A 5 YEAR RETROSPECTIVE EPIDEMIOLOGICAL ANALYSIS OF PATIENTS DIAGNOSED WITH MAXILLOFACIAL FRACTURE

A research report submitted to the Department of Plastic Surgery, MGR University, Chennai, TamilNadu of the in partial fulfillment of the requirements for the degree of Master of Chirurgical in Plastic surgery

CHRISTIAN MEDICAL COLLEGE, VELLORE 2013

Dedication

To my parents who nurtured and guided me

To my teachers for their support.

To my friends from whom I draw strength and happiness

CERTIFICATE

I hereby declare that this dissertation entitled **"**A 5 year retrospective epidemiological analysis of patients diagnosed with maxillofacial fracture" is a bonafide research work carried out by Dr. Sandeep Dawre in partial fulfillment of the requirement for the degree of the requirement for the degree of M.Ch. in Plastic Surgery.

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ENDORSEMENT BY THE H.O.D. OF PLASTIC SURGERY

This is to certify that this dissertation entitled "A 5 year retrospective epidemiological analysis of patients diagnosed with maxillofacial fracture**"** is a bonafide and genuine research work carried out by **Dr. Sandeep Dawre** under the guidance of **Dr. Ashish Kumar Gupta** Professor and unit head, Department of Plastic Surgery, Christian Medical College, Vellore.

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I sincerely thank The Director and the members of the IRB committee, Christian Medical College, Vellore for approving my thesis topic and gave permission to conduct the study.

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ABSTRACT

TITLE OF THE ABSTRACT : A 5 year Retrospective epidemiological analysis of Patients diagnosed with maxillofacial fracture

DEPARTMENT : Department Of Plastic Surgery

NAME OF THE CANDIDATE : Dr.Sandeep Dawre

DEGREE AND SUBJECT : M.Ch (Plastic Surgery)

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OBJECTIVES:

The objectives of the present study is to assess retrospectively the profile including the etiology, epidemiologic and demographic factors related to maxillofacial injuries among patient reported in our hospital .

METHODS:

Patients with maxillofacial fractures who presented in the casualty over 5 year period from Jan 2007 to December 2012 were included in the study. Data was recorded on age, race, gender, date and cause of injury, associated injuries and use of alcohol at the time of injury. The fractures were grouped into Le Fort, mandible fracture and other associated fractures.

The descriptive statistic such as means, frequency and percentage will be calculated for each variable. The data will be represented graphically using pie chart and bar plot. The association between the variables, chi-square will be used; the comparison of mean values will be done using students t-test

RESULT:

The sample comprises of 280 patients: 255 (90.7%) males and 25(8.9%) females with range of 3-80 years with mean of 34.85. Most common cause of maxillofacial fracture was road traffic accident 258(92.2%) followed by fall (4.6%) and assault (2.5%). Le Fort fracture was 176 (62.9%) as compared to mandible fracture 131(46.8%).

These studies showed male were commonly involved in maxillofacial injuries due to road traffic accident. Lefort is more common that mandible fracture in maxillofacial trauma.

Introduction

Introduction

Applied Anatomy of Maxillofacial bones:

The midface is composed of two maxilla, two zygomatic bones, two palatine bones, two zygomatic process of temporal bones, two nasal bones, two lacrimal bones, vomer ethmoid and its attached conchae, two inferior conchae, pterygoid plates of sphenoid. These bones are weak individually but are strong when they articulate together[1, 2.] They gain strength in groups for which Manson[3] described their arrangement into vertical and horizontal struts that support facial skeleton. The horizontal struts are formed by supraorbital rim and nasal process of the frontal bone, infraorbital rim, nasal bridge, alveolar process of maxilla and the zygomatic arch.

The vertical strut is formed medially by the piriform rims which continue as the frontal process of the maxilla superiorly. Secondly the zygomatic buttresses which continue with the lateral orbital rims form the lateral pillars and finally the most caudal pillars are formed by the pterygoid plates.

Mandible:

Due to its position it is one of the most frequently injured facial bones like nose and zygoma. Mandible is U- shaped bone consists of horizontal and vertical segment (fig1). Horizontal segment consists of body on each side and symphysis in the centre. The vertical segment consists of angles and rami, which articulate with the skull through condyle and temporomandibular joint. The mandible is attached to maxilla through the occlusion of the teeth.

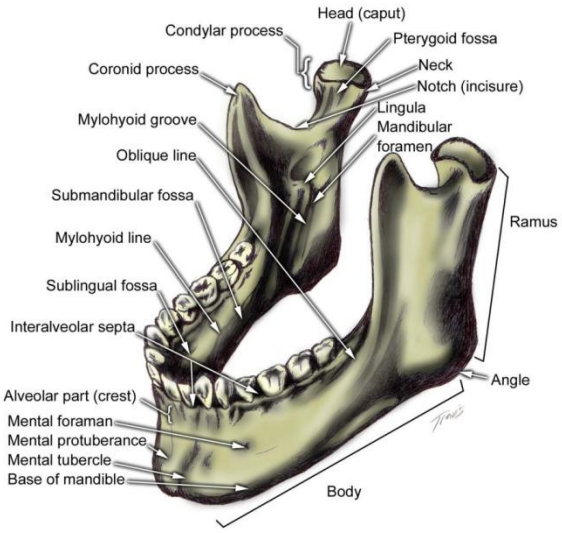


Fig 1: Mandible bone

Though the mandible is strong bone it has several areas of weakness that are prone for fracture. Mandible thickness is less in angle where body joins the ramus. In an unerupted third molar it further weakens the region. Other weak areas are neck of condyle, root of teeth and mental foramen. Mandibular movement is determined by muscles attached to the bone. Muscle function is important factor in mandibule fracture influencing the degree and displacement of fracture. The muscle of mastication i.e. temporalis, the masseter, the medial and lateral pterygoids are posterior group of muscle which are short , thick and put strong force on mandible . All these group of muscles generally move the mandible in upward, forward and medial direction. The anterior (depressors) group of muscles made up of geniohyoid, genioglossus, mylohyoid and digastrics muscles.

Mandible fractures are classified according to the location and condition of teeth, direction of the fracture and its favorability for treatment, presence of compound injury through the skin or

through the mucosa and the characterization of the anatomic area and fracture pattern. Dingman and Natvig[4] classified mandibule fracture by anatomic location.

Fry et al[5] pointed out mandible fractures may be favorable or unfavorable for displacement according to their direction and bevel.

Zygoma

The term zygoma means "yoke "derived from the Greek word Ζυγόμα *zygoma*. Zygoma (fig 2) is a paired bone which articulates with maxilla, temporal bone, sphenoid bone and frontal bone. It is commonly called the malar bone and is quadrilateral in shape. It has strongest attachment with frontal bone and maxilla but thinner and weaker attachment with sphenoid bone and through zygomatic arch.

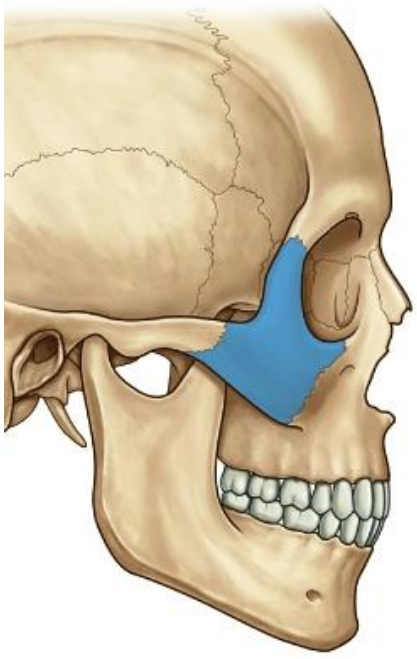


Fig 2: Zygoma Bone

The lateral surface of zygoma is convex forming the prominence of the cheek. The posterior surface contributes to the temporal fossa. Zygoma projects superiorly to articulate with frontal bone through its frontal process in front and greater wing of sphenoid behind to form the lateral

wall. The zygoma forms the lateral and superior wall of the maxillary sinus. Zygoma articulate with the maxilla inferiorly and medially to form inferior orbital rim to contributes to the orbital floor as well as the zygomaticomaxillary buttress which forms one of the struts mentioned above[6]. It has attachment for the master, temporalis, zygomaticus major and minor and zygomatic head of the quadrates labii superioris muscle.

Small foramina are present in the lateral wall and malar eminence through which zygomaticoptemporal and zygomaticofacial[7] nerves pass.

Maxilla

The maxilla is formed by fusion of two bones along the palatal fissure forming upper jaw. It forms the middle third part of facial skeleton and has four processes namely the frontal, zygomatic, alveolar and palatine process. It forms part of orbit, the nasal fossa, oral cavity, palate, nasal cavity and pyriform aperture.

Maxilla articulates with two cranium bones i.e. frontal and ethmoid bone. It also articulates with seven bones of midface i.e. nasal, zygomatic, inferior nasal concha, palatine, vomer, lateral pterygoid plate of the sphenoid[6]. The maxillary process of frontal bone articulates with frontal process of maxilla as well as nasal bone anteriorly and posteriorly to lacrimal bone. The fracture of this part involves lacrimal creast into which medial canthal ligament is attached that Markowitz called the central fragment known as nasoethmoidal-orbital fractures[8].

Nasal Bone

The nose is triangular pyramid externally composed of cartilaginous and osseous structure. The nose in upper third is supported by maxilla and frontal bone and in lower third supported by upper and lower lateral cartilage. The framework is made up of the semi rigid cartilaginous structure attach to solid and inflexible bony parts of nose. The paired nasal bones articulate in the midline with each other, firmly supported by articulation with the frontal bone and the frontal process of the maxilla and by a thickened perpendicular plate of the ethmoid. The nose is commonly fractured in lower half as it is thin as compared to upper half which is thick bone.

Lacrimal bones

The lacrimal bone is front part of medial wall of orbit and is smallest and most weak bone of face. Lacrimal bone articulates inferiorly with maxilla and superiorly with frontal bone and posterior with part of ethmoid bone.

The medial canthal anterior limb is attachéd to anterior lacrimal crest and frontal process of maxilla. The crest over the orbital surface ends as hook like projection, the lacrimal hamulus which articulates with the lacrimal tubercle of maxilla and forms the upper opening of nasolacrimal canal[6]**.**

Orbit

The orbit is formed by paired bone structure forming cavities, separated in midline by inter-orbital space which contains ethmoid and frontal bone. Portion of the roof of the orbit forms the floor of anterior cranial fossa. The orbit is protected medially by the nasal bone, nasal spine of frontal bone and frontal process of the maxilla, superiorly by supraorbital rim of the frontal bone, laterally by frontal process of zygoma and zygomatic process of frontal bone and inferiorly by infraorbital rim. The frontal bone , lesser and greater wing of the sphenoid, the zygoma, the maxilla, the lacrimal bone , a small portion of the palatine bone and the ethmoid bone form the skeletal component of the orbital cavity.

Orbital cavity is conical in and the widest diameter is 1-1.5cm behind the orbital rim. Orbital rim is thick as compared to thin bone in the middle third of orbit. Most frequent site of orbital fracture is orbital floor as it is formed by orbital plate of the maxilla, partly by the zygomatic bone and the orbital process of the palatine bone. Orbital canal is on the floor of orbit from the medial to lateral direction.

Classification

There are many classifications proposed for different types of facial fractures. But due to variety of fracture pattern and complexity of facial bones no universal consensus is reached. These classifications were made to help the clinician to treat patient in a systematic manner.

Zygomatic Fracture

In 1961, Knight and North proposed a classification for zygoma fracture based on the direction of anatomic displacement and pattern formed by fracture[9].

- Group 1 : No significant displacement; fracture visible on radiography , but fragments remain in line
- Group 2 : Arch Fracture , which involve inward buckling of the arch with no orbital or anterior involvement
- Group 3 : Unrotated body fracture ; downward and inward displacement but no rotation
- Group 4 : Medially rotated body fracture ; downward, backward and Backward displacement with medial rotation
- Group 5: Laterally rotated body fracture; downward, backward and Medial displacement with lateral rotation of the zygoma
- Group 6: All cases in which additional fracture line cross the main fragment

The principle of vertical and horizontal rotation and whole body displacement to classify zygoma fracture was utilized by Rowe and Killey in 1968[10].

Rowe & Killey (1968)

Type I: No significant displacement

Type II: Fracture of the zygomatic arch

Type III: Rotation around vertical axis

- Inward displacement of orbital rim

- Outward displacement of orbital rim

Type IV: Rotation around longitudinal axis

- Medial displacement of frontal process

- Lateral displacement of frontal process

Type V: Displacement of the complex en bloc

- Medial

- Inferior

- lateral (Rare)

Type VI: Displacement of orbitoantral partition

- Inferiorly

- Superiorly

Type VII: Displacement of orbital rim segments

Type VIII: Complex comminuted fractures.

In 1978, Larsen and Thompson proposed a classification for zygoma fracture[10]

Group I: no or minimally displaced fracture

Group II: Fracture requiring reduction and fixation

Group III: Include all other fractures that require reduction and fixation

In 1990, Manson and Markowitz[11] proposed their classification of midface fracture based on the amount of energy dissipated by facial bones. They classified onto high, moderate and low energy fracture based on CT scan. High energy fracture has extreme displacement, comminution and segmentation of bone on the other hand low energy is characterized by displacement but without comminution of bone

The decision to intervene should be based on sign, symptoms, and functional deficit. There are many methods available for both the reduction and fixation of zygoma fracture but no one technique is superior to others. It should be stressed that not the technique, but proper application of principles, that produce satisfactory results.

Maxillary Fracture

Le Fort classified maxillary fracture into Le Fort I, II, and III. The Le Fort type I (fig 3) results from impact delivered above the level of teeth. Fracture line from lateral border of pyriform sinus across the lateral antral wall behind the maxillary tuberosity and across pterygoid junction. Due to pull of pterygoid muscles maxilla is pulled posteriorly and inferiorly, may be noted as classic open bite.

