ORIGINAL ARTICLE ASIAN JOURNAL OF MEDICAL SCIENCES

Objective assessment of the factors affecting outcome of immediate management of mandibular fractures – A prospective study in a Level-I trauma care center

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Submission: 03-09-2023 Revision: 04-11-2023 Publication: 01-12-2023

ABSTRACT

Background: Mandibular fractures lead to complications if improperly treated. The management of mandibular fractures includes open reduction and internal fixation (ORIF) or closed reduction. Associated complications include malocclusion, infection, hardware extrusion, and nerve injury. **Aims and Objectives:** The aims of this study were to evaluate the functional outcome of various treatment modalities of mandibular fracture and to identify the factors affecting the outcome. **Materials and Methods:** The study included patients admitted in the trauma care center, between 13 and 70 years of age, and having mandibular fracture. Patients underwent ORIF or closed reduction according to the type of fracture. Mandibular injury severity score (MISS), Mandibular functional impairment questionnaire (MFIQ) score, and pain visual analog score were used to assess the functional outcome of treatment and complications. **Results:** Majority of the patients were male and were in the age group 21–30 years. The most common cause of fracture was road traffic accident (RTA). Majority of the patients underwent ORIF. Patients having higher injury severity scores, severe MFIQ scores and pain visual analog scores had more complications. Overall, complications in open reduction cases were higher than closed reduction ones. However, weight loss and time to functional improvement were more in closed reduction cases. **Conclusion:** Young males are most commonly affected with fracture of mandibles and mostly due to RTAs. There should be minimal delay from presentation to operative intervention in case of patients who require ORIF. Scoring systems such as MISS, MFIQ, and pain visual analog scale scores may help in the early prognostication of injury and warn against imminent complications.

Key words: Mandibular fractures; Severity score; Pain visual analogue score

Access this article online

Website: http://nepjol.info/index.php/AJMS

DOI: 10.3126/ajms.v14i12.58309

E-ISSN: 2091-0576

P-ISSN: 2467-9100

INTRODUCTION

Mandible fracture is one of the most common facial injuries, second only to nasal bone fracture.[1] If improperly treated, fracture of mandible can result in complications such as malocclusion, infection, nerve injury, and poor functional outcome causing immense distress to the patient and reducing the overall quality of life. A detailed knowledge of relevant surgical anatomy, pathophysiology of injury, treatment options, and possible complications is vital for full recover and rehabilitation of the patient.

A glance through the available literature would reveal a plethora of surgical techniques available at the healthcare worker's disposal to manage mandibular fractures vary ranging from bandages and external appliances, extraoral and intraoral appliances, intermaxillary wiring, plates, and screws.[2]

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The goal of this study is to determine the factors that affect the outcome of the management of mandibular fracture.

Aims and objectives

The study has two main objectives:

1. To assess the functional outcome of the treatment modalities of mandibular fracture
2. To identify the factors affecting the functional outcome of the treatment given to the patients.

MATERIALS AND METHODS

This study included patients presenting with mandibular fracture to the trauma care center, IPGME&R. SSKM Hospital during the period June 2022 to May 2023. Ethical clearance was obtained from the institutional Ethics Committee (No. IPGME&R/2022/229 dated: 18 April 2022).

Inclusion criteria

All patients of age group 13–70 years, having isolated mandibular fractures presenting to trauma care center were included in the study.

Exclusion criteria

Patients having associated other maxillofacial fractures apart from mandibular fracture, previous history of such injuries or deformities, were not included in the study. Patients with concomitant head injury or severe systemic illness which rendered them unfit for operative intervention were also excluded from the study.

Investigations

All patients with suspected mandible fracture were underwent computed tomography facial bones.

The mandibular fractures were classified according to the site such as ramus, condyle, symphysis, body, parasymphysis, and angle.

In addition, the following parameters are assessed:
Site of fracture

a. Nature of fracture
b. Pre-treatment mouth opening
c. Pre-treatment occlusion
d. Pre-treatment displacement of fracture segments
e. Weight at initial clinical presentation prior to treatment
f. Mandibular injury severity score (MISS).

The following criteria were used to segregate the patients according to treatment modality.

Criteria for closed reduction/treatment[3]

a. No or minimal displacement of a stable fracture
b. No or minimal mobility across the fracture line
c. No impairment of function
d. Ability to obtain preinjury occlusion
e. Good patient cooperation and follow-up
f. Patient refuses ORIF
g. Lengthy surgery is required, but is not possible (patient is not fit for surgery).

Closed reduction consisted of maxillomandibular fixation for 4 weeks with emphasis on soft diet and good oral hygiene practices.

Rest of the patients who did not fit the criteria for closed reduction underwent open reduction and internal fixation (ORIF). Open reduction consisted of miniplate fixation according to Champy's principle of osteosynthesis.

If operative treatment was the decided line of management, then time to operation from initial presentation was also calculated.

