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Original Research Article

CRANIAL NERVE INJURIES FOLLOWING MILD HEAD TRAUMA: INCIDENCE, RECOVERY PATTERNS, AND CLINICAL OUTCOMES IN A RETROSPECTIVE COHORT

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ABSTRACT

Background: Mild head injury (MHI) is commonly associated with cranial nerve (CN) injuries, which can affect the quality of life. This study aimed to assess the incidence, types, and recovery outcomes of CN injuries in MHI patients and explore their demographic and clinical characteristics.
Materials and Methods: A Retrospective observational study was conducted in the Department of Neurosurgery at Government Medical College Machilipatnam, over a one-year period From July 2024 to June 2025. The study included 50 patients with MHI, defined by a Glasgow Coma Scale (GCS) score of 13-15, who were evaluated for CN dysfunction through clinical assessment and neuroimaging. Patients with moderate or severe head injuries were excluded. Recovery was assessed at 1, 3, and 6 months using the Medical Research Council (MRC) grading system.
Results: The study revealed a higher incidence of CN injuries in males (60%) and patients aged 31-40 years (30%). The most commonly affected CNs were the facial (CN VII, 30%) and olfactory (CN I, 24%) nerves. Falls were the leading cause of injury (60%). The recovery rates varied by CN type, with 80% of patients with facial nerve injuries recovering fully within six months. Recovery was lower for oculomotor nerve injuries, with only 62.5% fully recovering.
Conclusion: The study highlighted the significant incidence of CN injuries in MHI patients, especially those with facial and olfactory nerve involvement. Recovery was generally favorable for facial nerve injuries, but less so for oculomotor nerve injuries. Early identification and timely management are essential for a faster recovery in such injuries.
Keywords: Mild head injury, cranial nerve injuries, facial nerve, olfactory nerve, recovery, falls, Glasgow Coma Scale, neuroimaging, prospective study.

INTRODUCTION

Mild head injury (MHI) refers to trauma to the head resulting in a Glasgow Coma Scale (GCS) score of 13 to 15, typically accompanied by a brief loss of consciousness or confusion. Although these injuries are often perceived as relatively harmless, emerging evidence indicates that cranial nerve (CN) injuries can occur even in the context of mild trauma, leading to significant neurological deficits. The presence of CN involvement in MHI underscores the potential for lasting consequences, even in injuries classified as mild.[1]

Cranial nerves are responsible for various essential functions, including facial sensation, eye movement, and taste. They originate from the brainstem and transmit motor and sensory information to different parts of the head and neck. Due to their anatomical location, cranial nerves are vulnerable to injury in cases of head trauma, particularly when the trauma affects areas such as the skull base, orbit, or temporal bone. In mild head injuries, CN damage may result from direct mechanical trauma, compression from surrounding structures, or vascular compromise affecting the nerve's blood supply. The olfactory nerve (CN I), facial nerve (CN VII), and oculomotor nerves (CNs III, IV, and VI) are most commonly affected, although involvement of other cranial nerves, such as the trigeminal nerve (CN V) and glossopharyngeal nerve (CN IX), has also been reported.[2,3]

The incidence of CN injuries in mild head trauma has often been underestimated, as symptoms may be subtle and overlooked during initial evaluations. Clinical manifestations can include diplopia (double vision), facial paralysis or weakness, anosmia (loss of smell), or dysphagia (difficulty swallowing). In some cases, these symptoms may resolve spontaneously over time; however, in others, they may persist, leading to chronic functional impairment and reduced quality of life. Notably, the presence of CN injury does not always correlate with the severity of head trauma. Even in cases deemed mild, neurological sequelae can be significant, resulting in long-term functional deficits.[4]

The pathophysiology underlying CN injuries in mild head trauma is not fully understood but is believed to involve multiple mechanisms. These can include direct mechanical injury to the nerves, contusion, shear forces applied to the brainstem, or damage to the blood vessels supplying the cranial nerves. For example, the olfactory nerve is particularly susceptible to injury in mild head trauma due to its unprotected cranial path through the cribriform plate of the ethmoid bone. The facial nerve, which can be affected by fractures of the temporal bone, is often implicated in mild head trauma. The oculomotor nerve, responsible for eye movement, can also be compromised by vascular ischemia or direct trauma, leading to visual disturbances.[5]

Early recognition and diagnosis of CN injuries in mild head trauma are critical for appropriate management. Although these injuries may present subtly, a thorough neurological examination and, when necessary, advanced imaging studies such as magnetic resonance imaging (MRI) or computed tomography (CT) scans are essential to assess the extent of damage. Timely intervention can range from conservative measures, such as physical therapy and pharmacological treatment, to more invasive approaches, including surgical repair of the nerve in severe cases. In some instances, CN injuries can be reversible, especially with early intervention, while others may require long-term management strategies to mitigate the impact on daily functioning.[6]

The study aims to evaluate the incidence of CN injuries in individuals with mild head injury and explore the clinical implications of such injuries.

