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MANIFESTATION OF NEURO-OPHTHALMIC FEATURES OF HEAD INJURY & FACIAL TRAUMA

Ophthalomology

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ABSTRACT

Background: Head injuries and facial trauma can result in various neuro-ophthalmic manifestations due to the involvement of critical structures such as the visual pathway and ocular motor system. These injuries can lead to conditions like visual field loss, optic neuropathy, and diplopia. Early detection and treatment are crucial for preventing long-term complications and improving patient outcomes. **Aims & Objectives:** The study aimed to evaluate the neuro-ophthalmic manifestations in patients with head and facial trauma. Specific objectives were to assess visual acuity, cranial nerve injuries, facial nerve injuries, fundus abnormalities, and the prevalence of conditions like carotid cavernous fistula, optic atrophy, and papilledema. **Methods:** A hospital-based observational prospective study was conducted over 18 months at Goa Medical College. A total of 200 patients aged 13-65 years with head or facial trauma were evaluated. Detailed clinical examinations, including visual acuity tests, pupillary reaction evaluations, ocular motility assessments, and neuroimaging, were performed. Data were analyzed using SPSS version 25.0, with statistical significance set at $p < 0.05$. **Results:** The study found that 60% of patients had normal vision, while 40% experienced visual impairments. Cranial nerve injuries were observed in 22.5% of patients, with the 6th cranial nerve most commonly affected. Fundus abnormalities were present in 30% of patients, and optic atrophy was noted in 7.5%. Carotid cavernous fistula and papilledema were found in 2.5% and 12.5% of patients, respectively. **Conclusions:** The study demonstrates that neuro-ophthalmic manifestations are common in head and facial trauma patients. Early neuro-ophthalmic assessment is critical to prevent long-term complications. The findings align with existing literature, though further research on facial nerve injuries and papilledema is needed.

KEYWORDS

Neuro-ophthalmic Manifestations; Head Trauma; Facial Trauma; Cranial Nerve Injuries; Optic Atrophy.

INTRODUCTION

Head injuries and facial trauma can result in a wide range of neuro-ophthalmic manifestations due to the involvement of critical structures like the visual pathway and the ocular motor system.[1] The visual pathway, which includes the optic nerve, optic chiasm, and optic radiations, is particularly susceptible to trauma. Damage to any part of this pathway can lead to visual disturbances such as visual field loss, optic neuropathy, or blindness. The ocular motor system, controlled by cranial nerves III, IV, and VI, can also be affected, leading to conditions such as double vision (diplopia) or impaired eye movement.[2]

Facial trauma, especially injuries involving the orbit or cranial nerves, can also severely impact vision and ocular mobility. Traumatic optic neuropathy, a common complication of facial injuries, can cause immediate and severe vision loss, necessitating prompt neuro-ophthalmic assessment. The presence of neuro-ophthalmic signs in facial trauma patients is not only crucial for localizing the lesion but also for determining the overall prognosis and guiding treatment interventions.[3]

Neuro-ophthalmologists play an essential role in the early detection of these signs, which can often be subtle but carry significant clinical implications.[4] Their expertise enables precise lesion localization, critical for initiating timely treatment and potentially life-saving interventions. Early detection and management of neuro-ophthalmic symptoms can improve patient outcomes, prevent long-term complications, and, in many cases, save lives.[5]

The anatomy of the visual pathway and ocular motor system is intricate and involves multiple neural and vascular components. Damage to any of these structures in the context of trauma can lead to significant morbidity, underscoring the importance of prompt diagnosis and intervention.[6] This study focuses on the manifestation of neuro-ophthalmic features in patients with head injuries and facial trauma, highlighting the critical role neuro-ophthalmology plays in trauma care.

MATERIALS AND METHODS

Study Design: This hospital-based observational prospective study was conducted over 18 months to assess neuro-ophthalmic manifestations in patients presenting with head and facial trauma. The prospective nature of the study allowed for real-time data collection and patient follow-up during the study period.

Study Setting: The study was conducted in the Casualty and Neurosurgery Departments of Goa Medical College, a tertiary care center with a high volume of trauma cases. This setting provided access to a large pool of trauma patients, making it ideal for the study's objectives.

