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Original Research Article

THE EFFECT OF MANDIBULAR NERVE BLOCK IN MANDIBULAR FRACTURE TO IMPROVE AIRWAY ASSESSMENT

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ABSTRACT

Background: Trismus, caused by inflammation and muscle spasms, is a major challenge in airway management for mandibular fractures. The mandibular nerve, a branch of the trigeminal nerve, supplies the masticatory muscles. This study aimed to evaluate the effect of a mandibular nerve block on improving mouth opening and airway assessment in adults with mandibular fractures. **Materials and Methods:** Patients with mandibular fractures underwent a mandibular nerve block. Regional anaesthesia was administered to provide both sensory and motor blockade to the masticatory muscles. Airway assessment included evaluation of mouth opening and Mallampati scores. Pain was measured using a Visual Analogue Scale (VAS). The block's effects on complications, heart rate, blood pressure, and mean arterial pressure were observed for changes over set intervals after administration. **Result:** The mean age of the 40 patients was 40.43±11.28 years, the mean weight was 66.65±9.14 kg, and the mean BMI was 25.80±4.78 kg/m². The ASA grade was I in 52.5% and II in 47.5% of patients. Complications were minimal, with haematoma in 7.5% of patients, swelling in 2.5%, and none experienced facial nerve palsy or allergic reactions. Mallampati score before block was 4.00±0.00, after block 3.90±0.34 ($p=0.156$, not significant). No significant changes in heart rate were observed. Significant reductions in diastolic BP and MAP were observed after the block ($p<0.001$). Ninety percent of the patients experienced no post-block complications. **Conclusion:** Mandibular nerve block in patients with mandibular fractures improved airway assessment with minimal complications and reduced pain, diastolic blood pressure, and mean arterial pressure without affecting heart rate or causing major adverse events.

INTRODUCTION

Mandibular fractures are among the most common facial injuries, comprising 23-97% of facial fractures.[1] These injuries present challenges in reconstruction and airway management, particularly when immediate life-threatening complications arise.[2] The mandible, the only movable bone of the face, is prone to fractures that can alter its anatomy and compromise the airway.[3] Studies show a male predominance (3.7:1 to 7.3:1) in mandibular fractures, peaking in the ages of 21-30.[4,5] The parasymphysis and angle regions are the most affected, significantly impacting airway compromise owing to their connection with the mouth floor and tongue support structures.[5]

Airway obstruction can occur due to the posterior displacement of fractured segments, especially in bilateral mandibular fractures of the symphysis and parasymphysis regions. These fractures can cause tongue displacement and airway narrowing in the patient. The genial tubercle is crucial for maintaining tongue position and ensuring airway patency.[6,7] Displaced mandibular fractures significantly decrease total airway volume, with acute airway compromise requiring immediate intervention in 1.9% of cases.[2,6]

Trismus, a restricted mouth opening due to muscle spasm or mechanical limitation, is the primary challenge in airway management.8 Its pathophysiology involves inflammation, muscle spasms, mechanical obstruction, and pain. The masticatory muscles are innervated by the mandibular division of the trigeminal nerve.9 Post-fracture, inflammatory mediators trigger muscle spasms, whereas mechanical disruption causes sustained contracture.[8,9] The mandibular nerve carries sensory and motor fibres that innervate the masticatory apparatus. It originates from the trigeminal ganglion and supplies the muscles of mastication, teeth, gums, and the surrounding tissues.[10]

The anatomical relationship between the mandibular nerve and masticatory muscles provides a basis for using nerve blocks to address trismus.10 Blocking motor innervation interrupts muscle spasms that limit mouth opening in patients with mandibular fractures.1 The masticator space contains the masticatory muscles, mandibular ramus, and nerves. Airway assessment is vital in the management of trauma. Maxillofacial trauma causes distortion and bleeding, which complicates the airway. These patients often require fibreoptic bronchoscopy.[11] Improved mouth opening enables better oropharyngeal visualisation for injury assessment, detection of loose fragments and secretion removal. This facilitates conventional airway management, potentially avoiding the need for surgical intervention.[12]

Regional anaesthetic techniques in facial trauma management provide analgesia while preserving airway reflexes and allowing for neurological assessment. These blocks reduce systemic analgesic requirements, minimising the risk of respiratory depression in critically ill patients.[13] Mandibular nerve blocks provide both sensory and motor blockade, addressing pain and muscle spasms in trismus. This makes them valuable for the acute management of mandibular fractures.[1] Pain management in mandibular fractures is crucial for functional and safety issues. Uncontrolled pain worsens trismus through muscle spasms. The visual analogue scale (VAS) provides an objective pain measurement.[3,8] Patients typically present with VAS scores averaging 5.14 ± 1.37, which is sufficient to cause functional impairment. Higher initial pain scores were correlated with increased postoperative complications.[1,3]

