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Prevalence Of Inferior Alveolar Nerve Injury in Mandibular Fracture Patients: A Study at Abbasi Shaheed Hospital

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ABSTRACT

Background: Mandibular fractures are among the most common facial bone injuries, often leading to complications such as inferior alveolar nerve (IAN) injuries. These injuries can significantly impact a patient's quality of life due to altered sensory function. Limited data exist regarding the prevalence of IAN injury in tertiary care centers in Karachi, Pakistan. The study aimed to determine the prevalence of inferior alveolar nerve injury in mandibular fracture patients presenting at Abbasi Shaheed Hospital and identify factors associated with its occurrence.

Methods: This cross-sectional study was conducted over six months (January-June 2024) in the emergency department of Abbasi Shaheed Hospital. A total of 90 patients aged 18–50 years with mandibular fractures were included. Data were collected through detailed clinical examinations and neurosensory evaluations using standardized protocols. Variables such as age, gender, fracture type, and etiology were recorded. SPSS version 23 was used for data analysis. Continuous variables were summarized as mean ± standard deviation (SD), while categorical variables were expressed as frequencies and percentages. The Chi-square test was applied to evaluate associations between inferior alveolar nerve injury and fracture characteristics, with a p-value of <0.05 considered statistically significant.

Results: The mean age of patients was 29.8 ± 6.3 years, with a male-to-female ratio of 2:1. Road traffic accidents (53.3%) were the leading cause of injury, followed by interpersonal violence (25.6%). The prevalence of IAN injury was 38.9%, with a significant association noted with displaced fractures ($p < 0.05$). Neurosensory dysfunction was more common in fractures involving the mandibular angle and body.

Conclusion: IAN injury is a frequent complication of mandibular fractures, particularly in displaced fractures. Early assessment and management can minimize long-term morbidity. Future studies should focus on long-term outcomes and potential preventive measures.

Keywords: Mandibular Fractures, Inferior Alveolar Nerve, Hospital, Maxillofacial Trauma.

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INTRODUCTION

Mandibular fractures are among the most frequently reported facial injuries worldwide, accounting for 36-70% of all maxillofacial fracture[1,2]. Their high incidence is attributed to the mandible's prominent and vulnerable position in the lower face[3]. The 20–30 age group remains the most affected demographic, with males being at greater risk due to engagement in high-impact activities such as road traffic accidents (RTAs), contact sports, and physical altercations[4,5]. These fractures can lead to severe functional impairments, including difficulty in mastication, speech, and occlusion, as well as aesthetic concerns[6].

Clinically, mandibular fractures are categorized based on location (e.g., condylar, angle, body, symphysis, or parasymphysis fractures) and their displacement status[7]. Displaced fractures tend to pose a higher risk for complications, including nerve injury, infection, and malunion[8]. Managing these fractures requires a multidisciplinary approach involving oral and maxillofacial surgeons, neurosurgeons, and rehabilitation specialists[9].

The inferior alveolar nerve (IAN) originates from the mandibular division of the trigeminal nerve and traverses through the mandibular canal, supplying sensation to the lower lip, chin, and mandibular teeth[10]. Due to its close proximity to the mandibular cortex, the IAN is highly susceptible to injury during trauma and fracture displacement[11]. The prevalence of IAN injuries in mandibular fractures ranges from 5.7% to 58.5%, with higher rates observed in displaced and comminuted fractures[12].

Patients with IAN injury commonly report sensory disturbances such as paresthesia (tingling), hypoesthesia (reduced sensation), and anesthesia (complete numbness), which can significantly impact their quality of life[13]. Persistent sensory deficits can interfere with daily activities, including eating, speaking, and oral hygiene maintenance, leading to psychological distress[14].

The primary causes of mandibular fractures vary globally, with RTAs, interpersonal violence, falls, and sports injuries being the leading contributors[15,16]. In Pakistan, RTAs account for over 50% of mandibular fractures, often due to inadequate traffic regulations, poor road infrastructure, and lack of helmet use[17]. Interpersonal violence, a significant contributor, is commonly linked to assaults, domestic violence, and criminal activities[18].

Despite the global literature on mandibular fractures and associated IAN injuries, there is a paucity of data from Pakistan, particularly from tertiary care centers like AbbasiShaheed Hospital. This study aimed to address this gap by determining the prevalence of IAN injury in mandibular fractures, evaluating the impact of fracture type and displacement, and exploring potential preventive and treatment strategies.

