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Original Research Article

A Study of Traumatic Brain Injury with Associated Faciomaxillary Injuries, A Clinico Radiological Correlation & Management Outcomes

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Conflict of interest: Nil

Abstract

Background: Traumatic brain injury associated with faciomaxillary trauma is a major cause of morbidity and mortality, particularly following high-velocity road traffic accidents. The close anatomical relationship between the facial skeleton and cranial structures makes early clinicoradiological assessment essential for identifying intracranial injuries and planning multidisciplinary management.

Materials and Methods: This single-centre retrospective study included 124 adult patients with radiologically confirmed traumatic brain injury and concomitant faciomaxillary trauma admitted to the Department of Neurosurgery, Government General Hospital, Kakinada, between August 2023 and August 2025. Demographic characteristics, mechanism of injury, clinical presentation, Glasgow Coma Scale score, computed tomography findings, facial fracture patterns, associated systemic injuries, management modalities and outcomes were analysed using descriptive statistics and appropriate tests of association.

Results: The majority of patients were male (94.4%), with a mean age of 37 years, and the predominant age group was 20–30 years. Road traffic accidents accounted for 80.5% of injuries. Alcohol consumption was reported in 58.6% of assessed patients, while 99% of evaluated patients were not wearing helmets. Maxillary fractures were the most frequent facial injuries, followed by nasal bone, orbital wall, zygomatic and mandibular fractures. Multiple facial fractures were observed more commonly than isolated fractures. The common intracranial findings were pneumocephalus (45.7%), cerebral contusion (33.7%), epidural haematoma (16.3%), subarachnoid haemorrhage (16.3%) and subdural haematoma (13.0%). Epistaxis, loss of consciousness and vomiting were the most frequent clinical presentations. Neurosurgical intervention was required in eight patients, while 40 patients underwent surgical treatment for faciomaxillary fractures. Four deaths were recorded, mainly among patients with polytrauma and associated systemic injuries.

Conclusion: Traumatic brain injury frequently coexists with faciomaxillary fractures, particularly following road traffic accidents. Midfacial and frontal bone fractures should raise a high index of suspicion for associated intracranial pathology. Combined CT evaluation of the brain and facial bones, early neurological assessment and coordinated multidisciplinary management are essential for reducing morbidity and mortality. Improved helmet use, road-safety awareness and strict enforcement of traffic regulations may substantially reduce the burden of craniofacial trauma.

Keywords: Head injury, maxillofacial trauma, craniofacial fractures, Neurosurgical implications, Road traffic accidents.

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Introduction

Head injury is one of the leading causes of mortality and morbidity in the developing as well as developed countries. Approximately 1.5–2 million people are injured and more than one million die every year due to head injury in India [1]. Facial fractures frequently are associated with craniofacial trauma, commonly stemming from incidents such as motor vehicle accidents, falls, assaults, and injuries related to sports [2]. Although these fractures can lead to significant functional

and cosmetic issues, their relationship with traumatic brain injury (TBI) is a crucial yet often overlooked factor in patient care.

Head injuries may occur in isolation and may also occur along with various injuries like long bones, spinal cord injuries, blunt injuries of chest, abdomen and, maxillofacial trauma following high-velocity impacts such as road traffic accidents, falls, and assaults [3].

In this study, we have analysed various clinical presentations of Tbi associated with faciomaxillary injuries. The clinical presentation of facial fractures accompanied by brain injuries can vary significantly, often complicating the initial diagnosis and management.

Neurological symptoms such as loss of consciousness, confusion, and memory loss may be present alongside features of facial trauma, highlighting the importance of a comprehensive neurological evaluation in these situations [4.5.6].

The anatomical proximity between the cranial vault and facial skeleton creates a continuum of injury, where in facial fractures may also present with associated Intracranial pathology ranging from cerebral concussion injury, contusions, and epidural hematomas, cranial nerve involvement, Diffuse axonal injury, and CSF rhinorrhoea [7].

Understanding the relationship between facial fractures and TBIs is essential for optimizing patient outcomes. Prompt recognition of brain injury in patients with facial fractures can lead to early interventions that mitigate long-term neurological deficits.