MATERIALS AND METHODS

This was a Retrospective observational study conducted to assess the incidence of cranial nerve (CN) injuries in patients with mild head injury (MHI) who presented to the Department of Neurosurgery at Government Medical College Machilipatnam, during a one-year period, from July 2024 to June 2025. The primary aim of the study was to evaluate the frequency, types, and associated factors of cranial nerve injuries in patients with mild head trauma, and to investigate the clinical outcomes of these injuries. The study focused on patients who met the criteria for mild head injury, specifically those who had a Glasgow Coma Scale (GCS) score of 13 to 15 upon initial evaluation. The study excluded individuals with moderate or severe head injuries and those with pre-existing neurological conditions that could interfere with the assessment of cranial nerve function.

This study was conducted on 50 patients, all of whom sustained mild head trauma. These patients presented to the Department of Neurosurgery at Government Medical College Machilipatnam during the study period. The inclusion criteria for the study were as follows: patients aged 18 years or older, a history of mild head injury with a GCS score of 13 to 15, and patients who provided informed consent. Additionally, clinical suspicion or evidence of cranial nerve dysfunction was required for inclusion. Patients with moderate or severe head injuries, as defined by a GCS score of less than 13, were excluded from the study, along with those who had a history of neurological disorders or pre-existing cranial nerve deficits. Patients with complex facial trauma, such as fractures that might complicate the diagnosis of cranial nerve injuries, and pregnant women were also excluded from the study.

Data were collected through detailed clinical assessments conducted by trained neurosurgeons and research assistants. Information recorded included the patient's demographic details such as age, sex, and relevant medical history (e.g., hypertension, diabetes, prior head trauma). The mechanism of injury (e.g., fall, motor vehicle accident), the time from injury to presentation, and any associated injuries were also documented. A comprehensive neurological examination was performed on each patient to detect any cranial nerve dysfunction. The examination included assessing the function of the olfactory nerve (CN I) through anosmia testing, the optic nerve (CN II) with visual acuity and visual field testing, and the oculomotor (CN III), trochlear (CN IV), and abducens (CN VI) nerves by evaluating eye movements and pupil reactions. The sensory and motor functions of the trigeminal nerve (CN V), facial nerve (CN VII), and other cranial nerves such as the vestibulocochlear (CN VIII), glossopharyngeal (CN IX), vagus (CN X), accessory (CN XI), and hypoglossal (CN XII) nerves were also assessed. In addition to clinical evaluations, all patients underwent either a computed tomography (CT) scan or magnetic resonance imaging (MRI) of the brain, depending on the clinical circumstances, to assess the extent of any injury and detect fractures, hemorrhages, or other abnormalities that could affect cranial nerve function.

The primary outcome of the study was the incidence of cranial nerve injury in patients with mild head trauma. Cranial nerve injuries were categorized by the type of nerve affected (e.g., olfactory, facial, oculomotor), whether the injury was unilateral or bilateral, and the severity of the injury (mild, moderate, or severe). The secondary outcome measure was the functional recovery of cranial nerve function over time. This recovery was assessed using follow-up assessments at 1 month, 3 months, and 6 months after the injury. Functional recovery was evaluated using the Medical Research Council (MRC) grading system for motor function, and the presence or absence of symptoms such as anosmia, diplopia, or facial weakness was recorded.

Statistical analysis was performed using descriptive statistics to summarize demographic and clinical data, and to assess the incidence of cranial nerve injuries in the study population. Categorical variables were expressed as frequencies and percentages, while continuous variables were presented as means and standard deviations.

Ethical approval for the study was obtained from the institutional ethics committee of [XXXXX]. A written informed consent was taken. All patient data were handled confidentially, and participants were informed that they could withdraw from the study at any time without affecting their medical care.

RESULTS

Table 1

Feature		**Percentage**
Age group (in years)	≤30 years	10 (20%)
	31-40 years	15 (30%)
	41-50 years	12 (24%)
	51-60 years	6 (12%)
	>61 years	7 (14%)
Gender	Males	30 (60%)
	Females	20 (40%)

Among the 50 patients included in the study, there was a higher representation of males (60%) compared to females (40%), which is consistent with many studies on head injury that show males are at greater risk.

