

ORIGINAL RESEARCH

A 10 year review on mandibular fractures managed at a tertiary care centre in central India- Original study

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ABSTRACT

Introduction: Mandibular fractures constitute common attendance in emergency trauma centers. The epidemiology of these fractures varies considerably among different study populations, globally. **Objective:** This retrospective study was planned to delineate the demography, etiology, pattern and management of mandibular fractures who attended the dental OPD and trauma emergency department at S. S. M. C, Rewa from July 2013 till July 2023. **Methodology:** The complete medical records of trauma patients over a period of 10 years were retrieved and reviewed for collecting information regarding variables like age, sex, etiology, seasonal variations, pattern of fractures and its management. **Results:** The incidence was higher in males 87% than in females 13% with the male: female ratio accounting to 6:1. The peak incidence was in the age group of 16 to 30 years for both genders, however, the patients age ranged from 04 years to 80 years. The most frequent etiological fact are countered in our study was Road Traffic Accidents (RTAs) seen in 498 (69.55%) cases. Variability was found in the seasonal and weekly changes. However, the highest frequency was encountered in the months of January. 211 (29.46%) number of cases revealed single fracture of mandible. The most common mandibular fracture was found to be parasymphysis fractures in 341 (47.62%) cases. Closed reduction via Inter maxillary fixation (IMF) was most commonly practiced to treat mandibular fracture cases which was used in 477 cases (66.62%). **Conclusion:** This study highlights the incidence, pattern, etiology and management of trauma cases. Proper association of the above-mentioned variables can give significant information to guide the dealing surgeons for timely enforcement of treatment and thereby reduce the morbidity and mortality in facial trauma patients. Publication of the data may guide government for launching strong implementation policy of road safety to reduce morbidity in RTA cases.

Keywords: Etiology, Incidence, Road Traffic Accidents, Mandibular Fractures, Retrospective Study

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INTRODUCTION

Maxillofacial trauma is a common cause of high morbidity and mortality in various trauma centres. ¹Despite of being the largest and the strongest facial bone, mandible is the second most common facial bone to get fractured. ^{2,3}These fractures can be isolated or combined with other facial and body injuries simultaneously. The incidence, etiology and pattern of mandibular fractures vary among different study populations throughout the world. The variations can be attributed to varying economic and social conditions, local behavior and laws. ^{3,4} Different trends have been reported in the developing countries ^{5,6,7,8} and the developing world ^{9,10,11} The epidemiology of mandibular trauma varies by change in age groups, etiologies of injuries, patterns and incidence of fractures among different population groups the complete understanding of epidemiology of facial

injuries essential for early and accurate diagnosis of mandibular fractures which further helps in prompt management and prevention of these injuries. Thus, this study was planned to highlight the present trends in patterns and management of mandibular fractures based on the demographic details of patients, etiology and associated injuries in cases of mandibular fractures reporting to our institute.

METHODOLOGY

This is an observational descriptive retrospective study which included the analysis of medical records of all trauma patients registered in Dental out door and emergency department at Shyam Shah Medical College (S. S. M. C) Rewa (M. P). A total of 2167 facial injury cases were treated and out of that 716 were the cases of mandibular fractures. The complete information regarding age, sex, cause, of injury, site

of injury, seasonal variations, associated injuries, treatment modalities were retrieved after reviewing medical records like case history, clinical notes, radiographs, photographs and surgical notes etc.

RESULTS

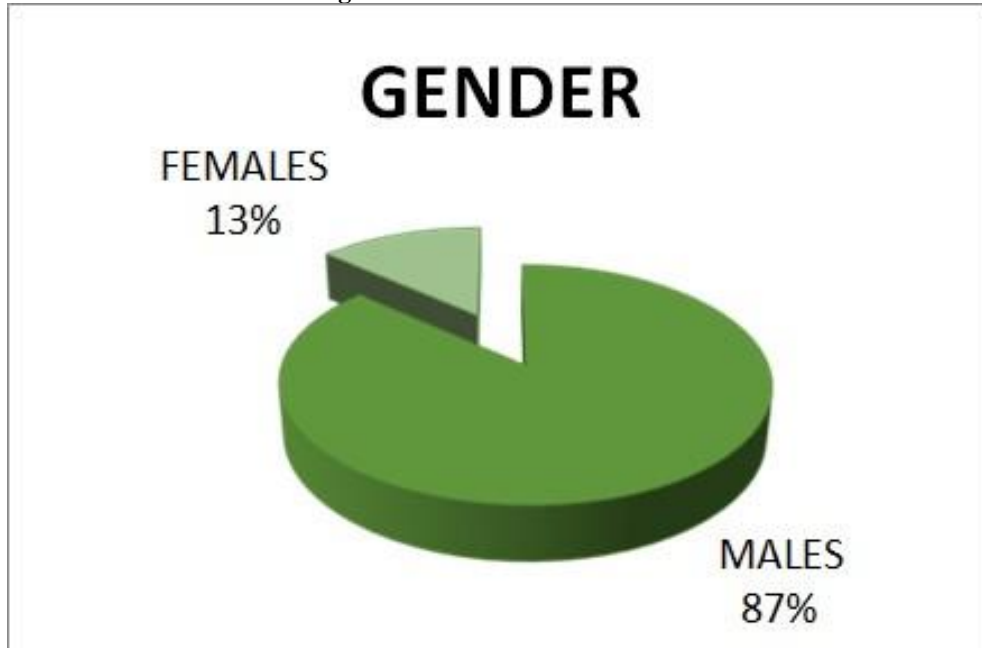
In a span of 10 years from July 2013 to July 2023, we managed 716 cases of mandibular fractures.