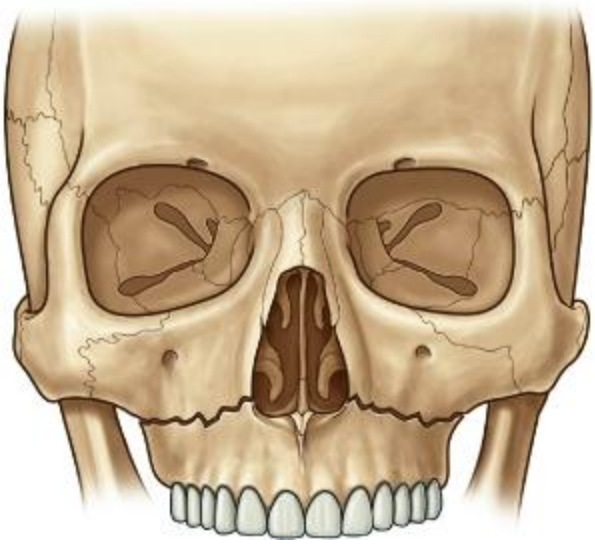


Fig 3: Le Fort I fracture

The Le Fort fracture II (pyramidal) results from direct blow at the level of nasal bone. The fracture runs from the nasofrontal suture, lacrimal bone and infraorbital rim and completes its course along the lateral antral wall at the junction of the pterygoid plates as shown in fig 4. This fracture leads to mobility of midface from the cranium.

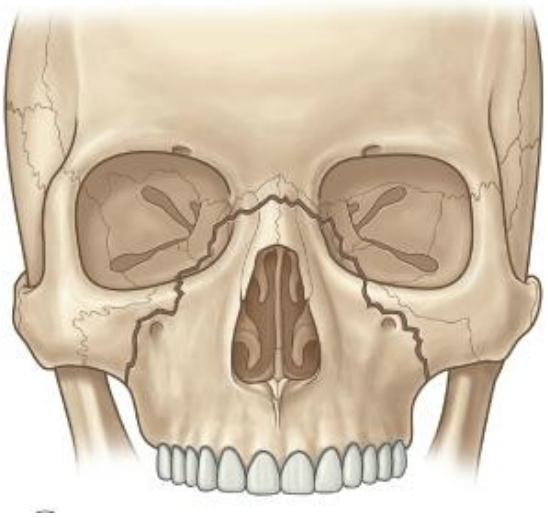


Fig 4: Le Fort II fracture

The Le Fort III (fig 5) fracture is caused by impact over the orbital level, resulting in craniofacial disjunction. The fracture line runs through the zygomaticotemporal and zygomaticofrontal sutures, along the lateral orbital wall, through the inferior orbital fissure and nasofrontal suture medially and it end at pterygomaxillary fissure.

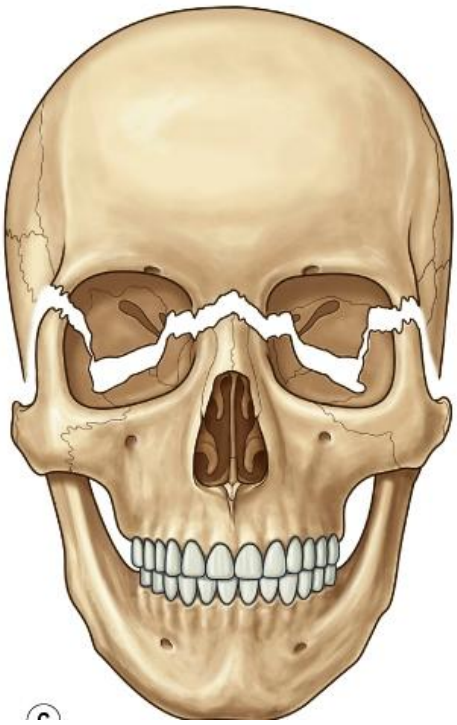


Fig 5: Le Fort III fracture

Classification of Le Fort fracture[12]:

The highest level and components of the fracture on each side

Le Fort I: Maxillary alveolus

Split palate

Alveolar tuberosity fracture

Le Fort II: Pyramidal fracture

Le Fort III: Craniofacial disjunction

Pattern of fragment that include the maxillary dentition (occlusal fragment)

Associated fractures

Mandible Fracture

Nasoethmoido-orbital fracture

Frontal sinus

Blood supply is via major palatine arteries. The sensory supply is through the 2nd division of the trigeminal nerve. Today, due to high velocity blunt injuries gave raise to variety of fractures which may not fit in Le Fort classification described by him.

Nasoethmoidal-Orbital Fracture (NOE)

The important part of nasoethomoidal–orbital fracture is displacement of medial orbital rim where medial canthal ligament is attached. This part is surrounded medially by ethmoidal air cells, laterally by orbit and its contents, nasal bone and pyriform aperture anteriorly and frontal bone cranially.

The most common classification used for NOE Fractures is Markowitz and Manson[8] (Fig 6, 7, 8) scheme based on central fragment and medial canthal ligament

Type 1: Mostly unilateral incomplete fracture, occasionally bilateral that is displacing inferiorly

Type 2: Comminuted central fragment is rotated and posteriorly displaced, canthus is not unstable and remains attached to large bone fragment

Type 3: Comminuted NOE fracture with fracture remaining outside the canthal ligament insertion

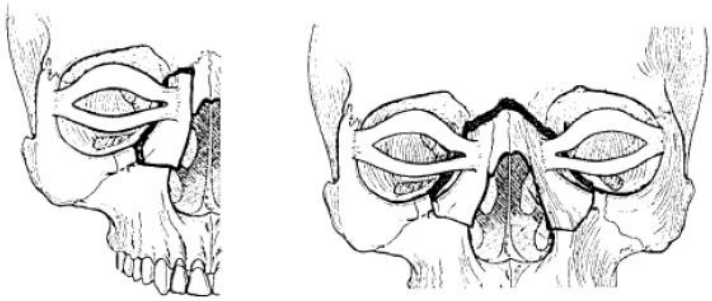


Figure 6: NOE type I fracture unilateral and bilateral

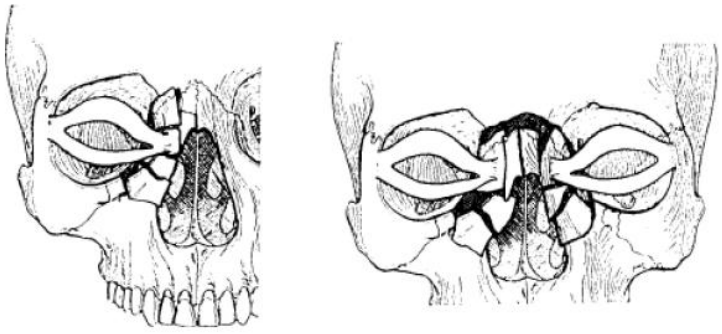


Figure 7: NOE fracture type II unilateral and bilateral

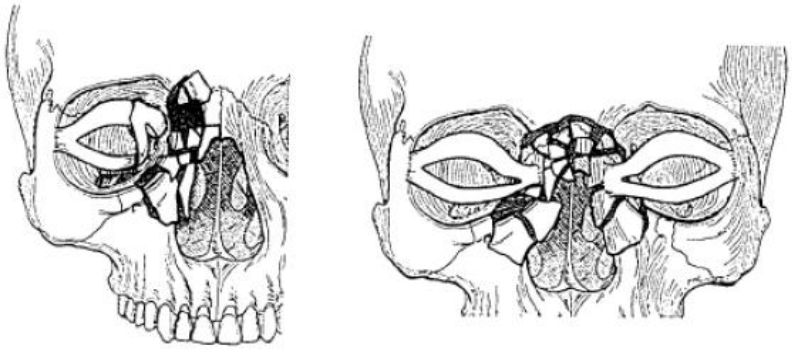


Figure 8 NOE fracture type III unilateral and bilateral

Mandible Fracture

The Mandible is tubular horse-shoe shaped bone. It is stronger in the midline than the lateral part towards condyle[13]. Mandible fracture is classified in several ways.

Classification of mandible fracture is according to anatomic region given by Dingman and Natvig[4].

1. Midline
2. Parasymphysis
3. Symphysis
4. Body
5. Angle
6. Ramus
7. Condylar process
8. Coronoid process
9. Alveolar process

Kazanjian and Converse[14] described mandible fracture by presence or absence of teeth in the relation to the line of fracture

Class I: teeth are present on the both sides of fracture line

Class II: teeth are present on only one side of facial fracture

Class III: Patient is edentulous

Rowe and Killey[15] described the mandible fracture into:

1) Mandible fracture not involving basal bone
2) Mandible fracture involving basal bone

Kruger and Schilli[16] developed four categories of mandible fracture

1) Relation to the external environment
    A. Simple or closed
    B. Compound or open
2) Types of fracture
    A. Incomplete
    B. Greenstick
    C. Complete
    D. Comminuted
3) Dentition of the Jaw with reference to the use of Splint
    A. Sufficiently dentulous Jaw

B. Edentulous or insufficient dentulous Jaw

C. Primary and mixed dentition

4) Localization

A. Fracture of the symphysis region between the canine

B. Fracture of canine region

C. Fracture of body of the mandible between the canine and the angle of the mandible

D. Fracture of the angle of the mandible in the third molar region

E. Fracture of the ramus between the angle of the mandible and the sigmoid notch

F. Fracture of the coronoid process

G. Fracture of the condylar process

Angle fracture may be classified as

1) Vertical favorable or unfavorable
2) Horizontal Favorable or unfavorable

Lindahl[17] in 1977, proposed a system that classified condylar fracture based on (1) the anatomic location of the fracture, (2) the relationship of the condylar segment to mandibular segment and (3) the relationship of the condylar head to the glenoid fossa(fig 9).

1. Level of condylar fracture
    a. Condylar head
    b. Condylar neck
    c. Subcondylar

2. Relationship of the condyle segment to the mandibular fracgment
    a. Nondisplaced
    b. Deviated
    c. Displacement with medial or lateral overlap
    d. Displacement with anterior or posterior overlap
    e. No contact between the fractured segments
3. Relationship between the condylar head and glenoid fossa
    a. Nondisplaced
    b. Displacement
    c. Dislocation

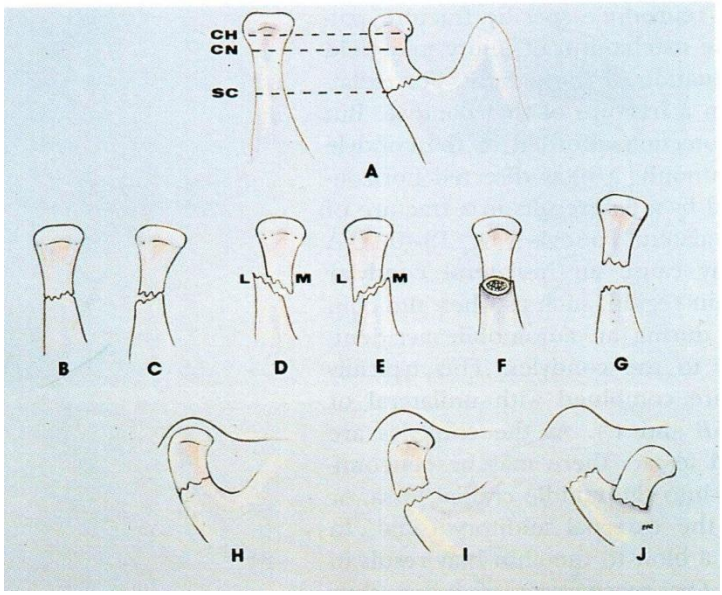


Figure 9: Lindahl classification of condylar fracture. A, level of fracture. B to G, Relationship of the proximal and distal fracture segments at the line of fracture. H to J, Relationship of the condylar head to the glenoid fossa. CH= condylar head; CN = condylar neck; SC = subcondylar

Sign and Symptoms

Nasoethmoidal-Orbital Fracture:

Facial laceration, facial edema, per-orbital ecchymosis may suggest NOE fracture. Nasal fracture, flattened nasal prominence, obtuse angle between lip and columella, telecanthus, subconjunctival hemorrhage, crepitus over medial canthal region are features of NOE. Intranasal examination shows septal fracture with swollen and bulging mucosa. It may be associated with frontal brain injury, CSF rhinorrhoea. A bimanual examination can be done for conformation with index finger over the medial canthal region to see fracture mobility and clamp inside the nose, clamp tip being underneath the finger. Central segment mobility by bimanual examination indicates fracture and requires open reduction.

Maxilla:

Hallmark of maxilla fracture is mobility of maxillary dentition. Facial edema, epistaxsis, bilateral ecchymosis, subcutaneous hematoma are suggestive of maxilla fracture. Other features are class III malocclusion with anterior open bite, step deformities, nasal fracture, CSF leak, elongated face with depressed nasal bridge giving classical 'Dish face' appearance. All Le Fort I fractures, II, III have bilateral maxillary sinus fluid and malocclusion while Le Fort II, III fracture have bilateral per-orbital ecchymosis. Nasal fracture is routine in Le Fort III and Le Fort II fracture.
The face may appear retruded, so called as "donkey facies" suggestive as craniofacial disjunction. If the zygoma is lower than maxilla medially, a zygomatic fracture is suggested

whereas if zygoma is higher than maxilla medially then it suggests pyramidal fracture. The maxillary segment can be examined using bimanual method, palpating through tips of the both finger externally on the skin and internally intraoral. Movement of maxilla demonstrated between the thumb and index finger but sometime manipulation test of maxillary mobility is not completely diagnostic as some fracture may be impacted or green stick which may not exhibit movement.

Diagnosis of fracture maxilla is suspected clinically and confirmed radio-graphically. Plain X-ray used was Waters, Caldwell and submentovertex view. Fracture of the maxilla are best documented by axial and coronal CT scan and 3D reconstruction CT scan helps in seeing the fracture in 3 dimensional view (fig 10). Bilateral maxillary sinus fluid should always be suspected of representing maxillary fracture until it is proved otherwise (fig 11). Fractures of pterygoid plates are diagnosed by CT scan (fig 12).

