

Clinical Profile of Third, Fourth, and Sixth Cranial Nerve Palsies Presenting to a Tertiary Care Ophthalmic Center

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Abstract

Introduction: Ocular motor nerve palsies differ in distribution and etiology in different studies depending on clinical settings and geographic distribution.

Materials and Methods: A cross-sectional study of patients presenting or referred as ocular nerve palsies to our center was done. History including age, sex, history of trauma, and vascular risk factors was noted. Detailed clinical evaluation including ophthalmological and neurological examination to diagnose the type of palsy was done. Neurology consultation and appropriate imaging studies were conducted in all cases to reach an etiological diagnosis.

Results: Of a total of 30 patients, 18 (60%) were male, and 12 (40%) were female. Age ranged from 8 to 68 years with a mean of 41.17 ± 14.38 years. Majority of patients were in the 30-60 years age group (70%). 93.3% were unilateral while 6.7% was bilateral. The most common presenting complaint was diplopia in 70% patients, followed by drooping of lids in 26.67%. Other complaints were defective vision, deviation of eyes (13.4% each), and pain and proptosis (3.33%). The most common ocular motor nerves involved were abducens nerve (46.7%) followed by oculomotor nerve (23.3%), combined nerve involvement (20%), and finally by trochlear nerve (10%). The most common cause was trauma (36.7%), followed by vascular causes (26.7%). Other causes included inflammation (10%), demyelination, meningitis and tumors (6.7% each), aneurysm and congenital causes (3.3%). Most common cause for 6th nerve palsy was vascular cause while it was a trauma for 3rd nerve palsy.

Conclusion: Based on good history taking and clinical examination a provisional diagnosis can be arrived at to decide on individualized investigations. This will help to make an accurate etiological diagnosis and management.

Key words: Etiology, Fourth, Sixth cranial nerve palsy, Third, Trauma, Vascular causes

INTRODUCTION

Extraocular muscles are innervated by the 3rd, 4th, and 6th cranial nerves which control ocular movements. These often present as diplopia, drooping of lids, deviation of eyes, and defective vision. As these often present initially to the ophthalmologist, a knowledge of the etiology and presentation of various ocular palsies is important to decide

on further investigations to reach a diagnosis and manage the condition. Multiple causes such as trauma, vascular disease, intracranial tumors, or aneurysm can result in palsy of these nerves. Various studies have shown differing etiology and affected nerve distribution. These may differ with the clinical settings and geographic distribution.

In this study, we aim to study the patterns of ocular nerve palsy and their etiology presenting to a tertiary ophthalmic care center.

MATERIALS AND METHODS

This was done as a cross-sectional study of patients presenting or referred to our outpatient department or

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neuro-ophthalmology clinic with features suggestive of ocular nerve palsies such as diplopia, drooping of lids, or sudden onset deviation of eyes. Institutional Ethics Committee approval was obtained for this study. Patients underwent a detailed history taking including age of onset, sex, history of head trauma, and previous medical history, especially the presence of vascular risk factors (diabetes, hypertension, ischemic heart disease, dyslipidemia, and vascular disease). Clinical examination included visual acuity, slit lamp examination, pupillary reflexes, fundus examination, ocular motility examination, and intraocular pressure recording. Other tests included cover test, prism bar cover test, diplopia charting, Park Belschowsky three-step test, and forced duction test, and active force generation test when needed. Based on the findings, patients were diagnosed as 3rd, 4th, or 6th nerve palsy. Those with supranuclear causes of motility disorders, myogenic causes and restrictive causes were excluded from the study. Blood pressure was recorded in all cases. Routine investigations of blood, urine, glycosylated hemoglobin, fasting blood sugar, postprandial blood sugar, and lipid profile were done. Neurology consultation and appropriate imaging studies were conducted in all cases. Lumbar puncture and cerebrospinal fluid study were conducted in indicated cases in the neurology department. Cases were managed appropriately with those requiring surgical interventions being referred to the department of neurosurgery.

RESULTS

A total of 30 patients presented to our center during the study period. Of these, 18 (60%) were male, and 12 (40%) were female. Age ranged from 8 to 68 years with a mean of 41.17 ± 14.38 years. Majority of patients were in the 30-60 years age group (70%) (Figure 1). 93.3% were unilateral while 6.7% were bilateral. The most common presenting complaint was diplopia in 70% patients, followed by drooping of lids in 26.67%. Other complaints were defective vision, deviation of eyes (13.4% each), and pain and proptosis (3.33%).

