Clinics of Surgery

Research Article ISSN: 2638-1451 | Volume 11

Concomitant Maxillofacial Injuries and Head Injuries: A Retrospective Study for the Incidence of Coinciding Maxillofacial and Head Injuries

Mustafa Emaduldeen Jameel[1*], Hasan Mijel Bdewi[2]

[1]Neurosurgeon – Alrmadi Teaching Hospital – Iraq

[2]Maxillofacial Surgeon - Alrmadi Teaching Hospital, Iraq

[*]Corresponding author:

Mustafa Emaduldeen Jameel,
Alrmadi Teaching Hospital, Iraq

Received: 18 Jan 2025

Accepted: 05 Mar 2025

Published: 10 Mar 2025

J Short Name: COS

Keywords:

Trauma; Road traffic accident; Head injury; Maxillofacial injury; Concussion; Lefort fracture; Skull Fracture

Citation:

Mustafa Emaduldeen Jameel. Concomitant Maxillofacial Injuries and Head Injuries: A Retrospective Study for the Incidence of Coinciding Maxillofacial and Head Injuries. Clin Surg. 2025; 11(3): 1-9

1. Abstract:

1.1. Background:

The study is a prospective study that was conducted in Al-Ramadi teaching hospital in Iraq. Patients with traumatic brain injuries are at high risk of concomitant facial injuries. Identification of type and severity of these associated injuries is important and these patients need early assessment and management. The study is designed to determine the pattern and incidence of combined head and maxillofacial injuries, the most common etiological factors of these injuries, the common type of head injury and its associated maxillofacial injury with any associated other injuries.

1.2. Result:

A total of 110 patients were presented to the emergency department / AL Ramadi-teaching hospital with concomitant maxillofacial injuries and head injuries; in some cases, also there was associated other body systems or site injuries. The mean of patients age is 28.4 years and the gender distribution is 88 males (80%) and 22 females (20%). The leading causes for the trauma are variable with RTA being the most common cause. The other causes are falling from height, industrial injuries, interpersonal violence, sports injuries, and ballistics injuries. For the resultant type of concomitant injuries, pan facial fracture was the most common type of facial injury. Skull fractures and concussions were the commonly associated type of head injury.

1.3. Conclusion:

There is a close relationship between maxillofacial injuries and head injuries. These concomitant injuries are commonly presented to the emergency department with middle-aged males' prediction. As the severity of maxillofacial injury increases, the severity of head and cervical spine injuries increases and these injuries need early maxillofacial and neurosurgical intervention. The frontal impact is associated with more severe facial and head injuries than the lateral impact.

2. Introduction:

Maxillofacial injuries are greatly associated with head injuries and the patients with traumatic brain injury are at high risk of concomitant facial injuries and vice versa. The facial bones are in close proximity to the cranium, so concomitant injuries are expected [1]. The maxillofacial trauma companied with head injuries are commonly seen in the emergency department with male predominance. Studies show a close relationship between head injuries and maxillofacial injuries. The head injury divided into three categories: brain contusion, skull fracture and intracranial hemorrhage [2]. Patients with head injuries may presented with one or more of these clinical signs:projectile vomiting, loss of consciousness and low Glasgow coma score 8 4.

The maxillofacial injuries could range from isolated facial soft tissue injuries to more severe injuries with facial bones fractures

and associated other body /systems injuries like head injuries, cervical spine injuries,abdominal injuries and extremities injuries [9,10]. The etiology of these injuries is variable between countries; in some cases, road traffic accident and motor vehicle accident are the main causes of these injuries, while in others, the cusses are sporting accidents or inter-personal violence or assaults. The risk of these injures are reported to be significantly increased [3,4,5,6,7]

The facial skeleton consists of thick vertical and horizontal boney buttresses that distribute the force throughout whole facial skeleton and skull 11 figure 1.

It was thought that facial bones act as cushion against impact and protect the underlying neurocranium from severe injury however, this is historical and recent studies show that facial skeleton may directly transmit trauma force to neurocranium and this lead to sever brain injuries8 [12,13].

The studies show a close relationship between head and maxillofacial injuries and these associated injuries usually result in a specific type of injury.The impact that led to these injuries usually is sever and associated with increase the mortality rate[14,15].

We conducted this study because we don't have a similar study in our region and focused on the importance of teamwork and proper management in these types of injuries.

Figure 1: Transilluminated skull and facial bones demonstrating the vertical and horizontal thick buttresses off acial skeleton [11].

3. Material and methods:

3.1. Study design:

The study is a prospective study, a total of 110 patients were presented to the emergency department at Al-Ramadi Teaching Hospital / Iraq were included in the study. The study was started from April 2021 to December 2023. In the emergency department, the details of trauma were recorded from the patient or his relative; these include the trauma etiology, trauma direction, and the mechanism of injuries. The patients in our study were assessed in the emergency department by an ER doctor, neurosurgeon, and maxillofacial surgeon following the ATLS (advanced trauma life support) protocol. Airway securing the cervical spine immobilization with a cervical collar was done early. After ensuring the airway is secured (in some patients, ETT is needed when the Glasgow coma score is below 8), the neurosurgeon assesses the

patient's level of consciousness and responsiveness, pupil reaction to light (direct and consensual reflex), and motor response. The GCS is determined probably by the patient's best motor response, best verbal response, and best eye-opening with a 15 score as the maximum and a 3 score as the least. A quick history from the patient or his relatives about the etiology and mechanism of injury and if any history of loss of consciousness or projectile vomiting in the pre-hospital time was taken, followed by a detailed clinical examination, followed by a brain and facial skeleton CT scan requesting so the type of head and facial injuries and any associated body injuries was determined and managed accordingly Figure 2.

