Fractures in the Maxillofacial Region: A Four Year Retrospective Study

Maj MG Venugopal*, Col R Sinha⁺, Col PS Menon[#], Col PK Chattopadhyay^{**},
Col SK Roy Chowdhury⁺⁺

Abstract

Introduction: The incidence of maxillofacial injuries is on the rise due to motor vehicle accidents and increased incidence of violence in recent times. The aim of this retrospective study was to determine the incidence, aetiology, the pattern of fractures, their management with open reduction and internal fixation (ORIF) and complications, if any.

Methods: A retrospective analysis of 621 fractures in 361 patients managed by ORIF over a four year period was carried out.

Result: The average age of patients was 24.3 years with a male to female ratio of 21.2:1. Panfacial fractures comprised 4.7%, frontal bone fractures 8.9%, orbital fractures 0.7%, naso-orbito-ethmoid complex (NOE) fractures 0.7%, zygomatic complex fractures 23.5%, fracture maxilla 11.5% and mandibular fractures 52.2% of all facial fractures. All the cases were successfully managed by ORIF under general anaesthesia (GA). Complications were noticed in 6.8% of cases in the form of reactive implants in 3.6%, deranged occlusion in 1% and infection at operated site in 1% cases which were managed satisfactorily.

Conclusion: The findings of this study reveal sharp annual increase in the number of cases of maxillofacial trauma. Road traffic accidents (RTA) were the commonest cause and the age group most affected was between 20-25 years. ORIF of these fractures was chosen for its obvious advantages of direct anatomical reduction, early return to function and minimal complications.

MJAFI 2010; 66 : 14-17

Key Words : Road traffic accidents (RTA); Inter maxillary fixation (IMF); Open reduction and internal fixation (ORIF)

Introduction

The maxillofacial skeleton is commonly fractured due to its prominent position [1,2]. The location and pattern of the fractures are determined by the mechanism of injury and the direction of impact. In addition, patient's age and the presence of teeth have a direct effect on the characteristic pattern of such injuries. The incidence of maxillofacial injuries is on the rise due to the increase in the number of motor vehicle accidents. Road traffic accident (RTA) still remains the commonest cause of these injuries (Fig. 1). These fractures have gained the attention of surgeons attempting to achieve improved and more predictable outcome by open reduction and internal fixation (ORIF).

A retrospective study based on a series of 621 fractures in 361 patients managed in the Department of Oral and Maxillofacial Surgery, Armed Forces Medical College (AFMC) Pune, between 01 June 2004 and 31 May 2008 is presented.

Material and Methods

A total of 361 patients with 621 fractures were treated by ORIF during the study period. The study group consisted of

17 females and 344 males in the age group of 14-65 years with a mean age of 24.3 years (Table 1). Most patients presented with pain, facial oedema, facial asymmetry, subconjunctival haemorrhage, ecchymosis, restriction in ocular movements, restriction of mandibular mobility and occlusal disturbances. Radiographical assessment using para nasal sinus (PNS) view, submentovertex, postero-anterior, lateral oblique, reverse townes view, orthopantomogram (OPG) and computed tomography (CT) scan was done (Fig. 2).

Patients with only dento-alveolar fractures, pure dental injuries (subluxation, luxation and avulsion), isolated nasal bone fracture and those managed by closed reduction / treatment were excluded from the study. Routine investigations and prior neurological, ophthalmological and otorhinolaryngological evaluation as per protocol was obtained in relevant patients, followed by pre-anaesthetic evaluation. Seven (2.6%) patients required submental intubation. All the fractures were managed by ORIF under general anaesthesia (GA) through single or multiple scattered approaches (Figs. 4, 5). Extra oral approaches through coronal, lateral brow, pre-auricular, infraorbital, subciliary, transconjunctival, submandibular, retromandibular or through the pre-existing scar as per the merit of the cases were used. Intraorally, maxillary and mandibular vestibular approaches

*Resident, *Professor & HOD, **Associate Professor (Department of Dental Surgery), AFMC, Pune 411 040. ++Classified Specialist (Oral & Maxillofacial Surgery), MDC (BEG) C/o 56 APO. #Dir (E&S), O/o DGDS, Integrated Headquarters of Ministry of Defence (Army), 'L' Block, New Delhi-110 001.

