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Original Research Article

POST-OP ANALGESIA WITH INFERIOR ALVEOLAR NERVE BLOCK IN MANDIBULAR FRACTURES COMPARISON OF BUPIVACAINE AND ROPIVACAINE

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ABSTRACT

Background: Postoperative pain relief is challenging owing to the side effects of opioids, such as nausea and drowsiness. Effective management aims to minimise pain with fewer side effects. This study aimed to evaluate postoperative analgesia with inferior alveolar nerve block for mandibular fractures and to compare 0.25% bupivacaine and 0.2% ropivacaine. **Materials and Methods:** This prospective randomised comparative study included 60 patients at Mahatma Gandhi Memorial Government Hospital, attached to K.A.P.V. Govt. Medical College, Trichy, 2019–2020. Patients were divided into group B, which received 0.25% bupivacaine, and group R, which received 0.2% ropivacaine for inferior alveolar nerve blocks, both alongside standard intraoperative analgesia. General anaesthesia was induced and maintained, with continuous monitoring of vital signs. **Result:** Age, weight, and height of groups B and R were not significantly different (p=0.783, p=0.448, and p=0.526, respectively). The mean duration of analgesia was significantly higher in group R (318±11.23 min) than in group B (226±11.97 minutes) (p<0.0001). Patient satisfaction scores were significantly higher in group R (9.20±0.48) than in group B (7.6±0.49) (p<0.0001). Pulse rates were similar preoperatively (p=0.285), but showed significant differences postoperatively, with ropivacaine resulting in lower rates at time points (p<0.0001). The blood pressure was significantly lower in group R (p<0.0001). The NRS scores were significantly lower in group R than in group B at 4 and 6 hours postoperatively (p<0.0001). **Conclusion:** Preoperative IANB with 0.2% ropivacaine provided superior postoperative analgesia, greater hemodynamic stability, and higher patient satisfaction than 0.25% bupivacaine in patients undergoing surgical unilateral mandibular fractures under general anaesthesia, suggesting that ropivacaine may be preferable for pain management.

INTRODUCTION

Postoperative pain relief remains a significant challenge, with opioid use limited by side effects like nausea, vomiting, drowsiness, pruritus, and urinary retention.[1] Effective postoperative pain management aims to eliminate pain and discomfort with minimal adverse effects, using methods that are straightforward, economical, and easily implementable.[2] The inferior alveolar nerve, a major branch of the trigeminal nerve, provides sensory innervation to a significant portion of the face.[3] Blocking this nerve with local anaesthetics can offer effective postoperative analgesia, reducing the need for opioids and their associated side effects.[4]

Managing postoperative pain after mandibular fracture surgery involves addressing intense pain while minimizing opioid-related complications. If not managed properly, severe discomfort can hinder recovery and potentially lead to chronic pain. The inferior alveolar nerve block (IANB) is a common technique for local anaesthesia in dental and maxillofacial procedures.[5] It involves injecting a local anaesthetic near the mandibular foramen to block the inferior alveolar nerve, which supplies

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sensation to the mandible, lower teeth, and associated structures.[6]

Bupivacaine and ropivacaine are long-acting local anaesthetics commonly used for postoperative analgesia following IANB.[7] This study compares bupivacaine at 0.5% and 0.25% with ropivacaine at 0.5% and 0.375% to evaluate their effectiveness in providing postoperative analgesia. Bupivacaine is known for its potent analgesic properties but has a higher risk of cardiovascular toxicity compared to ropivacaine, which has a more favourable safety profile and fewer side effects while still providing effective pain relief.[7,8]

Local anaesthetics, such as bupivacaine and ropivacaine are integral to multimodal pain management strategies. Their use in regional nerve blocks, particularly IANB, allows targeted analgesia in mandibular procedures. Both provide effective pain relief, but their pharmacological profiles differ: bupivacaine is more potent but carries a higher risk of cardiotoxicity, while ropivacaine is considered safer with fewer systemic side effects.[1,2] Reducing opioid use is critical in managing postoperative pain following mandibular fractures due to the potential for adverse effects that can complicate recovery; therefore, optimizing local anaesthetic techniques is essential for improving patient outcomes and minimizing reliance on opioids.[9,10]

Aim

This study aimed to evaluate postoperative analgesia with inferior alveolar nerve block for mandibular fractures and to compare 0.25% bupivacaine and 0.2% ropivacaine.

