## ORIGINAL RESEARCH PAPER

**EPIDEMIOLOGY AND EVALUATION OF EARLY MANAGEMENT OF MIDFACIAL FRACTURES IN A TERTIARY CARE HOSPITAL**

| Dr.K.K.Senthilkumararan | M.B.B.S., D.N.B., M.Ch., Senior Assistant Professor, Department of Plastic Surgery, KAPV Govt Medical College, Trichy, Tamilnadu. |
| Dr.K.Chandra Mohan | M.S., M.Ch., Senior Assistant Professor, Department of Plastic Surgery, KAPV Govt Medical College, Trichy, Tamilnadu. - Corresponding author |

### ABSTRACT

**Objectives:** Facial trauma in often associated with severe morbidity with respect to loss of function and disfigurement as well as the impact of increased financial cost to both the state and affected individual. We have done this study to analyze etiology, biomechanics and demography of patients with midfacial fractures and assessed its association with gender, occupation, mechanism of injury and also to evaluate early management and its effect on functional and outcome of midfacial fracture.

**METHODS:** 61 cases of midfacial fractures were taken for study from 297 cases of facial injuries within 27 months duration. Patients with trauma only in the midface were included for study, fractures involving frontal bone and mandible were excluded in study.

**RESULTS:** Gender distribution revealed Male/Female ratio 5:1 with very less number of patients in both extremes of age <20 (1.8%) 60<80.8%. Infemale population more number of patients were 41 to 50 yrs age. Main cause of injury was Road Traffic Accident (RTA) then followed by Assault. Out of 61 cases 30(49.1%) were under the influence of alcohol. Helmet was used by only two patients out of 37 case of RTA. This study showed majority of patients with isolated zygoma fracture (49.2%) followed by Zygomatico maxillary fracture (26.2%) nasal and Lefort II fracture were (8.2%) and least was Lefort III (1.6%). On the other hand, management of isolated Zygoma fracture with elevation these patients had good mouth opening, occlusion and cosmatic results. Chi-square test revealed significant variation (p<0.01) between early (1 to 14 days) intervention and late (above 14 days) intervention.

**Conclusion:** Early management of midfacial fractures showed better result functionally and aesthetically when compared to delayed management.

---

### INTRODUCTION

Midfacial trauma are commonly seen associated with multisystem trauma which affect various functions such as vision, hearing, breathing, smell and speech because of association of all these sensory organs in the face.

Most of the injuries are the result of low energy impact. Major injuries are due to complex high energy impact involves multidisciplinary team of surgeons with plastic surgeons. In urban areas the most common cause of facial injuries are due to motor vehicle accidents followed by assault, fall, industrial accidents and sports injuries.

- Midface is defined as the area bounded above by a transverse line joining the zygomatico-frontal suture bilaterally which also passes in the middle through the fronto-maxillary and fronto-nasal suture and bounded below by incisal and occlusal plane of maxillary teeth.

Various parameters like age, gender, type of injury, time of accident, site of injury, various modalities of treatment, duration between accident and surgery, results of early and late management of fractures and their complications have been analysed in this study.

### AIM OF STUDY

This study was done to collect and analyse current data on aetiology, biomechanics and demography of patients admitted with midfacial fractures at Chengalpattu medical college and to assess the association of midfacial fracture with gender, occupation, social behaviour and mechanism of injury.

It is also to evaluate the result of early management and its effect on functional and aesthetic outcome of midfacial fractures.

### MATERIALS AND METHOD

The study was done during the period of October 2010 to December 2012 totally for a period of 27 months. 297 cases of facial injuries were referred to the Department of Plastic Surgery during this period. Out of which only 61 cases of midfacial fractures were taken up for study.

Proforma was prepared to study the various epidemiological factors like age, gender, occupation, causes of injuries, association of injuries with alcohol consumption, usage of helmet, type of fractures, and to analyze the out come of results of early and late management of these midfacial fractures.

This topic was submitted for the approval of the Human Ethical committee and the approval was granted, [Ref no.493/MEI/2007].

Verbal explanation about the study was given to the patients who fulfilled the inclusion criteria. Patients history, symptoms & signs were recorded, photos were taken, their contact address and phone numbers were collected with their consent.

### INCLUSION CRITERIA

Midfacial fractures were included as per Frost in the area bounded by frontozygomatic and frontonasal sutures superiorly and occlusal plain inferiorly, pterygoid plates posteriorly, till the root of the zygomatic arch laterally. So all the patients with fractures in the above mentioned territory were included for the study.

