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Associated Maxillofacial Injuries in Patients with Severe brain Injuries: Institutional Study of Ateritiary Care Hospital

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Abstract
There is dearth of information in the literature regarding the relationship between head injuries and facial trauma in literature. The objective of our study was to study this important relationship.
We evaluated 230 patients with maxillofacial trauma and intracranial injury admitted to our hospital, between 2012 and 2017. The rate of head injuries associated with facial trauma was 63 %. The most common associated head injury was concussion, followed by cerebral contusion and skull fractures. Falls were most common mode of injury followed by motor vehicle accidents.
This study also revealed that fracture of facial bones in anatomic proximity to the cranium was indicator for an amplified risk of brain injuries.
Keywords: *Intracranial trauma, Traumatic brain injury, maxillofacial injury.*

Introduction

Incidence of traumatic head injuries is significantly increasing worldwide with each passing day. The injury could range from a minor bruise or serious injury on the head and brain[1]. The most common causes of such injuries are road traffic accidents, fall, physical assault or others. Such injuries can often result in unrecoverable brain damage. Patients with maxillofacial trauma are at increased risk for head injuries due to close anatomic proximity of the facial skeleton and cranium. Varying rates of head injuries associated with maxillofacial fracture have been reported in studies; a rate as high as 86 % has been noticed in some [2,3]. Timely recognition of head injuries is an important part of initial assessment and treatment planning in maxillofacial trauma patients which can significantly minimize morbidity and mortality associated with such fatal injuries.

The purpose of the present study is to document the pattern of maxillofacial trauma and head injury in cases of poly-trauma. The interrelation of facial injury and cranial injury was evaluated with the idea to identify which type of facial injury predisposes to intracranial injury most commonly. Such data could support a more efficient management and judicious use of computed tomography to detect brain and skull injuries in patients of maxillofacial fractures.

Material and Methods

This study was carried out at the departments of Neurosurgery, Maxillofacial surgery and emergency medicine, Govt medical college,

Srinagar and cases of head trauma admitted from the year 2011 to 2017 were included in the study. Patients more than 15 years of age presenting to emergency department who were diagnosed of having head injuries were selected. Workup of the patients with trauma included history, complete physical examination, radiographic evaluation, and any other consultations if needed. Patients with minor facial trauma whose history and clinical examination suggested head injury and all patients with a major facial trauma were immediately evaluated by a neurosurgeon. In our center, any trauma patient suspected of having a head injury should have a head CT done. Information about age, gender, cause of injury, pattern of facial and/or head injuries, loss of consciousness, and duration of stay were obtained and recorded. The causes of injury were summarized as falls, road traffic accidents, assault and others. Facial injuries included all forms of facial bone fractures and/or soft tissue injuries. Facial bone fractures were classified as mandibular, Lefort I, Lefort II, Lefort III, dentoalveolar, zygomatic, nasal–orbital–ethmoid (NOE), nasal, frontal sinus fractures and miscellaneous. Head injuries included skull fractures and/or intracranial hematomas (epidural, subdural, intracerebral, and subarachnoid), brain contusions, diffuse axonal injuries and others.

Statistical analysis was performed using descriptive analysis, Pearson's chi-squared test, Fisher's exact test, and the Student's t-test, as applicable. A p-value of less than 0.05 was considered statistically significant. Odds ratios and 95 % confidence intervals were calculated to analyze relationship of different variables to cranial trauma. It was also followed by logistic regression analysis to obtain the predictive ability of any variable in the presence of other factors.

Fig 1 : Frontal bone fracture with raccoon eyes sign.

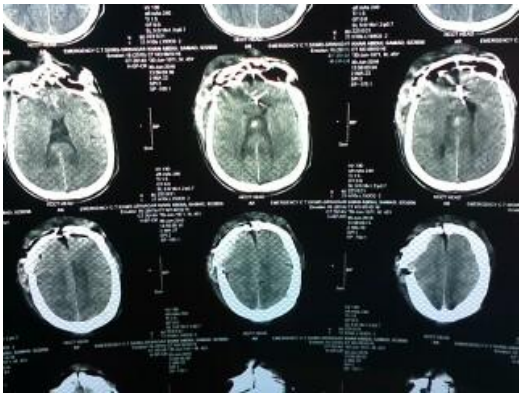

Fig 2 : Severe head injury with skull base, frontal sinus fracture and intracerebral bleed.

