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Evaluation of Inferior Alveolar Nerve Injury Following Mandibular Surgery

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ABSTRACT: Damage to the inferior alveolar nerve is a significant complication of mandibular surgery and particularly after surgery in the area of the mandibular canal. The purpose of this study was to assess the prevalence, risk factors, severity and recovery rate of inferior alveolar nerve (IAN) injury after mandibular surgery. This was a retrospective observational study that included 60 patients who were admitted in a major teaching hospital in Baghdad, Iraq, from January to June 2025 and whose follow-up records were analyzed for a maximum of six months. All the clinical, radiographic, operative and postoperative neurosensory data were gathered from hospital records and statistically analyzed. 14 patients out of 60 had suffered an injury of the inferior alveolar nerve with an overall incidence of 23.3%. Close Canal proximity, Cortical Border interruption, Canal narrowing, High risk CBCT findings, Prolonged operative time, High surgical difficulty, Bone removal and Intra-operative canal exposure were significant factors associated with injury. The neurosensory disturbances in most cases gradually improved with 64.3% of the injured cases fully recovered at 6 months. The authors summarized that careful radiographic examination, surgical planning, and structured neurosensory evaluation postoperatively is crucial to minimize the risk of nerve injury and enhance outcomes.

KEYWORDS: Inferior alveolar nerve injury; Mandibular surgery; Neurosensory disturbance; Mandibular canal; CBCT; Risk factors; Oral and maxillofacial surgery.

1. INTRODUCTION

How the damage of the inferior alveolar nerve is a clinically important complication in various mandibular surgeries. The inferior alveolar nerve is one of the large branches of the mandibular division of the trigeminal nerve and carries sensory fibers to the lower lip, chin, and its soft tissues, as well as to the teeth of the mandible. Hence, damage to this nerve can lead to transient or permanent neurosensory abnormalities, which can impair patient well-being, oral function and quality of life [1, 2].

The inferior alveolar nerve is at risk in mandibular surgical procedures where they are done near the mandibular canal. These procedures include the surgical removal of impacted mandibular third molars, placement of implants in the lower jaw, removal of cysts or lesions, treatment of mandibular fractures, orthognathic or lower jaw surgery, and other surgical procedures in the posterior lower jaw. Of these surgeries, impacted mandibular third molar surgery continues to be one of the most common surgeries reported to cause disturbance of the inferior alveolar nerve, especially when roots of the tooth are near the mandibular canal [3, 4].

The incidence of IA nerve injury is quite variable in the literature, as a consequence of differences in study design, type of surgical procedure, radiographic criteria, follow-up period, and type of neurosensory assessment. In the literature, various factors like patient-related factors, anatomical factors, radiographic findings, and surgical variables like degree of difficulty in surgery, bone removal, number of instruments used, level of surgeon experience and exposure of the mandibular canal during surgery have been reported to affect the risk of nerve injury [2], [4],[5].

Signs and symptoms of inferior alveolar nerve injury can include numbness, hypoesthesia, paresthesia, tingling sensation, dysesthesia, burning sensation, neuropathic pain, or complete anesthesia of the region involved. The symptoms may be mild and temporary in some patients, and in others, may last for many months and cause a decreased ability to eat, speak, drink, shave or engage in other oral functions. Neurosensory disturbance is also a significant clinical issue that persists for a long time and can lead to decreased patient satisfaction with the treatment and may necessitate additional follow-up or management [6] and [7].

Radiographic assessment is a key element in the preop surgical plan. The panoramic radiograph is a readily available, inexpensive and helpful initial imaging tool for the general evaluation of anatomical relationships. There are however limitations of panoramic radiography since it only gives two-dimensional information and can be inaccurate in determining the buccolingual position of the mandibular canal and the real spatial relationship between the surgical area and the nerve.

Cone-beam computed tomography is useful for 3-dimensional imaging of the mandibular canal, and it could help to assess high-risk cases. CBCT can assist in visualizing the proximity of the canal, narrowing of the canal, interruption of the cortex, deviation of the canal, contact with the nerve root, position of canal in relation to the lingual or buccal surfaces, and other anatomical landmarks

that may be indicative of a higher risk of nerve injury. However, CBCT should be indicated clinically and not routinely used for all patients, particularly those who do not show significant risk based on conventional radiographic findings.

Another important consideration in mandibular implant surgery is the proximity of the implant to the mandibular canal. The latest findings indicate that the neurosensory changes are more likely to occur when implants are placed very near the mandibular canal, which underlines the importance of correct pre-surgical planning, adequate implant size selection and 3-dimensional radiographic evaluation in anatomically challenging situations.

Disturbance of the inferior alveolar nerve is also an important complication following orthognathic mandibular surgery, particularly bilateral sagittal split osteotomy. While most cases of this will show delayed sensory recovery, some patients may have ongoing or prolonged neurosensory disturbances. This indicates the need for a standardized neurosensory evaluation and meticulous documentation of postoperative recovery patterns [8].

Although there is clinical importance of the inferior alveolar nerve injury, there are disparate definitions, assessments and follow-up methods of nerve disturbance after mandibular surgery that are present in many studies. Some studies rely primarily on patient complaints and others rely on neurosensory objective tests. However, the lack of standardization hampers comparison among studies and strongly suggests the need for a clearly structured clinical assessment of the hospital patient, radiographic results, operative variables, and postoperative follow-up.