MATERIALS AND METHODS

This prospective randomised comparative study included 60 patients who underwent general anaesthesia for unilateral mandibular fractures at the Department of Oral and Maxillofacial Surgery and Plastic Surgery at Mahatma Gandhi Memorial Government Hospital, attached to the K.A.P.V. Government Medical College, Trichy, 2019–2020. This study was approved by the Institutional Ethics Committee before initiation, and informed consent was obtained from all patients.

Inclusion Criteria

Patients with ASA physical status 1-2, posted for unilateral mandibular fracture surgery, aged between 18-60 years, and BMI of 17–35 kg/m2 were included.

Exclusion Criteria

Patients who refused to block, polytrauma, need for postoperative ventilation, hepatic, renal, or respiratory disease, bleeding disorder, local infection at the puncture site, systemic infection, hypersensitivity to study medications, peripheral neuropathy or neurological deficits, pregnancy and breastfeeding, history of psychiatric diseases, convulsions, drug abuse, or chronic pain disorder were excluded.

Methods

The patients were divided into groups B and R. Group B (n=30) patients were given an injection of fentanyl 2µg/kg was used routinely in all cases as an intraoperative analgesic, and an inferior alveolar nerve block was administered 0.25% bupivacaine (6 ml). Group R (n=30) patients were administered fentanyl 2µg/kg was used routinely for all cases as an intraoperative analgesic and an inferior alveolar nerve block was administered with 0.2% ropivacaine (6 ml).

Patients were premedicated with Injection of Glycopyrrolate 0.2 mg IV, and Injection Midazolam 1 mg IV before being transferred to the operation theatre. After positioning and connecting the monitors, patients were pre-oxygenated with 100% oxygen for 3 min. The standard analgesic dose of Injection Fentanyl 2 µg/kg IV was administered followed by induction with Injection of Thiopentone (5 mg/kg), and Injection of Succinylcholine (2 mg/kg). General anaesthesia was maintained with oxygen, nitrous oxide, and isoflurane as volatile anaesthetics, while muscle relaxation was achieved using Injection Atracurium 0.5 mg/kg IV. Continuous monitoring of vital signs, including pulse oximetry, non-invasive blood pressure, ECG, EtCO2, respiratory rate, and heart rate, was conducted, and patients were subjected to the landmark technique.

Technique

The patient was positioned supine, and the head was positioned such that when the mouth was wide, the body of the mandible was parallel to the floor. The mouth was opened with the help of oral tongue blade toileting, and under strict aseptic precaution, the index finger or thumb was used to palpate the external oblique ridge on the anterior border of the ramus of the mandible, and the coronoid notch was identified. The palpating finger moved lingually across the retromolar trigone and on the internal oblique ridge. While palpating intraoral marks with the thumb, the index finger is placed extra orally behind the ramus of the mandible to access the anteroposterior width of the ramus of the mandible. A syringe with a 22-gauge needle was then inserted parallel to the occlusal plane of the mandibular teeth at a level bisecting the finger, penetrating the pterygomandibular space.

The needle penetrates the tissues until the bone gently contacts the internal surface of the ramus of the mandible. The needle was withdrawn by 1 mm and aspirated, and on negative aspiration, 6 ml of 0.2% ropivacaine or 6 ml of 0.25% bupivacaine was slowly deposited over 1 min. At the end of the procedure, a sterile dressing was applied, and surgery was commenced. After surgery, the neuromuscular blockade was reversed, and the patient was extubated and transferred to the post-anaesthesia care unit. Before induction of anaesthesia, patients are explained how to use a Numerical pain Rating Scale (NPRS-0 with end-point labelled “no pain” and “10 to worst conceivable pain”). The duration of analgesia with the block and the degree of

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postoperative pain between both the drug groups were assessed at 2, 4, and 6 h using the NPRS score, which is a marker of primary outcome measure.

