

Original Article

Influence of local anesthetics with or without epinephrine 1/80000 on blood pressure and heart rate: A randomized double-blind experimental clinical trial

Mohammad Ketabi¹, Mehrnaz Sadighi Shamami¹, Maryam Alaie², Mehrnoosh Sadighi Shamami³

¹Department of Periodontology, School of Dentistry, ²Undergraduate Student, School of Dentistry, Islamic Azad University, Khorasgan Branch, Isfahan, ³Department of Periodontology, School of Dentistry, Tabriz Medical University, Tabriz, Iran

ABSTRACT

Background: Local anesthesia (LA) with epinephrine have an important role in pain and bleeding control. However, most clinicians believe LA + epinephrine may cause rapid raise in blood pressure (BP) and heart rate (HR). The aim of this research was to compare the changes in HR and BP after administration of lidocaine with and without epinephrine 1/80000 in two infiltration (INF) and inferior alveolar nerve block methods (IANB).

Materials and Methods: The study was a randomized double-blind experimental clinical trial. Forty subjects were divided into two equal groups and two subgroups. In one group, INF and in the other group, IANB were used and, further, in one subgroup lidocaine and in another subgroup, lidocaine plus epinephrine were used. BP and HR were recorded before and 10 min after. The paired t-test for intragroup differences and independent t-test for intergroup analysis were used at the significant level of $P \leq 0.05$.

Results: The mean BP and HR values were reduced after injection of lidocaine in both INF and IANB compared with baseline. The differences were statistically significant ($P < 0.05$), but, on comparing these values between the two injection methods, the differences were not statically significant ($P = 0.089$ and 0.066 , respectively). The mean BP and HR values were increased after injection of lidocaine plus epinephrine in both INF and IANB compared with baseline, and these were statistically significant ($P < 0.05$) but, on comparing these values between the two methods, the differences were not statically significant ($P = 0.071$ and 0.092 , respectively).

Conclusion: The rise in BP and HR following injection of lidocaine plus epinephrine was statistically significant compared with baseline in both INF and IANB, but this was not clinically and numerically considerable.

Key Words: Anesthesia, epinephrine, heart rate, lidocaine

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Address for correspondence:

Dr. Mehrnaz Sadighi Shamami, Department of Periodontology, School of Dentistry, Islamic Azad University, Khorasgan Branch, Arqavanie Blvd, Isfahan, Iran.

E-mail: mz_si_82@yahoo.com

INTRODUCTION

Local anesthesia (LA) is the most common form of anesthesia that is used in most dental procedures. It is almost unavoidable in many dental treatments.

In 1948, lidocaine (LID) became the first local amid anesthetic to be marketed, and is the most widely used LA in many countries. It is currently the "gold standard"^[1] against which all the new LAs are measured.^[2-4]

Lidocaine is available in various forms like injection, cream, gel and spray and in different concentrations of 0.5%, 1%, 2%, 5% and 10%.^[5]

Lidocaine is usually used with epinephrine in a single cartridge. Epinephrine is added to lidocaine to reduce toxicity, prolong duration of anesthesia and control bleeding. It is available in a synthetic form and can

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be harvested from the central part of the adrenal gland. An LA cartridge usually contains 1.8 mL of lidocaine with 1/200,000, 1/1,000,000 and 1/80,000 concentrations of epinephrine (10 µg, 20 µg and 25 µg of epinephrine, respectively).^[6]

A common belief in medicine, dentistry and even among the patients is that the use of epinephrine is contraindicated in cardiovascular patients as epinephrine suddenly raises the blood pressure (BP) and hearth rate (HR).^[1,2,4,5] On the other hand, some studies have shown that the amount of epinephrine in dental cartridges is so low that use of one to three cartridges of lidocaine with epinephrine is safe and has no considerable effect on the cardiac parameters like BP, HR, etc.^[7-9]

Therefore, it is imperative that professionals be alerted to the proper use of LAs and to the care needed when choosing and administering these anesthetic agents, bearing in mind that the use of an inappropriate volume or concentration of anesthetic solution may produce systemic complications.^[10,11]

The purpose of the present study was to compare the effects of 2% lidocaine with and without epinephrine 1/80,000 on BP and HR in two methods of infiltration and inferior alveolar nerve block. The main aim was to verify the possible effects of epinephrine in LAs on vital cardiac constants.

