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Cranial nerve injuries in adult faciomaxillary trauma: prospective study in a tertiary referral centre

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ABSTRACT

Background: Cranial nerve injury is often an overlooked aspect of faciomaxillary trauma. Most of these injuries do require active intervention in the acute stage. Cranial nerve injuries require long-term management, repeated surgical procedures or reconstructive measures.

Methods: The study was conducted for one-year prospective study of clinical evaluation of 180 patients with faciomaxillary injuries from May 2017 to May 2018 at tertiary care hospital. There were 154 male patients (86.3%) and 26 (13.7%) female patients. The patients from the age of 18 onwards were included in the study group after obtaining consent. A number of parameters, including age, gender, injury of cranial nerve injuries, sensory and motor deficit in relation to soft tissue trauma and bone fracture were evaluated. The objective of the present study is to evaluate early management and document the frequency of cranial nerve injuries associated with maxillofacial trauma.

Results: In 180 cases of faciomaxillary trauma, 60 patients presented with cranial nerve injuries including olfactory, optic, trigeminal, facial, vestibulocochlear, abducens nerve either as an isolated or combined cranial nerve injuries. Out of which most common nerve to get injured was trigeminal followed by facial nerve observed in our study.

Conclusions: Cranial nerve injury in maxillofacial trauma is significant and it should be addressed at the time of treatment so that quality of life of patient is improved by getting back his sensory and motor functions of the injured nerves.

Keywords: Cranial nerve, Head injury, Facial injury, Optic nerve injury

INTRODUCTION

Hippocrates first described cranial nerve injury (optic nerve) following head injury when he wrote, "dimness of vision occurs in injuries of the brow and those placed slightly above". Examination of the faciomaxillary trauma patient meticulously and looking for signs and symptoms of cranial nerve injury is important.

Searching the literature, there is a paucity of documentation especially of its incidence, clinical significance with special reference to disability and

prognosis.² Complete evaluation of individual cranial nerves, though a time-consuming and elaborate exercise is important in a conscious patient and it may not be feasible in a comatose patient or in one with altered sensorium.³ Cranial nerve injuries increase the morbidity of already suffering patients by giving rise to visual loss, olfactory disturbances, hearing and equilibrium, taste, speech etc.

Though much emphasis is given in treating the bony fractures and facial deformities, special interest should be shown towards the evaluation of cranial nerve injuries by clinically and by application of modern technology.⁴ Though every institution spends much money towards the purchase of radiological evaluation which would be showing the anatomical defect, functional evaluation of the cranial nerves by olfactometer, electrogustometry, neurodiagnostic test for facial nerve etc are not given importance.

Our study is to stress the importance of the cranial nerve evaluation in patients with faciomaxillary trauma by describing the prevalence, cranial nerve injures, severity of injuries clinically. This would in due course will stress the demand for providing the infrastructural support for further evaluation.

METHODS

Study design: A prospective cohort study.

Study place

The study was conducted at Government Stanley Medical College and Hospital, Chennai.

Study period: The study was conducted for one year from May 2017 to May 2018.

We studied 180 consecutive cases of faciomaxillary injury. 60 of these patients were found to have cranial nerve injuries and were included in this study. The patients were grouped into mild, moderate and severe head injury, based on the GCS at the time of admission-mild (13-15), moderate (9-12), severe (<9).

All patients were investigated with cranial scan of the brain at the time of admission. Clinical examination of cranial nerves was done meticulously. High-resolution temporal bone CT scan, audiogram, CT facial bones with 3D reconstruction and other investigations were done with thorough clinical examination.

Optic nerve 3, 4 and 6 nerves were evaluated by ophthalmologist based on visual field analysis, colour vision and perimetry done for optic nerve examination, extraocular movements for 3, 4 and 6 cranial nerve injuries.⁵ Facial nerve level of lesion assessed using electrophysiological ENoG and topodiagnostic tests and clinically motor functional deficit was evaluated by checking facial expressions i.e., asking the patient to perform various facial movements like producing wrinkles on the forehead, raising the eyebrows, tight closure of the eyes, smiling, showing teeth and whistling. Vestibulocochlear nerve assessed by audiometry, caloric testing and VNG. Post traumatic sensory and motor deficit was studied objectively through light touch with cotton pellets and pin prick by using sterile needle performed bilaterally on the face in the distribution of trigeminal (sensory) nerve. Cranial nerves like olfactory, glossopharyngeal and vagus and hypoglossal examined clinically.

