

## COMPARATIVE EVALUATION OF BUPIVACAINE AND LIGNOCAINE FOR IMPACTED MANDIBULAR THIRD MOLAR REMOVAL

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### ABSTRACT

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**Introduction:** Removal of impacted teeth is the most frequent oral surgical intervention, often associated with significant post-operative pain. In this study bupivacaine and lignocaine were compared for use in surgical extraction of impacted mandibular third molars. **Methods:** In this prospective, randomized, double blind study, 50 patients requiring surgical removal of impacted mandibular third molars were randomly divided into two equal groups. 0.5% Bupivacaine without any vasoconstrictor and 2% lignocaine with 1:80,000 adrenaline were used in a double blind manner. All required parameters were noted during surgery and questionnaires given to all patients, to assess onset of anaesthesia, the time of complete disappearance of numbness, pain

perception and postoperative analgesic requirement. **Results:** Longer duration of action and longer painless period postoperatively, lesser pain intensity and decreased postoperative analgesic requirement were observed for bupivacaine with statistical significance. However, the onset of anaesthesia was earlier for lignocaine as compared to bupivacaine. **Conclusion:** Bupivacaine has better pain control, increased duration of anaesthesia, lesser postoperative pain and decreased analgesic requirement postoperatively than lignocaine. The application of bupivacaine to minor oral surgical procedures like removal of impacted teeth, is desirable.

**KEYWORDS:** Bupivacaine; Impaction; Lignocaine; Local anaesthesia; Pain; Third molar.

## INTRODUCTION

Pain is a universal fear we try to avoid. Anaesthesia creates a painless state which enables surgery to be performed. Local anaesthetics are the mainstay of intra-operative pain control for most dental surgeries but adequate pain control is still a major treatment concern.<sup>[1]</sup> Recent advances in agents/techniques have revolutionized dental practice and allow a safer, pain free surgical experience. Newer amide anaesthetics (lignocaine, bupivacaine, etidocaine, mepivacaine, prilocaine, articaine) are commonly used in oral and maxillofacial surgery.<sup>[2]</sup>

Lignocaine (Diethyl-2,6-acetanild), the first amide local anaesthetic and the most popular, revolutionised pain control in regional anaesthesia by replacing procaine and other ester-type compounds. It is more potent, with swifter onset of anaesthesia and produces more profound and longer action.<sup>[1,3]</sup> It is used in ideal concentration of 2% and when used in conjunction with adrenaline(1:80,000 is standard), takes more time to dematerialize from the site of administration. Because of its potency, safety and effectiveness lignocaine has become the standard for comparison amongst the newer agents.

Bupivacaine (1- Butyl2', 6'-pipecoloxidine), also an amide available in different concentrations, is used in an ideal concentration of 0.5%. The potency of bupivacaine is similar to tetracaine and about four times greater than mepivacaine, prilocaine and lignocaine but toxicity is relatively less by four times than lignocaine and mepivacaine. Addition of a vasoconstrictor does not seem to prolong its duration of action.<sup>[4]</sup>

This study was aimed to compare the efficacy of bupivacaine and lignocaine in the impacted lower third molar surgery by comparing time of onset and duration of anaesthesia, onset of postoperative pain, comparative pain evaluation, postoperative analgesic requirement and signs of systemic toxicity.

## MATERIAL AND METHODS

A prospective, double-blind, parallel, randomized controlled study was conducted on patients referred to the Department of Oral Surgery for surgical removal of impacted lower third molars after approval by the College Ethics Committee. 50 patients between 18 to 40 years, irrespective of sex, caste, religion and in good health, were included. Patients allergic to lignocaine or bupivacaine, having pericoronitis, infection or pathology in the area of

injection, cardiovascular diseases, thyrotoxicosis, diabetes or immunosuppression and patients on medications that could affect anaesthetic assessment were excluded.

Anaesthetic agents used were 2% Lignocaine with 1:80,000 adrenaline (LIGNOX 2% A, INDOCO REMEDIES LTD) and 0.5% Bupivacaine without vasoconstrictor (ANAWIN® 0.5%, NEON LABORATORIES LIMITED).

Informed consent was obtained and pertinent patient data recorded. 25 patients each were allocated to the two anaesthetic groups according to a random table of numbers on the day of surgery. As 0.5% bupivacaine is only available in 20ml vial in India, a person independent of the clinic transferred this into a sterilized resembling vial of lignocaine 30 ml under strict aseptic conditions. The 2 vials were relabelled 'A' and 'B', according to the codes of the randomization list. The colour of the solutions, shape and appearance of the vials were similar, except for the labelling. The patient, surgeon and assistant were double blinded to the local anaesthetic given.