The maxillofacial injuries were classified as isolated soft tissue injuries, isolated bone fractures, and combined soft tissue and bone injuries. The facial fractures are classified by region into mandibular fracture, lefort/maxillary fracture, frontal sinus fracture, zygomatic-maxillary complex fracture, and orbital rim and floor fracture. These patients were examined in the emergency department and the details of the injuries were confirmed by a facial CT scan examination Figure 3.

The maxillofacial surgeon also encountered in airway securing by removing any foreign bodies or blood clotting from the oral cavity and assessing the patient's indication for emergent cricothyroidotomy in cases of pan facial fractures with a clinical sign of upper airway obstruction. In some cases, with bleeding from the fracture site, early fracture reduction and temporary fixation with bridle wire may be needed to control hemorrhage.

The visual acuity, pupil reaction to the light, and ocular motility were also cheeked to exclude orbital compartment syndrome or orbital apex syndrome which may need emergent intervention (sight-saving surgery).

In some patients with severe injuries, an emergent neurosurgical and maxillofacial surgical intervention is needed and for the others, a close follow-up for 72 hours' post-trauma then cases managed

accordingly. For the follow-up protocol, all patients were followed regularly for 6 months postoperatively in the neurosurgical and maxillofacial consultation clinics. Some patients need an ancillary procedure to deal with the post-traumatic / post-surgical residual facial defects.

The aim of this study is to determine the relationship between head injuries and maxillofacial injuries regarding the severity and type of resultant injuries, mechanisms of injuries, age and gender of the patients, and any associated other body injuries.

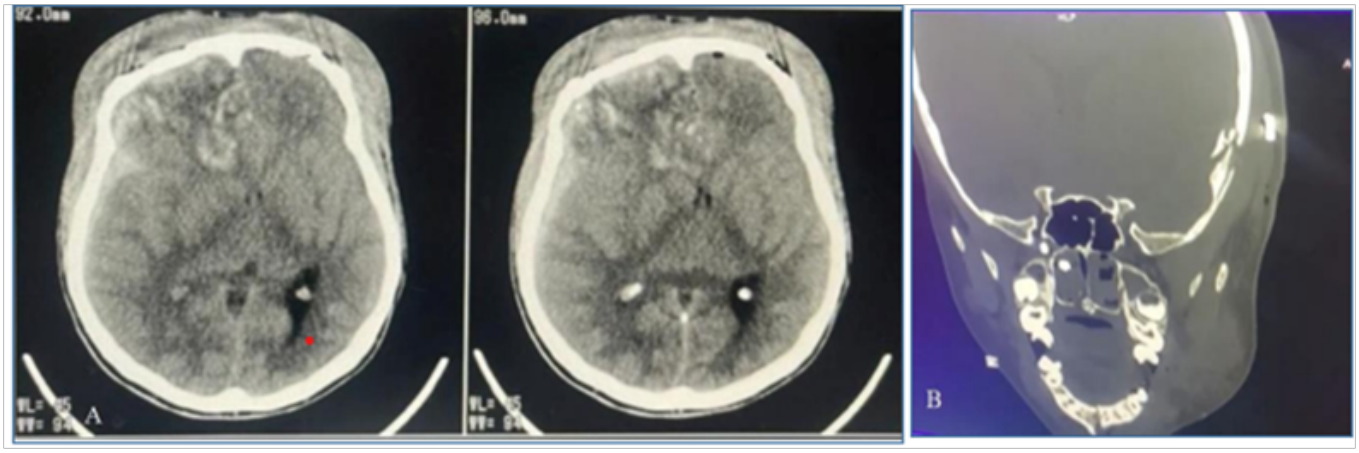

Figure 2: CT scans for patients with concomitant head and maxillofacial trauma.
A: Brain CT scan show intracranial hemorrhage.
B: Coronal CT scan for young patient with multiple head and face shells injury.

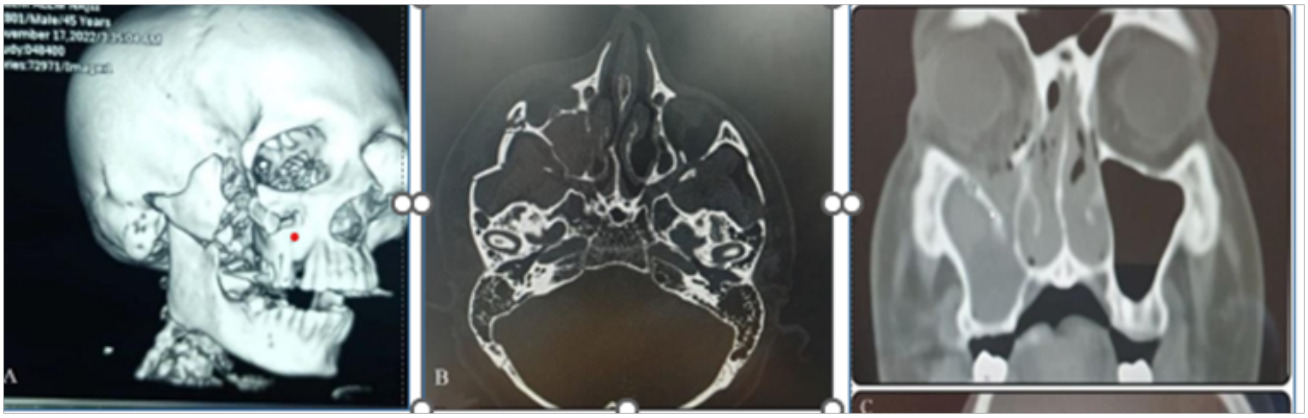

Figure 3: CT scans for different patients with concomitant head and maxillofacial trauma.
A: 3D imaging for patient with comminuted zygomaticomaxillary fracture.
B: Axial section shows depressed V shape zygomatic arch and lateral orbital wall fracture.
C: Coronal section shows orbital floor fracture.