Incusion criteria

All adult patients from 18 years onwards who came to hospital with faciomaxillary trauma and patients with faciomaxillary trauma with GCS>12 were included in the study.

Exclusion criteria

Patients with faciomaxillary trauma associated with intracranial injuries which would cause cranial nerve injuries. The patients with previous neurological deficits in the oral and maxillofacial region due to previous trauma, or any systemic disease that may cause neurological deficit including both sensory and motor function deficit and patient unwilling and uncooperative for the study were excluded.

The informed consent was taken from the patients for performing various diagnostic procedures, use of photographic and radiographic readings of the patients for scientific and educational purposes and publication of these materials where ever required.

RESULTS

In this prospective cohort study on faciomaxillary trauma about 180 cases were screened for cranial nerve injuries out of which 60 patients had cranial nerve injuries either as isolated injury or combined cranial nerve injuries. Study group with male patients 154 and female as 26 and more common age group were between 18 to 30 years of age.

Olfactory nerve

In our study, 7 patients presented with total loss of smell, out of which 1 patient had CSF rhinorrhoea which was managed conservatively, 3 patients had isolated injury and 4 patients had multiple cranial nerve injury. After a year of follow-up the showed no improvement in sense of smell.

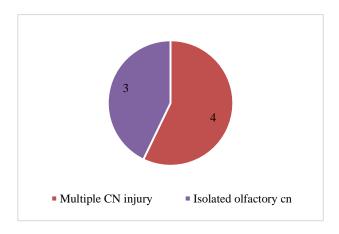


Figure 1: Incidence.

Optic nerve

In our series of cases 7 patients were diagnosed with traumatic optic nerve injury in which 5 cases optic nerve decompression was done within 48 hours, Megadose of IV methylprednisolone (initial dose of 0.75 mg/kg, followed by 0.33 mg/kg every six hours for next 24 hours) showed vision improvement 70%. 1 case has been referred to our institute after 15 days of trauma, oral steroids from the day of injury was started showed 10% vision improvement. 1 case of optic chiasma injury with associated optic nerve injury, mega dose steroid showed no improvement.

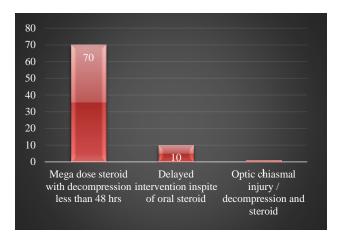


Figure 2: Vision improvement.

Trigeminal nerve injury

20 cases reported with trigeminal nerve injury of which most common branch to get injured was infraorbital nerve in midface, inferior alveolar nerve in lower face. Zygomatic complex fractures showed infraorbital nerve injury, mandibular fractures causing inferior alveolar nerve injuries.

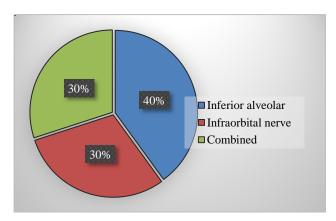


Figure 3: 20 cases of trigeminal n injury.

Abducens nerve

Two cases of abducens nerve injury observed in our study group.

Facial nerve

In our series of case study population, 16 cases were diagnosed with traumatic facial nerve palsy, 10 cases were treated with steroid and surgery with ENoG>50% axonal injury and 6 cases with steroid only with ENoG<50% axonal injury. 5 cases had transverse fracture, 4 cases with longitudinal fracture, 2 patient oblique fracture and 4 patients had no obvious fracture in HRCT temporal bone.

Vestibulocochlear nerve

18 patients presented with 8 symptoms and evaluated with audiological testing, calorie stimulation and clinical vestibular function test and managed conservatively in the form of labyrinthine sedatives and hearing aids in long term.

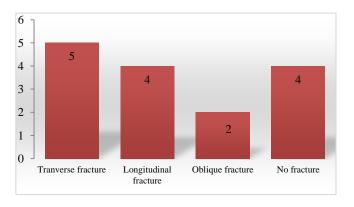


Figure 4: Temporal bone fracture site.

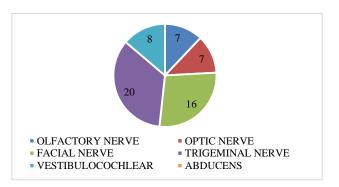


Figure 5: Total cranial nerve injury.



