

Effect Of Mepivacaine With Or Without Adrenaline On Blood Pressure And Heart Rate In Normotensive And Hypertensive Subjects - A Clinical Study

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ABSTRACT

OBJECTIVES: In this study dental extraction was performed under 2% mepivacaine with/without adrenaline, in patients with/without hypertension. Changes in blood pressure and pulse rate were noted to establish whether these changes are attributable to addition of adrenaline.

METHODS: This prospective study was carried out in 60 walk-in patients who presented at the exodontia clinic of the college of dentistry, King Khalid University, for intra-alveolar tooth extraction. Patients were randomly allocated to two groups being normotensive and hypertensive. Each group was further divide into two more groups based on type of anaesthetic solution employed. Group A1 having 15 normo tensive patients, had tooth extraction done under 2% mepivacaine without adrenaline while group A2 had 15 normotensive patients with tooth extraction done under 2% mepivacaine with vasoconstrictor 1:80000 adrenaline .Group B1 was having 15 hypertensive patients whose tooth extraction was done under 2% mepivacaine without adrenaline while group B2 with 15 hypertensive patients had tooth extraction done under 2% mepivacaine with 1:80 000 adrenaline. One tooth was extracted from each patient. Blood pressure and pulse rate measurements were recorded in the waiting room before surgery, 5 minutes after local anaesthetic injection, 5 minutes after tooth extraction and 30 minutes after tooth extraction.

RESULTS: The study population consisted of nearly equal number of both genders. The age for normotensive patients i.e group A was lesser as compared to hypertensive patient group B. There was an overall increase in mean SBP and mean DBP and PR in all patients after LA was given followed by a gradual decrease. However, after waiting for a long time an overall increase in all cardiovascular parameter was seen in LA with adrenaline group and an overall decrease in LA without-adrenaline group.

CONCLUSION: The haemodynamic changes induced by injecting mepivacaine with or without adrenaline in both normotensive or hypertensive are not that profound to cause any CVS event. So it is always wise to use LA with adrenaline to get all its benefits mentioned in pharmacology, without worrying about untoward CVS event.

Keywords: Adrenaline, hypertension, heart rate, tooth extraction.

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I. INTRODUCTION

Dentists have always been concerned about the fear of systemic absorption of vasoconstrictor used in local anesthesia (LA) solution and the induction of adverse cardiac effects, particularly among patients with cardiovascular diseases.[1] Adrenaline is the most commonly used vasoconstrictor in the LA solution, worldwide.[2] Adding adrenaline or another vasoconstrictor has many benefits, such as reducing the systemic toxicity of the local anesthetic by reducing its absorption and increasing its activity at the site of deposition. Additionally, local bleeding control can be very beneficial. [3,4] So vasoconstrictors such as adrenaline are indispensable in achieving the excellent local anaesthesia perioperatively which is required to provide safe and effective control of intra-operative pain in daily clinical dental practice [3]. However, adrenaline acts on both alpha and beta receptors in blood vessels. Its action on alpha 1 and beta 1 receptors can cause increased blood pressure (BP) at moderate plasma concentrations. It has positive chrono, dromo and ionotropic effect on heart muscles to cause palpitations. [5,6]

As a result, patients with hypertension represent a potentially significant risk group for dental treatment under the above LA. [5] The clinical effects of exogenous adrenaline on cardiovascular and hemodynamic changes

make its use in hypertensive patients a contentious topic in dentistry. [5,7] While the general contraindication to vasoconstrictors is well established there is a complaint about the current guidelines' ambiguity and vagueness for patients with cardiovascular disorders.

Thus the present study aimed to assess blood pressure and pulse rate (PR) variations in both normotensive and hypertensive patients undergoing dental extractions under local anesthesia i.e 2% mepivacaine with and without adrenaline. Also it will provide an insight into safety of LA containing adrenaline and whether these CVS parameter variations are related to the addition of adrenaline.

II. MATERIAL AND METHODS

This study was conducted at the exodontia clinic of the college of dentistry, King Khalid University and hospital. Patients included in this study were 60 walk in patients (27 females and 33 males) who presented at the clinic with indication of intra-alveolar tooth extraction. Both hypertensive patients and normotensive patients were included in the study. All the patients in the hypertensive group had a history of medically diagnosed high blood pressure controlled with antihypertensive medication except for non selective beta blockers. The normotensive group had subjects without any history of hypertension or any cardiovascular drug intake.

