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RESEARCH ARTICLE

MANAGEMENT OF FACIAL FRACTURES, ITS DEMOGRAPHY AND CLINICAL OUTCOME

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Abstract

A retrospective study was performed on maxillofacial fractures among patients presented to our emergency department and treated at McGann Hospital, Shivamogga Institute of Medical Sciences, Shivamogga from May 2017 to June 2023.

Aim: The aim of this study was to give an insight into the retrospective analysis of number of maxillofacial trauma cases reported to our institute and research centre and to understand the clinical aspects of facial fractures with treatment modality.

Materials And Methods: The data for this study was obtained from the medical records and outpatient prescription slips of cases treated at McGann Hospital, Shimoga Institute of Medical Sciences, Shimoga from May 2017 to June 2023. The data included age, gender, etiology, pattern of fracture; type of treatment modalities and the type of anaesthesia given were recorded.

Results: The analysis involved a total of 158 patients treated at our institute from May 2017 to June 2023. It was found that, the mandible was the most commonly fractured bone with parasymphysis as the most frequent site, followed by the zygomatic arch complex in the facial skeleton. Facial fractures were primarily among men in the age group of 21-30 years of age. Road traffic accidents were the main etiological factor associated. This study showed that patients were maximally treated by Open reduction and internal fixation [ORIF], some by intermaxillary fixation [IMF] and few by closed reduction.

Conclusion: It was concluded that road traffic accidents were reported as the leading cause of maxillofacial fractures followed by assault, falls, and familial dispute. Open reduction and internal fixation remains the gold standard treatment modality.

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Introduction:-

The face is the most commonly injured in the setting of blunt and penetrating trauma, although these injuries are rarely life-threatening in nature. Maxillofacial trauma is a common presentation following injury to the face². Injury to the face requires prompt assessment and management of the airway, particularly when lower face soft tissue and bone involvement is present. Because edema can worsen rapidly, early intubation can be lifesaving if there is

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concern about airway stability. Blood or debris in the oropharynx can greatly complicate intubation, and the application of backup airway options, including a surgical approach, should be anticipated and may be necessary.

Facial bone fractures are routinely identified in this setting. One specific injury pattern includes the Le Fort class of facial fractures, consisting of three variations of mid face disruption from the surrounding facial bones². Significant morbidity can result from injuries to the face, particularly when there is associated sensory disruption from trauma to the eyes, ears, nose, or mouth. Injury to the face requires prompt assessment and management of the airway, particularly when lower face soft tissue and bone involvement is present. Because edema can worsen rapidly, early intubation can be lifesaving if there is concern about airway stability².

Mandible fracture was the most common fracture observed in this study because it is the most prominent bone in the face and is often fractured more than the supported middle third of the face. The management of a patient with facial trauma must begin with an immediate assessment of the airway, breathing and circulation in keeping with the advanced trauma life support (ATLS) principles.

Causes :

The fracture etiology is classified as: motor vehicle accidents/road traffic accidents (cars, motorbikes, and trucks), bicycles, assaults, physical violence, accidental falls, bullet injuries, sports injuries, accidents with animals and other causes.

Classification

Classification of facial injuries¹

1. Divide the face into thirds
2. Assess orbit independently
3. Assess bony and soft tissue injuries

❖ The facial skeleton can be divided into thirds vertically:¹

1. upper face (from level of canthi upwards);
2. midface (from maxillary teeth to canthi);
3. lower face (mandible and mandibular teeth).

Facial fractures were classified as: mandibular, zygomatic, maxillary, nasal and frontal fractures.

Fracture in maxillofacial region can be grouped as⁷ :

1. Fracture lower third that comprises mandible.
2. Fracture middle third that comprises maxilla, zygoma and nose.
3. Fracture upper third of the face involving part of the orbit, frontal bones.

Maxillofacial fracture also can be grouped as:

1. Fractures of the face which do not involve the dental occlusion—fractures of zygoma and nose.
2. Fracture which involves the dental occlusion—fracture mandible and maxilla.

