DOI: https://doi.org/10.54393/pjhs.v4i07.916

PAKISTAN JOURNAL OF HEALTH SCIENCES

https://thejas.com.pk/index.php/pjhs

Volume 4, Issue 7 (July 2023)

Original Article

Frequency of Inferior Alveolar Nerve Damage After Open Reduction and Internal Fixation in Mandibular Fractures

Afifa Tariq[1], Sobia Kanwal[2], Anum Javed[3], Zainab Jadoon[4*], Sajjad Afzal Khan[2] and Munir Ahmed[5]

[1]Ayub Teaching Hospital, Abbottabad, Pakistan
[2]Khyber College of Dentistry, Peshawar, Pakistan
[3]Civil Hospital, Quetta, Pakistan
[4]Ayub Medical College, Abbottabad, Pakistan
[5]Regional Head Quarter Hospital, Chilas, Pakistan

ARTICLE INFO

Key Words:
Mandible Fractures, Inferior Alveolar Nerve, Hyperasthesia, Hypoesthesia, Open Reduction Internal Fixation, General Anesthesia

How to Cite:
Tariq, A. ., Kanwal, S. ., Javed, A., Jadoon, Z. . ., Afzal Khan, S. ., & Ahmed, M. . (2023). Frequency of Inferior Alveolar Nerve Damage After Open Reduction and Internal Fixation in Mandibular Fractures: Frequency of Inferior Alveolar Nerve Damage . Pakistan Journal of Health Sciences, 4(07). https://doi.org/10.54393/pjhs.v4i07.916

***Corresponding Author:**
Zainab Jadoon
Ayub Medical College, Abbottabad, Pakistan
doc.zainabjadoon007@gmail.com

Received Date: 7th July, 2023
Acceptance Date: 27th July, 2023
Published Date: 31st July, 2023

ABSTRACT

One of the most frequent injuries to the maxillofacial region is mandibular fracture. Numerous places experience fractures. The inferior alveolar nerve is often injured as a result of mandibular fractures. **Objective**: To ascertain how frequently patients in the oral and maxillofacial department of the Ayub Teaching Hospital in Abbottabad experienced inferior alveolar nerve injury following open reduction and fixation of a mandibular fracture. **Methods:** This was a Descriptive case series carried out at Oral and Maxillofacial Department, Ayub Teaching Hospital, Abbottabad after approval from the IRB of the institution and CPSP vide number (CPSP/REU/DSG-2018-010-2532). Using the formula to evaluate proportion with absolute precision and the following premises, the sample size was determined to be 96 using the WHO software for sample size computation in health studies: The expected percentage of inferior alveolar nerve injury following fixation in mandibular fracture is 45%, the confidence level is 95%, and the absolute precision is 10%. **Results**: The mean age of participants was 35.81±5.63 years with range from 26 to 45 years. Most common age group was 36-40 years and 41-45 years (n=26, 27.08%) followed by 26-30 years (n=23, 23.96%). There were 70 (72.92%) males and 26 (27.08%) females in the study. Majority (n=88; 91.67%) of the patients were given general anesthesia while the remaining (n=8; 8.33%) received local anesthesia. Perioperative inferior alveolar nerve injury was observed in 56 (58.33%) patients while permanent inferior alveolar nerve injury was diagnosed in 39 (40.63%) patients. **Conclusions**: Damage to inferior alveolar nerve is a frequent problem of open reduction and fixation of mandibular fracture. However, utmost care should be exercised to reduce its occurrence in patients with mandibular fracture.

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 frequency 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 [5]. Inferior alveolar nerve & lingual nerve are the most injured branches of trigeminal nerve in mandibular fractures [6, 7]. 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 [8, 9]. 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 [10, 11]. Inferior alveolar nerve

DOI: https://doi.org/10.54393/pjhs.v4i07.916

injury is the common problem after surgical reduction and fixation of mandibular fracture [4]. It might be of temporary or permanent in nature affecting the normal routine [12-15]. 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 [16]. The features that add 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 [9]. 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 frequency of postoperative nerve damage is 0.6% to 92.3% [1-3, 7, 8]. While the reported frequency of permanent inferior alveolar nerve damage is up to 45% [2]. The study's goal was to ascertain how frequently patients in the oral and maxillofacial department of the Ayub Teaching Hospital in Abbottabad experienced inferior alveolar nerve injury following open reduction and fixation of a mandibular fracture.

