

Maxillofacial trauma with head injuries at a tertiary care hospital in Chitwan, Nepal: clinical, medico-legal, and critical care concerns

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Aim: Maxillofacial trauma is commonly associated with other injuries, predominantly head injuries. The present study aimed to evaluate 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 oral and maxillofacial surgery. A case series of 63 patients who were admitted to the intensive care unit with maxillofacial trauma and head injuries was evaluated. The data were then compiled systematically and analyzed using SPSS for Windows and values of $P < 0.05$ were considered significant and $P < 0.0001$ as highly significant.

Results: Among the 63 patients, the majority of them had had roadside accidents (90%) and there was a predominant sex bias with a male to female ratio of 7:1. Fractured maxilla and nasal bones were the most commonly encountered injuries (49.21%), followed by mandibular fractures (38.09%). Forty-two patients (66.67%) required mechanical ventilation, tracheostomy was needed in 19 (30.16%) patients, and 42 (66.67%) patients were operated on for head injuries. The majority of the victims were aged between 15 and 40 years.

Conclusion: Maxillofacial trauma with head injuries demands special attention as airway compromise is invariably present. Equally critical is the surgical intervention as simultaneously cranial and maxillofacial surgeries were performed. Preventive measures and legislation regarding traffic rules require a review also as the higher incidence of accidents among young adults has acquired epidemic status.

Key words: Maxillofacial injury, craniofacial trauma, road traffic accidents, head injuries, mechanical ventilation, tracheostomy, tracheal intubation

Introduction

The increasing number of road traffic accidents (RTAs) in Nepal has made it extremely difficult to analyze the exact reported incidence of mortality and morbidity due to airway and facial trauma. The day by day increasing competition in all fields has reduced the chances of employment. As a result, the 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. The increasing

use of mobile phones while driving is acquiring an epidemic proportion and the number of accidents during such negligent driving has not been reported accurately. 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 (1–3). In Nepal alone, accidents account for the highest fatality rate, reaching a peak of almost 15–20 times that of developed nations. RTAs have acquired an epidemic

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proportion and are putting an extra burden on our health resources (4–6).

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. Although there is heterogeneity in the actual reported incidences of such trauma, the common denominator in the majority of these accidents is the involvement of young males (7,8), and orbito-zygomatic complex fractures account for a significant component of facial trauma affecting young people (9). Many times the role of alcohol and drug addiction cannot be overlooked.

A thorough knowledge of the anatomy of the face and airway is essential and helps in saving many lives. Equally important is the availability of back-up services like an intensive care unit (ICU) and trauma team so that the necessary interventions are carried out at the earliest possible time.

The present review 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 to identify preventable factors in such injuries.

Materials and methods

After obtaining permission from the concerned hospital authorities, we reviewed retrospectively the records of 63 patients who had sustained maxillofacial trauma and concomitant head injury over the previous 2 years. The institute is located on a highway, catering to a 2.5–3 hundred thousand rural population. The study specifically stresses upon the facts related to the 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 the availability of multiple support facilities.

Little time was lost in bringing these patients to the emergency department (ED) as our institute is located on the national highway with an easy approach and access. The services of the well-equipped hospital ambulances were sought in many cases with the wide publicity through emergency helpline numbers.

In the ED a rapid assessment of the general condition of the patients was carried out by the trauma team. A rapid clinical examination and airway assessment were made by the attending anesthesiologist using the Glasgow Coma Scale (GCS) score, MP grading, thyro-mental distance, and cervical spine assessment for the possible need to secure the airway. The airway management either in the ED or ICU did not pose much difficulty as a fiber optic bronchoscope was available.

After establishing and securing the airway and carrying out the primary resuscitation, blood samples were sent for the required investigations including the necessary radiological investigations like computed tomography scan, ultrasound, and X-rays. Patients who required immediate operative intervention were shifted to the emergency operation theater after stabilizing their clinical condition and optimization of hemodynamic status. The rest of the patients were shifted to the ICU for further observation and management and after the necessary surgical procedure operated patients were also shifted to the ICU. Mechanical ventilation was carried out as and when required while tracheostomy was also performed in a few patients for various indications. Delayed surgical interventions were also carried out after initial conservative management especially for maxillofacial trauma. During their stay in the ICU routine monitoring was carried out, which included heart rate, blood pressure, pulse oximetry, ECG, end tidal carbon dioxide etc. Day to day investigations was carried out to monitor and individualize the treatment. Only those patients that regained consciousness and had a good recovery were discharged. At the end of study all the data were arranged and compiled systematically and were subjected to statistical analysis using Mann–Whitney and chi-square tests using SPSS version 10.0 for Windows. Values of $P < 0.05$ were considered significant and $P < 0.0001$ as highly significant.