Criteria for selection of patients.

Inclusion:

- Any patients needing a firm-tooth extraction
- Patients in which lower molars are indicated for extraction.

Exclusion:

- Patients with any other current medical problems other than hypertension or a previous history of other medical problems, or
- Current history of using any other medications for the treatment of cardiovascular related diseases apart from anti-hypertensive drugs.
- Patients on non-selective beta blockers
- Patients who underwent surgical or lengthy extraction.
- The data obtained from 60 patients selected according to the above criteria was collected. The subjects were allocated into the following 4 groups

Group A1 consisted of 15 normotensive patients who had tooth extraction done under 2% mepivacaine without 1:80 000 adrenaline

Group A2 consisted of 15 normotensive patients had tooth extraction done under 2% mepivacaine with 1:80 000 adrenaline

Group B1 consisted of 15 hypertensive patients had tooth extraction done under 2% mepivacaine without 1:80 000 adrenaline

Group B2 having 15 hypertensive patients who had tooth extraction done under 2% mepivacaine with 1:80 000 adrenaline

All extractions were performed by same oral surgery resident doctor while the haemodynamic readings were taken by another surgeon. Systolic blood pressure (SBP), Diastolic blood pressure (DBP) and Pulse rate (PR) measurements were recorded with a pre-calibrated non-invasive electronic digital blood pressure monitor (BPL india). In all the patients/subjects basal readings of BP were taken in the waiting room after making the patient to rest for atleast 30 minutes of their arrival in the reception. Reading were then taken after 5 minutes after local anaesthetic injection, 5 minutes after extraction and 30 minutes after extraction.

Data analysis was done using the Statistical Package for Social Sciences, SPSS® for Windows, version 20.0 (SPSS Inc, Chicago, IL) statistical software package.

III. RESULTS

The study population consisted of nearly equal number of both genders, 33 males and 27 females to avoid any gender bias. The age for normotensive patients i.e group B was lesser as compared to hypertensive patient group. The mean age of the groups ranged from 34 for normotensive group to 59 for hypertensive group.

In the normotensive subjects in whom plain mepivacaine was used the mean systolic and diastolic BP increased (119.9; 79.27) as compared to the basal level (116.2; 76.2) then decreased (117.6;78.13) below the basal levels. Similar observation was seen with the heart rate. Basal level mean PR was 78.53 which increased then decreased and ultimately settled at 73.27. However the decrease after initial increase in heart rate was more marked. (Figure 1.)

In the normotensive subjects in whom mepivacaine with adrenaline was used the mean systolic BP increased (123.6) as compared to the basal level (118.4), increased again to above the basal level to settle at (124.1). Mean DBP remained unaltered with only a very small gradual increase from the baseline mean BP after 30 minutes of extraction. However there was a more marked overall increase in mean heart rate with a decrease in between (from 71.53 baseline to 81.73 30 minutes after extraction) (Figure 2.)

In the hypertensive subjects in whom plain mepivacaine was used the mean systolic BP increased (145.2) as compared to the basal level (140.8) then decreased (135.9) below the basal levels. Similar observation was made with respect to the heart rate changes. However the mean DBP remained unaltered (around 90) with only a slight decrease than the basal level 30 minutes after extraction. (Figure 3.)

In the hypertensive subjects in whom mepivacaine with adrenaline was used the mean systolic BP got increased (to 142.4) five minutes after giving LA, then decreased (135.5) five minutes after extraction and then increased (140) thirty minutes after extraction. The baseline mean SBP was 137.2 mmHg . Similar observation was made regarding the heart rate values. The DBP levels got slightly altered ultimately to reach above the basal level only slightly as against the changes in SBP which were more marked.(Figure 4.)