Table 1**Year wise comparison of maxillofacial injuries**

Fracture	2004-2005	2005-2006	2006-2007	2007-2008	Total	Percentage
Total cases	69	86	94	112	361	100
Females	02	03	05	07	17	4.7
Age	27.3	26.1	24.9	23.3	24.3	-
Pan facial trauma	02	01	03	11	17	4.7
Frontal bone	06	13	05	09	33	5
Naso-orbito-ethmoid complex	01	01	01	02	05	0.7
Orbit	02	-	02	01	05	0.7
Zygomatic complex	28	44	33	41	146	23.5
Isolated zygomatic arch	03	-	02	04	09	1.4
Maxilla Le Fort I, II, III	09	21	17	25	72	11.5
Mandible	46	58	116	104	324	52.1
Complications	09	10	13	12	44	6.8
Average length of stay	17	51.1	14.3	9.7	11.3	-
Total fractures	97	138	179	207	621	-

were used whenever deemed necessary.

Stabilization was achieved using titanium mini and micro systems. Resorbable system was used in select cases. Palatal and lingual splints were used on the merits of the case. Post operative intravenous antibiotics consisting of Inj Ampicillin 25-50 mg/kg body weight six hourly, Inj Gentamicin 3-5 mg/kg body weight eight hourly, Inj Metronidazole 25-50 mg/kg body weight eight hourly for one to three post operative days based on age, weight, systemic factors, presence of comminution and pre-existing infection were used.

Fig. 1 : Etiology of fractures in the maxillofacial region

Post operative analgesics consisting of Inj Diclofenac sodium 1-2 mg/kg body weight intramuscular eight hourly on the first post operative day followed by combination of Tab Paracetamol 5 mg/kg body weight and Tab Ibuprofen 5 mg/kg body weight every eight hourly for three to five days were administered on as required basis.

Inter maxillary fixation (IMF) was not required in most of the cases in the post operative period. In a select few cases of panfacial fractures with comminution, post operative IMF for 1-2 weeks was utilized. Most of the patients were followed up on regular intervals at one, three, six and twelve months post operatively. Clinical evaluation for reduction, stability, facial symmetry, mandibular mobility, tympano-mandibular joint (TMJ) function, occlusion and neurological disturbances of the facial, infraorbital, mental and auriculotemporal nerves was carried out. Reduction and consolidation of the fractured fragments were assessed radiographically. The time interval from trauma to ORIF and the duration of hospital stay was recorded.

Results

In the four years of study there has been no significant change in the aetiology of maxillofacial injuries. RTA, predominantly two wheeler accidents, is still the single major cause as seen in 314 (87%) patients, followed by inter-

Fig. 2 : a & b show clinical presentation of maxillofacial injuries; c & d are 3D reformatted CT images of fractures in the maxillofacial region showing gross displacement and comminution.

personal violence in 22 (6%), fall and accidental injuries in 14 (4%) and sports injuries in 11 (3%) (Fig. 1). Injuries due to violent offences were 3.2% in 2004 which almost doubled to 6% in 2008. The highest number of injuries were observed in the second and third decades of life, the mean age being 24.3 years. The male to female ratio was 21.2:1. Most of the patients reported to our centre within seven days of sustaining injury.

Panfacial fractures were observed in 17 (4.7%) cases, involving the upper, middle and lower third of the facial skeleton. Frontal bone was involved in 33 (8.9%), of which anterior table of frontal sinus was involved in 19 (5.2%) cases and posterior table in 6 (0.9%) cases. Orbital fractures (pure blow-out) occurred in 5 (0.7%) cases and impure blow-out with naso-orbito-ethmoid (NOE) complex in 5 (0.7%) cases. Zygomatic complex fractures involving body and arch was seen in 146 (23.5%) cases, however isolated zygomatic arch fractures comprised 9 (1.4%) cases, whereas 19 (3%) zygomatic complex fractures were comminuted. In all, 72 (11.5%) cases had fracture maxilla in the form of Le Fort I in 37 (6.2%), Le Fort II in 16 (2.1%) and Le Fort III in 19 cases (3.2%). The study showed an increase in the number of fractures of the mandible. Mandibular fractures were recorded in 108 cases; 324 (52.2%) of all facial fractures were mandibular fractures of which fracture parasymphysis were 167 (26%), body fractures 36 (5.7%), angle fractures 41 (6.5%) and condylar fractures 80 (14%).