METHODS

This was a Descriptive case series carried out at Oral and Maxillofacial Department, Ayub Teaching Hospital (ATH), Abbottabad after approval from the IRB of the institution and CPSP vide number (CPSP/REU/DSG-2018-010-2532). Using the formula to evaluate proportion with absolute precision and the following premises, the sample size was determined to be 96 using the WHO software for sample size computation in health studies: The expected percentage of inferior alveolar nerve injury following fixation in mandibular fracture is 45%, the confidence level is 95%, and 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. Well-versed consensus was taken from the patients after fulfilling the inclusion criteria. Data was collected from the Oral and Maxillofacial Surgery, ATH with the help of structured questionnaire via interview. The surgery was performed by an oral and 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 26.0. 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

The mean age of participants was 35.81±5.63 years with range from 26 to 45 years. Most common age group was 36-40 years and 41-45 years (n=26, 27.08%) followed by 26-30 years (n=23, 23.96%). There were 70 (72.92%) males and 26 (27.08%) females in the study. Majority (n=88; 91.67%) of the patients were given general anesthesia while the remaining (n=8; 8.33%) received local anesthesia. Fracture segment manipulation was required in 70 (72.92%) patients with fractured mandible while manipulation was not required in the remaining 26 patients. Open reduction and fixation were 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: Frequency of gender, type of anesthesia, fragment manipulation, fracture segment displacement, fracture fixation method

Variables	Categories	N (%)
Gender	Male	70 (72.92)
	Female	26 (27.08)
Type of Anesthesia	General Anesthesia	88 (91.67)
	Local Anesthesia	8 (8.33)
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)

Perioperative inferior alveolar nerve injury was observed in 56 (58.33%) patients while permanent inferior alveolar nerve injury was diagnosed in 39 (40.63%) patients (Table 2).

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

Variables		N (%)
Perioperative IAN Injury	Present	56 (58.33)
	Absent	40 (41.67)
Post-Surgical 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=.838) and age (P=.286). The detailed statistics are shown in the

DOI: https://doi.org/10.54393/pjhs.v4i07.916

Table 3.

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

Variables		IAN Outcome		p-value
		Yes	No	
		N (%)	N (%)	
Gender	Male	28 (40)	42 (60)	0.286
	Female	11 (42.3)	15 (57.7)	
Age Groups	26-30	7 (30.4)	16 (69.6)	0.838*
	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: Frequency of inferior alveolar nerve injury stratified type of anesthesia, fragment manipulation, degree of fracture segment displacement, fixation method

Variables		IAN Outcome		p-value*
		Yes	No	
		N (%)	N (%)	
Type of anesthesia	General	36 (40.9)	52 (59.1)	0.851
	Local	3 (37.5)	5 (62.5)	
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