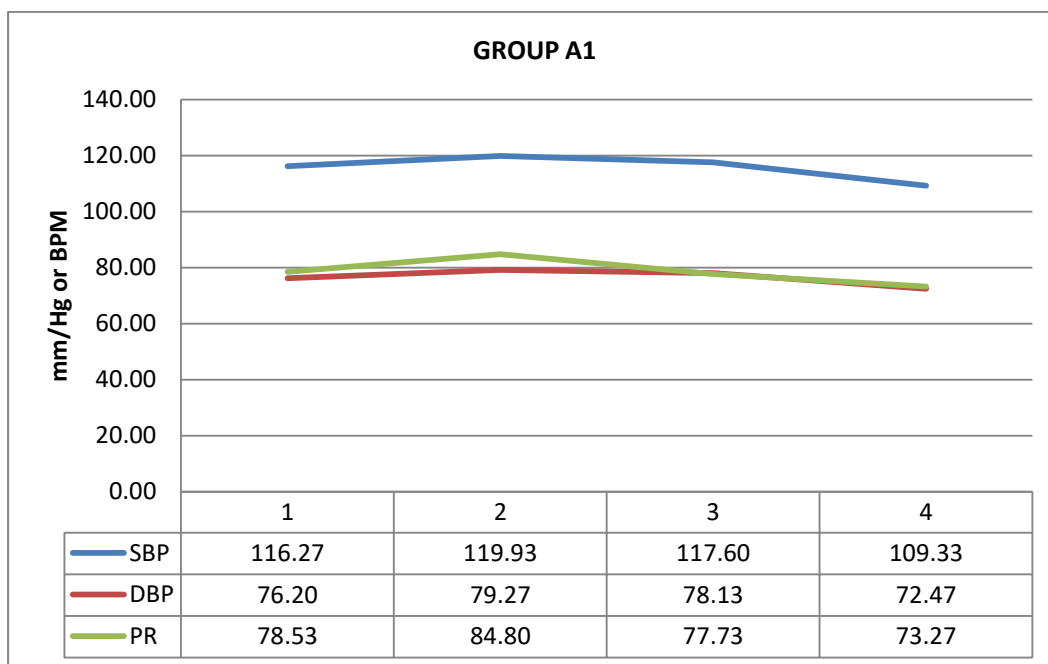


Fig 1: Normotensive patients in which LA without adrenaline was given

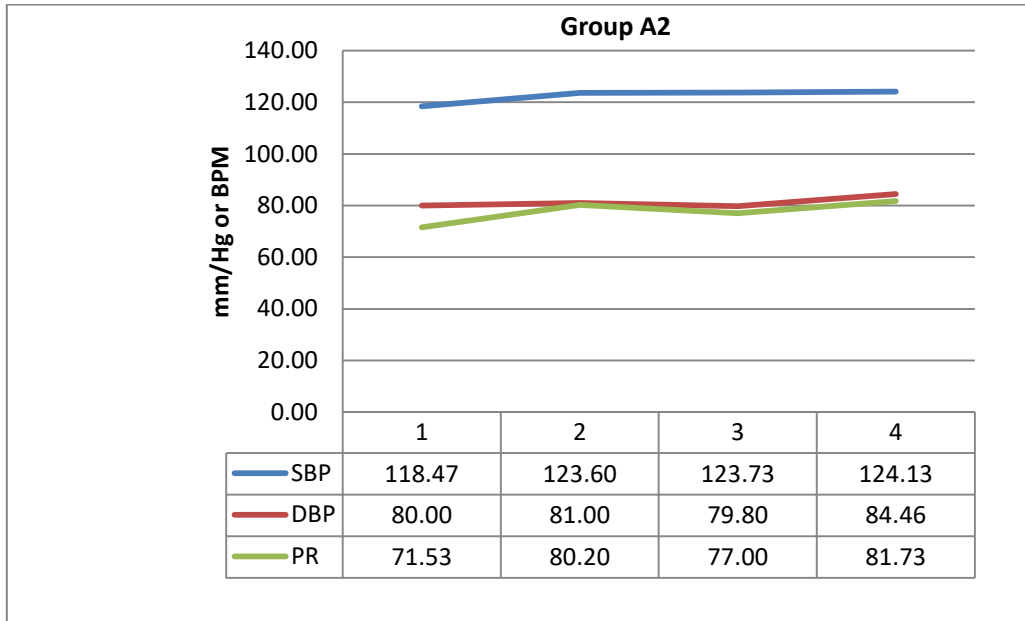


Fig.2 : Hypertensive patients in which LA with adrenaline was given

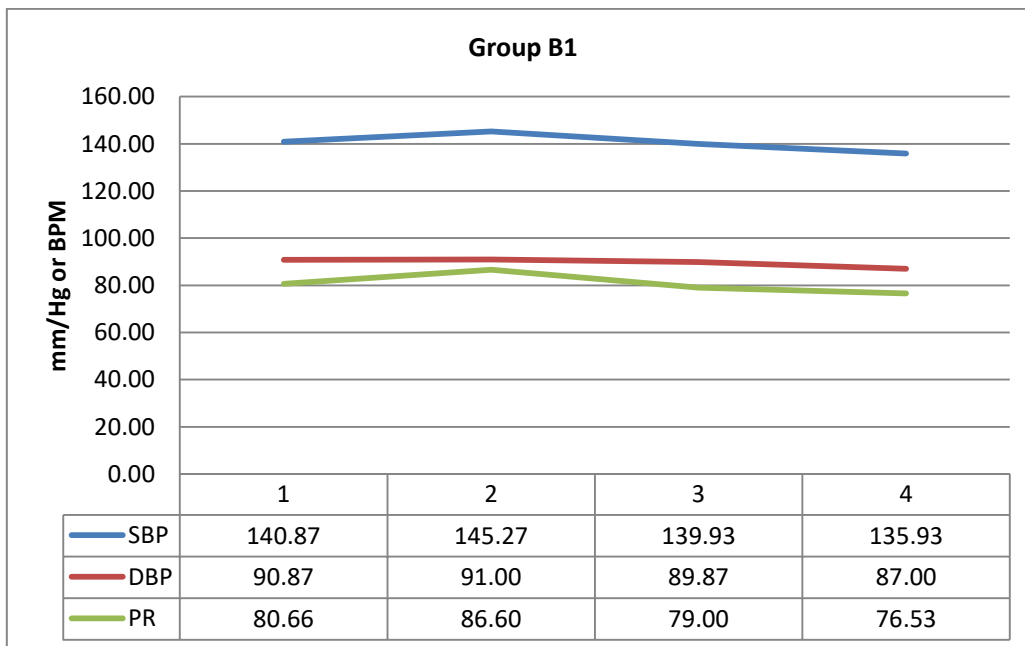


Fig.3: Hypertensive patients in which LA without adrenaline was given

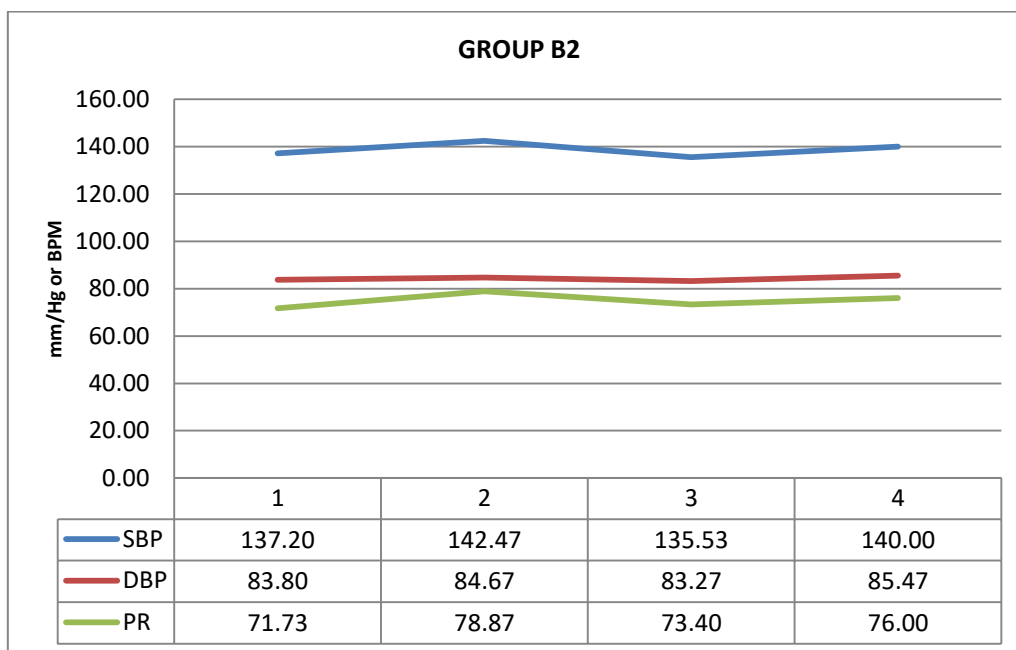


Fig.4: Hypertensive patients in which LA with adrenaline was given

There is a 2.04%, 2%, 5.09% increase in mSBP, mDBP and mPR increase from the baseline values in group B2, respectively. Whereas 4.77%, 5.57%, 14.25% increase respectively in the same variables in group A2. For group A1 there is 5.96%, 4.89%, 6.69% decrease in the mSBP, mDBP and mPR from the baseline values where as for group B1 the decrease is 3.5%, 4.2%, 5.12% respectively.

