

Comparison of Hemodynamic Changes Associated with Two Different Concentrations of Adrenaline in 2% Lignocaine Solution

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Abstract

Local anesthetic (LA) drugs are frequently used to manage pain during surgical procedures in dentistry. Different amounts of adrenaline have been added to a range of LA agents on the market to boost their effectiveness. Although the systemic effects of adrenaline, which is utilized as a vasoconstrictor in LA solution, are momentary or fleeting, there have been cases of related cardiovascular issues. This study compares the cardiovascular effects and effectiveness of using two different doses of adrenaline with 2% lignocaine.

Introduction

Local anesthetic (LA) are chemical solutions that reversibly inhibit the transmission of neuronal membrane action potentials.¹ While there is a wide range of LAs on the market, 2% lignocaine is the industry standard.² The fast beginning of action of lignocaine is caused by its easy diffusion across lipid-rich nerves and interstitial tissues. Prilocaine and mepivacaine do not have the same vasodilating action as this one.³ The anesthetic action of lignocaine alone is transient since it is a strong vasodilator. As a vasoconstrictor addition, adrenaline shortens the duration, deepens the anesthesia, and increases its start time. It works well to stop or reduce blood loss that occurs during surgery. Adrenaline reduces the systemic toxicity of LA by delaying its absorption through its peripheral vasoconstrictive effect. In healthy individuals, 0.2 mg of adrenaline can be used safely; for cardiac patients, it is recommended to keep the total dose to 0.04 mg. Direct action of adrenaline is observed on both α and β -adrenergic receptors. While majority of the circulatory changes caused by systemically adrenaline-like medications are temporary, they can also result in persistent damage or unfavourable cerebrovascular and cardio-vascular accidents.^{4,5}

Materials And Methods

The objectives of the study were the following:

1. To study the cardiovascular effects of LA with adrenaline in two different concentrations -
1:100000 and 1:200000
2. To compare the efficacy of 2% lignocaine with two different concentrations of adrenaline - 1:100000 and 1:200000
3. To study the impact and changes associated with oxygen saturation in different adrenaline concentration 1:100000 and 1:200000

Hundred cases that required extraction of maxillary and/or mandibular teeth were selected and allocated to Group 1 and Group 2 randomly in patients requiring bilateral extractions.

Unilateral extractions were carried out in a single sitting and the other side was completed on the next visit. All the cases were carried out by a single operator.

The following data were collected during the study:

1. Time of administration of LA
2. The onset of anesthesia noted as subjective and objective symptoms (subjective: tingling and numbness in the lower lip and tongue; objective: absence of pain on instrumentation)
3. Amount of LA used

The pulse rate, blood pressure (BP), and oxygen saturation were recorded using an automated multi-nodular monitor. This was done before and immediately after the administration of LA, after extraction, and 20 mins post-operatively. The evaluation of analgesia was done by the operator and recorded as 'successful', 'partial success', and 'failure'. Any sign of systemic toxicity was recorded.

Results

The safety and efficacy of the two solutions with two different concentrations of adrenaline were studied in 100 patients randomly by dividing them into two groups. The first patient was allocated by draw to Group 1 and all the other patients were divided randomly between the two groups. Group 1 patients received 2% lignocaine with 1:100000 adrenaline, while Group 2 patients received 2% lignocaine with 1:200000 adrenaline. The age varied from 18 to 75, while the mean age was 36.

There was no significant change in both the groups from the point of view of the time of onset. With regard to the duration of action of LA, the anesthetic duration of 1:100000 adrenaline concentrations were longer than that of 1:200000. This is due to the faster absorption of LA when used with less concentration of adrenaline. The amount of LA used for both the groups was almost the same.

There was a significant rise in the pulse rate immediately after LA with 1:100000 adrenaline concentrations were used; it dropped to the normal rate gradually after 20 min as seen in Figure-1 But when LA with 1:200000 adrenaline concentrations was used, there was no significant rise in the pulse rate.

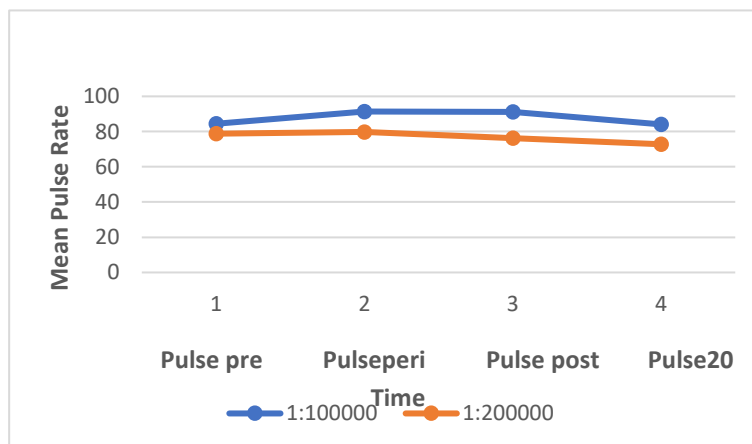


FIGURE 1: Mean pulse rate in both groups

Pulse pre = Before the administration of LA; Pulse peri = Immediately after the administration of LA;

Pulse post = After the extraction; Pulse 20 = 20 mins post-operatively

While assessing the BP, there was significant rise when LA with 1:100000 adrenaline concentrations was used, whereas there was no major change observed when LA with 1:200000 was used (Figure-2).

