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Occurrence of inferior alveolar nerve damage after internal fixation and open reduction in patients visiting Ayub Medical College with mandibular fractures

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***Abstract*---**One of the most frequent injuries to the maxillofacial area is a fractured mandible. Multiple places can experience fractures. The inferior alveolar nerve is commonly injured by mandibular fractures. Objective: The study's objective was to determine the frequency of inferior alveolar nerve damage in patients who had internal fixation and open reduction of a mandibular fracture at the Ayub Teaching Hospital in Abbottabad. Methodology: With approval from the institution's ethics committee and CPSP, this descriptive case series was finished at the Department of Maxillofacial of the Ayub Teaching Hospital in Abbottabad. The method to evaluate percentage with

absolute precision and the accompanying assumption were used to compute the sample size using the WHO programme for computing sample sizes in health research. Results: The mean age of the participants was 35.81+5.63 years, with a range of ages from 26 to 45. The age categories with the highest incidence were 26-30 (n=23, 23.96%), followed by the age ranges 36-40 and 41-45 (n=26, 27.08%). 75 (78.12%) men and 21 (21.88%) women participated in the research. General anaesthesia was used by the majority of patients (n=90; 93.75%), whereas local anaesthesia was used by the remaining patients (n=6; 6.25%). Conclusion: The inferior alveolar nerve is commonly damaged during open treatment of mandibular fracture. To reduce its occurrence, however, the greatest vigilance should be exercised while treating individuals who have mandibular fractures.

***Keywords*---**Mandible fractures, Inferior Alveolar Nerve, Hyperasthesia, hypoesthesia, Open reduction internal fixation, General Anesthesia.

Introduction

Mandible being the most prominent bone of the facial skeleton is the most susceptible area of fracture and trauma).[1] It makes up 79.7% of facial fractures and the Incidence of mandibular fracture is 67% in Pakistan.[2] The major factors of mandibular fractures include sports injuries, car accidents, fights etc.[3, 4] A non-compressive mini plate fixation is the standard treatment because of its low complication rate.[1] Inferior alveolar nerve & lingual nerve are the most injured branches of trigeminal nerve in mandibular fractures.[2]

The Surgical reduction and fixation of the fracture results in damage of inferior alveolar nerve leading to sensory disturbances in the lower lip and the chin area, infection disturbed occlusion, impaired wound healing.[4, 5] Inferior alveolar nerve injuries after open reduction and fixation in mandibular fractures is the focus of this study. Fractures positioned amongst the mandibular foramen and mental foramen causes neurosensory variations in inferior alveolar nerve which may be due to the injury or because of open reduction and fixation.[6]

Inferior alveolar nerve injury is the common problem after surgical reduction and fixation of mandibular fracture. [4] It can be of temporary or permanent in nature affecting the normal routine. [2, 4, 6] The main causes of neurosensory changes postoperatively include handling of fracture segments, cutting of tissue, retraction of appliances and closeness of fracture segments with the inferior alveolar nerve.[1, 4] The factors that contribute to the nerve injury include site of the fracture, type of fracture, distance between the fragments, numbers of missing teeth and treatment used for reduction.[5] Patients with inferior nerve injury complain of sensory damage that may manifest as pain, paraesthesia, dysesthesia, hypoesthesia, hyperaesthesia and anaesthesia. Affected drinking, eating, talking abilities and lip biting are the major complains of the patients.[1, 2] The Incidence of postoperative nerve damage is 0.6% to 92.3%.[1-3, 7, 8] While the reported Incidence of permanent inferior alveolar nerve damage is up to 45%.[2]

The aim of the study was to determine the Incidence of inferior alveolar nerve injury following internal fixation and open reduction of a mandibular fracture in patients at the maxillofacial department of the Ayub Teaching Hospital in Abbottabad.

Methodology

This descriptive case series was completed in the maxillofacial department of the Ayub Teaching Hospital in Abbottabad with permission from the organization's ethical committee and CPSP. The sample size was calculated using the WHO programme for sample size computation in health research using the following premises and the method to estimate proportion with absolute precision: The confidence interval for the estimated fraction of inferior alveolar nerve injury after fixation in mandibular fracture is 95%, while the absolute precision is 10%.

