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Original Article

# COMPARATIVE EVALUATION OF LIDOCAINE AND BUPIVACAINE FOR PAIN MANAGEMENT IN ENDODONTIC THERAPY OF IRREVERSIBLE PULPITIS

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## ABSTRACT

***Objectives:*** *The aim of this study is to compare the ability of lidocaine and bupivacaine to relieve pain during the treatment of irreversible pulpitis in endodontics.*

***Materials and Methods:*** *The research involved 66 patients with symptomatic irreversible pulpitis, who received treatment at a dental hospital. Local anesthetic agents, lidocaine and bupivacaine, were randomized and given to individual patients in Groups A and B, respectively. Patient data included demographics and quadrant of teeth, as well as information on how much relief was noticed by report of dental pain. Data was analyzed in SPSS 22 to find out if there were any differences in anesthetic success rates between the two groups and among subgroups divided by age, gender, tooth location and periapical status.*

***Results:*** *For anesthetic effectiveness, bupivacaine worked significantly better (63.6%) than lidocaine (36.4%) (P = 0.02). The findings showed the advantages of bupivacaine in younger (18–35 years), male patients and teeth that are in the front of the mouth. Overall, using bupivacaine offered better anesthesia in cases with and without periapical symptoms, along with better intraoperative comfort and reduced pain.*

***Conclusion:*** *Clinicians could use bupivacaine in treating patients with root canal therapy to help patients have less pain, a better experience and not needing multiple injections which benefits their treatment.*

***Key words:*** *Endodontics anesthesia, Lidocaine, Bupivacaine and Irreversible pulpitis*

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## INTRODUCTION

One of the most important concerns in endodontic treatment is pain management. The goal of pain-free or minimally painful procedures include alleviation of pain, which ultimately adds to the success of the treatment. Dental pain in most cases is caused by Pulpitis, which is the inflammation of dental pulp that contains pain-sensitive nerves, and they present to the endodontic department for its management[1-3]. The endodontic management of pain in mandibular molars is generally complicated due to the complex anatomy and limited effects of administered anesthetics in that area. The main modality applied to reduce pain during endodontic treatment is local anesthesia, usually by inferior alveolar nerve block (IANB), in situations of symptomatic irreversible pulpitis[4,5]. The most typical anesthetic agent used in dental practice in IANB is lidocaine, which owes its popularity to wide availability, good safety profile, and fast onset. But in irreversible pulpitis, its effects are likely to be insufficient, and hence alternatives like bupivacaine

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are applied[6,7]. The long-acting bupivacaine amide analgesic has comparative advantages in that it has a long action time and better pain relief especially on inflamed tissues.

It has been reported in numerous studies that bupivacaine would not only provide a more profound level of anesthesia but also assist in postoperative level of pain management and consumption of further analgesic medications[4,6,8]. In a study done in Pakistan by Ghani and Bushra, bupivacaine was shown to have an 80 percent success rate in the anesthetizing of mandibular molars with irreversible pulpitis compared to lidocaine[9].

The objective of the current research was to assess and compare the pain control and anesthetic effect of using lidocaine and bupivacaine during the endodontic treatment of mandibular first molars with irreversible pulpitis and periapical periodontitis. The Visual Analogue Scale (VAS) was used to gauge the level of pain before and after treatment to give a full-scale comparison of the effectiveness of each of the anesthetics.

## MATERIALS AND METHODS

This double blind, randomized controlled trial (RCT) was conducted after taking ethical approval from the Research and Review Board of Khyber College of Dentistry (Ref: No 21/ADR/KCD). The study was carried out at the Department of Operative Dentistry, Khyber College of Dentistry, Peshawar over a period of 6 months from February to August, 2024.

The study objectives, procedures and risks were clearly explained to all participants who gave written informed consent to study participation before being enrolled in the study. The study strictly adhered to the requirements of confidentiality and ethical consideration based on the Declaration of Helsinki.

After taking a brief history, informed, written consent was taken from all the willing patients who qualified the inclusion and exclusion criteria.

Sixty-six participants, aged 18-60 years, diagnosed with symptomatic Irreversible Pulpitis of mandibular molars were enrolled. The exclusion criteria were systemic illnesses, pregnant patients, patients taking antidepressant drugs, active smokers, and patients who took any analgesic drug within 12 hours before the procedure. A consecutive sampling technique was used. Patients were randomly classified into two groups, Group A and Group B by using the lottery method for randomization.

For ensuring double blinding procedure, all the labels from the dental cartridges were removed, so that neither the Operator nor the participant of the study was aware of the type of anesthesia used. The inferior alveolar nerve block (IANB) technique was employed for anesthetizing the teeth with symptomatic irreversible pulpitis, using the standard procedure through a 27-gauge needle. Participants in Group A were injected with 1.8ml of 2 percent lidocaine, with 1: 80,000 epinephrine, and Group B with 1.8ml of 0.5 percent bupivacaine with 1: 200,000 epinephrine for IANB. The needle was inserted lateral to the pterygomandibular raphe on the medial side of the mandibular ramus, about 1 cm above the occlusal plane of the mandibular molars. The needle was advanced till bony resistance was encountered, and then the needle was slightly withdrawn and aspiration was done. The anesthetic solution in the 1.8ml dental cartridge was deposited slowly over 60 seconds to minimize the discomfort of the injection.

