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Comparison of Efficacy of Lignocaine with Adrenaline and Bupivacaine without Adrenaline in Pain Management During Extraction of Mandibular Third Molars: A Prospective Study

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KEYWORDS

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ABSTRACT:

Background: Extraction of lower third molar is the most commonly performed surgery in oral and maxillofacial practice. Pain associated with this procedure is a frequent reason for patient anxiety and discomfort. A variety of anaesthetic agents are administered in order to provide intra operative pain relief.

Materials and methods: Participants were divided into 2 groups with 25 patients each. One group was administered 2% lignocaine hydrochloride with adrenaline 1:80,000 as local anaesthesia while the other group was administered 0.5% bupivacaine without adrenaline as anaesthesia. Intra operative and post operative pain scores were measured using Visual Analog Scale.

Results: While making statistical comparison between the two groups, a significant P value ($p = 0.03$) was observed, favouring the bupivacaine group for Intra operative pain relief. The p value obtained for post operative pain was also statistically significant (0.04) in favour of the bupivacaine group.

Conclusion: It was found that 0.5% bupivacaine without adrenaline was a better anaesthetic when compared to 2% lignocaine with 1:80,000 adrenaline for pain control during third molar extractions. This study demonstrated that bupivacaine, a long-acting amide anaesthetic provides better intraoperative and postoperative pain control during extractions of mandibular third molars and is especially significant in patients where adrenaline is contraindicated.

1. Introduction

Pain is an unpleasant sensory and psychological experience resulting from actual or potential tissue damage (1). It can range from mild localised discomfort to agony and is one of the most commonly experienced symptoms in oral surgery.

Pain control is a fundamental goal in oral and maxillofacial surgery, particularly during third molar extractions which are among the most frequent procedures performed. Patients often report anxiety and discomfort as a result of pain both during and after the procedure. The management of pain during oral surgical procedures is an important requisite to achieve patient comfort and to obtain desired result in an effective manner. (2)

The selection of an appropriate local anesthetic agent plays a pivotal role in ensuring not only intraoperative comfort but also in minimizing postoperative pain, thereby improving overall patient satisfaction and clinical outcomes.

Local anaesthesia is defined as the ‘temporary loss of any sensation or that of pain in any part of a body which is be

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produced by applying or injecting an anaesthetic drug or agent which aids in causation of depression of consciousness level' (3). Various anaesthetics can be used to achieve regional or local anaesthetic effect in this regard. Anaesthetic agents work by reversibly binding to sodium channels, preventing the entry of sodium into the cells and thereby inhibiting the propagation of nerve impulses. Consequently, nociceptive impulses associated with painful stimuli do not reach the brain, and the patient does not perceive pain (3, 4).

Lignocaine is most widely used local anesthetic agent due to its low cost and rapid onset of action. Lignocaine has a pKa of 7.85 and diffuses readily through the interstitial tissues and into the lipid-rich nerve fibers giving a rapid onset of anaesthesia.

Lignocaine can be used solitarily as plain LA, or it can be used in combination with adrenaline. Plain lignocaine is a potent vasodilator with the anaesthetic effect being poor and lasting only a short while (5). Hence, in a bid to increase the efficacy of the local anaesthetic, adrenaline is used as vasoconstrictors in varying concentrations of 1:50,000, 1:80,000, 1:100,000,1:200,000. Adrenaline increases the depth of anaesthesia, shortens its onset, minimises systemic toxicity and reduces blood loss during the procedure (6). However, adrenaline can present contraindications in certain patient populations, particularly those with cardiovascular conditions. Additionally, lignocaine's relatively short duration may necessitate supplemental analgesics postoperatively.

Bupivacaine, on the other hand, is a long-acting amide-type local anaesthetic that was introduced for clinical use in 1963. Its high lipid solubility and protein binding ability confer a prolonged duration of action (7). Its use can potentially obviate the need for vasoconstrictors and reduce postoperative analgesic requirements, making it an appealing alternative in dental procedures such as third molar surgeries.

Despite both agents being commonly used in dental practice, direct clinical comparisons assessing their effectiveness in surgical extraction of third molars, particularly in the absence of adrenaline with bupivacaine, remain limited. This study was therefore undertaken to compare the analgesic efficacy of 2% lignocaine with 1:80,000 adrenaline versus 0.5% bupivacaine without adrenaline during and after the extraction of impacted mandibular third molars. By evaluating intraoperative and postoperative pain outcomes, the study aims to inform clinical decision-making in pain management for oral surgery.

2. Materials and Methods

This study was designed to compare the efficacy of two local anaesthetic drugs- 2% lignocaine with 1:80,000 adrenaline with 0.5 % bupivacaine without adrenaline for analgesia control during the extraction of mandibular third molars. 50 study participants indicated for mandibular third molar surgical extractions were included. The study subjects were categorised into two groups: Group I (n=25): Extractions performed using 2% Lignocaine with 1: 80,000 adrenaline as local anaesthesia for inferior alveolar nerve block & Group II (n =25): Extractions performed with 0.5% bupivacaine without adrenaline as local anaesthesia for inferior alveolar nerve block. Inclusion criteria for subject inclusion were – (a) impacted mandibular third molars which were symptomatic and (b) Patients willing for the procedure from whom written consent was obtained while exclusion criteria were – (a) patients with any comorbidities (b) patients not willing to undergo the extraction. The patients' response to pain intra operatively and post operatively (at one hour) was recorded using the Visual Analog Scale (VAS). Standardized surgical protocols were followed across both groups to ensure consistency. Pain levels were assessed using the Visual Analog Scale (VAS) at two time points: intraoperatively and at one hour postoperatively. Data were statistically analyzed and compiled using SPSS software (Version 23, IBM Corp., Armonk, NY). The Visual Analog Scale (VAS) scores for intraoperative and postoperative pain were compared between the two groups using the Mann–Whitney U test. A p-value of <0.05 was considered statistically significant.

