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Case Series

# Analgesic efficacy of inferior alveolar nerve block for mandibular fracture surgeries: A prospective case series

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## Abstract

**Background:** Mandibular fractures are the most common facial bone injuries following road traffic accidents. Open reduction and internal fixation (ORIF) of these fractures is associated with significant perioperative pain, which traditionally necessitates high doses of opioids and NSAIDs, leading to adverse effects and complicating airway management due to trismus. Combining regional anaesthesia with general anaesthesia offers a promising multimodal approach. The inferior alveolar nerve block (IANB), particularly the Conventional Halstead technique, effectively anesthetizes the mandible. While commonly used in dentistry, its application for perioperative analgesia in mandibular trauma surgery is underexplored. This case series evaluates the analgesic efficacy of IANB in patients undergoing ORIF for mandibular fractures.

**Methods**: This prospective case series included five ASA I-II patients (aged 19-37) with mandibular fractures and limited mouth opening (inter-incisor distance [IID] ≤20 mm). Preoperatively, all patients received an IANB using the Halstead technique with 2 mL of 0.25% bupivacaine. Mouth opening (IID) and pain scores (Visual Analogue Scale, VAS) were assessed before and 10 minutes after the block. The primary outcome was the duration of postoperative analgesia; secondary outcomes included improvement in IID, intraoperative hemodynamic stability, and 24-hour opioid consumption.

**Results:** The IANB significantly improved mouth opening, with a median IID increase of 9 mm (35-81% improvement), facilitating conventional laryngoscopy. Post-block VAS scores decreased markedly (median pre-block: 6; post-block: 2). Intraoperative hemodynamics were stable, and no additional intraoperative opioids were required. The median duration of postoperative analgesia was 16 hours, with patients requiring only a single rescue analgesic (IV paracetamol) within the first 24 hours.

**Conclusion:** The preoperative Inferior Alveolar Nerve Block is a highly effective component of a multimodal analgesic strategy for mandibular ORIF. It significantly improves mouth opening, facilitates airway management, provides profound intraoperative and prolonged postoperative analgesia, minimizes opioid requirements, and promotes hemodynamic stability.

**Keywords:** Inferior alveolar nerve block, Mandibular fracture, Regional anaesthesia, Postoperative analgesia, Multimodal analgesia, Trismus, Halstead technique.

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## 1. Introduction

Mandibular fractures represent a frequent presentation in the emergency department, often resulting from road traffic accidents.[1] Open reduction and internal fixation (ORIF), the standard surgical treatment, is associated with significant perioperative pain and trismus, which complicates airway management and postoperative recovery.[1-3] Conventional pain management relying on systemic opioids and NSAIDs is fraught with side effects, including respiratory depression, nausea, vomiting, and gastrointestinal irritation, which can impede recovery.[4,5]

Regional anaesthesia techniques, when integrated with general anaesthesia, can mitigate these challenges by providing targeted analgesia, reducing systemic drug exposure, and improving patient outcomes. The mandible is

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primarily innervated by the inferior alveolar nerve (IAN), a branch of the mandibular nerve.[2] Among various techniques for blocking this nerve, the Conventional Halstead approach is considered the gold standard due to its reliability, ease of execution based on clear anatomical landmarks, and efficacy in anesthetizing a wide area, including the lingual and long buccal nerves.[7,8]

Despite its proven utility in dental procedures, the application of IANB for perioperative analgesia in elective mandibular fracture surgery is not well-documented. This case series aimed to evaluate the analgesic efficacy of a preoperative IANB in improving mouth opening, facilitating intubation, providing intraoperative hemodynamic stability, and prolonging postoperative analgesia in patients undergoing ORIF for isolated mandibular fractures.

## 2. Case Series

Upon arrival in the operating theater, standard monitoring (electrocardiography, non-invasive blood pressure, pulse oximetry) was established. The pre-block IID was measured using a Vernier caliper and recorded (**Figure 1**).

### *2.1. Inferior alveolar nerve block technique*

The conventional Halstead technique was performed under aseptic conditions.[7] The steps were as follows:

1. The patient was asked to open their mouth maximally. The ipsilateral mucobuccal fold was palpated, and the operator's thumb was placed on the anterior border of the ramus.
2. A 24-gauge dental needle was attached to a syringe containing 2 mL of 0.25% bupivacaine hydrochloride (prepared by diluting 1 mL of 0.5% bupivacaine with 1 mL of sterile water).[2]
3. To target the Inferior Alveolar Nerve (IAN): The syringe barrel was placed on the contralateral premolars. The needle was inserted into the retromandibular trigone and advanced to a depth of 18-20 mm until bone contact was made. The needle was withdrawn approximately 1 mm, aspiration was confirmed to be negative for blood, and 1.5 mL of the local anesthetic solution was injected slowly (**Figure 2**).
4. To target the Lingual Nerve: Keeping the needle at the same insertion site, the syringe barrel was swung to the ipsilateral side. After negative aspiration, 0.3 mL of the solution was deposited (**Figure 3**).
5. To target the Long Buccal Nerve: With the syringe maintained in the same ipsilateral position, the needle was partially withdrawn and redirected distally towards the last molar, where 0.2 mL of the solution was injected.[2,7]

