Causes and Outcome of Neurogenic Vision Loss

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ABSTRACT

Background: Neurogenic vision loss is often a medical emergency. Early evaluation and urgent treatment of the causes is the key to better visual prognosis.

Methods: This was a retrospective cross-sectional study based on hospital records of patients admitted to the Neurology department of Tribhuvan University Teaching Hospital with complain of diminution of vision from April 2023 to March 2024. The visual outcome of the patients was recorded based on telephone interviews with the patients or their family members.

Results: A total of 64 patients were identified of which 62 were interviewed for visual outcome. The median age was 38 years of which 62.5% were female. Bilateral eye involvement was reported in 59.4% of the cohort and half of the patients had normal optic disc. The distribution of visual acuity at presentation was 39.1% for 6/60 or better, 9.4% for 3/60 to less than 6/60, 32.8% for 3/60 and 18.8% having no perception of light. The commonest diagnosis in decreasing order of frequency was idiopathic intracranial hypertension, neuromyelitis optica spectrum disorder, idiopathic optic neuritis and myelin oligodendrocyte glycoprotein antibody disease with the frequency being 17.2%, 15.6%, 10.9% and 9.4% respectively. Of 62 patients interviewed, 67.7% reported a complete recovery of vision, 14.5% reported a partial recovery and 17.8% reported no visual recovery. Severity of visual loss at presentation was associated with poor visual outcome (p=0.021) whereas age, gender, number of eyes affected and duration of visual symptoms had no significant relation to visual recovery.

Conclusions: Idiopathic intracranial hypertension, neuromyelitis optica spectrum disorder, Idiopathic optic neuritis, myelin oligodendrocyte glycoprotein antibody disease were the commonest causes of neurogenic visual loss. The severity of visual loss at onset is a prognostic marker of the visual recovery in these patients.

Keywords: Blindness; Vision Disorders; Optic Nerve Diseases; Neural Optical Lesion

INTRODUCTION

Diminution of vision is one of the common presentations to a neurology and an ophthalmology clinic. The causes include milder disease to vision threatening diseases like Neuromyelitis Optica Spectrum Disorder (NMOSD).[1] Acute onset of loss of vision is a medical emergency. Early evaluation and urgent treatment of the condition is the key to better visual prognosis.[2]

A background knowledge of the possible etiologies is warranted to avoid unnecessary delay in management and referral to a specialized care facility especially in cases that present with complaints of acute onset decrease in vision.

The objective of this study is to describe the etiological spectrum, clinical findings, imaging results, treatment modalities, visual outcomes and its relationship to the severity of vision loss at presentation in patients admitted to a neurology ward who presents with acute onset diminution of vision in either of or both eyes.

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METHODS

This was a retrospective cross-sectional study done at Tribhuvan University Teaching Hospital, Kathmandu, Nepal after obtaining an ethical clearance from the Institutional review board (Ref:205). All the patients admitted to the Department of Neurology for a period of one year, from April 2023 to March 2024, with diminished vision were included in the study. Patients presenting with similar complains who attended at other departments, including Ophthalmology were not included in the study.

Hospital records were used to obtain the demographic, clinical and radiological data of the patients. Details of treatment provided to the patients were also recorded. Either the patient or the patient's relatives were called on their telephone numbers to make an enquiry about the current visual status. They were asked if they have no change in their visual status, if they have partial recovery or if they have complete visual recovery similar to their premorbid status. Patients unreachable by phone were excluded from outcome analysis.

Data were initially tabulated in an Excel sheet. Statistical analysis was performed using SPSS 16.0. Nominal variables are presented in percentages in tables and graphs. Measurement variables were expressed in either mean with Standard deviation (SD) or median with interquartile range. For the purpose of the univariate analysis visual outcome is dichotomized into two categories: No visual improvement and at least some visual improvement. The association between visual outcome and measurement variables (age of the patient, duration of visual symptoms at admission) was analyzed using independent sample t-tests. The Chi-square test was used to study the association of the visual outcome and other nominal variables (gender, number of eyes affected and severity of visual loss in the worse eye). A p-value of <0.05 was considered significant.

RESULTS

Out of 1545 hospital discharge records during the specified time frame, 64 cases meeting the inclusion criteria for the study were identified. Of these, 62 patients could be reached upon for the outcome questioning and the last patient discharged was 3 months ago at the time of the telephone call.