DISTRIBUTION ACCORDING TO GENDER

Table No. 1: Distribution According To Gender (n=716)

S.No.	Gender	No. Of Patients	%Age
1.	Males	623	87
2.	Females	93	13
TOTAL		716	100

Pie Chart No. 1: Distribution According To Gender



There were 716 males and females in our study accounting to male: female ratio of 6:1.

DISTRIBUTION ACCORDING TO AGE

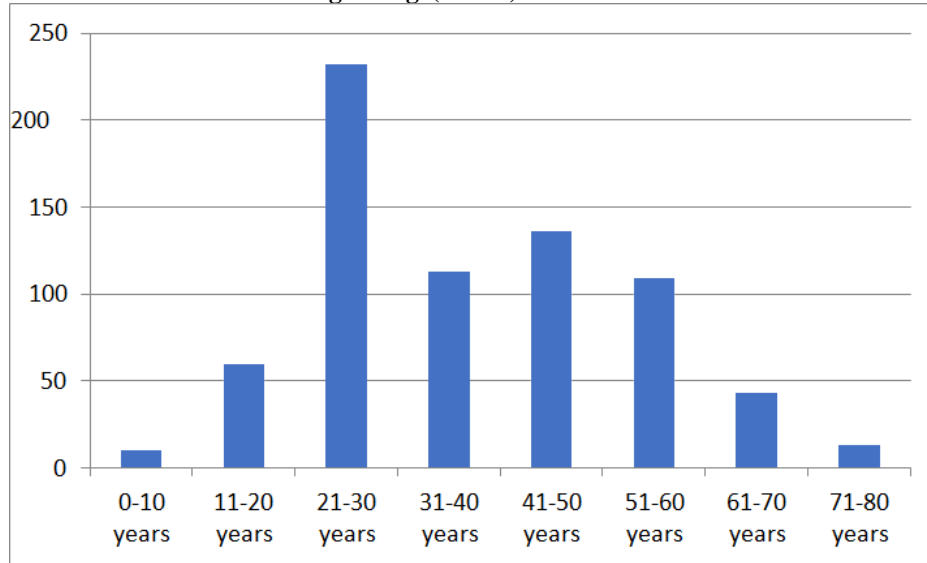
Their ages ranged from 4 to 80 years, the mean age being 36 years. The most common age group showing mandibular fractures seen in 21-30 years age group with 232 fractures (32.40%).

Table No. 2: Distribution According To Age

(n= 716)

S.No.	Age Group	Number Of Patients	%Age
1.	0-10years	10	1.39
2.	11-20years	60	8.37
3.	21-30years	232	32.40
4.	31-40years	113	15.78
5.	41-50years	136	18.99
5.	51-60years	109	15.22
7.	61-70years	43	6.01
8.	71-80years	13	3.63
TOTAL		716	100

Bar Graph No. 1: Distribution According To Age(n=716)



