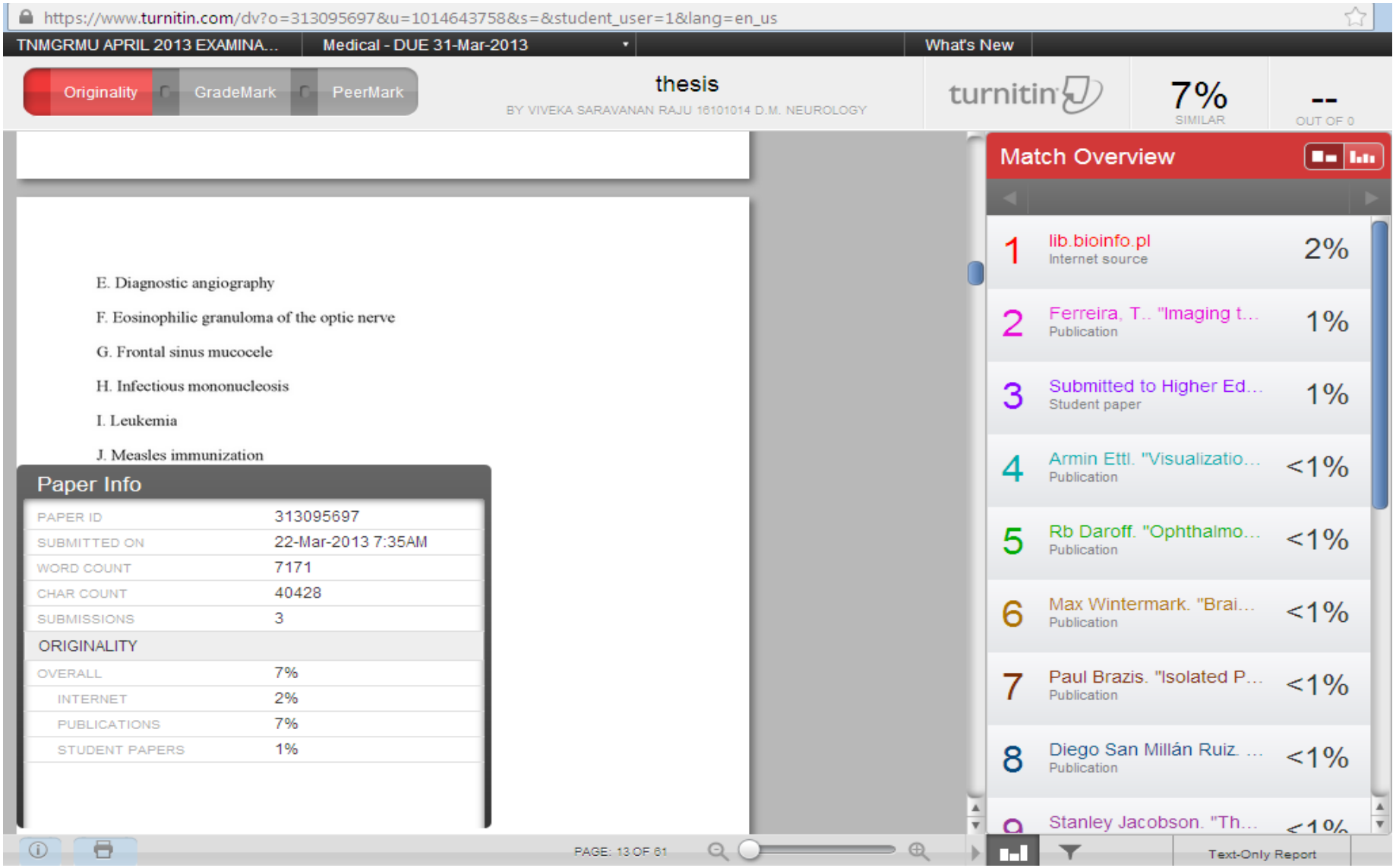
RADIOLOGY

1) X-ray skull with foraminal views

2) CT Brain plain and contrast (if necessary)