The median age of the cohort was 38.0 years (IQR 28.25-48.25 years), and 40 patients (62.5%) being females.

The presenting symptoms and signs are tabulated in Table 1.

More than half of the patients (59.4%) had diminished vision of both eyes at presentation of which 68.4% had simultaneous involvement of both eyes. Median duration of visual symptoms at the time of hospital admission was 30 days (IQR 10.25-82.5 days). Few of the patients (17.2%) already had a history of visual impairment in the past. Abnormalities in fundoscopy was seen in half of the patients.

Around two-fifths (18.8%) of the patients did not have perception of light (NPL), and additional 21 (32.8) had a visual acuity of less than 3/60. Few patients 6 (9.4%) had a visual acuity more than or equal to 3/60 but less than 6/60. Of the one-half patients with abnormal optic disc, 37.5% had disc edema while 12.5% had atrophic disc.

Table 1. Clinical characteristics of the study population.

Variables (N=64)	Frequency (%)
Presenting complains	
Diminished vision of both eyes	38 (59.4)
Diminished vision of one eye	26 (40.6)
Headache	21 (32.8)
Myelopathic symptoms	9 (14.1)
Cortical symptoms	7 (10.9)
Diplopia	6 (9.4)
Painful diminution of vision	15 (23.4)
Duration of visual symptoms at the time of admission in days (Median, IQR)	30.0 (10.25-82.5)
Simultaneous involvement of both eyes (N=38)	26 (68.4)
Past history of diminution of vision	11 (17.2)
Clinical examination findings	
Abnormal fundoscopic findings	32 (50.0)
Myelopathic findings	10 (15.6)
Cortical findings	13 (20.3)
Brainstem findings	7 (10.9)
Lateral rectus palsy as false localizing sign	4 (6.3)
Visual acuity in worst eye at admission	
6/60 or better	25 (39.1)
3/60 to less than 6/60	6 (9.4)
Less than 3/60	21 (32.8)
No Perception of light (NPL)	12 (18.8)
Fundoscopy findings	
Normal optic disc	32 (50.0)
Disc edema	24 (37.5)
Optic atrophy	8 (12.5)

Magnetic Resonance Imaging (MRI) findings of our patients are shown in Figure 1. In 81.3% of the cases, a single abnormality or a combination of abnormalities was observed in the MRI scans. The most common abnormality reported in MRI being Optic Nerve enhancement suggestive of optic neuritis (39.1%) followed by findings suggestive of myelopathy and cortical involvement (17.2% each). MRI in 14.1% of the cases revealed Empty Sella and/or other features suggestive of raised intracranial pressure (ICP).