Fig 3: Left frontal Extradural haematoma

Results

A Total of 230 patients with head trauma were included in the study. The gender distribution of the study population is as shown in Table 1 below. There were 170 (74%) males and 60 (26%) females.

Table 1. There were 170 (74%) males and 60 (26%) females.

Gender	Total	%Age
Female	60	26%
Male	170	74%
Total	230	

The age distribution of the study population is as shown in Table 2 below.

Table 2. There were 115 (51%) cases between ages 15 – 30, 52 (23%) cases with ages from 31 – 50 years males and 60 (26%) with age over 51 years old.

Age	Total	%Age
15 – 30	115	51%
31 – 50	52	23%
51+	60	26%
Grand Total	115	

Table 3. Presence of facial trauma according to sex

The presence of facial trauma according to age is shows in table 4 along with graphical representation. Out of 115 patients monitored, 59 patients were between ages 15 - 30. From these 59 patients 51 have facial trauma where head injuries were evident, this make 86% of the population.

The patients between 31 - 50 years of ages were 26, where only 14 were found to have facial trauma which makes 54% of the population.

The patients over 51 years of age were 30 where 22 were found to have facial trauma which makes 73% of the population

Age	No	Yes	Total	%Age
15 – 30	8	51	59	86%
31 – 50	12	14	26	54%
51+	8	22	30	73%
Total	28	87	115	76%

Table 5 shows prevalence of facial trauma by gender according to the causes of injuries. Out of 87 patients where facial trauma was also observed 11% female had it because of road traffic accident comparing to 39% male. Fall in female was 9% comparing to 17% male; no assault in female was observed while 14% male had facial trauma during assault.

Table 5. Prevalence of facial trauma by gender according to Cause of injury

Gender	RTA	Fall	Assaults	Others	Total
F	10	8	0	1	19
M	34	15	12	7	68
Total	44	23	12	8	87

Table 6 below shows the details of prevalence of facial trauma by age according to cause of injury. The detail shows higher number of road traffic accident, followed by fall, assault and other causes of injuries.

Table 6. Prevalence of facial trauma by age according to Cause of injury

age	RTA	Fall	Assaults	Others	Total
15 - 30	29	12	7	3	51
31 - 50	6	3	5	0	14
51+	9	8	0	5	22
Total	44	23	12	8	87

Discussion

In literature highly variable incidence of head injuries associated with facial trauma has been reported[4,5]. Lim et al. reports the rate of head injuries in patients with facial bone fractures NEAR 5.4 %, while incidences of 79.4 % and 86 % were reported by Martin et al. and Hayter et al., respectively[6]. In our study, 43.3% of patients with facial bone fractures and 63% of patients with all types of maxillofacial trauma (bone fractures and/or soft tissue injuries) had ASSOCIATED head injuries. Authors suggest that when forces are applied the facial skeleton absorbs the energy of the trauma, protecting the brain from grave injury [7,8]. However, other authors state that when the momentum and energy leading to trauma is significant enough to cause facial fractures, it also has the potential for concomitant head injury [9,10].

In our study 230 patients with head trauma were included with sex ration of 2.8M: 1F which seems to be consistent with previous studies from different part of the globe [8 shazi]. The findings in our study also revealed the most common age group was 15 – 30 years of age; which constituted 51% of all age groups consistent with other

studies [8,16]. The reason for high prevalence of head and facial trauma to this age group (15 – 30 years) as compared to other age group is obvious due to active lifestyle of this age group which leads to increase in accidents and violence [11].

In this study it was also found that males are more commonly involved as compared to females as 74% were male patients and 26% were female patients.

In our study fall from height (trees mostly) was the most common mode of injury followed by road traffic accidents. This was different from other studies which showed most common etiologies were car crash (39%), followed by assaults (28%) [12]. In one important study, the most Common cause was sports injuries (25.8%); followed by road traffic accidents (23.1%); assault (3.4%); work injuries (3.4%)[13]. These differences may be due to difference in socio-economic conditions of each geographical area. reason being that fruit and agriculture is most common proffession in this region while vehicular traffic being not as much of due to poor economic condition of the state.