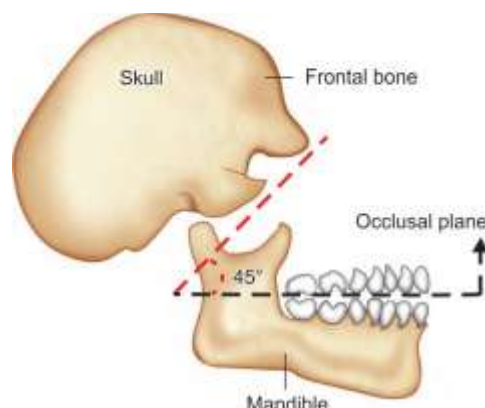


Fig:- Relation between middle third and cranium in 45° plane⁷.

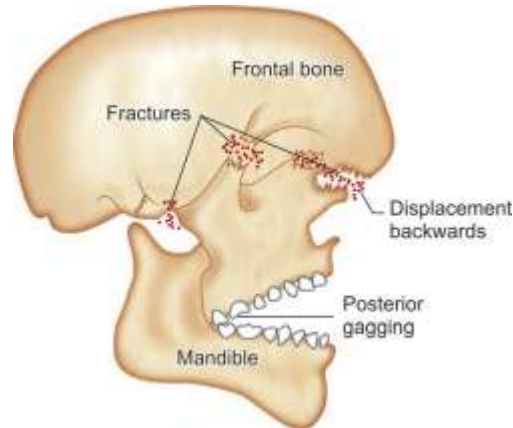


Fig:- Posterior gagging of occlusion due to backward displacement of fracture segment in middle third fracture⁷.

Soft tissue Injuries⁷

1. Lacerations, contusions, cut wounds, etc.
2. Eyelid injuries with black eyes.
3. Facial nerve injury: Primary repair is required.
4. Parotid duct injury: Here primary anastomosis of the injured duct is done, with a fine polythene cannula is kept as a stent inside the duct which will be removed in 14 days.
5. Lacrimal apparatus injury: Here the duct is sutured with a fine nylon thread in the canaliculus which is kept for 3 months.

Injuries to the Facial Bones⁷

- Fracture nose:
 - ✓ Nasal bones are most commonly injured bones in face.
 - ✓ Patient presents with pain and swelling in the nose with deviation and displacement.
 - ✓ Treatment : Here reduction of the fractured nasal bones and nasal septum under general anaesthesia is done.
 - ✓ Later position is maintained by nasal packs from inside (which is removed in 7days) and by a nasal plaster from outside (which will be kept for 14 days).
 - ✓ Procedure is done using Walsham's and Asch's forceps.
- Injuries to the maxilla.
- Zygomatic bone injuries.
- Mandibular bone fracture and mandibular dislocation.
- Orbital bone fracture: Presents with diplopia, enophthalmos, sensory loss in the area of infraorbital nerve.
- Infraorbital ecchymosis of the orbit is called Panda sign.

Evaluation :

Midface and mandibular stability, proper occlusion, and quality of the dentition are assessed. Forehead and midface deformities are indicative of underlying frontal and maxillary bone fractures, respectively. When fractures or soft tissue injuries are identified, the motor function of the face should be assessed to evaluate facial nerve function.

Clinical Features include :

1. Localised swelling due to haematoma.
2. Facial oedema.
3. Bleeding with open wounds.
4. Asymmetry which is clinically confirmed by observing supraorbital ridges, nasal bridge.
5. Localised tenderness.
6. Step deformity.
7. Trismus.
8. Diplopia.
9. Features of associated injuries like intracranial, abdominal or thoracic injuries.

Palpation of the bony contours of the facial bones should identify sites of tenderness, steps and asymmetry¹. This can start at the supraorbital margins, move around the infraorbital margins and then along the zygomatic arches, moving onto the condylar heads of the mandible and then running along the lower border of the mandible¹.

The investigations required fall into two major categories: first, those required to confirm the provisional and specific clinical diagnosis with regard to the facial injuries and, second, those to assess and manage the systemic condition of the patient¹. In patients with facial trauma, MDCT i.e. multidetector computed tomography is the first-choice imaging test because it can easily detect and characterize even the small fractures and their associated complications quickly and accurately. Surgeons often use three-dimensional images for planning operations to restore alignment and correct cosmetic deformities²².

