Content available at: https://www.ipinnovative.com/open-access-journals

Indian Journal of Clinical and Experimental Ophthalmology

Journal homepage: www.ijceo.org

Original Research Article

Neuro-ophthalmic manifestations in road traffic accident: A hospital based study

Rajeshwari M[1], Rubina Huda[1], Mohan Ram Kumar[1], R Deborah Rinita[1], Syed Ali Nasar Waris[1]*, Himaja Singana[1], Thirupuraa V[1]

[1]Dept. of Ophthalmology, Shri Sathya Sai Medical College and Research Institute, Kanchipuram, Tamil Nadu, India

Abstract

Background: Road traffic accidents (RTAs) continue to remain a significant public health concern globally as well as locally, leading to various forms of trauma, often resulting in irreversible morbidity and in the worst cases, causing in death.

Aim and Objective: The present study was aimed to provide a detailed demographic profile and neuro-ophthalmic manifestation following Road traffic accident.

Materials and Methods: Hospital based cross-sectional study was performed on 110 patients presenting to emergency department following a road traffic accident for a duration of 18 months. Detailed neurological & ophthalmic evaluation was done and documented in the data collection proforma sheet. Collected data was analysed using SPSS software.

Result: A majority of the subjects (65.5%) did not exhibit any neuro-ophthalmic manifestations, while 34.5% experienced such manifestations. Optic nerve dysfunction was seen in 34.5% while 15.5% presented with disc edema. Retrobulbar Neuritis was observed among 2.7% study subjects. The most commonly affected cranial nerve was the oculomotor nerve (6.4%), followed by the abducens nerve (3.6%), trochlear nerve, trigeminal nerve (1.8%) and facial nerve (0.9%).

Conclusion: This study highlights the significant burden of neuro-ophthalmic manifestations following road traffic accidents and the importance of early diagnosis and intervention to prevent long-term visual impairment and associated disabilities.

Keywords: Alcohol influence, Road traffic accident, Neuro-ophthalmic manifestations.

Received: 03-03-2025; **Accepted:** 07-07-2025; **Available Online**: 13-09-2025

1. Introduction

Road traffic accidents (RTAs) cause a great deal of morbidity and mortality, making them a major global public health concern. The World Health Organization (WHO) reports that approximately 1.35 million people lose their lives annually to RTAs, with millions more sustaining debilitating injuries that lead to substantial personal and societal costs.[1] Among these, neuro-ophthalmic manifestations represent a critical subset of injuries, characterized by their potential to cause long-term visual impairment and diminished quality of life.[2]

India has a particularly high burden of RTA-related ocular and neuro-ophthalmic injuries because of the country's fast urbanization, rising car population, and disregard for traffic safety regulations. Two-wheeler riders are especially vulnerable, often accounting for a significant proportion of injuries due to inadequate helmet usage and exposure to high-speed impacts.[3]

A variety of disorders are included in neuro-ophthalmic traumas, such as retinal injury, cranial nerve palsies, and optic nerve dysfunction. These injuries often arise from direct trauma, compressive forces, or blunt impacts and can manifest as vision loss, diplopia, or other debilitating symptoms. This study aims to provide a comprehensive understanding of the demographic profile and neuro-ophthalmic manifestations in RTA patients, contributing to

*Corresponding author: Syed Ali Nasar Waris
Email: alinasarwaris@gmail.com

https://doi.org/10.18231/j.ijceo.v.11.i.3.9

the development of targeted interventions to address this growing public health issue.

2. Materials and Methods

This hospital-based cross-sectional study was conducted over a period of 18 months. The study included 110 patients who presented to the emergency department following road traffic accidents. Informed consent was obtained from all participants or their legal representatives before their inclusion in the study.

2.1. Inclusion criteria

1. Patients of all ages and both genders.
2. Patients involved in road traffic accidents (as driver or passenger).
3. Patients who sustained any kind of injury during an alleged road traffic accident.
4. Patients who gave written informed consent for participation in this study.

2.2. Exclusion criteria

1. Patients who sustained ocular injuries due to domestic trauma or assault.
2. Patients who sustained ocular chemical injuries.
3. Patients who sustained workplace ocular injuries.