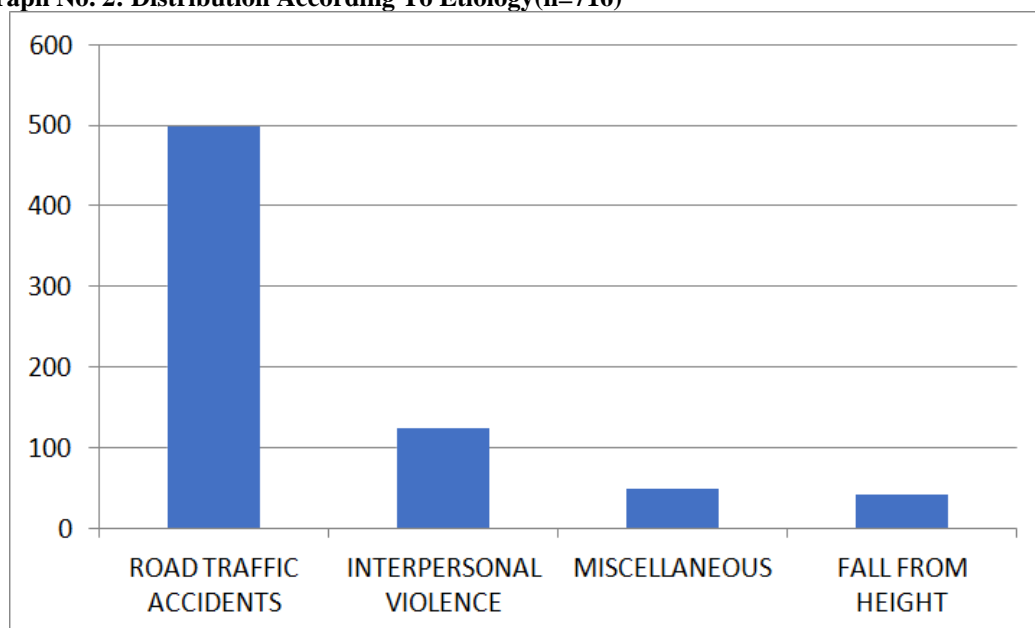
DISTRIBUTION ACCORDING TO ETIOLOGY

The most frequent etiological factor was RTA in 498(69.55%) patients, and then common cause was found to be interpersonal violence (IPV) in 125 (17.45%) patients. The miscellaneous group comprised of injuries due to hit by animals, sport injuries, gun- shot injuries, hit by heavy automobiles like trains, animal bites etc.

Table No. 3: Distribution According To Etiology (n=716)

S.No.	Etiology	Number Of Patients	%Age
1.	Road Traffic Accidents	498	69.55
2.	Interpersonal violence	125	17.45
3.	Fall from height	49	6.84
4.	Miscellaneous Hit By Animals Sport InjuriesGun- Shot Injuries Hit By Heavy Automobiles LikeTrains Animal Bites	42	5.86
TOTAL		716	100

Bar Graph No. 2: Distribution According To Etiology(n=716)



SEASONAL VARIATIONS (MONTHS) AND WEEKLY VARIATIONS

When the seasonal variations were evaluated, it was detected that the mandibular fractures were seen maximum in the month of January in which 100 (13.96%) cases were reported. The next month with maximum frequency of patients was in the month of November showing 94 cases (13.12%) and the maximum number of cases were reported on Mondays with 207 patients (28.91%).

Table No. 4: Monthly Distribution
(n= 716)

S. No	Months	Number Of Patients	%Age
1	JAN	100	13.96
2	FEB	62	8.65
3	MAR	64	8.93
4	APR	47	6.56
5	MAY	46	6.42
6	JUNE	48	6.70
7	JULY	64	8.93
8	AUG	53	7.40
9	SEP	56	7.82
10	OCT	31	4.32
11	NOV	94	13.12
12	DEC	51	7.12
TOTAL		716	100

Line Graph No 1: Seasonal Variations

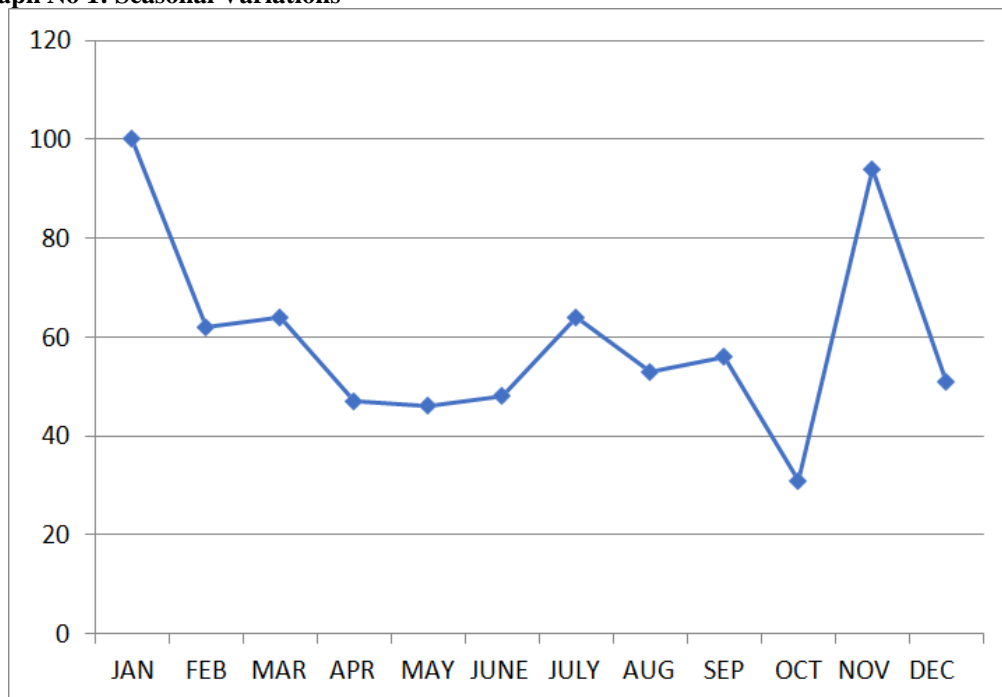
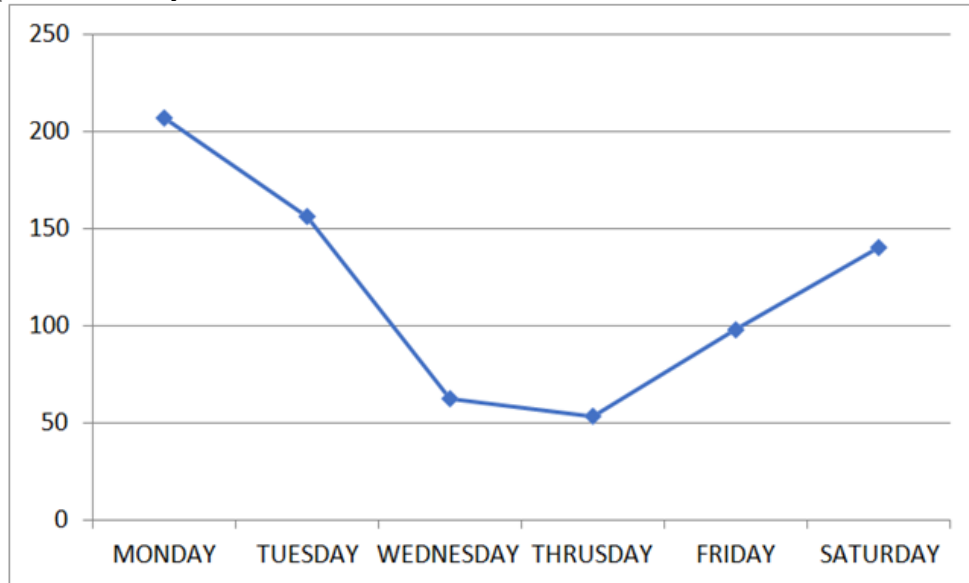