Specific Injuries:

Mandibular Fractures

The most common site of facial fractures is Mandible following Nasal bones; mandibular fractures often require open reduction. Mandibular fractures typically occur at specific sites. In previous years the reduction and immobilisation was often achieved by wiring the teeth together, known as intermaxillary fixation (IMF). However, in recent years this technique has largely been superseded by the use of open reduction and internal fixation (ORIF) techniques utilising titanium fixation plates secured with screws. In general, the facial bones heal well and undisplaced fractures or those treated with ORIF heal after about 4 weeks. If the patient has had IMF a liquid diet is required and those who have had an ORIF procedure must also remain on a very soft sloppy diet for the same period²⁰. In general, mandibular fractures treated with ORIF techniques have 2 mm diameter screws engaging a single bone cortex. Undisplaced or minimally displaced condylar neck fractures can be treated non-operatively or with elastic IMF.

Fractures Of The Zygomatico-Orbito Complex (ZMC)

ZMC (malar/cheekbone) fractures are the commonest facial fractures and from a clinical perspective, considering the cheekbone as a four-legged stool is helpful – the four legs are comprised of the zygomatic arch running anteroposteriorly, the zygomatic process running vertically (to join the frontozygomatic process of the frontal bone at the frontozygomatic (FZ) suture), the infraorbital rim running horizontally and the maxillary buttress running vertically. With the exception of isolated zygomatic arch, isolated infraorbital rim and extensively comminuted fractures, if the ZMC is fractured then all four legs of the stool are fractured and displacement occurs about two axes, running vertically through the line from the FZ suture to the maxillary buttress or running anteroposteriorly along the zygomatic arch¹⁸. The mainstay of treatment is ORIF with fixation at one of the four ‘legs of the stool’, namely the frontozygomatic suture, the buttress region, the infraorbital rim or the zygomatic arch. The necessity for single, double, triple or four-point fixation will depend on the stability of the fracture post reduction and the degree of comminution.