The management of mandibular fractures presents challenges beyond orthopaedic reconstruction, including airway management. Anatomical disruption, pain, and muscle spasms create scenarios in which traditional airway approaches may be unsafe. The mandibular nerve block addresses pathophysiological mechanisms, providing analgesia and muscle relaxation to improve mouth opening. While current evidence is encouraging, it requires expansion through prospective studies in the future. This study evaluated the efficacy of mandibular nerve blocks by assessing mouth opening, pain scores, and complications.

Objectives

This study aimed to assess changes in inter-incisor distance, Mallampati score, and pain score (VAS) before and after the block at set intervals. It also aimed to compare haemodynamic parameters pre-block and 30 minutes post-block and document complications such as paraesthesia, haematoma, swelling, or facial nerve palsy.

MATERIALS AND METHODS

This prospective interventional study included 40 patients from the Department of Anesthesiology at Kanyakumari Government Medical College, India. Medical College, Asaripallam, Tamil Nadu, India, for one year and six months between January 2023 and July 2024. The study was approved by the Institutional Ethics Committee, and informed consent was obtained from all patients before the study initiation.

Inclusion Criteria

The study included patients aged 20–60 years, classified as ASA Physical Status I or II, who provided written informed consent. Eligible participants had unilateral mandibular fractures with restricted mouth opening.

Exclusion Criteria

Patients classified as ASA Physical Status III or IV, with known hypersensitivity to local anaesthetics, or with local site infections were excluded. Patients with disorientation due to associated head injury, absence of incisors, and females who were pregnant or breastfeeding were excluded from the study.

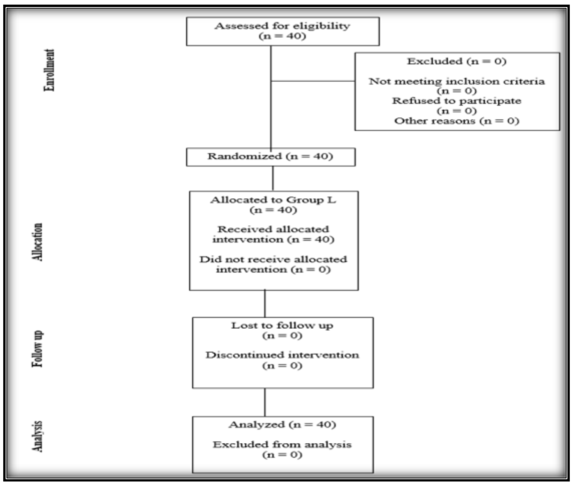

Figure 1: CONSORT flow chart

Methods: After the pre-anaesthetic assessment, the patients were shifted to the preoperative room, where the 10-point Visual Analogue Scale (VAS) was explained, with 0 denoting no pain and 10 denoting severe pain. In the block room, baseline monitoring was established, and the inter-incisor distance was measured using Vernier callipers. A mandibular nerve block was administered using a landmark-guided technique via the extraoral coronoid approach. The mandibular notch was palpated between the coronoid and condylar processes, below the zygomatic arch. At the notch's midpoint, approximately 1 cm anterior to the tragus, a skin wheal was raised.

A 22G Vygon intravenous cannula was inserted at a 30-degree angle towards the ala of the nose. The depth was marked upon hitting the lateral pterygoid plate. The needle was withdrawn, redirected posteriorly, and advanced to the marked depth near the mandibular nerve branch. Five millilitres of 0.5% bupivacaine was injected for post-block, the inter-incisor distance was measured, and pain scores were recorded at 2, 5, 10, 15, 20, 25, and 30 minutes. Patients were intubated following the ASA difficult airway algorithm, and general anaesthesia was induced using propofol, fentanyl, and succinylcholine.

Statistical analysis: Data were presented as mean, standard deviation, frequency and percentage. Continuous variables were compared using one-way analysis of variance (ANOVA) and post hoc tests. Significance was defined by P values less than 0.05 using a two-tailed test. Data analysis was performed using IBM-SPSS version 21.0.