Aims:

1. To analyze various types of head injuries associated with faciomaxillary injuries and their presentation.
2. To analyze clinicoradiological corelation and various management strategies in a multidisciplinary team approach

Objectives:

1. To assess burden of head injuries and to find out the no. of faciomaxillary injuries associated.
2. To identify various clinical presentations, clinicoradiological corelation of faciomaxillary injuries that are associated with head Injuries.
3. To evaluate various management options and outcomes by multidisciplinary team approach.

Materials & Methods

This is a single centre retrospective study.

Data analysis includes Records of patients presenting with head injury and concomitant facial trauma admitted to Neurosurgery department, GGH, Kakinada, treated both conservatively and surgically in both neurosurgery and plastic surgery departments over past 2 years (August 2023 - August 2025).

Data including demographics, mechanism of injury, Clinical presentation, CT brain findings (SDH, EDH, contusion, pneumocephalus), and type of facial bone fracture, management modality, and outcomes were analysed.

Methodology:

Head injuries were categorized into three grades: mild, moderate, or severe categories (based on the presenting GCS).

The types of cranial fracture were classified by anatomic location as frontal, sphenoid, temporal, parietal and occipital.

Maxillofacial trauma included trauma of the craniofacial skeleton (extending from the frontal bone to the mandible).

Fractures of the facial skeleton based on facial bone imaging were grouped as lower face (LF - mandible), mid face (MF - maxilla, nose, zygoma, and orbits) and upper face (UF - frontal). Systemic injuries were grouped into following categories as lacerations and abrasions, injuries to liver, kidney, bladder and bowels, hemothorax, pneumothorax, loss of vision, fractures, long bone fractures, fracture, and spinal cord injury.

All patients meeting inclusion are studied

Faciomaxillary injuries may present with spectrum of symptoms like epistaxis, CSF Rhinorrhoea, oral bleed, facial asymmetry, racooning eyes along with ear bleed, vomitings, seizures, loss of conscio usness etc

Inclusion Criteria:

1. Patients with radiologically confirmed head injury (CT brain) and clinical/radiological evidence of maxillofacial trauma.
2. All patients with Age ≥18 years admitted under Neurosurgery department.
3. Polytrauma cases were included

Exclusion Criteria:

1. Isolated head injury without facial trauma.
2. Isolated facial fractures without intracranial pathology.
3. Patients with GCS less than 8

Statistical Analysis: Descriptive statistics were used to summarize demographic and clinical characteristics of the study population. The prevalence of brain injury among patients with different types of maxillofacial fractures was calculated to identify potential patterns and correlations. Associations between the types of

facial fractures and clinical outcomes, including the presence of brain injuries, were evaluated using chi-square (χ^2) tests for categorical variables.

Results

In the study, 124 patients were involved, with a significant proportion being male (94.4%) and an average age of 37 years (age range: 18-78 years), Predominant age group being 20-30 years.

(Figure 1) The primary causes of injury were motor vehicle accidents, which made up 80.5% of the cases, followed by falls at 11.4% and interpersonal violence at 6.1%. The remaining 2% of incidents were attributed to sports injuries and occupational accidents.