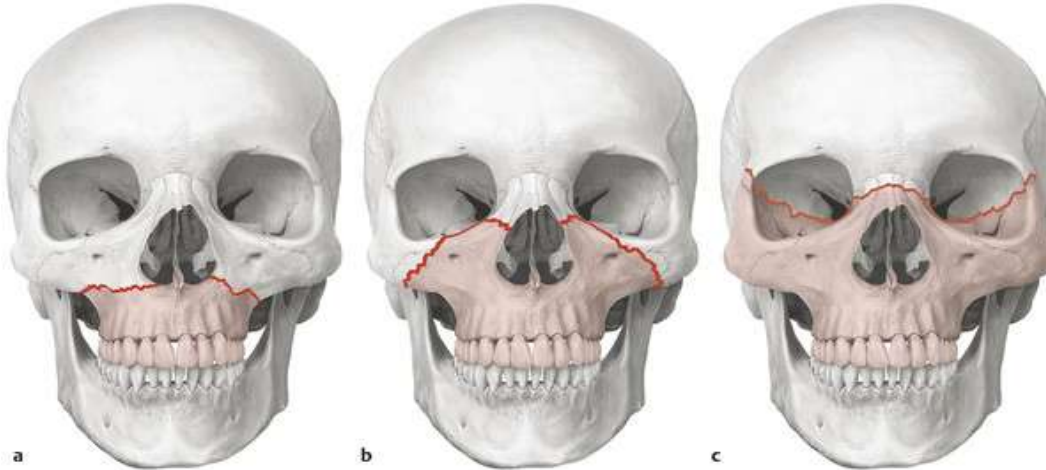
Maxillary Fractures

Maxillary fractures are traditionally classified after René Le Fort’s work, in which he recreated the maxillary fractures utilising cadavers and a sandbag. Interestingly, the numbering, in modern usage, has become reversed from the original: the Le Fort I fracture being inferior and the Le Fort III being superior. Midface fractures are often accompanied by significant facial swelling and this makes palpation of the skeleton difficult. The characteristic finding is of a mobile maxilla which tends to be displaced backwards and inferiorly¹⁵. There is often infraorbital nerve injury resulting in altered sensation and, with upper level (Le Fort II and III) fractures, the orbit is involved to a greater or lesser degree. The treatment of maxillary fractures, in all but the entirely undisplaced fractures, involves ORIF techniques utilising a variety of miniplates (1.5/1.7 mm diameter screws) and/or microplates (1.0/1.2 mm diameter screws). Fixation is usually placed along the main facial buttresses (the ‘four legs of the stool’) for optimal strength and bone quality to be able to hold the screws.

❖ The three types of Le Fort fractures that can be classified according to the level of injury: ⁷

- a. **Le Fort I (Guerin’s fracture- low level) (floating fracture, horizontal fracture of maxilla):** It runs horizontally above the floor of the nasal cavity involving lower third septum, palate, alveolar process of maxilla and lower third of pterygoid plates of maxilla.
- b. **Le Fort II (pyramidal fracture):** From the nasal bones at top-most, fracture runs laterally towards lacrimal bones, medial wall of orbit, infraorbital margin, through medial to infraorbital foramen and backwards below the zygomaticomaxillary area through lateral wall of maxillary sinus and pterygoid plates. Zygoma is intact with skull base.

- c. **Le Fort III (craniofacial disjunction, high level):** Here fracture runs parallel to skull base. It passes through the nasal bone, lacrimal bone, ethmoid bone, optic foramen, inferior orbital fissure, pterygomaxillary fissure and lateral orbital wall with frontozygomatic suture with zygomatic arch.



Orbital Fractures

1. Visual acuity and motility must be assessed
2. In children, orbital floor injuries should be assessed and treated as emergencies because muscle injury may be permanent, resulting in reduced ocular motility

Reconstruction of the orbital rim is usually accomplished with ORIF techniques and the orbital walls repaired with autologous materials such as cranial bone or rib grafts, but proving more popular are preformed titanium implants or patient-specific custom-made implants.

Craniofacial Fractures

1. Usually managed by a multispecialty team involving neurosurgery, ear, nose & throat (ENT) and oral & maxillofacial surgery
2. Significant head injuries are common

Naso-Orbito Ethmoidal Fractures

1. Naso-orbito ethmoidal injuries indicate significant force transfer
2. Other associated injuries should be excluded, particularly craniofacial/anterior cranial fossa injuries

Dental Injuries

1. It is important to account for all missing teeth and/or dental fragments – a chest radiograph may be indicated
2. Exposed dentine and pulp can be exquisitely painful and referral for emergency dental treatment can be very helpful
3. Avulsed teeth should be reimplanted as soon as possible

Soft Tissue Injuries

1. Examination of both motor and sensory nerve function should be conducted prior to the administration of local anaesthetic
2. Tissue loss can occur and usually warrants specialist referral
3. Careful cleaning (debridement) with removal of all dirt minimises the chances of wound tattooing

Where there has been skin loss the management depends on the size of the defect, the elasticity of the surrounding skin and the circumstances. Small defects can be closed with direct closure, but for larger defects the mobilisation of local skin flaps may be necessary. When there is greater tissue loss, skin grafting and/or free tissue transfer may be required.

Materials and Methods:-

The required data for this study was obtained from the medical records and outpatient prescription slips of cases treated at McGann Hospital, Shimoga Institute of Medical Sciences, Shimoga from May 2017 to June 2023.

The data included age, gender, etiology, pattern of fracture; type of treatment modalities and the type of anaesthesia given were recorded.

All the cases of facial injuries sustained by RTA, assaults, self falls, etc associated with facio-maxillary bone fractures, of all age groups, and both the genders and those requiring surgical line of treatment were all included in the study. The study conducted after obtaining the ethical clearance from the institute and after obtaining the consent from the patient.

All those cases whose GCS was low with intra-cranial bleed, who were unfit for surgery, unstable vitals weren't included in this study.