RESULTS

Most patients were aged 46-60 years (17, 42.5%), followed by 31-45 years (13, 32.5%), and 20-30 years (10, 25.0%). The mean age of the patients was 40.43 ± 11.28 years. Regarding body weight, 15 (37.5%) patients weighed 71-80 kg, 14 (35.0%) 61-70 kg, and 11 (27.5%) 50-60 kg, with a mean of 66.65 ± 9.14 kg. Regarding height, 17 (42.5%) participants were above 1.6 meters, and the same proportion measured 1.51-1.6 meters. Six (15.0%) were below 1.5 m, and the mean height was 1.61 ± 0.19 m.

BMI was <23 in 10 (25.0%) patients, 23.1-27.0 in 16 (40.0%), and >27.0 in 14 (35.0%), with a mean of 25.80 ± 4.78 kg/m². Of the study population, 21 (52.5%) were ASA Grade I and 19 (47.5%) were ASA Grade II. Post-block complications were minimal, with haematoma in 3 (7.5%) patients, swelling in 1 (2.5%), no facial nerve palsy or allergic reactions, and the remaining 36 (90.0%) had no complications [Table 1].

Table 1: Demographic and clinical profile of patients

		N (%)
Age (years)	20 - 30	10(25.0%)
	31 - 45	13(32.5%)
	46 - 60	17(42.5%)
	Mean	40.43±11.28
Weight (kg)	50 - 60	11(27.5%)
	61 - 70	14(35.0%)
	71 - 80	15(37.5%)
	Mean	66.65±9.14
Height (in meters)	< 1.5	6(15.0%)
	1.51 - 1.6	17(42.5%)
	> 1.6	17(42.5%)
	Mean	1.61±0.19
BMI (Kg/m2)	< 23	10(25.0%)
	23.1 - 27.0	16(40.0%)
	> 27.0	14(35.0%)
	Mean	25.80±4.78
ASA grade	I	21(52.5%)
	II	19(47.5%)
Complications	Swelling	1(2.5%)
	Hematoma	3(7.5%)
	Facial nerve palsy	0
	Allergic reaction	0
	Nil	36(90%)

The mean Mallampati score before the mandibular nerve block was 4.00 ± 0.00, which slightly decreased to 3.90 ± 0.34 30 min post-block, with no significant difference (p = 0.156) [Table 2].

Table 2: Comparison of Mallampati score pre and post-block (30 minutes)

	Mean ± S.D.		**P value**
	Pre block	**Post block (30 minutes)**	
Mallampatti Score	4.00±0.00	3.90±0.34	0.156

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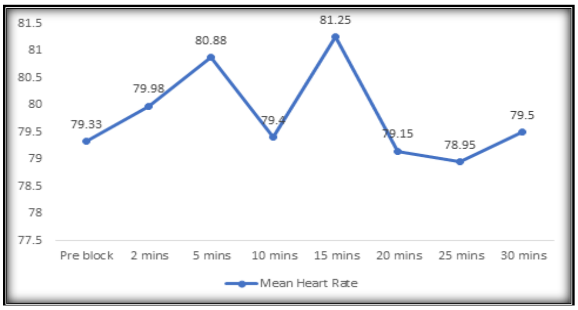

Figure 2: Comparison of mean Heart Rate

There were no significant changes in the mean heart rate from pre-block and after-block up to 30 min ($p > 0.05$) [Figure 2].

There was a significant reduction in the Systolic Blood Pressure (SBP) after block from 2 min to 30 min compared with the pre-block SBP ($p < 0.001$) [Figure 3].

There was a significant reduction in Diastolic Blood Pressure (DBP) after block from 2 to 30 min compared with pre-block DBP ($p < 0.001$) [Figure 4].

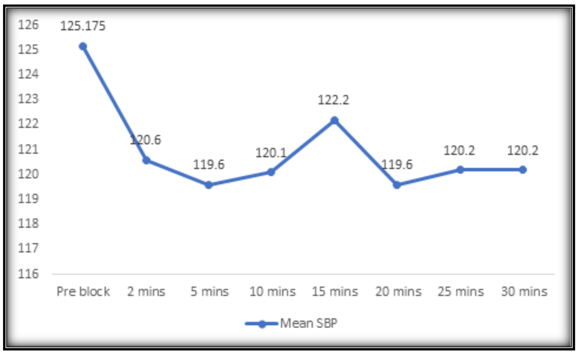

Figure 3: Comparison of mean SBP

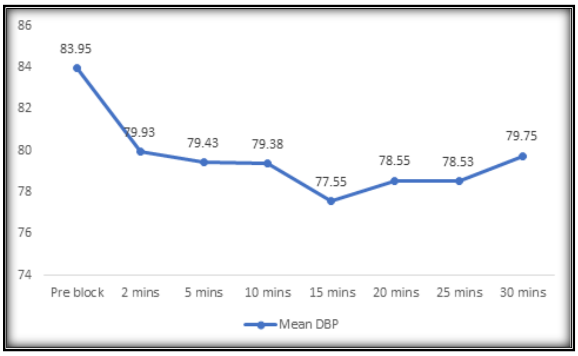

Figure 4: Comparison of mean DBP

There was a significant reduction in Mean Arterial Pressure (MAP) after block from 2 to 30 min compared with pre-block MAP ($p < 0.001$) [Figure 5].