The frequency of inferior alveolar nerve injury in study participants was 40.63%. A broad range of IAN injury has been reported in literature and it could be due to demographics of the study participants. In general, the occurrence of IAN injury was 33.7% beforehand management and 53.8% after management, according to a study from Singapore. In this investigation, 123 mandibular sides (43 bilateral) from 80 patients were examined. The most common causes of injuries were assault (33.8%), falls (31.3%), car accidents (25.0%), and sports injuries (6.3%). All condylar fractures (13.0%) lacked NSD, and 49.6% of the fractures elaborate the posterior mandible, which bears the IAN. Open reduction and internal fixation (ORIF; 74.8%), closed reduction and fixation (22.0%), and no treatment (3.3%) were the available options for treatment [1]. In dissimilarity, the follow up period for our study was very short and therefore, we were unable to determine recovery of the neurosensory deficit in our study population. In another investigation, the sharp/blunt differentiation method was used to assess the inferior alveolar nerve for neurological deficit following damage. The progression of brain recovery was evaluated over the observation period. This study comprised 52 patients with mandibular fractures affecting the ramus, angle, and body. The likelihood of neural injury to the inferior alveolar nerve was 42.3%; comminuted and displaced linear fractures were related with a higher risk of neural injury to the inferior alveolar nerve and a slower rate of recovery; and 91% of patients had their inferior alveolar nerve function return. Injuries to the inferior alveolar nerve are more common in cases of mandibular fractures affecting the ramus, angle, and body, as well as comminuted and displaced linear fractures [17]. In dissimilarity; we did not determine the mode / type of trauma to mandible and did not determine its relationship with the outcome. In contrast a seven-year retrospective study from China reported that in patients with mandibular fracture, 38 fractures (13%) had a worsened neurosensory status after treatment in areas supplied by IAN or mental nerve (MN) [2]. 209 patients with 293 fractures were examined in this study. Among the lingula and the mental foramen, there were 120 fractures (41%), and there were 173 fractures (59%) distal to the mental foramen. 211 (7%) of the samples had an offset of 5 mm or greater. A significantly significant risk (p 0.05) for postoperative deterioration of IAN/MN feeling was linked in a multivariate model to fracture displacement, operator inexperience, and two plate fixations [18]. In difference; our investigation did not find a statistically significant correlation amongst fracture displacement and IAN damage. Subjects with unilateral mandibular fracture reported within a day after injury were monitored over the course of a year in a prospective cohort study that included sixty patients cared for mandibular fracture. 52 patients (86.7%) were found to have a post-traumatic neurosensory deficit, albeit this number fell to 23.3% over the follow-up period. Angle fracture cases (33.3%) had abnormal postoperative neurosensory ratings that were substantially greater than body fracture cases (11.1%). 90% of body fracture cases had considerable recovery associated to 67% of mandibular angle fracture cases when non-recovered and recovered neurosensory scores were related by fracture location. Neurosensory recovery scores were statistically substantially higher in cases with less than 5mm fracture dislocation (90.6%) than in cases with more than 5mm fracture displacement (59.9%) [17]. In difference; the current study did not find any statistically significant association amongst IAN injury and fracture displacement. We did not take into account the location of mandibular fracture and its association with the outcome in our study population. The probability of IAN injury was 35% in a Lahore-based randomized controlled experiment

DOI: https://doi.org/10.54393/pjhs.v4i07.916

that examined the frequency of inferior alveolar nerve impairment following reduction of open and close mandibular fractures [19]. In 21 patients (35%) with NS deficits or disturbances, 18 (60%) belonged to open reduction, while only three (10%) belonged to closed reduction. In the closed reduction cluster, there were 27 patients (90%) without any NS deficit, however in the open reduction cluster; twelve patients (40%) had an NS defect or disturbance. Researchers used the chi-square test to discover that patients in the closed reduction group had considerably smaller NS deficit than those in the open reduction cluster, with a p-value of 0.000 (0.0001) [20]. Even though in our analysis fewer patients underwent closed reduction, there was no discernible difference between the two fixation strategies in terms of the frequency of IAN injury.

CONCLUSIONS

Damage to inferior alveolar nerve is a frequent problem of open reduction and fixation of mandibular fracture. Utmost care should be exercised to reduce its occurrence in patients with mandibular fracture.

Authors Contribution

Conceptualization: AT
Methodology: AT, ZJ
Formal analysis: ZJ, MA
Writing-review and editing: SK, AJ, SAK

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

Source of Funding

The authors received no financial support for the research, authorship and/or publication of this article.

REFERENCES

[1] de Assis Santos VP, Rocha-Junior WG, Luz JG. Effects of light-emitting diode (LED) therapy on sensory changes in the inferior alveolar nerve after surgical treatment of mandibular fractures: A randomized controlled trial. Oral and Maxillofacial Surgery. 2022 Nov: 1-9. doi: 10.1007/s10006-022-01127-1.

[2] Sulistyani L, Julia V, Noviantika D, Irfan I, Muskab M, Kawisana P. Evaluation of neuro-sensory disturbances of the inferior alveolar nerve after ORIF procedure in mandibular fracture: a systematic review. Journal of Stomatology. 2022 Mar; 75(2): 130-7. doi: 10.5114/jos.2022.117413.

[3] Kwon G and Hohman MH. Inferior Alveolar Nerve and Lingual Nerve Injury. StatPearls Publishing; 2023.

[4] Shah NS, Panchal KV, Agrawal P. Prevalence of mental nerve injury in facial fractures: a 3-year retrospective study. International Journal of Research in Medical Sciences. 2019 Dec; 7(12): 4578. doi: 10.18203/2320-6012.ijrms20195522.