The most common ocular motor nerves involved were abducens nerve (46.7%) followed by oculomotor nerve (23.3%), combined nerve involvement (20%), and finally by trochlear nerve (10%) (Figure 2). The most common cause was trauma (36.7%), followed by vascular causes (26.7%). Other causes included inflammation (10%), demyelination, meningitis and tumors (6.7% each), aneurysm, and congenital causes (3.3%).

Demographic features of each nerve palsy are summarized in Table 1. Majority of 6th nerve palsy was vascular (50%) followed by traumatic (28.6%) and demyelination (14.3%),

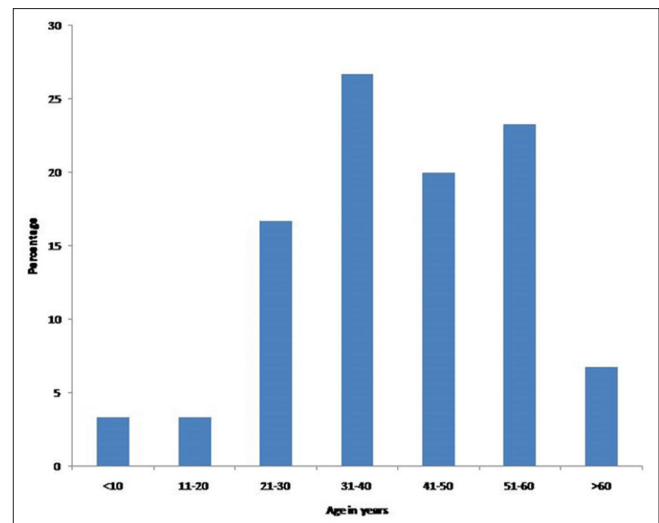


Figure 1: Age distribution of ocular nerve palsies

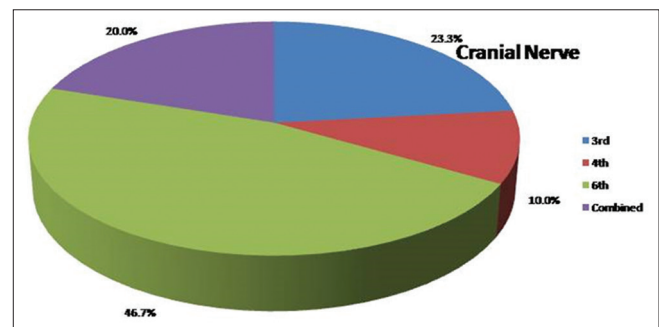


Figure 2: Distribution of various ocular nerve palsies

Table 1: Demographic distribution of the ocular nerve palsies

Cranial nerve	Mean age in years (range)	Sex ratio M: F	U/L:B/L	No (%)
III	44.14 (17-62)	3:4	7:0	7 (23.3)
IV	22.3 (8-37)	3:0	3:0	3 (10.0)
VI	45.57 (23-68)	7:7	13:1	14 (46.7)
Combined	40.1 (24-56)	5:1	6:0	6 (20)
Total	41.17(+/-14.38) (8-68)	18:12	29:1	30 (100)

and meningitis (7.1%) where there was bilateral involvement. All patients with vascular 6th nerve involvement had a history of both diabetes and hypertension except two with only diabetes of which one had dyslipidemia along with diabetes. All patients except one had uncontrolled diabetes with elevated blood sugar and HbA1C of more than 9. Of the 4 cases due to trauma, computed tomography (CT) brain showed evidence of head injury in 50% cases, one contusion, another subdural hematoma, while the rest was normal.

Most common cause of 3rd nerve palsy was trauma (57.14%). Other causes were vascular causes, aneurysm (Figure 3) and invasive pituitary adenoma (14.2% each). Of the trauma cases, CT brain was normal in 2 patients, while the other two had evidence of head injury with a subdural hematoma and subarachnoid hematoma. Both the latter were hypertensive. The patient with vascular ischemic 3rd nerve palsy was having uncontrolled diabetes and hypertension with a history of ischemic heart disease. Pupil was spared in 28.6% while 71.4% had pupil involvement. Pupil was not involved in the vascular case and 1 case of trauma in which only superior division was affected. All other compressive lesions had pupillary involvement.

Of isolated 4th nerve palsy, one was congenital while other two were traumatic, one due to orbital trauma and fractures and another due to head injury with an extradural hematoma. This was found to occur in a younger age group than the other nerves as shown in Table 1.