Patient tolerability and satisfaction score

The rates of patient tolerability and satisfaction with the procedure were ranked as follows: satisfaction scores were recorded on a 10-point scale, with zero being very unsatisfied and 10 being completely satisfied.

Numerical pain rating scale

Assessment of the level of pain (on a numeric pain rating scale) and the time of rescue analgesia were administered if the NPRS score was > 4.

Data Collection

Age, anthropometric measures, blood pressure, pulse rate, pain score (NRS 0-10), duration of pain relief, and patient satisfaction score (0-10).

Statistical Analysis

Data were collected, entered, and double-checked using a Microsoft Excel spreadsheet. Data analysis was performed using IBM SPSS version 21.0. Data are presented as mean and standard deviation. Continuous variables were compared using an independent-sample t-test. Statistical significance was set at $p<0.05$.

RESULTS

Table 1: Comparison of demographic details between groups

	Group B (Bupivacaine)	Group R (Ropivacaine)	P value
Age	35.5±12.05	36.33±11.29	0.783
Weight in kg	59.07±5.05	60.07±5.08	0.448
Height in cm	160.07±6.16	160.93±4.16	0.526
Duration of pain relief (in minutes)	226.50±11.97	318.50±11.23	<0.0001
Patient's satisfaction score	7.63±0.49	9.20±0.48	<0.0001

Comparison of age, weight, and height between the two groups showed no statistically significant differences (p=0.783, p=0.448, and p=0.526, respectively). The mean duration of analgesia for group B was 226±11.97 minutes and the mean duration of analgesia for group R was 318±11.23 minutes. The mean patient satisfaction score for group B (Bupivacaine) was 7.6±0.49 and for group R (Ropivacaine) was 9.20±0.48. The differences in the duration of analgesia and patient satisfaction scores between the two groups were statistically significant (p<0.0001). [Table 1]

Table 2: Comparison of pulse rate, SBP, DBP, and numerical rating scale score between groups

		Group B (Bupivacaine)	Group R (Ropivacaine)	P value
Pulse rate (in min)	Pre-op	100.27±6.64	102.07±6.27	0.285
	At the end of surgery	76.87±4.92	73.53±4.57	0.009
	2 h	78.73±3.54	74.07±2.90	<0.0001
	4 h	97.67±3.64	87.87±6.37	<0.0001
	6 h	78.73±3.54	76.60±4.34	0.041
Systolic blood pressure (in mins)	Pre-op	138.07±5.89	137.33±4.34	0.589
	At the end of surgery	109.53±4.54	105.27±3.30	<0.0001
	2 h	108.27±3.39	105.07±3.05	<0.0001
	4 h	130.93±4.23	125.07±3.70	<0.0001
	6 h	108.27±3.39	106.33±3.20	0.027
Diastolic blood pressure (in mins)	Pre-op	85.73±4.78	86.80±5.16	0.41
	At the end of surgery	66.33±66.20	66.20±65.40	0.884
	2 h	65.40±62.73	62.73±2.43	<0.0001
	4 h	76.13±3.19	71.60±3.54	<0.0001
	6 h	65.40±2.42	62.33±2.17	<0.0001
Numerical rating scale score	At the end of surgery	0	0	n/a
	2 h	1.17±0.75	1.03±0.67	0.469
	4 h	4.47±0.51	3.20±0.71	<0.0001
	6 h	6.37±0.49	4.97±0.18	<0.0001

The pulse rate was not significantly different preoperatively (p=0.285), but significant differences emerged at the end of surgery (p=0.009), 2 hours (p<0.0001), 4 hours (p<0.0001), and 6 hours postoperatively (p=0.041), with ropivacaine showing a generally lower pulse rate than bupivacaine. Systolic blood pressure was not significantly different preoperatively (p=0.589), but ropivacaine showed significantly lower systolic blood pressure at the end of surgery and up to 6 h postoperatively (p<0.0001). At 6 h, the difference remained statistically significant (p=0.027).