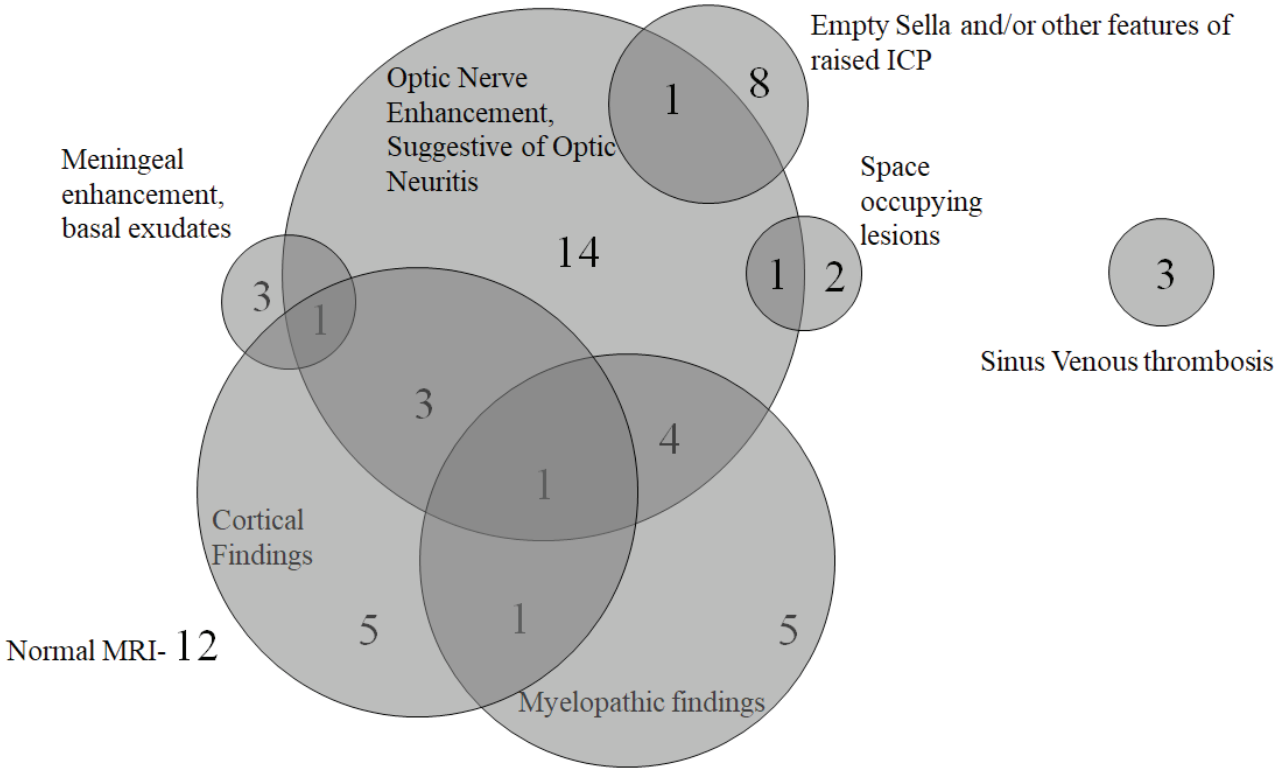

Figure 1. Magnetic Resonance Imaging findings.

Lumbar puncture was done in 49 (76.6%) of the patients among which 15 (30.6%) had an inflammatory picture (Elevated CSF counts and/or raised CSF Protein) while 34 (69.4%) had a normal routine CSF study.

Final diagnosis to which the decreased vision was finally attributed to, is shown in Table 2.

The most frequent diagnosis made was Idiopathic Intracranial Hypertension (IIH) (17.2%), followed by Neuromyelitis Optica Spectrum disorder (NMOSD) (15.6%), Idiopathic Optic Neuritis (10.9%), Myelin Oligodendrocyte Glycoprotein antibody disease (MOGAD) (9.4%).

Table 2. Final diagnosis of the patients.

Final Diagnosis (N= 64)	Frequency (%)
Idiopathic Intracranial Hypertension	11 (17.2)
NMOSD	10 (15.6)
Idiopathic Optic neuritis	7 (10.9)
MOGAD	6 (9.4)
Multiple sclerosis	4 (6.3)
Seronegative NMOSD	3 (4.7)
Sinus venous thrombosis	3 (4.7)
Post infectious demyelinating optic neuritis	2 (3.1)
Optic atrophy secondary to Vitamin B12 deficiency	2 (3.1)
TB meningitis with Chiasmitis	2 (3.1)
Others*	14 (21.9)

* Others include cases each of the following diagnosis: Ophthalmic vein thrombosis, Copper deficiency related optic neuropathy, Development venous anomalies, Ethambutol induced toxic neuropathy, Ischemic optic neuropathy, Neurofibromatosis with optic glioma, Neurosarcoidosis, Arrested hydrocephalus with optic atrophy, ANCA associated vasculitis, Pachymeningitis secondary to Herpes Simplex, Posterior Reversible Encephalopathy Syndrome secondary to eclampsia, Cytomegalovirus retinitis, Krait bite induced optic neuritis, Leber Hereditary Optic Neuropathy.

Most of the patients who were diagnosed with inflammatory conditions (especially NMOSD, Idiopathic optic neuritis, MOGAD, Multiple sclerosis and seronegative NMOSD) received treatment with multiple modalities of therapy. Approximately half of the patients (51.6%) were treated with Intravenous (IV) Methylprednisolone, followed by oral steroids. Additionally, 9.4% were prescribed oral steroids only without IV induction. Low volume plasma exchange was performed in 18.8% of the patients as part of acute management. For long-term immunosuppression, the most commonly prescribed drugs were Rituximab (17.2%) and Azathioprine (7.8%). In isolated cases, Cyclophosphamide and Mycophenolate Mofetil were also used (1.6% each).