### EXCLUSION CRITERIA

Fractures involving Frontal bone and Mandible were excluded.

When patients were referred to our department all details were recorded in the proforma. Patients’ age, sex, occupation, residential address and contact number were noted first. Mode of injury was recorded as Road Traffic Accidents (RTA), assault, fall, industrial accident and, sports injury. In RTA option, whether the patient was a pedestrian, bike rider, or pillion rider was recorded. History of alcohol consumption during driving was noted. Usage of helmet during driving by the rider and pillion rider was recorded. The site of accident, whether occurred on the street, or road within the urban area, or on the national highway were recorded. Whether the accident had taken place during day time or night time was also recorded.

Thereafter symptoms were recorded as relevant to the midfacial fractures. These include pain, ear nose throat (ENT) bleeding,
difficulty to open mouth, malocclusion, loss of sensation over infraorbital area and others. All these patients were examined and the important signs were recorded like periorbital edema, diplopia, sub conjunctival ecchymosis, step in infra orbital region and zygoma region, malar flattening, trismus and cerebrospinal fluid (CSF) rhinorrhea. Oral examination was done to look for palatal split, malocclusion, oral mucosa, and floor of the mouth, loose or broken teeth.

Associated injuries were recorded and Ophthalmology, Neurology, Orthopedics and ENT opinions were obtained whenever necessary. Comorbid factors such as Diabetes Mellitus, Hypertension, and Ischemic Heart Disease were recorded and opinion from the relevant specialty was obtained. Basic blood investigations, X-ray chest, electro cardio gram (ECG), X-ray paranasal sinus (PNS) view and CT scan of facial bones were taken and reviewed in the following appointment. These patients were classified after review of X-ray and CT scan and classified as Dento Alveolar fractures, Zygomatico Maxillary complex fractures, Nasal complex fractures and Maxillary Le Fort fractures.

According to the diagnosis relevant treatment was planned. The time gap between the day of injury and the day of surgical treatment was recorded. This duration was classified as within 7 days, between 7 days to 14 days (early management), and later than 14 days (late management). Patients who had only midfacial fracture with no other injuries were referred early to our department and we have managed them early. Those with associated injuries and other comorbid factors along with midfacial fractures were referred late after getting treatment for other injuries and our treatment was delayed. Some of the patients came to the hospital very late after taking treatment at other places. Some of the patients were managed conservatively.

Patients planned for surgery were referred to anesthesiologist for fitness. After getting consent, these patients were operated under local anesthesia or general anesthesia (either through oral or nasal route) as per anesthesiologist advice. Various techniques of reduction, fixation of fractures with plates and with MMF were recorded. Proper photos were taken in the intra operative period, post operative period, and at the time of discharge.

Follow up was done after two weeks, after one month and after three months. During follow up, the cosmetic and functional results and complications were recorded. All the various demographic factors, etiology, type of treatment and results were analysed and compared with other similar results which was done by different authors.

RESULTS

In a total of 61 patients, details of history, examination findings, operation records, follow up photos and the results were entered in the proforma. Then master chart was prepared and the results were analysed, (annexes).

GENDER DISTRIBUTION

Out of 61 patients, 53 patients were males and 8 patients were females. Gender distribution revealed male predominance in a ratio of 5:1.

Out of 53 male patients, 20 (37.7%) were involved in the age group of 20 to 30 yrs. Followed by 16 patients in the 31 to 40 year age group. There were very less patients in both extremes of age group that is below 20 and above 60 yrs. In the 20 to 30 yrs age group all were involved in road traffic accidents.

Out of 8 females, 7 were in the age group of 20 to 30 yrs and 1 was in 41 to 50 yrs age group. In the female population more number of patients (50%), were in the 41 to 50 yrs age group. The main cause of the injury was assault, followed by fall and lastly road traffic accidents. This pattern is very different from men.

Main cause of injury was road traffic accidents (49.2%), followed by assault (18%). Out of 37 patients who were involved in the two wheeler accidents, bike riders were more than the pillion riders.
Majority of the injuries have taken place on the roads (64.0%), within the city and around the nearby villages. 22% of injuries have occurred at home due to assault and fall.

Out of 61 cases 30 (49.1%) were under the influence of alcohol in overall cases of midface injury.

Out of 37 cases of road traffic accidents only two of them had used helmets (5.4%), rest of the 35 patients (94.6%) did not use helmet.