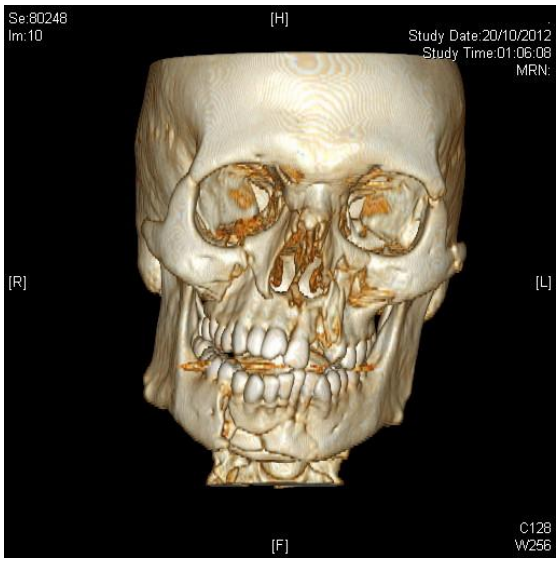


Figure 10: 3D reconstruction of skull showing Le Fort III fracture with right comminuted parasymphysis fracture.

Figure 11: Coronal section shows fracture of bilateral frontozygomatic fracture with bilateral fluid in maxillary sinus in Le Fort III fracture

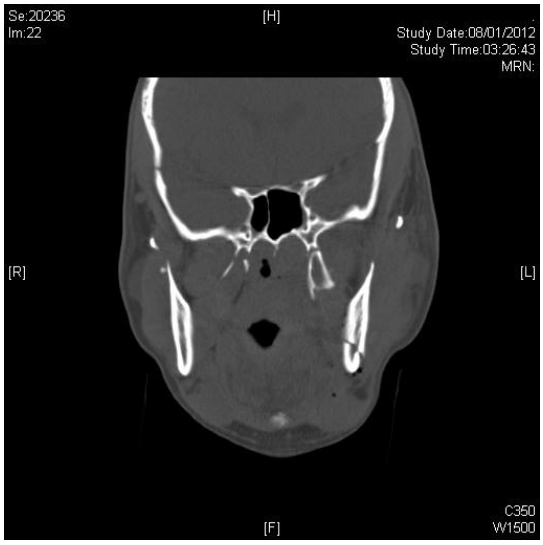


Figure 12: Coronal CT scan shows fracture of pterygoid plates with fracture of right side of ramus of mandible.

Zygoma

Ecchymosis and periorbital hematoma is common sign of orbitozygomatic complex. Other features are subconjuctival hemorrhage, telecanthus, diplopia, enopthalmas, depressed malar

eminence, trismus, antimongloid slant, step deformity at orbital rim, decreased sensation over infra-orbital region. Mouth opening may be restricted if the fractured zygoma is displaced backward to impinge on the coronoid process leading to slight lateral open bite. The characteristic feature is ecchymosis in the periorbital skin so called spectacle hematoma and eccyhmosis may be seen intraorally over the fracture zygomaticomaxillary buttress. If the orbital floor is lowered down with the zygoma, globe will displace downward producing enopthalmos and orbital dystopia.

The waters view is the best single plain film to demonstrate the fracture of zygomatic buttress. To see zygomaticofrontal buttress fracture caldwell view is second most helpful film. Zygomatic arch fracture is well documented by submentovertex view. CT scan obtained in axial (fig 13, 14) and coronal plane show the degree of the comminution and displacement of zygoma fracture

Figure 13: Axial CT scan showing bilateral zygoma arch fracture.

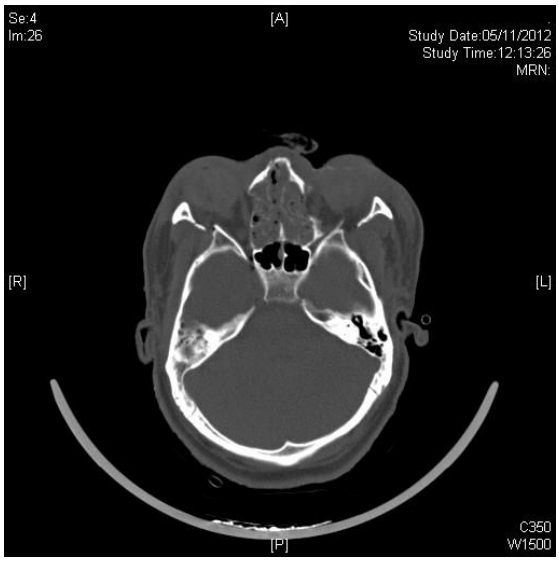


Figure 14: Axial CT scan showing fracture of zygoma at the greater wing of sphenoid

Mandible fracture

Change in occlusion is highly diagnostic. Clinical features include facial edema , laceration , missing tooth , jaw deviation to one side on mouth opening , open bite deformity , retruded appearance of lower 3rd face, anterior open bite suggest condylar fracture or angle fracture, posterior open bite is common with parasymphysis fracture , unilateral open bite is with ipsilateral angle or parasymphysis fracture , retrognathia seen with condylar or angle fracture. On bimanual manipulation, the degree of mandible mobility and site of fracture mandible, numbness in the distribution of mental nerve was accessed. Radiographic examination is imperative for confirmation. Plain films are less useful at present because of superiority of CT scan taken in axial and coronal planes. 3D scan of skull helps in seeing the skull in 3D (fig 15, 16). Coronal CT scan (fig 16) showing right condylar fracture.

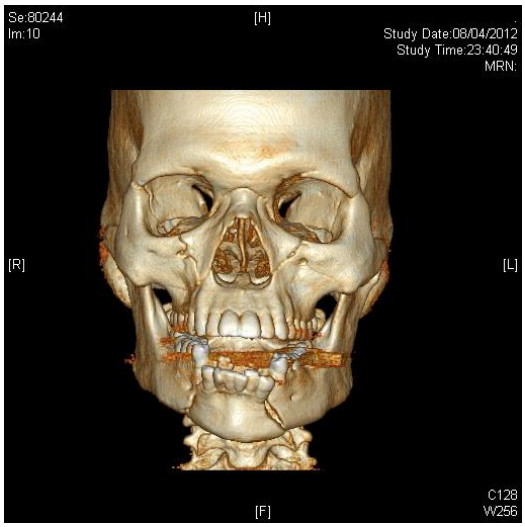


Figure 15: 3D reconstruction of skull showing bilateral parasymphysis fracture

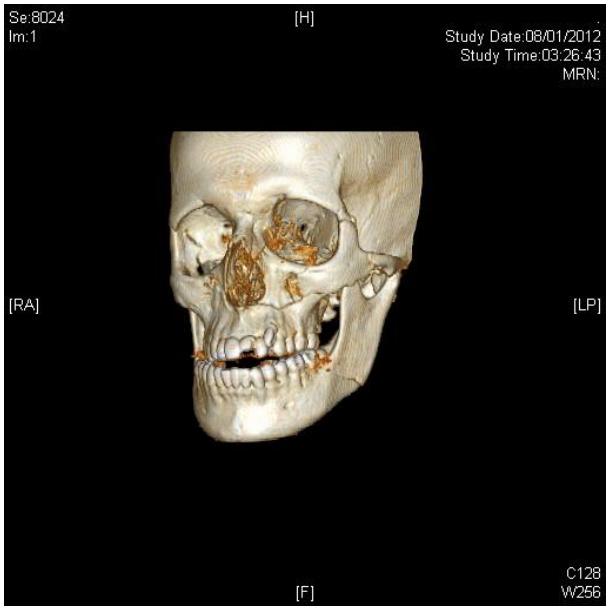
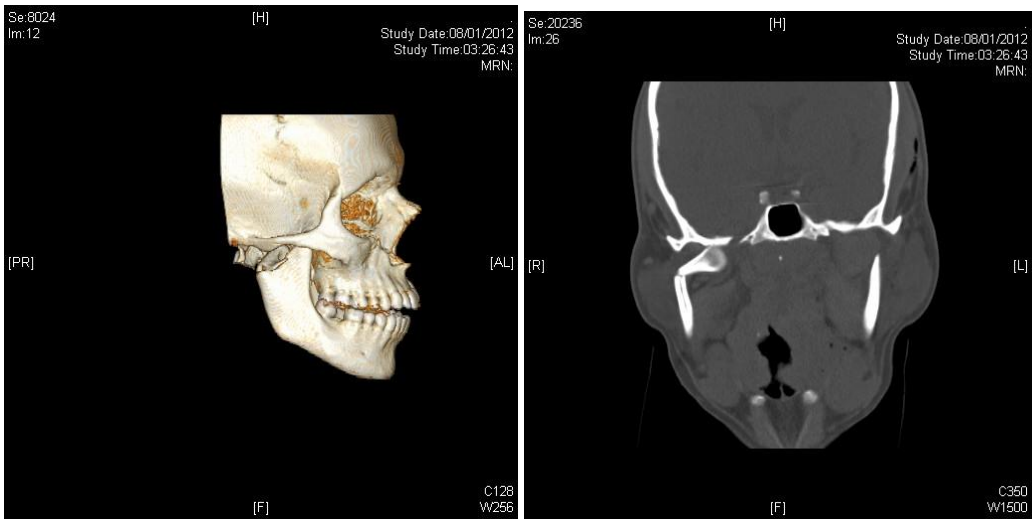


Figure 16: 3D reconstruction of skull showing left angle fracture



A B

Figure 17: Side view of 3D reconstruction showing right condylar fracture. B, Coronal CT scan showing medially displaced condylar fracture.

Literature Review

Literature Review:

The earliest known writing in maxillofacial fracture was recorded in 1650BC by Edwin Smith Papyrus which was published in 1852 by Smith[18, 19]. In the illustrations of Hellenic period at the temples of Asklepios, healing and religion were closely intertwined. Hippocrates often portrayed as the "father of medicine "described a myriad of facial injuries around 400BC. He provided insight of bandaging and single Jaw interdental wiring as a method of fixation and stabilization of facial fractures[20]. He taught the method of mandible fracture immobilization by gold or linen thread tied around the teeth. He also recommended extraoral fixation by strip of Carthaginian glue to skin and ends were tied to skull.

The Roman encylopedist Aulus Comelius Celus addressed the treatment of mandible fracture in the 8th volume[21 in] a series of volume entitled Artes. Indian surgeon Sushruta in 500 AD treated jaws by bandaging and bamboo stick mixed with flour and glue in complicated manner[22]. Initially in early 17th century dental treatment were provided by people who were called as "barber surgeon". Then in early 18th century Barber surgeons started using classical treatment ie resetting fracture, maintaining normal occlusion , fracture line were joined by ligature and immobilization with bandaging[23]. In 1728, Pierre Fauchard published book called *Trait'e de chirurgie dentaire* [24] *providing* details of basic dental anatomy so was credited with "Father of modern dentistry".

Baudens was the first to use wires for fixing mandible fractures as he used circumferential wires to immobilize oblique fracture[25]. Buck directly drilled holes in fracture segment and sutured them together using wire suture[26].

The first details of treating maxillary fracture were provided by Charles Fredrick Reiche in 19th century. Earlier elastic tubes were placed into the nose to maintain airway patency and use of head frame to treat maxillary fracture as reported by Carl Van Graefe[20]**.** Hamilton introduced gutta-percha Splint in 1855 that was prepared in patient's mouth and reduction of fracture[26].

Metallic splint was introduced by Hayward in 1858, used for severely dislocated fracture[27]. Thomus Gunning[28] in 1866 designed a splint known as "Gunning Splint". This splint was single piece with hole for eating. Screw was used to fix the splint to hard palate and mandible.

Gumell Hammond[29], a dentist, developed wire ligatures to immobilize mandible fracture in 1877. In 1887, Thomas L Gilmer[26] used arch and reintroduced intermaxillary fixation for mandible fracture.

Rene Le Fort, a French surgeon, in 1901 published his classical paper in mid facial fractures. He studied fracture pattern of facial skeleton on 35 cadavers following blunt facial trauma inflicted by him[30]. His experiment determined the areas of structural weakness of maxilla. Lothrop in 1906 described the use of antrostomy approach to reduce zygoma fracture. Keen in 1909 introduced intraoral approach to zygoma arch .Fracture zygoma reduction and manipulation was described by Gillies[31] in 1927.

At same time, Robert H.Ivy [26] in 1922 was modifying his technique of splinting and intermaxillary fixation. His technique of eyelet loop in wire ligature for intermaxillary fixation becomes popular as "Ivy Loop".

The first percutaneus nailing with use of kirschner wire to treat mandible fracture was introduced by Parkhill in 1897 but published in 1932 [25]. Now it was start of modern traumatology with the development of osteosynthesis. Sir William Lane was first to use osteosynthesis plate for mandible fracture[14].

Osteosynthesis came in picture for facial fracture in 1970 with the Swiss Arbeitsgemeinschaft für osteosynthesefragen (Association for the Study of Internal Fixation or AO) developing miniplate fixation. Now miniplate provides the principal modality of treatment for reduction and fixation of displaced midfacial fractures.

Increasing incidence of facial trauma is often associated with morbidity which leads to severe facial disfigurement and some loss of function with increase in treatment costs for the patients. The analysis between the epidemiology and associated injuries is important to improve treatment and prevention. Rowe and Kelly[15] analyzed 1500 facial fracture in which 629 (41.9%) midface fractures were involved. Kelly and Harrigan[52] studied 4317 maxillofacial fractures in which 594 (13.76%) involve middle 3rd of face.

Beaumont et al studied 389 maxillofacial fractures in three population groups. Male to female ratio was 4:1. The highest incidence of fracture was in 3rd and 4th decade. The mean age of 32, 30 and 27 were noted for black, asians and whites respectively. Interpersonal violence was more common in blacks, while motor vehicle accident was predominant cause in Whites. Mandible fractures were the most common in all the groups followed by midfacial fracture and then combined fracture of mandible and maxilla fracture.