Table No. 5: Weekly Distribution of Patients
(n=716)

S. No	Week days	Number Of Patients	Percentage
1	MONDAY	207	28.91
2	TUESDAY	156	21.78
3	WEDNESDAY	62	8.65
4	THURSDAY	53	7.40
5	FRIDAY	98	13.68
6	SATURDAY	140	19.55
TOTAL		716	100

Line Graph No 2: Weekly Variation



DISTRIBUTION ACCORDING TO PATTERN OF FRACTURES

The trend of associated injuries involving brain injuries, chest injuries, limb injuries and multiple fractures of mandible were a common finding in cases of RTAs in 498 (69.55%) patients as seen in table no 3. When the anatomic distribution of mandibular fractures was investigated, the most commonly affected area was the parasymphysis region in 341(47.62%) fractures followed by fractures of condylar process of mandible in 134(18.71%) cases.

Table No. 6: Pattern of Fractures

S.No	Pattern Of Fracture	Number Of Patients	Percentage
1	SINGLE FRACTURE OF MANDIBLE	211	29.46
2	MULTIPLE FRACTURE OF MANDIBLE	384	53.63
3	PAN FACIAL TRAUMA	74	10.33
4	ASSOCIATED INJURIES	47	6.56

Pie Chart No. 2: Pattern of Fractures

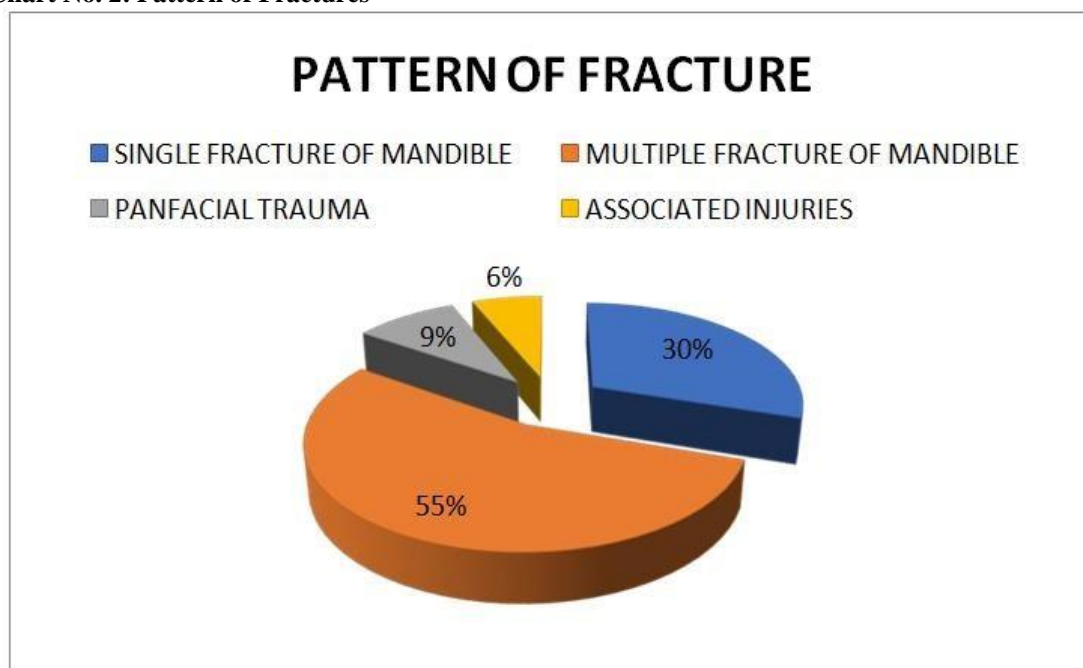
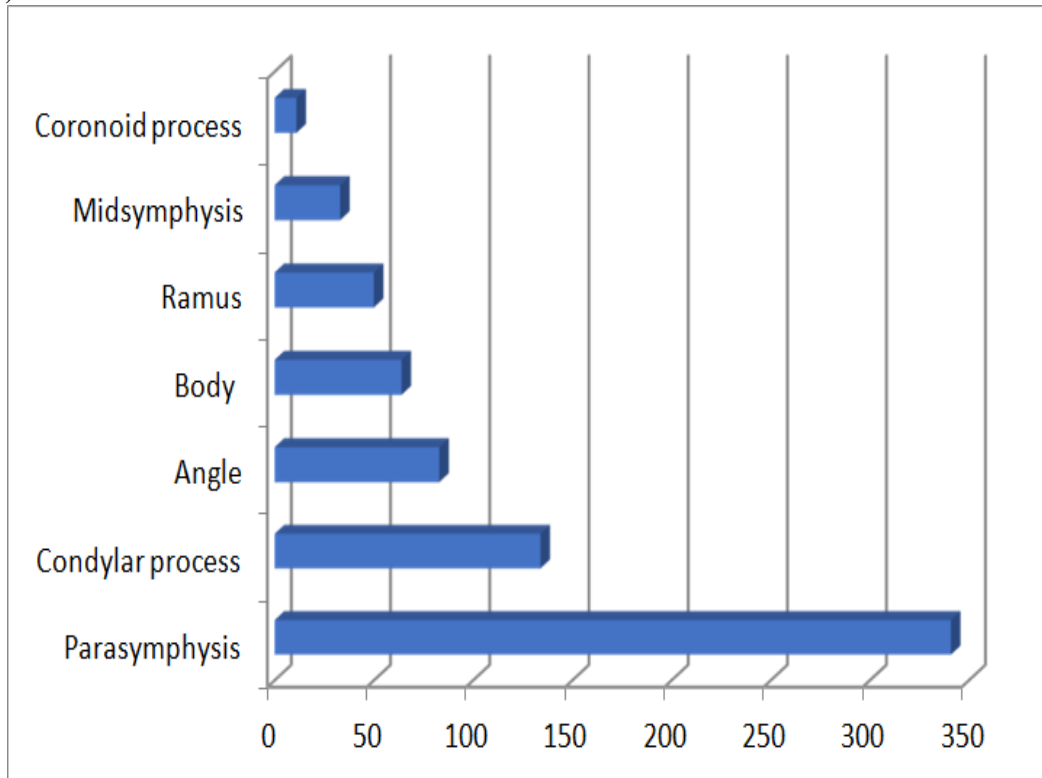


Table No. 7: Distribution According To Anatomical Site

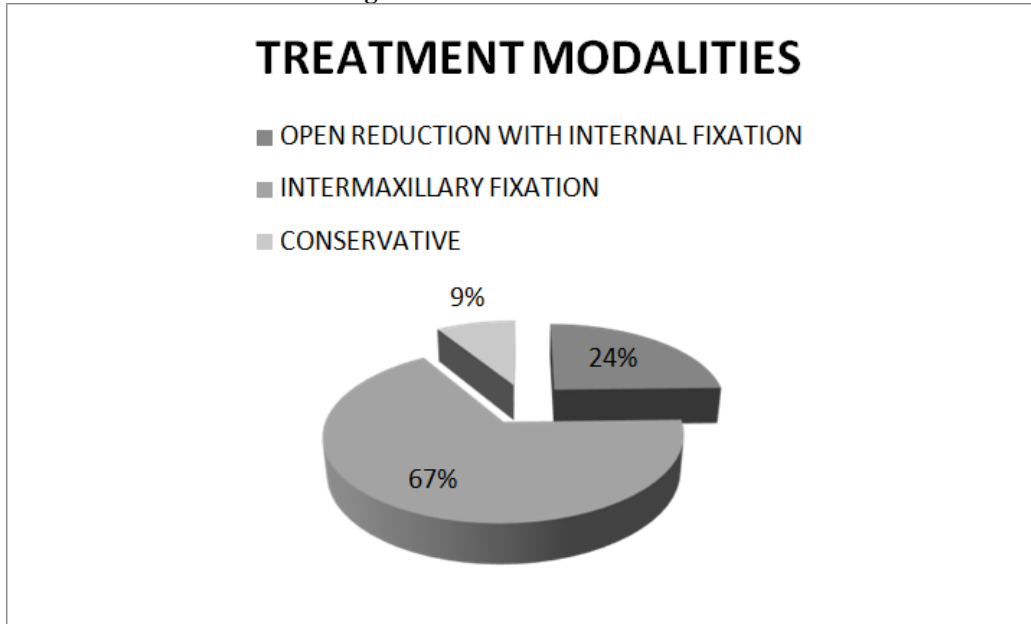
S. No.	Anatomical Site	No. Of Patients	% Age
1.	Parasymphysis	341	47.62
2.	Condylar process	134	18.71
3.	Angle	83	11.59
4.	Body	64	8.93
5.	Ramus	50	6.98
6.	Midsymphysis	33	4.60
7.	Coronoid process	11	1.53
TOTAL		716	100