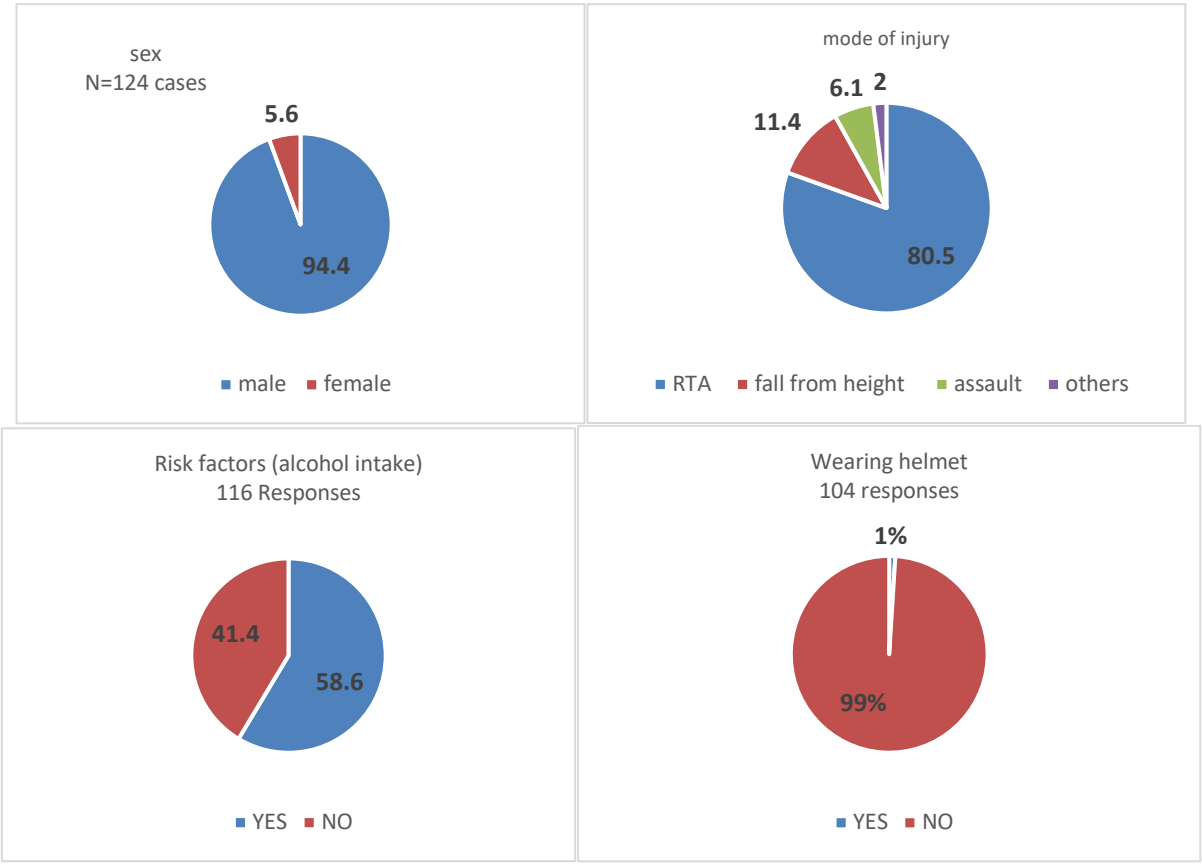
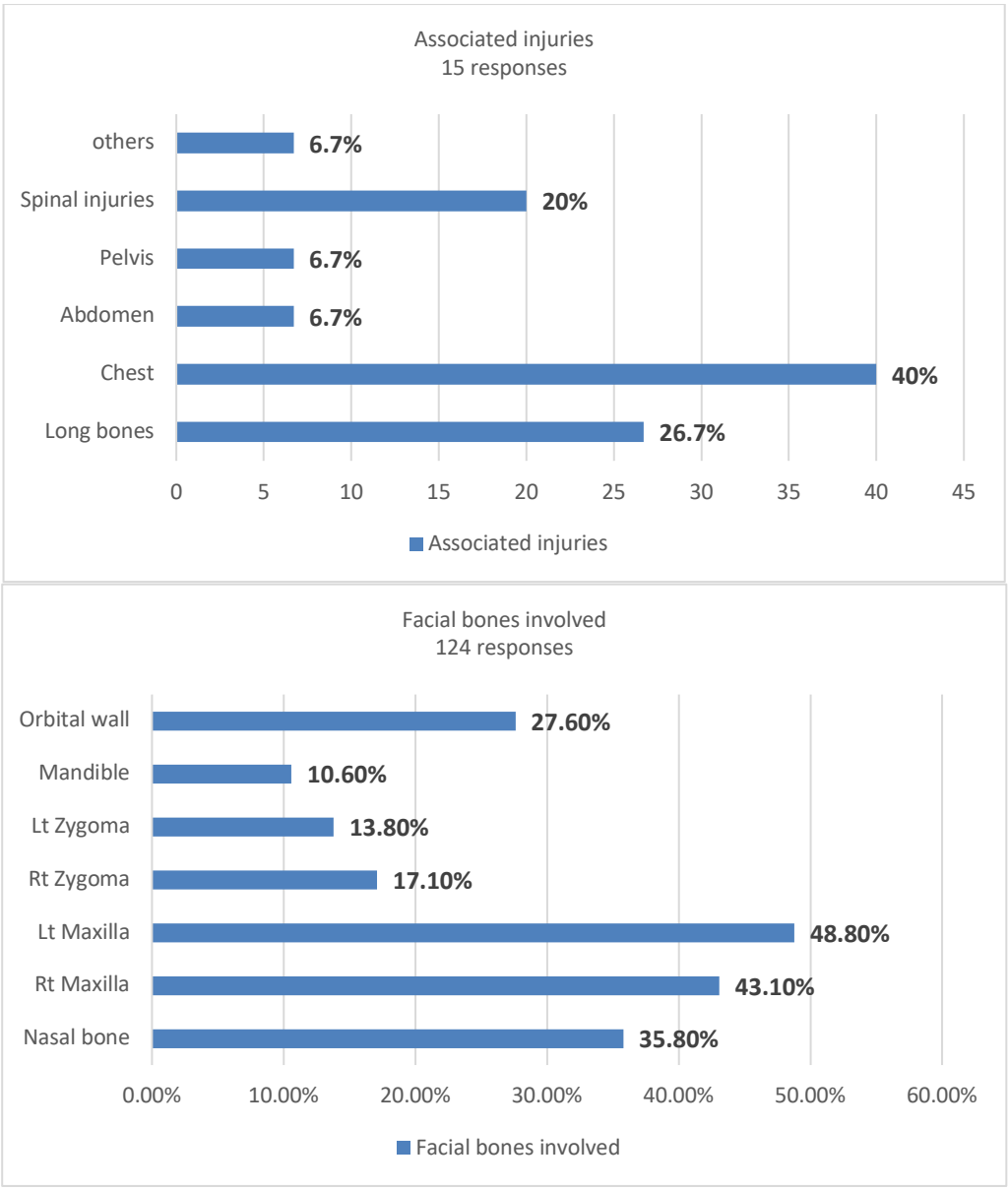


