

# Clinical and critical care concerns of cranio-facial trauma: A retrospective study in a tertiary care institute

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## ABSTRACT

**Background and Objectives:** Maxillofacial trauma is commonly associated with other injuries, predominantly head injuries. The predictors of outcome in such concomitant injuries have been studied the least. The present study aims at the evaluation of types of injury, management and outcome of patients sustaining maxillofacial trauma and concomitant cranial injuries. **Materials and Methods:** A retrospective study was carried out in the department of anesthesiology and intensive care. A case series of 129 patients was evaluated who were admitted in ICU (Intensive Care Unit) with maxillofacial trauma and head injuries. The data was then compiled systematically and analyzed using SPSS windows and value of  $P < 0.05$  was considered significant and  $P < 0.001$  as highly significant. **Results:** Among the 129 patients, majority of them had roadside accidents (RSA > 90%) and male gender predominance with male to female ratio of 5 : 1. Fracture maxilla and nasal bones were the most commonly encountered injuries (51.93%) followed by mandibular fractures (39.53%) and fracture of zygomatic bones (28.68%). Eighty five patients (65.90%) required mechanical ventilation, tracheostomy was needed in 29 (22.48%) patients and 81 (62.8%) patients were operated for head injuries as well. Majority of the victims were aged between 15 and 40 years. **Conclusions:** Maxillofacial trauma and cranial injuries are common among young males and so is the nature of injuries, that is, RSA. Besides facial injuries, head injuries are important determinant of outcome in such patients. Timely resuscitation and surgical interventions at specialized centers are of prime importance as far as a better prognosis is concerned in such injuries.

**Key words:** Craniofacial trauma, head injuries, maxillofacial injury, mechanical ventilation, tracheal intubation, tracheostomy

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## INTRODUCTION

The increasing number of road traffic accidents in our

country has made it extremely difficult to analyze the exact reported incidence of mortality and morbidity due to airway and facial trauma. The incidence of maxillofacial trauma and airway involvement as a result of roadside accidents is quite varied and an approximate incidence of 22% is reported from developed countries.<sup>[1-3]</sup> In India alone, accidents account for the highest fatality rate reaching to almost peak of 15–20 times than that of developed nations. The roadside accidents have acquired an epidemic proportion and are putting an extra burden on our health resources.<sup>[4-6]</sup>

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The primary management of the injuries, specifically to the airway and facial structures, is of prime importance to the attending anesthesiologist and the intensivist. Maxillofacial trauma is invariably associated with head injuries and injuries to the other vital organs can further increase the mortality and morbidity statistics. Though there is heterogeneity in the actual reported incidences of such trauma but the common denominator in majority of these accidents is the involvement of young males.<sup>[7,8]</sup> Many a times the role of alcohol and drug addiction cannot be overlooked. However, the primary concerns remain about the initial resuscitation and further management of such injuries.

While attending to such patients, numerous challenges have to be faced by the attending anesthesiologist and intensivist besides clinical difficulties. Medico-legal and ethical aspects are also few of the major concerns in the present day scenario of increased awareness among general public when such patients are attended to in various hospital settings. Equally important is the availability of back-up services like intensive care unit (ICU) and trauma team so that the necessary interventions are carried out at the earliest. There are only a few isolated reports in Indian set-up which have reported concomitant maxillofacial trauma with associated head injuries and as such larger studies are required to evaluate and manage such challenging injury patterns. The predictors of outcome in such concomitant injuries have been studied the least. However, the most important aspect during initial assessment include the difficulties of appropriate evaluation of neurological status as majority of these patients are either under the influence of alcohol or suffer serious associated head injuries.

The present study was carried out to analyze retrospectively the demographic profile of the patients, nature of injuries, types of interventions needed, factors responsible for such trauma, management of these injuries and the outcome in these patients, medico-legal and ethical aspects and a genuine attempt for the identification of preventable factors in such injuries.