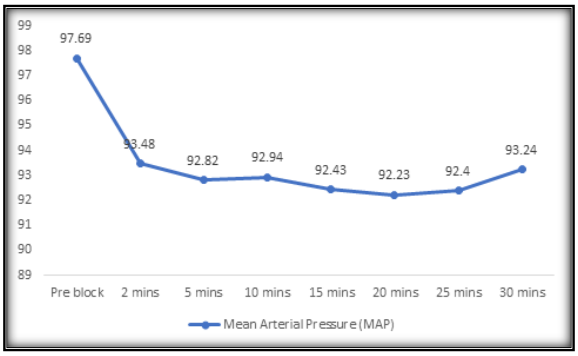

Figure 5: Comparison of mean MAP

There was a significant step-by-step increase in mouth opening after block from 2 to 30 min compared to the pre-block mouth opening value ($p < 0.001$) [Figure 6].

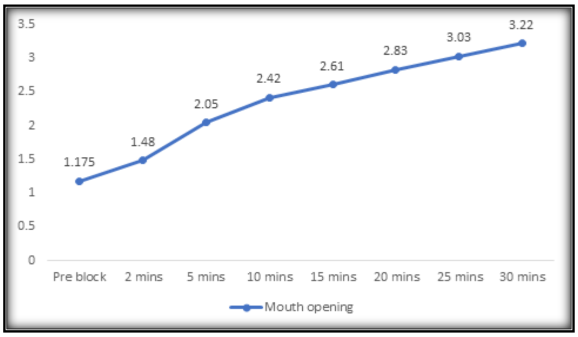

Figure 6: Comparison of mouth opening value

The VAS score (pain) was significantly decreased after block from 2 to 30 min compared to the pre-block pain score ($p < 0.001$) [Figure 7].

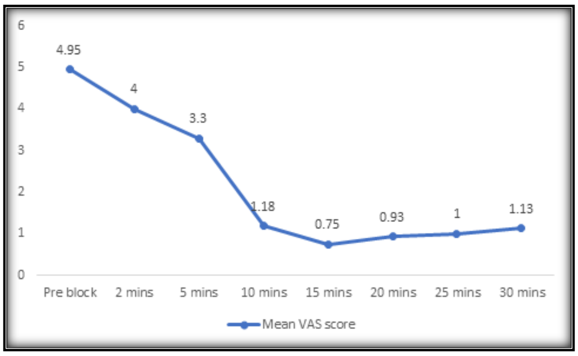

Figure 7: Comparison of pain (VAS) score

DISCUSSION

In our study, most patients were within the 46–60-year age group (42.5%), followed by 31–45 years (32.5%) and 20–30 years (25.0%) age groups, with a mean age of 40.43 ± 11.28 years. his demographic distribution differs notably from Prasad et al., who reported a younger patient population with a mean age of 27.02 ± 4.84 years in their mandibular nerve block study.1 Similarly, Zavlin et al. found a mean age of 34.0 ± 14.8 years in their multi-institutional analysis of mandibular fractures, which is closer to but still younger than our patients.[14]

The largest proportion in our study weighed between 71 and 80 kg (37.5%), while others weighed between 61 and 70 kg (35.0%) and 50 and 60 kg (27.5%), with a mean weight of 66.65 ± 9.14 kg. Regarding height, 42.5% were above 1.6 m and 42.5% between 1.51–1.6 m, with 15% below 1.5 m; the mean height was 1.61 ± 0.19 m. For BMI, 25% were below 23 kg/m², 40% between 23.1–27.0 kg/m², and 35% above 27.0 kg/m², with a mean BMI of 25.80 ± 4.78 kg/m². Prasad et al. reported a lower mean weight of 62.14 ± 9.58 kg, while Zavlin et al. documented a mean BMI of 23.6 ± 8.2, which is comparable to our mean BMI of 25.80 ± 4.78 kg/m².[1,14]