Uneventful recovery occurred in 317 (87.8%) patients, while 22 (6.8%) patients had post operative complications in the form of reactive implants 13 (3.6%), deranged occlusion 4 (1%), infection 1 (0.4%), wound dehiscence 1 (0.4%), posterior facial height reduction 1 (0.4%), ectropion 1 (0.4%),

Fig. 3 : Distribution of fractures in the maxillofacial region

painful mandibular movements 1 (0.4%), transient neurological deficit 1 (0.4%), residual deformity 2 (0.8%), parotid fistula 2 (0.8%) and Frey's syndrome like presentation in 2 (0.8%) patients, which were managed during the post operative period. Most patients were discharged on an average of 7.3 days (range 4-22) after surgery.

Discussion

The incidence of maxillofacial fractures varies with geographic region, socioeconomic status, culture, religion and era. The majority of patients are in their third decade of life [2]. The predominance of male population is a relatively consistent finding in most studies. In our study, the male to female ratio was 21.2:1 which corroborates with the worldwide data [3]. Maxillofacial fractures are commonly caused by RTA, assaults, sports, industrial accidents and warfare [4,5]. In this study, RTA were the commonest cause in 314 (87%) fractures, followed by inter-personal violence in 22 (6%), fall and accidental injuries in 14 (4%) and sports injuries in 11 (3%) cases. Analysis showed predominance of two wheeler accidents. The incidence of non-wearing of the helmet and marked increase in the number of vehicles were significant findings in the category of RTAs. In RTA, the commonest fracture site was mandible and the zygomatic complex. The literature reveals that the common site of mandibular fracture following assault is usually the mandibular angle (32.8% to 42.3%) [6], whereas in our study it was 19.2%. Accidental falls (36.3%) were the commonest cause of mandibular condylar fracture in other studies [4,5]. Sports injuries are on the rise due to increasing participation in sports activities [7].

The classical patterns of maxillary fractures in the level of Le Fort fractures I, II and III were less commonly seen. However, we found comminution of fractures at various levels. A total of 59 (16.3%) patients had sustained closed head injury while 17 (4.7%) had sustained panfacial fractures. All patients were effectively managed by ORIF [8-10]. Submental intubation was beneficial in ORIF of panfacial fractures in obtaining unhindered access to occlusion [11]. The rationale for choosing each approach was to obtain the

Fig. 4 : Intra-operative photographs of fractures managed by ORIF; a) Frontal bone defect reconstructed with Titanium micromesh, b) Fractured infra orbital rim, c) Orbital floor and rim reconstructed, d) Fracture maxilla exposed, e) Fracture mandible left parasymphysis with rigid fixation

best exposure and to provide optimal function and aesthetics. Hemicoronal/bicoronal incisions were chosen in cases of panfacial, NOE, frontal bone fractures and in case of grossly comminuted/displaced/delayed treatment of zygomatic complex fractures. Isolated zygomatic complex fractures were managed via multiple scattered incisions such as lateral brow, infra orbital / subciliary and high vestibular approach. Two and three point fixation by ORIF was done.

Infra orbital/subciliary approach was used in orbital floor reconstruction in gross discrepancy in the orbital floor or in cases with diplopia to facilitate exploration and release of adhesions/reconstruction in blow out fractures, while intra oral high vestibular approach was preferred for ORIF of Le Fort I and II level fractures.

This study shows intra oral vestibular approach as the preferred method in the management of the most mandibular fractures extending upto the mandibular angle (parasymphysis, body, angle fractures). Submandibular approach for ORIF of angle fractures was chosen as per merits of the case. ORIF of the condylar neck fractures required retromandibular antero-parotid transmasseteric approach or preauricular approach [9]. Pre existing CLW / scar as per the cases was chosen to eliminate use of additional incision and better cosmesis.