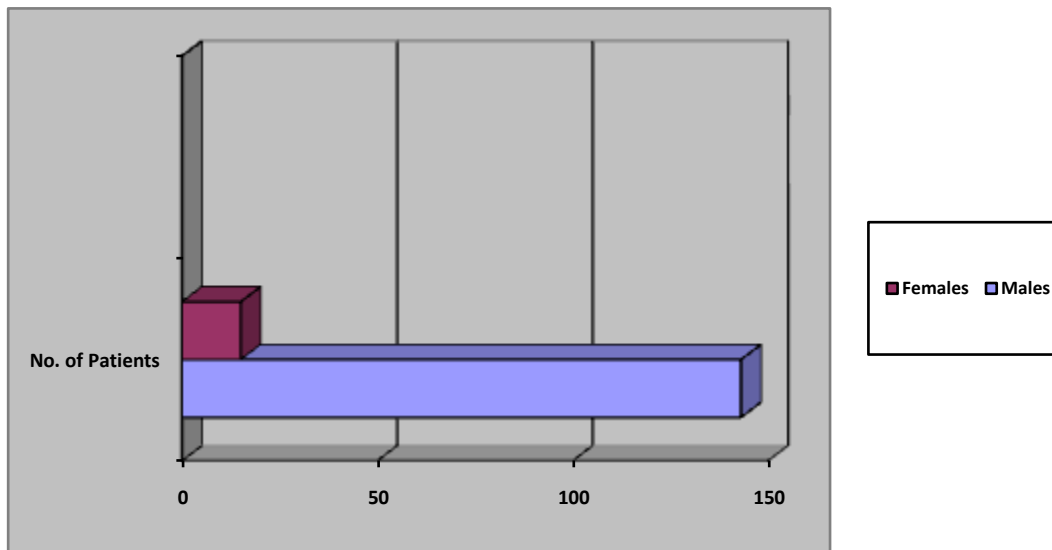
A systematic analysis of the data obtained was done regarding the pattern of facial injuries, isolated facial bone fractures such as mandible, maxilla, etc, or in combination with other facial bone fractures, soft tissue injuries, type of injuries sustained, age groups affected, gender preponderance, and the treatment of each type of facial fractures were studied and the results were analysed and interpreted.

Results:-

1. In our study, A total of 158 patients sustaining maxillofacial fractures were studied. 143 were males and 15 were females. Mandibular fractures were the most common than other injuries, representing 70% of all facio-maxillary fractures followed by zygomatic arch complex accounting to 23%.
2. All the cases included in the study were surgically treated under General Anesthesia.