[5] Monarchi G, Girotto R, Paglianiti M, Balercia P. A Single Center Experience: A Retrospective Study Over 10-Years Period on Mandible Fractures. Craniomaxillofacial Trauma & Reconstruction. 2023 May: 19433875231176338. doi: 10.1177/19433875231176338.

[6] El Hadidi YN, Taha AMA, Abu El Sadat SM, Saber SM. Anatomical Analysis of Inferior Alveolar Nerve Relation to Mandibular Posterior Teeth Using Cone Beam Computed Tomography: A Retrospective Radiographic Analysis Study. Journal of Maxillofacial and Oral Surgery. 2022 Sep; 166: 1-7. doi: 10.1007/s12663-022-01792-5.

[7] Sobrero F, Roccia F, Galetta G, Strada C, Gerbino G. Pediatric mandibular fractures: Surgical management and outcomes in the deciduous, mixed and permanent dentitions. Dental Traumatology. 2023 Jun; 39(3): 233-9. doi: 10.1111/edt.12814.

[8] Maqbool H, Abro M, Hassan SG, Yousuf H, Punjabi SK, Shams S. Assessment of post-traumatic and postoperative inferior alveolar nerve function in mandibular angle fracture. Open Access Journal of Biomedical Science. 2020 July; 2(4): 517-20. doi: 10.38125/OAJBS.000205.

[9] Singh A and Lone PA. Evaluation of post traumatic neurosensory disturbances in the distribution of inferior alveolar nerve in case of mandibular fractures and their management. International Journal of Applied Dental Science. 2021 Jul; 7: 314-21. doi: 10.22271/oral.2021.v7.i3e.1318.

[10] Kwon G and Hohman MH. Inferior Alveolar Nerve and Lingual Nerve Injury. StatPearls Publishing; 2023.

[11] Pellegrini Rocha-Junior WG, Pavan EP, Luz JG. Occurrence and remission of loss of sensitivity of inferior alveolar nerve in mandibular fractures. Revista CEFAC. 2021 Jul; 23: e0221. doi: 10.1590/1982-0216/20212340221.

[12] Ellis III E and Miles BA. Fractures of the mandible: a technical perspective. Plastic and Reconstructive Surgery. 2007 Dec; 120(7): 76S-89S. doi: 10.1097/01.prs.0000260721.74357.e7.

[13] Brook IM and Wood N. Aetiology and incidence of facial fractures in adults. International Journal of Oral Surgery. 1983 Oct; 12(5): 293-8. doi: 10.1016/S0300-9785(83)80016-7.

[14] Bataineh AB. Etiology and incidence of maxillofacial fractures in the north of Jordan. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and

DOI: https://doi.org/10.54393/pjhs.v4i07.916

Endodontology. 1998 Jul; 86(1): 31-5. doi: 10.1016/S1079-2104(98)90146-9.

[15] Zachariades N, Mezitis M, Mourouzis C, Papadakis D, Spanou A. Fractures of the mandibular condyle: a review of 466 cases. Literature review, reflections on treatment and proposals. Journal of Cranio-Maxillofacial Surgery. 2006 Oct; 34(7): 421-32. doi: 10.1016/j.jcms.2006.07.854.

[16] Snell RS. Clinical anatomy by regions. Lippincott Williams & Wilkins; 2011.

[17] Malamed SF. Handbook of Local Anesthesia 6th ed. Mosby Elsevier; 2013.

[18] Eroschenko VP and Di Fiore MS. DiFiore's atlas of histology with functional correlations. Lippincott Williams & Wilkins; 2013.

[19] Khan SA, Zulfiqar G, Aslam AB. Efficacy of Bupivacaine Inferior Alveolar Nerve Block Versus Intravenous Use of Tramadol for Postoperative Pain Control in Mandibular Parasymphysis Fractures. Pakistan Journal of Medical & Health Sciences. 2023 May; 17(03): 689. doi: 10.53350/pjmhs2023173689.

[20] Yadav S, Mittal HC, Malik S, Dhupar V, Sachdeva A, Malhotra V, *et al.* Post-traumatic and postoperative neurosensory deficits of the inferior alveolar nerve in mandibular fracture: a prospective study. Journal of the Korean Association of Oral and Maxillofacial Surgeons. 2016 Oct; 42(5): 259. doi: 10.5125/jkaoms.2016.42.5.259.