3) CT angiogram- in selected cases

4) MRI Brain plain with MRA and MRV and contrast study(if necessary)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H. Infectious mononucleosis
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Text-Only Report

S. No	NAME	AGE	GENDER	ONLY 3RD	ONLY 4TH	3,4,6	UNILAT 6TH	BIL 6TH	BIL MULTIPLE	INO	DIABETES	DURATION OF DM	HYPERTENSION	VASCULITIC PROFILE
1		65	1			1					YES		NO	
1	MURUGESAN	65	MALE			RT					YES	12		
2	KAMALA	25	FEMALE	RT										
3	KESAVAN	49	MALE	LT									YES	
4	VIMALA	45	FEMALE					YES						
5	RAJAN	65	MALE			RT					YES	12		
6	VINNARASI	36	FEMALE							YES				ABNORMAL
7	GOVINDAN	65	MALE	LT							YES	15		
8	MATHAIYAN	38	MALE			LT					YES	6		
9	KANNAN	54	MALE		RT								YES	
10	BABULAXMI	32	FEMALE					YES						
11	LAXMI	60	FEMALE	LT							YES	20		
12	KALAIARASI	27	FEMALE		RT									
13	ROJA	34	FEMALE					YES						
14	VELAMMAL	28	FEMALE	RT										
15	KASIAMMAL	35	FEMALE					YES						
16	MANGALAM	46	FEMALE							YES				ABNORMAL
17	SUDHA	38	FEMALE					YES						
18	GIRIJA	65	FEMALE			RT					YES	15		
19	BALAKUMAR	40	FEMALE	RT										
20	VELU	46	MALE			RT								
21	GANESAN	53	MALE	RT										
22	SUDHA	23	FEMALE					YES						
23	KUMAR	35	FEMALE			LT								
24	RENUKA	23	FEMALE	LT										
25	PERIYASAMY	66	MALE	RT							YES	15	YES	
26	mayilammal	72	female						yes		YES	20	YES	
27	MOSES	40	MALE	LT							YES	12		
28	SEKAR	32	MALE				YES							
29	LINGAM	56	MALE	RT							YES	12		
30	KAMARAJ	66	MALE	LT							YES	13		
31	UMA	28	FEMALE					YES						
32	BANUMATHI	55	FEMALE	RT							YES	11		
33	DEVARAJ	34	MALE						YES					
34	SUDALAI	36	MALE					YES						
35	ARASU	43	MALE			RT								
36	VENKATESAN	48	MALE											
37	AMSA	32	FEMALE			RT					YES			
38	KAVITHA	28	FEMALE		LT									
39	ELUMALAI	52	MALE	LT									YES	
40	MANI	47	MALE	RT							YES	16	YES	

CSF OPENING PRESSURE	XRAY SKULL	CT SCAN BRAIN P&C	CT ANGIO	MRI BRAIN P&C	IMPROVEMENT	HPE	PONTINE IN FARCT	CS THROMBOSI	OPTHALMOPLEGIC MIGRAINE
		ABNORNAL		ABNORMAL	YES			YES	
				ABNORMAL	YES				YES
			ABNORMA		NO				
				ABNORMAL	YES				
		ABNORMAL		ABNORMAL	NO	MUCORM		YES	
				ABNORMAL	YES		YES		
					NO				
		ABNORMAL		ABNORMAL	NO				
				ABNORMAL	YES				
INCREASED				ABNORMAL	YES				
					NO				
					YES				YES
INCREASED				ABNORMAL	YES				
					YES				YES
INCREASED				ABNORMAL	YES				
				ABNORNAL	YES		YES		
INCREASED				ABNORMAL	YES				
					NO				
				ABNORMAL	YES				
		ABNORMAL		ABNORMAL	NO				
			ABNORMA		NO				
		ABNORNAL		ABNORMAL	YES				
		ABNORMAL		ABNORMAL	YES				
				ABNORMAL	NO				YES
					YES				
	ABNORM	ABNORMAL		ABNORMAL	NO	sq cell			
					YES				
				ABNORMAL	YES				
					NO				
					NO				
INCREASED				ABNORNMA	YES				
					YES				
				ABNORMAL	NO	ASPERGIL		CS THROMBOSIS	
		ABNORMAL		ABNORMAL	YES				
				ABNORMAL	YES				
		ABNORMAL		ABNORMAL	NO				
		ABNORMAL		ABNORMAL	YES				
				ABNORMAL	NO				
				ABNORMAL	NO				
				ABNORMAL	YES				