Figure 1:

Facial fractures involving the Maxilla were the most commonly associated with brain injury, found in 53% of patients with brain trauma. Nasal bone fractures were associated with brain injury in 35.8% of cases, while orbital fractures accounted for 27.6%. Patients with zygomatic and frontal bone fractures were more likely to have severe brain injuries, including intracranial hemorrhage and skull fractures, compared to those with mandibular or nasal fractures. Most of the facial fractures were associated with multiple facial bone fractures than isolated fractures cases to be added. Among single bone facial fractures maxillary fractures are predominant.



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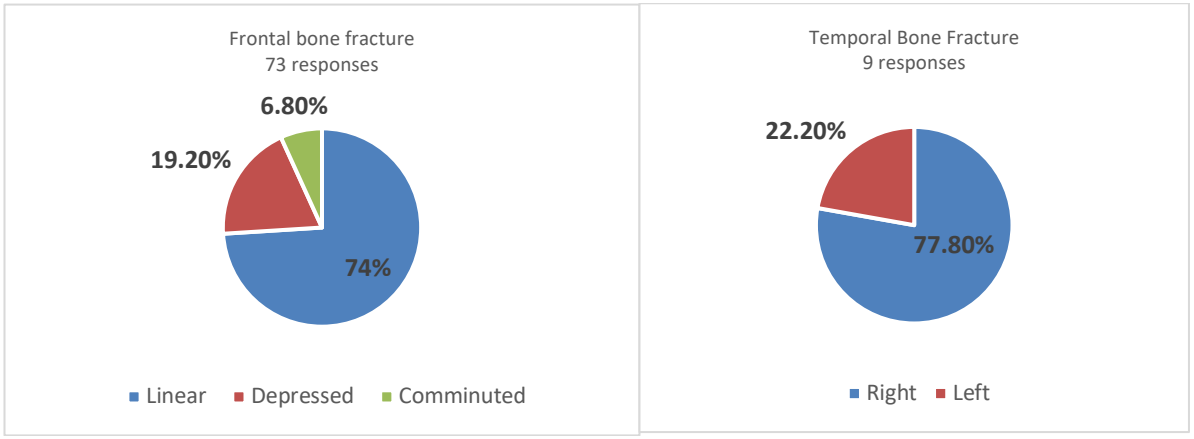