Post-treatment assessment was done at 3, 6, 9, and 12 weeks.

Table 1: Distribution of etiology of mandibular fracture

Etiology	Frequency	Percent
Assault	5	4.7
Fall	4	3.8
RTA	97	91.5
Total	106	100

RTA: Road traffic accidents

Table 2: Comparing weight loss between patients who underwent open and closed reduction

Body weight	Treatment	N	Mean	SD	P value
Weight loss (kg)	ORIF	92	4.7	1.238	<0.001
	Closed	14	8.21	1.311	

ORIF: Open reduction and internal fixation, SD: Standard deviation

Table 3: Distribution of complications

Complication	Frequency	Percent
None	73	68.9
Hardware exposure	4	3.8
Hardware exposure and malocclusion	1	0.9
Infection	3	2.8
Infection and malocclusion	4	3.7
Infection and hardware exposure	1	0.9
Malocclusion	15	14.2
Nerve injury	2	1.9
Nerve injury and infection	1	0.9
Nerve injury and malocclusion	1	0.9
Nerve injury, infection, and malocclusion	1	0.9
Total	106	100

Table 4: Association of MISS with complications

Complications	N	Mean MISS	SD	95% CI		P value
				Lower bound	Upper bound	
No	72	7.7639	1.4679	7.4189	8.1088	<0.001
Yes	33	11.3636	2.42149	10.505	12.2223	

SD: Standard deviation, MISS: Mandibular injury severity score, CI: Confidence interval

Table 5: Association of complications with time to operation

Interval between injury and surgery	Complications				P value
	No		Yes		
	Mean	SD	Mean	SD	
Time to operation (days)	4.66	1.63	8.94	2.19	<0.001

SD: Standard deviation

Table 6: The relation of MISS to MFIQ score

MIFQ scores at different time intervals	Mean MISS			P value
	Low	Moderate	Severe	
MFIQ score at 3	-	8.31±1.89	12.4±2.67	<0.001
MFIQ score at 6	8.31±1.42	8.31±2.2	12.4±2.67	<0.001
MFIQ score at 9	8.43±1.73	7.64±2.59	12.4±2.67	<0.001
MFIQ score at 12	8.2±1.89	9.5±1.6	12.4±2.67	<0.001

MISS: Mandibular injury severity score, MFIQ: Mandibular functional impairment questionnaire

Post treatment parameters that were assessed:

a) Post-treatment mouth opening
b) Pain visual analog scale score at 3, 6, 9, and 12 weeks
c) Mandibular functional impairment questionnaire (MFIQ) score 3, 6, 9, and 12 weeks
d) Weight loss at the end of 12 weeks
e) Presence of complications specifically malocclusion, infection, hardware exposure, and nerve injury.

RESULTS

In this study, a total of 106 patients were examined. The most prevalent age group was 21–30 years, comprising 56 patients (52.8%), followed by 31–40 years, which accounted for 21 patients (19.8%).

The primary cause of mandibular fractures was road traffic accidents (RTA), affecting 97 patients (91.5%). Assault was responsible for 5 cases (4.7%), while falls accounted for 4 cases (3.8%) (Table 1).

As far as the nature of the fracture was concerned, they were categorized as follows: Comminute fractures: 27 cases, accounting for 25.5%. Simple fractures: 79 cases, making up 74.5% of the total cases.

In terms of the location of mandibular fractures, the parasymphysis was the most common site, observed in 56 cases (52.8%), followed by the body with 12 cases (11.3%), and the symphysis with 11 cases (10.4%). Simple fractures were prevalent among 79 patients (74.5%), whereas 27 patients (25.5%) presented with comminuted fractures.

Out of 106 patients, 92 patients (86.8%) underwent ORIF.

Whereas 14 patients (13.2%) underwent closed reduction.

Patients who underwent ORIF had a mean weight loss of 4.7±1.238 kg whereas those who underwent closed reduction had a weight loss of 8.21±1.311 kg. (P value <0.001, T test) (Table 2).

Of the 106 patients, 33 patients (31.1%) developed various complications. The most common complication was malocclusion (Table 3).

Association between MISS and complications

Patients with higher MISS were found to be associated with a greater number of complications (P<0.001, t-test). The mean MISS of patients with complications was 11.3636±2.42149, whereas for those without complication, it was 7.7639±1.4679 (Table 4).

Association between time to operate and complication

Patients with complications had a time to operation of 8.94±2.19 days. Patients without complication had a time to operation of 4.66±1.63 days. P-value <0.001, T test (Table 5).

At the end of 12 weeks of assessment, it was found that patients with higher MISS had persistently severe MFIQ score (P<0.001, t-test). The mean MISS with severe MFIQ score at the end of 12 weeks was 12.4±2.67, for moderate MFIQ Score was 9.5±1.6, for low MFIQ score was 8.2±1.89 (Table 6).

