Cardiovascular responses to local anesthesia with adrenaline (1:200000) in hypertensive patients: An observational study

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ABSTRACT

Background: The use of adrenaline in local anesthetics in cardiac compromised patients during dental extraction has been controversial. The current guidelines concerning cardiac compromised patients recommend a maximum of 0.04 mg of adrenaline during one appointment.

Aim: To document safety of administrating 1.8 ml of a 2% lignocaine with 1:200000 adrenaline dental local anesthetic (LA) in a group of hypertensive patients by recording changes in blood pressure and pulse rate.

Methods: One hundred patients, both male and female, attending Department of Oral and Maxillofacial Surgery for removal of teeth were enrolled in this study. Hypertensive patients on medication were randomly selected. All patients were administered 1.8 ml of dental local anesthesia containing 2% Lignocaine with 1:200,000 adrenaline. Blood pressure (BP) and pulse rate (PR) were measured thrice; pre-injection, 2 minutes and 5 minutes after injection.

Results: The findings of our study showed that injection of 1.8 ml of 2% lidocaine with 1:200000 adrenaline has negligible effects on blood pressure and pulse rate.

Conclusion: In procedures such as dental extraction, no significant changes in blood pressure and pulse rate in well controlled hypertensive patients are seen attributable to anesthetic use with a vasoconstrictor.

Keywords: epinephrine, hypertension, heart rate, lignocaine

INTRODUCTION

The use of vasoconstrictors in local anesthesia (LA) is a standard practice during dental procedures. The combination of adrenaline (epinephrine) and lignocaine is the most widely used vasoconstrictor and local anesthetic preparation. Epinephrine vasoconstriction increases duration and depth of anesthesia, provide hemostasis and decrease systemic toxicity of local anesthesia.[1] Local anesthesia with insufficient amount of epinephrine is reported to offer inadequate pain and hemostasis control.[1] There is considerable disparity in views regarding the changes which may result from the use of vasoconstrictors in local anesthetics. Clough found that in hypertensive patients the rises in blood pressure produced by epinephrine injections were much greater than those observed in normal subjects.[2] However, studies also have reflected that cardiac complications, such as pre cordial pain or coronary thrombosis, when they occur, are caused by the vasoconstrictors in the anesthetic solution.[3] Another author has listed the contraindications to the use of epinephrine containing local anesthetics, such as; aortic regurgitation, mitral insufficiency, exophthalmic goiter, arteriosclerosis, and hypertension.[4]

In contrast, many workers have reported similar pressure responses in hypertensive and normotensive subjects. Many stidies have notedthere is no distinct difference in the response of hypertensive and normotensive subjects to epinephrine.[5,6] Its is also reported by a study that in patients with cardio-vascular disease no untoward effects were observed after the injection of vasoconstrictors with local anesthetics.[7]

Although cardiovascular responses to

infiltration anesthesia have been documented in numerous studies.[10,11] it is difficult to specifically evaluate the effects of a local anesthetic solution containing epinephrine because the cardiovascular system is greatly affected by the anxiety and pain produced during injection. In other words, it is affected by both exogenous epinephrine contained in local anesthetic solution and endogenous catecholamine released by the anxiety and pain during injection. However, because the effect of the anxiety and pain during dental injection can be reduced to a minimum by stress reduction methods, such as premedication, sedation and topical anesthesia, a study of hemodynamic response to exogenous epinephrine is meaningful.

MATERIALS AND METHODS

This study was conducted at the dental outpatient department of Oral and Maxillofacial surgery. One hundred patients, of both sex and age between 40 to 65 years attending Department of Oral & Maxillofacial Surgery for removal of teeth were randomly selected and enrolled in this study. Hypertensive patients on medication and indicated for extraction and periodic visit to physician for 1 year were included in the study. Patient on warfarin, heparin, steroids, or non-steroidal anti-inflammatory drugs as well as patient with systemic conditions like diabetes or any other and patient taking irregular medication for hypertension were excluded in the study.Institutional ethical committee approval was sought. Informed consent was obtained from all study subjects.

Pre-injection blood pressure and pulse rate were measured; if the blood pressure was in range 120-140/ 80-90 mmHg, then only local anesthesia was given. Local anesthetic injection containing 2% lignocaine with 1:2,00,000 adrenaline was administered to the patient. Aspiration was done prior to injecting the anesthetic both for infiltration and regional block to avoid the direct entry into the vessels. After that 1.8 ml of solution was injected.