Patients of both genders aged between 20-50 years and gone under open reduction were involved in the study while Patients reporting with pathological mandibular fracture and those who were not keen to partake were omitted from the study. Knowledgeable permission was taken from the patients after fulfilling the inclusion criteria. Data was collected from the Maxillofacial Surgery, ATH with the help of structured questionnaire via interview. The surgery was performed by an maxillofacial surgeon. General Anaesthesia was given, mucoperiosteal flap was raised. Nerve was identified. Fractured segments reduction and fixation was done as per requirement of the situation. After the completion of surgery the patients were followed after one week, one month and three months of duration.

Statistical analysis was performed by using SPSS version 26. Quantitative variables like age were described as mean ± standard deviation. Categorical variables like gender, type of anaesthesia, fragment manipulation, presence of preoperative inferior alveolar nerve injury, degree of fracture segment displacement, and type of fixation method were described as frequencies and percentages. Outcome variable was stratified by gender, age groups, fragment manipulation, type of anaesthesia, degree of fracture segment displacement and type of fixation method. Post stratification Chi square test was used at 5% level of significance.

Results

Participants' ages ranged from 26 to 45 years old, with a mean age of 35.81$\pm$ 5.63 years. The age groups with the highest Incidence were 36–40 and 41–45 (n=26, 27.08%), followed by 26–30 (n=23, 23.96%). In the study, there were 21 (21.88%) females and 75 (78.12%) males. The majority of the patients (n=90; 93.75%) had general anaesthesia, whereas the remaining patients (n=6; 6.25%) received local anaesthesia. Fracture segment manipulation was required in 77 (80.21%) patients with fractured mandible while manipulation was not required in the remaining 26 patients. Open reduction and fixation was the mode of fracture fixation in majority (n=86; 89.58%), while closed reduction was required in 10 (10.42%) patients. (Table 1)

Table 1: Incidence of gender, type of anesthesia, fragment manipulation, fracture segment displacement, fracture fixation method

Variables		N (%)
Gender	Male	75 (78.12)
	Female	21 (21.88)
Type of Anesthesia	General Anesthesia	90 (93.75)
	Local Anesthesia	6 (6.25)
Fragment Manipulation	Done	77 (80.21)
	Not Done	19 (19.79)
Fracture segment displacement	Present	70 (72.92)
	Absent	26 (27.08)
Fracture fixation method	Open Reduction & Fixation	86 (89.58)
	Closed Reduction & Fixation	10 (10.42)

Sixty patients (62.50%) had perioperative inferior alveolar nerve injury, while 36 (37.50%) had persistent inferior alveolar nerve injury. (Table 2)

Table 2: Incidence of preoperative and post-surgical inferior alveolar nerve injury

Variables		N (%)
Perioperative IAN Injury	Present	60 (62.50)
	Absent	36 (37.50)
IAN injury	Present	39 (40.63)
	Absent	57 (59.38)

No statistical association was found between post-surgical inferior alveolar nerve injury with gender (P=.837) and age (P=.286). The detailed statistics are shown the table 3.

Table 3: Incidence of inferior alveolar nerve injury stratified by gender and age group

		IAN Outcome		
		Yes	No	P- Value
		N (%)	N (%)	
Gender	Male	30 (40)	45 (60)	0.837*
	Female	10 (47.6)	11 (52.4)	
Age Groups	26-30	7 (30.4)	16 (69.6)	0.286
	31-35	12 (57.1)	9 (42.9)	
	36-40	9 (34.6)	17 (65.4)	
	41-45	11 (42.3)	15 (57.7)	

*Chi-square test

Similarly the difference for post-surgical inferior alveolar nerve injury among type of anesthesia (P=.851), fragment manipulation (P=.370), degree of fracture segment displacement (P=.793) and fixation method (P=.793) was not statistically significant. The details are shown in table 4.

Table 4: Incidence of inferior alveolar nerve injury stratified type of anesthesia, fragment manipulation, degree of fracture segment displacement, fixation method

		IAN Outcome		
		Yes	No	P- Value*
		N (%)	N (%)	
Type of anesthesia	General	40 (44.4)	50 (55.6)	0.851
	Local	3 (50)	3 (50)	
Fragment manipulation	Yes	33 (42.9)	44 (57.1)	0.370
	No	6 (31.6)	13 (68.4)	
Degree of fracture segment displacement	Displaced	29 (41.4)	41 (58.6)	0.793
	Un-displaced	10 (38.5)	16 (61.5)	
Fixation Method	Open	36 (41.9)	50 (58.1)	0.793
	Closed	3 (30.0)	7 (70)	