The patient was monitored for 10 minutes. Post-block, the IID was measured again with the Vernier caliper to assess improvement in mouth opening (**Figure 4**), a method adapted from Devarakonda et al.,[9] and the Visual Analogue Scale (VAS) score was reassessed.

**Figure 1**: Measurement of the pre-block Inter-Incisor Distance (IID) using a Vernier caliper

**Figure 2:** Needle insertion in the retromandibular trigone with the syringe barrel positioned on the contralateral premolars to target the Inferior Alveolar Nerve

**Figure 3:** The syringe barrel is turned to the ipsilateral side to deposit local anesthetic for the Lingual Nerve block

**Figure 4:** Measurement of the post-block Inter-Incisor Distance (IID) showing significant improvement

*2.2. General anaesthesia protocol*

Patients with demonstrated improvement in mouth opening subsequently underwent standard general anaesthesia induction. Premedication included intravenous (IV) glycopyrrolate (5 µg/kg), ondansetron (0.1 mg/kg), midazolam (0.1 mg/kg), fentanyl (1 µg/kg), and paracetamol (1 g). Anaesthesia was induced with IV propofol (2 mg/kg) and neuromuscular blockade was achieved with scholine (1 mg/kg). Nasotracheal intubation was successfully performed using a direct Macintosh laryngoscope. Anesthesia was maintained with oxygen, air, and sevoflurane (2.0%), vecuronium bromide (0.1 mg/kg) under volume-controlled ventilation, as per standard practice.

Intraoperative hemodynamic parameters were monitored continuously. A >20% increase from baseline in heart rate or blood pressure was considered a sign of inadequate analgesia and was treated with a rescue dose of fentanyl (0.5 µg/kg).

*2.3. Postoperative assessment*

Following extubation, patients were observed for 24 hours. Pain was assessed using the VAS score immediately upon becoming conscious and oriented, and then at 1, 4, 8, 12, 16, 20, and 24 hours. IV paracetamol (1 g) was administered as rescue analgesia when the VAS score was ≥4. The time from extubation to the first rescue dose was recorded as the duration of postoperative analgesia.

## 3. Results

The demographic and clinical outcomes for all five patients are summarized in **Table 1**. The study included five patients with a median age of 24 years (range: 19–37), comprising four males and one female. The median duration of surgery was 2.5 hours (range: 1.5–3). Preoperatively, patients exhibited limited mouth opening with a median inter-incisor distance (IID) of 14 mm (range: 11–20) and a median Visual Analogue Scale (VAS) pain score of 6 (range: 4–8). Following the administration of the inferior alveolar nerve block (IANB), a significant improvement was observed in both parameters. The median post-block IID increased to 22 mm (range: 20–28), representing a median absolute improvement of 9 mm and a percentage improvement ranging from 35% to 81% (**Figure 5**). Concurrently, the median VAS score decreased to 2 (range: 2–3) after the block (**Figure 6**).

Intraoperatively, all patients maintained stable hemodynamic parameters. The median heart rate was 96 beats per minute (range: 85–102), systolic blood pressure was 136 mm Hg (range: 128–140), diastolic blood pressure was 80 mm Hg (range: 76–86), and end-tidal carbon dioxide ($EtCO_2$) was 36 mm Hg (range: 35–40). Peripheral capillary oxygen saturation ($SpO_2$) was maintained at 100% in all cases. No additional doses of fentanyl were required beyond the initial pre-induction dose during surgery.

Postoperatively, patients experienced prolonged analgesia with a median duration of 16 hours (range: 16–20) before the first request for rescue medication. Pain scores remained low throughout the 24-hour observation period (**Figure 7**), and only one rescue analgesic (intravenous paracetamol) was required within the first 24 hours for all patients. No adverse events or block failures were observed in any case.

