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Evaluation of Safety of Lidocaine with Epinephrine In Known Hypertensive Patients Requiring Dental Surgery

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ABSTRACT

Objective: To demonstrate safety of changes in blood pressure and heart rate in a group of hypertensive patients following administration of 3.6 ml of a 2% lignocaine with 1: 100,000 epinephrine dental local anaesthesia.
Study Design: Quasi-experimental study
Place and Duration of Study: This study was done at 20 Military Dental Centre, CIMS Dental College, Multan, Pakistan, from Jan to Jun 2023.
Methodology: The study involved 80 patients scheduled for tooth extraction in the OMFS outpatient department. Of these, 15 had stage 1 hypertension, 15 had stage 2 hypertension, and 15 were pre-hypertensive. The Control Group included 35 normotensive patients requiring tooth extraction, matched for age and sex.
Results: Out of 80 participants, 48(60.0%) were male, and the Mean age of the patients was 52.11±4.22 years. Mean of (Systolic Blood Pressure) SBP increased in all the groups after two minutes of local anesthetic injection. After five minutes, Systolic blood pressure drops off to baseline in all groups. The overall fall in SBP had a statistically significant difference before and after two and five minutes' local anesthetic injection in all groups, as *p*-values < 0.05.
Conclusions: Patients with stage 2 hypertension involved in this trial had a reduction in systolic blood pressure thanks to dental local anaesthetic using epinephrine. Patients with systolic blood pressure hypertension experienced a drop of 21mm Hg, however there were no negative side effects.

Keywords: Epinephrine, Lignocaine, Hypertension

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INTRODUCTION

Blood pressure that is controlled by antihypertensive prescription drugs, a mean systolic blood pressure of 140 mm Hg or higher, or a mean diastolic blood pressure of 90 mm Hg or above are all regarded as indicators of hypertension. Of this hypertensive group, 48% receive no treatment, 24% receive effective treatment, and 29% receive insufficient treatment.[1] These findings imply that a sizeable fraction of adult patients in a typical dental practice are hypertensive people.

The additional dangers associated with administering epinephrine to hypertensive individuals result from a variety of unique causes. Epinephrine can worsen pre-existing high systolic blood pressure in persons who are not taking antihypertensive medication.[2] Acute left ventricular failure, cerebral hemorrhage, and hypertensive encephalopathy can all result from such an elevation in blood pressure.3 If the heart is unable to adequately adjust to the blood pressure and heart rate changes brought on by epinephrine, long-standing hypertension can result in cardiac hypertrophy and atherosclerotic changes in the arteries, which increases the risk of angina pectoris, myocardial infarction, and cardiac arrhythmias. As the first line of treatment for hypertension, beta blockers are frequently utilized.[3]

However, the depth and duration of anaesthesia are increased when a vasoconstrictor like Epinephrine is added to the local anaesthetic solution. The amount of bleeding in the surgical area is also decreased. Dental local anaesthetics with Epinephrine are relatively more effective and potent than a simple anaesthetic solution.[4]

Literature regarding the safe use of dental local anesthesia containing Epinephrine in hypertensive patients found that the use of two 1.8 ml cartridges of Lignocaine containing 1:100,000 epinephrine (0.036 mg) was effective in controlling hypertension and stage 1 hypertension (HTN-1) (BP 159/99) patients.

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Therefore, there is insufficient evidence to support the use of this medication in people with stage 2 (HTN-2) hypertension (BP > 160/100 mmHg). While authors like Bader *et al.,* showed concerns against using the solution,[5] others indicate it can be administered with the proper safeguards and supervision.[6]

Kahri *et al.* highlighted the occurrence frequency of medical emergencies in dental practice. Cardiovascular emergencies, while infrequent, cannot be ignored as they are the most life-threatening events if they occur.[7]

To gather more comprehensive data on this controversial topic, a pilot study was conducted at the Military Dental Centre and CIMS Dental College in Multan, Pakistan. The study focused on patients diagnosed with hypertension stages 1 and 2 (HTN-1 and HTN-2) to assess the safety of administering two cartridges containing 1:100,000 Epinephrine combined with 2% Lignocaine. This research aims to shed light on the implications of using these anesthetic agents in a population with elevated blood pressure, contributing valuable insights to dental practices involving hypertensive patients.

METHODOLOGY

This quasi-experimental study was carried out at 20 Military Dental Centre/ CIMS Dental College in Multan, Pakistan, from Jan 2023 to June 2023 after taking approval from the Institutional Review Board (IRB), vide reference number (Dated 02 January 2023).

Sample size was calculated by WHO calculator at 95% confidence interval, with 5% margin of error. A total of 80 participants were included in the study using convenience sampling.