Bar Graph No. 3: Distribution According To Anatomical Site (n=716)**DISTRIBUTION ACCORDING TO TREATMENT MODALITIES**

As far as the treatment modalities were considered, the closed reduction of fractures with intermaxillary fixation (IMF) using arch bars was the most commonly practiced treatment in our institute used in 477 (66.62%) fractures out of 716 cases. Patients on an average were followed up for a period of 6 months.

Table No.8 Treatment Modalities Used

S. No	Type of Treatment	Number of Patients	Percentage
1	OPEN REDUCTION WITH INTERNAL FIXATION	176	24.58
2	INTERMAXILLARY FIXATION	477	66.62
3	CONSERVATIVE	63	8.79

Pie Chart No. 3: Distribution According To Treatment Modalities**DISCUSSION**

Ours is a retrospective study of mandibular fractures treated over a span of 10 years in our institute. The results of this study coincide with previous reports regarding age and sex of patients. Epidemiological surveys of mandibular fractures are consistently influenced by geographic area, population density, socioeconomic status, cultural difference of the study population.^{4, 10, 12, 13,14, 15, 16}

Trauma patients need special care and treatment because of their associated injuries, which might affect the outcome of treatment and consequence of injuries.

GENDER

In the present study, ratio of men to women with maxillofacial trauma was 6:1, which is similar to the ratio found in several studies, conducted in Korea, Iran, Japan and other parts of India (Chennai) etc.^{7,8,10,11,15,17} While was far more than the data found in some countries like Thailand, Tanzania and Brazil.^{12,13,19} The reason behind may be related to increased mobility and social engagements of females.

AGE

In this exploration, it was found that the peak incidence of mandibular fractures is found in the age group of 21–30 years (32.40%), which is similar to most studies conducted in developing countries like Nigeria and India in literature.^{5,6,10,15} and is in contrast with the study of Boonkasemetal.¹² Where the number of patients in each age group was not different.

We noticed the incidence of mandibular fracture in all age groups ranging from a 4-year-old girl with right condylar and left parasymphysis fracture to 80-year-old male with right angle fracture, which is a consistent finding in other studies.^{16,17} Young adults account for high activity in society and are more

vulnerable to altercations. Leading to intentional and unintentional injuries. Early bikers, lack of safety measures advent in the form of helmets and seat belts and more over poor road conditions also are responsible for young adults predominantly involved in RTAs in our area.

ETIOLOGY

Mandibular fractures can result from many different factors such as interpersonal violence, traffic accidents, gun shot wounds, sports accidents, road accidents and falls.¹⁴ There is a stark difference in the cause of maxillofacial injuries in developing and developed nations. RTAs account for the commonest etiology in developing countries like India, Nigeria, Iran, Korea, Egypt etc.^{4,5,7,8,20,21} While IPV and sports injuries are the common causes in the developed world like Canada, Brazil etc.^{9,10,11,22,23} The present study supports these inferences as 73.03% of cases suffered injuries due to RTAs. Road crashes were distributed homogeneously among various age groups.

The decrease in RTAs in developed nations has dramatically occurred with the advent of low speed limits, implementation of strictly enforced traffic rules and regulations with best practice on seat belts, drink driving, speed limits,²⁴ helmet laws and child restraints. Our study reflects upon the fact that similar strict government implementation of road safety legislations are the principal remedy measures required for reducing incidence of maxillofacial trauma in our region too.

SEASONAL VARIATIONS

When reviewing the time of occurrence, it was seen that maximum number of trauma cases were encountered in January (13.96%) followed by in the month of November (13.12%). This can be attributed to the change in season, with the onset of winters, fog

and also due to rash driving involving festival celebrations lead to traffic clashes in India. Moreover, marriages during this season are responsible for rash driving and more public in market places. These months were also reported of having high precedence for trauma cases in few other studies conducted in Canada and Toronto.