A detailed history was taken from each patient following the road traffic accident, encompassing demographic details, the nature and mechanism of the accident, including the mode of transportation and the impact site; and a focused ophthalmic history. Neurological and neuro-ophthalmic evaluations were conducted systematically. Neurological assessment included the Glasgow Coma Scale (GCS) to evaluate the level of consciousness and the severity of head injury. Cranial nerve examination focused on cranial nerves II, III, IV, V, VI, and VII to detect functional impairments. Brain imaging, such as computed tomography (CT) or magnetic resonance imaging (MRI), was performed when clinically indicated to identify traumatic brain injury or cranial nerve pathologies. (**Figure 1**)

Figure 1: CT showing optic nerve thickening

Ophthalmic examination began with visual acuity testing using a Snellen's chart to determine the degree of visual impairment. Pupillary reflexes were assessed for direct and consensual responses, including the detection of relative afferent pupillary defects (RAPD).(**Figure 2**) Fundoscopic examination was performed using indirect ophthalmoscopy to detect optic disc oedema, haemorrhages, or other posterior segment abnormalities. Intraocular pressure (IOP) was measured using a non-contact tonometer to rule out ocular hypertension secondary to trauma. Colour vision testing was conducted using Ishihara plates to detect subtle optic nerve dysfunction.

Figure 2: Relative afferent pupillary defect

Specific neuro-ophthalmic tests included Humphrey automated perimetry to evaluate visual field defects, optical coherence tomography and B-Scan to assess the posterior segment. In some cases, orbital ultrasound was used to detect retrobulbar abnormalities or optic nerve swelling.

All collected data were entered into SPSS software for statistical analysis. Descriptive statistics were used to summarize the demographic and clinical profiles, while the prevalence of neuro-ophthalmic manifestations was reported as percentages.

The study was conducted in compliance with ethical standards, and approval was obtained from the institutional ethics committee.

3. Result

Patients were taken from all age group with mean age being 35.6+/- 18.2 years. In the current study, majority of 36.4% were in the age group of 36 to 40 years and least of 13.6% belong to age group of 55 to 80 years. Males were found to be 69% compared to 31% female. According to Modified BG Prasad Socio economic status classification.[4] 34.5% belong to the middle class and 55.5% of the study subjects were residing in the urban areas. Majority of 55.5% of vehicles involved in RTA was two-wheeler and 57.3% of the study subjects were under the influence of alcohol at the time of RTA. The majority of participants (56.4%) presented with a visual acuity of 6/6, indicating normal vision. A significant portion (24.5%) had visual acuity ranging from 6/60 to 6/9, while 10.9% had a visual acuity of "CFCF" (counting fingers close to face), and 8.2% had a visual acuity of "PL+" (perception of light).

A majority of the subjects (65.5%) did not exhibit any neuro-ophthalmic manifestations, while 34.5% experienced such manifestations.

While a majority of the study subjects had a GCS score of 15, 28.2% had GCS score of 13 – 14, and 20% had GCS score of 9 – 12. The mean GCS score was 13.81 ± 1.55. (**Table 1**)

The most commonly affected cranial nerve was the oculomotor nerve, with 7 cases (6.4%), followed by the abducens nerve with 4 cases (3.6%). Injuries to the trochlear nerve and trigeminal nerve each occurred in 2 subjects (1.8%), while the facial nerve was the least affected, with only 1 case (0.9%). (**Table 4**)

The 26 to 40 years age group had the highest proportion of cranial nerve palsy, with 10 out of 40 subjects (55.6%) affected. The 10 to 25 years group had 2 out of 33 subjects (11.1%) with cranial nerve palsy, while the 41 to 55 years group had 4 out of 22 subjects (22.2%). The 55 to 80 years group had 2 out of 15 subjects (11.1%) affected. Overall, 18 subjects (16.4%) experienced cranial nerve palsy. The Chi-square value of 5.32 and P-value of 0.056 suggests a marginal association between age and cranial nerve palsy, though it is nearly statistically significant at the 0.05 level. (**Table 3**)

The prevalence of disc edema was observed among 15.5% study subjects.

34.5% had relative afferent pupillary defect whereas 65.5% showed fairly good optic nerve function.

26.4% showed restriction in extraocular movements while 16.4% showed cranial nerve palsy.