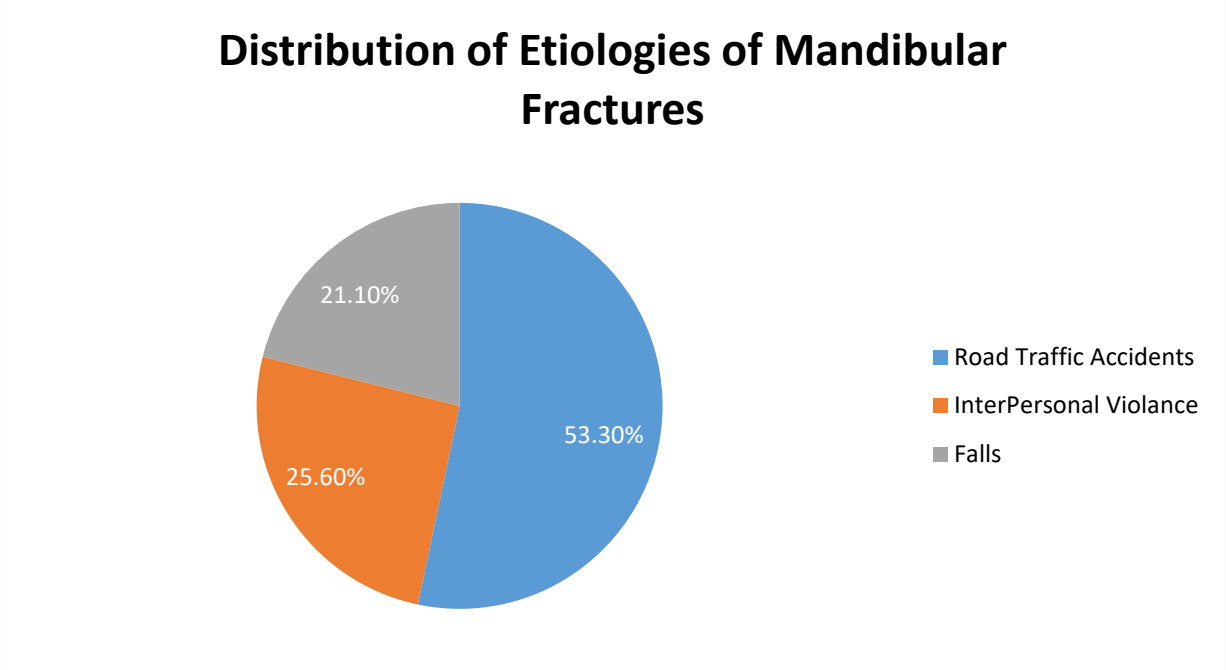
METHODS

This descriptive cross-sectional study was conducted in the Emergency Department of Abbasi Shaheed Hospital, Karachi, over a six-month period from January to June 2024, after obtaining ethical approval from the Institutional Ethics Review Committee (ERC No: 17/22). The study population comprised patients aged 18–50 years who presented with clinically and radiographically confirmed mandibular fractures. The sample size for this study was calculated using the single population proportion formula n=Z2p(1−p)/d2n = Z^2 p(1-p)/d^2n=Z2p(1−p)/d2, taking a 95% confidence level (Z = 1.96), expected prevalence of inferior alveolar nerve injury at 39%, and a margin of error of 10%, which yielded a sample of approximately 91 patients. For feasibility, 90 patients were finally enrolled. A non-probability consecutive sampling technique was used, whereby all eligible patients presenting during the study period were included until the required sample was achieved. The method of calculation is based on the approach described by Naing et al. and the WHO manual by Lwanga and Lemeshow for health studies. Only those presenting within 24 hours of injury were included. Patients with severe systemic injuries, unconsciousness at presentation, a history of previous mandibular trauma, or fractures resulting from pathological conditions were excluded.