Blood pressure and pulse rate were measure thrice; first before the injection, then 2 minutes after injection followed by 5 minutes after injection without any further intervention during this period.

RESULTS

Mean systolic blood pressure (SBP) and diastolic blood pressure (DBP) increased after two minutes of local anaesthetic injections. After 5 minutes of injections SBP returned to baseline. The overall fall in SBP was not significant both statistically and clinically.Mean pulse rate (PR) increased from one to three beats per minute.

Table.1. Variation in Systolic, Diastolic blood pressure and pulse at regular interval

	Mean Systolic B.P	Mean Diastolic B.P	Pulse
Before the procedure	131.14	82.44	82.36
after 2 minutes	135.42	84.70	83.31
after 5 minutes	132.76	82.54	83.39

DISCUSSION

Epinephrine is an effective vasoconstrictor when used in dental anesthesia. Despite this, its use has been limited by a fear of systemic absorption and the induction of adverse cardiac effects.[10] There have been many guidelines for the rational use of vasoconstrictors in patients with cardiovascular diseases. In 1964, a working conference of the American Dental Association and the American Heart Association[11] stated

that the concentrations of vasoconstrictors normally used in dental local anesthetic solutions were not contraindicated in patients with cardiovascular diseases when administered carefully and with preliminary aspiration. Malamed[12] recommended a much smaller maximal dose of vasoconstrictors (no more than 40 micro g of epinephrine at 1 appointment) for patients with severe cardiovascular diseases.

The use of epinephrine in cardiac patients is contraindicated particularly in those with unstable angina, recent myocardial infarction, recent coronary artery bypass surgery, refractory dyshythmia, uncontrolled hypertension and uncontrolled congestive heart failure.[13] This is supported by Meechan et al[14], who stated that epinephrine is a catecholamine that increases the rate and force of heart contraction and thus should be avoided in cardiac patients.

Niwa et al[15] reported that lidocaine-epinephrine is safe in hemodynamic consequences in patients with cardiovascular diseases. They concluded that a low dose of epinephrine in local dental anesthesia was well tolerated by cardiovascular patients who were in New York Heart Association (NYHA) classes I through III. In contrast to their results Hirota et al[16] reported that greater hemodynamic changes were observed in class III patients than in patients in other NYHA groups. However, their subjects were so few (n=2) that their findings should be discussed. Cintron et al[17] reported that dental anesthetics with 1.0 ml of 2% lidocaine with 1:100,000 epinephrine caused no significant changes in HR or blood pressure and was well tolerated by patients with recent myocardial infarction.

In present study, we investigated the changes in heart rate and blood pressure before and after local anesthetic with adrenaline during extraction. The important changes in hemodynamic values were heart rate and blood pressure. Heart rate was increased after 2 minutes and after 5 minutes of injection of local anesthesia with adrenaline. The increases in heart rate immediately after injection were likely an expression of endogenous catecholamine because of the injection pain. We noted rise in diastolic blood pressure and systolic blood pressure of patients with hypertension from the time of administering injections up to 2 minutes and fall after that till 5 minutes. The fall in blood pressure was statistically significant. Our results are similar to previous reports as far as fall in diastolic blood pressure is concerned[18] but contradict with most of the previous studies that have found an increase in systolic blood pressure after dental local anesthesia with adrenaline. A systemic review of all the relevant studies published till 2002 reported an increase in systolic blood pressure of 4 mmHg in hypertensive patients who received injections of lignocaine with 1:1,00,000 adrenaline.[18]

Significant fall in systolic blood pressure has also been observed after dental local anaesthesia in normal individuals. A study done on West Indian population reported 20% decrease in systolic blood pressure after dental local anaesthesia containing 0.06 mg of epinephrine during periodontal surgery.[19] Takahashi et al compared the effect of different doses of epinephrine in volunteers. They observed a 4-5 mmHg decrease in systolic blood pressure after five minutes in a group that received 10Qg of epinephrine in 2% lignocaine with a final

volume of 4 ml.[20] The systolic blood pressure of the normal individuals in our study was similar to the baseline value after five minutes of injections.