The prevalence of Retrobulbar Neuritis was observed among 2.7% study subjects. (**Table 2**)

Table 1: Distribution of study subjects based on GCS score (n=110)

GCS	Frequency	Percent
<= 8	0	0.0
9 – 12	22	20.0
13 – 14	31	28.2
>= 15	57	51.8
Total	110	100.0

Table 2: Distribution of study subjects based on neuro-ocular manifestations (n=110)

Neuro-ophthalmic manifestations	Frequency	Percent
RAPD	38	34.5
EOM Restriction	29	26.4
Cranial nerve palsy	18	16.4
Disc edema	17	15.5
Retrobulbar neuritis	3	2.7

Table 3: Age group versus cranial nerves affected

Age group	Cranial nerves affected				Total
	Oculomotor	Trochlear	Abducens	Trigeminal	
10 TO 25	0	0	1	0	1
26 TO 40	4	2	1	2	9
41 TO 55	1	0	1	0	2
55 TO 80	2	0	1	0	3
Total	7	2	4	2	15

Yates' Chi-square =3.513; Yates' P value = 0.940

Table 4: Distribution of study subjects based on various cranial nerves injuries (n=110)

Cranial nerve	Frequency	Percent
Oculomotor nerve	7	6.4
Trochlear nerve	2	1.8
Abducens nerve	4	3.6
Trigeminal nerve	2	1.8
Facial nerve	1	.9

4. Discussion

Road traffic accidents (RTAs) remain a major public health issue globally, contributing significantly to mortality and morbidity rates.[1] This study highlights the specific neuro-ophthalmic sequelae of RTAs, underscoring their prevalence and clinical characteristics. Neuro-ophthalmic manifestations, observed in 34.5% of our study participants, align with findings from prior studies indicating significant ocular complications following RTAs.[2,3]

4.1. Demographic insights

Our study's demographic distribution revealed that males were disproportionately affected (69%), consistent with global trends suggesting higher male involvement in RTAs due to occupational exposure, risk-taking behaviours, and alcohol consumption.[5,6] The predominance of two-wheeler vehicles in these accidents (55.5%) and the significant association of alcohol influence (57.3%) are also corroborated by other studies in similar settings.[7,8]

4.2. Cranial nerve palsy

The oculomotor nerve emerged as the most commonly affected cranial nerve (6.4%), followed by the abducens (3.6%) and trochlear nerves (1.8%). These findings mirror previous studies that identified the oculomotor nerve as particularly vulnerable to trauma, likely due to its anatomical positioning and susceptibility to shearing forces during impact.[9,10] Furthermore, the age group of 26-40 years exhibited the highest prevalence of cranial nerve palsy (55.6%), possibly attributable to their higher involvement in road traffic accidents.[11]

4.3. Optic nerve dysfunction and other manifestations

Optic nerve dysfunction, noted in 34.5% of participants, represents a substantial proportion of the neuro-ophthalmic burden. Optic nerve injury can be of various mechanism like direct, indirect or papilledema. Several retrospective studies have reported a high incidence of neuro ophthalmologic findings after severe head injury.[12,13] A hospital-based study from Nepal by Gurung et al. reported a high frequency of neuro-ophthalmic manifestations in traumatic brain injury, including traumatic optic neuropathy, which contrasts with the lower incidence of 2.7% observed in our study.[14] Disc edema observed in 15.5% of cases, further underscores the need for immediate ophthalmic evaluation to mitigate long-term visual deficits.[15] The low incidence of retrobulbar neuritis (2.7%) aligns with its known rarity in trauma-related contexts.[16]

5. Limitations & Strengths

This study's cross-sectional design and single-centre setting limit its generalizability. The reliance on self-reported data for factors like alcohol use may introduce bias. Additionally, the study does not assess long-term outcomes of neuro-ophthalmic injuries. The study provides a comprehensive evaluation of neuro-ophthalmic manifestations in RTAs using standardized clinical protocols. Its detailed demographic and clinical data contribute valuable insights into a significant yet under-researched area of trauma care.

6. Recommendations

To reduce neuro-ophthalmic injuries from RTAs, stricter enforcement of traffic laws, mandatory helmet use, and alcohol reduction programs are essential. Routine neuro-ophthalmic assessments should be included in trauma protocols, and specialized trauma centres established for advanced care. Community safety initiatives, improved road infrastructure, and targeted education for healthcare workers can enhance prevention and management. Telemedicine services can ensure accessible follow-up care, especially in remote areas. Longitudinal research on outcomes and interventions is also recommended.

6.1. Clinical implications for emergency practitioners

Emergency department practitioners should maintain a high index of suspicion for neuro-ophthalmic injuries in RTA victims, especially when there is a history of head trauma, altered GCS, or visual complaints. A rapid but thorough cranial nerve examination, assessment of visual acuity, and fundoscopy should be included in the initial trauma evaluation. Prompt referral to ophthalmology or neurology can be crucial for optimal outcomes.