In our investigation, men with facial trauma were more prone to sustain a concomitant head injury than women due to aggressive driving and violence related activities. Also motorcycle accidents increased the chance of sustaining combined facial and head injuries (mostly riding without helmets), while falls, sports, and assaults were associated with a lower risk. In our state poor traffic law enforcement by police (especially for motorcyclists), and bad road conditions explain why road traffic accidents (especially motorcycle), were the strongest risks for head injuries.

In prior studies, only patients with facial bone fractures had been evaluated excluding those with soft tissue injuries but we observed that nearly 19 % of head injuries occurred in patients with soft tissue injuries alone. Thus, the absence of facial bone fractures does not rule out the possibility of having an associated head injury.

Studies conducted also revealed that amongst facial trauma the most common sites are nose (50%) [14] and maxillofacial trauma (25%) [15] .In our study most common site of facial injury was mandible (55%), maxilla (27%), nose (13%) and others in 5%. However, in studies by Pappachan and Alexander, Haug et al., and Rajendra et al., zygomatic and mandibular fractures were the most frequent maxillofacial fractures associated with head injuries [16, 17] .Because nasal bone fractures may be treated in several services (maxillo- facial surgery, ENT, plastic surgery), its frequency reported in previous studies is so conflicting, which was true for our study also. By the way of Logistic regression analysis we found that frontal sinus and Le-fort II fractures of face were the strongest predictors of cranial injuries in maxillofacial trauma. Frontal sinus fractures were associated with more than 80-fold risk of head injuries. Due to close proximity of the frontal sinus to the brain and the force necessary to fracture it, the chance of concomitant head injury is highest. Also Le-fort II fractures were associated with a nearly 37-fold increase in risk of head injury, reason is, magnitude of force required to cause Le-fort II fractures, with the risk of dural tear in the cribriform plate area associated with this kind of fracture. Mandibular, zygomatic, dentoalveolar, nasal, and Lefort–I and III fractures were also associated to cranial injuries, but to lesser extent.

During the review of literature we found that results of studies evaluating the relationship between facial and head injuries are conflicting. Hohlrieder et al. reported that Le Fort II and III, orbit, nose, zygoma, and maxillary fractures were associated with a 2- to 4-fold risk of intracranial hemorrhage, while mandibular fracture had lowest risk[18]. Kloss et al. reported the zygoma and orbit to be the most common fractured bones patients with intracranial bleed and concomitant facial fractures[19]Haug et al. reported that although the mandible was the most frequent fractured bone in patients with concomitant facial and head injuries, midface fractures were more frequently associated

with closed head injuries than mandible fractures [20] . Our study had somewhat similar results with mandible fracture and cranial injury most commonly associated.

In our study, similar to prior studies, the most common head injury in maxillofacial trauma patients was concussion. Frontal and temporal contusion was the second and acute subdural hematoma was 3rdmost frequent type of head injury. Other studies also reported cerebral contusion as a common type of cranial injury in patients with facial trauma[2].

In our study, 45 % of patients with head injuries had fracture of frontal bone followed by the skull base. Pappachan and Alexander and Haug et al. reported the frontal bone to be the most commonly fractured cranial bone[2] but Hohlrieder et al. reported the basal skull as the most common fractured calvarial bone Because the skull base and frontal bone are in direct anatomic contact with the facial bones, they may be more prone to fracture in facial trauma as compared with other cranial bones. We observed that CSF rhinorrhea was more common in head injuries with facial trauma than those without facial trauma[18].

Most of the patients with concomitant head and facial injuries had a low GCS score (3-8) at the time of admission. Hence cases who present with a low GCS score at admission and apparent severe maxillofacial trauma are more likely to have grave intracranial injuries. Such patients need immediate securing of airway to prevent aspiration and also to keep the airway open. Trauma guidelines recommend intubation and ventilation in all cases with GCS score of less than 8 and falling oxygen saturation levels. Ventilation also helps to keep the intracranial pressures low and buys time till patient is taken for surgical management of brain and maxillofacial injuries if warranted.

Conclusion

We concluded that it is vital to maintain a high index of suspicion for inracranial injuries in all patients with a facial trauma, even those with no obvious signs and symptoms of brain injury. Due to high mortality and morbidities associated with brain injuries, we recommend the routine use of head CT for all patients sustaining a facial trauma and close monitoring of neurological status of these patients. Those patients who have significant facial trauma associated with low level of consciousness first need timely resuscitation and even intubation and ventillatory support otherwise fatality can be high.

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