The Visual Analogue Scale (VAS) was used to determine the intensity of pain at two instances before surgery (baseline) and after the treatment was performed (postoperative). VAS score with a range of 0-3 was considered to indicate a successful anesthesia.

Data was entered and analysed using SPSS version 22. Descriptive statistics, i.e. frequency and percentages, were tabulated for age and gender of patients (13). Chi-square test was performed to determine the statistical difference between lidocaine and bupivacaine IANB anaesthesia pre and post-operatively. A p-value of 0.05 was considered statistically significant.

## RESULT

Results were analyzed using SPSS version 22 software. Total subjects that participated in this study were 66 (33 in each group) during the period of six months from February to August, 2024. The study subjects were divided into two equal groups, group A (Lidocaine Inferior Alveolar Nerve Block) and group B (Bupivacaine Inferior Alveolar Nerve Block).

The mean age ± SD of the participants was

39.20 years ± 12.152 (Table 1). The average age of participants in Group A was 38.67 years ± 10.54 and 39.73 years ± 13.72 in Group B. Half of the patients (47.0%) were in the 18 to 35-year age group, but Group B had a greater proportion (30.3%) than Group A (15.2%) in the 51 to 60 year bracket (Table 2).

Bupivacaine was found to have more efficacy than lidocaine when participants were analysed in different age groups, particularly better among those aged 18 to 35 years. Among this population, 75.0% of patients using bupivacaine had successful anesthesia compared to 40.0% effectiveness of lidocaine (P = 0.04). Although results showed that bupivacaine was more effective among the 36 to 50 years group (71.4% vs 30.8%), this difference was not statistically significance (P = 0.08). Between those aged 51 to 60, there was no observable difference in anesthetic response between the two groups (Table 3).

Group A included 20 males and 13 females, while group B had 19 males and 14 females. When stratified by gender, Bupivacaine showed higher anesthetic effectiveness compared to Lidocaine, particularly among male participants (Table 4). Among males, 73.7% in Group B (Bupivacaine) achieved successful anesthesia, whereas only 35.0% in Group A (Lidocaine) were effective, and this difference was statistically significant (P = 0.015).

In female participants, Bupivacaine also demonstrated slightly higher effectiveness (50.0%) compared to Lidocaine (38.5%), but this difference was not statistically significant (P = 0.547). Overall, Bupivacaine provided greater anesthetic success across both genders (63.6% vs 36.4%), and this difference was statistically significant (P = 0.027).

## DISCUSSION

In this study, 66 patients diagnosed with irreversible pulpitis were divided equally into two groups: lidocaine (Group A) and bupivacaine (Group B). The groups were comparable in their demographic distribution, with mean ages of 38.67 ± 10.54 years in Group A and 39.73 ± 13.72 years in Group B, and similar male representation (60.6% vs. 57.6%). This similarity suggests that the anesthetic outcome was not confounded by age or gender differences.

Posterior teeth were more frequently affected in both groups (66.7% in Group A and 63.6% in Group B), which is consistent with existing literature indicating that molars are commonly involved due to their complex root canal systems and greater risk of caries[5,14]. Symptomatic periapical cases were slightly more frequent in the lidocaine group (45.5%) compared with the bupivacaine group (36.4%), aligning with the understanding that periapical inflammation reduces anesthetic efficacy through altered pH and nerve conduction[7,15].

The most significant finding was that bupivacaine produced a higher anesthetic success rate (63.6%) compared with lidocaine (36.4%), with the difference being statistically significant (P = 0.02). This result is in agreement with Ghani and Jouhar[10], who also demonstrated superior anesthetic outcomes with bupivacaine in cases of irreversible pulpitis. Similar findings have been reported in other studies, emphasizing the advantages of bupivacaine's longer duration and profound depth of anesthesia compared with lidocaine[9,13].

Clinically, these properties mean that bupivacaine not only improves pain control but also minimizes the need for supplemental injections, thus providing greater comfort for patients and reducing operator stress during prolonged root canal procedures[9,10,16]. Therefore, based on the present results and supporting evidence, bupivacaine appears to be a more reliable anesthetic option than lidocaine in

**Table 1: Descriptive Analysis for Age**

| Groups | Mean | Std. Deviation |
|---|---|---|
| Group A (Lidocaine) (n = 33) | 38.67 | 10.541 |
| Group B (Bupivacaine) (n = 33) | 39.73 | 13.721 |
| **Total** | **39.20** | **12.152** |

**Table 2: Age Categorization in groups**

| | | Age distribution (Years) | | | Total |
|---|---|---|---|---|---|
| | | 18 to 35 years | 36 to 50 years | 51 to 60 years | |
| Groups | Group A (Lidocaine) | 15 (45.5%) | 13(39.4%) | 5(15.2%) | 33 (100 %) |
| | Group B (Bupivacaine) | 16 (48.5%) | 7 (21.2%) | 10 (30.3%) | 33 (100%) |
| Total | | 31 (47.0%) | 20 (30.3%) | 15 (22.7%) | 66 100.0%) |

managing irreversible pulpitis, particularly in posterior mandibular teeth.