So the present study was conducted to assess inferior alveolar nerve injury after mandibular surgery by using patient data from a big teaching hospital in Baghdad, Iraq. This study aims to clarify about the incidence, risk factors, severity and recovery pattern of inferior alveolar nerve injury in patients who had undergone surgery in the mandible using clinical, radiographic, surgical and postoperative follow-up information.

Aim of the Study

To assess the prevalence, risk factors, degree of injury and healing trajectory of the inferior alveolar nerve after surgery to the mandible.

Null Hypothesis

No statistically significant relationships between clinical, radiographic or surgical factors and inferior alveolar nerve injury after mandibular surgery are found.

2. MATERIALS AND METHODS

2.1 Study Design

This study is retrospective observational clinical research for the evaluation of inferior alveolar nerve injury after surgical operations in the mandible. Based on clinical, radiological, operative and follow up information from the hospital records. A retrospective design enabled the incidence, risk factors, severity, and recovery pattern of inferior alveolar nerve injury in patients undergoing mandibular surgery in close proximity to the inferior alveolar canal to be assessed.

2.2 Study Setting

This study was carried out at the Department of Oral and Maxillofacial Surgery in a main teaching hospital at Baghdad city in Iraq. The hospital is one of the known referral centers for all types of oral and maxillofacial surgery cases, and patients with various mandibular surgical conditions such as impacted mandibular third molar, mandibular cystic lesion, mandibular fracture, implant related surgeries and other surgeries around the inferior alveolar canal come here for treatment.

2.3 Study Duration

The study was conducted over a 12-month period (2025-01 to 2025-12). The patients who had undergone surgery of mandible in the first 6 months of the study period from January 2025 to June 2025 were included. Their postoperative follow-ups were assessed for neurosensory recovery and inferior alveolar nerve injury for up to six months until December 2025.

2.4 Sample Size

Initially 84 hospital records were examined. The final number of patients included after the inclusion and exclusion criteria were applied was 60 patients who had undergone surgeries within the close vicinity of the inferior alveolar canal in their mandible.

Patients were classified according to the type of mandibular surgery as follows:

- Group I: Surgical extraction of impacted mandibular third molars
- Group II: Mandibular implant placement
- Group III: Mandibular cyst or lesion surgery
- Group IV: Mandibular fracture fixation or other mandibular surgeries near the inferior alveolar canal

The final distribution of patients depended on the available hospital records during the selected study period.

2.5 Source of Patient Information

Hospital records and clinical documentation in the Department of Oral and Maxillofacial Surgery were used to obtain patient information.

The collected data included:

- Patient files
- Outpatient clinic records
- Surgical admission records
- Operative notes
- Radiographic reports
- Panoramic radiographs
- CBCT records, when available
- Postoperative follow-up sheets
- Documented neurosensory examination findings

All patient information was collected anonymously, and no personal identifying data were used in the study.

2.6 Inclusion Criteria

- Patients aged 18 years or older
- Patients who underwent mandibular surgery close to the inferior alveolar canal
- Availability of preoperative clinical records
- Availability of preoperative panoramic radiography and/or CBCT
- Documented normal or assessable preoperative inferior alveolar nerve function
- Availability of postoperative follow-up data
- Patients with at least one documented postoperative neurosensory evaluation

2.7 Exclusion Criteria

- Previous inferior alveolar nerve injury
- Pre-existing neurosensory disturbance
- Neurological disorders affecting sensory function
- History of previous mandibular surgery in the same region
- Mandibular trauma with preoperative nerve deficit
- Uncontrolled systemic diseases affecting healing or nerve function
- Incomplete clinical or radiographic records
- Absence of postoperative follow-up documentation

2.8 Preoperative Assessment

All of the above information was obtained from hospital records and included age, gender, medical history, smoking status, surgical indication, type of intended mandibular surgery, side of the surgery, presence of preoperative pain or symptoms, status of neurosensory evaluation if done before surgery, radiographic evaluation, difficulty of surgery if documented.

2.9 Radiographic Assessment

Preoperative radiographic findings were checked to assess the relationship between the location of the surgical site and the inferior alveolar canal. All patients were included and panoramic radiography was available for all and CBCT was examined when it was available or if requested from the clinical record.

The following radiographic parameters were recorded:

- Close proximity to the mandibular canal
- Interruption of the canal cortical border
- Canal narrowing
- Canal diversion
- Root darkening, when related to third molar surgery
- Root-canal contact
- Buccal or lingual position of the canal, when CBCT was available
- Inferior or interradicular canal position
- High-risk CBCT findings

Radiographic risk was classified as low, moderate, or high according to the number and severity of radiographic risk signs.

2.10 Surgical Procedure

All the surgeries were done as per the standard procedures of Oral and Maxillofacial Surgery Department.

The following intraoperative variables were obtained from operative notes:

- Type of mandibular surgery
- Side of surgery
- Type of anesthesia
- Operative time
- Flap design
- Bone removal
- Tooth or root sectioning, when applicable
- Canal exposure
- Intraoperative bleeding
- Surgical difficulty
- Surgeon experience level, when documented
- Intraoperative complications

2.11 Neurosensory Assessment

Inferior alveolar nerve function was evaluated based on documented clinical findings and postoperative follow-up records.