A. Gender distribution:

Gender	No. of patients (%)
Male	143 (91%)
Female	15 (9%)
Total	158

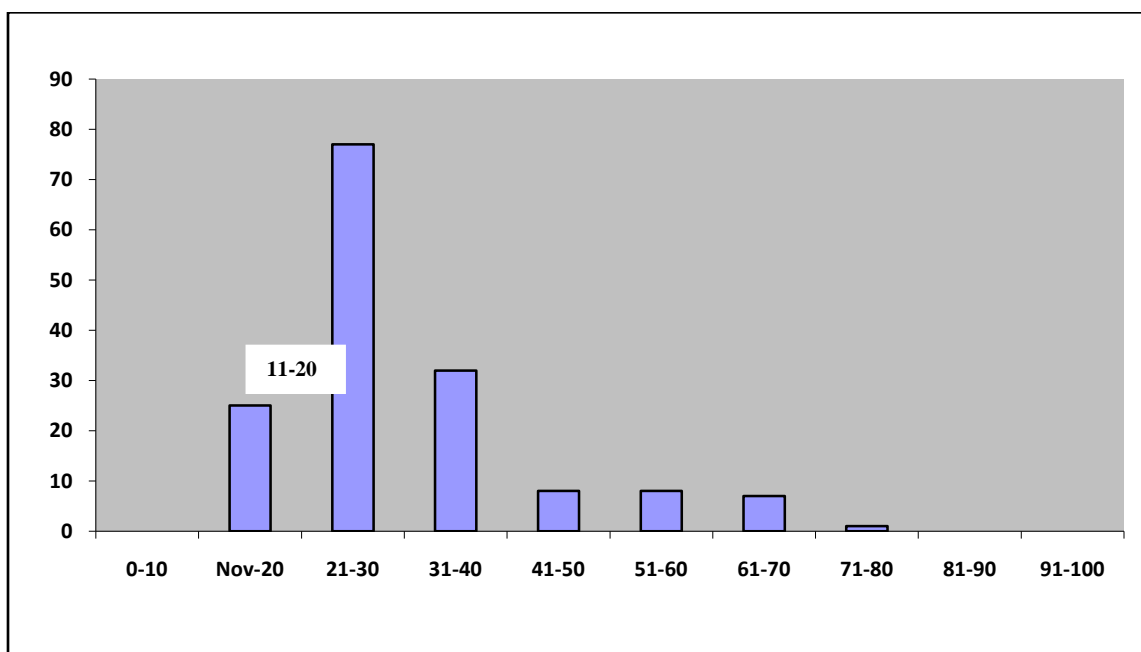


Graph 1:- Gender distribution of patients with facial fractures.

- Among 158 patients in our study, 143 were male and 15 were females, so 91% of patients affected in our study were males with females being only 9%

B. Age distribution:

Age group	No. of patients (%)
0-10	0
11-20	25 (16%)
21-30	77 (49%)
31-40	32 (20%)
41-50	8 (5%)
51-60	8 (5%)
61-70	7 (4%)
71-80	1 (nearly 1%)
81-90	0
91-100	0
Total	158



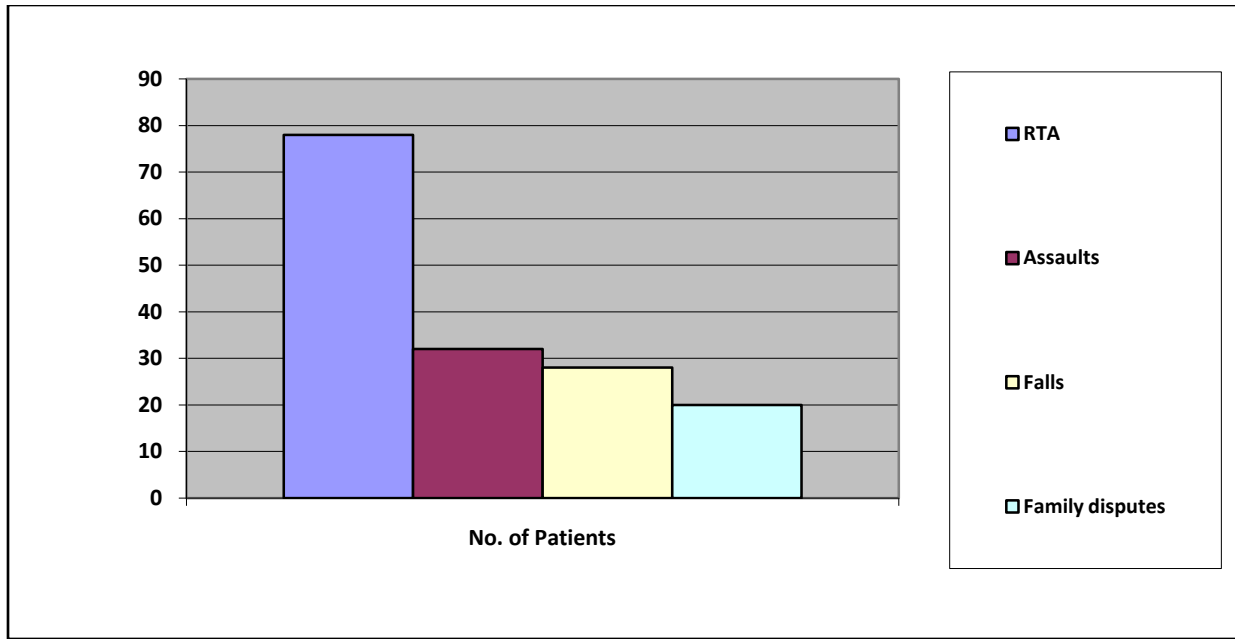
Graph 2:- Age distribution of patients with facial fractures.