MATERIALS AND METHODS

The study was a randomized, double-blind experimental clinical trial. The subjects were recruited from the patients referred to endontics, oral surgery, restorative and periodontics departments of Khorasgan Dental School (Iran) between February 1 and June end of 2009.

Forty non-smoker patients (22 female, 18 male) in the 18–35 years old range, with no history of systemic disease and no medications in the previous 6 months with normal BP ($\leq 120/80$)^[11] were selected for this study. Subjects were divided into two groups: in the first group, the infiltration method (upper arch teeth) and in the second group, inferior alveolar nerve block technique (lower arch teeth) was applied. These two groups were further divided into two subgroups. In one subgroup, pure lidocaine (persocaine-E, DAROPAKHSH, Iran) and in the other subgroup, lidocaine with epinephrine 1/80,000 (perisonocaine-E, DAROPAKHSH, Iran) were used.

Procedure

Each subject was asked to take rest for at least 5 min before measuring the BP and HR. The cartilages of the anesthetic were covered with a colored tape in one of two colors: green or blue, thereby constituting the blind element of the study, the color code being known only by the research supervisor. Then, immediately before and at least 10 min after injection, systolic and diastolic BP and HR were measured (Microlife AG/Switzerland). All the injections and measurements were done by one operator. For the statistical analysis, the paired *t*-test was used for comparison of the mean differences of BP and HR in each group and independent *t*-test was used between the two groups at the significant level of $P \leq 0.05$. All analyses were done by means of SPSS Version 11 software.

RESULTS

The results of this study are summarized in Figures 1 and 2:

1. The mean systolic and diastolic BP was reduced after injection of lidocaine without epinephrine in the inferior alveolar nerve block method. The differences were statistically significant ($P < 0.05$).
2. The mean systolic and diastolic BP were reduced after injection of lidocaine without epinephrine in the infiltration method. The differences were statistically significant ($P < 0.05$).
3. The mean HR was reduced after injection of lidocaine without epinephrine in the infiltration method. The differences were statistically significant ($P < 0.05$).
4. The mean HR was reduced after injection of lidocaine without epinephrine in the inferior alveolar nerve block method. The differences were statistically significant ($P < 0.05$).
5. The mean systolic and diastolic BP were increased after injection of lidocaine with epinephrine in the inferior alveolar nerve block method. The differences were statistically significant ($P < 0.05$).
6. The mean systolic and diastolic BP were increased after injection of lidocaine with epinephrine in the infiltration method. The differences were statistically significant ($P < 0.05$).
7. The mean HR was increased after injection of lidocaine with epinephrine in the infiltration method. The differences were statistically significant ($P < 0.05$).
8. The mean HR was increased after injection of lidocaine with epinephrine in the inferior alveolar nerve block method. The differences were

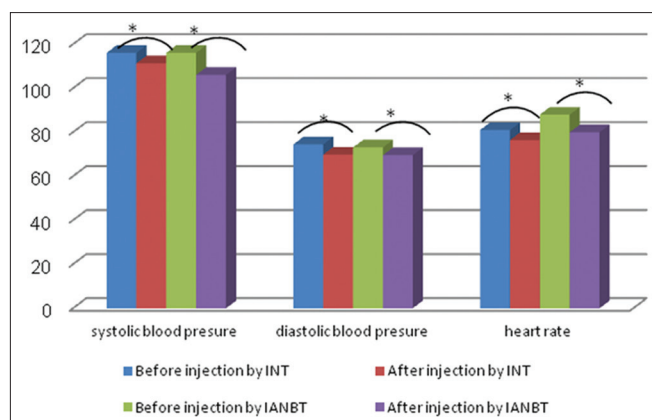


Figure 1: Comparison of The mean systolic and diastolic Blood presure and hearth rate before and after injection of lidocaine*: $P < 0.05$

statistically significant ($P < 0.05$).

9. The reduction in BP after injection of lidocaine without epinephrine in the infiltration and inferior alveolar nerve block methods was not statistically different ($P = 0.089$).
10. The reduction in HR after injection of lidocaine without epinephrine in the infiltration and inferior alveolar nerve block methods were not statistically different ($P = 0.066$).
11. The rise in BP after injection of lidocaine with epinephrine in the infiltration and inferior alveolar nerve block methods was not statistically different ($P = 0.071$).
12. The rise in HR after injection of lidocaine with epinephrine in the infiltration and inferior alveolar nerve block methods were not statistically different ($P = 0.092$).