## MATERIALS AND METHODS

After obtaining the permission from the concerned hospital authorities, the records of 129 patients were reviewed retrospectively who had sustained maxillofacial trauma and concomitant head injury and were admitted in our institute during the period of July 2008 to August 2011. The inclusion criteria consisted of only those patients who had sustained combined cranio-facial trauma and/or associated injuries to neck, chest and peripheral tissues. Patients

with fractures of long bones, pelvic fractures, and blunt abdominal injuries were excluded from the study. The study specifically stresses upon the facts related to demographic profile of the patients, nature and type of injuries, factors responsible for infliction of such injuries, need for airway management/intubation and possible mechanical ventilation, need for tracheostomy and the outcome in such patients due to availability of multiple support facilities. The institute is located on national highway and caters to 4.5–5 lakh of rural population of the adjoining areas.

Patients had received initial resuscitative measures by trauma team in the emergency department after admission. Airway assessment and securing was managed by an anesthesiologist. Blood samples, computed tomography scan, ultrasound and X-rays were the main diagnostic intervention which had been undertaken during initial primary resuscitation. Some of the patients had undergone emergency operative interventions. Rests of the patients had been shifted to ICU for observation and management and after the surgical procedures; operated patients had also been shifted to the ICU. Majority of the patients were mechanically ventilated and in few of them tracheostomy had also been performed for various indications. Delayed surgical interventions had also been carried out after initial conservative management especially for the maxillofacial trauma. During their stay in ICU, routine monitoring had been carried out which included heart rate, blood pressure, pulse oximetry, ECG, end tidal carbon dioxide etc. Day to day investigations had been carried out to monitor and individualize the treatment. Only those patients were discharged who had regained consciousness and had a good recovery.

## Statistical analysis

At the end of study, all the data was arranged and compiled systematically and was subjected to statistical analysis using Mann-Whitney and Chi-square tests using SPSS version 15.0 for windows. Value of  $P < 0.05$  was considered significant and  $P < 0.001$  as highly significant.

## RESULTS

A total of 129 patients were admitted to the emergency ward of our institute from July 2008 to August, 2011 with injuries to facial structures and cranium alone, and/or associated injuries to other organs in few of the patients. Majority of these cases were of roadside accidents that were brought either by relatives and friends or by the passersby and police personals. In all these patients, initial baseline parameters were observed and duly recorded into their respective

records. The demographic profile of these patients is as shown in Table 1.

The nature of injuries sustained by these patients was diverse and majority of them had multiple patterns of injuries as shown in Table 2.

The presenting clinical picture of these patients also exhibited a huge diversity [Table 3]. Ear, nose and throat bleeding was present in a significant percentage of patient population (70.54%). The loss of consciousness (33.33%), restlessness and agitation (25.58%), dyspnea and chest pain (19.38%) and vomiting (11.62%) on admission were the other presenting symptoms and signs. Majority of these patients (91.47%) presented with associated superficial bruises, abrasions, lacerations and external soft tissue injury.

Majority of these patients were managed by immediate airway securing and intubation (59.69%) and immediate operative intervention (41%). Mechanical ventilation, blood transfusion, tracheostomy and ionotropic support was instituted wherever deemed necessary [Table 4].

**Table 1: Demographic profile of craniofacial trauma victims**

Demographic characteristics	Number of patients (total no. of patients n = 129)	Percentage (%)
Age		
> 60 years	7	5.4
40–60 years	27	20.9
15–40 years	81**	62.8
5–15 years	11	8.5
Preschoolers	3	2.3
Gender		
Male	108**	83.72
Female	21	16.28
Location		
Rural	98**	76
Urban	31	24
Alcohol/drug intake	41	31.78
Cause of injury		
Two wheeler riders	74**	57.36
Four wheelers	21	16.28
Pedestrians/cyclists	26	20.15
Fall from the height/assault	8	6.2

\*\*P < 0.001

**Table 2: showing the nature of injuries sustained by the patients**

Nature of injury	Number of patients (n = 63)	Percentage
Fracture maxilla and nasal bones	67	51.93
Fracture mandible	51	39.53
Fracture zygomatic bone	37	28.68
Extra-dural hemorrhage	27	20.93
Sub-dural hemorrhage	23	17.83
Sub-arachnoid hemorrhage	17	13.18
Frontal bone fracture	26	20.15
Cribiform/Ethmoid complex injury	21	16.28
Sphenoid bone fracture	15	11.63
Orbital roof fracture	17	13.18
Associated injuries to other organs	47	36.43

## DISCUSSION

The inclusion of combined maxillofacial trauma and head injury patients alone in the present study was deliberate as the basic concept revolved around the airway and intensive care management and not the surgical aspect alone. Secondly, an attempt was made to assess the predictors of outcome in such patients. The assessment of such patient is very difficult as they are usually either under the influence of alcohol or have decreased GCS score due to associated head injuries. The emphasis was to dwell upon the factors responsible for injuries, types of interventions needed specifically for the airway management, the outcome of timely management and the impact of availability of ICU services and trauma team in the prognosis of these serious fatal injuries.