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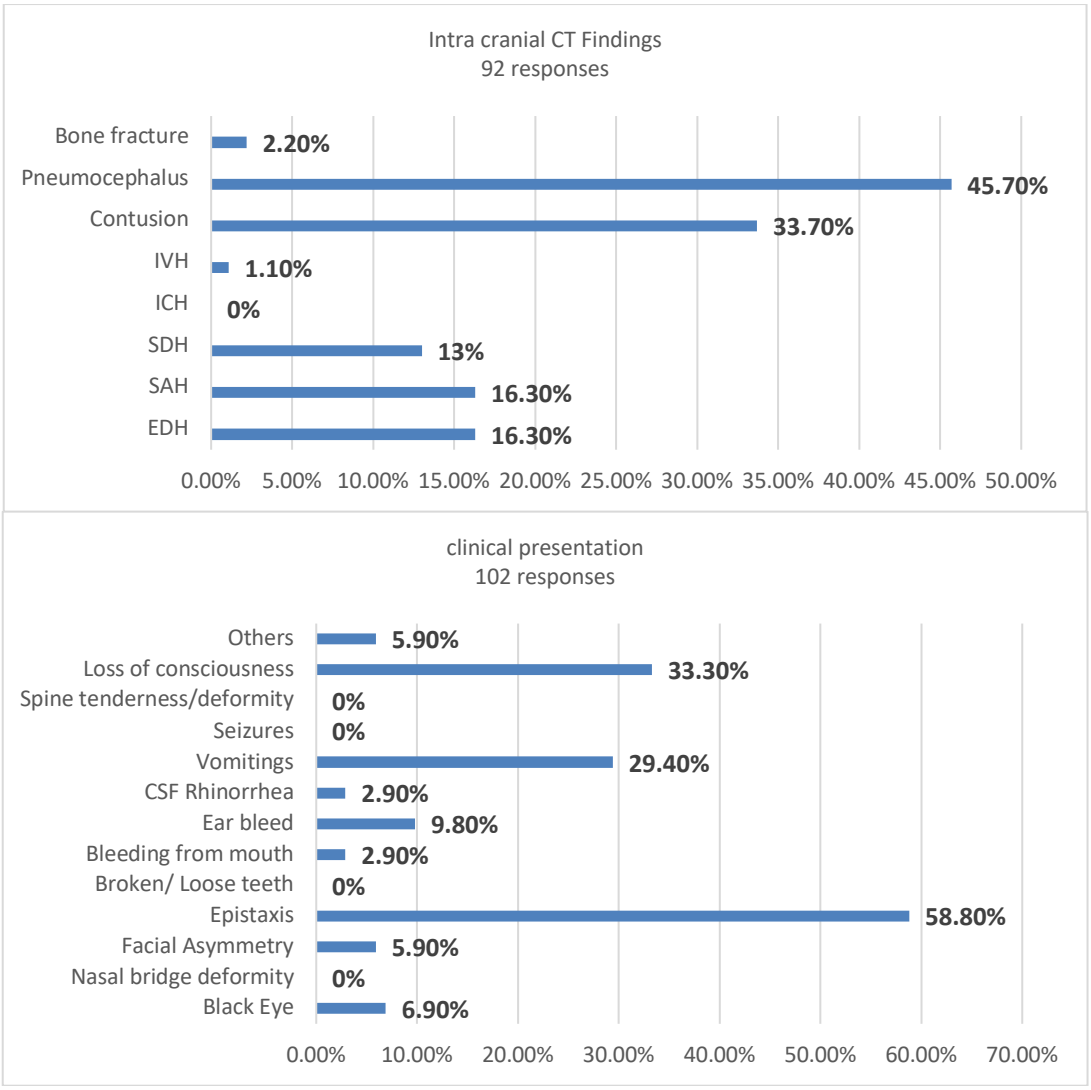

Figure 4:

Of the 124 patients with Cranio facio maxillary injuries, the most frequent types of brain injuries were Pneumocephalus (45.7%), Contusion (33.7%), Sub arachnoid hemorrhage (16.3), epidural hematomas (16.3%) and subdural hematomas (13%).

