

## Hemodynamic Effects of 2% Lidocaine with 1:80000 Epinephrine in Inferior Alveolar Nerve Block

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### ABSTRACT

**Introduction:** Lidocaine plus epinephrine is the most common anesthetic drug used in dentistry which has important cardiovascular side-effects like increase in blood pressure and cardiac arrhythmia. The goal of this study was to evaluate cardiovascular effects of one cartridge of 2% lidocaine + 1:80000 epinephrine.

**Methods and Materials:** 60 Cases without any systemic diseases who had been admitted for right and lower molar tooth extraction were studied. For all of them, inferior alveolar nerve was blocked with one cartridge of 2% lidocaine + 1:80000 epinephrine. Blood pressure and pulse rate were measured with Omron digital sphygmomanometer (model M4) and recorded in 5 stages (At the admit time until 10 minutes after injection), and compared with together.

**Results:** The findings of our study showed that injection of one Cartridge of 2% lidocaine + 1:80000 epinephrine has negligible effects on blood pressure and pulse rate.

**Discussion:** Because of the minimum cardiovascular effects of one cartridge of 2% lidocaine + 1:80000 epinephrine in healthy cases, it seems to be safe for patients with mild cardiovascular disease.

**Key words:** Epinephrine, Lidocaine, Blood Pressure, Pulse Rate.

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### Introduction

Lidocaine with epinephrine is the most common local anesthetic drug used in Dentistry<sup>1</sup>. Epinephrine is added to lidocaine to:

- 1- minimize the hemorrhage,
- 2- minimize systemic absorption of lidocaine, and
- 3- increase duration of anesthesia<sup>2</sup>.

One of the most important side-effects of lidocaine /epinephrine is its cardiovascular effect that limits its use in some specific cases<sup>1</sup>.

Anesthetic success of 2% lidocaine + 1:100000 epinephrine for molar teeth is 50%, and its duration of action is 30 minutes that this duration is ideal for dentistry<sup>3</sup>.

Systemic absorption of lidocaine initially causes central nervous system (CNS) symptoms, such as vertigo, dizziness, light headedness, and seizure. If a large dose of lidocaine is injected in to intravascular space, cardiac complications

such as hypotension, cardiac arrhythmia, and cardiac depression can be seen and CNS complications usually occur after cardiovascular ones<sup>4</sup>.

It is well known that epinephrine has arrhythmogenic effect that can be life-threatening when interacting with the electrophysiological abnormalities of the infarcted myocardium<sup>5</sup>.

With recommended dose, cardiovascular effects of lidocaine/epinephrine are due to systemic absorption of epinephrine from site of injection or to its intravascular injection<sup>2</sup>.

Systemic absorption of epinephrine causes cardiovascular effects such as hypertension, chest pain, tachycardia, and other cardiac arrhythmia<sup>6</sup>. Maximum dose of epinephrine in healthy dental patients is 200 micrograms of 1/250000 solution<sup>6</sup>.

Hypertension is the blood pressure over than

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140/90 mmHg and if occurs during dental procedure, needs special considerations and probably treatment<sup>7,8</sup>.

In one study, it was determined that there were no significant changes in the blood pressure (BP) and the pulse rate (PR) of hypertensive patients during surgical procedure, with one cartridge in local anesthesia with lidocaine containing 0.012 mg of epinephrine, and it may be used safely in hypertensive patients with blood pressure equal to or smaller than 154 / 99 mm Hg<sup>9</sup>.

Inappropriate reactions which have been reported include: central nervous system stimulation manifesting as nausea, vomiting, syncope, blurred vision, convulsion, central nervous system depression, decreased tolerance, and allergic reactions. Allergic reactions, however, may not be related to the anesthesia itself but are more commonly caused by the additive adjuants<sup>10</sup>.