No premedication or topical anaesthetic was used before, during or after surgery. 2 ml of the local anaesthetic was administered (for inferior alveolar, lingual and long buccal nerve block) with 26gauge, 5ml disposable syringe. The local anaesthetic used and time of administration was noted. Standard Ward's incision was placed, mucoperiosteal flap reflected and bone removed by Moore-Gillbe Collar technique under copious saline irrigation. Tooth was elevated with straight Coupland elevator and removed. Bony margins were filed, wound irrigated, flap repositioned and sutured with 3-0 non-absorbable black braided silk. Alcohol consumption was prohibited for 24hours after surgery and patients were asked to avoid analgesics unless absolutely necessary.

Post-operatively patients were asked to fill a questionnaire and record the time of complete disappearance of numbness, time of pain onset and number of analgesics taken at 2 hours, 4 hours, 8 hours, 12 and 24 hours. Patients were instructed to record their subjective postoperative pain intensity on visual analogue scale(VAS) as 'no pain'(0 mm) to 'worst pain'(100 mm) on the questionnaire.<sup>[5]</sup>

Onset of anaesthesia was recorded from the time of administration of local anaesthetic to the time of appearance of numbness of the lip and tongue as subjective symptoms. Duration of surgery was recorded between placement of incision and the last suture. Duration of

anaesthesia was measured from onset of anaesthesia to complete disappearance of numbness on the lower lip. Time of onset of pain was measured from onset of anaesthesia of lip to onset of pain. Number of analgesics taken and any sign of systemic toxicity were noted.

Statistical Package for the Social Sciences (SPSS version 16, IBM, Chicago, IL) was used for analyses. Comparison between mean VAS pain scores were analysed by Mann Whitney U test and Friedman's test while Student's unpaired t test was used to assess the difference between parameters. P value  $\leq 0.05$  was considered statistically significant.

## RESULTS

50 patients (23 males and 27 females) participated, of which 25(13 males and 12 females) were administered bupivacaine (mean age  $27.8 \pm 2.5$ ), while 25(10 males and 15 females) were administered lignocaine (mean age:  $24.6 \pm 7.2$ ).

**Onset of action-** Mean time of onset of subjective symptoms for bupivacaine was  $4.4 \pm 1.2$  minutes and for lignocaine was  $3.4 \pm 0.9$  minutes. Mean time of onset of objective symptoms for bupivacaine and lignocaine was  $6.2 \pm 1.3$  and  $4.3 \pm 1.1$  minutes respectively. The mean difference between subjective and objective symptoms for bupivacaine and lignocaine was 1.2 and 1.8 minutes respectively, which was statistically significant.

**Duration of surgery-** The duration of surgery ranged from 30-87 minutes. In patients on bupivacaine, the mean duration of surgery was 47.4 minutes while for lignocaine it was 44.9 minutes, the difference not significant.

**Duration of anaesthesia-** The mean painless period for bupivacaine and lignocaine was  $434 \pm 119.7$  and  $169 \pm 30.9$  minutes respectively, with mean difference of 265 minutes, which was highly statistically significant. Maximum patients with lignocaine experienced pain around the third postoperative hour. With bupivacaine, painless period was significantly high, 12hours and 30minutes in one patient.

**Post-operative Analgesics-** The average number of analgesics taken after bupivacaine was  $2.3 \pm 0.5$  tablets as compared to  $3.3 \pm 0.9$  tablets after lignocaine with mean difference of 1 tablet, which was highly statistically significant.

**Postoperative pain assessment-** At the 2nd postoperative hour the mean pain score was  $0.8 \pm 0.9$  and  $1.3 \pm 1.3$  for bupivacaine and lignocaine respectively with mean difference of 0.5

which was statistically insignificant. At the 4th postoperative hour the mean pain score was  $1.6 \pm 1.4$  and  $5.7 \pm 2.4$  for bupivacaine and lignocaine respectively with mean difference of 4.1 which was highly statistically significant. The 8th postoperative hour showed values of  $4.7 \pm 2.1$  for bupivacaine and  $5.8 \pm 0.7$  for lignocaine with mean difference of 1.1 which was statistically significant. At 12th postoperative hour the mean pain score was  $4.5 \pm 2.0$  and  $4.1 \pm 1.3$ , and  $4.1 \pm 1.6$  and  $3.8 \pm 1.4$  at 24 hours postoperatively for bupivacaine and lignocaine respectively, showing no statistical significance. Therefore, up to 8 hours patients on bupivacaine perceived significantly less postoperative pain while at 12 and 24 hours, pain was insignificantly higher in them.