Diastolic blood pressure was not significantly different preoperatively (p=0.41) or immediately postoperatively (p=0.884); however, significant differences were observed at 2, 4, and 6 h postoperatively (p<0.0001), with ropivacaine consistently showing lower diastolic pressures. The difference in the numerical rating scale (NRS) between the two groups was statistically significant (p<0.0001 at 4 and 6 h). [Table 2]

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DISCUSSION

In our study, 60 patients who underwent elective unilateral mandibular fracture surgery under general anaesthesia were randomly divided into two groups: group B and group R. A dose of 6 ml was fixed in both groups, as the area to be blocked had a confined space. Group B received an inferior alveolar nerve block with 0.25% bupivacaine 6 ml and group R received an inferior alveolar nerve block with 0.2% ropivacaine 6 ml.

The analgesic efficacy of the two groups was compared based on postoperative hemodynamic and pain assessments using a numerical rating scale. The demographic profile in both groups in terms of age, height, and weight showed no statistically significant differences; hence, both groups were comparable in the above-mentioned parameters.

In group B (bupivacaine), there was a statistically significant difference in the increase in systolic blood pressure compared to group R (ropivacaine) at the end of the surgery and at the 2nd and 4th hours postoperatively, suggesting that group B patients showed a statistically significant increase in systolic blood pressure compared to group R patients in the postoperative period.

In group B, there was a slight increase in diastolic blood pressure postoperatively compared to group R (ropivacaine) at 2, 4, and 6 h postoperatively. Hence, we inferred that group B showed a statistically significant increase in diastolic blood pressure during the postoperative period compared to that in group R.

In group R, we inferred that the decrease in pulse rate in group R was statistically significant in the postoperative period compared to that in group B.

Shetmahajan et al. reported that 49 patients had comparable age, sex, ASA physical status, baseline heart rate (HR), and blood pressure (BP). The mean intravenous fentanyl requirement during primary tumour excision in the IANB arm was 70 µg (32 µg), which was significantly lower than the 183 µg (48 µg) requirement in the control arm ($p<0.001$). The mean maximum HR during primary tumour excision was 82 and 99 per minute in the IANB and control arms, respectively ($p<0.001$), whereas the maximum mean BP was 88 and 101 mmHg, respectively ($p<0.001$).[11]

In our study, group B (bupivacaine) showed an early increase in NRS scores in the postoperative period, while group R (ropivacaine) showed a delayed and mild increase in NRS scores in the postoperative period. Hence, we inferred that the NRS scores were significantly lower in group R than in group B, according to statistical observations. Patients who received an inferior alveolar nerve block with 6 ml of 0.2% ropivacaine had a longer duration of analgesia of approximately 320 min postoperatively when compared to patients who received the block with 6 ml of 0.25% bupivacaine, which lasted for approximately 220 min.

Hickey et al. showed that the mean onset time for analgesia ranged from 11.2 to 20.2 min, and the mean onset time for anaesthesia ranged from 23.3 to 48.2 min. The onset of motor block differed only for paresis of the hand, with bupivacaine demonstrating a shorter onset time than ropivacaine. The mean duration of analgesia ranged from 9.2 to 13.0 h, and the mean duration of anaesthesia ranged from 5.0 to 10.2 h. Both groups required supplementation with peripheral nerve blocks or general anaesthesia in many cases, with nine of the 22 patients in the bupivacaine group and eight of the 22 patients in the ropivacaine group requiring supplementation to allow surgery to begin.[12]

CONCLUSION

An inferior alveolar nerve block with 0.2% ropivacaine administered preoperatively provided greater hemodynamic stability in the perioperative period, and the duration of analgesia was longer than that with 0.25% bupivacaine, thereby reducing postoperative pain and the need for additional analgesics during the postoperative period in patients undergoing surgical correction of orofacial and mandibular fractures under general anaesthesia.

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