PCOM ANEURYSM	IIH	DIABETIC THIRD NERVE PALSY	LEPRA REACTION	MIDBRAIN INFARCT	MS	TOLOSSA HUNT	TBM	SQ CELL CA	CAROTICO CAVERNOUS FISTULA	CLAUDES
YES										
	YES									
		YES								
			YES							
				YES						
	YES									
		YES								
					YES					
	YES									
	YES									
	YES									
		YES								
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YES										
							YES			
						YES				
		YES								
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							YES			
		YES								
		YES								
	YES									
							YES			
							YES			
					YES					
									YES	
										YES

INSTITUTIONAL ETHICS COMMITTEE
MADRAS MEDICAL COLLEGE, CHENNAI -3

Telephone No: 04425305301
Fax : 044 25363970

CERTIFICATE OF APPROVAL

To
Dr. R. Viveka Saravanan
PG in DM Neurology
Madras Medical College, Chennai-3

Dear Dr. R. Viveka Saravanan

The Institutional Ethics Committee of Madras Medical College reviewed and discussed your application for approval of the proposal entitled " Nuclear and infranuclear lesions of 3,4,6 cranial nerves & their clinic radiological correlation" No. 10052012.

The following members of Ethics Committee were present in the meeting held on 30.05.2012 conducted at Madras Medical College, Chennai -3.

1.	Prof. S.K. Rajan, MD	-- Chairperson
2.	Prof. Pregna B. Dolia MD Vice Principal , Madras Medical College, Chennai -3 Director , Instt.of Bio Chemistry, MMC, Ch-3	-- Member Secretary
3.	Prof R. Nandhini, MD Director, Institute of Pharmacology, MMC, Ch-3	-- Member
4.	Prof. P. Karkuzhali MD Director i/c Prof & Head , Dept. of Pathology, MMC, Ch-3	-- Member
5.	Prof.A. Radhakrishnan MD Prof. of Internal Medicine, MMC, Ch-3	-- Member
6.	Prof. P. Raghumani MS Prof. of Surgery, Dept. of Surgery, MMC, Chennai -3	-- Member
7.	Thiru. S. Govindasamy . BA.BL	-- Lawyer
8.	Tmt. Arnold Soulina MA	-- Social Scientist

We approve the proposal to be conducted in its presented form.

Sd /. Chairman & Other Members

The Institutional Ethics Committee expects to be informed about the progress of the study, any SAE occurring in the course of the study, any changes in the protocol and patient information / informed consent and asks to be provided a copy of the final report

Member Secretary, Ethics Committee

PATIENT CONSENT FORM

Study detail:

"NUCLEAR AND INFRANUCLEAR LESIONS OF 3,4,6 CRANIAL NERVES&THEIR MRI CORRELATIONS "

Study centre : Rajiv Gandhi Government general hospital, Chennai.