7. Conclusion

This research highlights the substantial burden of neuro-ophthalmic symptoms that occur after road traffic accidents (RTAs). Neuro-ophthalmic problems, such as optic nerve dysfunction, cranial nerve palsies, and retrobulbar neuritis, were observed in a noteworthy 34.5% of patients. The findings emphasize the critical need for early detection and management of these injuries to prevent permanent disability and ensure improved patient outcomes. The study also shows the significance of two-wheeler accidents, the influence of alcohol, and the disproportionate impact of RTAs on young males as major causes of the injuries that have been reported. Nevertheless, the findings stress the urgent need for public health interventions to improve road safety measures, promote helmet use, and reduce alcohol-impaired driving. This research serves as a vital step toward understanding the demographic and clinical profile of neuro-ophthalmic injuries in RTAs, guiding public health interventions and clinical practices. While this study provided valuable cross-sectional insights, future research should aim to assess the long-term outcomes of neuro-ophthalmic injuries post-RTA. A longitudinal cohort study could provide information on the progression, recovery rates, and lasting visual or neurological deficits, enabling better patient prognosis and rehabilitation planning.

8. Source of Funding

None.

9. Conflict of Interest

None.

10. Ethical Approval

Ethical No.: 900/2023.

References

1. Global status report on road safety 2023. World Health Organization; 2023. Available from: https://www.who.int/teams/social-determinants-of-health/safety-and-mobility/global-status-report-on-road-safety-2023.
2. Menon L, Mani S, Mathew A. The prevalence of ocular manifestations in road traffic accidents treated at a rural tertiary care hospital in south India: a cross sectional study. *Int J Res Med Sci*. 2017;5(10):4380–4.
3. Sujatha MA, Bokhari SS. Ocular manifestations in road traffic accidents. *IP Int J Ocul Oncol Oculoplasty*. 2021;7(2):157–62.
4. Mahantshetti S, Singh J, Dhandapani S. Updated modified BG Prasad classification for October 2023. *Natl J Community Med*. 2024;15(1):89–90.
5. Mohan D. Traffic safety and health in Indian cities. *J Transp Health*. 2009;6(2):185–96.
6. Shinar D. Traffic safety and human behavior. 2nd ed. Bingley: Emerald Publishing Limited; 2007.
7. Murray CJ, Lopez AD. Global mortality, disability, and the contribution of risk factors: Global Burden of Disease Study. *Lancet*. 1997;349(9063):1436–42.
8. Peden M, Scurfield R, Sleet D, Mohan D, Hyder AA, Jarawan E, et al., editors. World report on road traffic injury prevention. World Health Organization; 2004.
9. Kim T, Nam K, Kwon BS. Isolated oculomotor nerve palsy in mild traumatic brain injury. *Am J Phys Med Rehabil*. 2020;99(5):430–5.
10. Coello AF, Canals AG, González JM, Martín JJA. Cranial nerve injury after minor head trauma. *J Neurosurg*. 2010;113(3):547–55.
11. McCartt AT, Shabanova VI, Leaf WA. Driving experience and crash involvement rates. *Inj Prev*. 2003;9(2):161–5.
12. Van Stavern GP, Biousse V, Lynn MJ, Simon DJ, Newman NJ. Neuro-ophthalmic manifestations of head trauma. *J Neuroophthalmol*. 2001;21(2):112–7.
13. Sharma B, Gupta R, Anand R, Ingle R. Ocular manifestations of head injury and incidence of post-traumatic optic neuropathy. *International Ophthalmology*. 2014;34(4):893–900.
14. Gurung J, Karn M, Gurung PK, Sapkota S. Neuro-ophthalmic manifestations in traumatic brain injury: a hospital-based study from Nepal. *Ann Med Surg (Lond)*. 2024;86:1920–4.
15. Levin LA, Beck RW, Joseph MP, Seiff S, Kraker R. The treatment of traumatic optic neuropathy: the International Optic Nerve Trauma Study. *Ophthalmology*. 1999;106(7):1268–77.
16. Finkelstein EA, Corso PS, Miller TR. The incidence and economic burden of injuries in the United States. New York: Oxford University Press; 2006.

Cite this article: Rajeshwari M, Huda R, Kumar MR, Rinita RD, Waris SAN, Singana H, Thirupuraa V. Neuro-ophthalmic manifestations in road traffic accident: A hospital based study. *Indian J Clin Exp Ophthalmol*. 2025;11(3):417–421.