Snijiman[32] and Duvenage[33] published similar data in their study conducted in Tshwane district of Gauteng province in 1963 and 1979 respectively. The highest incidence of maxillofacial fracture was noted in 3rd decade. Assault was the most common cause of facial fracture in blacks as

compared to while motor vehicle accident was predominate cause in whites. Mandible was the most common fracture in the study.

Bataineh et al[34] did a 5 year retrospective study of incidence of maxillofacial fracture in Jordan. He studied 563 patients in which mandible fracture was most frequently fractured (74.4%) followed by maxilla, zygomatic arch and dentoalveolar process respectively. Road traffic accident (55.2%) was most common cause followed by accidental fall (19.7%) and assault (16.9%). Male to female ratio was 3:1 and mean age for injury was 3rd decade.

In 1980s, Balakrishna[40] reviewed 313 cases in his study. He found marked male preponderance (93.3%) as most people who drive vehicle were males. Here most common cause of maxillofacial accident was road traffic accident followed by assault and mean age of injury was 3rd decade.

There was increase incidence of maxillofacial fracture due to violence and sport injuries as compared to road traffic accidents as described by Van Beek[35] in Netherland. Result was different in Austria as reported by Gassner[36] who found that "daily activities and play accidents were main reason followed by road traffic accident, interpersonal violence and sports. He also noted increase incidence in female patients with male: female ratio of 2.1:1.

Midfacial fractures involving the zygomaticomaxillary complex was highest as noted by Greene[37] followed by orbital blowout, nasal, zygomatic arch fracture, Le Fort and NOE fracture respectively. Greece[38] had a different associated fractures distributation pattern as zygoma

fracture being more common followed by Le Fort II, NOE, Le Fort III, nasal Le Fort I, palatal split and dentoalveolar fractures respectively.

Zygomatic complex fractures incidence was highest among midfacial fractures followed by NOE, isolated orbital fracture and Le fort fractures respectively as analyzed by Al-Khateeb[39] in United Arab Emirates.

A zygoma fracture was more prevalent in a study done by Ferreira et al[40] followed by alveolar fractures, Le Fort fractures, orbital fractures and hard palate respectively.

Aims and Objectives

Aims and Objective

1) To find out the incidence, demographic profile and pattern of facial injuries
2) To study the association of fracture pattern and mechanism of maxillofacial injuries
3) Improve knowledge of etiological factors and mechanism of injuries

Material and Methods

Material and Methods

Ethical Clearance

An application for ethics clearance was sought with ethical IRB committee, Christian medical college, Vellore

Inclusion criteria

Patient presented in Casualty with Maxillofacial fracture.

Clinical study

This study was done retrospectively in the Department of Plastic Surgery, Christian Medical College, Vellore. A total of 280 patients record who were admitted in casualty with maxillofacial fracture were collected over the period of 5 years from Jan 2008- Nov2012.

The data recorded include demographic profile, etiology of the fracture, history of alcohol intake, loss of consciousness and associated injuries.

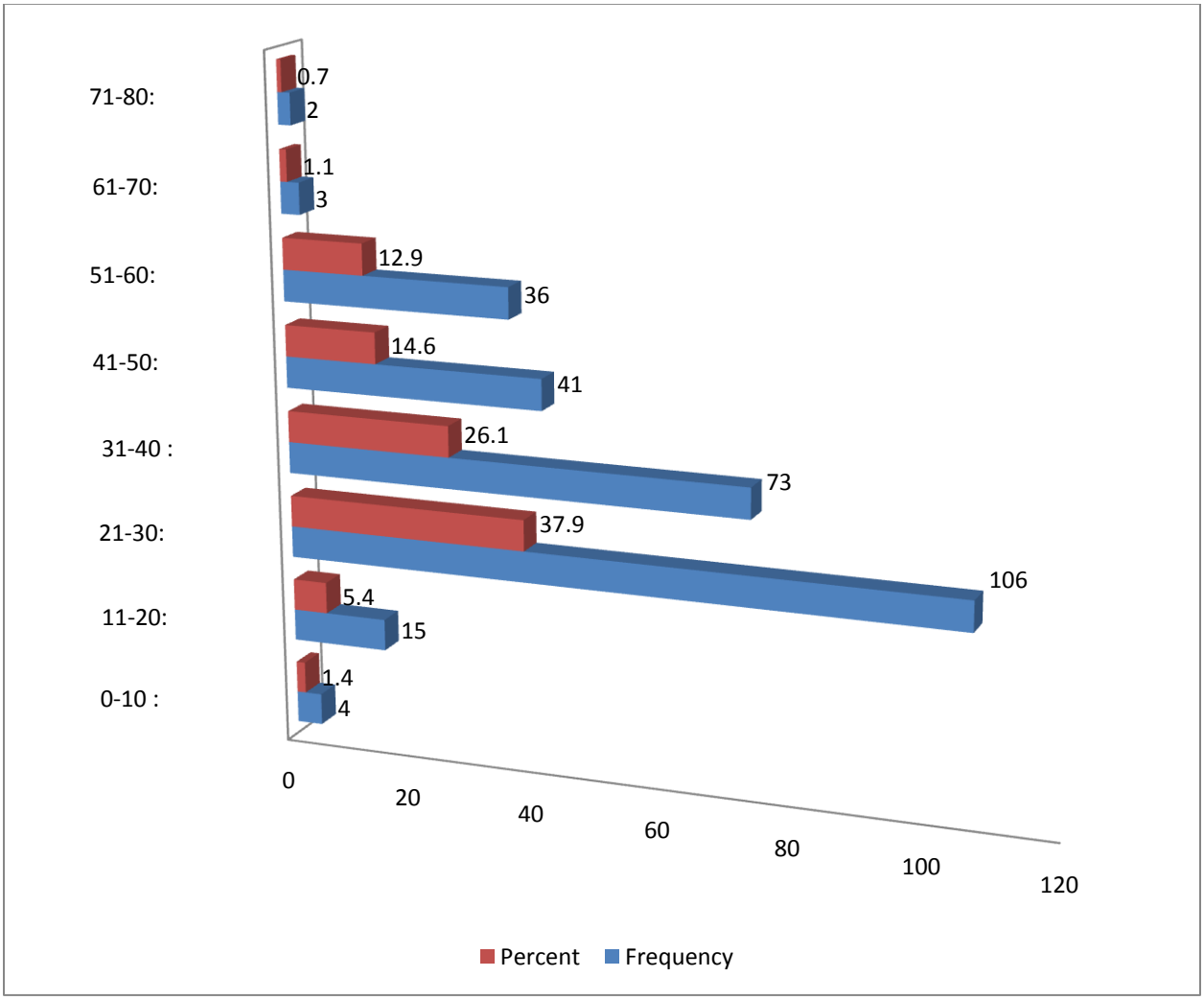
Results

Results

Records were obtained from a total of 280 patients who sustained maxillofacial fracture.

The patients ranged from three to 80 years. The ages were defined per decade for comparative studies listed below.

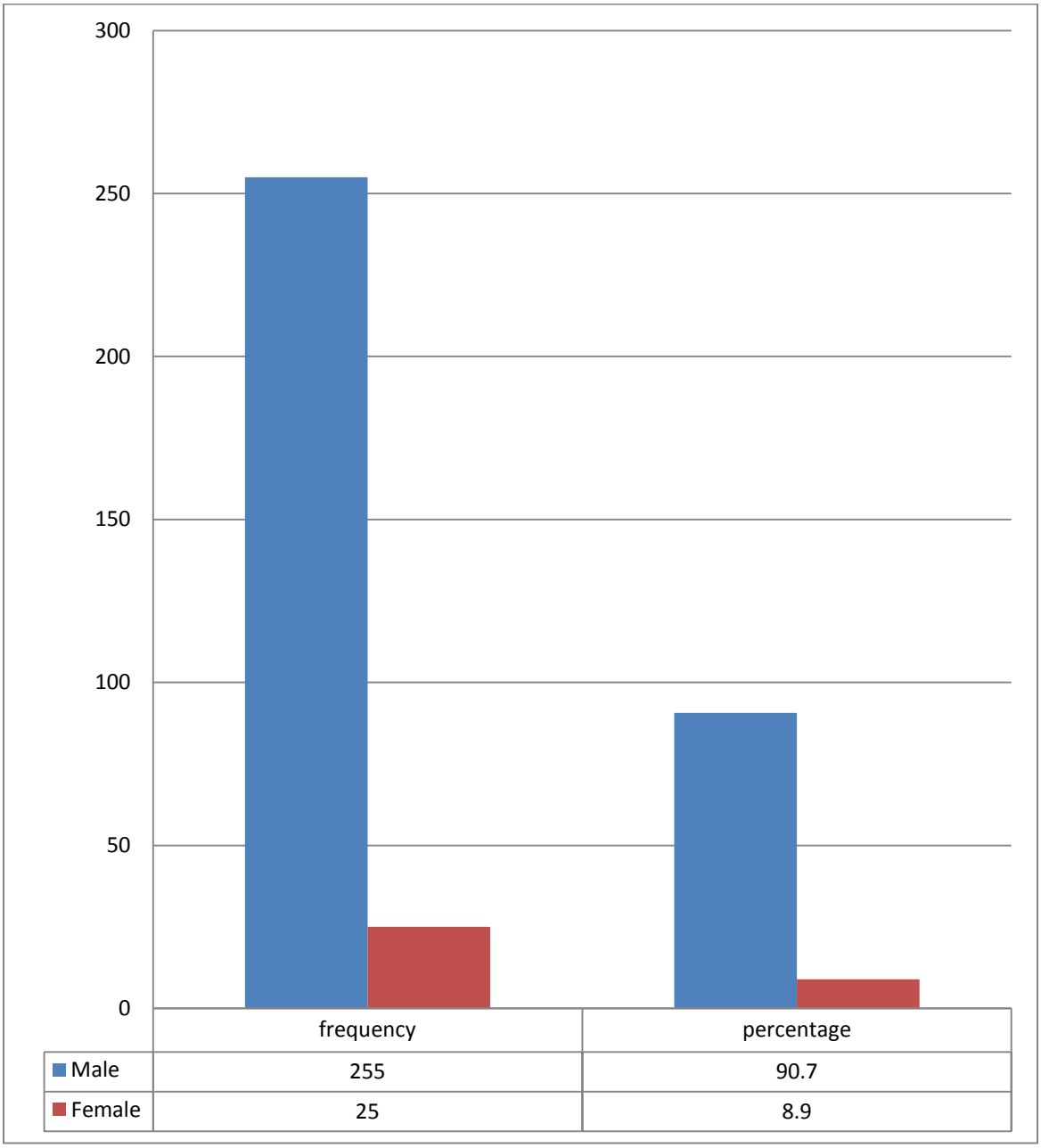
Table 1: Frequency and percentage distribution by ages in decades (N=280)



Age group between 21-40 years was more commonly involved in maxillofacial fracture as compared to other group.

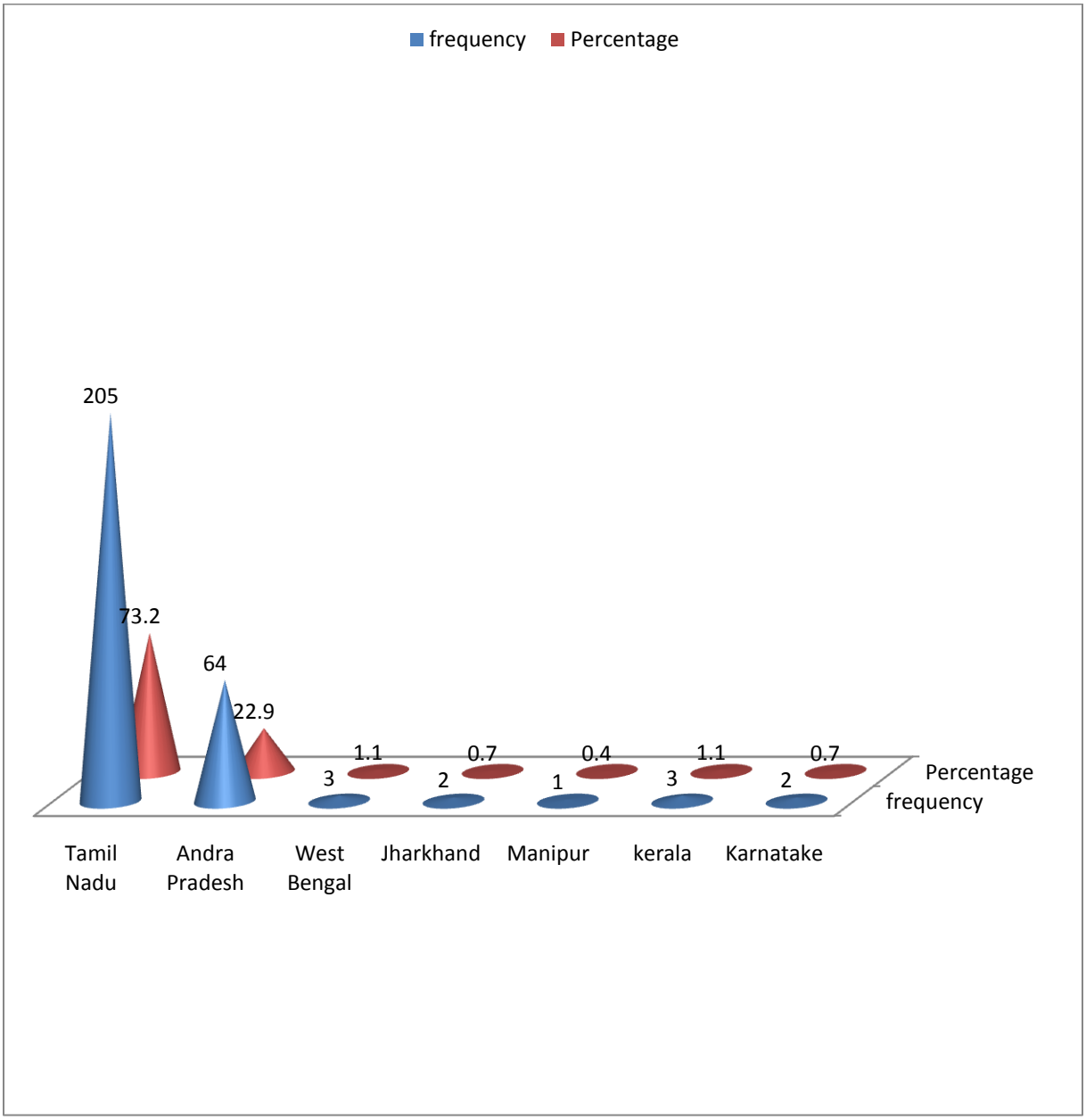
Gender distribution revealed a male predominance in a ratio of 10.2:1

Table 2: Frequency and percentage distribution of Gender (N=280)



Most of the patients were from the Tamil Nadu.

