Efficiency of mepivacaine 2% versus lignocaine 2% in the extraction of impacted third molars: Randomized, clinical trial

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Abstract

Background: Most commonly performed the minor oral surgical procedure is removal of a lower third molar. And to ease this procedure many local anesthetics are available, and the commonly used local anesthetics are lignocaine with adrenaline, but recently mepivacaine with levonordefrin is used as it is longer acting than lignocaine with the same concentration. However, very less clinical studies have been conducted to compare these two to know the efficacy and depth of anesthesia.

Aim: Purpose of the study is to compare the efficiency of mepivacaine 2% with levonordefrin versus lignocaine 2% with adrenaline in the extraction of bilaterally impacted third molars: A single-blind, clinical trial.

Materials and Methods: In the study, 128 patients were selected with all types of mandibular third molar impactions. Inferior alveolar nerve block is given with mepivacaine 2% with levonordefrin or lignocaine 2% with adrenalin surgical procedure was started 5 min after anesthesia is achieved.

Result: The mean onset of anesthesia in mepivacaine group is 4.38 and in lignocaine group is 4.86. Moreover, mean duration of anesthesia in Group A 170.31 min and 168.72 min in Group B. There is statistically significant difference in the depth of anesthesia in -Group A and Group B intraoperatively, in-Group A 28 (43.7%) patient experienced pain during a procedure on visual analog scale, whereas in-Group B 9 (14.06%).

Conclusion: In our study mepivacaine with levonordefrin has inferior performance in relation to lignocaine with adrenaline in terms of depth of anesthesia.

Clinical Significance: Literature says mepivacaine with levonordefrin is better than lignocaine with adrenaline in duration of action and in depth of anesthesia, but clinically we found there is no statistically difference in duration and in depth of anesthesia, we found lignocaine with adrenaline is better.

Introduction

In minor oral surgery, surgical extraction of impacted third molars is the most frequently carried out intervention. The third molars are the last teeth to erupt in the oral cavity and most commonly lack adequate space for eruption and are impacted, surgical extraction of these impacted third molars varies in the degree of difficulty and amount of trauma to the surrounding tissue based on their location and direction in the bone. Intraoperative pain management is one of the most important aspects to win the trust of the patient by the surgeon. Pain control has been a subject of great debate since time immemorial and in the recent past lot of research has been done on improving the local anesthetic agents for effective pain control. Among local anesthetics, lidocaine hydrochloride with 1:100,000 concentration of adrenaline has more potency, less allergic and is most commonly used. Since its development in 1943 by a Swedish chemist Nils Lofgren, It is widely used and is considered as a gold standard.

Mepivacaine was first introduced to dentistry in 1960 with synthetic vasopressor levonordefrin, in recent times many dentists consider mepivacaine as a safer alternative to lignocaine because it comes without vasoconstrictor and also with
levonordrerin as vasoconstricor which is said to be 25% less effective on beta-receptors of heart: It gives longer duration of anesthesia as compared to lignocaine when it is given 3% without vasoconstricor due to its mild vasodilating property.

This study was conducted to compare the efficacy and depth of anesthesia between 2% lignocaine with 1:100000 adrenaline and 2% mepivacaine with 1: 20000 levonordefrin in surgical removal of bilateral mandibular third molar teeth.

**Materials and Methods**

The study was conducted on 128 patient’s male 80 and female 48 age ranging from 24 to 33 from 2012 to 2016, who reported to the outpatient department of a private hospital in India, and required surgical extractions of bilaterally impacted mandibular third molars. Institutional Ethical Clearance was obtained for the study [Table 1].

**Selection criteria**

1. Patient age group for the study is 25–50 years
2. Patients with any allergic history to the local anesthesia were excluded
3. Medically compromised patients were excluded
4. The patients who were willing and cooperative were included
5. Acute pericoronitis patients were excluded
6. Written informed consent was taken from patients who are going to participate.