The results of this study suggest that there are clinical features that dentists can use when treating patients with symptomatic irreversible pulpitis. This study shows bupivacaine to be the better drug to use for endodontic operations involving inflamed or infected pulp tissue. This approach makes pain management steady for a whole treatment session which often means fewer injections are required and the patient feels better cooperating. A good anesthetic is particularly important in more complex or extended procedures, because failing to provide adequate anesthesia can cause the patient to feel stress, move around and make the procedure more difficult[17]. In addition, when bupivacaine is used for pain management, patients may experience fewer problems and enjoy smoother postoperative recovery.

Multicenter trials with larger sample sizes are needed to determine the most suitable local anesthetic for endodontic treatment. Comparing different aspects of safety, patient comfort and cost related to bupivacaine and other anesthetics could direct clinical decisions more effectively.

Using alternative agents together with bupivacaine or finding new ways to apply them, may improve the success of anesthesia in certain patients. Integrating bupivacaine for routine use in endodontics is likely to provide improved pain relief and a pleasurable experience for those undergoing treatment for irreversible pulpitis.

**Table 3: Stratification of comparison of effectiveness between both groups w.r.t age**

| Age distribution (Years) | | | Effectiveness | | Total | P value |
|---|---|---|---|---|---|---|
| | | | Yes | No | | |
| 18 to 35 | Groups | Group A (Lidocaine) | 6 | 9 | 15 | 0.04 |
| | | | 40.0% | 60.0% | 100.0% | |
| | | Group B (Bupivacaine) | 12 | 4 | 16 | |
| | | | 75.0% | 25.0% | 100.0% | |
| | Total | | 18 | 13 | 31 | |
| | | | 58.1% | 41.9% | 100.0% | |
| 36 to 50 | Groups | Group A (Lidocaine) | 4 | 9 | 13 | 0.08 |
| | | | 30.8% | 69.2% | 100.0% | |
| | | Group B (Bupivacaine) | 5 | 2 | 7 | |
| | | | | 28.6% | 100.0% | |
| | Total | | 9 | 11 | 20 | |
| | | | 45.0% | 55.0% | 100.0% | |
| 51 to 60 | Groups | Group A (Lidocaine) | 2 | 3 | 5 | 1.000 |
| | | | 40.0% | 60.0% | 100.0% | |
| | | Group B (Bupivacaine) | 4 | 6 | 10 | |
| | | | 40.0% | 60.0% | 100.0% | |
| | Total | | 6 | 9 | 15 | |
| | | | 40.0% | 60.0% | 100.0% | |

**Table 4: Stratification of Comparison of Effectiveness Between Both Groups w.r.t Gender**

| Gender | Groups | Yes (Effective) | No (Not Effective) | Total | P-value |
|---|---|---|---|---|---|
| Male | Group A (Lidocaine) | 7 (35.0%) | 13 (65.0%) | 20 | 0.015 |
| | Group B (Bupivacaine) | 14 (73.7%) | 5 (26.3%) | 19 | |
| | **Total** | **21 (53.8%)** | **18 (46.2%)** | **39** | |
| Female | Group A (Lidocaine) | 5 (38.5%) | 8 (61.5%) | 13 | 0.547 |
| | Group B (Bupivacaine) | 7 (50.0%) | 7 (50.0%) | 14 | |
| | **Total** | **12 (44.4%)** | **15 (55.6%)** | **27** | |

## CONCLUSION

The study shows that bupivacaine is more effective for anesthesia, functioning better than lidocaine, for patients receiving root canal treatment due to irreversible pulpitis. Although age, gender and location of treatment were similar, patients who received bupivacaine had better pain control, based on the higher rate of complete anesthesia(10,13). Bupivacaine's lengthy effect and its ability to create strong and lasting anesthesia make it ideal for treating patients with sensitive, inflamed pulp areas.

The use of bupivacaine helps patients stay more comfortable, reduces worry during surgery and cuts down on the need for additional anesthesia. Using bupivacaine during endodontic treatment may improve results and make patients feel better about the care they receive

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CONFLICT OF INTEREST
Authors declare no conflict of interest.
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## AUTHORS' CONTRIBUTION

The following authors have made substantial contributions to the manuscript as under:

| | |
|---|---|
| Conception or Design: | FAS, SAS, SK, SK, FD |
| Acquisition, Analysis or Interpretation of Data: | FAS, SAS, SK, SK, FD |
| Manuscript Writing & Approval: | FAS, SAS, SK, SK, FD |

All the authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.