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Evaluation of Postoperative Complications Following Management of Mandibular Fractures with Open Reduction & Internal Fixation under Regional Anaesthesia: A Retrospective Study

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Abstract---Aim: To assess the rate of postoperative complications and its association with respect to aetiology, gender, age, time lapse between injury and commencement of treatment, history of substance abuse, number and location of the fractures in mandibular fracture patients treated with open reduction and internal fixation (ORIF) under regional anaesthesia. Materials and method: All patients fulfilling the selection criteria with mandible fracture reporting to our institution, from March 2017 to August 2021, were included in the study and were divided into three groups based on anatomic site involved. Patient's records were analysed for deriving complications that occurred during the postoperative period of ORIF and association with different variables. The values were subjected to Chi-square tests. Results: Out of 160 study population, patients with combined Para symphysis involving angle (Group C) were reported with the highest number of complications such as minor occlusal discrepancies (20.4%), surgical site infection (4.1%), wound

dehiscence and paraesthesia (4.1%) as compared to fractures involving symphysis & para symphysis region (Group A and Group B respectively). Conclusion: The most common postoperative complication in this study was surgical site infection which can be managed effectively with local wound care, antibiotics and can be prevented with aseptic technique.

Keywords--Complications, Local Anaesthesia, Mandibular Fractures, Open reduction internal fixation, Paraesthesia.

Introduction

Mandibular fractures play significant role in craniofacial trauma, accounting for the second most common bone to be fractured after nasal bone with the frequency of 36% to 70%. Most commonly males are affected more as compared to females in their twenties and thirties. Road traffic accidents (RTA), interpersonal violence, assault being more common causes whereas fall, sports injuries, and gunshot injuries being less common¹.

Mandible is a 'U' shaped bone, bicortical with thin medullary cortex articulating with cranium at the temporomandibular joint. Most peculiar feature being alveolar bone housing teeth that provides vertical stop and muscle attachments along the entire course placing dynamic internal forces rendering the management of mandibular fractures more difficult².

Treatment modalities in the management of mandibular fractures have greatly evolved with the introduction of miniplate osteosynthesis. Traditionally, mandibular fractures were treated with closed reduction by maxillomandibular fixation, having certain disadvantages such as compromised airway, difficulty in maintaining oral hygiene, malnutrition due to liquid diet, possible damage to the teeth, difficulty in placing the arch bar in posterior teeth and in case of crowding, periodontal tissue trauma, chances of needle stick injuries to surgeon etc. In today's era, an open reduction and internal fixation (ORIF) has replaced traditional methods of managing mandibular fractures with advantages such as accurate approximation of fractured edges, achieving proper anatomic form and function, and early return to normal function with improved quality of life³.

No surgical treatment is devoid of complications. Outcome of management of mandibular fractures with open reduction and rigid internal fixation depends on variety of factors such as etiology, the type and number of fracture, dislocation or displacement, uni-/bilateral involvement, systemic condition of patient and the surgical technique employed. The overall complication rate for all mandibular fractures ranges from 9-36%⁴.

Most common complications observed so far include postoperative wound infection, wound dehiscence, malocclusion, temporomandibular joint pain, paresthesia, pseudoarthrosis, hardware & osteosynthesis failure⁵. This study was aimed to evaluate the incidence of postoperative complications of symphysis, Para

symphysis and angle fractures of mandible treated with open reduction and internal fixation under regional anesthesia in Indian population.

Material and Methods

This retrospective study was carried out in our institution, from January 2017 to August 2021. All the records of 160 patients reporting to the hospital, fulfilling the selection criteria were studied.

Inclusion criteria

Patients diagnosed with isolated mandibular fracture treated by ORIF under regional anaesthesia were included in the study.