Table 7: Correlation of MISS with pain VAS score

Correlations	Correlation with MISS			
	Pain (VAS) score)@ 3	Pain (VAS) score)@ 6	Pain (VAS) score)@ 9	Pain VAS) score)@ 12
r	0.314**	0.393**	0.470**	0.621**
P value	0.001	<0.001	<0.001	<0.001

MISS: Mandibular injury severity score, VAS: Visual analog scale

At the end of 12 weeks of assessment, it was found that patients with higher MISS had persistently high pain visual analogue scale score (P<0.001, analysis of variance [ANOVA] and correlation) (Table 7).

DISCUSSION

In our study, 56 patients (52.8%) were in the age group 21–30 years. Chaurasia and Katheriya[4] found that the highest incident of mandible fracture was in the age group of 21–30 years. Gualtieri et al.,[5] and Cha et al.,[6] reported similar findings.

The study found that 93 (87.7%) of patients who had mandibular fractures were male. 13 (12.3%) were female. Saravanan et al.,[7] in their study reported that males constituted up to 88% of the patients. Similar findings were reported by Saluja et al.[8] (2022) and Farzan et al.[9] (2021).

In our study, 97 patients (91.5%) out of 106 patients had RTA as the mechanism of injury followed by assault (4.7%) and fall (3.8%). Similar findings were reported by Shah et al.,[10] Saluja et al.[8] (2022) and Tabatabaee et al.[11] Lapeña et al.,[12] advocated road safety measures such as proper use of helmets to prevent mandible fractures.

Out of 106 mandible fracture cases, 56 (52.8%) were parasymphysis, followed by 12 cases of body (11.3%), and 11 cases of symphysis (10.4%). Malhotra et al.,[13] in their study found that parasymphysis (34.6%) was the part of the mandible most frequently injured.

Out of 106 patients, 92 patients (86.8%) underwent ORIF. Whereas 14 patients (13.2%) underwent closed reduction. Treatment was done according to the protocols laid down in literature.[8] Saluja et al.[8] (2022) and Panesar and Susarla[14] found that ORIF was the most common modality of treatment in mandible fractures.

Patients who underwent ORIF had a mean weight loss of 4.7±1.238 kg whereas those who underwent closed reduction had a weight loss of 8.21±1.311 kg (statistically significant, P<0.001, t test).

- Complication rate was 31.1% in our study. The most common complication was malocclusion (14.1%). Hsieh et al.,[15] reported a complication rate of 21.2%.

Patients with higher MISS were found to be associated with a greater number of complications (statistically significant, P<0.001, t-test). The mean MISS of patients with complications was 11.3636±2.42149, whereas for those without complication, it was 7.7639±1.4679.

Nishimoto et al.,[16] suggested that the MISS could be a valid measurement of mandibular injury severity as evidenced by the positive correlation between the MISS and post-operative complications, duration of operation, and length of stay.

Patients with complications had a time to operation of 8.94±2.19 days. Patients without complication had a time to operation of 4.66±1.63 days (statistically significant, P<0.001, t test). Hsieh et al.[15] found that an increase time to treatment is an independent risk factor for complications.

At the end of 12 weeks of assessment, it was found in our study that patients with higher MISS had persistently severe MFIQ score (statistically significant, P<0.001, t-test). The mean MISS with severe MFIQ Score at the end of 12 weeks was 12.4±2.67, for moderate MFIQ Score was 9.5±1.6, and for low MFIQ score was 8.2±1.89.

Similarly, at the end of 12 weeks of assessment, it was found that patients with higher MISS had persistently high pain visual analogue scale scores (statistically significant, P<0.001, ANOVA and correlation).

Niezen et al.,[17] suggested that pain, perceived occlusion, and absolute difference between left and right laterotrusive movements are risk factors for mandibular function impairment. Thus, the MFIQ can be used to assess the functional outcome of treatment of mandibular fractures.

Limitations of the study

This is a single centre study. So the study may suffer from lack of generalizability. Given the frequency of occurrence of such cases a larger number of cases would give more accuracy.

CONCLUSION

Most victims of mandible fracture are young males and RTA being the most common cause of such injuries.

If the fracture requires operative intervention, it should not be delayed to avoid unfavorable results.

A higher MISS and poor MFIQ score predict poorer results of treatment. These clinical scoring systems may aid in the prognostication and help guide intervention to avoid an imminent complication.

ACKNOWLEDGEMENT

The authors would like to acknowledge the cooperation of the Director, Superintendent of IPGME&R, SSKM Hospital, Kolkata in conducting this study.

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Authors' Contributions:
TD- Literature survey, conducting the study including implementation of study protocol, data collection, data analysis, and preparation of first draft of manuscript.
SB- Concept, designing of the study, supervising, and guiding the study, data analysis, manuscript revision, and editing.

Work attributed to:
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Source of Support: Nil, **Conflicts of Interest:** None declared.