Combined nerve palsies were most commonly seen in inflammatory causes - Tolosa-Hunt syndrome (50%) with the involvement of 3rd and 4th in 2 cases and 3,4,6 in one. Other causes were nasopharyngeal carcinoma (bilateral 3,4,6 along with optic nerve involvement and proptosis), trauma with (4,6 nerves), and meningitis (3,4,6 nerves). The aetiological distribution of ocular nerve palsies is summarized in Table 2 while their demographic features are summarized in Table 3.

Table 2: Aetiological distribution of ocular nerve palsies

Causes	III	IV	VI	Combined	Total (%)
Trauma	4	2	4	1	11 (36.7)
Vascular	1	0	7	0	8 (26.7)
Tumors& Aneurysms	2	0	0	1	3 (10)
Demyelination	0	0	2	0	2 (6.7)
Meningitis	0	0	1	1	2 (6.7)
Inflammatory	0	0	0	3	3 (10)
Congenital	0	1	0	0	1 (3.3)

Table 3: Demographic features of aetiological causes of ocular nerve palsies

Causes	Mean age years	Range years	Sex ratio M:F	Total
Trauma	36 . 73	22-54	7:4	11
Vascular	55 0.75	47-68.	3:5	8
Tumors& Aneurysms	28.5	17-40	1:1	3
Demyelination	40	30-50	1:1	2
Meningitis	30.5	23-38	2:0	2
Inflammatory	47	35-56	2:1	3
Congenital	8	8	0:1	1

Traumatic nerve palsies more commonly involved 3rd and 6th nerves (36.4% each) (Figure 4) followed by 4th nerve (18.2%) followed by combined nerve palsies (9%). Mean age of these patients was 36.73 years (22-54 years). Males were more commonly affected (63.6% vs. 36.4%).

Vascular ocular nerve palsy commonly involved the 6th nerve (87.5%) followed by 3rd nerve (12.5%). 4th nerve was not affected. Mean age group was 55.75 years (47-68 years). Patients with vascular causes were older than those with traumatic cause. Females showed slightly more preponderance (62.5% vs. 37.5%). All patients with vascular nerve palsy were diabetic, 75% had both diabetes and hypertension, 12.5% (Figure 5) had dyslipidemia with diabetes, and 12.5 had ischemic heart disease with diabetes and hypertension. Hence, 87.5% had 2 or more vascular risk factors. Vascular risk factors were also present in 22.7% of cranial nerve palsies due to other causes but only either diabetes or hypertension, though both were present in a patient with aneurysm. All these patients except one had traumatic 3rd nerve palsy with subarachnoid and dural bleed seen in patients with hypertension.

Demyelination involved only the 6th nerve in our study. Inflammatory cause - Tolosa-Hunt syndrome accounted for the combined nerve palsies with the involvement of 3rd and 4th in 2 cases and 3,4,6 in one. Meningitis was



Figure 3: Total 3rd nerve palsy due to right posterior communicating artery aneurysm



Figure 4: Traumatic left Sixth Nerve. Note the restricted abduction in the left eye

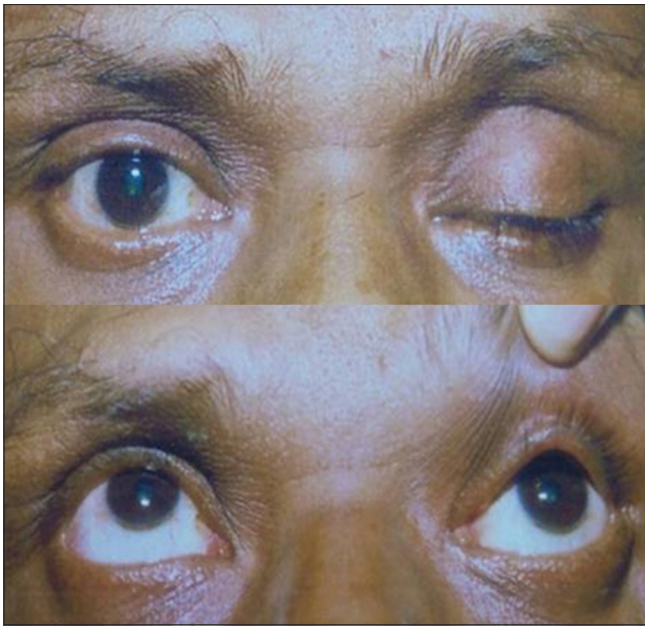


Figure 5: Ischaemic Left 3rd Nerve Palsy. Note the ptosis and elevation restriction

responsible for bilateral 6th nerve with optic neuritis due to tuberculosis and unilateral combined 3rd, 4th, and 6th nerve involvement in another.