IV. DISCUSSION

In individuals aged 40-89, the risk of dying from ischemic heart disease and stroke has been found to double for every 20 mm of mercury (systolic) or 10 mm of mercury (diastolic).[8] As a result, dental professionals need to be extremely careful when performing risk assessments and being aware of everything that can affect cardiovascular parameters like blood pressure and heart rate readings. High levels of stress, including dental anesthetic needle prick, can in fact cause temporary increases in blood pressure. [9,10] In addition to stress, medications used in local anesthetic solution can also affect these parameters. Furthermore, cardiovascular accidents caused by hypertension during dental surgery have also been reported. [11]

The results indicated that all subjects undergoing extractions, whether they are normotensive or hypertensive, experience small increases (statistically insignificant) in mean DBP, mean SBP, and mean heart/pulse rate (mPR) associated with the use of a local anesthetic containing epinephrine (4 mm Hg and 6 bpm, respectively). These changes occur five minutes after the local anesthetic is administered, suggesting a reflex sympathetic activation due to the discomfort or stress caused by the needle prick rather than a sympathetic effect of the solution. All subjects experience these small increases, regardless of whether the local anesthetic was administered with or without adrenaline. Similar observations were observed in some other studies [1,2,12]

Five minutes after extraction, there was an overall decrease in all the CVS parameters compared to five minutes after injecting LA. This was observed in all the subjects, regardless of the group to which they belonged to. This suggests once again the role of stress in changing CVS parameters. While as thirty minutes after extraction, there was inconsistency in the parameters depending on all the variables like whether the subject was normotensive or hypertensive and whether the subject received LA with adrenaline or without adrenaline. Comparing the reading to the baseline, there was an overall decrease of the mSBP, mDBP, and mPR in the LA without adrenaline group and an overall increase in the same variables in the LA with adrenaline group. The reason for this can be attributed increasing plasma levels of vasoconstrictor after being absorbed from the site of injection, in patients where LA with adrenaline was used. The reason for decrease in CVS parameters in patients

where LA without adrenaline was given can be due to unopposed action of mepivacaine which when absorbed into blood stream depress CVS parameters and have hence been used as good antiarrhythmics. [13]

Same has been shown by Köhler-Knoll et al.[12] that the catecholamines found in local anesthetics raised blood pressure. However the changes in mean arterial blood pressure (mDBP) were not as significant as those in mean systemic blood pressure (mSBP), with changes of only 4-5 mm of Hg. Nevertheless, it is likely that the response was mediated by the direct action of the epinephrine found in the local anesthetic, as plasma epinephrine concentrations remain high 30 minutes after administration.[14] Additionally, it was observed that the increase in mean arterial blood pressure with adrenaline was more pronounced in normotensives than in hypertensives. This could be explained by the fact that the hypertensives were taking anti-hypertensive medication, which would counteract the effects of exogenous adrenaline's alpha agonist activity. [15]

The function and regulation of the autonomic nervous system are impaired in elderly patients; therefore, the combination of factors including painful stimuli, psychological stress, and the direct effect of epinephrine contained in the local anesthetics may elicit a greater sympathetic response in younger normotensives. These results suggest that the responses and the regulation of the autonomic nervous system between younger and older patients are different during dental surgery. No adverse outcomes were reported among any of the subjects in the studies included in the study.

V. Conclusion:

The haemodynamic changes induced by injecting mepivacaine with or without adrenaline in both normotensive or hypertensive are not that profound to cause any CVS event. However it should be made sure that the hypertensive patient is taking medication properly and is not on erratic treatment or the BP measurements are too skewed. It is always wise to use LA with adrenaline to get all its benefits mentioned in pharmacology, without worrying about untoward CVS event.

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