3.2. The study inclusion criteria:

All patients without age limitation who sustained accompanying head and maxillofacial injuries due to varying causes.

3.3. The study exclusion criteria:

Isolated head injuries.

Isolated maxillofacial injuries.

Patients arrive dead to the emergency department or after resuscitation.

4. Result:

A total of 110 patients were presented to the emergency department / AL Ramadi-teaching hospital with concomitant maxillofacial injuries and head injuries; in some cases, they were associated with other body systems/site injuries Table 1. The patient's age is between 3 & 65 years (mean 28.4) and the gender distribution is 88 males (80%) and 22 females (20%). The leading causes for trauma are variable and RTA was the most common cause. The other causes were fall from height, industrial injuries, interpersonal violence, sports injuries, and ballistics injuries Figure 4.

The direction of trauma in most cases was anteroposterior (frontal) direction and this direction was associated with the more significant form of concomitant maxillofacial & head injuries. These injuries include severe forms of head injuries and their associated facial injuries (pan facial fractures, midface fractures, mandibular & bilateral condyle fractures, and frontal sinus fractures). The lateral trauma direction is less in incidence and usually associated with less severity of associated injuries Table 2.

The patients were classified into three groups (in regards to the severity of head injury) Figure 5, these groups are:

Group I / Mild head injury (GCS between [13-15].

Group II / Moderate head injury (GCS between [9-12] Figure 6.

Group III / Severe head injury (GCS between [3-8] Figure 7.

The airway in all these groups needs to be checked and secured initially in the emergency department with usual maneuvers following the advanced trauma life support (ATLS) protocol, however in some patients a surgical airway (cricothyroidotomy) was planned in patients with severe facial bone fractures with upper airway obstruction. The airway in some other Patients with severe head injury (group III) was secured with an endotracheal tube in the emergency department.

The patients were further classified (in regard to the resultant head injury) into the following groups: Groups A / Concomitant facial and head injury patients with a normal level of consciousness or return to normal within a few hours following trauma (concussion and cerebral edema).

Group B / Concomitant facial and head injury with traumatic intracranial hemorrhage (extradural hematoma, subdural hematoma, and intracerebral hemorrhage) Figure 8.

Group C/ Concomitant facial and head injury with CSF leak, pneumocephalus, and skull fracture Figure 9 & Figure 10.

Concussion was the most common pattern of associated head injury followed by skull and skull base fracture (CSF rhinorrhea and Pneumocephalus) and intra-cranial hematoma (extradural, subdural, and intracerebral hemorrhage). For the associated maxillofacial injury, the resultant facial injuries were varying between soft tissue injury, isolated bony fracture, and more complex & comminuted bony fractures.

Pan facial fracture was the most common form of facial injury followed by mandible fracture. The pan facial fracture was associated with a significant form of head injury (intracranial hemorrhage and skull fracture). Pan facial fracture is associated with intracranial hemorrhage and skull base fracture with CSF rhinorrhea & pneumocephalus. Frontal sinus fracture is associated with concussion and skull fracture and for the other types of facial injury, the associated head injury is concussion Table 3.

The surgical teamwork (maxillofacial surgeon and neurosurgeon) is important to reduce the mortality and morbidity of these types of injuries and each surgeon plays a significant role in patient management. In some cases, early neurosurgical intervention was needed and in others later maxillofacial surgical intervention (up to 3 weeks post-trauma) was needed.