Exclusion criteria

Patients with isolated sub-condylar fractures who were managed by nonsurgical measures

Patients with pan facial and dento-alveolar fractures

Patients with diabetes, hypertension, and other systemic illnesses that cause immunosuppression

Methodology

All the patients included in the study, diagnosed with the help of panoramic radiographs with isolated, unilateral, dentate mandibular fractures were divided into three groups, symphysis fracture (Group A), Para symphysis fracture (Group B), and Para symphysis involving angle region fractures (Group C).

All the fractures were treated by open reduction internal fixation under regional anaesthesia, approached by intraoral approach under regional anaesthesia (vestibular incision). The main surgical access used was intraoral being safe with less chances of facial nerve injury. Either miniplate or 3D plate and screws were used for osteosynthesis. After achieving haemostasis, the wound was closed. Postoperatively, standard Antibiotics, Analgesics were given for 5 days. Patients were advised to take B protein powder and maintenance of oral hygiene. Patients with minor occlusal discrepancies were put on intermaxillary fixation. The follow-up period was between 7th postoperative day, 3 months and 6 months. The patient's records were analysed for deriving the number and type of complications that occurred during the postoperative period of ORIF in these groups. Variables such as gender, age, aetiology, time lapse between injury and commencement of treatment, history of substance abuse (tobacco, alcohol, illicit drug abuse) (self-declaration), number and location of the fractures, and neurosensory disturbances were recorded. Association of variables with postoperative complications such as surgical site infection (SSI), wound dehiscence, neurosensory disturbances, malocclusion, and non-union were recorded. Chi-square test was applied to find association between postoperative complications and multiple variables.

Results

The study population consisted of total 160 patients. Patient age was between 15 to 52 years. Out of 160 patients, 123 (76.9%) were males and 37 (23.1%) were females with a mean age of 28.66 (SD+/-8.2) years. The most frequent etiologic factor for mandibular fracture detected in this study was road traffic accidents (RTA) (n=73, 45.6%) followed by assault (n=44, 27.5%), fall (n=25, 15.6%) and sports injuries (n=18, 11.3%). In patients affected by RTA, 35% were not using safety devices and 10% were under the influence of alcohol (self-declaration) at the time of accident. The mean timing of fixation for each subset of patients was 4.93 days with standard deviation of 2.93 days (Table I).

We noted all complications on seventh postoperative day in each group. In Group A surgical site infection was seen in 18.2% patients. In Group B SSI was seen in 7.9% patients whereas wound dehiscence was seen in 4.5% cases. In Group C 20.4 % patients showed minor occlusal discrepancies and 4.1% patients showed SSI. In Group C paraesthesia was noted in 4.1% patients on 7th post operative day which was gradually resolved after 3 to 6 months. No complications were noted after 6 months. It was also noted that the patients who were identified as substance abuser developed SSI and wound dehiscence on 7th post operative day. Statistically, significant association was found between post ORIF complications with anatomic site of fracture involved and substance abuse (p value 0.001) (Table II).

Table III demonstrates our complications with regard to timing. There were four complications occurring in 29 patients. Thirteen patients experienced surgical site infection (8.1%) and four cases of wound dehiscence (2.5%). Ten patients developed malocclusion (6.3%) whereas four patients developed paraesthesia (1.3%). All the cases were managed conservatively with local wound care and healed uneventfully. There were no cases of non-union. In our study, timing to repair was evaluated as a continuous variable, and logistical regression was performed. We also evaluated whether timing to repair had any effect on complications postoperatively. All results failed to demonstrate a correlation between increased time to repair with untoward outcomes.

Discussion

As human face constitutes the first contact point during various person to person interactions, injuries to maxillofacial complex results in disastrous influence leading to severe morbidity, loss of function, disfigurement and financial burden on person affected.