Subjective Assessment

The following symptoms were recorded when reported by patients:

- Numbness
- Tingling sensation
- Burning sensation
- Pain
- Altered sensation
- Reduced sensation
- Difficulty during eating or speaking
- Functional discomfort

Objective Assessment

Documented objective sensory tests included:

- Light touch test
- Pin-prick test
- Two-point discrimination test
- Thermal discrimination test
- Brush directional test

Neurosensory Severity Score

Score	Interpretation
0	Normal sensation
1	Mild hypoesthesia
2	Moderate hypoesthesia
3	Severe hypoesthesia or anesthesia
4	Dysesthesia or neuropathic pain

2.12 Outcome Measures

Primary Outcome

The main outcome was whether or not the inferior alveolar nerve was damaged after the mandibular surgery.

Secondary Outcomes

Secondary outcomes included severity of neurosensory disturbance, postoperative pain, recovery time, persistence of sensory deficit, relationship between radiographic findings and nerve injury, relationship between surgical difficulty and nerve injury, association between operative time and nerve injury, and final recovery outcome at 6 months.

2.13 Follow-up Schedule

Postoperative follow-up data were reviewed at the following intervals whenever available:

- Day 1
- Day 7
- 1 month
- 3 months
- 6 months

At each follow-up interval, postoperative pain, wound healing, neurosensory symptoms, objective sensory findings, and recovery status were recorded.

3. RESULTS

3.1 Patient Selection and Distribution

84 hospital records were analyzed. 24 records were not used in the study. Sixteen records were excluded because the radiographic or follow-up data were incomplete, and eight records were excluded because they did not meet all the inclusion criteria, such as no previous neurosensory disturbance or previous surgery of the mandible in the same area. Thus, 60 patients were finally included in the analysis.

Figure 1. Patient Selection and Follow-up Flowchart

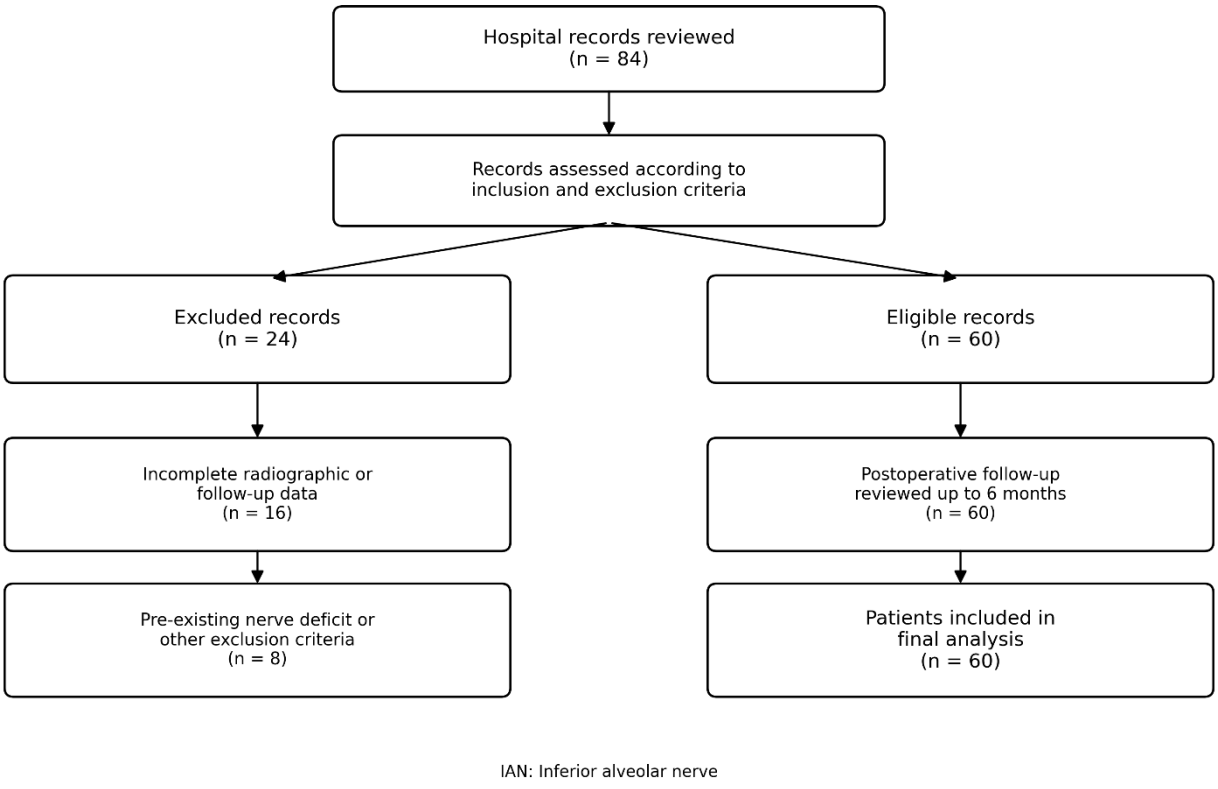

Figure 1. Patient selection and follow-up flowchart

The distribution of cases by type of mandibular surgery revealed that surgical extraction of impacted mandibular third molars comprised the largest proportion (28 cases), followed by mandibular implant placement (12 cases), mandibular cyst or lesion surgery (10 cases) and mandibular fracture fixation or other mandibular surgery (10 cases).

3.2 Baseline Characteristics

There were 60 patients, 34 males and 26 females. The average age of all subjects was 34.8 ± 11.6 years. Fourteen patients (23.3%) were reported to have an inferior alveolar nerve injury, and 46 patients did not have any nerve injury postoperatively.