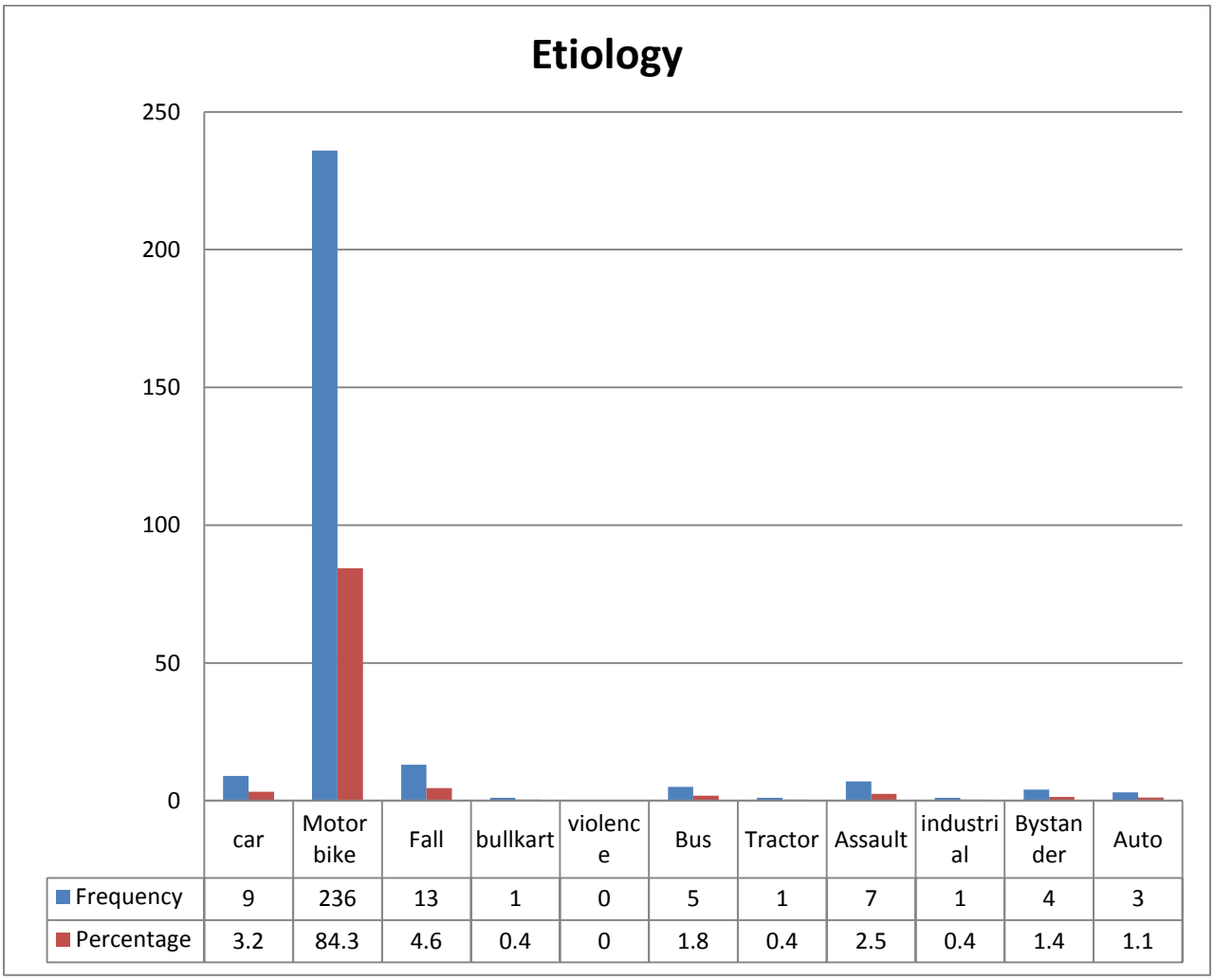
Table 3: Frequency and percentage distribution of residence (N=280)



Etiology of maxillofacial injury

The distribution of the causes of the fracture is shown in the table. The most common cause of maxillofacial fracture was road traffic accident while driving motorbike (84.3%) followed by fall from height (4.6%), car (3.2%), assault (2.5%). We had no case of maxillofacial fracture due to violence which were more common in western countries.

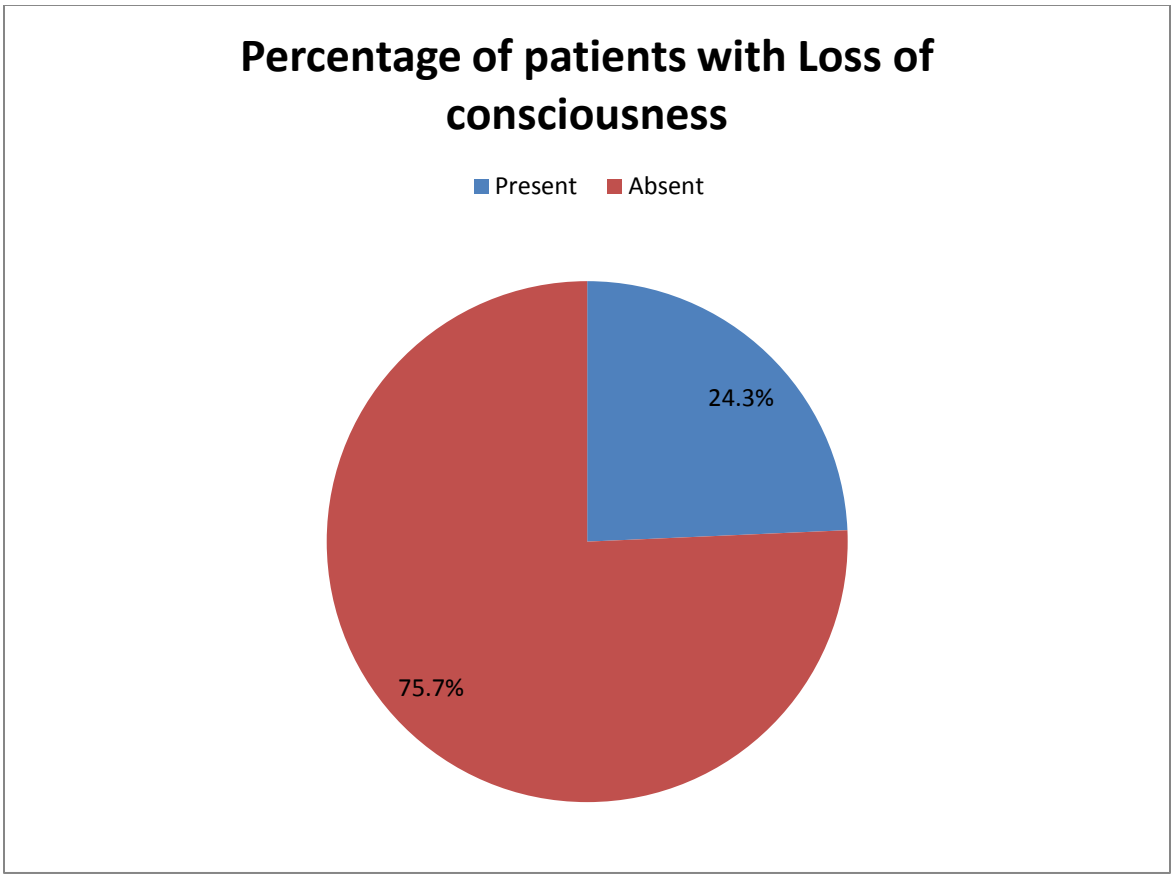
Table 4: Frequency of distribution of etiology of maxillofacial fractures



	car	Motor bike	Fall	bullkart	violence	Bus	Tractor	Assault	industrial	Bystander	Auto
Frequency	9	236	13	1	0	5	1	7	1	4	3
Percentage	3.2	84.3	4.6	0.4	0	1.8	0.4	2.5	0.4	1.4	1.1

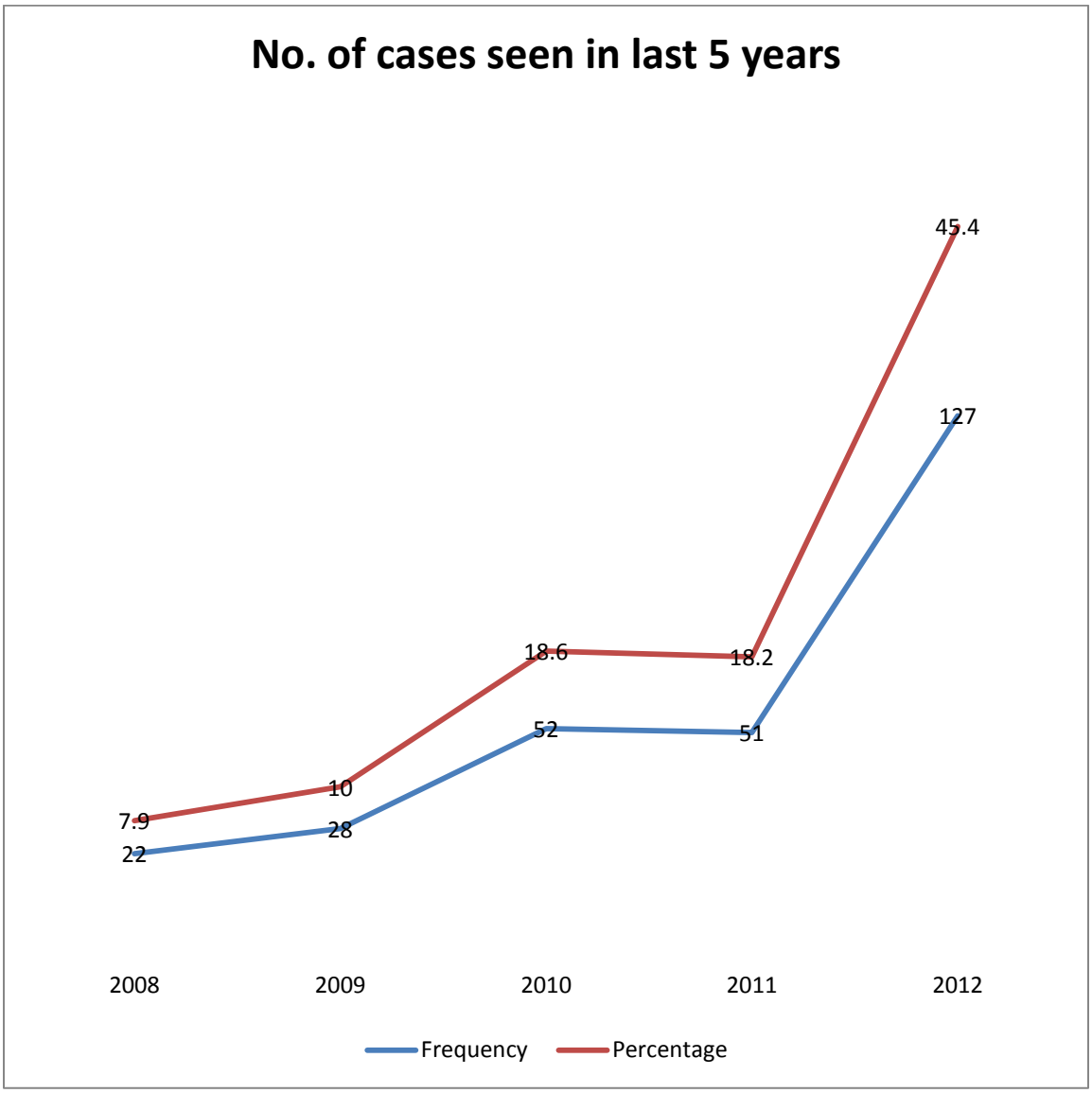
Social habit of alcohol consumption was also seen in 13.6% of the patients presented with maxillofacial fracture. Approximately 24.3% of patients had some degree of loss of consciousness as illustrated in the table 5.

Table 5: Percentage of Distribution of Loss of Consciousness



In 2012, cases of maxillofacial fracture were more compared to previous years with 45.4%.

Table 6: Frequency and percentage distribution of maxillofacial fractures cases in last 5 years



The monthly distribution of maxillofacial fracture was more in June and August i.e. 10.4% and 10.7% respectively. February and December months had less no of cases i.e. 16% and 18% respectively.

Table 7: Frequency and percentage of distribution by month in a year.