The demographic profile of our patients throws a light on some significant facts. The number of patients who suffered roadside accidents was significantly higher in the age group of 15–40 years ( $P < 0.001$ ). The male gender predominance (83.72%) among these victims was statistically significant ( $P < 0.001$ ) as was the alcohol consumption (31.78%). Another finding of statistical significance ( $P < 0.001$ ) was that majority of these victims (76%) belonged to rural background. Thus, demographic characteristics of craniofacial trauma are no different from those due to polytrauma where young male predominance is a common characteristic, and in majority of the cases alleged alcohol consumption is invariably present.<sup>[2,9-11]</sup> However, a strikingly different

**Table 3: Clinical presentation of signs and symptoms on admission**

Presenting clinical picture	Number of patients	Percentage
Ear, nose and throat trauma/bleed	91*	70.54
Loss of consciousness	43	33.33
Restlessness/agitation	33	25.58
Dyspnea/chest pain	25	19.38
Circulatory shock	34	26.35
Vomiting	15	11.62
Associated lacerations, bruises, abrasions and external soft tissue injuries	118**	91.47
Mean GCS score	10.8	-

\*P < 0.05, \*\*P < 0.001

**Table 4: Methods of management of injured patients**

Initial admission, diagnosis, management and resuscitation statistics	Number of patients	Percentage
Airway management and intubation	77	59.69
Emergency operative intervention within first six hours	53	41.08
Delayed surgery	76	59
Mechanical ventilation	85	65.90
Immediate blood transfusion requirement	37	28.68
Ionotropic requirement	28	21.70
Chest tube insertion	11	8.52
Tracheostomy	29	22.48
Survival/mortality statistics	101/28	78.29/21.71

aspect from other studies is the predominance of rural population in the present study and this is due to the fact that institute is located on the national highway and there are more than a hundred of villages in the surrounding area which it caters to.<sup>[2,9-11]</sup> The higher consumption of alcohol and substance abuse in our country has further enhanced the statistical record of RTA. Alcohol consumption was a common denominator in 31.78% of our patients. The day by day increasing competition in all the fields has reduced the chances of employment and jobs. As a result, younger generation has to move from place to place in search of a suitable job and sometimes the job demands too much travelling on their part. One other big reason is that males in our Indian society, whether young or old, tend to take responsibility upon them to carry out all the away home chores.<sup>[2,3,9-11]</sup> The increasing use of mobile phones while driving is acquiring an epidemiologic proportion and the number of accidents during such negligent driving has not been reported accurately up till now.

In the present study, nature of head injuries revealed that extra-dural hematoma (20.93%) was the most common finding followed by sub-dural (17.83%) and subarachnoid hemorrhage (13.18%). The injury to skull included fractures of frontal bone (20.15%), sphenoid bone (11.63%), orbital roof (13.18%) and fracture of cribriform and ethmoid bone complex (13.18%) with associated CSF rhinorrhea. There were few associated injuries to other organ systems as well (36.43%), which were not life threatening and included undisplaced fractures of minor bones including ribs, abrasions, bruises and lacerations to various soft tissue structures.

The biggest drawback during initial care includes lack of proper pre-hospital care and the timely transportation of these accident victims to the health centers.<sup>[12,13]</sup> From time to time various guidelines have been published in dealing with craniofacial trauma but till today there is no universally accepted protocol in managing and prevention of this menace in the developing nations like India.<sup>[14]</sup> The popularity of pre-hospital trauma life support guidelines has increased manifold in the west but it is a big laggard in our country due to a multitude of problems. The one big solution is the extensive training of paramedics in the transportation and resuscitation of critically injured patients. At present, our institute has come out with a novel and innovative reform as we have started a 1-year international academic and practical course in critical care for technicians and paramedics in collaboration with a Canadian university. This project is the first of its kind in the country, and the basic aim is to train these primary caregivers with the best of knowledge and practices of both the developing and the developed world.