Figure 6: Panda eye sign in orbital floor fracture.

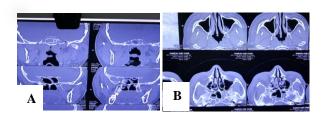


Figure 7: (A) Coronal; (B) axial view of sphenoid sinus roof fracture.



Figure 8: (A) Left side LMN traumatic facial nerve palsy; (B) Schimers test in patient with traumatic facial nerve palsy.



Figure 9: Mandibular fracture.

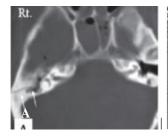




Figure 10: (A) Longitudinal fracture; (B) transverse fracture of temporal bone.

DISCUSSION

Road traffic accident has been the most important cause for faciomaxillary trauma as observed in our study. In our study the patients of age ranging from 18 to 30 years constituted the group with highest frequency of facial injuries consistent with other studies and most of our patients who suffered from motor cycle accidents are mainly driven by male. In literature all over the world males are suffered more than females from maxillofacial trauma. Among the cranial nerves that has been injured, our study showed branches of trigeminal nerve been the commonest compared to other cranial nerve injuries.⁷

Olfactory nerve

Cause of loss of olfaction, due to disruption of the olfactory fibres prior to their decussation. Olfactory nerve is the commonest cranial nerve damaged in head injury. Olfaction is impaired due to injury to the olfactory nerve filaments at the cribriform plate, or due to injury to the olfactory bulb or the olfactory tracts correlates with the study conducted by Patel et al.⁸

In our study, 7 patients presented with total loss of smell out of which 1 patient had CSF rhinorrhoea managed conservatively, in which 3 patients had isolated injury and 4 patients had multiple cranial nerve injury. Similar to the study conducted on post traumatic cranial nerve injuries by Patel et al.¹

Optic nerve injury

The optic nerve is about 4.5 to 5.0 cm in length, of which the intraorbital segment is the longest, and the intraocular segment is the shortest. The intracanalicular portion (contained within the bony optic canal of the sphenoid) measures about 5 to 7 mm and is relatively immobile owing to the fusion of the dural sheath of the nerve to the periosteum.⁹

In our series of cases, 7 cases had optic nerve injury out of which 5 patients managed surgically with mega dose of methylprednisolone, 1 case presented with optic chiasmal injury, 1 case of optic nerve injury managed conservatively. Our study shows similar observation as Patel et al.¹

Trigeminal injury

Branches of trigeminal nerve are often injured during severe maxillofacial and skull base injury, as these nerves exit the various foramina from the skull. ¹⁰ The supraorbital and infraorbital nerves are injured in trauma to the forehead, orbit and maxilla. ¹¹ The inferior dental branch and the mandibular division can be injured in fractures of the mandible, lot of variation in frequency of trigeminal nerve injury in the literature and its incidence varies from 1% to 90%.

In our series of cases, 20 cases reported with trigeminal nerve injury of which most common was infraorbital nerve in midface, inferior alveolar nerve in lower face. Correlates with study conducted on peripheral nerve injuries in faciomaxillary trauma.

Abducens nerve injury

Faciomaxillary trauma with head injury accounts for nearly 3-15% of abducens palsies. In a recent series from India the incidence has been found to be 3.02%, majority of whom had multiple cranial nerve injury.

The long intradural course, its passage over the petrous ridge with its relative fixity under the petro clinoid ligament and to the cavernous sinus makes it vulnerable to stretch or tear. Hyperextension trauma to cervical spine can also cause abducens nerve palsy, accompanied with lower cranial palsies. In our case study 2 cases diagnosed with abducens nerve palsy.

Facial nerve injury

In deceleration injury and facial nerve is injured at its site of tethering: at the geniculate ganglion, where it is tethered by the greater superficial petrosal nerve. The meatal foramen due to its narrow size in the labyrinthine segment is another site of compression. The extratemporal facial nerve, the stylomastoid foramen and the vertical segment are the sites most often injured. The nerve is generally completely transected.

Immediate paralysis occurs due to transection or other form of severe neural trauma, and carries a worse prognosis. Delayed paralysis (after 24 hours of injury), on the other hand, occurs due to nerve edema and swelling of the nerve within its sheath or epineurium, and carries a better prognosis. ¹³ Delayed paralysis can also occur due to external compression by an expanding haematoma or oedema of loose fibrous tissue and periosteum between the nerve and the bony canal.