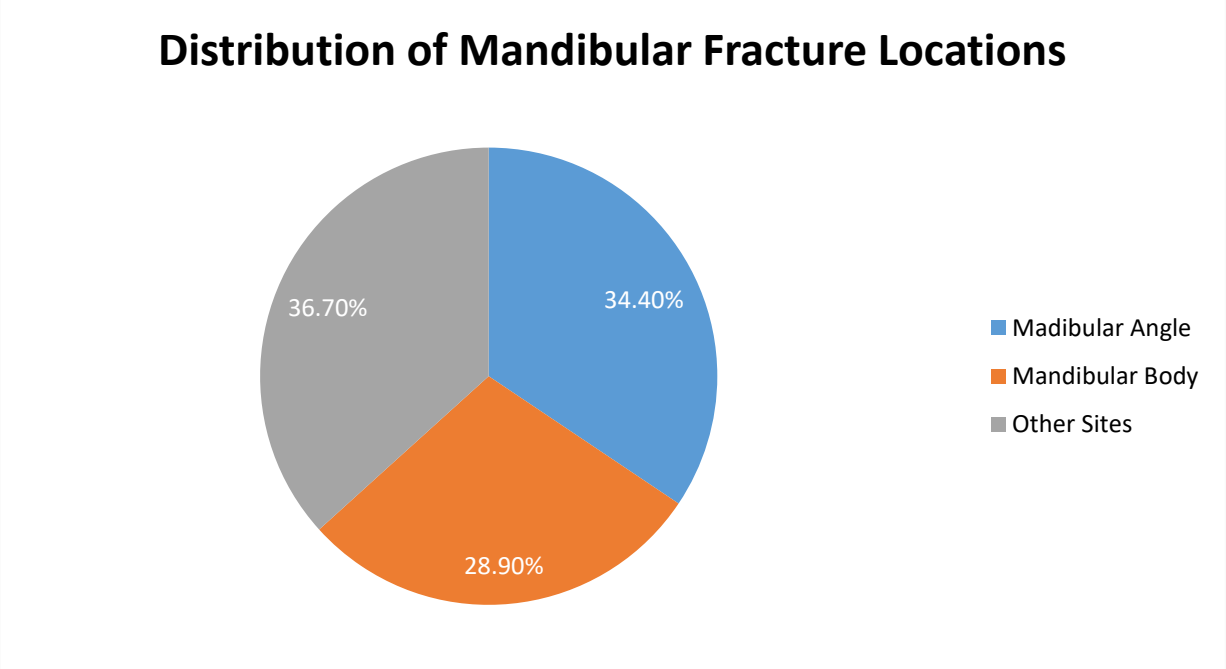
Data were collected using a structured proforma that recorded demographic information, etiology of injury, and fracture characteristics. Neurosensory assessment of the inferior alveolar nerve was performed at the time of presentation using standardized methods, including tests for light touch, pin-prick pain sensation, and two-point discrimination[15]. All data were entered and analyzed using SPSS version 23.0 (IBM Corp., Armonk, NY, USA). Continuous variables were summarized as mean ± standard deviation (SD), while categorical variables were expressed as frequencies and percentages. The Chi-square test was applied to evaluate associations between inferior alveolar nerve injury and fracture characteristics, with a p-value of <0.05 considered statistically significant.

RESULTS

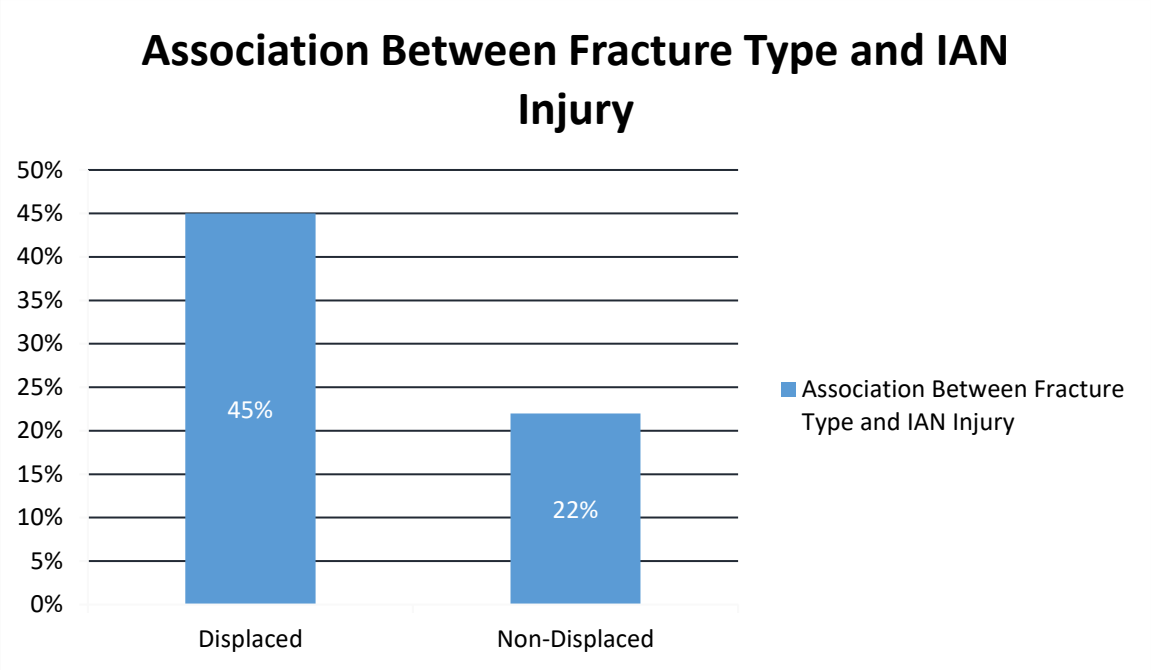
The mean age of patients was 29.8 ± 6.3 years, with 60 (66.7%) males and 30 (33.3%) females. Most patients (58%) were between 20–30 years old. Road traffic accidents accounted for 53.3% of fractures, followed by interpersonal violence (25.6%) and falls (21.1%).