Patients with elevated intracranial pressure were primarily treated with Acetazolamide (20.3%). Additionally, one patient (1.6%) underwent bilateral optic nerve fenestration surgery.

The assessment of visual outcomes during telephone interviews occurred at least 3 months after the patients' last admission. Out of 64 patients, 62 (96.9%) were reachable by phone for the interview. Among those interviewed, 42 patients (67.7%) reported a complete recovery of vision to premorbid status. Additionally, 9 patients (14.5%) had a partial recovery and were independent in activities of daily living. However, 11 of them (17.8%) reported no visual recovery.

The distribution of the visual outcome as a function of the severity of visual loss in the worse eye at admission is as shown in Figure 2.

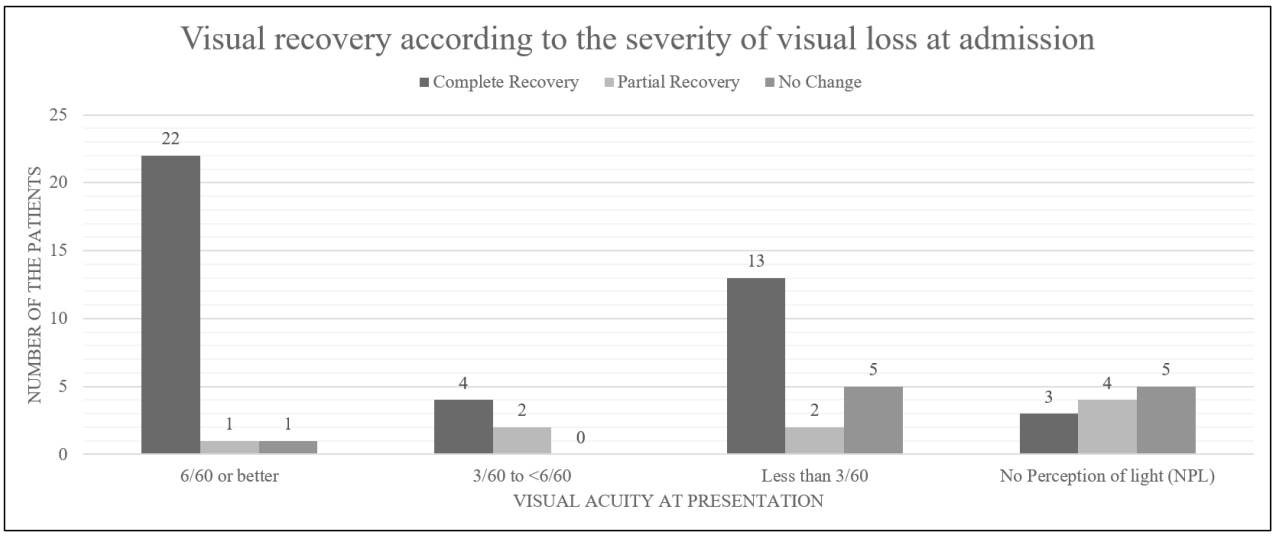

Figure 2. Visual outcome according to severity of visual loss at admission.

The visual outcome as per the diagnosis is shown in figure 3.