Prolonged diplopia following a mandibular block injection of 2% lidocaine with 1:80,000 epinephrine can occur. Since the complications have relatively slow onsets and last for 24 hours, the commonly suggested explanations based on vascular, lymphatic, and neural route theories do not adequately fit the observations<sup>11</sup>.

Unintended intravascular injections during inferior alveolar nerve blocks results in both systemic and local complications<sup>12</sup>.

The aim of this study was to evaluate the cardiovascular effects (changes in BP and PR) after infiltration of one cartridge of 2% lidocaine + 1:80000 epinephrine for inferior alveolar nerve block to extract right, inferior third molar.

## Methods and Materials

In a clinical trials study, 60 patients with no systemic diseases (ASA PS- Class 1\*) at the age of 20 to 40 years old who had been referred to oral surgery department of Isfahan dental faculty were chosen<sup>2</sup>. For all of them, right inferior alveolar nerve was blocked with one cartridge of

2% lidocaine + 1:80000 epinephrine for right, inferior third molar to be extracted by the investigator. Total administered drugs were 36 mg of lidocaine and 28 µg of epinephrine.

Systolic and diastolic blood pressures and PR were measured in 5 stages by Omron digital sphygmomanometer (model M4):

BP and PR were reported as mmHg and beat per minute (bpm), respectively.

**First stage:** at the admit time, before injection.

**Second stage:** at the beginning of injection, from the time that dental syringe was seen by the patient, until when the needle was inserted in to the tissue. After insertion of needle, aspiration was performed. If blood seen we the operation was cessated and patient was excluded from study.

**Third stage:** during injection, from beginning of injection to the end of cartridge lasted for 60 seconds.

**Fourth stage:** at the end of injection, when the dental syringe was extracted.

**Fifth stage:** 10 minutes after injection.

Surgery was performed after the completion of blood pressure and pulse rate measurement, at least 15 minutes after local anesthesia injection. Patients data were recorded and analyzed in SPSS software, version 10, with Repeated Measure Test (one type of ANOVA) and t-test. P-value less than 0.05 was considered statistically significant.

## Results

Systolic blood pressure rised during the injection, but 10 minutes later (stage 5), it was lower than that during injection (stage 3) with significant difference (P= 0.008). No significant difference was seen between systolic blood pressure of the other stages (figure 1).

In all stages, systolic blood pressures were lower than 130 mmHg; Systolic hypertension was not seen in these five stages.

The comparison between diastolic blood pressures of five stages showed a slight, but meaningful, vacillation. A slight decrease in diastolic blood pressure was seen at the end of injection (stage 4) and 10 minutes after injection (stage 5), comparing with beginning of injection (stage 2). In all stages, diastolic blood pressures were lower than 77 mmHg and diastolic

\* ASA PS= American Society of Anesthesiologists Physical Status :

Class 1 = A normal healthy patient

Class 2 = A patient with mild systemic disease

Class 3 = A patient with sever systemic disease

Class 4 = A patient with sever systemic disease that is constant threat to life

hypertension was not seen in any stage (figure 2).

The comparison between diastolic and systolic blood pressures of two groups of 20 – 30 and 30-40 years old patients showed no significant difference. In males, diastolic blood pressure was more than females in stags 1 and 2 ( $P<0.05$ ).

Another studied index was pulse rate (PR), that has predictable increase during injection (stage 2), comparing to before injection (stage 1)

( $P=0.001$ ). Similarly, the PR, 10 minutes after injection (stage 5) has predictable increase, comparing to before injection (stage 1) ( $P=0$ ).

The highest PR was seen in stage 3 with mean as 84.34/bpm ( $SD= 14.73$ ). The range was from 69 to 100 which was in normal range (PR lower than 60/bpm is called bradycardia and higher than 100/bpm is called tachycardia that non of them was seen in this study) (figure 3).