Main symptom was pain in 95% of patients, followed by difficulty to open the mouth (65.6%). Loss of sensation in infraorbital region (42.6%), was the next common symptom.

About 40 patients (65.6%) had step in the infraorbital rim, zygomatico frontal suture line and in the zygomatic arch. Trismus was the next common sign (63.9%). Around 50% of them had subconjunctival ecchymosis and malar flattening.
Isolated zygoma fracture was the most comprising (49.2%) of the total cases. Out of these, left zygoma fractures were more than right. Zygomatico maxillary complex fractures followed by 26.2%. Two patients had Le Fort II & III on either side of the face.

Maximum number of injuries associated with midface fractures in this study were soft tissue injuries (9.8%). They were lacerations, contusion and abration injuries. It was followed by neurological injuries.

Most of the cases were managed by surgery. Out of these, majority were elevation only (34.4%) in 21 cases. This was done in isolated zygoma fracture and ZMC fracture with minimal displacement. Those unstable and comminuted fractures were managed with elevation of zygoma plus open reduction of fracture and fixation with plates (ORIF) (29.5%). Plates with two holes to six holes 1.5 mm size plates were selected and fixed with 1.5X 6 mm screws. Only six cases of Le Fort II and III fractures were managed with MMF with ORIF. Out of 61 cases 8 of them refused treatment. 6 patients (9.8%) were managed conservatively, since they all had isolated fracture zygoma and ZMC fracture with only pain during full mouth opening. 2 cases of Nasal Bone Fractures was managed with closed reduction. All elevations were done under Gillies Temporal approach. Zygomatico frontal fractures were approached by making incision lateral to eyebrow and fixed with plate and screws. The infraorbital rim fracture and nasozygomatico buttress were approached through subciliary incision.

All our patients were referred from other departments only. These patients were first seen at casualty and were admitted in surgical wards. They were referred to our department only after ruling out all other injuries like Neurological, Dental and ENT. So most of these patients were seen by us only around the 4 th day. Then we send for investigations X-rays and CT scan and anesthesiologist opinion. By this time the facial edema would have subsided and they will be posted for surgery. We have managed to do only 8 (17%) cases within the first week of injury. Rest of the 34cases,(72.3%) were managed within two weeks. Only cases which needed cardiologist opinion and those with comorbid factors like diabetes and hypertension were taken up for surgery after three weeks.

17 cases of isolated zyngoma and ZMC fractures were managed under local anasthesia (36.2%). This was done in very cooperative patients and early fractures and fractures with minimal displacement where elevation only was the main treatment. All ZMC fractures and few zygoma fractures were managed under oral ETGA (51.0%). In patients with Le Fort II,III fractures who needed correction of occlusion, we had requested for nasal ETGA. In one patient with bilateral comminuted Le Fort fracture intubation was difficult. He was given anasthesia through nasal ETGA under endoscopid guidance.
women with the ratio of 5:1 in this study. In a study done by
Overall incidence of midfacial fractures was more in men than in
maximum number of patients during the month of May,
was noted for seasonal variation of incidence and this showed
Cases which were referred to our department during each month
All patients were followed up after post operative period and
reviewed after one month and again after six months. Some of the
patients were on regular follow up even for two years. 30 patients
(49.2%) were able to get good occlusion, full mouth opening,
good malar prominence with symmetry and very minimal scar. The
main complaint was persistent infraorbital anaesthesia 19.7%.
Drooping of the nasolabial region and malar flattening
were among other complaints. Only one patient had implant site
infection which was managed with antibiotics.

Darashingh et al at Aligarh it shows that 88% were males and
12% were females. Road traffic accidents was the common cause
of midfacial fracture in this study(62.3%). Similarly Zachariades et
al, and Van Beek et al, also noted in their study at Greece and
Netherlands that road traffic accidents were comprised more then
half of their patients.

This was followed by assault which was around 18% and the least
cause was fall (11.5%) in this study.

The incidence of RTA was more among male and it was more in the
younger age group ranging from 20 to 30 yrs. This was also similar
to the study done at Aligarh by Darashingh et al in 1202 patients.
32.36 % was involving the same age group and 56 % of cause was
RTA followed by fall. In male population most of them were labourers, farmers and students. Darashingh et al[61] in their
study also reported similar results. In their 1202 patients 421(35%) were farmers and labourers. 40 year old women
constituted the majority and assault was the main cause. Most of
them were house wives. This was also similar to the study done by
Darashingh et al which showed 8% of women were house wives.
In contrast a study by Eggensperger at Central Switzerland
showed 5% women were office workers.