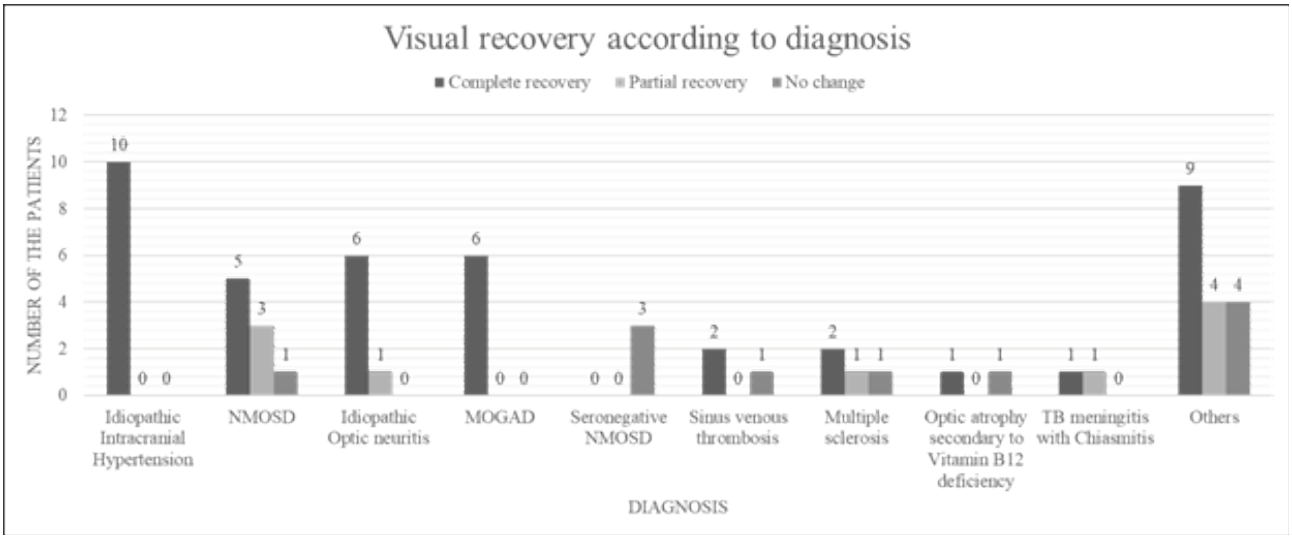

Figure 3. Visual recovery according to the diagnosis.

Among the patients with a visual outcome data, cases diagnosed with irreversible causes of optic atrophy (including four patients with the diagnoses being each of developmental anomaly, chronic ischemic optic atrophy, optic nerve glioma and old arrested hydrocephalus with secondary optic atrophy) were excluded from univariate analysis. For the purpose of univariate analysis, visual outcome was dichotomized to two categories: 'No visual improvement' and 'At least some visual improvement'.

The results of the univariate analysis are shown in Table 3. Of the different variables studied, the visual acuity at admission was found to have a significant association with the visual outcome; X^2 (3, n=58) = 0.753, p =0.021.

Table 3. Univariate analysis of different variables with respect to dichotomized visual outcomes.

Variables	No visual improvement (N=8)	At least some improvement (N=50)			
Tests for measurement variables					
	Mean + SD	**Mean + SD**	**t value**	**df**	**P value**
Age in years	43.9 + 21.9	38.3 + 14.1	0.691	56	0.509
Duration of visual symptoms	283.9 + 624.6	40.0 + 57.1	1.103	56	0.306
Tests for nominal variables					
	Percentage	**Percentage**	**X^2**	**df**	**P value**
Gender: Female (n=36)	13.9	86.1	0.001	1	1.00
Number of eyes affected: Both eyes (n=37)	16.2	83.8	0.146	1	0.702
Visual acuity at admission					
6/60 or better (n=24)	4.2	95.8			
3/60 to less than 6/60 (n=6)	0.0	100.0	0.753	3	0.021
Less than 3/60 (n=20)	25.0	75.0			
No Perception of light (NPL) (n=12)	41.7	58.3			

DISCUSSION

The study presented data of patients admitted in neurology ward of one of the largest tertiary hospitals in Nepal.

Although studies on neurogenic visual loss as a group are scarce, few studies from Nepal in optic neuritis have been done. A previous study done at a tertiary hospital in patients with optic neurites reported a similar age distribution with a mean age of 31.2 + 17.1 years as compared to the median age of 38.0 years in our cohort. They, however had a higher male to female ratio of 2.18:1 in contrast to our findings, where almost two-third were female. Also, fewer patients had bilateral eye involvement (25.7%) as compared to 57.8% in our cohort.[3] A study from India also reported only 23.3% of patients having bilateral involvement.[4] The spectrum of diagnosis in our population was, however, heterogenous and also included diseases well known to commonly affect bilateral eyes such as IIH, NMO, MOGAD and Multiple sclerosis, as compared to idiopathic optic neuritis where unilaterality is commoner. Similarly, the median duration of visual symptoms was longer (30 days) in our patients as compared to a mean duration of 8.3 + 5.9 days in their cohort.[3]