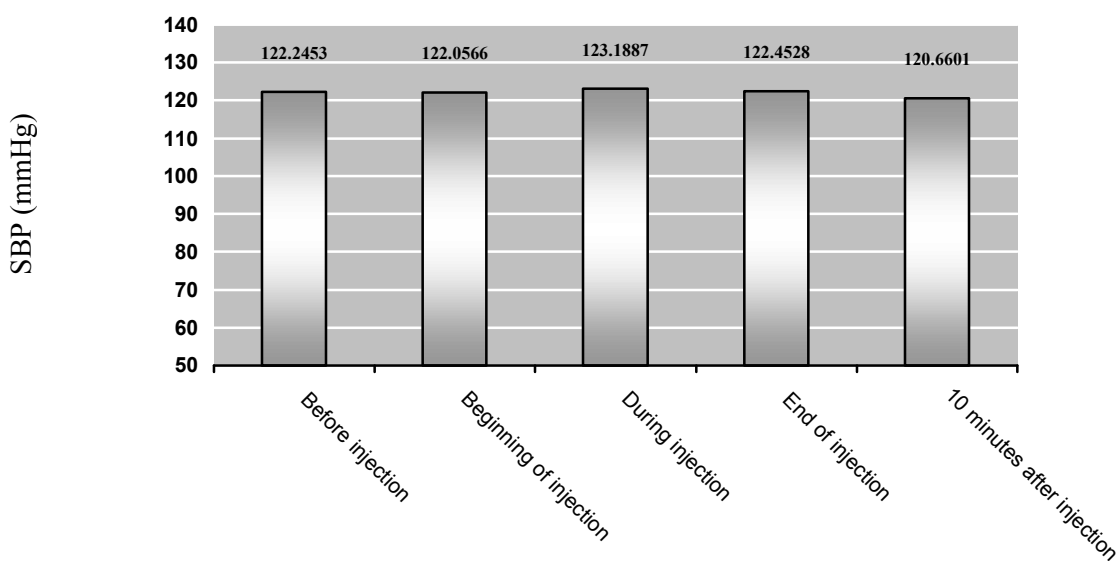


Figure 1. Mean systolic blood pressures in 5 stages.

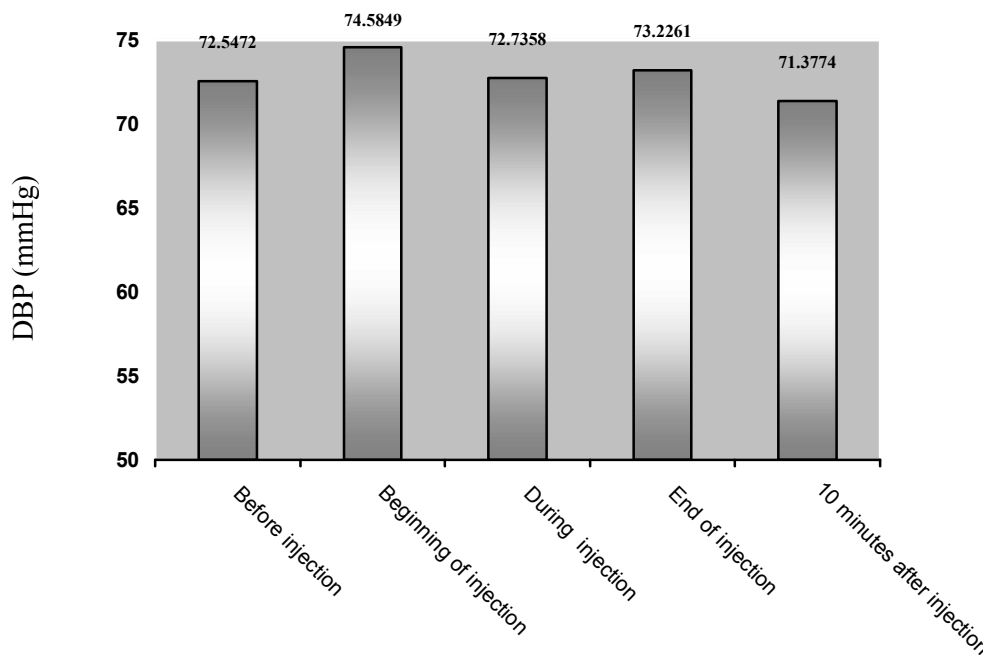


Figure 2. Mean diastolic blood pressures in 5 stages.