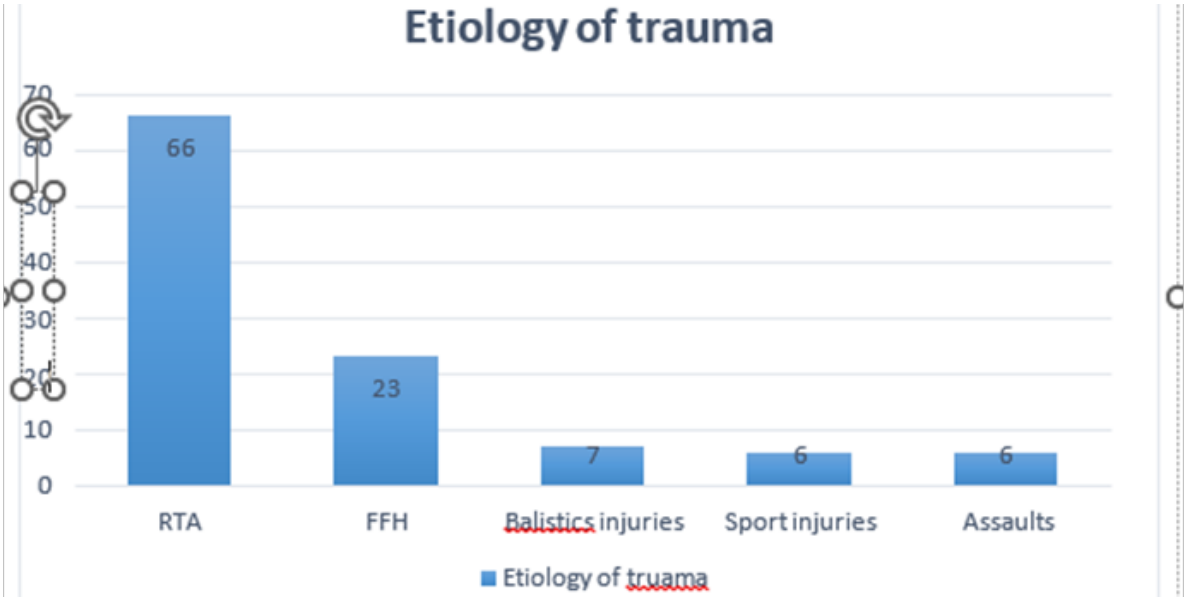

Figure 4:The Etiology of trauma.

Table1: The patients with concomitantheadandmaxillofacialinjurywithotherssystem/bodysiteinjury.
*Eyeinjuriesincludecornealabrasion,foreignbody,penetratingwoundsandrupture globe.
**concomitant maxillofacial & head injury with cervical, ocular and long bones injuries.

Number of patients with Concomitant head and maxillofacial injuries	Patients with Concomitant head & maxillofacial injuries with other injuries				
77	Cervical spine injury	*Eye injury	Lower and upper extremities injury	**Multiple injuries	Total number
	4	8	11	10	33

Table 2: The association between trauma direction and resultant injuries.

Trauma details	Trauma direction	
1/ Maxillofacial injuries	Anteroposterior direction	Lateral direction
- Lefort fracture	12	-
- NOE fracture	9	-
- Mandible &bilateral condyle fracture	8	2
- Orbital floor fracture	4	3
- Frontal sinus # (Anterior table)	4	-
- Zygomatic-maxillary fracture	11	2
- Condyle fracture	2	4
- Pan facial (Multiple facial bones) fractures	29	9
- Soft tissue injuries	7	4
Total number and percentage	86 (78.7%)	24 (21.8 %)
2/ Head injuries		
- Traumatic intracranial hemorrhage	14	2
- skull fracture	24	5
- frontal sinus (mixed posterior& anterior table) fracture	13	-
- concussion	39	13
Total number and percentage	90 (81.8%)	20 (18.1%)

Table 3: The details and types of head injury and its associated maxillofacial injuries.

Thepan facialfractureisthemostcommontypeofresultantfacialinjuryinpatientwithconcomitanthead &maxillofacial injury.

Theconcussionisthemostcommontypeofresultantheadinjuryinpatientwithconcomitanthead&maxillofacial injury.

Typeofheadinjuries	Typeofassociatedmaxillofacialinjuries	Patients number	Patients percentage
Intracranialhematoma 1– Epiduralhematoma - Subduralhematoma - -Intracerebralhemorrhage	Pan facialfracture (Combinedupper,middle&lowerthird facial bones fractures) ‡	45	40.9%
2-Skullfracture -CSF Rhinorrhea			
Pneumocephalus – Skullbasefracture –			
3-Concussion(mildtraumatic brain injury) •	-Softtissueinjury -IsolatedMandiblefracture -Zygomaticomaxillarycomplexfracture -Isolatedmaxillaryfracture -IsolatedOrbitalfloorfracture -Anteriortablefrontalsinusfracture	52	47.2%
4-Frontalsinusfracture(mixed anterior &posterior table)	-Naso-orbito-ethmoidalfracture -superiororbitalrimfracture	13	11.7%