Visual loss in neurogenic diseases can be both rapid and severe. Just more than a half (51.6%) of our patients were blind (as per WHO cutoff of visual acuity worse than 3/60), of which 36.6% did not even perceived light (NPL). Although not exactly comparable in terms of the heterogenicity of the diagnosis in our cohort, 35.7% of the patients recruited for the Optic Nerve Treatment Trial (ONTT) had visual acuity of 20/200 or worse.[5] Indian study of patients with neurogenic vision loss reported a frequency of 75.2% (85 out of 113) for visual acuity less than 3/60, of which 31.5% (27 out of 85) had no perception of light.[6] The study had a higher incidence of blindness than seen in our study as they considered number of eyes (113) of total 64 patients, however, we have reported the visual acuity in the worse eye only. More than half (59.4%) of our patients had bilateral eye involvement at presentation.

Fundoscopy is abnormal only when the optic nerve is involved anteriorly or when there is a raised intracranial pressure. The optic disc appeared normal in half of our cases. This is in contrast to the similar study in India, where they had normal disc in 31.9% of total 113 eyes evaluated. Around a quarter (26.5%) of times, they reported optic atrophy, the frequency of which in our cohort is 12.5% only. The frequency of disc edema in our study was 37.5% which is comparable to 41.5% in their study.[6] Optic atrophy is a sequalae to chronic insult to the optic nerve.[7] The difference in time of the symptom onset between the studies, might have been reflected in the difference in the frequency of disc edema and optic atrophy.

The three commonest diagnoses in our patients were idiopathic intracranial hypertension (17.2%), NMOSD (15.6%) and Idiopathic optic neuritis (10.9%). Although the spectrum of diagnosis is similar, the frequency of the diseases in our cohort is different from what was found in a cohort of 64 patients with neurogenic visual impairment in India.[6] The commonest diagnosis in the cohort was Tubercular meningitis (23.8%), Isolated optic neuritis (19%), and NMOSD (7.9%). In contrast to our study, idiopathic intracranial hypertension was the diagnosis they made in only 4.8% of the cases. Being a referral center, IIH patients referred to us usually have concerning symptoms like visual impairment than just headache.

It is also quite unfortunate to note that 23.8% of the patients in the Indian cohort had visual impairment due to TB meningitis, which in our case contributed only to 2(3.1%) of cases. TB meningitis causes visual impairment by either involving the optic chiasma by either tuberculoma or arachnoiditis or may cause optic nerve damage when complicated by hydrocephalus. Both of our patients had optic chiasmitis. However, 6 of 15 cases had optochiasmatic tuberculoma, 2 out of 15 cases had optochiasmatic arachnoiditis and all of them had hydrocephalus in the Indian cohort. This might reflect the difference in the incidence, management and complications of tuberculosis between the two countries. The prognostic factors that have been described for poor vision in patients with TBM include papilledema, cranial nerve palsies, SF protein >1g/L and presence of optochiasmatic arachnoiditis in MRI.[8]

Complete recovery of vision was evident in 67.7% of our patients. In comparison, study by Verma et al, had 48.7% of the eyes with visual acuity more than 6/60 after treatment, while they had only 19.5% of the eyes with visual acuity > 6/60 at presentation. They had greater proportion of patients with optic atrophy at presentation itself, which could be one of the factors for the discrepancy.[6]

We found that the poorer the visual acuity at presentation, the poorer the visual outcome. Similar results have been demonstrated in other studies across many spectra of neurogenic causes of visual loss. A study done using optic neuritis treatment trial (ONTT) data base found baseline visual acuity of < 20/50 to be an independent predictor of

6-month abnormal vision.[9] Another study found that optic neuritis at onset was a risk predictor of visual disability in patients with NMOSD.[10] The severity of visual loss in demyelinating optic neuritis gets worse with delay in treatment initiation and thus affects the visual outcome as well. An analysis of the French MOGAD database identified that a delay in time to first methylprednisolone treatment by > 10 days is associated with a poor visual outcome at 3 months.[11] Similarly, multiple studies have shown that visual acuity at presentation is the most important predictor of final visual outcome in patients with IIH.[12, 13]

Our study had some limitations. The study being a single center, retrospective study, it carries the inherent limitations pertaining to it. We didn't have the formal visual acuity follow up values. As cases of IIH and idiopathic optic neuritis are also being managed by the Ophthalmology department in our center, these diseases might have been under represented in the cohort.