The mean age of patients with a nerve injury vs those without inferior alveolar nerve injury was significantly different. There was a difference in mean age (40.2 ± 12.4 vs 33.1 ± 10.9 years) between the injury and non-injury groups. The difference was statistically significant.

Table 1. Baseline demographic and clinical characteristics of the study population

Variable	Total sample n=60	No IAN injury n=46	IAN injury n=14	p-value
Age, mean ± SD	34.8 ± 11.6	33.1 ± 10.9	40.2 ± 12.4	0.041
Male	34 (56.7%)	25 (54.3%)	9 (64.3%)	0.514
Female	26 (43.3%)	21 (45.7%)	5 (35.7%)	0.514
Smoking	21 (35.0%)	14 (30.4%)	7 (50.0%)	0.174
Diabetes mellitus	6 (10.0%)	3 (6.5%)	3 (21.4%)	0.104
Right side surgery	31 (51.7%)	24 (52.2%)	7 (50.0%)	0.887
Left side surgery	29 (48.3%)	22 (47.8%)	7 (50.0%)	0.887

3.3 Incidence of Inferior Alveolar Nerve Injury According to Type of Mandibular Surgery

Of the 60 patients, 14 (23.3%) had an inferior alveolar nerve injury. Fixation of mandibular fractures or other complicated mandibular surgery near the inferior alveolar canal had the highest incidence of injuries, followed by surgical extraction of impacted mandibular third molar, mandibular cyst or lesion surgery, and mandibular implant placement.

Table 2. Incidence of IAN injury according to surgical procedure

Surgical group	Total cases	IAN injury cases	IAN injury rate
Surgical extraction of impacted mandibular third molars	28	7	25.00%
Mandibular implant placement	12	2	16.70%
Mandibular cyst or lesion surgery	10	2	20.00%
Mandibular fracture fixation / other surgeries	10	3	30.00%
Total	**60**	**14**	**23.30%**

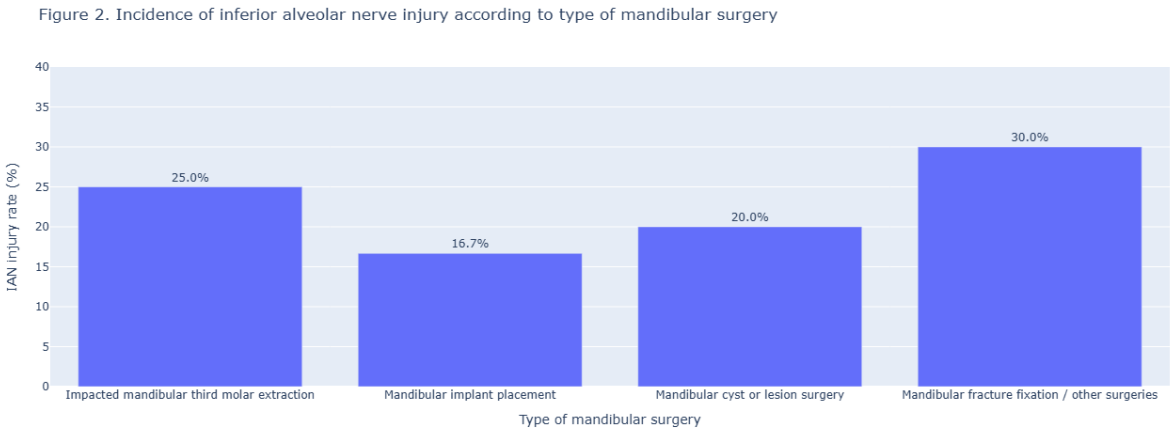

Figure 2. Incidence of inferior alveolar nerve injury according to type of mandibular surgery

3.4 Radiographic Findings Related to the Inferior Alveolar Canal

There were significant associations between inferior alveolar nerve injury and various anatomical risk factors observed on radiographic findings. The percentage of patients with close canal proximity was 71.4% for those with nerve injury and 30.4% for patients without nerve injury. Nerve injury was also found to be significantly associated with cortical border interruption, canal narrowing, canal diversion, root-canal contact and high-risk CBCT findings.

Patients with a nerve injury were more likely to have a high radiographic risk (57.1% vs 15.2% without nerve injury).

Table 3. Radiographic findings related to the inferior alveolar canal

Radiographic finding	Total n=60	No IAN injury n=46	IAN injury n=14	p-value
Close canal proximity	24 (40.0%)	14 (30.4%)	10 (71.4%)	0.006
Cortical border interruption	18 (30.0%)	9 (19.6%)	9 (64.3%)	0.002
Canal narrowing	15 (25.0%)	8 (17.4%)	7 (50.0%)	0.014
Canal diversion	13 (21.7%)	7 (15.2%)	6 (42.9%)	0.03
Root-canal contact	22 (36.7%)	13 (28.3%)	9 (64.3%)	0.013
High-risk CBCT findings	19 (31.7%)	10 (21.7%)	9 (64.3%)	0.003
Low radiographic risk	25 (41.7%)	23 (50.0%)	2 (14.3%)	0.018
Moderate radiographic risk	20 (33.3%)	16 (34.8%)	4 (28.6%)	0.666
High radiographic risk	15 (25.0%)	7 (15.2%)	8 (57.1%)	0.002