Results

A total of 378 patients were admitted to the ED of our institute in the past 2 years with polytrauma and multiple injuries. Out of these, 63 patients sustained injuries to facial structures and the cranium alone with associated minor injuries to other organs. The majority of these patients were victims of RTAs that were brought in either by relatives and friends or by passersby and police officers. In majority of the cases, the trauma ambulance of our institution was also pressed into service. The demographic profile of these patients is shown in Table 1.

The demographic profile of our patients throws light on some significant facts. The number of patients who suffered RTAs was significantly higher in the age group of 15–40 years ($P < 0.0001$). The male sex predominance (87.30%) among these victims was statistically significant ($P < 0.0001$) as was the alcohol consumption (36.50%). Another finding of statistical significance ($P < 0.0001$) was that majority of these victims (73.02%) had a rural background. The mean time for initiation of resuscitative efforts from the time of injury was calculated to be about 30.32 min with a standard deviation of 7.42 (Table 1).

The numbers of motorbike victims were significantly higher (55.56%) than the cyclists,

pedestrians, and persons in four wheelers like cars, jeeps, etc. who sustained injuries during RTAs (Table 2). There were a few patients (7.93%) who were admitted with maxillofacial trauma and head injury after a fall from a height and assault during personal altercations. All these patients were reported to the police after admission by the emergency medical officer from the medico-legal perspectives. The mean GCS score in these patients was estimated to be 11.2.

The nature of injuries among these patients showed a variety of patterns (Table 3). Thirty-one patients suffered fractures of the maxilla and nasal bones while 24 patients suffered mandibular fractures. Among the head injuries with maxillofacial trauma extradural hematoma (EDH) (22.22%) was the most common finding, followed by subdural hematoma (SDH) (17.46%) and subarachnoid hemorrhage (SAH) (14.28%). The injuries to the skull included fractures of the frontal bone (20.63%), sphenoid bone (11.11%), and orbital roof (14.28%), and fracture of the cribriform and ethmoid bone complex (15.87%) with associated cerebrospinal fluid (CSF) rhinorrhea. There were associated injuries to other organ systems as well (34.92%) that were not life threatening and included undisplaced fractures of minor bones including the ribs, abrasions, bruises, and lacerations to various soft tissue structures.

Table 1. The demographic profile of craniofacial trauma victims.

Demographic characteristics	Number of patients (total no. of patients n = 63)	Percentage
Age	>60 years: 3	4.76
	40–60 years: 6	9.52
	15–40 years: 48**	76.19
	5–15 years: 4	6.34
	Preschoolers: 2	3.17
Sex	Male: 55**	87.30
	Female: 8	12.70
Location	Rural: 46**	73.02
	Urban: 17	26.98
Alcohol/drug intake	23	36.50
Time to trauma and initial resuscitation in minutes (mean \pm standard deviation)	30.32 \pm 7.42	

** $P < 0.0001$

Table 2. The modes of transportation used by the victims.

Cause of injury	Number of patients/percentage
Motorbike	35** (55.56)
Four wheelers	13 (20.63)
Pedestrians/cyclists	10 (15.87)
Fall from height/assault	5 (7.93)
Mean GCS score on admission	11.2

*P < 0.0001

The presenting clinical picture of these patients exhibited a huge diversity (Table 4). Ear, nose, and throat (ENT) bleeding was present in a significant percentage of the patient population (76.19%). Loss of consciousness (36.51%), restlessness and agitation (28.57%), dyspnea and chest pain (17.46%), and vomiting (11.11%) on admission were the other presenting symptoms and signs. The majority of these patients (93.65%) presented with associated superficial bruises, abrasions, lacerations, and external soft tissue injuries.