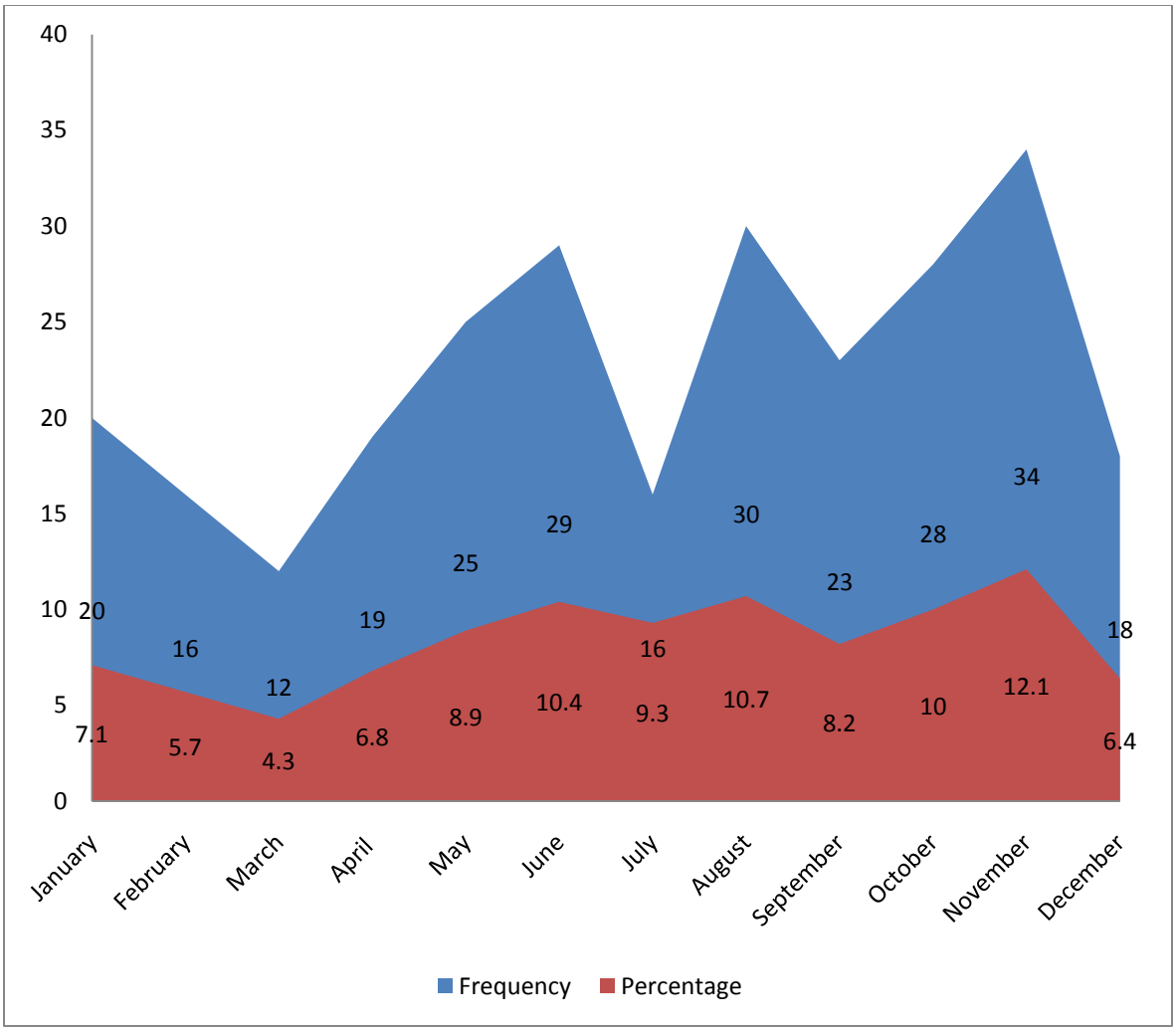


Table 8: Frequency and percentage distribution by day of the week (N=280)

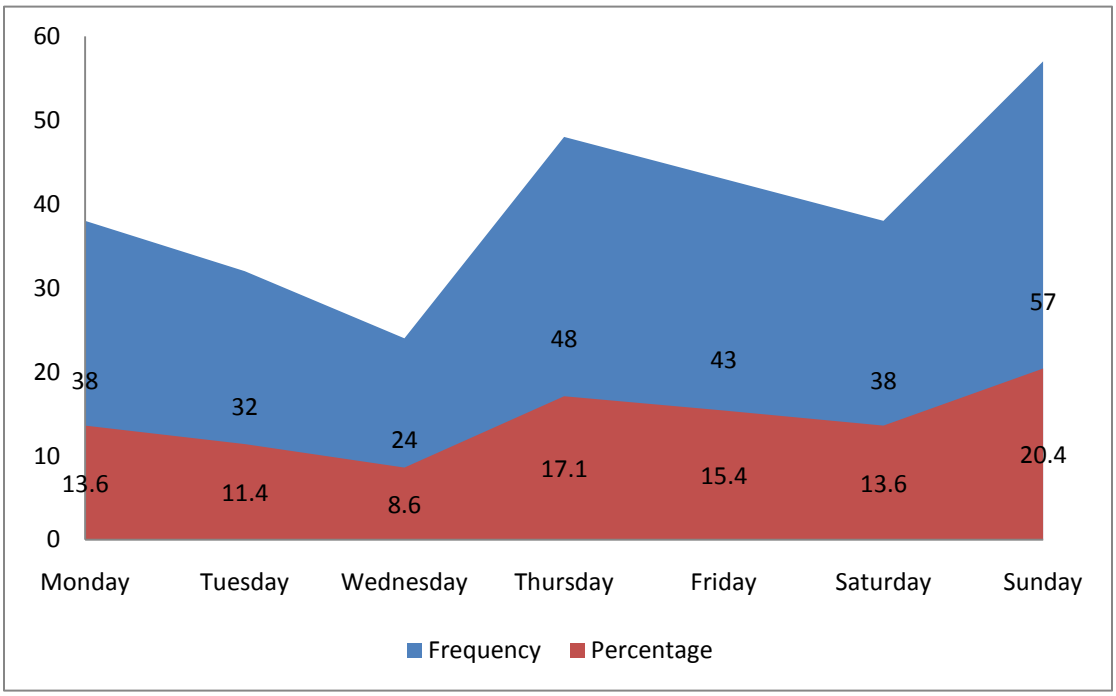


Table 9: Frequency distribution of hospital stay

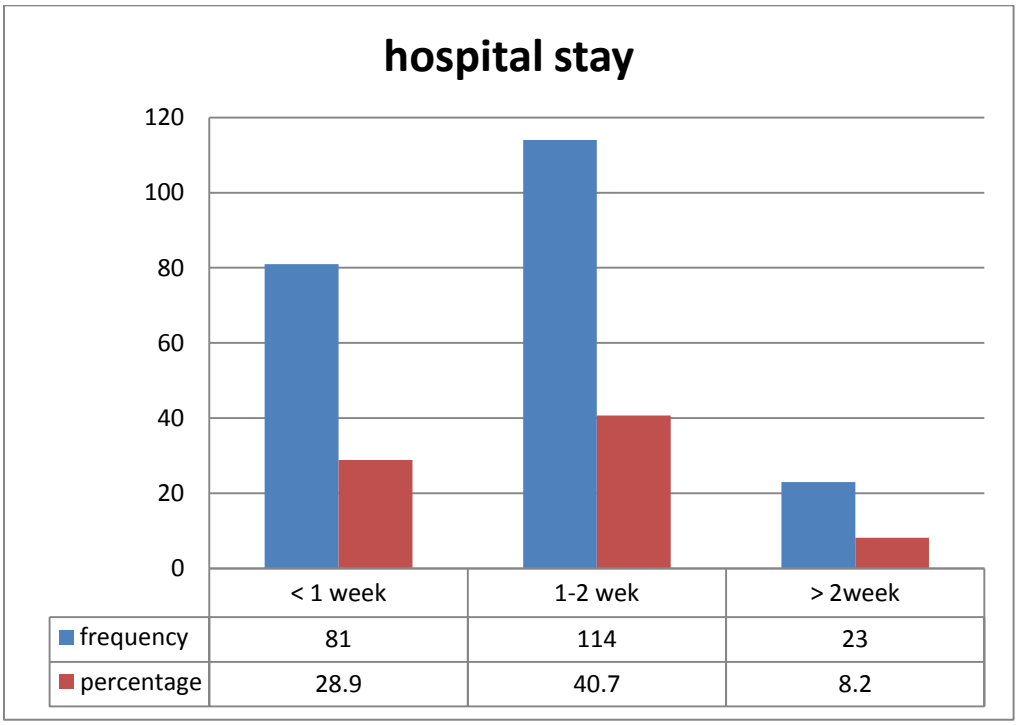
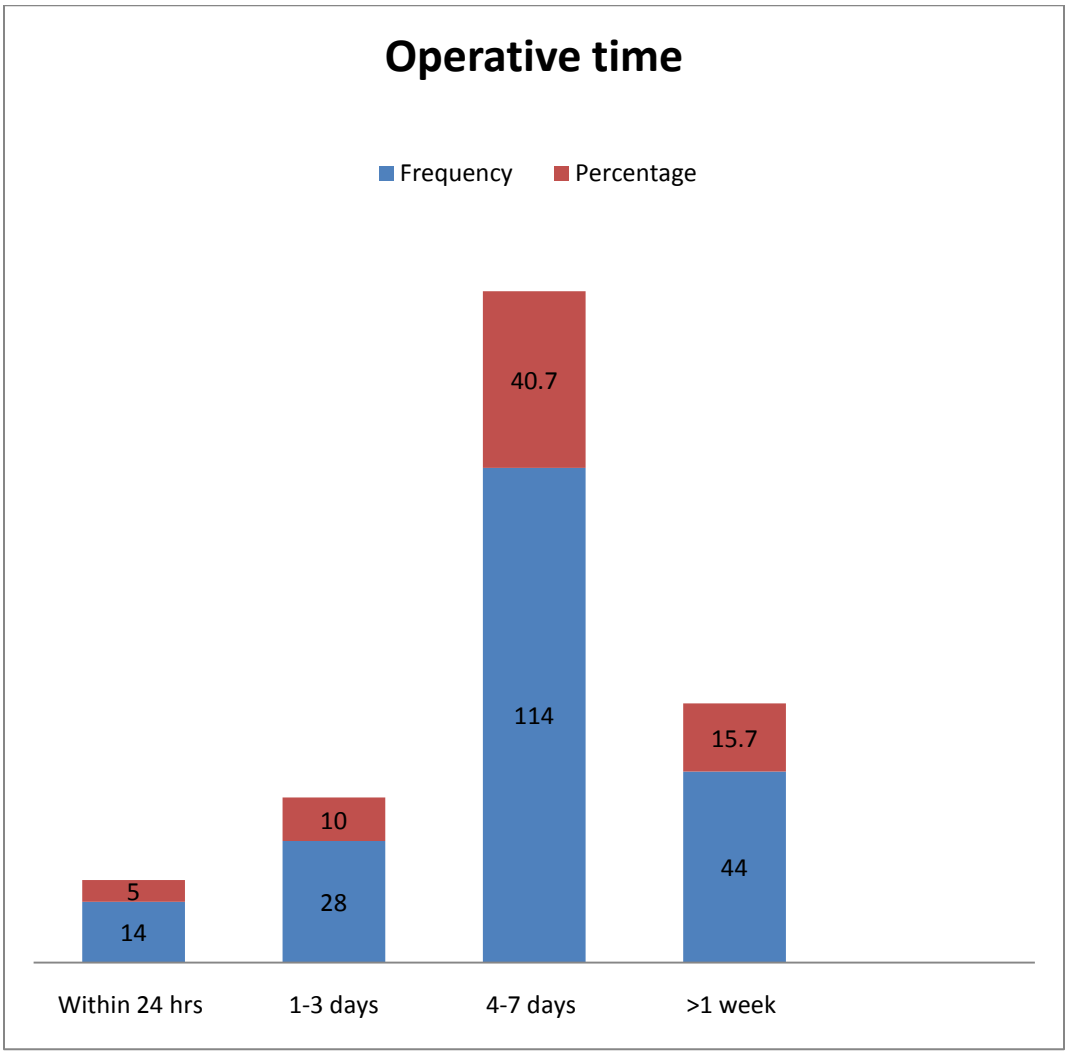


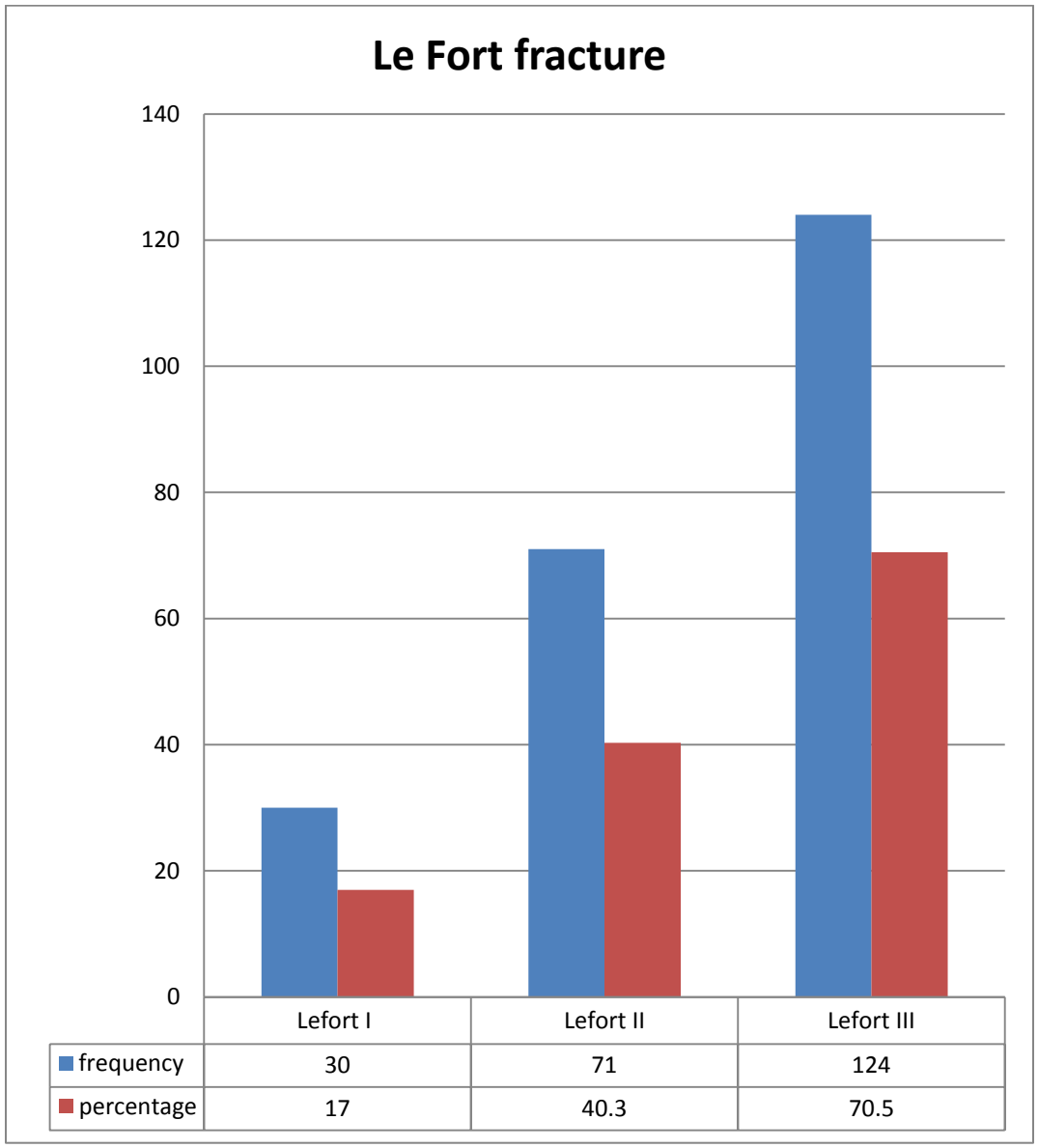
Table 10: Frequency (N=200) distribution of surgery from the day of injury



Most of patients with maxillofacial injuries were been operated between 4-7 days of injury (40.7%).