In our study, ASA grade I comprised 52.5% of the patients, and ASA grade II comprised 47.5% of the patients. Post-block complications included haematoma (7.5%) and swelling (2.5%), with no facial nerve palsy or allergic reactions; 90% had no complications. This distribution aligns well with Prasad et al., who included ASA grade I-II patients and is consistent with Zavlin et al., who reported that 84.4% of mandibular fracture patients were ASA class 1 or 2.1,14. Prasad et al., who observed higher complication rate; swelling in 2.3% and hematoma in 4.6% of patients.[1]

Regarding Mallampati scores, our study showed minimal change from 4.00 ± 0.00 pre-block to 3.90 ± 0.34 at 30 min ($p = 0.156$). This finding indicates that the mandibular nerve block has a limited impact on airway assessment parameters, which contrasts with the primary objective of improving airway evaluation. Our study reported significantly improved mouth opening from 1.175 pre-block to 3.22 mm at 30 min ($p < 0.001$), which is superior to the improvement reported by Prasad et al., who documented an increase from 1.20 ± 0.32 mm to 2.35 ± 0.26 mm at 30 min.1 Similarly, Heard et al. reported that maximal inter-incisor distance improved following mandibular nerve block but plateaued after general anaesthesia, highlighting the block's role in pre-induction airway optimisation.[16] Our findings further support the early effectiveness of the block in facilitating airway access.

The consistently high Mallampati scores in our patients reflect the severity of trismus associated with mandibular fractures, where traditional airway assessment tools may have limited utility.[15] Heard et al. demonstrated that the maximal inter-incisor distance significantly improved following the mandibular nerve block, with median values increasing from 16.5 mm (range: 14–30 mm) to 34 mm (range: 32–35 mm; $p = 0.027$). However, no additional improvement was noted after induction of general anaesthesia, as the post-induction median remained comparable at 37 mm (range: 30–40 mm; $p = 0.276$) when compared to the post-block measurement. Our study observation support with findings by Heard et al., who also noted that while mandibular nerve block improved mouth opening, it did not consistently translate into significant changes in Mallampati classification, likely due to persistent oropharyngeal structural limitations in trauma patients.[16]

In our study, heart rate remained stable throughout (means 79.33-81.25) with no significant difference between the pre- and post-block values ($p > 0.05$). Significant reductions occurred in systolic blood pressure from a pre-block mean of 125.18 ($p < 0.001$), diastolic blood pressure from 83.95, and mean arterial pressure from 97.69 to 93.24 at 30 min ($p < 0.001$). This finding is consistent with Prasad et al., who similarly reported no significant haemodynamic changes in their study.1 Misbah et al. reported significant variations in blood pressure and pulse rate across four stages, with most patients showing normal blood pressure in stage 1 (120/80 mmHg), progressing to stage 1 hypertension (139/89 mmHg) in stages 2–4, and stage 2 hypertension (140/90 mmHg) in stages 3 and 4. A small proportion (1.3%) experienced hypertensive crisis in stage 4, while pulse rate predominantly remained normal, followed by episodes of tachycardia and bradycardia. Misbah et al. observed more variable haemodynamic responses with lidocaine-adrenaline blocks, suggesting that bupivacaine-based mandibular nerve blocks may offer more stable cardiovascular profiles during the perioperative period.[17]

The VAS pain scores in our study decreased from 4.95 to 1.13 ($p < 0.001$), which is comparable to the results of Prasad et al., who reported a reduction from 5.14 ± 1.37 to 1.12 ± 0.80.1 This consistent finding across studies confirms the excellent analgesic efficacy of the mandibular nerve block in managing pain associated with mandibular fractures.[18,19] Heard et al. observed a significant reduction in pain scores ($p = 0.027$) without any reported adverse effects, suggesting that preoperative mandibular nerve block effectively alleviates trismus related to pain and muscle spasm.16 Similarly, Prasad et al. documented a rapid decrease in VAS scores within 2 minutes of the block, confirming its analgesic efficacy.[1]

In a randomised trial by Rajagopalan et al., similar reductions in VAS scores were reported after mandibular nerve block, underscoring its analgesic efficacy in acute trauma settings.[18] These converging results reinforce the role of regional anaesthesia in perioperative pain control for mandibular fractures.

CONCLUSION

This study concludes that mandibular nerve block effectively reduces pain and facilitates airway assessment by significantly increasing inter-incisor distance, thereby supporting anaesthetic planning. The observed reduction in MAP likely reflects the analgesic effect of the block. Given its safety, ease of administration, and clinical utility, the technique may be considered as part of standard management in patients with mandibular fractures.

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