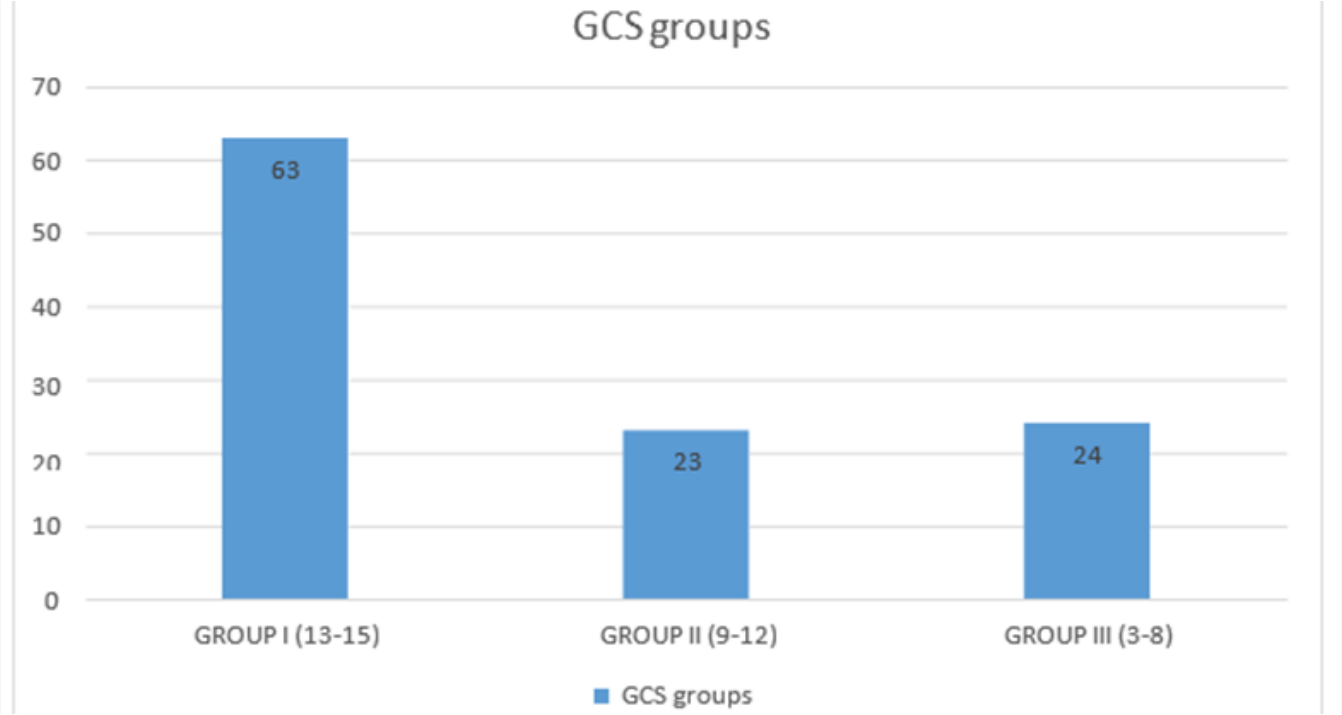

Figure 5: The Glasgow coma scale patient's groups.

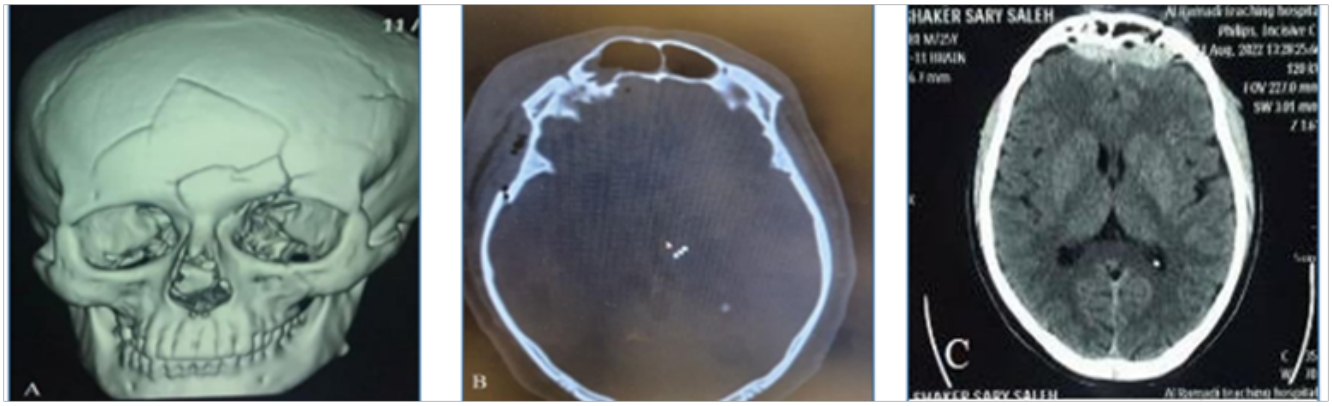

Figure 6: CT scans for different patients with concomitant moderate head injury with maxillofacial trauma.

A: 3D imaging for a patient with anterior and posterior table frontal sinus fracture.

B: Axial section for a patient with depressed skull fracture.

C: Axial section soft tissue window shows small epidural hematoma in patient with frontal sinus fracture.

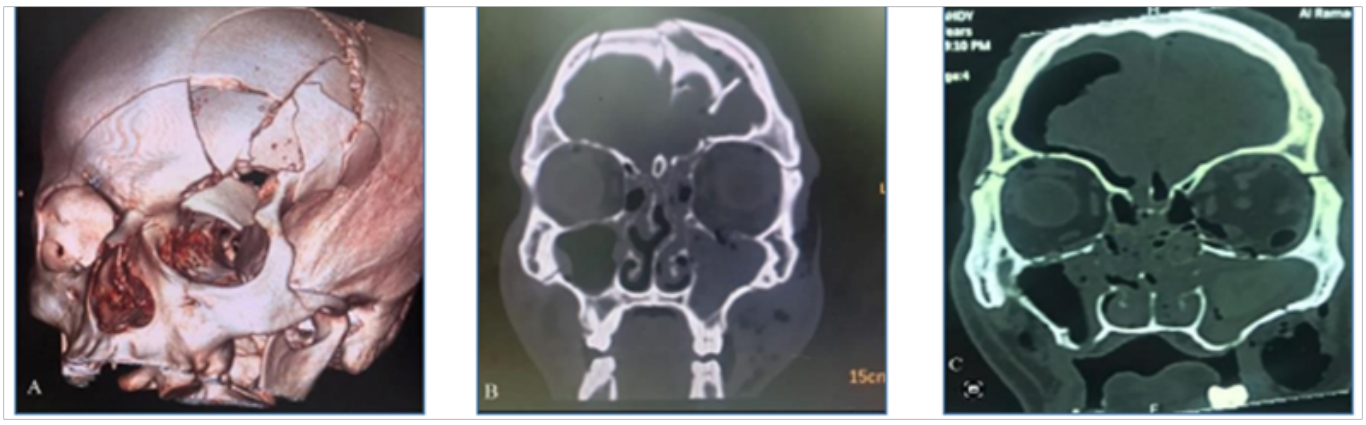

Figure 7:CT scans for different patients with concomitant severe head injury with maxillofacial trauma.