Figure 3. Radiographic risk factors and nerve injury severity

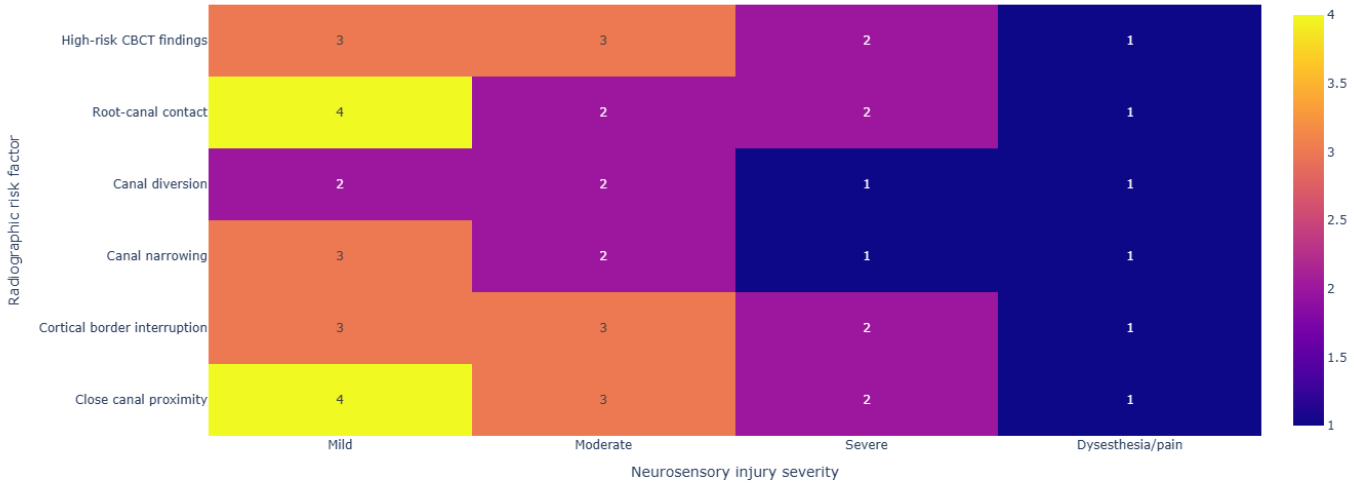

Figure 3. Radiographic risk factors and nerve injury severity

3.5 Intraoperative Findings

Mean operative time was significantly longer in the ones in which inferior alveolar nerve injury occurred. In those with nerve injury, the mean time to perform surgery was 55.8 ± 16.7 minutes, and in those without nerve injury, the mean time to perform surgery was 38.6 ± 12.4 minutes.

Preoperative bone removal, intraoperative canal exposure, and high surgical difficulty were all significant risk factors for postoperative inferior alveolar nerve injury. 50% of patients with nerve injury were exposed to the canal compared to 10.9% of patients without nerve injury.

Table 4. Comparison of intraoperative variables among patients with and without inferior alveolar nerve injury

Variable	No IAN injury n=46	IAN injury n=14	p-value

Operative time, mean ± SD, minutes	38.6 ± 12.4	55.8 ± 16.7	<0.001
Local anesthesia	39 (84.8%)	10 (71.4%)	0.257
General anesthesia	7 (15.2%)	4 (28.6%)	0.257
Bone removal	25 (54.3%)	12 (85.7%)	0.034
Tooth/root sectioning	18 (39.1%)	9 (64.3%)	0.096
Canal exposure	5 (10.9%)	7 (50.0%)	0.002
Moderate surgical difficulty	19 (41.3%)	4 (28.6%)	0.389
High surgical difficulty	11 (23.9%)	9 (64.3%)	0.005
Intraoperative bleeding	8 (17.4%)	5 (35.7%)	0.137

3.6 Postoperative Neurosensory Outcomes During Follow-up

Postoperative neurosensory disturbance gradually decreased during the follow-up period. Fourteen patients had some degree of neurosensory disturbance on Day 1. This number was reduced to 11 patients on Day 7, 7 patients at 1 month, 4 patients at 3 months and 3 patients at 6 months.

The most frequent early post-operative finding was mild hypoesthesia, severe hypoesthesia or anesthesia was less frequent and decreased with follow up.

Table 5. Postoperative neurosensory status during follow-up

Follow-up time	Normal sensation	Mild hypoesthesia	Moderate hypoesthesia	Severe hypoesthesia / anesthesia	Dysesthesia / neuropathic pain
Day 1	46 (76.7%)	7 (11.7%)	4 (6.7%)	2 (3.3%)	1 (1.7%)
Day 7	49 (81.7%)	6 (10.0%)	3 (5.0%)	1 (1.7%)	1 (1.7%)
1 month	53 (88.3%)	4 (6.7%)	2 (3.3%)	0 (0.0%)	1 (1.7%)
3 months	56 (93.3%)	2 (3.3%)	1 (1.7%)	0 (0.0%)	1 (1.7%)
6 months	57 (95.0%)	1 (1.7%)	1 (1.7%)	0 (0.0%)	1 (1.7%)