^{9,11}However, summer season was the mentioned time with highest frequency in other studies.²⁵

There is a concentration cases on Mondays (28.91%) and Tuesdays (21.78%) in our study population which can be most likely be attributed to the haste and negligence in following of rules on the working days after weekend while reaching to offices, shops and schools. These findings of the present study differ from other studies conducted in western countries like the surveys conducted in cities like Amsterdam and Toronto^{9,11,14} where due to planned recreation activities maximum number of trauma cases occurred on weekends.

ANATOMICAL SITE OF FRACTURE

Trauma type and etiologic factors are essential to define the localization of the mandibular fractures. IPV was most often associated with isolated angle and combined angle and parasymphysis fractures.^{10,14} On the other hand, parasymphysis fractures were most commonly affected in RTA cases.^{14,26} Condylar fractures were most commonly

seen in cases of falls and RTAs.^{10,27} Victims of violent crimes such as assault and gunshot wounds were found more likely to suffer body and angle fractures. The anatomic distribution and incidence of fractures are widely variable.^{10,14,16,27}

In our study, the site of mandibular fracture correlated with the cause. Therefore, it is not surprising that the most common fractures occurred at the parasymphyseal region in 341 cases (47.62%) during RTAs. We also found that 211 cases (29.46%) had single fracture of mandible. The most common combined fracture in our study was parasymphysis and angle fracture. These findings are similar to some studies,^{14,26,28} and different from other studies conducted at cities like Amsterdam, New York etc.^{10,14,20,27,29} Multiple fractures of mandible and Le Fort fractures of midface with Zygomatico-Maxillary Complex (ZMC) fractures were a common finding in pan-facial trauma patients in RTA cases (Table no. 6).

Associated non maxillo facial injuries like brain injury, chest injury, limb injuries were managed simultaneously in 37 patients (6.31%) in collaboration with surgery and orthopedics department. The mechanism of injury correlates significantly with the anatomic location of fracture and knowledge of these associations help and guide the treating surgeons in planning effective and successful management of maxillofacial trauma cases.

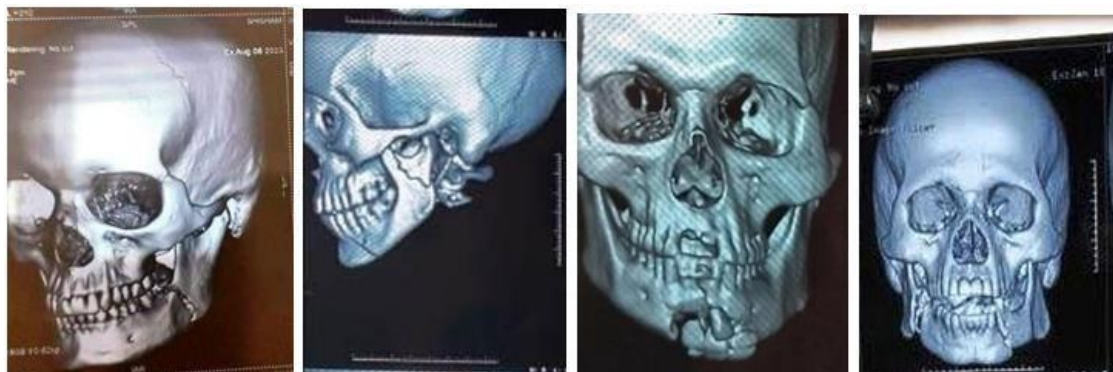


FIG1: Various sites of mandibular fractures

MANAGEMENT OF MAXILLOFACIAL FRACTURES

Definitive repair of mandibular fractures is not a surgical emergency and treatment is often delayed in patients with multiple injuries. It has been observed and reported that mandibular fractures undergoing repair within 3 days of injury found no post-operative complications.²⁹ We also tried to manage all maxillofacial trauma cases within 7 days of incident. In case of delay in treatment, a stay-wire and Barton's bandage were used for preventing displacement of fractures, which also helped in decreasing pain and edema.

The main goal of treatment for jaw fractures is to rearrange the bone pieces in the same plane (anatomical reduction) for good cosmetic

results and function, especially occlusion.³⁰ Treatment of mandibular fractures can be classified as surgical and non-surgical management.^{30,31} Planning of the surgical treatment depends on many factors such as age, trauma, type, associated injuries, dental profile of the patient and anatomic sites of fractures.³² There are many different treatment options such as closed reduction, open reduction and internal fixation, closed reduction with external fixation and also use of Kirschner wires in management.³² However, there is still no consensus about the ideal treatment strategy.