Le Fort fractures are present in 176(62.9%) out of 280 patients. Le Fort I fracture is 17%, lefort II 40.3% and lefort III 70.5%. Maximum patients present were Le Fort III fracture 124 out of 176.

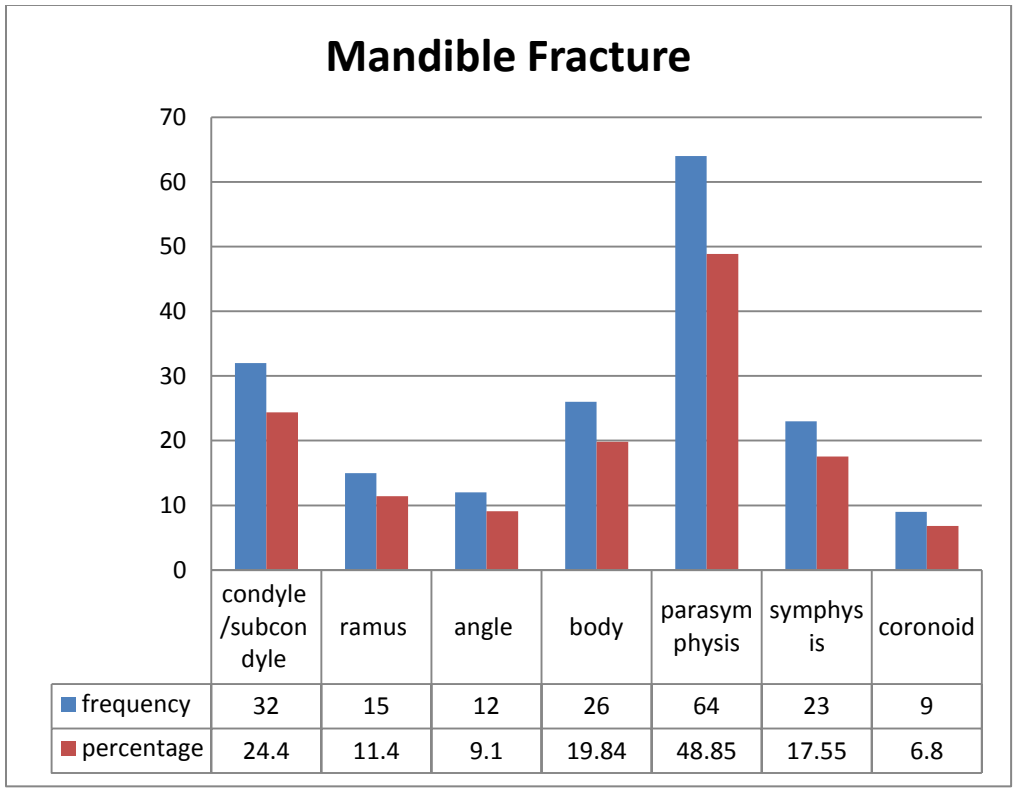
Table 11: Frequency and percentage distribution of Le Fort fractures



Mandible fracture including condyle, parasymphysis, symphysis, body, ramus and angle was 131 (46.8%).

The most common fracture was parasymphysis 48.85%. The common combination was parasymphysis with condyle fracture is 21.

Table 12: Frequency and percentage distribution of mandible fractures

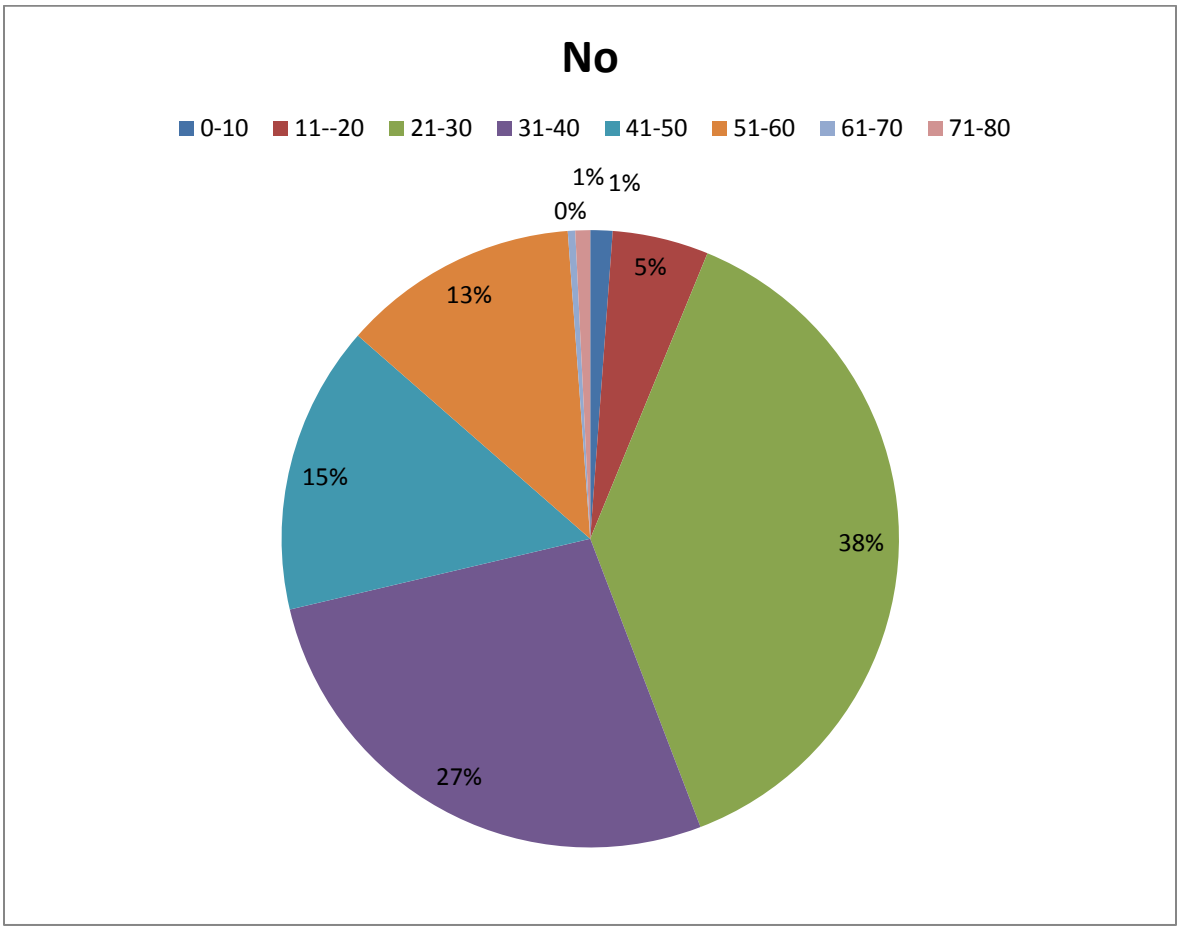


Mandible fracture was common in the age of group 21-30 years (36.6%) and in the age group 31-40 years (30.5%). Le Fort fracture was common in age group 21-30 years (37.5%) and in the age group 31-40 years (29%).

History of alcohol in Le Fort fracture is in 24 out of 176 and mandible fracture is 21 out of 131.

Panfacial fracture is mandible and Le Fort fracture is in about 131 out of 280.

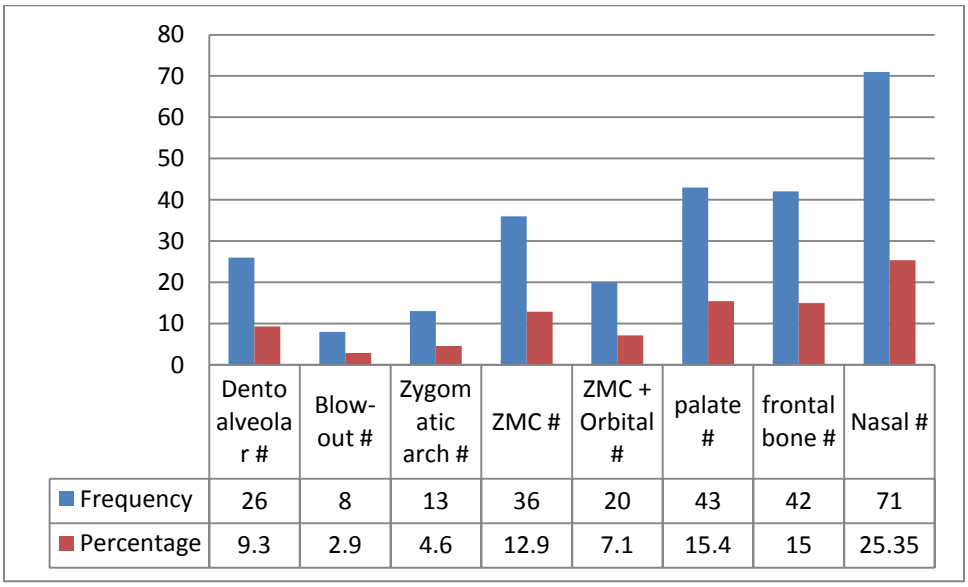
Table 13: Percentage of road traffic accident and distribution in the different age group.



Road traffic accident is more common in 21-30 year age grope is 98 and 31-40 years age group is 70 out of 258. Alcohol is present in 13.56% of cases of road traffic accident.

Patients had non-Le Fort fracture which involve only maxilla: 26(9.3%). In 8 (2.9%) case patients had blowout fracture. 24.6% of total cases patients had fracture of zygoma with variable involvement of maxilla and orbit. Patients had palate and frontal bone fracture i.e. 15.4% and 15% respectively.

Table 14: Other associated facial fracture (N: 280)



C-spine injuries associated with facial fracture were 1.4 %[4]. Injury to globe was about 0.7% which was managed by ophthalmic unit. Incidence of long bone fracture including tibia, femur, radius and ulna with maxillofacial fracture was 13.1%. Pelvic fracture was 1.8% associated with facial fracture. We found 2 cases with facial nerve injury which was managed conservatively.

Chi-square test was done to see significance of the study

Age group is compared with road traffic accident. P value was 0.008 which is significant at 1% value. Mandible fracture is compared with age and P value was 0.521 which was not significant. Le Fort fracture compared with age group and P value was 0.020 at 5% level which is not significant. Significance is tested between RTA and alcohol and P value was 0.99 which is not significance.

Student T test

Students T test between motorcycle with age and P value was 0.296 which was not significant. Mandible fracture with age and P value was 0.582 with was not significant. Le Fort fracture with age and P value was 0.372 which was not significant.

Discussion

Discussion

The Department of Plastic Surgery, Christian medical college provides services including maxillofacial surgery with trauma to this northern part of TamilNadu. This institute also accepts referrals from the other adjacent part of south India.

The most common etiology in our study was motorbike accidents accounting for 84.3%. Other causes were car accidents (3.2%), fall (4.6%). But in our study no maxillofacial fracture was due to violence, but in other study i.e studies conducted in Africa which indicate violence as the principle modality of maxillofacial fracture[32, 33]. Greene et al[37] also found that most of maxillofacial fracture are from non-penetrating injury. Our results are comparable to the other studies.

This study shows road traffic accident accounted for 92.2% of all facial fracture. In study conducted by Zachariades et al[38] and Van Beek et al[35] also noted road traffic accident for more than half of maxillofacial fracture in Greece and Netherlands respectively.

Van Beek et al[35] noticed increase in violence with decrease in road traffic accident as a cause of maxillofacial injuries in over 27 years as a etiology of maxillofacial injuries due to strict strict rules.

In this study we noted that the male to female ratio is 10.2:1. This marked male predominance which is similar to other epidemiological studies conducted in Jorden[34] and Netherlands[35]. The findings are favorable in studies conducted in south Africa[32, 33, 41.] In studies conducted in Austria[35] and in Chennai[42], India where the author reported high incidence of female but still with male predominance.

71.4% of patients admitted took treatment in our hospital. Out of it 73.2% of them were from Tamil Nadu but many patients came from Chittor, AndraPradesh (22.9%) as it is only 2 hr from the CMC hospital. In South African, 77.6% of patients with maxillofacial fracture are black and are also unemployed compared to other race in the region[43].