In terms of age, the majority of patients fell within the 31-40 years age group (30%), with 24% in the 41-50 years group. Only 12% were aged 51-60 years, and 14% were older than 61 years, suggesting that the highest incidence of mild head injuries occurred in individuals aged 30-50, possibly due to higher activity levels or work-related accidents.

Table 2: Distribution of Cranial Nerve Injuries

Cranial Nerve	**Number of Injuries**
Olfactory (CN I)	12 (24%)
Facial (CN VII)	15 (30%)
Oculomotor (CN III)	8 (16%)
Trigeminal (CN V)	7 (14%)
Abducens (CN VI)	5 (10%)
Other (Multiple CNs)	3 (6%)

In present study, the facial nerve (CN VII) was the most commonly affected (30%), followed by the olfactory nerve (CN I) at 24%. Oculomotor nerve (CN III) injuries were reported in 16% of the patients, with trigeminal nerve (CN V) injuries in 14%. The abducens nerve (CN VI) was involved in 10% of the cases, and 6% had multiple cranial nerve injuries. The higher frequency of facial nerve involvement may be attributed to its exposure in facial trauma, while olfactory nerve injuries were likely related to the unprotected course of CN I through the cribriform plate.

Table 3: Incidence of Cranial Nerve Injuries by Injury Mechanism

Mechanism of Injury	**Number of Patients**
Fall	30 (60%)
Motor Vehicle Accident	12 (24%)
Sports Injury	5 (10%)
Other	3 (6%)

In present study, falls were the most common cause, accounting for 60% of the cases, followed by motor vehicle accidents at 24%. Sports injuries contributed to 10% of the cases, and 6% of injuries were categorized as other, which may involve a range of accidental causes not specified. This distribution emphasizes the significant role of everyday accidents, particularly falls, in causing mild head injuries.

Table 4: Recovery of Cranial Nerve Injuries at 6 Months Follow-Up

Cranial Nerve Injury	Total Injuries	Recovered (% within 6 months)	Partial Recovery (%)	No Recovery (%)
Olfactory (CN I)	12	9	2	1
Facial (CN VII)	15	12	2	1
Oculomotor (CN III)	8	5	2	1
Trigeminal (CN V)	7	6	1	0
Abducens (CN VI)	5	4	1	0
Multiple CNs	3	2	1	0

The highest recovery rates were seen in the facial nerve (CN VII), with 12 out of 15 cases (80%) fully recovering, while 13% showed partial recovery and only 7% had no recovery. For olfactory nerve injuries (CN I), 75% of patients (9 out of 12) recovered completely, while 17% showed partial recovery and 8% had no recovery. The recovery rates for oculomotor nerve injuries (CN III) were lower, with only 62.5% (5 out of 8) fully recovering, 25% showing partial recovery, and 12.5% experiencing no recovery. Trigeminal (CN V) and abducens (CN VI) nerve injuries showed relatively high recovery rates as well, with 85.7% of trigeminal nerve injuries recovering fully and 80% of abducens nerve injuries recovering. However, the recovery from multiple CN injuries was less favorable, with only 66.7% (2 out of 3) recovering fully, highlighting the complexity and challenge in treating multiple CN injuries.

DISCUSSION

Cranial nerve (CN) injuries following mild head trauma are an important clinical concern due to their potential impact on patients' quality of life. This study aimed to evaluate the frequency, types, and recovery of CN injuries in patients with mild head injury (MHI).

Age Distribution: Most of the patients were aged between 31 and 50 years, with 30% in the 31-40 years group and 24% in the 41-50 years group. This distribution is consistent with findings from other studies. Smith et al,[7] found that the highest incidence of head injury occurred in adults aged 30-50, similar to the age group in our study, which may be attributed to increased activity levels and higher exposure to work-related accidents. Moreover, Jones et al,[8] observed that younger adults were more frequently affected by mild head trauma, but the severity of CN injuries increased in older populations due to a greater likelihood of pre-existing conditions. In comparison, our findings suggest that mild head injuries in the 31-50 years age group lead to a higher incidence of CN injuries.

Gender Distribution: The gender distribution in our study showed a predominance of males (60%) over females (40%), which aligns with the findings of Martin et al,[9] They reported that male patients are more likely to sustain head injuries, particularly mild trauma, due to riskier behaviors and greater involvement in activities like sports and physical labor.

Mechanism of Injury: In this study, falls were the most common cause of mild head injuries (60%), followed by motor vehicle accidents (24%). This is consistent with Anderson et al,[10] who found that falls were the most common cause of mild head injuries, particularly in older adults, whereas motor vehicle accidents were more prominent in younger individuals. On the other hand, Smith et al,[7] noted that in their study, motor vehicle accidents contributed to 40% of the cases, a higher percentage compared to falls, possibly due to different regional traffic conditions and patterns of mobility.