Out of all road traffic accidents only 2 patients were wearing
helmet. There is no study to compare this because in other
countries helmet usage is a must while driving motor bike.

Alcohol consumption was noted in more then 50% of cases which
was the prime reason in causing road traffic accidents, assault and
interpersonal violence in this study. Kontio et al reported that
maximum number of RTA and assault have occurred during
weekends under the influence of alcohol where the violence was
extreme with more severe injuries and more number of associated
injuries.

In the types of fractures observed, maximum cases of zygoma
fracture were observed in non-alcoholic patients, with a mean of
17±2.8 and nasal bone fractures with a mean of 3.0±1.4.
Whereas, maximum cases of severe fractures like zygomatico
maxillary complex and Le Fort I/II/III were observed in alcoholic
patients, with mean cases 11±1.4 and 6.0±3.5 respectively (Table-
16).

TABLE 16. TYPES OF FRACTURES OBSERVED IN ALCOHOLIC AND NON-ALCOHOLIC PATIENTS (MEAN VALUE STANDARD DEVIATION)

<table>
<thead>
<tr>
<th>S. No</th>
<th>Type of Fracture</th>
<th>Alcoholic Mean ± SD</th>
<th>Non-Alcoholic Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Zygoma</td>
<td>13±2.8</td>
<td>17±2.8</td>
</tr>
<tr>
<td>2</td>
<td>Zygomatico maxillary complex</td>
<td>11±1.4</td>
<td>9.0±1.4</td>
</tr>
<tr>
<td>3</td>
<td>Nasal bone</td>
<td>1.0±1.4</td>
<td>3.0±1.4</td>
</tr>
<tr>
<td>4</td>
<td>LeFort I/II/III</td>
<td>6.0±3.5</td>
<td>1.0±3.5</td>
</tr>
</tbody>
</table>

In the types of fractures observed, maximum cases of zygoma
fracture were observed in non-alcoholic patients, with a mean of
17±2.8 and nasal bone fractures with a mean of 3.0±1.4.
Whereas, maximum cases of severe fractures like zygomatico
maxillary complex and Le Fort I/II/III were observed in alcoholic
patients, with mean cases 11±1.4 and 6.0±3.5 respectively.

TABLE-17.A F-TEST FOR FRACTURES BETWEEN ALCOHOLIC AND NON-ALCOHOLIC PATIENTS

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Squares</th>
<th>Df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrected Model</td>
<td>217.375</td>
<td>3</td>
<td>72.458</td>
<td>11.830</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Intercept</td>
<td>465.125</td>
<td>1</td>
<td>465.125</td>
<td>75.939</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>FRACTURE</td>
<td>217.375</td>
<td>3</td>
<td>72.458</td>
<td>11.830</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Error</td>
<td>24.500</td>
<td>4</td>
<td>6.125</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>707.000</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrected Total</td>
<td>241.875</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Two way Anova revealed that there was significant difference
(P<0.01) in the frequency of major fractures in alcoholic patients
compared to those of non-alcoholic patients, thus confirming also
the fact that the fractures of severe nature were more in alcoholic
patients.

Post-hoc analysis using SNK test revealed the variations in the
frequency of midfacial fractures. Among the midfacial fractures,
frequencies of nasal bone and LeFort fractures were significantly less, while those of zygoma were significantly more. Fractures of the zygoma Maxillary complex occupied a medium rank in its frequency (Table-17a, b.).

Table-17b. SNK Test for variation in fractures in alcoholic and non alcoholic patients

<table>
<thead>
<tr>
<th>Type of Fractures</th>
<th>N</th>
<th>Subset</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nasal bone</td>
<td>2.000</td>
<td>1</td>
</tr>
<tr>
<td>LeFort</td>
<td>3.500</td>
<td>2</td>
</tr>
<tr>
<td>Zygoma Maxillary complex</td>
<td>10.000</td>
<td>2</td>
</tr>
<tr>
<td>Zygoma</td>
<td>15.000</td>
<td>2</td>
</tr>
</tbody>
</table>

Means for groups in homogeneous subsets are displayed. Based on Type III Sum of Squares

The error term is Mean Square (Error) = 6.125. a Uses Harmonic Mean Sample Size = 2.000.