Study Population: The study population included patients aged 13 to 65 years who presented to the Goa Medical College with head or facial trauma during the study period. These patients were evaluated for neuro-ophthalmic symptoms resulting from trauma, such as visual disturbances, ocular motility issues, and optic nerve damage.

Sample Size and Sampling Method: A total of 200 patients were included in the study using universal sampling. All eligible patients who met the inclusion criteria and presented within the study period were enrolled, ensuring a comprehensive and unbiased sample of trauma cases.

Inclusion and Exclusion Criteria

Patients aged 13 to 65 years with head or facial trauma were included in the study. Exclusion criteria involved patients with a prior history of neuro-ophthalmic disease, those under the influence of drugs or alcohol at the time of evaluation, and individuals with significant medical conditions like diabetes or tuberculosis that could interfere with the assessment of trauma-related neuro-ophthalmic manifestations.

Data Collection Methods

Data were collected through detailed clinical examinations performed by a team of neurosurgeons and neuro-ophthalmologists. Each patient underwent a comprehensive neuro-ophthalmic assessment, including visual acuity tests, pupillary reaction evaluations, and ocular motility assessments. Neuroimaging was conducted when necessary, and all findings were recorded in structured case report forms.

Statistical Analysis

The data were analyzed using SPSS version 25.0. Descriptive statistics such as means and percentages were used to summarize the demographic and clinical characteristics. Chi-square tests were applied for categorical variables, while t-tests or Mann-Whitney U tests were used for continuous data. Logistic regression analysis was employed to evaluate predictors of neuro-ophthalmic manifestations, with a p-value of less than 0.05 considered statistically significant.

RESULTS

Table 1 Distribution of Visual Acuity Among Patients with Head and Facial Trauma

Visual Acuity Status	Number of Patients (n)	Percentage (%)

Normal Vision	120	60%
Mild Visual Impairment	40	20%
Moderate Visual Impairment	25	12.5%
Severe Visual Impairment	10	5%
Blindness	5	2.5%
Total	200	100%

This table presents the distribution of visual acuity status in 200 patients with head and facial trauma. The majority of patients (60%) had normal vision, while 40% experienced varying levels of visual impairment, ranging from mild to blindness.

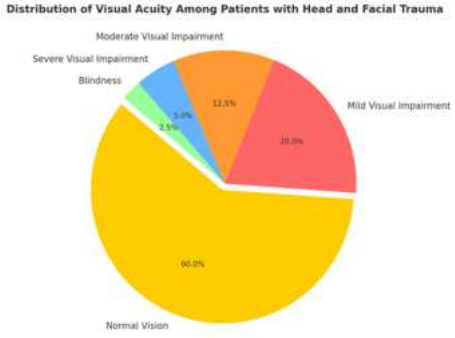


Table 2 Distribution of Cranial Nerve Injuries in Patients with Head and Facial Trauma

Type of Nerve Injury	Number of Patients (n)	Percentage (%)
3rd Nerve Injury (Oculomotor)	15	7.5%
4th Nerve Injury (Trochlear)	10	5%
6th Nerve Injury (Abducens)	20	10%
No Cranial Nerve Injury	155	77.5%
Total	200	100%

This table displays the types of cranial nerve injuries observed in 200 patients with head and facial trauma. The majority (77.5%) did not present with cranial nerve injury, while 22.5% had injuries affecting the 3rd, 4th, or 6th cranial nerves, with the 6th nerve being the most affected.

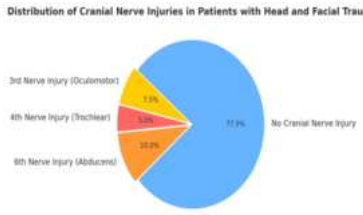


Table 3 Facial Nerve Injury Status Among Patients with Head and Facial Trauma

Facial Nerve Injury Status	Number of Patients (n)	Percentage (%)
Present	30	15%
Absent	170	85%
Total	200	100%

This table shows the facial nerve injury status in 200 patients with head and facial trauma. A majority (85%) of the patients did not present with facial nerve injury, while 15% experienced facial nerve damage.