The age range was noted that 64% of individuals who sustained maxillofacial fracture were reported to be in their third and fourth decade with highest incidence noted in the third decade (37.9%). 1.8% incidence of maxillofacial fracture in the age group more than 60 years. In Desai[44] study, as described in this group as the unskilled labor force that are weakly paid so that may lead to increased in interpersonal violence with robbery often being the motive. But in our study the motor vehicle accidents are more common as it is easy means of transport and traffic rules are not strict i.e. not wearing helmet , leading to maxillofacial trauma and fracture.

Consumption of alcohol is strongly associated with maxillofacial injuries. Alcohol impairs judgment which often leads to violence and is a major factor in motor vehicle accident. In our study 13.6%, patients were intoxicated at the time of injury. In study conducted by Chandra Shekar BR[45] et al and Zix JA et al[46], the incidence of alcohol intoxication was 41% and 13% respectively. In study, Al Ahmed et al[47] reported nil alcohol consumption in patient's presented with maxillofacial injuries in Sharjah, United Arab Emirates. This can be explained by the fact that they have strict law in sales and consumption of alcohol which is effective in preventing alcohol related injuries.

Kontio et al[48] reported 67.02% loss of consciousness in their study due to violence causing maxillofacial injuries. In our study it was 24.3%.

Kontio et al[48] also noted high incidence of maxillofacial injuries over the weekends. We had long supported the hypothesis that maxillofacial fracture occurred during weekends. This study confirms our suspicion in that 34% of 280 patients were injured in the weekend, with sunday (20.4%) being the day of most injuries least incidence on wednesday (8.6%). Chandra Shekar BR et al[45] reported 90% of cases over the weekend. Batista AM et al[54] also reported high incidence of maxillofacial injury on weekends 73%.

We had high incidence of patients presented with maxillofacial fracture in 2012 (45.4%) as compared to 2008 (7.9%). This may be due to increased buying capacity of people buying motorcycle.

There is higher incidence of maxillofacial fracture during festival season i.e. October and November (22.1%). Subhashraj K et al[42] also reported the 19 % of incidence at same time.

We have patients operated maximum in between 4-7 days (40.7%). In other studies patient were operated in mean 13.9 days.

The cause of etiological and pattern of maxillofacial fracture have been reported to vary from one geographical region to another depending on geographic condition, socioeconomic status and culture.

The male predominance in our study agrees with what is reported in literature[36-38, 49-52.] Male are more prone to facial fracture due to their greater involvement in high risk activities such as driving vehicle, sports , active social life and alcohol consumption.

The majority of patients in our study were young adults in their third decade 21-30years which is in agreement with other studies[42, 49, 53, 54] .But in some studies, Erol et al[55]and Quamuddin et al[40],

reported the dominant age group having high incidence were 0-10 years and 11-20 years respectively.

The present study shows that the most common cause of maxillofacial fracture was motor vehicle accident, which is consistence with other studies reported (45,48,53,54,56), But in Kapoor et al[57]reported assault as a most common cause of maxillofacial injuries in their study.

Midfacial complex is equipped to withstand direct impact directly upward from below but it is poorly constructed to withstand lateral and frontal assaults. Le Fort classification for maxillary fracture was mostly used.

The incidence of Le Fort fracture I (10.7%), Le Fort II (25.4%) and Le Fort III (25.4%). In other studies its incidence of Le Fort fracture is less [48, 54]. But in study done by Gilyoma JM et al[58] reported high incidence of Le Fort fracture.

Midfacial fracture studied by Beaumont et al, zygomatico maxillary complex was predominant followed by Le Fort fracture. But in our study zygomatico maxillary complex fracture is 24.6% and Le Fort fractures were most common with 62.9%.

Due to sheer pace of our life and high speed travelling makes us prone for facial trauma. Mandible is one of the facial bone common for fracture and if not appropriately treated may lead to severe deformity both cosmetically and functionally. The incidence of mandible fracture in our study is 131(46.8%). As children age progress, they are more involved in physical activities makes them more prone to mandible fracture.

In our study, the incidence was highest in 21-30 years of age 48(36.34%) followed by 31-40 years of age 40(30.53%). This is comformity with Natu SS et al[49], Chandra Shekar BR[45], Sakre

et al[50]. Male are predominant as compared with females. This is conformity with Sakre et al[50] and Ogundare et al[51]. Passeri et al[52] had slight variation from this study. The table shows the etiology division of study objects. The most common etiology for mandibular fracture is road traffic accident 131(280), which is in accordance with Passeri et al[52] and Olasoji et al[59]. In our study, fall from the height is second most common etiological factor. Road traffic accident is still the major cause of maxillofacial fracture due to heavy traffic, high seep driving, and reluctance to wear helmet and poor implementation of traffic safety rules.

In our study, 45 were isolated mandible fracture and 86 cases had associated Lefort fracture. This differs from the observation of Sakr et al[50] who reported 91% cases as isolated mandible fracture and about 9% cases with other associated injuries.

Among the 131 mandible fracture site observed in this study, the commonest site is the parasymphysis which accounts for 64(48.85%), followed by condyle 32(24.4%), angle 12 (9.1%), symphysis 23 (17.55%), ramus 15(11.4%), body 26(19.84%). The parasymphysis being most commonest in this study is contrary to Ellis et al[60] , Adi et al[61] , Bataineh et al[62]and Shah et al[63] who reported body as commonest while Sakre et al[59] reported angle; Motamedi et al[64]and Passeri et al[52]reported condyle as the most common site of fracture.

The most common site is parasymphysis due to presence of permanent tooth bud in children presenting a high bone ratio, while in adult the length of canine root weak the structure. At the maximum convexity of the curvature the force per unit area is greatest resulting in fracture.

The commonest combination of fracture in this study is parasymphysis with condylar fracture accounting for 21(16.03%). This is probably due to horizontal direct impact to parasymphysis resulting in force proceeding to mandibular condyle leading high tensile strength at the condyle

causing fracture. This is study is in contrary to Dongas and Hall et al[65] who observed parasymphysis with angle, Ogundare et al[51] reported body with angle as the commonest combination.

Conclusion

Conclusion:

The study done showed that the majority of patient with maxillofacial fractures were male as compared with females. The majority of this patient was injured maximum over the weekends and around the festival season ie diwali and dusherra. Road traffic accident due to motorcycle was the most common cause of maxillofacial fracture. The Lefort fracture was the most common observed facial fracture. All of patients presented with maxillofacial were not wearing helmet.

The maxillofacial skeletons are prone for injury in road traffic accident. This study reveals the need of preventive measure. To avoid maxillofacial injuries due road traffic accidents necessitates strict traffic law. People are required to educate regarding alcohol abuse. Patients with maxillofacial inury should have accesses to local hospital and medical college to receive treatment from the trained doctors and paramedical personnel. Most of the victims are in the age group of 20-40 years, as these people are their prime life which affected and it is huge loss to the society and country.

We in this study had tried to assess only some of parameters related to maxillofacial fractures. We suggest more detailed study to identify the cause and changing trends of maxillofacial fractures, to assess to impact of maxillofacial injuries in patients life, to assess to effectiveness of management and public education.

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Annexure-1

INFORMATION SHEET AND CONSENT.

Dear patient

My name is Dr Sandeep Dawre and I am a registrar in the Department of Plastic Surgery. As part of my training, I am conducting a study about maxillofacial fracture (broken bones of the face from the eyebrow, nose, the bones around the cheek and upper jaw and lower jaw. This study aims to provide a five-year retrospective statistical analysis of maxillofacial injuries in patients from 2008 and 2012 in our Hospital. The data will be collected included age, sex, cause of injury, site of injury, type of injury, associated injury, monthly and daily variation, treatment, and complications will be recorded. I require your help by allowing me to use your clinical records and analysis of your radiological records for the purposes of this study. It is hoped that this study will help our department better understand this injury, and improve on our service to all of our patients.

Your participation in this study is purely voluntary if you so wish at any time and that whether you participate or not will not affect your personal life and such you may choose whether you would like to participate in this study or not. Please note that it is your right to withdraw from this study if you wish at any time. You will notice that the all information gathered is strictly confidential and will be used for research purposes only.

If you have any more queries, please contact PHONE: 04162282017

CELL PHONE: 91 8940850559

Annexure - 2

Informed Consent form to participate in a research study

Study Title: A 5 year Retrospective Epidemiological Analysis of patients diagnosed with Maxillofacial Fractures.

Study Number:

Subject's Initials: _____ Subject's Name: _____

Date of Birth / Age:_____

(i) I confirm that I have read and understood the information sheet dated _____ for the above study and have had the opportunity to ask questions. [ ]

(ii) I understand that my participation in the study is voluntary and that I am

Free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected. [ ]

(iii) I understand that the Sponsor of the clinical trial, others working on the Sponsor's behalf, the Ethics Committee and the regulatory authorities will not need my permission to look at my health records both in respect of the current study and any further research that may be conducted in relation to it, even if I withdraw from the trial. I agree to this access. However, I understand that my identity will not be revealed in any information released to third parties or published. [ ]

(iv) I agree not to restrict the use of any data or results that arise from this study provided such a use is only for scientific purpose(s) [ ]

(v) I agree to take part in the above study. [ ]

Signature (or Thumb impression) of the Subject/Legally Acceptable Representative:_____

Date: _____/_____/_____

Signatory's Name: _____

Signature of the Investigator: _____

Date: _____/_____/_____ Study Investigator's Name: _____

Annexure- 3

Proforma

Name:
Hospital No:
M/F:
Residence:
History of Alcohol intake: Yes /NO
History of Unconsciousness: Yes / NO
Year of Injury:
Month of Injury:
Day of injury:
Total hospital stay:
Time of surgery from the day of injury:
History of Head injury:

Mechanism of injury

Car:
Motorbike:
History of fall:
Bullock cart:
Bus:
Auto:
Tractor:
Assault:
Pedestrian Foot:
Industrial:
Other:

Treatment:

Nontreated:

Treated:

Conservative:

Require: Tracheotomy:

ICU care:

Diagnosis:

Le Fort I, II, III

NonLefort Fracture: Yes / No

Blowout orbital Fracture: Yes / No

Isolated Zygoma fracture: Yes / No

ZMC Fracture: Yes / No

ZMC + Orbital Fracture: Yes / No

Nasal Bone Fracture: Yes / No

Palate bone Fracture: Yes / No

Naso-orbito-ethimoidal fracture: Yes / No

Mandibular Fracture

	Bilateral	Right	Left
Condyle			
Parasymphyses			
Symphyses			
Body			
Ramus			
coronoid			
Angle			

Associated injuries:

Frontal bone fracture:

Optic Neuropathy/corneal tear/ globe injury:

Orthopedic injury:

Tibia # / Wrist # / Radius # / Ulna # / Femur #/ Pelvic # :

C-spine injury: Yes / No

CSF Leak: yes/ No

Facial nerve injury: Yes /No

sno	Age	sex	Residence	Alcohol	LOC	year	Month	Day	Hospital stay	operation	Car _	motorbike car	Fall	bullkart	Violence	Bus	Auto	tractor	Assault	industrial	bystander	Nontreated	Treated	conservative	Postop ICU	Tracheostomy	Forearm fracture	Optic Neuropathy	head injury	corneal tear	Lefort I	Lefort II	Lefort III	Non Lefort	Blowout	Isolated zygoma	ZMC
1	2	1	2	1	1	1	5	3	1	3	2	1	2	2	2	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2	1	1	1	2	2	1	2
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43	4	1	4	1	1	1	8	1	2	1	2	2	1	2	2	2	2	2	2	2	2	1	2	2	1	2	2	2	2	2	4	1	1	2	2	2	2
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ZMC_plus_Orbital	palatal_number	Frontal bone	nasal_number	condyle	body	ramus	parasymphyses	symphyses	C_spine_number	Globe injury	coronoid	Radias_number	ulna_number	Tibia_number	NOE	angle	laceration	CSF leak	femur_number	pelvic_number	infection	facial N.	Humer_number
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Statis details

Age :

0-10 : 1

11-20: 2

21-30: 3

31-40 : 4

41-50: 5

51-60: 6

61-70: 7

71-80: 8

Sex :

Male : 1

Female : 2

Residence

Tamil Nadu : 1

Andrapradesh: 2

West Bengal : 3

Jharkhand: 4

Manipur : 5

Kerela: 6

Karnatake: 7

Alcohol

Present : 1

Absent : 2

Loss of consciousness :

Present : 1

Absent : 2

Year :

2008: 5

2009: 4

2010: 3

2011: 2

2012: 1

Months

January: 1

February: 2

March: 3

April: 4

May: 5

June: 6

July: 7

August: 8

September: 9

October: 10

November: 11

December: 12

Day

Monday : 1

Tuesday: 2

Wednesday: 3

Thursday: 4

Friday: 5

Saturday: 6

Sunday: 7

Hospital stay

. < One week : 1

1-2 week : 2

. > 2 week : 3

Not admitted : 0

Operation

Within 24 hrs : 1

1-3 days : 2

4-7 days : 3

.> one week : 4

Not admitted : 0

Car , motorbike, fall, bullkart, violence, bus , Auto, Tractor, Assault, Industrial, Bystander

Yes : 1

No : 2

Nontreated , treated , conservative

Yes : 1

No: 2

Post-op ICU , tracheostomy, forearm #, optic neuropathy , head injury, corneal tear

Present : 1

Absent : 2

Lefort I, Lefort II, Lefort III

Absent : 1

Right side : 2

Left side : 3

Bilateral : 4

Non-lefort #, Blowout #, Isolated zygoma #, ZMC #, ZMC+Orbital , palate #, Frontal bone #, Nasal Bone #

Present : 1

Absent : 2

Condyl e #, Body #, Ramus #, Parasymphyses #, Coronoid #, angle#

Absent : 1

Right side : 2

Left side : 3

Bilateral : 4

Symphyses #, C-spine #, Globe injury , radius #, ulna #, Tibia #, NOE #, laceration , CSF leak , femur # , pelvic #, infection , facial nerve injury, humerus #.

Present : 1

Absent : 2