Fukudaetal[21] investigated the concentration of lidocaine during continuous epidural injection on 14 patients for 5 hours and they reported that the addition of epinephrine didn't affect the lidocaine concentration results. In contrast, according to this study's concentration results, addition of epinephrine to lidocaine for dental anesthesia reduced peak plasma lidocaine concentrations following the injection of local anesthetics in 1 hour values. Epinephrine in the local anesthetic solution prolongs the duration of anesthesia, allowing for smaller amounts of anesthetic to be used.[22]

Gokce M et al.,[23] concluded that the adverse effects of local anesthesia with epinephrine are safe and have minimal hemodynamic consequences on mandibular impacted third molar surgery operations in healthy young patients. Additionally, by providing increased depth and duration of anesthesia, epinephrine enables a greater percentage of dental procedures to be completed without pain, with a lower total dose of anesthetic. But they also recommend that high-risk patients should be carefully monitored if epinephrine is used and greater care should be taken during the injection to prevent intravascular injection of the solution, even in healthy patient populations. Additional studies to determine the safety of epinephrine containing local anesthetics are always needed. They conclude that lidocaine with epinephrine had no different hemodynamic effects or plasma concentrations than lidocaine alone during mandibular impacted third molar surgery on young healthy patients with no systemic diseases and medications.

There have been many studies of vasoconstrictors contained in local anesthetics for dental use, particularly the hemodynamic effects of epinephrine. However, few experiments have been carried out to compare these effects with those of exercise-stress testing.[24] It reported that hemodynamic changes caused by local anesthesia with 1.8 mL of L-E were at the same level as those produced by going upstairs. However, it is impossible to evaluate cardiac performance properly from his results because his observations were limited to blood pressure and heart rate, which were unaffected by low doses of epinephrine.[25]

Hemodynamics during infiltration anesthesia is greatly affected not only by the agent, but also by the pain and anxiety associated with the injection. Therefore, it is necessary to eliminate such effects as much as possible when attempting to evaluate the effects of the agent alone. Particularly in studies of patients, the effects of psychological stress on hemodynamics can be greater than those of the drug. Psychological effects should have been minimal in this study because dentists who were familiar with the injection procedure were used as volunteers for the experiment. The use of dentists as subjects probably also minimized the release of endogenous catecholamines. The dose of epinephrine infusion that causes cardio-vascular responses similar to those of infiltrate anesthesia was determined in the younger subjects. On the basis of these results, epinephrine-infusion testing instead of Lignocaine- Epinephrine infiltration anesthesia was performed in the older patients to facilitate the evaluation of the contribution of exogenous

epinephrine to the cardiovascular system.

Drug-stress testing with epinephrine has been used in many studies and its safety has been well established.[26,27] Epinephrine infusion has some defined advantages. First, the effects of pain and anxiety associated with the injection can be avoided. Secondly, a fixed rate of the infusion of epinephrine can be ensured and the administration of repeated doses of epinephrine at different rates is feasible.

Kondo et al[28] reported that there were no significant hemodynamic changes after a single dose of lignocaine and that, if lignocaine is administered with epinephrine, the lignocaine reduces the effects of epinephrine on hemodynamics. In the infiltration-anesthesia testing, the effects of epinephrine on the cardiovascular system might have been reduced by lignocaine.

Dionne et al[29] found that after the administration of 5.4 ml of 2% lignocaine with epinephrine 1:100,000, taking care to avoid intravascular injection, the heart rate were increased in 19% of the cases, and cardiac output in up to 30%. According to Silvestre et al[30] the fact of using or not using a vasoconstrictor with the local anesthetic solution exerts no effect upon blood pressure in normotensive patients – though a certain increase in systolic blood pressure (SBP) was noted at the moment of tooth extraction and at the end of the procedure. This was attributed to increased patient anxiety during extraction, taking into account that the difference was comparatively greater between SBP at the start of the procedure and at the actual moment of extraction. Fellows et al[31] using intravenous injections of epinephrine (3.5 pg in one minute), recorded a 30% increase in heart rate (HR), though the values returned to base-line levels after 15 minutes.

CONCLUSION

Local anesthesia with a vasoconstrictor does not produce any significant changes on blood pressure and heart rate.

AUTHOR NOTE

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