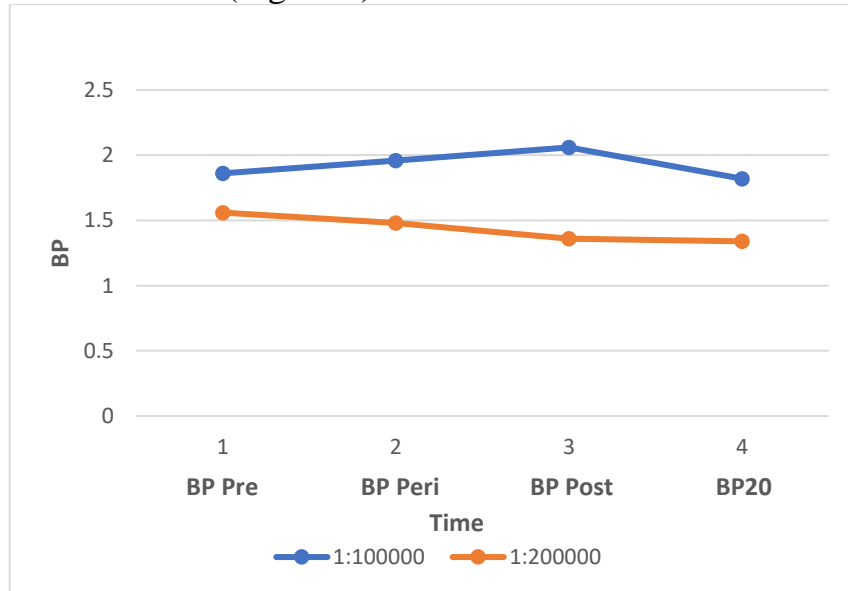


FIGURE 2: Blood pressure in both groups

BP pre = Before the administration of LA; BP peri = Immediately after the administration of LA;

BP post = After the extraction; BP20 = 20 mins post-operatively.

There was no significant change in oxygen saturation in both groups as shown in Figure-3.

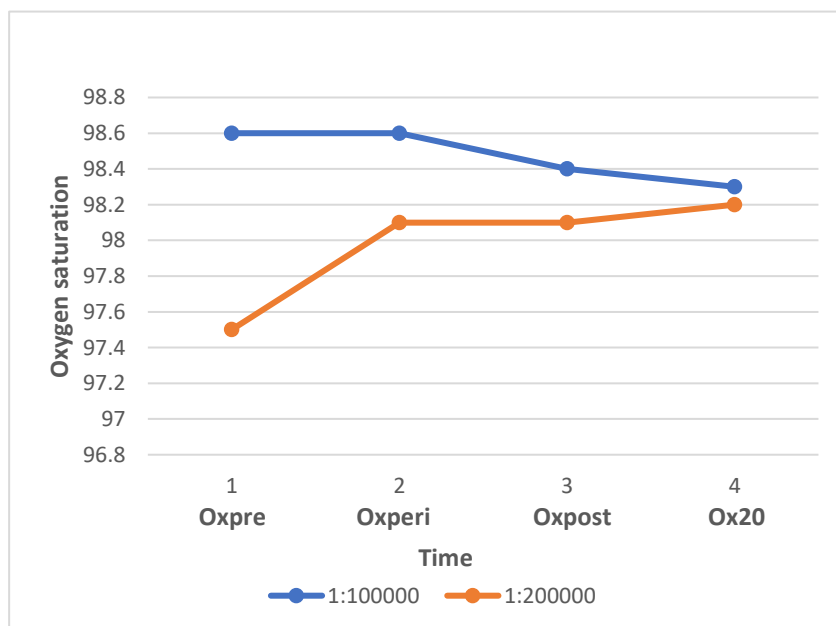


FIGURE 3: Oxygen saturation in both groups

Oxpre = Before the administration of LA; Oxperi = Immediately after the administration of LA;

Oxpost = After the extraction; Ox20 = 20 mins post-operatively.

Discussion

In dentistry, lignocaine is the most commonly used anesthetic. Other anesthetics are frequently compared to lignocaine, which is regarded as the gold standard. Lignocaine has a strong vasodilation feature, which is primarily responsible for its short duration of anesthetic effect when taken alone. It can also be used in combination with a vasoconstrictor. Vasoconstrictors are added to the LA solution in order to get around this problem.⁶ A broad range of medications may interact with vasoconstrictors used in LA solutions.⁷

Alterations in heart rate and blood pressure, dysrhythmias, ischemia alterations (ST segment and T wave), the release of endogenous catecholamines, the endocrine response to surgery, and hypokalemia are among the physiological reactions linked to LA solutions containing adrenaline.⁸ When utilized for surgical soft tissue and bone treatments in the oral region, LA agents with adrenaline as the vasoconstrictor typically result in more post-operative discomfort than LA agents without adrenaline as the vasoconstrictor.⁹

The statistical analysis of the study revealed substantial cardiovascular effects. Using 1:100000 adrenaline resulted in a considerable increase in the mean pulse rate, while using 1:200000 adrenaline did not show any significant change in the study. When LA with 1:100000 adrenaline was used, there was a considerable increase in both the systolic and diastolic blood pressure, but the group using 1:200000 adrenaline did not exhibit any significant change.^{10,11} Our study's anesthetic start time and LA dosage are comparable to those of Malamed et al.'s¹² investigation.

Although the effectiveness of either solution is unaffected, LA can be used for any concentration of adrenaline in an adult healthy patient. However, LA with an adrenaline concentration of 1:200000 may be preferable in geriatric and heart patients. LA with a ratio of 1:100000 is recommended for lengthy treatments because the duration of anesthesia varies considerably between the two solutions.

Conclusion

The present study concluded that two varieties of 2% lignocaine at two different concentrations, indicated that their efficacy was the same. When comparing the cardiovascular effects of 1:100000 adrenaline concentrations to the other medication, there was a notable increase in both pulse rate and blood pressure. 1:200000 adrenaline concentration may be advised for geriatric and cardiac patients because to its greater cardiac stability.

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