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Original Article

Hemodynamic Changes in Normotensive and Hypertensive Patients after Administration of Infiltration Anesthesia for Dental Extraction

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Abstract

Objective: The objective of current study was to evaluate variations in systolic and diastolic blood pressure and the pulse rate of normotensive and hypertensive patients going through extraction after giving two cartridges of local anesthesia with 1:100000 epinephrine.
Study type, settings & duration: This prospective study was carried out at Department of Oral Surgery, Riphah International University, Islamic International Dental College (IIDH), Islamabad from January to April 2020.
Methodology: Sixty patients between 20-60 years of age who presented at Oral and Maxillofacial Surgery clinic for tooth extraction were included in research. Group A was hypertensive patients and Group B was normotensive patients. Their systolic and diastolic BP and pulse rates were documented at five different time intervals during the extraction. Independent t-test was used to check the statistical variance between mean BP and pulse rates of Group A and Group B at five different time intervals.
Results: There was a significant difference in diastolic BP at T2 and T3 which means during the extraction, the diastolic blood pressure of hypertensive patients got significantly higher than normotensive patients. There was significant difference between diastolic blood pressure at T4 as well which signifies that diastolic BP of hypertensive patients took longer to come back to pre-anesthetic state. Difference in pulse rate remained insignificant at all time intervals.
Conclusion: Local anesthesia with epinephrine does not significantly increase the systolic blood pressure of hypertensive patients during the extraction and but it does increase diastolic blood pressure significantly during extraction in hypertensive patients. It also takes longer for diastolic blood pressure of hypertensive patients to return to pre extraction state.
Key words: Local anesthesia, dental extraction, hypertension.

Introduction

An individual having systolic blood pressure more than 140 of mm of Hg, a diastolic blood pressure more than 90 mm of Hg or an individual taking medicine to control or manage blood pressure is classified as a hypertensive patient. To confirm the diagnosis two or more readings should be taken at primary screening and at two more visits.[1]

Multiple systems, including autonomic nervous system, the angiotensin-renin system, chemical and hormonal mediators, maintain blood pressure.[2,3] Equilibrium between peripheral vascular resistance and cardiac output is also crucial in maintaining arterial blood pressure.[4] Acute increases in cardiac output and peripheral resistance alter systolic blood pressure, while diastolic arterial pressure reveals possible changes in peripheral resistance. Pain, discomfort, anxiety or fear during dental extraction can produce catecholamines that can alter blood pressure.[5] Invasive procedures involving application of local infiltration anesthesia can stimulate the sympathetic system triggering a chain of events whose outcome

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Authors Contribution

KA conceptualized the project, did the data collection, statistical analysis, literature search. KK did the drafting, revision & writing of manuscript.

may be reflected in an increase in arterial pressure and heart rate.[6, 7]

About 24 percent of America's adult population is hypertensive. Forty-eight percent of this adult hypertensive population remains untreated whereas 24 percent are efficiently treated, and 28 percent are unproductively treated.[8] In Pakistan, one in five adults above the age of 15 years suffers from hypertension.[9] As a result, a significant percentage of a classic dental practice will include both controlled and uncontrolled hypertensive individuals.[10]

Endogenous catecholamines produced as a result of pain and discomfort, can cause hemodynamic changes eliciting arise in blood pressure and heart rate and can even initiate arrhythmias. Simple procedures, like root planning and scaling using anesthesia, have proven to significantly alter systolic blood pressure in patients.[11]

Use of local anesthetics includes reversible blockage of nerve conduction which in turn controls pain. Most commonly used local anesthetics in dental practice include lidocaine in combination with a vasoconstrictor. There are multiple advantages of vasoconstrictor in local anesthesia, which include slow systemic absorption of the anesthetic solution from the operative field therefore extending its action and strength of block. Use of lower anesthetic doses increases safety which leads to decreased chances of systemic toxicity. A definite gradation of ischemia is also sustained, which aids hemostatic action and less bleeding at operative sites. The most often used vasoconstrictors are norepinephrine and epinephrine.[12] The action of epinephrine includes activation of the alpha-adrenergic receptors of vascular smooth muscle, causing vasoconstriction in the local microcirculation.[13]

Use of epinephrine, in local anesthetic solution, in patients with known cardiovascular problems has led to many controversies. Many clinicians have a preference of using local anesthetics without vasoconstrictors in hypertensive patients due to the undesirable effects of vasoconstrictors on cardiovascular system. Administration of epinephrine at concentrations less than those used in dental practice can even give rise to increases in myocardial yield and oxygen consumption, thus leading to cardiac sequelae.[14] Whereas Meyer et al reported that there is possible hazard of hypertensive crisis due to the probable pain produced by inadequate intraoperative anesthesia by the use of anesthetic solutions without vasoconstrictors.[15]

The aim of current study was to assess variations in systolic and diastolic blood pressure and the pulse rate of normotensive and hypertensive patients going through extraction of upper premolar under two cartridges of local anaesthesia with 1:100000 epinephrine and to assess whether these differences are significant or not.