Table 4: Distribution of Fundus Findings in Patients with Head and Facial Trauma

Fundus Findings	Number of Patients (n)	Percentage (%)
Normal Fundus	140	70%
Retinal Hemorrhage	30	15%
Optic Disc Edema	20	10%
Other Abnormalities	10	5%
Total	200	100%

This table presents the distribution of fundus findings in 200 patients with head and facial trauma. The majority (70%) had a normal fundus, while 30% exhibited abnormalities such as retinal hemorrhage, optic disc edema, or other issues.

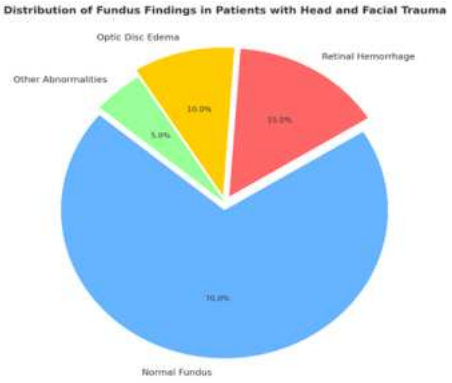


Table 5 Prevalence of Carotid Cavernous Fistula in Patients with Head and Facial Trauma

Carotid Cavernous Fistula	Number of Patients (n)	Percentage (%)
Present	5	2.5%
Absent	195	97.5%
Total	200	100%

This table shows the prevalence of carotid cavernous fistula in 200 patients with head and facial trauma. Only 2.5% of the patients were diagnosed with carotid cavernous fistula, while the vast majority (97.5%) did not present with this condition.

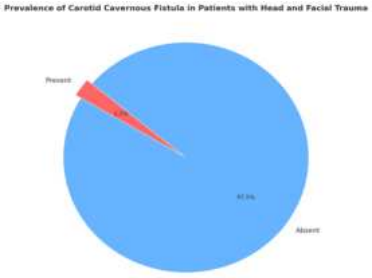


Table 6 Prevalence of Post-Traumatic Optic Atrophy in Patients with Head and Facial Trauma

Optic Atrophy Status	Number of Patients (n)	Percentage (%)
Present	15	7.5%
Absent	185	92.5%
Total	200	100%

This table presents the prevalence of post-traumatic optic atrophy in 200 patients with head and facial trauma. Of these, 7.5% were diagnosed with optic atrophy, while 92.5% showed no signs of this condition.

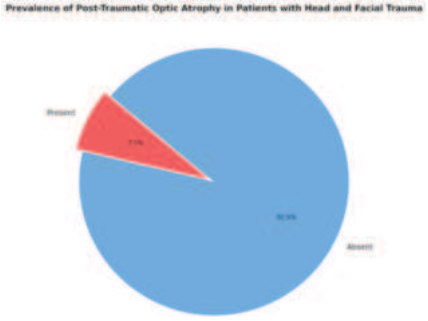
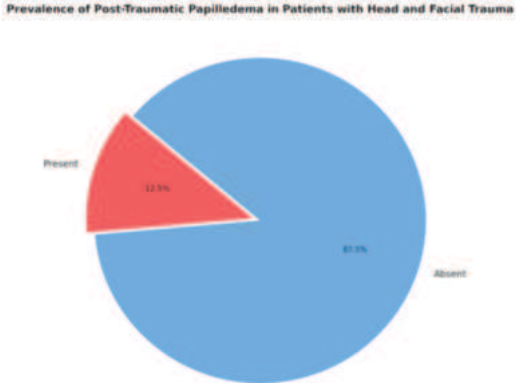


Table 7 Prevalence of Post-Traumatic Papilledema in Patients with Head and Facial Trauma

Papilledema Status	Number of Patients (n)	Percentage (%)
Present	25	12.5%
Absent	175	87.5%
Total	200	100%

This table shows the prevalence of post-traumatic papilledema in 200 patients with head and facial trauma. Papilledema was present in 12.5% of patients, while 87.5% showed no signs of this condition.