Patients presented with LMN type facial nerve palsy, hemotympanum, battels sign and investigated with high resolution CT temporal bone, audiological evaluation and ENoG to decide upon the need for surgery, topodiagnostic and electrophysiological testing been done, approaches used for facial nerve decompression were trans canal and trans mastoid approach. ¹³

Facial nerve paralysis House Brackman grading system Correlates with study conducted on peripheral nerve injuries in faciomaxillary trauma.

Vestibulocochlear nerve injury

Hearing loss can occur due to damage to the nerve, end organ or the conducting elements. Pressure waves generated by a blow to the head damage the hair cells in the cochlea and cause high frequency hearing loss and tinnitus.¹

Conductive deafness usually shows useful recovery and is amenable to surgical intervention. However, sensorineural deafness shows poor recovery, especially if the hearing loss has been complete. Tinnitus is usually self-limiting and requires no more treatment than reassurance. However, labyrinthine symptoms (vertigo, nausea, dizziness) may persist, and may require treatment with labyrinthine sedatives. Vertigo and nystagmus was more common in-patient with transverse temporal bone fracture and are more refractory to medication shows similar results of the study conducted by Patel et al.¹

In our study population 18 patients presented with vestibulocochlear symptoms and evaluated with audiological testing, calorie stimulation and clinical vestibular function test and managed conservatively in the form of labyrinthine sedatives and hearing aids in long term.

CONCLUSION

In our prospective study population of 180 cases of faciomaxillary trauma in a tertiary care centre showed trigeminal nerve injury being the commonest in which infraorbital branch followed by facial nerve injury. Early intervention of traumatic optic neuropathy showed good prognosis. ENoG in traumatic facial nerve palsy showed need for surgery based on the axonal injury. Olfactory dysfunction did not show any improvement in a year after follow-up. Early identification and management of facial and optic nerve injury as an ENT surgeon gives a guarded prognosis, since these nerve injuries can be devasting if not identified earlier and managed. At last team approach is much needed for identifying and early intervention in cranial nerve injuries of faciomaxillary trauma.

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Institutional Ethics Committee

REFERENCES

- 1. Patel P, Kalyanaraman S, Reginald J. Post-traumatic cranial nerve injury. Ind J Neurotrauma. 2005;2(1):27-32.
- Mahapatra AK. Rationale of optic nerve decompression in optic nerve injury. Ind J Neurotrauma. 2004;1:33-6.
- 3. Gjerris F. Traumatic lesion of visual pathway. In: Vinken PJ, Bruyn GW, eds. Handbook of Clinical Neurology. Amsterdam: North Holland Publishing Company; 1976: 24.

- 4. Hughes B. Indirect injury of optic nerve and chiasm. Bull John Hop Hosp. 1962;111:98-126.
- 5. Tos M. Fractures of the temporal bone. The course and sequelae in 248 fractures of the petrous temporal bone. Acta Otolaryngol. 1973;75(4):353-4.
- 6. Guy J, Sherwood M, Day AL. Surgical treatment of progressive visual loss in traumatic optic neuropathy. J Neurosurg. 1989;70(5):799-801.
- 7. Keane JR, Baloh RW. Post-traumatic cranial neuropathies. In: Evans RW, ed. The Neurology of Trauma. Philadelphia: Saunders; 1992: 849-868.
- 8. Doty RL, Yousem DM, Pham LT. Olfactory dysfunction in patients with head trauma. Arch Neurol. 1997;54:1131-40.
- 9. Schecter PJ, Henkin R. Abnormalities of taste and smell after head trauma. J Neurol Neurosurg Psychiat. 1974;37:802-10.
- 10. Sumner D. Post-traumatic anosmia. Brain. 1964;87:107-20.

- 11. Levin HS, High WM, Elsnberg HM. Impairment of olfactory recognition after closed head injury. Brain. 1985;108:579-91.
- 12. Sumner D. Disturbance of the senses of smell and taste after head injuries. In, Vinken PJ, Bruyn BW eds. Handbook of Clinical Neurology Vol 24: Injuries of the Brain and Skull Part 2. Amsterdam: Elsevier; 1976: 1-25.
- 13. Harjinder S, Bhatoe M. Trauma to cranial nerve injuries. Indian J Neurotrauma. 2007;4(2):89-100.

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