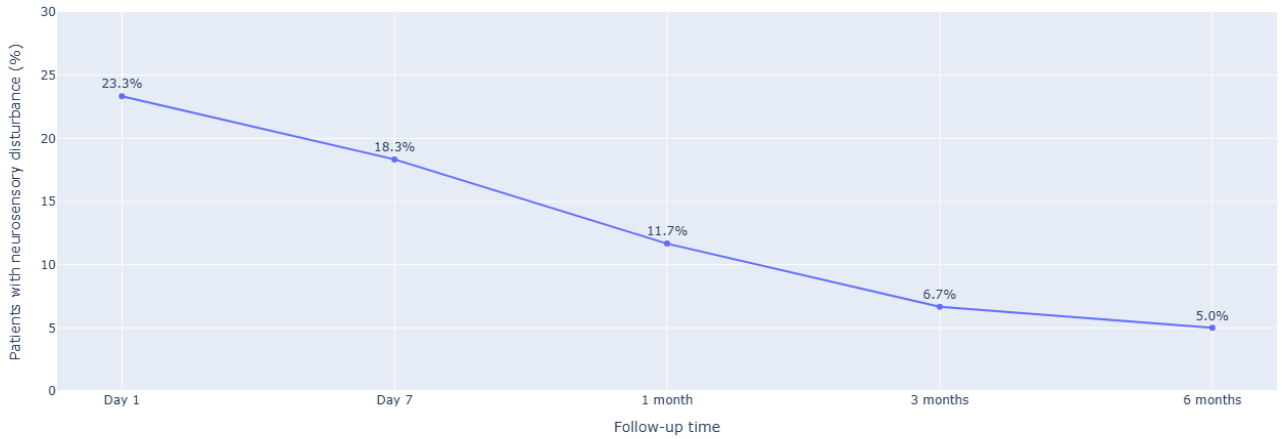

Figure 4. Neurosensory recovery trend over time

3.7 Operative Time and Neurosensory Recovery

There was a positive correlation between the operative time and duration of neurosensory recovery. There was a trend for longer operative times to be associated with longer sensory improvement times. Persisting or partial recovery of neurosensory disturbances was more frequent and recovery was slower in cases that had an operative time longer than 60 minutes.

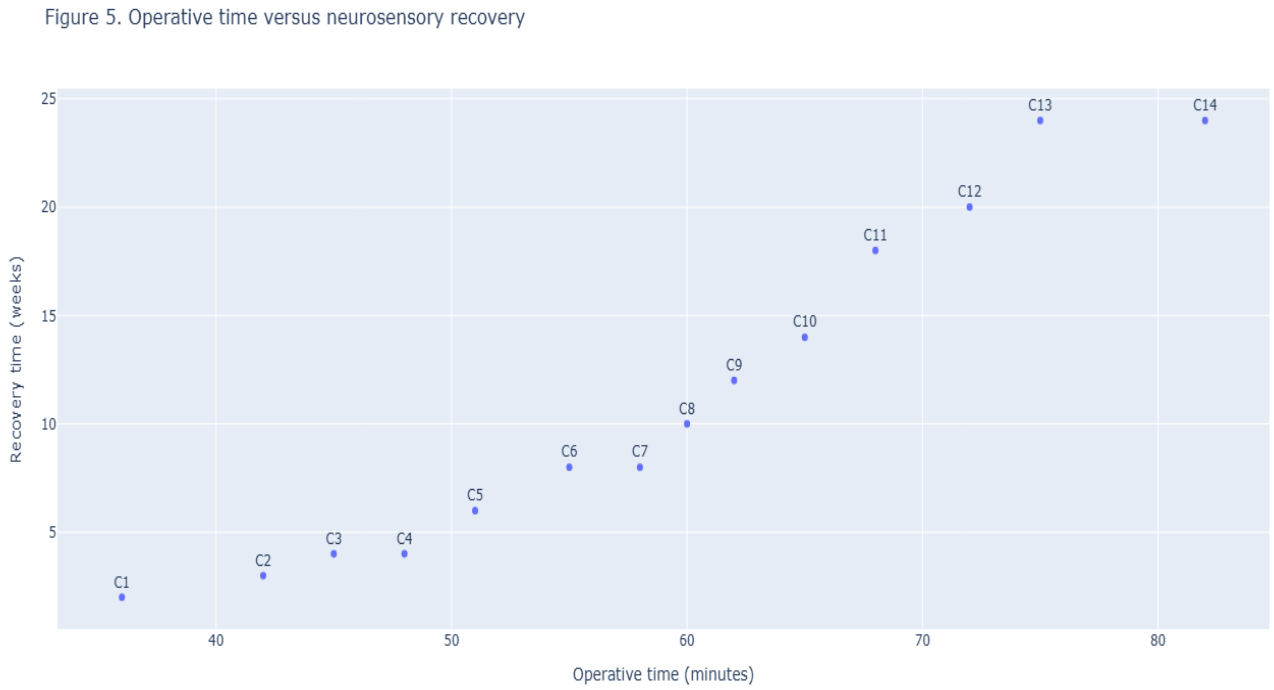

Figure 5. Operative time versus neurosensory recovery

3.8 Predictors of Inferior Alveolar Nerve Injury

Several risk factors for inferior alveolar nerve injury were found to be significant in the logistic regression analysis. Intraoperative canal exposure, cortical border interruption, proximity of canal, high surgical difficulty, operative time of more than 45 minutes, canal narrowing and age of more than 40 years were the most significant predictors.