A: section show sever and comminuted skull and supraorbital rim fracture.

B: Coronal section shows severely displaced skull fracture with facial bones fractures.

C: Coronal section shows a large pneumocephalus in lefort III patient.

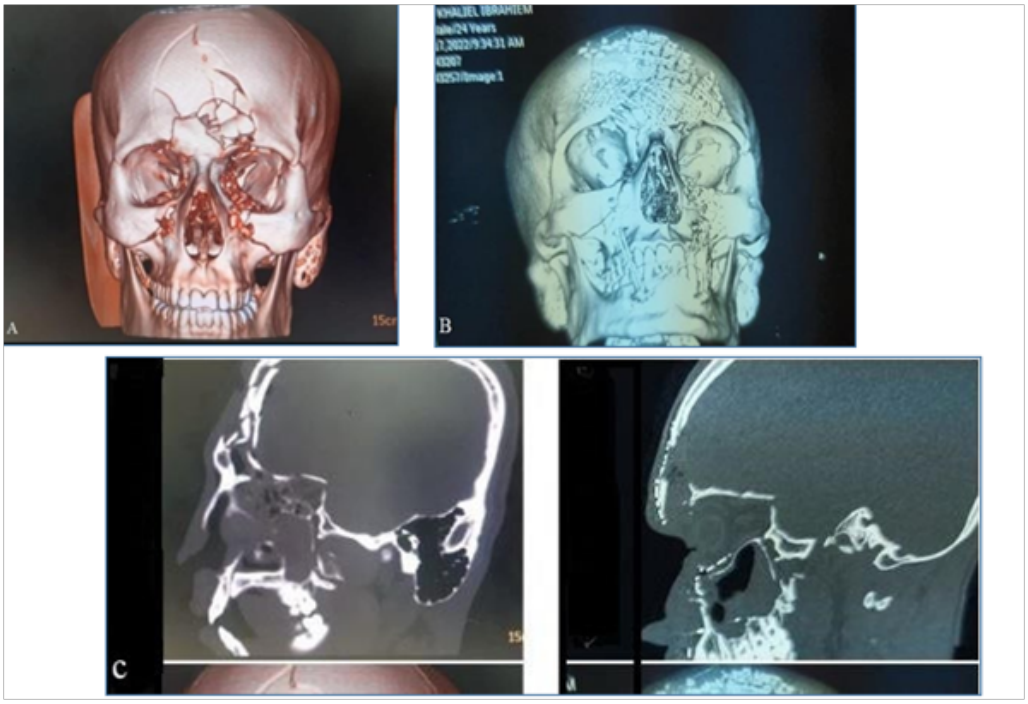

Figure 8: RTA patient with anteroposterior trauma direction have moderate to severe form of concomitant head and maxillofacial injuries.
A: 3D CT scan show comminuted frontal bone and sinus fracture with lefort II fracture.
B: postoperative 3D CT scan show reconstructed frontal bone with cranial mesh, left orbital mesh for orbital floor reconstruction and IMF screws.
C: Preoperative and postoperative sagittal section CT scan.

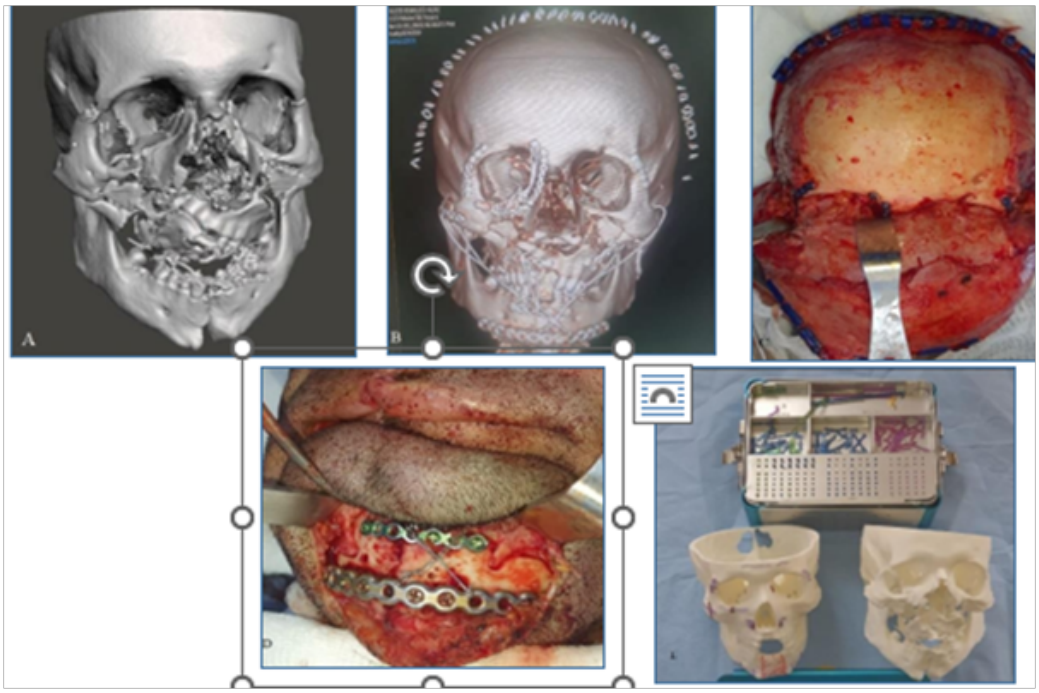

Figure 9:RTA patient with sever and multiple head and maxillofacial injuries.
A: 3D CT scan show pan facial fracture.
B: Postoperative CT scan show a reduced fractured and fixed with reconstruction plate, miniplate, circumzygomatic suspension wire and orbital mesh.
C: Intraoperative photograph shows a bicoronal flap for exposure of the upper part of the facial skeleton.
D: Intraoperative photograph shows a submental incision for exposure and fixation of mandibular sympvseal fracture.
E: Preoperative virtual planning and 3D printed module.