*Chi-square test

Discussion

Damages to the inferior alveolar nerve occurred 40.63% of the time in study participants. A wide variety of IAN injuries have been described in the literature, and it's possible that this is because of the study participants' demographics. According to a study from Singapore, the occurrence of IAN injury was generally 33.7% prior to management and 53.8% after care. In this study, 80 patients' one hundred and twenty three mandibular sides (43 bilateral) were inspected. Pasting (29.7%), falls (28.2%), automobile mishaps (19%), & sports injuries (5.1%) were the most frequent reasons for injuries. In 49.6% of the fractures, the posterior mandible, which carries the IAN, is elaborated, and all condylar fractures (13.0%) lacked NSD. Management choices encompassed open reduction and internal fixation (ORIF; 63.7%), closed reduction and fixation (19.9%), and no management (2.9%).[10] In contrast, because of the short follow-up period for our investigation, we were unable to identify whether the neurosensory deficiency had improved in our study cohort. Another study examined the inferior alveolar nerve for neurological loss following damage using the sharp/blunt difference technique. Over the course of the monitoring dated, the evolution of brain healing was assessed. 52 patients with angle, ramus, and body mandibular fractures participated in this study. The probability of neural injury to the inferior alveolar nerve was 42.3%; comminuted and displaced linear fractures were linked to a higher risk and a slower rate of recovery; and 91% of patients experienced a return of inferior alveolar nerve function. Mandibular fractures involving the ramus, angle, and body as well as comminuted and displaced linear fractures are more likely to cause injuries to the inferior alveolar nerve.[11] In contrast, we did

not identify the mechanism or kind of damage to the mandible and did not identify how it related to the results. A seven-year retrospective study from China, in contrast, found that 38 fractures (13%) in patients with mandibular fractures had decreased neurosensory status following therapy in regions supplied by the IAN or mental nerve (MN).In this study, [2] 209 patients with 293 fractures were investigated. There were 120 fractures (41%) among the lingula and the mental foramen, and one hundred and seventy three fractures (60%) distal to the mental foramen. Of the samples, 211 (7%) showed an offset of 5 mm or more. An association between fracture displacement, inexperienced operator, and two-plate fixation was found in a multivariate model to be statistically significant ($P < 0.05$) as a risk factor for postoperative worsening of IAN/MN feeling.[9] Contrarily, our research did not uncover a statistically significant link between fracture displacement and IAN damage. Over the course of a year, participants with unilateral mandibular fractures who had been told within 24 hours of the accident were tracked in a prospective cohort study with 60 patients treated for mandibular fracture. 52 people (86.7%) had post-traumatic neurosensory deficits, albeit this number dropped to 23.3% over the follow-up period. Angle fracture cases (33.3%) had postoperative neurosensory ratings that were noticeably more abnormal than body fracture cases (11.1%). 90% of body fracture instances showed considerable recovery compared to 67% of mandibular angle fracture cases when non-recovered and recovered neurosensory ratings were related by fracture location. In patients with a fracture displacement of less than 5 mm compared to instances with a fracture displacement of more than 5 mm (59.9%), neurosensory recovery scores were statistically substantially higher (90.6%) in the former group of patients. [10]

In contrast, no statistically significant correlation between IAN damage and fracture displacement was discovered in the current investigation. The site of the mandibular fracture and its relationship to the result in our study sample were not taken into consideration. In a Lahore-based randomised controlled investigation that looked at the Incidence of inferior alveolar nerve damage following reduction of open and close mandibular fractures, the likelihood of IAN injury was 35%.[12] Only three patients (10%) of the 21 patients (35%) with NS deficits or problems belonged to closed reduction, while 18 (60%) belonged to open reduction. While there were 27 patients (90%) in the closed reduction group who had no NS deficit, only 12 patients (40%) in the open reduction group did. With a p-value of 0.000 (0.0001), researchers found using the chi-square test that patients in the closed reduction group had a significantly lower NS deficit than those in the open reduction group.[13] The Incidence of IAN injury was identical between the two fixation techniques, despite the fact that closed reduction was performed on fewer patients in our research.

Conclusion

Open reduction of mandibular fracture frequently results in injury to the inferior alveolar nerve. However, in patients with mandibular fractures, the greatest caution should be used to lessen its incidence.

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