Complications were recorded in 22 (6.8 %) patients in the form of reactive implants in 13 (3.6%) cases, difficulty in opening the mouth fully in two (0.5%) patients, transient diminished mandibular laterotrusion in five (1.3%), pain on palpation of TMJ in two (0.5%) which corroborates with patterns and rates by various studies [2, 7]. The occlusion was restored successfully in 344 (95.2%) patients. Deranged occlusion was seen in 17 (4.8%) of which 15 cases were conservatively managed. Subsequent surgical correction of the residual occlusal deformity was required for two patients. The mouth opening varied between 35 to 46 mm (mean 41mm). Parotid fistula developed in two (0.5%) patients and two (0.5%) reported with Frey's syndrome like presentation four months after surgery. Postoperative healing was uneventful in all cases. No permanent neurological disturbance was seen. Radiological evaluation revealed good anatomical reduction and consolidation along the fracture line in all but 14 (3.6%) patients.

To conclude, RTA still remains the main etiological factor of maxillofacial fractures. Inadequate enforcement of obligatory wearing of crash helmet is probably responsible in our scenario. Various studies note a decrease in maxillofacial injuries caused by RTA by preventive measures such as compulsory wearing of seat belts, crash helmets, enforcement of law regarding drunken driving and use of mobile phones while driving.

Improved road conditions and passive safety devices of automobiles (e.g. airbags, safety glass) also contribute to injury prevention.

Open reduction of fractures has emerged as the management tool of these injuries. Improved fixation systems directly translate into reduced IMF time and early return to function with minimal morbidity. Advances in management techniques are likely to further reduce the morbidity associated with maxillofacial fractures.

Conflicts of Interest

None identified

Intellectual Contribution of Authors

Study Concept : Col R Sinha, Col PS Menon

Drafting & Manuscript Revision : Col PK Chattopadhyay

Statistical Analysis : Maj MG Venugopal

Study Supervision : Col SK Roy Chowdhury

References

1. Motamedi MHK. An Assessment of Maxillofacial Fractures: A 5-Year Study of 237 Patients. *J Oral Maxillofac Surgery* 2003; 61: 61-4.
2. Gassner R, Tarkan T, Oliver H, Ansgar R, Ulmer H. Cranio-maxillofacial trauma: A 10 year review of 9543 cases with 21 067 injuries. *J Cranio-Maxillofac Surgery* 2003; 31: 51-61.
3. Gerber B, Ahmad N, Parmar S. Trends in maxillofacial injuries in women 2000-2004. *Br J Oral and Maxillofac Surg* 2008; online 10.1016/bjoms.2008.09.006.
4. Thapliyal GK, Sinha R, Menon PS, Chakranarayan A. Management of mandibular fractures. *MJAFI* 2008; 64 : 218-20.
5. Bolaji O, Andrea B, Neil B. Pattern of mandibular fractures in an urban major trauma center. *J Oral and Maxillofac Surg* 2003; 61: 713-8.
6. Bach TL, Eric JD, Brett AU, Louis DH, Bryce FP. Maxillofacial injuries associated with domestic violence. *J Oral and Maxillofac Surg* 2001; 59: 1277-83.
7. Subhashraj K, Nandakumar N, Ravindran C. Review of maxillofacial injuries in Chennai, India: A study of 2748 cases. *Br J Oral and Maxillofac Surgery* 2007; 45: 637-9.
8. Edward E. Passive repositioning of maxillary fractures: An occasional impossibility without osteotomy. *J Oral and Maxillofac Surg* 2004; 62: 1477-85.
9. Wilson AW, Ethunandan M, Brennan PA. Transmasseteric antero-parotid approach for open reduction and internal fixation of condylar fractures. *Br J Oral and Maxillofac Surg* 2005; 43: 57-60.
10. Schneider M, Erasmus F, Gerlach KL. Open reduction and internal fixation versus closed treatment and mandibulo-maxillary fixation of fractures of the mandibular condylar process: A randomized, prospective, multicenter study with special evaluation of fracture level. *J Oral and Maxillofac Surg* 2008; 66: 2537-44.
11. Arun C, Witherow H, Andrew S. Submental intubation in orthognathic surgery: initial experience. *Br J Oral and Maxillofac Surg* 2007; 46: 561-3.