- The most common age group affected in our study with facial fractures were between the age group 21-30 with a total of 77 patients (49%) , next common age group is 31-40 with 32 patients (20%). Facial injuries were not seen in age group <10 years and >80 years. Hence, most commonly affected are middle aged individuals <35 yrs of age.

C. Etiology of trauma:

Sl.No.	Etiology	No. of patients (%)
1	RTA	78 (49%)
2	Assaults	32 (20%)
3	Falls	28 (18%)
4	Family disputes	20 (13%)
5	Total	158

(RTA: Road Traffic Accidents)



Graph 3:- Etiology of injuries of patients with facial fractures.

➤ In our study, 49% of cases were recorded due to RTA with a total of 78 patients followed by 20% cases of assaults being the next common cause.

D. Pattern of Fractures:

Sl.No.	Pattern of Facial Fracture (#)	No. of patients (%)
1. Mandibular #		
	1. Parasymphysis	32
	2. Symphysis	17
	3. Body	11
	4. Angle	8
	5. Ramus	1
	6. Condyle	
	a. Unilateral	4
	b. Bilateral	0
	7. Body & Angle	0
	8. Parasymphysis & Body	8
	9. Parasymphysis & Angle	11
	10. Parasymphysis & Ramus	1
	11. Parasymphysis & Condyle	9
	12. Symphysis & Body	1
	13. Symphysis & Angle	5
	14. Symphysis & Condyle	2
	15. Parasymphysis + Symphysis	1
	Total Mandibular #	111 (70%)
2. ZMC (isolated)		
	a. ZMC (isolated)	32
	b. ZMC + Frontal Sinus	1
	c. ZMC + Maxilla + Orbital	1
	d. ZMC + Symphyseal	1
	Total ZMC #	36 (23%)
3. Le Fort I		
		2 (1%)

	a. Le Fort I + Symphyseal	1
	b. Le Fort I + Para Symphyseal	1
4. Le Fort II		5 (3%)
	a. Unilateral	1
	b. Bilateral	3
	c. With Parasymphysis # of mandible	1
5. Orbital #		0
6. Nasal bone #		1 (nearly 1%)
7. Frontal Sinus + Soft tissue injuries		3 (2%)
Total		158

(FZ: Frontozygomatic suture, ZMC: Zygomaticomaxillary complex fractures)

➤ In our study, the most common facial bone injured was Mandible with a total of 111 cases (70%) among which Parasymphyseal fracture of mandible was the highest fractured. Next common was ZMC with 23%. The least fractured part of facial bone was orbital fractures.



Fig: Left orbital floor # with racoon eyes with Left sided Maxilla #

Fig: B/L orbital floor # with racoon eyes with Right sided Maxilla # with Right sided Ramus of mandible #