Inclusion Criteria: The first eighty (n=80) walk-in patients aged 18–60 years diagnosed for tooth extraction at the OMFS OPD were assessed for inclusion in the study.

Exclusion Criteria: All children under 18 years and patients with cardiovascular conditions other than hypertension were excluded.

A non-random consecutive sampling method was used to select our sample. Informed consent was obtained from the participants before collecting the data. The data was collected using a questionnaire specifically designed to capture their demographic information and laboratory results. The information was securely stored in a database with a password, and strict confidentiality throughout the process was ensured.

Patients were divided into four groups: Group-1 was healthy individuals or the Control Group. Group-2 had pre-hypertension, defined as a blood pressure of 130/90. Group-3 was Stage 1 HTN-1, with blood pressure ranging from 140 to 159 and 90 to 99. Group-4 was Stage 2 HTN-2, with blood pressure ranging from 160 to 179 and 100 to 109. (Figure) Blood pressure was measured using a digital/electronic BP apparatus. Each patient received two cartridges (each 1.8 ml) of local anesthetic containing 2% lignocaine and 1:100,000 epinephrine from the same dentist. Aspiration was performed before administering the anesthetic in both infiltration and regional block procedures to prevent needle penetration into a vessel. Blood pressure was checked twice as a risk indicator: once before the injections and again five minutes later, when no other interventions were performed.

Collected data was processed Statistical Package for the the Social Sciences (SPSS) version 21, to assess both quantitative and qualitative variables. The mean and standard deviation (SD) were calculated. The ANOVA test was employed to determine if there were any notable differences among the groups. The p values ≤ 0.05 was considered as significant.

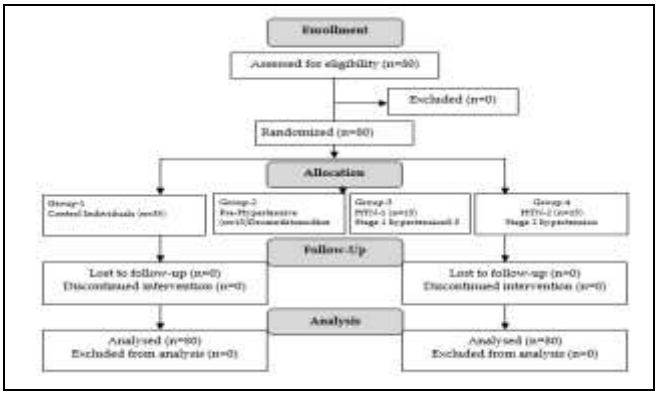

Figure: Patient Flow Diagram (n=80)

RESULTS

Out of eighty Participants, 48(60.0%) patients were male and 32(40.0%) were female. The mean age was 52.11±5.16 years. The mean age of Pre-Hypertensive, Stage-1, and Stage-2 patients was 51.33±2.72 years, 55.33±4.71 years, and 57.53±3.09 years, as compared to 48.88±3.82 years for the normo-tensive patients comprising the Control Group. The details of gender and age distribution concerning study groups are shown in Table-I. Mean of (SYSTOLIC BLOOD PRESSURE) SBP increased in every group after two minutes of local anesthetic

injection. After five minutes, Systolic blood pressure drops off to baseline in all groups. The overall fall in SBP had a statistically significant difference before and after two and five minutes of local anesthetic injection in all groups, as *p*-values < 0.05. Similarly, Diastolic Blood Pressure (DBP) also increased in all the groups after two minutes of local anesthetic injection and had statistically significant differences as *p*-values < 0.05. Mean plus rates increased from two to four beats per minute in all groups, but in HTN-2 patients decreased slightly. The results of blood pressure and rates are displayed in Table-II.

Table-I: Demographic Data of Participants (n=80)

Characteristics		Control Individuals (n=35)	Pre Hypertensive (n=15)	HTN-1 (n=15)	HTN-2 (n=15)
Gender	Male	22(62.9%)	10(66.7%)	6(40.0%)	10(66.7%)
	Female	13(37.1%)	5(33.3%)	9(60.0%)	5(33.3%)
Mean Age (Years)		48.88±3.82	51.33±2.72	55.33±4.72	57.53±3.90

**HTN – Hypertension*
HTN-1 Stage 1 hypertension
HTN-2 Stage 2 hypertension

Table-II: Comparison of Mean Blood Pressure and Pulse Rate Before and After Epinephrine Dental Anesthetic Administration