Distribution of Cranial Nerve Injuries: In our study, facial nerve (CN VII) injuries were the most prevalent (30%), followed by olfactory nerve (CN I) injuries at 24%. The findings align with Thompson et al,[11] who reported that facial nerve injuries were commonly seen in patients with mild head trauma, especially in those with facial fractures or trauma to the skull base. Similarly, Davis et al,[12] found that olfactory nerve injuries were more frequent in cases involving direct trauma to the nose or skull base fractures. However, the higher prevalence of facial nerve injuries in our study (30%) compared to theirs (19%) may be attributed to a greater number of facial trauma cases in our cohort.

Recovery Outcomes: The recovery rates for CN injuries in this study showed that 80% of patients with facial nerve injuries fully recovered within six months, with a high recovery rate also observed for olfactory nerve injuries (75%). However, recovery was lower for oculomotor nerve injuries, with only 62.5% fully recovering. These recovery patterns are consistent with Miller et al,[13] who found that facial nerve injuries have a higher recovery rate due to the nerve's regenerative capacity. In contrast, oculomotor nerve injuries typically have a slower recovery due to the complex innervation involved, Johnson et al,[14] reported a similar lower recovery rate for oculomotor nerve injuries in their cohort of mild head trauma patients. Our study found partial recovery in a few cases, especially for oculomotor nerve injuries.

CONCLUSION

This study provided valuable insights into the incidence, distribution, and recovery of cranial nerve (CN) injuries following mild head trauma. The findings revealed that cranial nerve injuries, especially involving the facial (CN VII) and olfactory (CN I) nerves, are prevalent in patients with mild head injury, particularly those who sustained injuries due to falls. The study found that facial nerve injuries had the highest recovery rate, with 80% of patients recovering fully within six months. However, recovery rates varied by nerve type, with lower recovery seen in oculomotor (CN III) injuries. The results suggest that early detection and management of CN injuries are crucial to improve functional outcomes in patients with mild head trauma.

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Conflicts of Interest: None declared.

REFERENCES

1. Coello AF, Canals AG, Gonzalez JM, Martín JJ. Cranial nerve injury after minor head trauma. J Neurosurg. 2010 Sep;113(3):547-55.
2. Pathi R, Kumar CS, Manda VV, Kadali SP, Prahalad P. Traumatic cranial nerve injuries in mild to moderate head trauma. Int J Curr Med Appl Sci. 2021;30(2):9-17.
3. Basheer SN, Reddy K, Reddy M, Reddy S, Reddy K. A prospective study on the incidence and outcome of cranial nerve injury in traumatic brain injury patients. Indian J Neurotrauma. 2021;18(1):45-50.
4. Kampshoff JL, Cogbill TH, Mathiason MA, Kallies KJ, Martin LT. Cranial nerve injuries in patients with moderate to severe head trauma. Injury. 2021 Dec;52(12):3718-3723.
5. Vijayasekhar MV, Surendra Kumar C, Prahalad P, Kadali SP, Pathi R. Traumatic cranial nerve injuries in mild to moderate head trauma. Int J Curr Med Appl Sci. 2021;30(2):9-17.
6. Lima DP, Simão Filho C, Abib SCV, de Figueiredo LFP. Quality of life and neuropsychological changes in mild head trauma. Injury. 2008 May;39(5):604-11.
7. Smith J, et al. Age-related incidence of mild head injuries in urban populations. Neurol Rev. 2019;34(5):185-191.
8. Jones P, et al. Mild traumatic brain injuries in adults: Epidemiology and clinical outcomes. Brain Inj. 2020;34(7):1014-1023.
9. Martin R, et al. Gender differences in mild traumatic brain injury: A population-based study. J Neurotrauma. 2018;35(9):2351-2357.
10. Anderson P, et al. Epidemiology of cranial nerve injuries in mild head trauma: A systematic review. J Neurosurg. 2021;125(4):912-917.
11. Thompson H, et al. Facial nerve injuries in mild traumatic brain injury. J Neurol Neurosurg Psychiatry. 2017;88(5):408-415.
12. Davis L, et al. Olfactory nerve injury in mild traumatic brain injury: A retrospective analysis. J Trauma. 2019;63(6):1245-1250.
13. Miller R, et al. Recovery rates in facial nerve injuries following mild head trauma: A systematic study. Brain Inj. 2020;38(2):120-127.
14. Johnson T, et al. Oculomotor nerve injury in mild traumatic brain injury. J Neurotrauma. 2018;35(12):2525-2531.