Fig: B/L orbital floor # with racoon eyes with Left sided Maxilla #

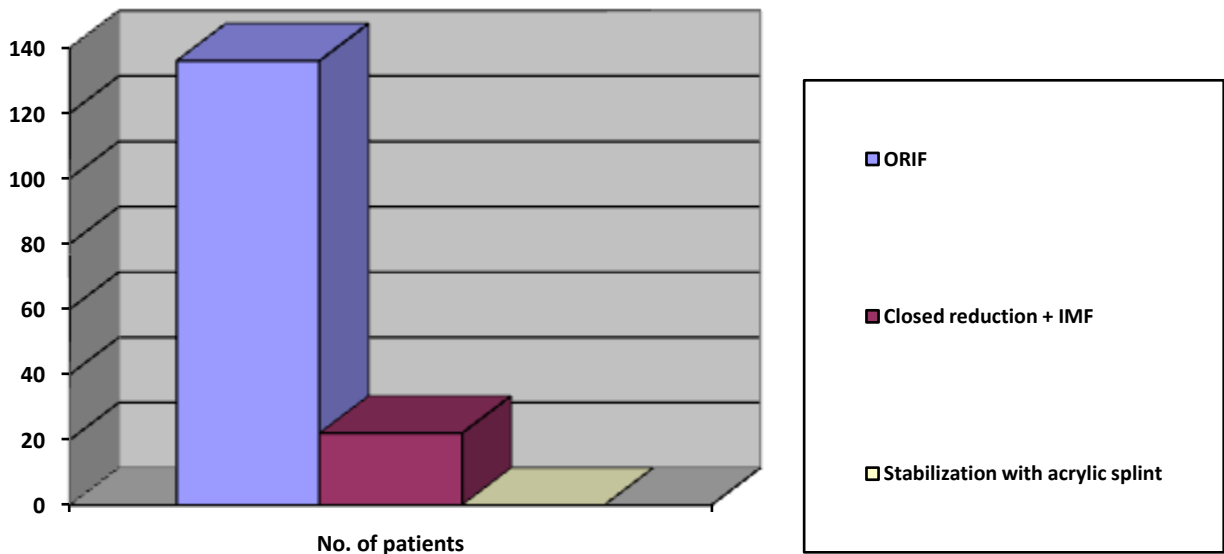
Fig: Rt ZMC # with #of Ramus of mandible

Fig.: Right sided Maxillary # with depressed nasal bone # with medial wall orbital # with b/l communitated frontal bone #

E. Surgical procedures performed:

Sl.No.	Surgical procedure	No. of patients (%)
1	ORIF	136 (86%)
2	Closed Reduction + IMF	22 (14%)
3	Stabilization with acrylic splint	0
	Total	158

(ORIF: Open reduction and internal fixation , IMF: intermaxillary fixation)



Graph 4:- Surgical procedure performed of patients with facial fractures.

- Most of the cases of our study were managed surgically by Open reduction and internal fixation (ORIF) in about 136 patients accounting to 86% of total, followed by Closed reduction in few cases with Inter-maxillary fixation (IMF).

Discussion:-

Many patients seen in emergency departments have facial trauma²². Our study has showed that the most common cause of facial injuries was RTAs, which was consistent with the observation in other studies in India and other countries of the world. The World Health Organization has estimated that nearly 25% of all injury fatalities worldwide are a result of road traffic accidents (RTAs), with 90% of the fatalities occurring in Low & Middle Income Countries like Africa and Asia¹⁰. The reductions in RTA in developed countries are largely attributed to a wide range of road safety measures such as seat belt use, traffic calming measures, and traffic law enforcement. Therefore, there is an urgent need to get down to what the developed nations have done to reduce/prevent RTAs¹⁰. Assaults and falls, respectively, were the second and the third most common cause of maxillofacial injuries in adults and children. The application of Acrylic splint (open occlusal) favours the rapid osteogenesis and remodelling by maintaining the continuity of periosteum and soft tissue in paediatric patients with mandible fractures.

Surgeons require information about the anatomical landmarks and features of the fracture such as the degree of displacement and comminution so they can plan treatment and predict possible complications and perform the surgery as and when required and also some cases to be continued with conservative medical line of management of facial fractures if the fractures aren't displaced or not causing much of facial distortion.

Conclusion:-

RTAs are reported as the leading cause of maxillofacial fractures followed by assault, falls, and familial dispute, respectively. Adult males were the majority of victims and majority belonged to third decade of life. Mandible was the most commonly fractured bone with most frequent site being parasymphysis of mandible. And the next common was found to be ZMC.

Application of Le Fort classification was also helpful in studying and analysing the results of facial bone fractures and its pattern of injuries. More of isolated facial bone fractures were noted in our study.

The "Face-It!" campaign headed by Dr. Sanjiv Nair and his team has built widespread acclaim and helped in expanding "Road Safety Awareness" as well as awareness about oral and maxillofacial surgeons as health care providers or as trauma care providers²⁵. Plastic surgeon and Maxillofacial surgeons as health care providers must continue their 'face it' campaign in lowering the incidence of road traffic accidents (RTAs). Open reduction and internal fixation (ORIF) remains the gold standard treatment modality. Acrylic splints can be used in complex facial injuries.

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