DISCUSSION

The results of this study showed that injection of lidocaine without epinephrine caused reduction of BP and HR in either infiltration or inferior alveolar nerve block. This is mostly due to the vasodilative effect of lidocaine.^[7,8]

The other important finding of this research was an increase in BP and HR after injection of lidocaine with epinephrine in either infiltration or inferior alveolar nerve block. Although the rise in BP and HR was statistically significant, it was not numerically and clinically considerable (mean rise in systolic BP was 7.36 mm Hg and in diastolic BD was 3.37 mm Hg).

Generally, the effects of LAs with epinephrine have been investigated in healthy subjects, in patients with cardiovascular problems and in animal studies.

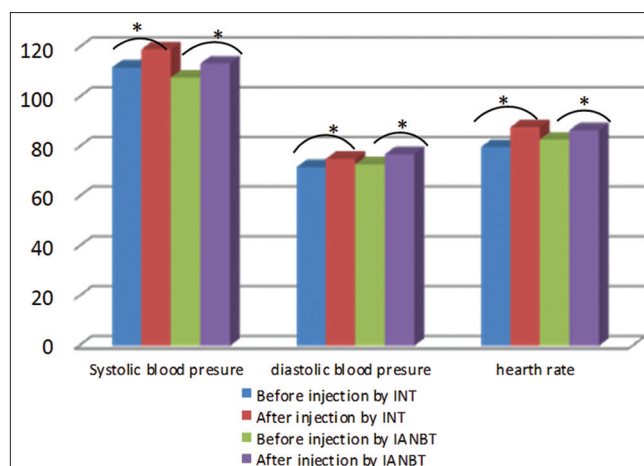


Figure 2: Comparison of The mean s'presure and hearth rate before and afepinephrir*: $P < 0.05$

The findings of this research were mostly in agreement with studies by Meral *et al.*,^[12] Silvestre *et al.*,^[7] and Faraco *et al.*^[13] all of which showed a small but not clinically important increase in cardiovascular parameters after injection of LA with epinephrine (BP, PR and HR).

Similar findings were also reported in patients with history of cardiovascular diseases,^[13,14] ischemic heart disease^[15,16] and cardiac valvular diseases,^[17,18] where LA with epinephrine did not cause an increase in HR, BP or any arrhythmic changes in patients referred for different dental treatments.

On the other hand, Faraco *et al.*^[19] studied the cardiovascular effects produced by intravascular injection of 2% lidocaine with 20 $\mu\text{g}/\text{mL}$ of norepinephrine on systolic, diastolic and mean arterial pressure and HR of rats, and the results showed significant increases in systolic, diastolic and mean arterial pressure and a noticeable decrease in HR.

Meechan *et al.*^[20] also investigated the cardiovascular responses of cardiac transplant recipients to dental local anesthetic solutions with and without epinephrine, and concluded that cardiac transplant patients experienced a significant tachycardia 10 min after injection of the epinephrine-containing solution. No significant change in HR was detected after the injection of an epinephrine-free solution. The BP was not also affected.

However, Faraco^[19] conducted an animal study in rats, which physiologically and pharmacologically showed quicker and different responses from human clinical experiments. The injection was also delivered intravascularly, which naturally produced rapid responses.

CONCLUSIONS

From the important results of this study that injection of one cartridge of lidocaine with epinephrine slightly raised BP and HR, it can be concluded that this small rise is not clinically and medically important. According to the results of this study and similar investigations on patients with cardiovascular problems, and considering the positive effects of epinephrine (less toxicity, prolonged anesthesia, minimal bleeding), it seems that one cartridge of lidocaine with epinephrine is allowed and safe even in cardiovascular patients. But, LA with epinephrine may be prohibited in patients with cardiac transplant recipients.

In accordance with previous studies, the maximum recommended dose of lidocaine in normoactive patients is 400 ug. The maximum recommended dose of epinephrine for cardiac patients is 40 ug.^[13]

To the best of our knowledge, this is the only study investigating the effects of LA with and without epinephrine on cardiac parameters in booth infiltration and inferior alveolar nerve block in patients receiving different dental treatments.

For future researches, it is suggested that the effect of more than one cartridge of LA with epinephrine (two or three cartridges) on BP and HR will be evaluated recruiting a higher number of subjects. The possible effects of anxiety on cardiac parameters will also be controlled before injection.

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