## DISCUSSION

Conventional local anaesthetics, though adequate, are short acting. However in most oral surgical procedures a prolonged duration of analgesia is desirable.<sup>[6]</sup> Patient's response to dento-osseous surgery is variable and benefits of long acting local anaesthetics for management of postoperative pain are difficult to estimate. Third molar surgery with bone guttering can cause a lot of physical and mental agony; so long acting local anaesthetics can be useful due to their longer anaesthetic effects and delay in pain onset.<sup>[6]</sup>

Equal amount of local anaesthetic was used in patients undergoing surgical removal of the lower third molars to prevent dose-response relation bias. Bupivacaine is four times potent than lignocaine in equal concentrations (the smaller 0.5% concentration of bupivacaine becomes equipotent to 2% lignocaine)<sup>[7]</sup> and their toxicities at these concentrations will be equal, so these concentrations were used for comparison in this study.<sup>[8]</sup>

The difference in onset of anaesthesia in lignocaine was much lesser than bupivacaine. The mean time difference between onset of subjective and objective symptoms was more for bupivacaine and previous studies show similar results.<sup>[8,9]</sup> The shorter onset time for lignocaine is often contributed to its lower pKa (7.7) than bupivacaine (8.1).<sup>[3,10]</sup>

No difference in intra-operative pain was noted when bupivacaine without adrenaline was compared with lignocaine containing it, so the former can be used without vasoconstrictor.<sup>[4]</sup> A combination of 0.5% bupivacaine with adrenaline 1:200,000 when used gives similar results.<sup>[7]</sup>

Action of local anaesthetics is dependent on their anaesthetic potency which indicates the minimal anaesthetic concentration required. Lipid solubility is the single most important determinant of this, making highly lipid soluble local anaesthetics like bupivacaine very potent.<sup>[3,10]</sup> The duration of local anaesthetic effect is directly proportional to higher protein binding properties due to which bupivacaine has longer action than lignocaine.<sup>[11]</sup> Mean duration for complete disappearance of lip numbness was 2.48 times more. Vast difference in pain free duration between the two anaesthetics suggests the benefit in use for extended numbness and analgesia post-operatively, with bupivacaine, in surgical removal of impacted teeth. For some, the increased period of numbness is annoying, but increased period of painlessness makes them more comfortable.

Bupivacaine delayed the onset of post-operative pain by 258.4 minutes more than lignocaine. Though bupivacaine is not recommended for short dental procedures, those of long duration or with pronounced pain in postoperative period, its long duration can have clinical usefulness.<sup>[12]</sup>

Pain after third molar surgery can be of varying intensity and has been found to correlate with the duration of the procedure and the amount of surgical trauma.<sup>[13]</sup> The maximum postoperative pain is usually experienced during the first 6-8 hours so the use of bupivacaine improves postoperative comfort and reduces the need for strong analgesics.<sup>[4,14]</sup> The number of analgesics required was 1 lesser with bupivacaine during the first 24 hours post operatively which was statistically highly significant. In view of this, there appears to be a definite place for the use of long acting local anaesthetics.

Pain intensity post-operatively in both groups through VAS scores in the first 2 hours was more for lignocaine, although not statistically significant. After this time the depth of blockade and numbness reduces for lignocaine which did not prevent patient from experiencing pain as compared to bupivacaine,<sup>[15]</sup> which still remains active due to its longer duration. At 4 hours post-operatively, the difference of pain between two groups was statistically significantly more for lignocaine. Lesser pain scores were found at 8 hours post-operatively for bupivacaine. At 12 hours and 24 hours post-operatively the pain was found to be slightly more for bupivacaine but the difference was not statistically significant.

We did not observe any signs or symptoms of any kind of systemic toxicity. Intra-operatively, more bleeding was noticed by the operators when bupivacaine was used as

compared to lignocaine. Bearing in mind the higher toxicity and cardiosuppressant property of bupivacaine,<sup>[7,16]</sup> the usual precautions should be taken like frequent aspirations before injection, minimizing the rate of administration and careful observation during injection.<sup>[10]</sup>

Although lignocaine has been used in oral & maxillofacial surgery since ages, postoperative pain was diminished, delayed in onset or even absent after use of bupivacaine. Thus 0.5% bupivacaine can be used safely and effectively in oral and maxillofacial surgery, especially in procedures of longer duration or where tissue trauma is more and where bone removal can cause physical and mental agony to the patient (like third molar surgeries) as it provides a much longer duration of action than lignocaine.

## CONCLUSION

More effective pain control was obtained with bupivacaine as compared to lignocaine due to less post-operative pain perception, increased numbness time and lesser need for postoperative analgesics. The application of bupivacaine to minor oral surgical procedures, particularly removal of impacted teeth, is desirable.

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