**Armamentarium**

The composition of local anesthesia used in the study is as follows:

I. Local anesthetic agent: Each mL contains

- Lignocaine 2% with 1:100,000 adrenaline
  - Lignocaine: 20 mg
  - Adrenaline as bitartrate: 0.01 mg
  - Potassium metabisulphite: 1.2 mg
  - Sodium chloride: 0.5 mg
  - Edetate disodium: 0.25 mg

- Mepivacaine 2% with 1:20,000 levonordefrin
  - Mepivacaine hydrochloride - 20 mg
  - Levonordefrin: 0.05 mg
  - Sodium chloride: 4 mg
  - Potassium metabisulphite: 1.2 mg
  - Edetate disodium: 0.25 mg
  - Sodium hydroxide q.s. ad pH: hydrochloric acid: 0.5 mg
  - Water for injection, qs. ad. 1 ml.

II. Needle 26 gauge

III. Metallic self-aspiration syringes

IV. Visual analog scale (VAS)

V. Periosteal elevator/explorer.

Patients were divided into Groups A and B with 64 in each group. Group A is given with mepivacaine with levonordefrin, and Group B is given with lignocaine with adrenaline, before the giving the local anesthesia vitals are recorded in both the groups (blood pressure and heart rate, pulse) and again were recorded at 5 min, 15 min, 30 min, 1 h, and 2 h after administration.

The standard technique was used to anesthetize inferior alveolar nerve block, (inferior, alveolar, lingual, and long buccal nerves) by administring 1.8 ml cartage with self-aspiring metallic syringe. The subject will not know which anesthetics he/she receives. Onset of anesthesia is (in seconds) determined by loss of sensitivity of lower lip, half of the tongue (same side), and the mucosa, and patient’s response to explorer (pinprick testing) is used for objective testing. The start of anesthesia tested every 30 s till the time when no any sensation. If the time taken for anesthetizing the patient is more than 10 min, then anesthesia would be regarded as unsuccessful. If more than 4 ml of the solution required achieving anesthesia then the case was said to be anesthetic failure and was deleted from the study. Post-surgery the patients were evaluated for anesthesia testing with pinpricks to establish the duration of anesthesia which is repeated every 30 min after surgery to the time point when patients felt blunt sensation then every 10 min till he feels slight pain.

The calculation of anesthetic duration was done by taking the total time from surgical anesthesia to the time numbness wore off. The surgery was carried out 5 min after the effect of anesthesia. A standard procedure (wards incision, bone guttering with low-speed hand piece and bur and sectioning the tooth if required) was adopted to remove the teeth followed by primary alveoloplasty. All wounds were closed by simple interrupted metallic self-aspiration syringes with low-speed hand piece and bur and sectioning the tooth if required. The total duration of the surgery was calculated from the time of incision until the last suture placed. During the surgery, intraoperative pain experience was recorded on a VAS.

The intraoperative pain experience of the patient was recorded on VAS form and the post-operative pain experience was recorded at intervals of 5 min, 30 min, 1 h, 2 h, and 3 h, the patientwas also asked to note the time of the return of normal sensation and the onset of pain in the same form. All patients were reviewed on next day and pain assessment forms were collected.
The following parameters are assessed, the amount of anesthetics used during the procedure (in ml).

Onset of anesthesia (in seconds), is determined by loss of sensibility of the lower lip, half of the tongue same side, and the mucosa, it is done by pinprick testing by explorer.

The start of anesthetic effect was tested every 30 s until there is no sensation to the pinprick. If the anesthesia was not obtained within 10 min, then it would be regarded as unsuccessful.

Postoperatively again pinprick test was used in patients to evaluate and record the duration of anesthesia. It was done every 30 min after surgery until the time when patients felt blunt sensation. Then, the test was repeated every 10 min until complete sensibility is achieved.

The anesthetic intensity and depth during and after the surgery was determined by VAS scale, which is from 1 to 10.

### Statistical analysis

Statistical analysis was performed by taking mean values of variables for different group separately. The significant comparison was analyzed using the independent samples t-test; Chi-square.

### Results

Data were collected from all the patient after the completion of the study, the data were tabulated, compared and statistically studied after decoding the drugs.

The study comprised 128 males divided into two groups. Statistical significant difference was found in the meantime for the onset of anesthesia between mepivacaine 4.38 min and lignocaine 4.86 min, and P value is 0.012.