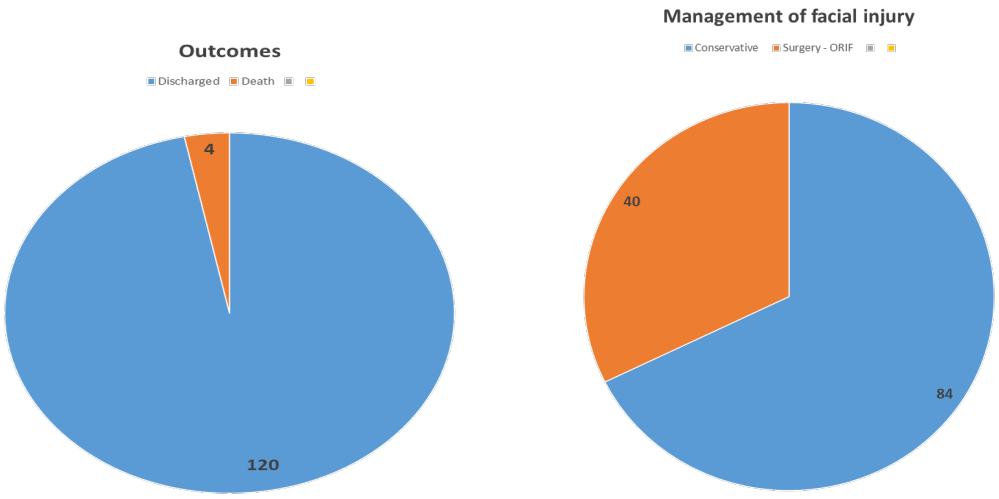

Figure 5:

Surgical intervention was performed for cranial pathologies in 8 cases (6.45%) and for maxillofacial fractures in 40 patients, which represents 33.3% of the total. the surgical treatment of facial fractures was postponed because immediate neurosurgical procedures were necessary, such as craniotomies and management of intracranial pressure.

Surgical procedures done in cranial injury cases -

Decompressive craniectomy -6 cases

Fracture fragment elevation - 2 cases

Surgical procedures done in faciomaxillary injury cases - ORIF (Open Reduction Internal Fixation) for displaced fractures - 27 cases (21.77%)

Maxillary Mandibular fixation for Maxilla and mandible fractures having malocclusion and cross bites - 13 cases

Inferences: Around 1940 cases were admitted under neurosurgery department for head trauma, out of which 124 cases have concomitant cranial and facial trauma were included in this study.

Around 102 out of 124 patients are presented with clinical findings that were discussed above have head injuries with concomitant faciomaxillary injuries

RTA cases predominate more with around 99% patients not wearing Helmets and around 58.6% patients under alcohol influence, Indicating High energy trauma. Male sex preponderance is higher with 94.6% when compared to female patients.

Age – 20-30 years, male, in Road traffic accidents, lack of safety precautions, High speed driving are main contributing factors observed in the study

Frontal bone fractures is seen in around 73 patients (58.87%) with around 40 patients having pneumocephalus in them and CSF rhinorrhoea in 3 cases (3.9%) Maxillary fractures predominates the facial fractures followed by nasal fractures, orbital wall fractures, zygoma fractures, mandible fractures. Most of the patients with craniofacial injuries are presented with complaints of Epistaxis in around 60% of cases f/b Loss of consciousness in 38% of cases.

Multiple facial bone fractures in noted in around 75% of cases than Isolated facial bone fractures, most common being maxillary fractures. 25 cases of Lefort fractures are noted and all of them treated surgically by plastic surgery intervention. 8 cases were operated for cranial injuries and rest all cases are treated conservatively for head injury. 40 cases were operated for facial fractures and rest of cases were treated conservatively with medical management. Overall 4 deaths were encountered in 124 cases with polytrauma that were associated with other systemic injuries like long bone fractures, chest and abdomen injuries.

In this study, we have evaluated statistically the number of head injury patients with associated faciomaxillary injuries admitted in neurosurgical ward by Clinical and radiological correlation and the presence of various types of Intra cranial pathologies in association with facial trauma and treated surgically and conservatively based on Intra cranial pathology.

It is noted that central midfacial fractures were most commonly associated with head injury, and hence, one must have high suspicion index of unsuspected cranial injuries to decrease morbidity and mortality associated with craniofacial trauma. We have evaluated the number of cases managed conservatively regarding faciomaxillary injuries and the number of cases which require ORIF.

We have evaluated and found that not all patients who have associated faciomaxillary injuires require ORIF and can be managed conservatively.

In this study, Facial asymmetry, Gross nasal bone fractures, Mandible fractures with occlusion problems were found to be most common indications for plastic surgery surgical Intervention.

Those faciomaxillary fractures which are not displaced and no occlusional defects were managed conservatively.

Conclusion

In Present study, the increasing number of RTAs in developing countries like India may be attributed to many factors besides severity of injury and clinical spectrum depends upon modify able and non-modify able factors like narrow roads and heavy traffic [8]. In addition to Increasing awareness of public about safety measures and enforcement of strict laws like mandatory use of seat belts and total head guard (with chin protector) rather than the conventional helmets can reduce most of the mandibular and mid facial injuries [9,10].