DISCUSSION

The study undertaken at our center showed similar results to various other studies in which the abducens was most commonly involved and trochlear least involved. Abducens was involved in 46.7% similar to these studies showing 40-57% occurrence.¹⁻⁷ The mean age of this series was 41.17 ± 14.38 years. The age of onset in 2 reports was higher 52.3 and 62.5 years.^{5,6} This may be due to only acquired cases being taken into account while in this study congenital cases were included. Excluding the congenital case, however, mean age was still lower at 42.31 years. Furthermore, in this study, the finding that trauma was the most common cause and not vascular cause as in the other studies may be the reason for the lower age of onset. However, another study reported a somewhat younger onset age of 48.1 years.⁷

Earlier studies by Rucker showed neoplasms and undetermined causes as more common.² In this study, the most common etiology was trauma unlike in other studies where vascular disease (31.1%) was the most common etiology.^{6,7} This may be due to our center being a referral center where medicolegal cases and road traffic accidents are referred, thus accounting of higher incidence of trauma cases.

Vascular cause accounted for 50% of 6th nerve palsies. Park *et al.* and Patel *et al.* also showed increased incidence of vascular causes for 6th nerve palsy.^{7,8} All patients were

diabetic with 71.4% having hypertension too. Patel *et al.* have shown increased association for diabetes compared to hypertension.⁹

Trauma was the most common cause of 3rd nerve involvement in this study. Another study showed that vascular disorders accounted for 34.9% of the 3rd nerve dysfunction,¹⁰ while it accounted for only 14.2% in our study. Pupil was involved (71.4%) in all but one case of trauma and tumor-pituitary adenoma whereas in the vascular palsy the pupil was spared. Berlit reported a 63% pupillary sparing which is explained by increased incidence of vascular lesions unlike in our study.⁶

Trochlear nerve involvement was most commonly due to trauma and occurred in a younger age group, while combined nerve palsy was more commonly due to inflammatory cause, namely, Tolosa-Hunt syndrome

Trauma equally involved 3rd and 6th nerve in this study whereas the 3rd nerve was found to be the most susceptible to damage in head-injured patients in other studies¹¹ Vascular ocular nerve palsy commonly involved the 6th nerve (87.5%) followed by 3rd nerve (12.5%). 4th nerve was not affected. Patients with vascular causes were older than those with traumatic cause (55.75 vs. 36.73 years). Traumatic causes were more seen in males compared to females (63.6% vs. 36.4%) while vascular causes showed a female predilection (62.5% vs. 37.5%). This may be explained by the fact that males are more predisposed to trauma. 100% vascular cases were diabetic, 75% both diabetic, and hypertensive with 87.5% 2 or more risk factors. However, vascular risk factors were also present in 22.7% cases due to other causes, but only with one risk factor. Of these, those with hypertension were seen to have subdural bleed following trauma. The hypertension may have predisposed to the bleed. Hence, it is important not to diagnose based on vascular risk factor history only. It is important to ask for a history of trauma and perform a detailed neurological evaluation as even a trivial trauma can predispose to intracranial bleed especially in those with vascular disease. Hence, appropriate neuroimaging may be required in such cases. A study conducted by Pineles *et al.* showed that in palsies presumed to be microvascular a significant number on follow-up were found to be due to other causes.¹²

Demyelination was found to account for 14.3% of 6th nerve palsies in this study with no cases of 3rd or 4th nerve involvement. Other reports show multiple sclerosis to be responsible for 4-9% of unilateral 6th nerve palsy in the general population.^{3,4,13} The lower incidence in these studies may be because they took place before advances in neuroimaging with undetermined causes accounting for a sizable proportion of cases. These large retrospective

studies found multiple sclerosis to account for 1.7% of 3rd nerve palsies.³⁻⁵ Trochlear nerve involvement in multiple sclerosis has also been reported.¹⁴ However, in this study no cases of 3rd or 4th nerve involvement were seen probably due to the smaller sample size.

Other causes such as Tolosa-Hunt syndrome and meningitis were associated with combined nerve palsies. One was a case of tuberculous meningitis. An Indian study had earlier described a high incidence of tuberculous meningitis in ocular nerve palsy¹⁵ unlike earlier studies by Rucker^{2,3} and attributed it to the high incidence of tuberculosis in the country.

CONCLUSION

Abducens was the most commonly involved nerve followed by 3rd nerve while trauma was most common etiology in our study. However, vascular cause accounted for 50% cases of 6th nerve palsy. Vascular risk factors were even found in non-vascular causes of nerve palsy. Demyelination was also found to be a cause of 6th nerve palsy.

Hence to reach an etiological diagnosis, investigations should be tailored to each patient according to clinical findings and provisional diagnosis.

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