The most common clinical presentation of these patients to emergency department includes loss of consciousness, agitation and restlessness, oro-nasal bleed, facial swelling, respiratory distress and vomiting and the similar scenario was observed in our study as well.<sup>[12,15]</sup> The most common indication for immediate surgical intervention included depressed skull fracture, extradural hematoma (EDH), sub-dural hematoma (SDH), brain contusion with intracranial bleed, CSF rhinorrhea and fractured maxillofacial bones interfering with airway. Airway management is of prime importance in these patients as the facial fractures, oro-nasal bleed and disrupted facial anatomy throws huge challenges to the attending intensivist in securing the airway. Equally critical becomes the support of circulation as the trauma in these patients is invariably associated with circulatory shock.<sup>[12,15]</sup> Pupillary examination is an important component during initial evaluation but one should not get misguided by these observations as pupillary signs and size can be misleading sometimes due to hypoxemia, hypotension, hypothermia, 3<sup>rd</sup> cranial nerve palsy, and various other etiological factors.<sup>[16]</sup>

The craniofacial trauma throws numerous challenges when they are first attended in the hospital. If the identity of the victim is in doubt, it opens the doors of numerous medico-legal concerns about the initiation of advance treatment after completion of initial resuscitative efforts. Many a times, decision has to be taken on urgent basis as head injury and other associated life-threatening injuries require urgent operative intervention.<sup>[17]</sup> The emergency surgery in craniofacial trauma is further warranted by CSF leak which occurs in 11–12% of cases with basal skull fractures,<sup>[18]</sup> and the incidence in our study prevailed to the extent of 15%. The main goals of neurosurgical intervention at the earliest are to prevent the irreversible pressure changes in the brain, external deformity of the skull, sealing the CSF leak and to avoid meningitis and sinusitis. Sometimes, after the initial resuscitation, surgery is delayed in consideration of the optimization of hemodynamic status and regression of soft tissue swelling. Long-term complications of such injuries include mucocele or pyocele, meningitis, subdural empyema and brain abscess. The controversy is never ending with regards to indication for surgery, timing of surgery, the best operative approach, the choice of material to close dural leaks and bone defects etc.<sup>[18]</sup>

The priority for surgery in craniofacial trauma should be based on collaborative interdisciplinary approach. This warrants a close co-ordination of neurosurgeon, anesthesiologist, intensivist, maxillofacial surgeon, plastic surgeon and the ENT specialist in the process of precise diagnosis, decision about the time of surgery



and surgical approach and availability of intensive care facilities.<sup>[19]</sup> Our task became much simpler as we have a well-equipped trauma unit and a trauma team, which is always available in the hospital for dealing with any type of emergency or mass disaster.

In 77 (59.69%) patients, immediate airway protection and intubation was mandatory on account of their airway trauma, respiratory distress, deteriorating clinical condition, intra-oral bleed and progressively decreasing GCS score [Table 4]. Among 129 admissions, immediate emergency operative intervention was required in 53 (41%) patients who had sustained head injuries while delayed surgery was carried out both for the head injury as well as the repair of facial bones in 76 (59%) of the patients. Mechanical ventilation was carried out in 65.90% of the patients as and when required during different stages of their stay in ICU. Blood transfusion was required due to presenting picture of severe hemorrhage or due to ongoing losses in emergency trauma ward in 28.68% of the victims, while 21.70% of these patients required inotropic support as well for maintaining the hemodynamic stability. Chest tube insertion was necessitated in 8.52% of the patients due to the presenting pneumo-hemothorax. Tracheostomy was performed in 22.48% of the patients and surprisingly this was performed as an elective procedure for various indications and the availability of fiberoptic bronchoscope negated the need for surgical airway intervention in the emergency trauma ward. We observed a mortality of 16.28% in these patients and that was mainly involving the patients with GCS score of less than 5 [Table 4].