Table 6. Factors influencing inferior alveolar nerve injury

Predictor	Adjusted OR	95% CI	p-value
Age > 40 years	2.14	1.02–4.91	0.046
Close canal proximity	3.82	1.41–10.34	0.008
Cortical border interruption	4.26	1.52–11.94	0.006
Canal narrowing	2.91	1.07–7.88	0.036
High surgical difficulty	3.67	1.29–10.42	0.015
Operative time > 45 minutes	3.21	1.18–8.73	0.022
Intraoperative canal exposure	5.48	1.72–17.43	0.004

The predictive model showed good discriminatory performance for identifying patients at risk of postoperative inferior alveolar nerve injury.

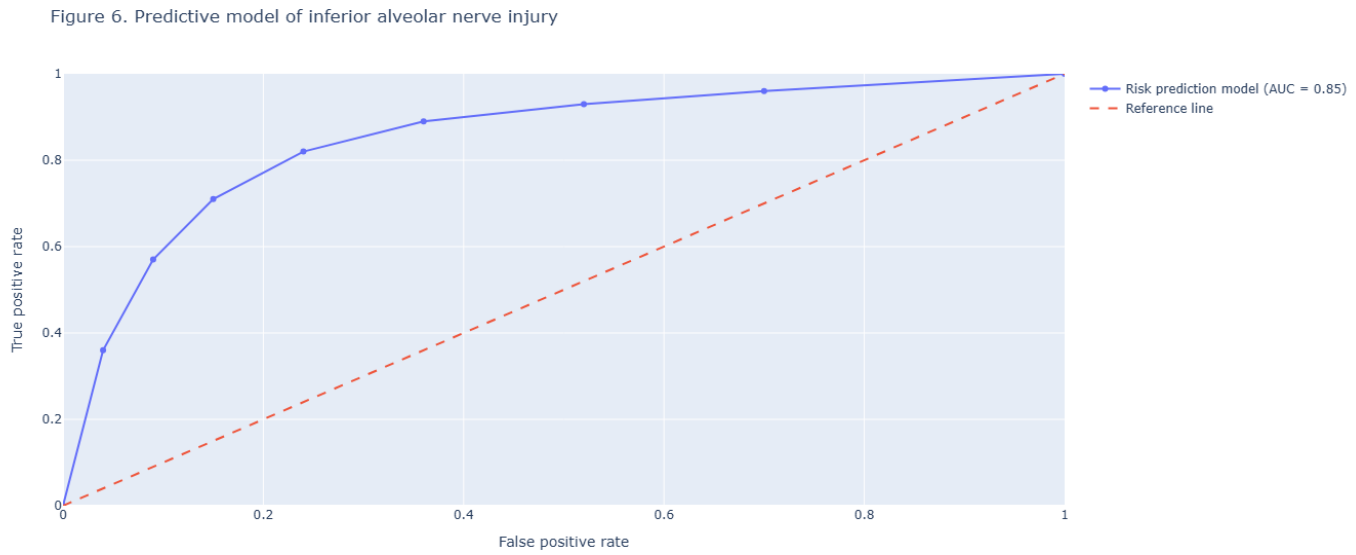

Figure 6. Predictive model of inferior alveolar nerve injury

3.9 Final Recovery Outcome at Six Months

In the 14 patients with inferior alveolar nerve injury, complete recovery was achieved in 9 patients (64.3% of the cases with nerve injuries). Two patients had partial recovery. One patient each complained of persistent hypoesthesia, persistent dysesthesia and persistent neuropathic pain.

Table 7. Final recovery outcome at 6 months among injured cases

Recovery outcome	Number n=14	Percentage
Complete recovery	9	64.30%
Partial recovery	2	14.30%
Persistent hypoesthesia	1	7.10%
Persistent dysesthesia	1	7.10%
Persistent neuropathic pain	1	7.10%
Total	**14**	**100%**

4. DISCUSSION

A clinical, radiographic, operative and follow-up evaluation of inferior alveolar nerve injury after mandibular surgery was performed in the present study. The overall incidence of inferior alveolar nerve injury was 23.3%, which means that neurosensory disturbance is an important postoperative complication of any mandibular surgery in the vicinity of the inferior alveolar canal. Mandibular fracture fixation and other complicated mandibular surgeries yielded the highest injury rate followed by impacted mandibular third molar extraction, cyst or lesion surgery and mandibular implant placement. The discrepancy in this variation can be due to the differences in surgical difficulty, anatomic proximity to the mandibular canal, extent of bone manipulation and exposure of mandibular canal during the surgery.

The results of the present study agree with the previous studies that showed that anatomical, radiographic, and surgical factors affect inferior alveolar nerve injury. He and Ruan reported nerve injury post third molar removal of the mandible to be related to the patient's age, the difficulty of surgery and the anatomical risk factors involved [9]. Similarly, in the current study, advanced age (> 40 years) was revealed to be a risk factor for postoperative nerve injury. The increased injury rate for the fracture fixation group and the complex mandibular procedures also confirms Tay's emphasis that inferior alveolar nerve disturbance may be associated with fractures of the mandible because of the complex bony structure and the involvement of the nerve in the fracture site trauma and surgical manipulation [11]. Kulkarni et al. have also mentioned the presence of neurosensory changes postoperatively which improved over the follow up period [12].