Study Groups	Injection Time			*p*-Value
	Before	After 2 Minutes	After 5 Minutes	
Control Group				
Systolic BP (mmHg)	114.37±3.48	120.91±8.36	112.20±6.77	0.001
Diastolic BP(mmHg)	76.19±6.18	74.99±7.73	71.12±6.38	< 0.001
Pulse Rate(bpm)	80.99±7.28	81.93±10.77	82.79±8.64	0.026
Pre Hypertensive				
Systolic BP(mmHg)	129.60±3.78	136.33±3.22	134.53±3.06	0.032
Diastolic BP(mmHg)	83.54±3.72	86.54±6.62	81.66±8.53	< 0.001
Pulse Rate(bpm)	81.26±9.91	83.44±13.26	84.56±11.29	0.001
HTN-1				
Systolic BP(mmHg)	141.33±2.78	144.86±4.50	136.61±6.09	0.010
Diastolic BP(mmHg)	84.33±6.77	84.44±7.46	82.15±1.10	0.001
Pulse Rate(bpm)	90.10±8.96	92.12±11.31	93.01±14.38	0.032
HTN-2				
Systolic BP(mmHg)	163.01±3.85	155.86±4.35	142.60±2.87	0.001
Diastolic BP(mmHg)	80.66±8.83	82.66±9.56	79.29±6.54	0.004
Pulse Rate(bpm)	84.56±6.54	83.33±5.01	82.63±4.36	0.030

**BP – Blood Pressure*
HTN – Hypertension

DISCUSSION

Due to the variety of anesthetics and associated side effects, as well as the individual differences among patients, dental professionals need to assess the pharmacokinetics and pharmacodynamics of these medications.[8,9] To enhance the effectiveness of anesthetic drugs, many vasoconstrictors are available in various concentrations. Epinephrine is the most commonly used vasoconstrictor in dentistry, but there is controversy over its use because of numerous cardiovascular conditions.[10,11] Therefore, some researchers recommend the use of epinephrine-free anesthetics in clinical dental practice. However, a vasoconstrictor can offer additional benefits, such as extending and improving the quality of anesthesia, lowering plasma levels of anesthetic drugs, reducing the amount of anesthetic needed for a nerve block, and minimizing bleeding during oral surgeries.[12] Nonetheless, the small sample sizes, different measurement times, and variations in the amounts of anesthetic drugs or vasoconstrictors limit the significance of these findings.

Massalha *et al.,* have investigated the fluctuations in arterial blood pressure and pulse rate during the injection of lidocaine with epinephrine in dental settings. This study also aimed to provide further evidence on this topic. International guidelines state that patients with controlled or stage 1 HTN conditions can safely receive local anesthesia with epinephrine.[13]

Shaban et al., and Managutti et al., also observed a significant increase in pulse rate among healthy individuals. This aligns with the results of this study, which showed a rise in pulse rate in patients

undergoing dental treatment.[14,15] The current study found that from the time of injection, the DBP and SBP of patients with HTN significantly decreased. This reduction in BP met statistical criteria. These findings differ from most other research, indicating an increase in SBP following dental local anesthetic with epinephrine, but they are consistent with previous studies showing a decline in DBP. Conversely, a study by Ehsan Aliabadi in 2020 found no significant changes in SBP and DBP after administration of an anesthetic with epinephrine in patients with HTN.[16] For maxillofacial surgery or the surgical removal of bilateral mandibular teeth, either one or two cartridges of 2% lidocaine with 1:80000 epinephrine are injected.

Takahashi *et al.* compared the effects of various epinephrine dosages in volunteers. After five minutes, a 4- to 5-mmHg decrease in SBP was observed in the group that received 10g of epinephrine in 4ml of 2% lignocaine.[17] Five minutes after injections, the SBP of healthy subjects in this study was comparable to the baseline.

The minimal cardiovascular risks associated with epinephrine usage in hypertensive patients are outweighed by their advantages. A painful extraction in a hypertensive patient may induce stress, which in turn may cause the body to produce excessive amounts of endogenous adrenaline. For such patients, this may turn out to be much more harmful. The current study provides proof that a dental local anesthetic solution test dose (2 cartridges) of 2% lignocaine with 1/100,000 epinephrine is likely to lower SBP in Group three patients.[18]

LIMITATIONS OF THE STUDY

The study was conducted on a limited number of participants due to the lack of prior sample size estimation; increasing the sample size could yield more comprehensive results. Additionally, examining gender-based variations in blood pressure may provide more precise treatment options.

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CONCLUSION

It is important to customize local anesthetics with a vasoconstrictor according to the patient's characteristics, such as systolic blood pressure (SBP), diastolic blood pressure (DBP), and pulse rate, before administration. In this trial, patients with stage 2 HTN who received two 1.8 ml cartridges of Lignocaine with 1:100,000 epinephrine experienced a reduction in their SBP. Observable changes in blood pulse rate were noted among the study participants; however, this decrease was not associated with any negative effects.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

SAS & SM: Data acquisition, data analysis, critical review, approval of the final version to be published.

DR & NAK: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

SE & TM: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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