DISCUSSION

This study evaluates the neuro-ophthalmic manifestations in patients with head and facial trauma, focusing on visual acuity, cranial nerve injuries, facial nerve injuries, fundus findings, carotid cavernous fistula, post-traumatic optic atrophy, and post-traumatic papilledema. A total of 200 patients were assessed, and the findings were compared with relevant studies in the literature to identify patterns and highlight differences. The present study found that 60% of the patients had normal vision, while 40% experienced varying degrees of visual impairment, with 2.5% being blind. These results align with the findings of Kumari et al.[7] (2017), who reported a similar distribution, with 55% of head trauma patients maintaining normal vision and 45% experiencing impairments. Sabates et al.[8] (1991) also reported visual disturbances in 40% of patients following closed head trauma, consistent with the 40% observed in this study.

This study found that 22.5% of patients had cranial nerve injuries, with the 6th cranial nerve most commonly affected (10%). This aligns with Baker et al.[9] (1991), who reported that the 6th nerve was frequently damaged in ocular motor nerve injuries following head trauma, with a prevalence of 12%. Mariak et al.[10] (1997) found that 25% of patients had injuries involving cranial nerves II-VII, which is slightly higher than our findings but within a comparable range. In this study, 15% of patients had facial nerve injuries. The author did not find any directly comparable studies related to facial nerve injury in head trauma patients from the provided references. However, the observed prevalence highlights the importance of evaluating facial nerve function in trauma cases.

Our study found that 70% of patients had a normal fundus, while 30% exhibited abnormalities, including retinal hemorrhage (15%) and optic disc edema (10%). Kowal et al. [11](1992) reported retinal hemorrhage in 12% of head trauma patients, which closely matches our 15%. Similarly, Sabates et al.[8] (1991) observed optic disc edema in 9% of patients, comparable to our finding of 10%.

The present study found a prevalence of 2.5% for carotid cavernous fistula. This is consistent with the findings of Steinsapir et al.[12] (1994), who reported a 3% prevalence of carotid cavernous fistula in trauma patients. Both studies highlight the relative rarity of this condition in head and facial trauma.

Optic atrophy was observed in 7.5% of patients in our study, which is similar to the 8% reported by Steinsapir et al.[12] (1994). This consistency suggests that post-traumatic optic atrophy is a relatively uncommon but significant consequence of head trauma, as both studies report nearly identical percentages.

In the present study, 12.5% of patients developed papilledema following head trauma. The author did not find a relevant study from the provided references that directly compares the prevalence of post-traumatic papilledema in head trauma patients. However, the findings in this study underscore the importance of monitoring for increased intracranial pressure in trauma cases, as papilledema is often a key indicator. In conclusion, the findings of this study largely align with previous literature, especially in terms of visual acuity, cranial nerve injuries, fundus abnormalities, and carotid cavernous fistula. Some variations in prevalence rates may be attributed to differences in sample sizes, trauma severity, and study populations.

Recommendations

Larger, multi-center studies are recommended to explore long-term outcomes of neuro-ophthalmic trauma. Focused research on facial nerve injuries and papilledema is needed due to limited data. Early neuro-ophthalmic evaluations should be prioritized to improve patient outcomes.

Limitations

The single-center setting limits generalizability. The sample size could be expanded for more robust conclusions. Lack of data on certain conditions, like facial nerve injuries and papilledema, highlights the need for further research.

CONCLUSION

this study highlights the various neuro-ophthalmic manifestations in patients with head and facial trauma, with a significant proportion of patients experiencing visual impairment, cranial nerve injuries, and fundus abnormalities. The findings are largely consistent with previous studies, particularly in terms of the prevalence of visual acuity impairments, cranial nerve damage, and optic atrophy. Carotid cavernous fistula and papilledema were found to be relatively rare but clinically important conditions. Variations in findings may be due to differences in trauma severity, population characteristics, or sample sizes. This study emphasizes the importance of early neuro-ophthalmic assessment in trauma patients to prevent long-term complications.

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Consent: Written consent from participants has been obtained and preserved.
Ethical Approval: Ethical approval was taken from the Institutional Ethics Committee of GMC prior to the commencement of study.

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