NON-SURGICAL TREATMENT/CONSERVATIVE APPROACH

In the present study, 63 patients (8.79%) were treated conservatively with non-surgical approach consisting

of soft diet, physiotherapy and regular clinical follow up. This treatment

Without the use of IMF was successfully used in all children with condylar fractures as well as adults with condylar head fractures and in complete angle and body fractures of mandible. This treatment modality was also selected by authors previously reported in literature.^{33,34}

CLOSED REDUCTION

Indications for closed reduction of mandibular fractures remain controversial but may include undisplaced or grossly comminuted fractures, fractures in the presence of mixed dentition or in atrophic mandible and fractures of coronoid or condylar process.³⁵ It is commonly achieved by IMF using arch bars, Ivy loops or suspension screws. Arch bars are applied to the upper and lower jaws with circum dental ligature wires.³¹ Occlusion can be maintained with either wires or elastics. Ivy loops are

useful in patients who are unable to tolerate arch bar application or the child patients with mixed dentition or geriatric patients with poor dentition.

Most of the patients in the present study were treated with closed reduction with IMF via arch bar application which was used in 477 patients (66.62%). Our study correlates with the findings in other studies which reported that this treatment costs significantly less than open reduction.^{31,36} IMF has certain disadvantages such as possible damage to the teeth, difficulty of its placement to the posterior teeth, periodontal tissue injury, poor oral hygiene and possible risk of needle-stick injuries for surgeons during application.^{37,38} Usage of IMF is thus a controversial aspect in the treatment of mandibular fractures. Although introduction of plating systems decreases the need for IMF, there are reports that suggest its usage intraoperatively to assist in reduction of fracture sites and postoperatively to assist in fixation.³⁹



FIG 2: Closed Reduction Open reduction and internal fixation:

In the past 20 years, plate osteosynthesis has become popular in the management of mandibular fractures. It involves usage of open reduction and internal fixation with rigid or semi rigid plates and if necessary, to support this treatment with IMF. ^{21,28} Surgeons prefer this modality as it offers stable anatomic reduction of the fragments, reducing the displacement on the fracture line in postoperative period and eliminates the need for IMF in the post-operative period and eliminates the need for IMF in the post-operative. ^{21,40} Besides these, the patients also choose it because it allows immediate recovery of function, shortens the period of bone remodeling and consolidation of fracture site. ^{41,42}

Adequate exposure is a key component of proper open reduction of mandible fractures. An intraoral buccal sulcus incision is commonly used for parasymphiseal and body fractures, with care taken to avoid injury to mental nerve and its branches. ³³

Either an external or an intraoral approach can be used for access to inferior border, but the marginal mandibular nerve may be placed at risk. ⁴⁰ The fracture line should be adequately debrided of all fibrin and hematoma to allow tight approximation of the bone edges. Reduction can often be achieved with application of IMF. ⁴³ There continues to be debate over whether to maintain IMF after ORIF. ^{44,45} The main goal of treatment for facial fractures is to rearrange bone pieces in the same anatomical reduction for best cosmetic results and functions, especially occlusion. ³⁰ All the various treatment modalities possess specific advantages and disadvantages, therefore there is no consensus on the best treatment approach. ^{27,28} The choice is influenced by the condition of fracture and associated injuries condition of patient and professional preference. In the present study closed reduction was preferred and practiced in 477 cases (66.62%).



FIG 3: Open Reduction and Internal Fixation

COMPLICATIONS

Prevention of complications after management is an important issue too. Infection, osteomyelitis, sensory dysfunction, motor deficit, nonunion, malunion and wound dehiscence are the possible complications.^{33,44,46} The complication rates are directly correlated to the type of injury, severity and localization of fracture, timely management of injuries and treatment modalities according to various authors in literature.^{27,32,44,46,47} According to various authors, mandibular fracture complication rates range from 7-29%.^{28,46,47} It was always found that complications commonly occurred in vehicular accident victims who sustained multiple injuries. It was concluded by various authors⁴⁷ that the incidence of complications remains unchanged over time regardless of the varied and presumably advanced methods of fixation and reduction. We observed that motor deficit and osteomyelitis were encountered in multiple injury cases and more in body and angle region of mandible.

LIMITATIONS

As, the present study was an institutional retrospective observational study, it may not represent the true situation in central India. The developing nations, like India, still have large number of mandibular fractures attributed to RTAs and incidence of mandibular fractures can be significantly reduced by strict enforcement of traffic rules.

The Indian government needs to enforce the laws with best practice on seat belts, drunk driving, speed limits, use of helmets, child restraints. The present study emphasize urgent action is needed to achieve the ambitious target for road safety. We recommend multi-centric prospective long span studies in our zone in order to suggest preventive programs to the state and national government policy makers will promote risk reduction to mandibular fractures. Programs to prevent violence and to improve tolerance among communities must be encouraged to reverse the role of violence in maxillofacial trauma.

The present single-center retrospective study of epidemiology and management of mandibular fractures revealed that the therapy applied was effective in treating the fractures and showed rates of success comparable with published data around the world.

COMPETING INTERESTS

None declared.

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