CONCLUSIONS

Our study showed that Idiopathic Intracranial Hypertension, NMOSD and Idiopathic Optic Neuritis are the commonest cause of neurogenic vision loss in our cohort. The severity of visual loss at onset is a prognostic marker of the visual recovery in these patients. Age, gender, duration of visual symptoms at presentation and number of eyes affected have no relation to the visual outcome.

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CONFLICT OF INTEREST

There are no conflicts of interest.

REFERENCES

1. Newman N, Biousse V. Diagnostic approach to vision loss. Continuum (Minneap Minn). 2014;20(4):785-815. doi:https://doi.org/10.1212/01.con.0000453317.67637.46

2. Sawaya R, El Ayoubi N, Hamam R. Acute neurological visual loss in young adults: causes, diagnosis and management. Postgrad Med J. 2015;91(1082):698-703. doi:https://doi.org/10.1136/postgradmedj-2014-133071

3. Shrestha B, Sharma M, Lavaju P, Pokharel S, Agrawal N, Tulsyan N. Demographic pattern, clinical profile and visual outcome of patients with optic neuritis in a tertiary level eye care center of eastern Nepal. Health Renaissance. 2013;11(3):250-3. doi:https://doi.org/10.3126/hren.v11i3.9641

4. Kinikar VP, Pendyala Y, Kumar KV. Clinical profile and visual outcome of optic neuritis patients in tertiary care hospital. IP Int J Ocul Oncol Oculoplasty. 2021;7:163-8. doi:https://doi.org/10.18231/j.ijooo.2021.032

5. Beck RW, Cleary PA, Anderson Jr MM, Keltner JL, Shults WT, Kaufman DI, et al. A randomized, controlled trial of corticosteroids in the treatment of acute optic neuritis. NEJM. 1992;326(9):581-8. doi:https://doi.org/10.1056/nejm199202273260901

6. Verma R, Gupta M, Chaudhari TS. Neurogenic vision loss: Causes and outcome. An experience from a tertiary center in Northern India. J Neurosci Rural Pract. 2014;5(4):340. doi:https://doi.org/10.4103/0976-3147.139971

7. Menon V, Arya AV, Sharma P, Chhabra V. An aetiological profile of optic atrophy. Acta ophthalmologica. 1992;70(6):725-9. doi:https://doi.org/10.1111/j.1755-3768.1992.tb04876.x

8. Sinha MK, Garg RK, Anuradha H, Agarwal A, Singh MK, Verma R, et al. Vision impairment in tuberculous meningitis: predictors and prognosis. J Neurol Sci. 2010;290(1-2):27-32. doi:https://doi.org/10.1016/j.jns.2009.12.012

9. Kupersmith M, Gal R, Beck R, Xing D, Miller N, Group ONS. Visual function at baseline and 1 month in acute optic neuritis: predictors of visual outcome. Neurology. 2007;69(6):508-14. doi:https://doi.org/10.1212/01.wnl.0000267272.60714.42

10. Shi Z, Du Q, Chen H, Zhang Y, Qiu Y, Zhao Z, et al. Effects of immunotherapies and prognostic predictors in neuromyelitis optica spectrum disorder: a prospective cohort study. J Neurol. 2020;267:913-24. doi:https://doi.org/10.1007/s00415-019-09649-7

11. Rode J, Pique J, Maarouf A, Ayrignac X, Bourre B, Ciron J, et al. Time to steroids impacts visual outcome

of optic neuritis in MOGAD. J Neurol Neurosurg Psychiatry. 2023;94(4):309-13. doi:https://doi.org/10.1136/jnnp-2022-330360

12. Takkar A, Goyal MK, Bansal R, Lal V. Clinical and Neuro-ophthalmologic Predictors of Visual Outcome in Idiopathic Intracranial Hypertension. J Neuroophthalmol. 2018;42(4):201-8. doi:https://doi.org/10.1080/01658107.2017.1400570

13. Agarwal A, Vibha D, Prasad K, Bhatia R, Singh MB, Garg A, et al. Predictors of poor visual outcome in patients with Idiopathic Intracranial Hypertension (IIH): An ambispective cohort study. Clin Neurol Neurosurg. 2017;159:13-8. doi:https://doi.org/10.1016/j.clineuro.2017.05.009