None of the patients complained of pain during incision placement and reflection of the flap in both the groups where the surgery started 5 min after onset of anesthesia in Group A 28 (43.7%) patient has pain sensation with varying intensity during bone cutting, tooth splitting and elevation of teeth, which was dealt with supplementary injection, infiltration or with solution-soaked gauze packing the site. Whereas in Group B 9 (14.06%) patient had experienced painful sensation, which required supplementary injection, infiltration, or with solution-soaked gauze packing the site, most of them had pain during bone cutting and elevation [Table 2].

The difference was statistically significant (P = 0.015) found to be significant relating to depth of anesthesia. The mean duration of anesthesia was measured as change (loss) of sensation, that is start of paresthesia of lower lip to the return of normal sensation, and it is 170.31 min in Group A (with mepivacaine group), whereas in Group B (lidocaine group) was 168.72 min. There is slightly more anesthetic effect seen in mepivacaine group, but there were no statistically significant differences (P = 0.069) [Table 3].

There is no statistically significant change in systolic and diastolic blood pressure in both the groups. However, there is a rise in pulse rate in both the groups at 5 min after injection of local anesthetics.

### Discussion

Dentist is one among the health profession who constantly deals with pain, anxiety and fear of patients.

Pain is difficult to measure according to OKESON, he has stated that pain is a personal and psychological experience and observation will not give correct direct measurement. In minor oral surgery pain, control can be done with the use of good nerve block with good local anesthetic agent. This study was done to evaluate the efficacy of mepivacaine 2% with levonordefrin versus lidocaine 2% with adrenaline, as local anesthetics agents in surgical removal of impacted mandibular third molars. The vasoconstrictors used in this study are epinephrine with lignocaine and levonordefrin with mepivacaine.

The vasoconstrictors used to increase the duration and depth of anesthesia. Levonordefrin is synthetic catecholamine and epinephrine is natural catecholamines. Levonordefrin has 75% alpha activity and 25% beta activity, whereas adrenaline has alpha and beta activity 50% each. Levonordefrin used in dental cartage is 1:20000 concentration, which is 5 times more, compared to adrenaline which is 1:100000 concentration. Mepivacaine belongs to amide group. It acts on nerve fibers by reducing the depolarization of action potential by impeding the initial rise in sodium conductance, which preventing the generation of conduction of nerve impulses. The depth of intraoperative anesthesia with mepivacaine was found to be inferior to that with lidocaine, as in mepivacaine group 28 (43.7%) patients felt pain, whereas in lignocaine group only 6 (9.3%). This difference was statistically significant (P = 0.018). Hence, our study does not coincide with the earlier studies of Gabreilo and Bella which reported no difference in the depth of anesthesia. According to the lipid solubility and anesthetic potency, mepivacaine and lignocaine are intermediate agents.
or depth of anesthesia is directly related to lipid solubility and increase membrane penetration is by hydrophobic binding site. Property of an agent to be readily soluble in nonpolar solvents but only sparingly in water. In mepivacaine, the hydrophobicity is least when compared to lignocaine. Wildsmith et al. had demonstrated in his study rabbit vagus and sciatic isolated nerve fibers that hydrophobicity correlates with conduction blockage, this study shows in vitro condition mepivacaine has less anesthetic potency compare to lignocaine or prilocaine.\(^\text{[16,17]}\)

The other reason could be levonordefrin is less potent than epinephrine studies has showed it is 1/6\(^\text{th}\) as potent as epinephrine.\(^\text{[18]}\)

It is also shown that effectiveness of mepivacaine is less in low PH it reduces 64.7% at 6.4 PH when compare to lignocaine which is 72.8%\(^\text{[18]}\) and its ionization constant (PKa) is 7.6 lowest when compare to lignocaine which is 7.9 at 36°C.\(^\text{[18]}\)

**Conclusion**

In our study, we have seen mepivacaine with levonordefrin has inferior performance in relation to lignocaine with adrenaline in terms of depth of anesthesia. Through we saw slightly more soft tissue anesthesia in mepivacaine group, but there is no statistically significant difference.

**References**


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