Displaced fractures were observed in 62.2% of cases, with the mandibular angle (34.4%) and body (28.9%) being the most commonly affected sites.



IAN injury was detected in 35 patients (38.9%), with displaced fractures significantly associated with higher rates of injury ($p < 0.05$). Fractures involving the mandibular angle and body were most frequently associated with neurosensory dysfunction.



DISCUSSION

This study revealed a 38.9% prevalence of IAN injury in patients with mandibular fractures, which aligns with global reports ranging from 5.7% to 58.5%. The significant association between IAN injury and displaced fractures ($p < 0.05$) reinforces findings from previous studies indicating that fracture displacement increases the risk of direct nerve compression or transection. Additionally, fractures involving the mandibular angle and body demonstrated the highest incidence of neurosensory dysfunction, likely due to their anatomical proximity to the inferior alveolar nerve.

The findings of this study reaffirm the global epidemiological trend that road traffic accidents (RTAs) are the predominant cause of mandibular fractures in developing countries. The predominance of young male patients (20–30 years) further reflects well-documented demographic patterns, as this group is at greater risk due to occupational exposure, risk-taking behavior, and involvement in interpersonal violence[16]. These observations highlight the need for targeted preventive strategies, particularly within this vulnerable population.

Consistent with earlier reports, displaced mandibular fractures, particularly in the angle region, were found to carry a higher risk of inferior alveolar nerve (IAN) involvement[17]. This is of clinical importance, as neurosensory deficits not only affect patient quality of life but may also complicate postoperative recovery and rehabilitation. A study further emphasized that patients with multiple maxillofacial fractures exhibit a higher incidence of permanent deficits, reinforcing the importance of comprehensive neurosensory evaluation at the time of initial presentation[18].

The current evidence underscores the necessity of integrating detailed neurosensory assessments into routine clinical practice. Timely recognition of nerve injury is vital, as delayed intervention may prolong nerve compression and result in irreversible damage[19]. A structured assessment protocol, including standardized

neurosensory testing, would not only guide treatment decisions but also serve as a valuable medicolegal record in cases of persistent impairment.

Treatment of IAN injuries remains challenging, and management strategies are largely dictated by the extent of nerve damage and fracture displacement[20]. Conservative approaches such as vitamin B complex supplementation, physiotherapy, and sensory retraining continue to play a role in early-stage or mild injuries[21,22]. However, in severe or persistent cases, surgical interventions including decompression, direct nerve repair, or nerve grafting may be required. Recent innovations in regenerative medicine, such as the application of stem cell therapy, platelet-rich plasma, and bioengineered nerve conduits, have demonstrated encouraging results in experimental models and early clinical trials[23]. These developments hold promise for improving long-term sensory recovery and should be explored further in maxillofacial trauma care.

Despite these valuable insights, the present study has limitations. The single-center design and relatively small sample size limit the generalizability of the findings. Moreover, the absence of long-term follow-up restricts conclusions regarding sensory recovery outcomes. Multicenter trials with larger cohorts, stratified analyses based on fracture site and severity, and standardized follow-up protocols are essential to validate these observations[24].

In addition to clinical management, preventive measures must not be overlooked. The adoption of protective gear, including helmets for motorcyclists and mouthguards for athletes, has been shown to significantly reduce the risk of mandibular fractures[25]. Furthermore, implementing community-based awareness programs focused on road safety regulations, traffic law enforcement, and violence prevention strategies could substantially reduce the incidence of maxillofacial trauma. Public health policies addressing these preventive dimensions may prove to be as impactful as advances in clinical management.

Overall, this study contributes to the growing body of evidence on the patterns and management of IAN injuries associated with mandibular fractures. By emphasizing both early intervention and preventive strategies, it reinforces the dual responsibility of surgeons and policymakers in mitigating the burden of these injuries.

CONCLUSION

Mandibular fractures were found to occur most frequently among young adult males, with road traffic accidents as the predominant cause. Inferior alveolar nerve injury was strongly associated with displaced fractures, particularly in the mandibular angle region, and was more common in patients with multiple maxillofacial fractures. These findings emphasize the importance of timely neurosensory evaluation and early surgical intervention to minimize the risk of permanent deficits. While conservative management remains effective in mild cases, advanced regenerative techniques hold promise for improving long-term recovery. Preventive measures, including the use of protective gear and community-based awareness programs on road safety and violence reduction, are equally crucial in lowering the incidence of these injuries. Multicenter

studies with larger cohorts and long-term follow-up are recommended to further validate these outcomes and guide treatment strategies.

LIST OF ABBREVIATIONS

None

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CONFLICT OF INTEREST

None

ETHICAL APPROVAL

The Ethical permission was taken from the Abbasi Shaheed Hospital, Institutional Review Board [Reference Number: ERC No: 17/22].

AUTHORS' CONTRIBUTION

All authors contributed equally as per ICMJE policy.

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