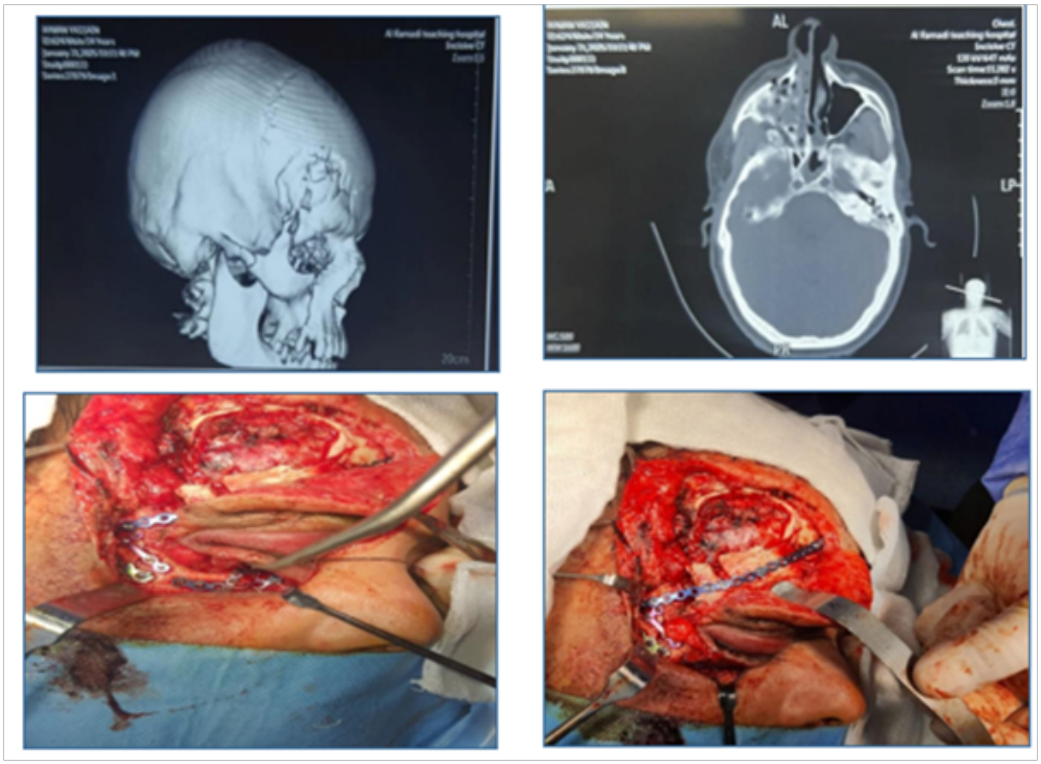

Figure 10: Motor cycle accident patient with frontal bone comminuted fracture and zygomaticomaxillary complex fracture, neurosurgical and maxillofacial intervention done for dura repair, reduction and fixation of fracture bones.

4. Discussion:

One of the most common causes for the emergency department visiting is trauma. The skull and maxillofacial region are highly vulnerable for thesetrauma, so these patients are commonly encountered in the emergency department. The ratio of male to female in the literature is around 3:1 [16 -19].

The concomitant head and maxillofacial injury are common and there is a close relationship between these injuries 3 15.

The leading causes for the trauma are variable with road traffic accident is the most common cause in most studies 2 17 5 6 while in other studies the assault 2 3 15 and sport injuries 4 19 are the most common etiological factors. In the current study, the road traffic accident is the most common cause for the trauma because people do not strictly follow the road traffic legislation regarding seat belts uses, speed limitation and phone uses during driving. The fall from height and the industrial trauma are the second cause of trauma and most of these patients are outdoor worker.

Maxillofacial injuries should raise the clinical suspicions of associated head injuries because the possibility of energy transfer through the facial skeleton to the brain 19. There is relationship between type and location of facial injuries and the type of resultant head injury.

The rate of intracranial hemorrhage in patients with maxillofacial trauma is 9% as reported by Kanno *et al*. 6 while Hohl Rieder*et al*. 19 report this rate as 9%. The severity of head injury and risk of intracranial hemorrhage is high in patients with maxillary fractures and pan facial fractures 6.

In the current study the rate of intracranial hemorrhage is 16.3% (14 out of 85 cases) and in all these cases the type of associated maxillofacial injuries was midface and pan facial fracture.

Regarding the maxillofacial trauma, some patient needs lifesaving intervention and in some may need sight- saving interventions. The lifesaving interventions are related to airway securing with usual maneuvers and assess the indications for emergent cricothyroidotomy in the emergency department. Early hemorrhage control with usual methods and in some cases temporary fracture reduction and fixation with bridle wire is important, however massive blood loss is not common in maxillofacial trauma. The orbital compartment syndrome (superior orbital fissure syndrome and orbital apex syndrome) is an emergent condition and need early medical and surgical interventions by canthotomy and cantholysis for decompression of the orbital content and prevent the irreversible optic nerve damage.