Our study demonstrates the incidence of postoperative complications in 160 patients with 209 fracture lines treated with ORIF under regional anesthesia. Most of the patients in our study were male (76.9%) with male to female ratio of 3:1. Studies by Ellis, Stacy and Bormann et al reported that young males were mostly affected with mandibular fractures which was similar to our study results. This can be explained by their aggressive nature, more involvement in physical activities & are more social than children or elderly⁶⁻⁸. In our study, we found results similar to literature, RTA was the most frequent etiologic factor followed by

interpersonal violence. Young males constitute large proportion of active population who uses motorcycles most often. High speed, imprudence, use of open helmets, or no use of helmets, increasing economic problems, influence of substance abuse, make young males more prone for RTA⁹.

During maxillofacial trauma, mandible is more vulnerable to injury due to less bony support as compared to midface skeleton and the fact that it is the only mobile bone of the facial skeleton. Most of the studies^{7,9,10}. Showed that involvement of mandibular fracture site depends upon type of trauma & direction of force, as these associations guide maxillofacial surgeons in their diagnostic work up of all trauma patients. Many studies reported that victims involved in interpersonal violence will more commonly receive a blow to lateral portions of the jaw, predisposing these patients to fractures at lateral locations. Similarly, in our study we reported combined parasymphysis-angle region being mostly affected due to assault whereas Parasymphysis was mostly affected site due to RTA¹¹.

The incidence of mandibular fractures based on anatomic distribution being widely variable, where some authors reported angle being most common site¹², whereas some reported body and condylar fractures being most common site of injury. In a study by Birde et al, out of 464 patients, Para symphyseal fractures were the most frequently involved site, followed by condyle and angle¹³. Similarly, in our study, we observed para symphysis (55.6%) being the most affected site followed by combined fracture of para symphysis involving angle (30.6%) region. Symphysis being least involved (13.8%).

Isolated mandibular fractures are treated either surgically or non-surgically. When mandibular fractures are treated surgically, there are different opinion about the time lapse between injury and commencement of treatment and its correlation with postoperative complications. Similar retrospective studies by Lucca et al, Barker et al, Lee et al in 2010, 2011 and 2016, respectively found that delay in surgical intervention did not influence the rate of complications^{14,15,16}. In our study, mean time between time lapse between injury and treatment was 4.93+/-2.39 days. It did not show any significant association with rate of postoperative complications.

In modern era, management of most of the mandibular fractures is done by using open reduction and internal fixation with rigid or semi rigid plates supported by intermaxillary fixation (IMF), if necessary¹⁷. Plate osteosynthesis has gained popularity due to its advantages such as providing stable anatomic reduction, reducing displacement of fracture segments in postoperative period, reduced recovery time, and better functional outcomes. It also decreases the need for IMF thereby increasing the quality of life. In our study population, mandibular fractures were treated with 3D plate or miniplate osteosynthesis. Although, 3D plate provides an advantage of less operative time, less implant material in symphysis and parasymphysis area and simultaneous stabilisation of fracture fragment in two planes. We did not find any significant correlation between type of plating system employed during ORIF and associated postoperative complications¹⁸.

Although one might expect a decreased potential for healing with increasing age, we found no statistical relationship between postoperative infection and age or gender. In our study, major complications observed were 13 (8.1%) surgical site infection (SSI), 4 (2.5%) wound dehiscence and 2 (1.3%) paraesthesia whereas minor complication observed was occlusal disturbances 10 (6.3%).

A significant association was found between site of fracture with type of complication (p value < 0.001). SSI was seen most commonly within Group A patients (18.2%) and wound dehiscence within Group B patients (4.5%) on 7th postoperative day. SSI was managed by postoperative Antibiotics. Wound dehiscence was effectively managed by margination followed by resuturing. Minor occlusal disturbances (20.4%), were most commonly seen in Group C patients (20.4%) which were corrected with guided elastics. Minor occlusal discrepancies may result from presence of third molar in fracture line. Sometimes, removal of third molar leads to decreased stability by reducing bone segment contact. A systematic review and meta-analysis by Fernandes et al, on effect of third molar in the line of mandibular angle fractures on postoperative complications concluded that there was no significant association between malocclusion with either retention or removal of third molar. Some studies advocate that retention of third molar perhaps helps in reduction of the fracture fragments properly¹⁹.