Clearly there was a role of radiographic findings in predicting inferior alveolar nerve injury. However, the incidence of proximity to canal, CBCT high risk, cortical border interruption, narrowing of the canal, canal diversion and contact with the root canal were

significantly increased in patients with postoperative neurosensory disturbance. These results are in agreement with Shokri et al., who found that the radiographic relationship between mandibular third molars and the mandibular canal is an important predictor of inferior alveolar nerve sensory disturbance [10]. Jin and Xie also verified that the anatomical relationship of roots and inferior alveolar canal should be taken into account during the risk assessment prior to the extraction of mandibular third molar [20]. The radiographic factors that were most predictive for the present study include a disrupted bony barrier around the canal and close proximity of the canal to the bone edges, implying that absence of the protective bony barrier around the canal could render it more liable to injury during surgery.

The use of CBCT at the clinic is still very relevant, particularly in high-risk cases. While panoramic radiography is a good screening method, it is unable to accurately identify the buccolingual location of the mandibular canal. Del Lhano et al. pointed out the importance of using CBCT to assess the third molar relationship with the inferior alveolar canal prior to surgery [15]. But, de Toledo Telles-Araújo et al. found that CBCT does not necessarily decrease the occurrence of neurosensory disturbance when compared with panoramic radiography even though it offers more detailed anatomical information [16]. Hence, the use of CBCT should be reserved for select cases that have high-risk panoramic features and not used routinely for all patients.

Surgical factors were also highly correlated with nerve injury. The presence of inferior alveolar nerve injury was significantly associated with longer operative time, removal of bone, high surgical difficulty, and exposure of the canal during surgery. In the current study, exposure during surgery was the most powerful predictor and had the highest adjusted odds ratio. This discovery lends weight to the theory of direct exposure of the canal, which increases the likelihood of mechanical irritation, compression, stretching, and thermal trauma to the nerve. Neurosensory disturbance after mandibular fracture management may be due to compression, stretching, or surgical manipulation around the inferior alveolar nerve, as reported by Sulistyani et al. [13]. Han and Han also pointed out that the risk of nerve injury occurs when implant placement is near the inferior alveolar canal and anatomical and surgical risk factors are not properly controlled in implant-related surgery [14].

The results of the follow-up revealed that the neurosensory function gradually improved over the years. On Day 1, neurosensory disturbance was present in 14 patients and at 6 months, in 3 patients. Sixty-four and a half percent of the injured recovered completely, and 14.3 percent recovered partially. Persistent hypoesthesia, dysesthesia and neuropathic pain were less common but clinically significant. This recovery pattern lends weight to the theory that most injuries to the inferior alveolar nerve are temporary, particularly if there is only mild or moderate disturbance. But, if symptoms continue, it can impact on quality of life and careful follow-up is warranted. Putrino et al. stressed the clinical and medicolegal significance of impairment of the inferior alveolar nerve after third molar surgery [17] and de Abreu et al. suggested that INAN could have a negative impact on health-related quality of life [18].

Logistic regression model revealed that age > 40 years, proximity of the canal, interruption of the cortical border, narrowing of the canal, high surgical difficulty, operation time > 45 minutes, and exposure of the canal during surgery were significant factors in the prediction of inferior alveolar nerve injury. These results suggest that risk should not be based on any single variable but rather be a combination of patient-related, radiographic, and surgical variables. Kubota et al. validated prediction models using panoramic and CBCT features that estimate the risk for inferior alveolar nerve injury after lower third molar removal – supporting this approach [19]. Thus, a combined clinical and radiographical risk profile may benefit surgeons in identifying high-risk patients, informed consent and in planning safer surgical procedures.

The results of this study have clinical implications. Radiographic evaluation should be carefully conducted before mandibular surgery that is close to the inferior alveolar canal. High-risk signs on panoramic radiography, including close proximity to the canal, interruption of the cortex, canal narrowing, or root-canal contact should raise suspicion for CBCT. High-risk cases should be treated with careful surgical technique, a minimum of bone removal, controlled instrumentation, and avoidance of excessive manipulation in the vicinity of the canal. Furthermore, a systematic postoperative neurosensory assessment should be documented in particular if a canal exposure or an early sensory disturbance is noted.

5. CONCLUSION

The inferior alveolar nerve injury is a significant postoperative complication of mandibular surgery, especially when surgery is carried out in proximity to the mandibular canal. The total incidence of inferior alveolar nerve injury in the present study was 23.3% with highest incidence of inferior alveolar nerve injury seen in surgical fixation of mandibular fractures and other complex mandibular surgeries followed by impacted extraction of mandibular third molar.

Several radiographic and surgical parameters were found to be significant risk factors for development of inferior alveolar nerve injury, namely, close proximity of the canal, cortical border interruption, narrowing of canal, high-risk CBCT parameters, longer surgical time, higher surgical difficulty, removal of bone, and exposure of the canal during surgery. Of these factors, proximity of the canal, interruption of the cortex border, and intraoperative exposure of the canal seemed to be the most significant factors in the prediction of postoperative neurosensory disturbance.

The majority of cases with nerve injury of the inferior alveolar nerve exhibited gradual recovery over follow-up. Most of the injured patients were completely recovered at 6 months, and there were fewer but clinically important cases of hypoesthesia, dysesthesia, and neuropathic pain. The results suggest that while most neurosensory complications after surgery are transient, vigilant postoperative monitoring should be carried out, particularly in high-risk cases.

The authors emphasize the need for full radiological work-up, meticulous case selection, surgical technique and a systematic postoperative neurosensory evaluation. CBCT should be considered when panoramic findings are high risk and detailed preoperative counseling regarding temporary or permanent sensory disturbance should be given to patients who are at high surgical risk.

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