Most of the incidence has occurred in the day time and inside the city. More number of cases were noticed in the month of May, November, December and January. The probable reason may be school holidays during the month of May and end of December where more travelling could have occurred. In the month of November, December due to fog there may be more number of accidents. In the month of January due to too much fog and also because of harvesting time in villages there must have been lot of work for the farmers and labourers which could have been the cause for the increased number of cases during this month. When studying speed of impact, all road traffic accidents are high velocity injuries and the rest like fall and assault are low velocity injuries. In this study there were more high velocity injuries 62.3% than low velocity injury which was only 37.7%, similar to results of other studies.

In this study major symptoms were pain 95%, difficulty in opening mouth 65.5%, loss of sensation in infra orbital region 42% and malocclusion 18%.

Major signs on examination in this study showed step in infraorbital rim and zygoma 65%, trismus 63%, subconjunctival ecchymosis 57%, flattening of malar region 52% and malocclusion 18%. One patient had CSF rhinorrhoea, 2 patients had palatal split. The more severe injuries had correlation with RTS in young bike and pillion riders who did not wear helmet and had consumed alcohol during accidents.

In the two patients who were wearing helmet there was less severe trauma. One of them had only undisplaced fracture of right zygoma with complaints of pain when opening mouth.He was managed conservatively and had good recovery. The other patient had fracture of left zygoma with difficulty in opening mouth. We had done elevation only under local anesthesia after which he had good recovery. So wearing helmet was associated with less severe injury to facial bones.

In this study more number of fractures were isolated zygoma fractures (49.2%) followed by ZMC fracture (26.2%), nasal and LeFort II were (8.2%) each and the least was Le Fort III (1.6%). Similar result was shown in a study done by Beaumont et al confirmed maximum fracture in midfacial injuries were ZMC fractures followed by Le Fort and later by dento alveolar fractures. In a study of faciomaxillary injuries by Darashingh et al isolated zygoma was common fracture 18%. In one study Rezzan and Nezih found zygomatic arch is the most common site of fracture which is also shown in this study.

In this study soft tissue injuries (9.8%) were the most common associated injuries along with midfacial fractures followed by neurological injuries (4.9%). This was also proved in the study done by Darashingh et al where soft tissue injuries with or without bone involvement were the most common presentation in faciomaxillary injuries.

In this study majority of patients were managed within 4 days to 2 weeks from the day of trauma. In the early management of isolated fractures of zygoma we have done elevation under local anesthesia. Patients were followed up in the postoperative period and after two weeks and then once a month. Most of them had good mouth opening, occlusion, good malar prominence and cosmetically good results. In isolated zygoma fracture two weeks later we could not do elevation satisfactorily and there was step in the arch and the malar flattening could not be corrected perfectly. Though all these patients could open their mouth after six weeks of regular physiotherapy they still had persistent infra orbital anaesthesia and pain while opening their mouth.

Time of Intervention

Chi-square test revealed that there was statistically significant variation (P<0.01) between early intervention (1-14 days) and late intervention (above 14 days). Early surgical intervention could bring forth good results with less complication, while in late interventions the frequency of complication was higher (Fig. 17).

FIGURE 17. TIME OF INTERVENTION

In ZMC and Le Fort II, III fractures we have done elevation with open reduction and fixation with plates atleast at two buttress points. In the early management group we could get good reduction and alignment of fracture segments after elevation and open reduction. These patients on follow up showed good results. All our Le Fort II, III patients were managed within one week because these patients were referred earlier as the symptoms were very severe. Among all the patients only one had implant site infection. Results of early management were definitely good even in patients with high velocity injuries after RTA with severe type of fractures.

CONCLUSIONS

This study shows that the incidence of midfacial fractures were more in males of 20 to 30 years age group than in females who were between 40 to 50 years.

The main cause in men were road traffic accidents and assault in the case of women.

Most of the men were of low socioeconomic group comprising farmers & labourers whereas the women were all housewives.

There is a strong correlation with alcohol consumption and helmet defaulters with severe midfacial injuries due to road traffic accidents.

There is a significant correlation with increased incidence during some months in a year when there are environmental changes, increased work load and holiday season which could have resulted in more traveling.

When compared to delayed management, early management of midfacial fractures showed better results functionally and aesthetically with less complications.

References:

4. Darashingh Rajput, L.M.Bariar. Study of maxillofacial trauma, its aetiology,
5. Eggensperger NM. Occupational maxillofacial fractures a 3 year survey in central Switzerland. J. of Oral Maxillofacial Surgery. 2006; 64; 270-6