Retrospective studies by Biller, Furr and Passeri found positive association between substance abuse and postoperative complications^{20,21}. In our study, 13 patients had postoperative surgical site infection who gave positive history of substance abuse (p value < 0.001), which was statistically significant. This can be explained by the fact that this patient population is more likely to have nutritional deficiencies, possible immunosuppression, poor oral hygiene and poor compliance leading to delayed wound healing.

Andrew Ban Guan Tay, et al in their prospective observational cohort study reported incidence of inferior alveolar nerve (IAN) sensory deficit post-injury was 46.2 to 53.1% that after intervention was 76.9 to 91.3%, and after 1 year was 7.7 to 46.6%. Reports from other studies revealed the overall prevalence of sensory disturbance after treatment of mandible fractures were 53.8% (95% CI: 46.0-61.6); that in the posterior mandible was 72.9% (63.0-82.7) and in the anterior mandible was 31.6% (20.0-43.3)²²⁻²⁴. This can be explained by plating in close proximity to the mandibular foramen with the inherent risk of manipulation or injury of the mental nerve as well as gap distance in fractured segments in angle region²⁵. In our study, we observed paraesthesia in combined parasymphysis-angle region (4.1%) which resolved over the period of 6 months without any intervention.

The present study has several limitations. Like other retrospective studies, present study may lead to information bias. More prospective studies should be conducted on a larger population at multicentre levels to confirm the findings of the present study.

Conclusion

ORIF has proved universally as a gold standard for the management of mandibular fractures. All patients in our study were successfully managed under regional anaesthesia. Our study showcases advantages of managing mandibular fractures under regional anaesthesia as patients require less postoperative care, shorter recovery period and cost effectiveness as it doesn't require hospital set up for general anaesthesia. Patients from rural areas and from low socioeconomic group are benefitted. Despite following aseptic protocol during management, surgical site infection was the most common complication observed in postoperative period. In our retrospective study, it can be attributed to poor oral hygiene and poor compliance of the patients with substance abuse. In this scenario, educating patients and creating awareness on adopting healthy lifestyle practices will eventually prevent occurrence of infection. However, other complications such as fracture of hardware, screw loosening, facial nerve damage and osteomyelitis were not observed owing to surgical expertise.

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Table 1
Clinical and demographic characteristics

Mean age, years	28.66
SD	8.2
Gender, % male	76.9
Gender, % female	23.1
Mean days to fixation	4.93
SD	2.39

Table 2
Correlation of patient demographics, fracture aetiology, site of fracture, and associated conditions with related complications

	No Complication (n=128)	Complication (n=32)	P value
Percent Males	79.7	20.3	
Percent Females	89.2	10.8	
Substance use associated with injury % (Tobacco, Alcohol, Others)	91.6	100	0.001*
Site of fracture %			
Type A	81.8	18.2	0.001*
Type B	87.6	12.4	
Type C	71.4	28.6	
Cause of Injury %			
Assault	79.5	20.4	0.798
Fall	88	12	
MVC	80.8	19.1	
Sports Injury	83.3	16.8	

*Statistically Significant.

Table 3
Multiple Logistic Regression Analysis between Time and Complication 7 Day

Complications	Number	Odd Ratio	SE	Confidence Interval	p-Value
Absent*	131 (81%)	-	-	-	-
Infection	13 (8.1%)	0.13	0.13	0.72-1.24	0.70
Paresthesia	2 (1.3%)	0.51	0.44	0.25-1.94	0.50
Malocclusion	10 (6.3%)	0.18	0.47	0.60-1.27	0.49
Wound dehiscence	4 (2.5%)	0.44	2.19	0.21-1.23	0.13

*Reference category