6. Conclusion:

In conclusion, there are close relationship between maxillofacial injuries and head injuries. Theses concomitant injuries are commonly admitted to the emergency department with middle-age male prediction. As the severity of maxillofacial injury increases the severity of head & cervical spine injury is increased and these injuries needs early maxillofacial and neurosurgical intervention. The frontal impact is associated with more severe form of facial

and head injury than lateral impact. The Glasgow coma score is ideal for the determination of head injury severity and when the score is dropped the severity of injuries is increased; however, in some trauma patients with combined facial and head injuries with a full score (15 GCS) the associated head injury cannot excluded, so a close follow-up is advised during the first 24 hours post trauma.

7. Declarations:

Ethics approval and consent to participate - Not applicable Consent for publication - Not applicable

Availability of data and material - applicable Competing interests - Not applicable Funding - Not applicable

Authors' contributions - applicable Acknowledgements - Not applicable

References:

1. Joshi UM, Ramdurg S, Saikar S, Patil S, Shah K. Brain Injuries and Facial Fractures: A Prospective Study of Incidence of Head Injury Associated with Maxillofacial Trauma. J Maxillofac Oral Surg. 2018 Jan 3;17(4):531-37.
2. Işik D, Gönüllü H, Karadaş S,Koçak OF, Keskin S, et al. Presence of accompanying head injury in patients with maxillofacial trauma. Ulus Travma Acil Cerrahi Derg.2012 May;18(3):200-6.
3. Béogo R, Dakouré P, Savadogo LB, Coulibaly AT, Ouoba K. Associated injuries in patients with facial fractures: a review of 604 patients. Pan Afr Med J. 2013 Nov 27:16:119
4. Kloss F, Laimer K, Hohlrieder M, Ulme H, Hackl W, et al. Traumatic intracranial haemorrhage in conscious patients with facial fractures - A review of 1959 cases. J Craniomaxillofac Surg. 2008 Oct;36(7):372-7.
5. Hogg NJ V, Stewart TC, Armstrong JEA, Girotti MJ. Epidemiology of Maxillofacial Injuries at Trauma Hospitals in Ontario, Canada, Between 1992 and 1997. J Trauma. 2000 Sep;49(3):425-32.
6. Kannol T, Mitsugi1 M, Furuki1 Y, Fujioka1 M, Katsumata1 A, et al. Traumatic intracranial haemorrhages in patients with maxillofacial / jaw fractures. Intensive Care Med. 2003 Jul;29(7).
7. Keenan HT, Brundage SI, Thompson DC, Maier R V, Rivara FP. Does the Face Protect the Brain? A Case-Control Study of Traumatic Brain Injury and Facial Fractures. Arch Surg. 1999 Jan;134(1):14-7.
8. Gary D, Michael J, Donovan T, Michelle A, Ann A. The Spectrum of Closed-Head Injuries in Facial Trauma Victims: Incidence and Impact. Ann Emerg Med. 1988 Jan;17(1):6-9.
9. Luce EA, Tubb TD, Moore AM. Review of 1,000 major facial fractures and associated injuries. Plast Reconstr Surg. 1979 Jan;63(1):26-30.
10. Follmar KE, DeBruijn M, Baccarani A, Bruno DA, Mukundan S, et al.Concomitant injuries in patients with panfacial fractures.J Trauma. 2007 Oct;63(4):831-5.
11. Perry M, Brown A, Banks P. Fractures of the Facial Skeleton. second edi. Wiely& Sons, Ltd.
12. Lee KF, WagnerLK, Lee YE, Ho Suh J, Lee RO. The Impact-Absorbing Effects of Facial Fractures in Closed-Head Injuries. J Neurosurg. 1987 Apr;66(4):542-7.
13. Rajandram RK, Syed Omar SN, Rashdi MFN, Abdul Jabar MN. Maxillofacial injuries and traumatic brain injury - a pilot study. Dent Traumatol. 2014 Apr;30(2):128-32.
14. Tung TC , WS Tseng, Chen CT, Lai JP, Chen YR. Acute Life-Threatening Injuries in Facial Fracture Patients: A Review of 1,025 Patients. J Trauma. 2000 Sep;49(3):420-4.
15. Alvi A, Doherty T, Lewen G. Facial Fractures and Concomitant Injuries in Trauma Patients.Laryngoscope. 2003 Jan;113(1):102-6.
16. Bataineh AB. Etiology and Incidence of Maxillofacial Fractures in the North of Jordan. Oral Surg Oral Med Oral Pathol Oral RadiolEndod. 1998 Jul;86(1):31-5.
17. Ferreira PC, Amarante JM, Silva PN, Rodrigues MJ, Choupina PM,et al. Retrospective study of 1251 maxillofacial fractures in children and adolescents. Plast Reconstr Surg. 2005 May;115(6):1500-8.
18. Mithani SK, St.-Hilaire H, Brooke BS, Smith IM, Bluebond-Langner R, Rodriguez ED. Predictable patterns of intracranial and cervical spine injury in craniomaxillofacial trauma: Analysis of 4786 patients. Plast Reconstr Surg. 2009 Apr;123(4):1293-1301.
19. Hohlrieder M, Hinterhoelzl J, Ulmer H, Hackl W, Schmutzhard E, Gassner R. Maxillofacial fractures masking traumatic intracranial hemorrhages. Int J Oral Maxillofac Surg. 2004 Jun;33(4):389-95.