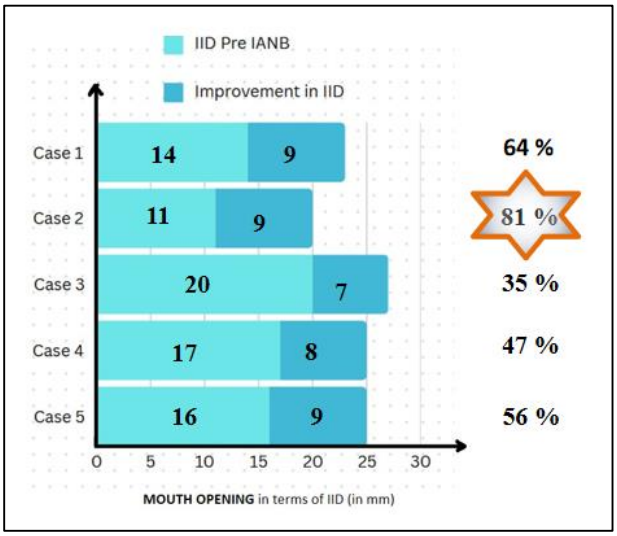


**Figure 5:** Improvement in inter-incisor distance (IID) in millimeters and percentage

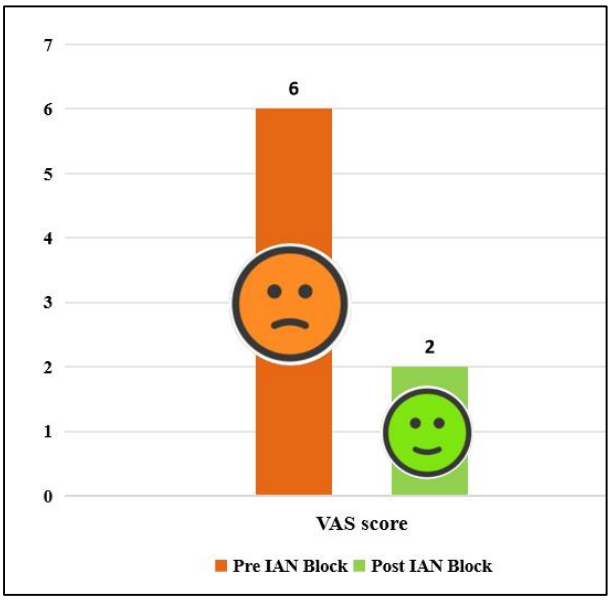


**Figure 6:** Visual Analogue Scale (VAS) scores before and after inferior alveolar nerve block (IANB)

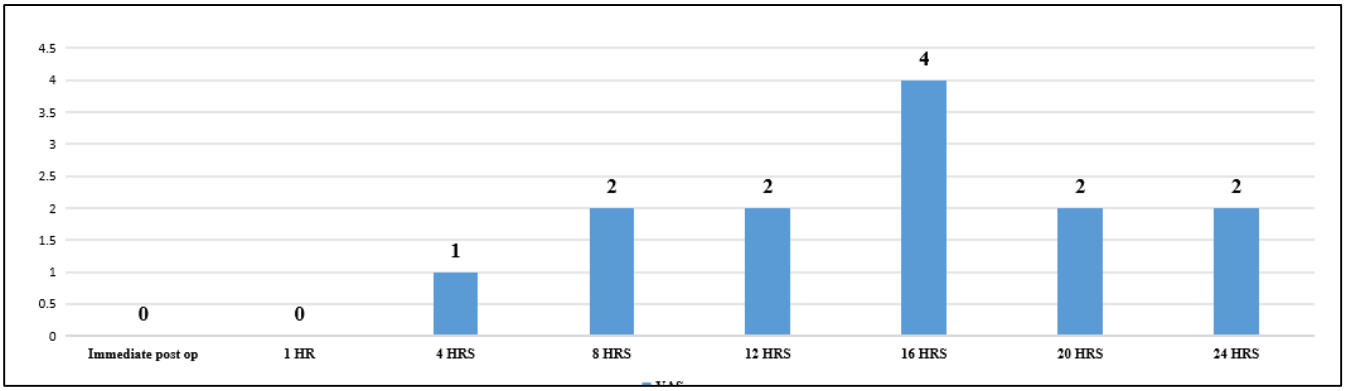


**Figure 7:** Postoperative VAS scores assessed over 24 hours

**Table 1:** Result expressed in median (RANGE)

| | | |
|---|---|---|
| **Demographic data** | Age (in years) | 24 (19-37) |
| | Gender (M:F) | 4:01 |
| | Duration of surgery (in hours) | 2.5 (1.5-3) |
| | Type of surgery | Open Reduction Internal Rotation |
| **Mouth opening** | Inter incisor distance (IID) Pre IAN Block (in mm) | 14 (11-20) |
| | Inter incisor distance (IID) Post IAN Block (in mm) | 22 (20-28) |
| | Improvement in IID (in mm, %) | 9 (7-9) 56% (35%-81%) |
| **Preoperative vas score** | VAS score | 6 (4-8) |
| | Pre IAN Block | |
| | VAS score | 2(2-3) |
| | Post IAN Block | |
| **Intraoperative hemodynamic parameters** | HR (/min) | 96 (85-102) |
| | SBP (in mm Hg) | 136 (128-140) |
| | DBP (in mm Hg) | 80 (76-86) |
| | SpO2 (in %) | 100 |
| | EtCO2 (in mm Hg) | 36 (35-40) |
| **Postoperative vas score** | Immediate post op | 0 |
| | 1 HR | 0 (0-1) |
| | 4 HRS | 1 (1-2) |
| | 8 HRS | 2 (1-2) |
| | 12 HRS | 2 (2-3) |
| | 16 HRS | 4 (2-5) |
| | 20 HRS | 2 (2-5) |
| | 24 HRS | 2 (1-2) |
| **Duration of postoperative analgesia(in first 24 hrs)** | 16 (16-20) | |
| **Total number of rescue analgesics (in first 24 HRS)** | 1 | |

Mouth opening, Improvement of inter-incisor distance, Intraoperative Hemodynamic parameters, HR: Heart Rate, SBP: Systolic Blood pressure, DBP: Diastolic Blood pressure, SpO2: Peripheral capillary oxygen saturation, EtCO2: End tidal Carbon dioxide, mm Hg: Milliliters of mercury, Postoperative VAS score, VAS Score: Visual Analogue Scale, HRS: Hours, Duration of postoperative analgesia, Total number of rescue analgesia. (Median and range)

## 4. Discussion

This case series demonstrates that a preoperative Inferior Alveolar Nerve Block (IANB) using the Conventional Halstead technique is a highly effective component of a multimodal analgesic regimen for patients undergoing ORIF for mandibular fractures.

Our findings indicate three principal benefits: profoundly prolonged postoperative analgesia, a dramatic resolution of trismus that facilitates routine airway management, and excellent intraoperative hemodynamic stability.

The most significant result is the extended median postoperative analgesic duration of 16 hours. This translated to a remarkably low opioid requirement; no patient needed additional intraoperative fentanyl, and only a single dose of non-opioid rescue analgesic was needed within the first 24 hours. This is a substantial improvement over traditional opioid-heavy regimens and directly addresses the known adverse effects of opioids and NSAIDs.[4,5] The reduction in median VAS score from 6 to 2 within 10 minutes of performing the block underscores its rapid and potent efficacy.