3. Results

On analysis of visual analog scale (VAS), it was observed that in Group I (2% Lignocaine with 1:80,000 adrenaline), no pain during the extraction procedure was demonstrated in 8 study participants while minimal or less pain was present in 17 patients. On the other hand, Group II patients whose mandibular third molars were extracted using local anaesthesia by injecting 0.5% bupivacaine without adrenaline, lack of any pain was observed in 12 patients while minimal pain was noted in

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13 individuals. While making statistical comparison between the two groups, a significant P value (p = 0.03) was observed, favouring the bupivacaine group. Also, postoperative pain was noted in 60% of cases (15 patients) who underwent extraction using 2% lignocaine (Group I) and 20% of cases (5 patients) who had third molar extractions under 0.5% Bupivacaine without adrenaline local anaesthesia. The p value obtained in this case was statistically significant (0.04) in favour of the bupivacaine group.

4. Discussion

The findings of the present study clearly demonstrate that 0.5% bupivacaine without adrenaline provides superior intraoperative and postoperative pain control compared to 2% lignocaine with 1:80,000 adrenaline in mandibular third molar extractions. This aligns with prior research that highlights the extended duration of action and analgesic effectiveness of bupivacaine, particularly in procedures where prolonged postoperative discomfort is anticipated (8,9)

Bupivacaine is a long-acting amide-type local anaesthetic that was introduced for clinical use in 1963(11,12,13). Its onset of action is 1–10 minutes, duration of action is about 2–9 hours, and half-life in adults is 2.7 hours(14). Its potency is four times that of lignocaine at equivalent doses (14,15). The onset of action of bupivacaine is slightly longer than that of lignocaine in case of block anaesthesia, but it is similar in case of infiltration anaesthesia. The major advantage of bupivacaine is that after the return of sensation, an analgesic period follows that reduces the need for analgesics postoperatively. (16)

Bupivacaine's pharmacological properties contribute to its clinical advantages. As a long-acting amide local anesthetic, it exhibits a higher lipid solubility and greater protein-binding affinity than lignocaine, resulting in a slower onset but significantly longer duration of action (17). In this study, patients receiving bupivacaine reported lower pain scores not only intraoperatively but also at the one-hour postoperative mark, a critical period for early recovery and patient comfort. Importantly, these benefits were achieved without the addition of a vasoconstrictor, reducing potential risks in patients with cardiovascular concerns. (18)

Previous studies support these observations. For instance, a meta-analysis by Su et al. 2014, (19) found that bupivacaine led to significantly lower postoperative analgesic consumption compared to lignocaine with epinephrine, reinforcing the findings of the present investigation. Berkay et al. similarly reported that patients anesthetized with bupivacaine experienced longer durations of postoperative anesthesia and reduced pain intensity even up to 48 hours postoperatively (20). The analgesic tail provided by bupivacaine effectively bridges the gap between surgery and the onset of oral analgesics, potentially reducing the need for early pharmacologic intervention. (21)

While lignocaine remains the agent of choice in many dental practices due to its fast onset and cost-effectiveness, its short duration—even when combined with adrenaline—makes it less ideal for procedures requiring extended anesthesia or prolonged pain control (21,22,23). The results from this study challenge the routine reliance on lignocaine with vasoconstrictors, suggesting that bupivacaine may be preferable in situations where patient comfort and postoperative pain reduction are priorities.

Furthermore, the omission of adrenaline in the bupivacaine group may offer a safety advantage for patients with systemic conditions where vasoconstrictors are contraindicated or must be used cautiously (24,25). This positions bupivacaine as a viable and potentially superior alternative in select patient populations. (26)

Nonetheless, the slightly delayed onset of bupivacaine should be acknowledged. While it did not significantly impact the clinical outcome in this study, procedural planning must accommodate this characteristic (26). Future studies with larger cohorts and longer follow-up periods could further validate the long-term benefits of bupivacaine and assess variables such as postoperative analgesic consumption and patient-reported satisfaction.

This study distinguishes itself from prior research in several meaningful ways. Many previous studies have compared bupivacaine with adrenaline versus lignocaine with adrenaline. However, your study evaluates bupivacaine *without* adrenaline against lignocaine *with* adrenaline, which is a less commonly explored comparison. This highlights the intrinsic analgesic capability of bupivacaine, independent of any

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vasoconstrictor, making the findings especially relevant for patients where adrenaline is contraindicated.

While some studies assess pain at multiple long-term intervals (e.g., 6–48 hours), our study emphasizes the critical early postoperative period, offering practical insights into immediate recovery, when patient discomfort is often most intense (26).

5. Conclusion

This study provides clinical evidence that 0.5% bupivacaine without adrenaline offers superior pain control compared to 2% lignocaine with 1:80,000 adrenaline for the surgical extraction of mandibular third molars. Bupivacaine not only reduced intraoperative discomfort but also significantly lowered early postoperative pain scores, thereby enhancing the overall patient experience.

These findings suggest that bupivacaine, due to its prolonged anesthetic effect and absence of vasoconstrictor-related side effects, may be a more effective and safer alternative for procedures requiring extended analgesia, particularly in patients with cardiovascular concerns or increased sensitivity to adrenaline.

Incorporating long-acting agents such as bupivacaine into routine oral surgical practice could improve postoperative recovery, reduce reliance on systemic analgesics, and contribute to better clinical outcomes. Further research with larger sample sizes and extended follow-up is recommended to assess long-term pain control, analgesic use, and patient satisfaction.

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