Patients Name :

Patients Age :

Identification Number :

Patient may check (✓) these boxes

I confirm that I have understood the purpose of procedure for the above study. I have the opportunity to ask question and all my questions and doubts have been answered to my complete satisfaction. ☐

I understand that my participation in the study is voluntary and that I am free to withdraw at any time without giving reason, without my legal rights being affected. ☐

I understand that sponsor of the clinical study, others working on the sponsor's behalf, the ethical committee and the regulatory authorities will not need my permission to look at my health records, both in respect of current study and any further research that may be conducted in relation to it, even if I withdraw from the study I agree to this access. However, I understand that my identity will not be revealed in any information released to third parties or published, unless as required under the law. I agree not to restrict the use of any data or results that arise from this study. ☐

I agree to take part in the above study and to comply with the instructions given during the study and faithfully cooperate with the study team and to immediately inform the study staff if I suffer from any deterioration in my health or well being or any unexpected or unusual symptoms. ☐

I hereby consent to participate in this study. ☐

I hereby give permission to undergo complete clinical examination and diagnostic tests including hematological, biochemical, radiological tests. ☐

Signature/thumb impression:

Patients Name and Address: Place Date

Signature of investigator :

Study investigator's Name : Place Date

INFORMATION SHEET

- ✓ We are conducting a study NUCLEAR AND INFRANUCLEAR LESIONS OF 3,4,6 CRANIAL NERVES AND THEIR CLINICORADIOLOGICAL CORRELATION.

- ✓ The purpose of this study is to analyse the ischemic penumbra in ischemic stroke patients.

- ✓ The privacy of the patients in the research will be maintained throughout the study. In the event of any publication or presentation resulting from the research, no personally identifiable information will be shared.

- ✓ Taking part in this study is voluntary. You are free to decide whether to participate in this study or to withdraw at any time; your decision will not result in any loss of benefits to which you are otherwise entitled.

- ✓ The results may be intimated to you at the end of the study period or during the study if anything is found abnormal which may aid in the management or treatment.

Signature of Investigator Signature of Participant

Date:

ஆராய்ச்சி ஒப்புதல் படிவம்

ஆராய்ச்சி தலைப்பு

3, 4, 6 மூளை நரம்புகளின் பாதிப்புகள் குறித்த ஆய்வு

ஆராய்ச்சி நிலையம் : நரம்பியல் துறை,
சென்னை மருத்துவக் கல்லூரி மற்றும்
ராஜீவ் காந்தி அரசு பொது மருத்துவமனை, சென்னை.

பங்கு பெறுவரின் பெயர் :

பாலினம் :

பங்குபெறபவரின் எண் :

பங்கு பெறுபவர் இதனை (✓) குறிக்கவும்

மேலே குறிப்பிட்டுள்ள மருத்துவ ஆய்வின் விவரங்கள் எனக்கு விளக்கப்பட்டது. என்னுடைய சந்தேகங்களை கேட்கவும், அதற்கான தகுந்த விளக்கங்களை பெறவும் வாய்ப்பளிக்கப்பட்டது. ☐

நான் இவ்வாய்வில் தன்னிச்சையாகதான் பங்கேற்கிறேன். எந்த காரணத்தினாலோ எந்த கட்டத்திலும் எந்த சட்ட சிக்கலுக்கும் உட்படாமல் நான் இவ்வாய்வில் இருந்து விலகி கொள்ளலாம் என்றும் அறிந்து கொண்டேன். ☐

இந்த ஆய்வு சம்பந்தமாகவோ, இதை சார்ந்த மேலும் ஆய்வு மேற்கொள்ளும் போதும் இந்த ஆய்வில் பங்குபெறும் மருத்துவர் என்னுடைய மருத்துவ அறிக்கைகளை பார்ப்பதற்கு என் அனுமதி தேவையில்லை என அறிந்து கொள்கிறேன். நான் ஆய்வில் இருந்து விலகிக் கொண்டாலும் இது பொருந்தும் என அறிகிறேன். ☐

இந்த ஆய்வின் மூலம் கிடைக்கும் தகவல்களையும், பரிசோதனை முடிவுகளையும் மற்றும் சிகிச்சை தொடர்பான தகவல்களையும் மருத்துவர் மேற்கொள்ளும் ஆய்வில் பயன்படுத்திக்கொள்ளவும் அதை பிரசுரிக்கவும் என் முழு மனதுடன் சம்மதிக்கின்றேன். ☐