In 36 (57.14%) patients, immediate airway protection and intubation were mandatory on account of their airway trauma, respiratory distress, deteriorating clinical condition, intra-oral bleeding, and progressively decreasing GCS score (Table 5). Among 63 admissions immediate emergency operative intervention was required in 29 (46.03%) patients who had sustained head injuries, while

delayed surgery was carried out for head injuries as well as the repair of facial bones in 34 (53.97%) of the patients. Mechanical ventilation was carried out in 66.67% of the patients as and when required during different stages of their stay in the ICU. Blood transfusion was required due to a presenting picture of severe hemorrhage or due to ongoing losses in ED in 28.57% of the victims, while 20.63% of these patients required inotropic support as well for maintaining hemodynamic stability. Chest tube insertion was necessary in 6.34% of the patients due to the presenting pneumo-hemothorax. Tracheostomy was performed in 30.16% of the patients and surprisingly this was performed as an elective procedure for various indications and the availability of a fiber optic bronchoscope negated the need for surgical airway intervention in the ED. We observed a mortality of 12.70% in these patients and that mainly involved the patients with GCS scores of less than 5 (Table 5).

Table 3. The nature of injuries sustained by the patients.

Nature of injury	Number of patients (n = 63)	Percentage
Fracture of maxilla and nasal bones	31	49.21
Fracture of mandible	24	38.09
EDH	14	22.22
SDH	11	17.46
SAH	9	14.28
Frontal bone fracture	13	20.63
Cribriform/ethmoid complex injury	10	15.87
Sphenoid bone fracture	7	11.11
Orbital roof fracture	9	14.28
Associated injuries to other organs	22	34.92

Table 4. The clinical presentation of signs and symptoms on admission.

Presenting clinical picture	Number of patients	Percentage
ENT trauma/bleeding	48*	76.19
Loss of consciousness	23	36.51
Restlessness/agitation	18	28.57
Dyspnea/chest pain	11	17.46
Circulatory shock	12	19.05
Vomiting	7	11.11
Associated lacerations, bruises, abrasions, and external soft tissue injuries	59	93.65

Discussion

The inclusion of combined maxillofacial trauma and head injury patients only in the present study was deliberate as the basic concept revolved around the airway and intensive care management and not the surgical aspect alone. The study intended to analyze vital statistics due to craniofacial trauma alone and it was independent of the impact of other concomitant injuries that could have raised the statistical figures of mortality and morbidity. The emphasis was upon the factors responsible for injuries, types of interventions needed specifically for airway management, the outcome of timely management, and the impact of availability of ICU services and a trauma team in the prognosis of these serious fatal injuries.

The demographic characteristics of craniofacial trauma are no different from those due to polytrauma

where young male predominance is a common characteristic and in the majority of cases alleged alcohol consumption is invariably present (2,9–13). The higher consumption of alcohol and substance abuse in this country has further enhanced the statistical record of RTAs. Alcohol consumption was a common denominator in 36.50% of our patients. Another major reason is that males in our Nepali society, whether young or old, tend to take responsibility upon themselves to carry out all the away from home chores (2,3,10–12).

The biggest drawback during initial care includes a lack of proper pre-hospital care and the timely transportation of these accident victims to the health centers (14,15). From time to time various guidelines have been published dealing with craniofacial trauma but to date there is no universally accepted

Table 5. The initial diagnosis, clinical procedures, resuscitation, and the other later therapeutic interventions carried out in these trauma victims.

Initial admission, diagnosis, management, and resuscitation statistics	Number of patients	Percentage
Airway management and intubation	36	57.14
Emergency operative intervention within first 6 h	29	46.03
Delayed surgery	34	53.97
Mechanical ventilation	42	66.67
Immediate blood transfusion requirement.	18	28.57
Inotropic requirement	13	20.63
Chest tube insertion	4	6.34
Tracheostomy	19	30.16
Survival/mortality statistics	55/8	87.30/12.70

protocol for managing and preventing this menace in developing nations like Nepal (16). The popularity of pre-hospital trauma life support guidelines has increased manifold in the west but progress has been slow in this country due to a multitude of problems. Trauma patients have been considered to require expedient transport because they are thought to require a short amount of time between injury and surgical intervention. Patients have the best chance of survival if they reach a trauma center within 1 h of injury; the duration is considered the golden hour in the emergency management of RTAs (17).

The most common clinical presentation of these patients to the ED includes loss of consciousness, agitation and restlessness, oro-nasal bleeding, facial swelling, respiratory distress, and vomiting, and a similar scenario was observed in our study as well (14,18). The most common indication for immediate surgical intervention included depressed skull fracture, EDH, SDH, brain contusion with intracranial bleeding, CSF rhinorrhea, and fractured maxillofacial bones interfering with the airway. Airway management is of prime importance in these patients as facial fractures, oro-nasal bleeding, and disrupted facial anatomy present huge challenges to the attending intensivist when securing the airway. Equally critical becomes the support of circulation as the trauma in these patients is invariably associated with circulatory shock (14,18).