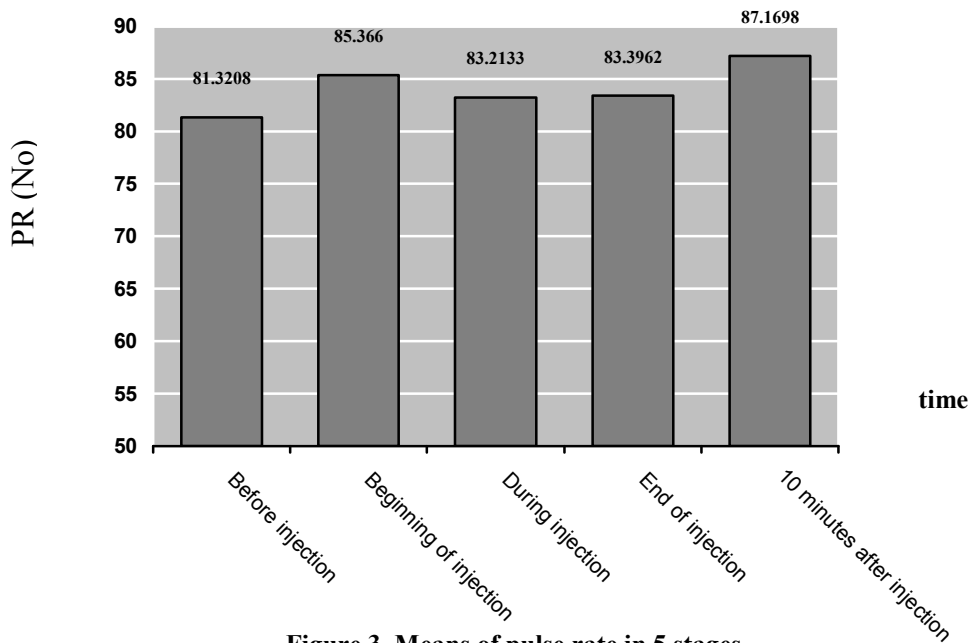


Figure 3. Means of pulse rate in 5 stages.

### Discussion

Systolic BP didn't rise during the injection and this showed that the increase of BP at the beginning of dental operation was probably due to stress.

In statistical analysis, systolic BP at 10 minutes after injection (stage 5) was lower than that during injection (stage 3) with meaningful difference ( $P=0.008$ ); It is probably because of disappearance of patients fear and stress after the injection. Most of patients were more worried about the injection than the treatment plan.

Considerable decrease in diastolic BP in stages 4 and 5, comparing with stage 2 could be because of decrease in dental syringe phobia after local anesthesia infiltration. In males, the diastolic BPs were more than in females in stages 1 and 2, which was probably due to a pain prohibition and feeling expression.

During the injection (stage 2), PR has significant increases comparing to that before

the injection (stage 1) ( $P=0.001$ ) which can be due to fear of injection and needle. Similarly at 10 minutes after injection (stage 5), PR has significant increase, comparing to that before injection (stage 1) ( $P=0$ ), which can be due to lidocaine vasodilating effect. Prevalence of severe bradycardia, tachycardia, and other hazardous arrhythmia, due to hemodynamic changes after administration of one cartridge of %2 lidocaine + 1:80000 epinephrine are very low and it's safe to use it in ASA PS class 1 patients.

Findings of this study showed that one cartridge of lidocaine/epinephrine has slight clinical effects on BP, and the prescribed dosage is without any sever hemodynamic effect on healthy patient. The effects of these drugs need further study in patients with compromised cardiovascular system.

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