இந்த ஆய்வில் பங்கு கொள்ள ஒப்புக்கொள்கிறேன். எனக்கு கொடுக்கப்பட்ட அறிவுரைகளின்படி நடந்து கொள்வதுடன் இந்த ஆய்வை மேற்கொள்ளும் மருத்துவ அணிக்கு உண்மையுடன் இருப்பேன் என்று உறுதியளிகிறேன். எனது உடல் நலம்பாதிக்கப்பட்டாலோ அல்லது எதிர்பாராத வழக்கதிற்கு மாறான நோய்க்குறி தென்பட்டாலோ உடனே அதை மருத்து அணியிடம் தெரிவிப்பேன் என உறுதி அளிக்கிறேன். ☐

இந்த ஆய்வில் எனக்கு இரத்தம், சிறுநீர், எக்ஸ்ரே, ஸ்கேன் மற்றும் தசை பரிசோதனை செய்துகொள்ள நான் முழு மனதுடன் சம்மதிக்கிறேன்.

பங்கேற்பவரின் கையொப்பம் ..... இடம்..... தேதி.....

கட்டைவிரல் ரேகை

பங்கேற்பவரின் பெயர் மற்றும் விலாசம் .....

ஆய்வாளரின் கையொப்பம் ..... இடம்..... தேதி.....

ஆய்வாளரின் பெயர் .....

தகவல் அறிக்கை

சென்னை மருத்துவக் கல்லூரி மற்றும் மருத்துவமனையில் "**3, 4, 6 மூளை நரம்புகளின் பாதிப்புகள் குறித்த ஆய்வு**" செய்து வருகிறோம். அதற்காக நோயாளிகளைத் தேர்வு செய்கிறோம்.

இந்த ஆராய்ச்சியில் பங்கேற்கும் நோயாளிகளின் விபரங்கள் ஆய்வு முடியும் வரை இரகசியமாக வைக்கப்படும். ஆராய்ச்சியின் முடிவு பற்றிய பதிப்புகள் அல்லது வெளியீடுகளில் யாருடைய தனிப்பட்ட விவரங்களும் பகிர்ந்து கொள்ளப்படமாட்டாது.

இந்த ஆராய்ச்சியில் பங்கேற்கும் உங்கள் முடிவு தன்னிச்சையானது, இந்த ஆராய்ச்சியில் பங்கேற்கும் எந்த நேரத்திலும் விலக்கிக் கொள்வதற்கும் உங்களுக்கு வாய்ப்பு உள்ளது. உங்களின் இந்த தீர்மானத்தினால் உங்களுக்கு இம்மருத்துவமனையில் வழங்கப்படும் பயன்களில் எவ்வித மாற்றமும் இருக்காது.

இந்த சிறப்பு ஆய்வின் முடிவுகள், இந்த ஆய்வின் முடிவில் அல்லது ஆய்வின்போது ஏற்படும் எதிர்மறையான விளைவுகளை அந்நோயாளியின் நலன் கருதியோ அல்லது சிகிச்சையளிக்கும் பொருட்டோ நோயாளிக்கு தெரிவிக்கப்படும்.

ஆய்வாளரின் கையொப்பம் **நோயாளியின் கையொப்பம்**

தேதி

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INTRODUCTION Palsies of any of the three cranial nerves supplying the extra ocular muscles have their presentations, disturbing ocular motility. Abnormalities of ocular motility help in the localization of lesions of the cerebral hemispheres, brain stem, cranial nerves (CNs), and even the striated muscle. Only one nerve may be involved or there may be a combination of the three nerves. The palsies are usually acquired. Sometimes palsies can be congenital due to the developmental defect of the nucleus or motor nerve fibers. Oculo motor fibers can be interrupted extraaxially or extraaxially. Lesions can be in the foramens or extra cranial e.g. Intraorbital. All these Oculomotor nerves can be...