The traditional surgical management of complex craniofacial trauma is usually performed in three stages where immediate craniotomy is followed by orbitofacial repair in 7–10 days and last of all cranioplasty is carried out after 6–12 months.<sup>[20]</sup> However, early single stage repair of craniofacial trauma was carried out in 12 of the craniofacial trauma victims due to massive disruption of facial bones and CSF rhinorrhea. The earlier studies have also concluded that such intervention can be undertaken with an acceptable rate of morbidity and mortality, a decreased need for re-operation and improved cosmetic and functional outcome. The further considerations in our cases include decreased ICU stay, cost-effectiveness and lesser anesthetic exposure as well.

But the big question in these circumstances pertains to obtaining the valid consent for such an emergency operative intervention. This problem was faced by us in more than 12% of the patients with craniofacial trauma who had a severe degree of intracranial bleed and disruption of facial bones that necessitated an emergency operative intervention. The consent for

surgery was obtained from the appropriate hospital authorities to proceed for surgery as that was the only possible life-saving measure. Otherwise a delay in the appropriate therapy could have put their life into a situation of no hope. There is huge debate about such interventions and on the basis of medico-legal aspects the answer to such problems is plain one and that is not to undertake any surgical intervention in such circumstances. But if we keep an ethical view in consideration, such operative intervention should be undertaken to prevent the precious lives. Certain protocols and amendments are also required in the constitution to deal with such delicate matters.

In certain other cases when the patient gets identified but the relatives express their inability to bear any expenses of surgery and intensive care, it causes a huge dilemmatic situation for the attending doctors because these types of injuries takes a little time but definitely these interventions are life saving. Referring them to another tertiary government institute again seems to be unethical as not only it will be a time-consuming transportation and wasting precious life-saving moments but will also not ensure whether they will get any timely and appropriate treatment there. The novel solution to this problem at least in our hospital included a clause for free treatment, which is provided to 25–30% of such poor patients who are fighting for their life in emergency wards and ICUs.

The provision of such a treatment methodology is not enough and the root cause of this menace has to be treated both at regional and national levels. Education of the public about all the risk factors of accidents and their hazards has to be properly disseminated. At a local level our institute has been continuously coming up with various educational and awareness camps related to the timely management of all the medical and surgical emergencies and cover more than 120 villages with a total population of more than 4.5–5 lakh. Continuing the efforts on similar lines, the institute is providing training to various volunteers from all these villages and teaching them how to effectively deal with such emergencies especially related to pre-hospital care and their transportation. Institute has deployed ambulances at various critical points along with helpline numbers to deal with such emergencies.

Though the incidence of spinal injury is approximately 10% in such trauma cases but surprisingly we observed cervical spine injury in only 7 patients and fortunately there were no significant neurological deficits in these patients.<sup>[21]</sup> The lower incidence can also be possibly explained on the basis of lower number of total cases in our study, which may have influenced the statistics. As per the American College of Surgeons' Advanced

Trauma Life Support (ATLS) Eastern Association for the Surgery of Trauma guidelines, a missed or delayed diagnosis of cervical spine injury may be associated with permanent neurological damage.<sup>[22]</sup> Though the GCS, no consumption of intoxicants and drugs, no significant distracting injuries and no signs or symptoms related to cervical spine injury are the essential parameters to exclude the diagnosis, it was however not possible in 36.50% of patients as they were under the influence of alcohol and GCS could not be measured with preciseness.

Craniofacial trauma should be managed on priority basis with an emphasis on initial resuscitation measures, which included securing the airway, hemodynamic stabilization and evaluation and treatment of injuries to other vital organs.<sup>[23]</sup> The decision of early and delayed surgical intervention can be well taken by a thorough discussion of the case between the various specialists of the trauma team.

## CONCLUSIONS

Maxillofacial trauma with head injuries demands special attention as airway compromise is invariably present and it is difficult to assess the neurological status always due to inebriated state and severity of head injury. Equally critical is the surgical intervention as simultaneously cranial and maxillofacial surgeries were performed. The management of craniofacial trauma requires special efforts from the well-trained trauma team and the early referral of such injuries to a well-equipped health center do decrease the incidence of mortality and morbidity. The role of pre-hospital care and pre-hospital trauma life support guidelines is as important as advanced trauma life support measures. Preventive measures and legislations regarding traffic rules require a review also as higher incidence of accidents among young adults has acquired gigantic epidemiologic picture. Certain amendments in the constitution as well as strict compliance of road traffic rules are essential to decrease the incidence of such injuries.

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