Craniofacial trauma causes numerous challenges when patients are first attended to in the hospital. If the identity of the victim is in doubt, it opens the doors to numerous medico-legal concerns about the initiation of advanced treatment after the completion of initial resuscitative efforts. Many times, a decision has to be made urgently as head injuries and other associated life-threatening injuries require urgent operative intervention (19). Emergency surgery in craniofacial trauma is further warranted by CSF leak, which occurs in 11%–12% of patients with basal skull fractures (20) and the incidence in our study extended to 15%. The main goals of neurosurgical intervention at the earliest stage are to prevent irreversible pressure changes in the brain and external deformity of the skull, to seal the CSF leak, and to avoid meningitis and sinusitis.

Sometimes, after the initial resuscitation, surgery is delayed as a result of optimization of hemodynamic status and regression of soft tissue swelling. Long-term complications of such injuries include muco- 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. (20).

The priority for surgery in craniofacial trauma should be based on a collaborative interdisciplinary approach. This warrants close coordination between the neurosurgeon, anesthesiologist, intensivist, maxillofacial surgeon, plastic surgeon, and ENT specialist during the process of precise diagnosis, decision about the time of surgery and surgical approach, and availability of intensive care facilities (21). Our task became much simpler as we have a well-equipped trauma unit and a trauma team that is always available in the hospital for dealing with any type of emergency or mass disaster.

The traditional surgical management of complex craniofacial trauma is usually performed in 3 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 (22). 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. Previous 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. Further considerations in our cases include decreased ICU stay, cost-effectiveness, and less anesthetic exposure.

The big question, however, in these circumstances pertains to obtaining valid consent for such an emergency operative intervention. This problem was faced by us in 12.70% of patients with craniofacial trauma who had a severe degree of intracranial bleeding and disruption of facial bones that necessitated an emergency operative intervention. Consent for surgery was obtained from the appropriate hospital authorities to proceed with surgery as that was the only possible life-saving measure. Otherwise

a delay in implementing the appropriate therapy could have put their lives at severe risk. There is huge debate about such interventions and on the basis of medico-legal aspects the answer to such problems is simple and that is not to undertake any surgical intervention in such circumstances. However, if we keep an ethical approach in mind and abide by the Hippocratic Oath, such operative interventions should be undertaken to save 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 is identified but the relatives express their inability to bear the expenses of surgery and intensive care, a huge dilemma is created for the attending doctors because these types of injuries take little time but definitely these interventions are life saving. Referring them to another tertiary government institute again seems to be unethical as not only will it result in time-consuming transportation and wasting precious life-saving moments but will also not ensure that they receive 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 lives in the emergency ward and ICU.

The provision of such a treatment methodology is insufficient and the root cause of this menace has to be treated at both regional and national levels. Education of the public about all the risk factors for accidents and their hazards has to be properly disseminated. At a local level our institute has been continuously organizing various educational and awareness camps related to the timely management of all the medical and surgical emergencies and cover more than 40 villages with a total population of more than 4–5 hundred thousand. 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 transportation. The institute has deployed ambulances at various critical points along with helpline numbers to deal with such emergencies.

The incidence of spinal injury is approximately 10% in such trauma cases but surprisingly we

observed cervical spine injury in only 2 patients and fortunately there were no significant neurological deficits in these patients (23). 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 (24). With 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, but it was not possible in 36.50% of patients as they were under the influence of alcohol and the GCS could not be measured with preciseness.

Craniofacial trauma should be managed on a priority basis with an emphasis on initial resuscitation measures including securing the airway, hemodynamic stabilization, and evaluation and treatment of injuries to other vital organs (25). The decision for early and delayed surgical intervention can be well made by a thorough discussion of the case between the various specialists of the trauma team.

In conclusions, maxillofacial trauma with head injuries demands special attention as airway compromise is invariably present. 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 does 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 legislation regarding traffic rules require a review also as the higher incidence of accidents among young adults has acquired epidemic proportions. Certain amendments to the constitution as well as strict compliance to road traffic rules are essential to decrease the incidence of such injuries.

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