Furthermore, the resolution of trismus was clinically dramatic. The median 9 mm (56%) improvement in mouth opening transformed a potentially difficult airway scenario into a straightforward one, allowing for safe nasotracheal intubation using a conventional laryngoscope. This finding is consistent with other studies that advocate for nerve blocks to facilitate airway management in maxillofacial surgery,[9] and it potentially avoids the complications associated with awake fibreoptic intubation.[6]

The stable intraoperative hemodynamic parameters (HR, BP) further confirm the analgesic adequacy of the block throughout the surgical stimulus, minimizing the neuroendocrine stress response to surgery.

While literature exists on IANB in dental and oncological maxillofacial surgery, there is a distinct paucity of studies focusing on its application in isolated traumatic mandibular fracture repair.[2,7] Our case series helps fill this gap. The outcomes align with the established principle that regional anesthesia techniques provide superior pain control and reduce systemic analgesic consumption.

The promising findings of this study must be interpreted within the context of its limitations. The small sample size and the lack of a control group for comparison limit the generalizability of the results. The subjective nature of pain scoring (VAS) also introduces potential for bias. Future prospective, randomized controlled trials with larger cohorts are necessary to validate these promising findings.

This case series demonstrates that a preoperative inferior alveolar nerve block is a highly effective component of multimodal analgesia for mandibular fracture surgery. This technique demonstrates significant improvement in mouth opening, facilitates airway management, and provides effective prolonged postoperative analgesia. The findings support incorporating this block into standard practice for enhanced patient outcomes in mandibular procedures.

## 5. Conclusion

The Conventional Halstead technique proves to be an efficient method for IANB. Administering IANB prior to conventional general anesthesia not only enhances mouth opening but also helps maintain stable intraoperative hemodynamics and improves postoperative duration of analgesia. This, in turn, contributes to better postoperative recovery and overall patient outcomes. IANB holds the potential to be a game-changer as part of a multimodal analgesia strategy in mandibular ORIF.

## 6. Declaration of Patient Consent

Written informed consent was obtained from the patient for publication of this case series and any accompanying images.

## 7. Source of Funding

None.

## 8. Conflict of Interest

None.

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