A significant association between head injuries and maxillofacial trauma was found in this retrospective study. More maxillofacial fractures and lower Glasgow Coma Scale (GCS) scores were associated with a higher risk of suffering a head injury. To rule out any possible brain injuries and lower the risk of death, every patient with a maxillofacial fracture should have a comprehensive clinical and radiographic evaluation. Since even brief episodes of hypoxia and edema can cause significant, long-lasting neurological deficits requiring early Tracheostomy & prolonged ICU care, timely diagnosis and treatment are essential for reducing morbidity and death, especially in

preventing traumatic brain injury (TBI)[11,12]. Even though mid facial fractures outnumber, the upper face fractures including frontal bones are more severe. CT facial bones along with CT brain result in early detection and intervention, thereby improving outcome.

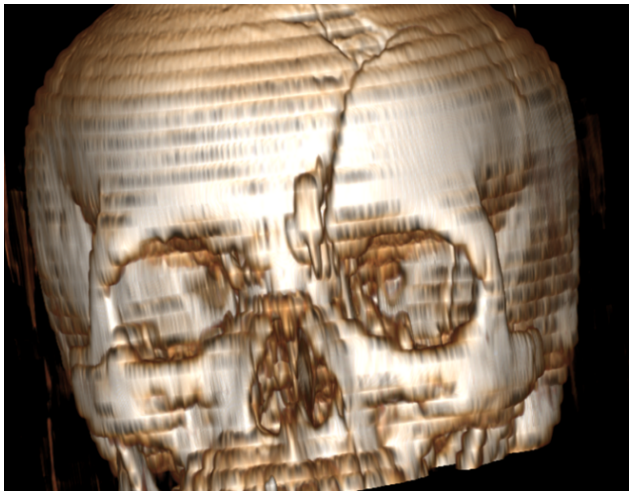

Figure 6: image showing 3D facial bones with Right Zygoma fracture, Nasal bone fracture, Left fronta temporal bone linear fracture of same patient

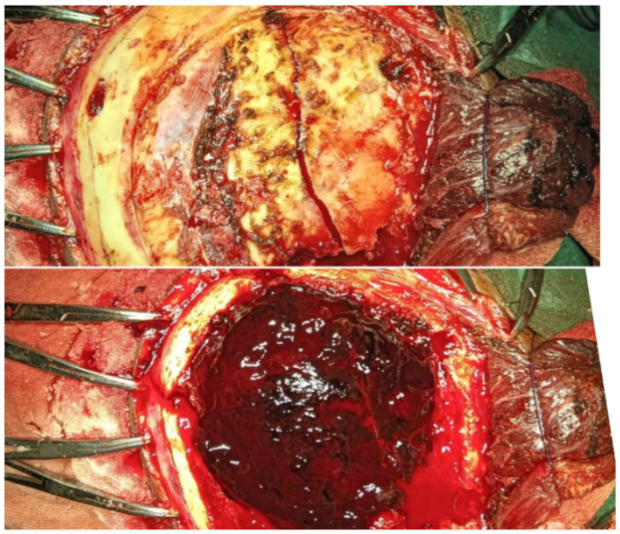

Figure 7: intra operative image showing extra dural hematoma and temporal bone fracture

Discussion

Craniofacial injuries can occur in a significant proportion in traumatic brain injury patients and hence high suspicion required for facial involvement. An understanding of the presentations of craniofacial injuries, associated systemic injuries and patterns of traumatic brain injuries is crucial for improving care, survival and recovery of these patients.

Craniofacial injuries can occur in a significant proportion in traumatic brain injury patients and these will require prompt diagnosis and management.

An understanding of the presentations of craniofacial injuries, associated systemic injuries and patterns of traumatic brain injuries is crucial for improving care, survival and recovery of these patients.

Evaluation of faciomaxillary injuries as per ATLS principles can avoid fracture gross facial deformities & malocclusion problem. Adequate care taken with interdepartmental monitoring[13]. Regardless of the MOI, the most common surgical treatment option used was ORIF. Decisions guiding operative intervention are largely directed by both clinical and radiographic findings such as level of displacement, malocclusion, entrapment, and fracture orientation.

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