Methodology

This study was carried out at Department of Oral Surgery, Riphah International University, Islamic International Dental College (IIDH), Islamabad from January to April 2020. There were 60 patients between 20–60 years of age who came for upper premolar extraction. The sudy population was divided in two groups, Group A included the patients with no history of medically identified high blood pressure i.e. normotensive patients with diastolic blood pressure 70-89 mm and systolic blood pressure 100-139 mm. Group B included the patients with history of hypertension and on anti-hypertensive medications i.e patients with systolic pressure ranging from 140 to 159 mm Hg or a diastolic pressure ranging from 90 to 99 mm Hg who were on anti-hypertensive medication as per WHO classification.

Patients with any other medical problems or medications except anti-hypertensive drugs were excluded from this study.

Inclusion criteria was normotensive and hypertensive patients between 20 and 60 years at age and indication for removal of maxillary premolar assessed on a panoramic radiograph and clinical examination. Hypertensive patients having a maximum SBP of 159 mmHg and a maximum DBP of 99 mmHg were included in the study.

The Individuals suffering from any mental disorders, chronic pain problems, pregnant or lactating women, patients reporting hypersensitivity to local anesthesia or epinephrine, having acute pulpitis, abscesses, or other acute infections, systemic disorder or on long-term steroids were excluded from the study.

All patients in both groups underwent extraction of tooth with 2% lignocaine with 1:100,000 epinephrine. Each patient underwent single extraction and two 1.8 ml cartridges of local anesthetic solution were injected using an aspirating dental syringe.

All extractions in the study were completed in morning sittings in peaceful atmosphere and no preoperative anxiolytic medication was prescribed. Systolic blood pressure (SBP), Diastolic blood pressure (DBP) and Pulse rate (PR) measurements

were recorded with digital blood pressure monitor. First reading was taken in the waiting area before surgery which was marked as reading at T0. Three minutes later, patient was seated and local anesthesia was administered. Before injecting anesthesia, aspiration was done. If blood was encountered in the syringe, the clinician withdrew the needle and replaced the cartridge. A total of four readings were taken. In the surgery 3 minutes after local anesthetic injection second reading was taken which was marked as reading at T1. After five minutes third reading was taken after initiation of tooth extraction which was marked as reading at T2, after five minutes during the extraction fourth reading was taken and it was marked as reading at T3. Final reading was taken five minutes after the completion of extraction which was marked as reading at T4. Standard time of twenty minutes was designated for extraction for all the patients. Data analysis was done using SPSS. Levene test was used to check the homogeneity of both groups Independent-sample t test was used to compare the mean BP and pulse rates of the two groups at different time intervals. The critical level of significance was set at p <0.05

Informed, written consent for infiltration anaesthesia and extraction was taken. Information was provided in a format that can be easily understood by patients. All the data acquired for research purpose was kept confidential to prevent disclosures of patient identity. Proper care and caution was taken in order to prevent the patient from any harm and adverse events.

The Ethical approval was obtained from Institutional Review Committee of Riphah Islamic International Dental College (IIDH), Islamabad.

Results

There were total sixty patients, thirty in group A and thirty in group B. There were 36 (60 %) females and 24 (40 %) males. Table-1 describes the number of male and female patients in both groups. Figure-1 & 2 explain the pattern of systolic and diastolic B.P at five different time intervals.

Table 1: Are you hypertensive patient.

Are you hypertensive?	*Gender*		*Total*
	Male	*Female*	
Control	13	17	30
Hypertensive	11	19	30
Total	24	36	60

Table-2 show the mean values and difference of means of systolic, diastolic blood pressure and pulse rate at five different time intervals and it shows that there is significant difference in mean of diastolic blood pressure at T4-T0 which signifies that diastolic blood pressure take more time to come to normal in hypertensive patients as compared to normotensive patients.

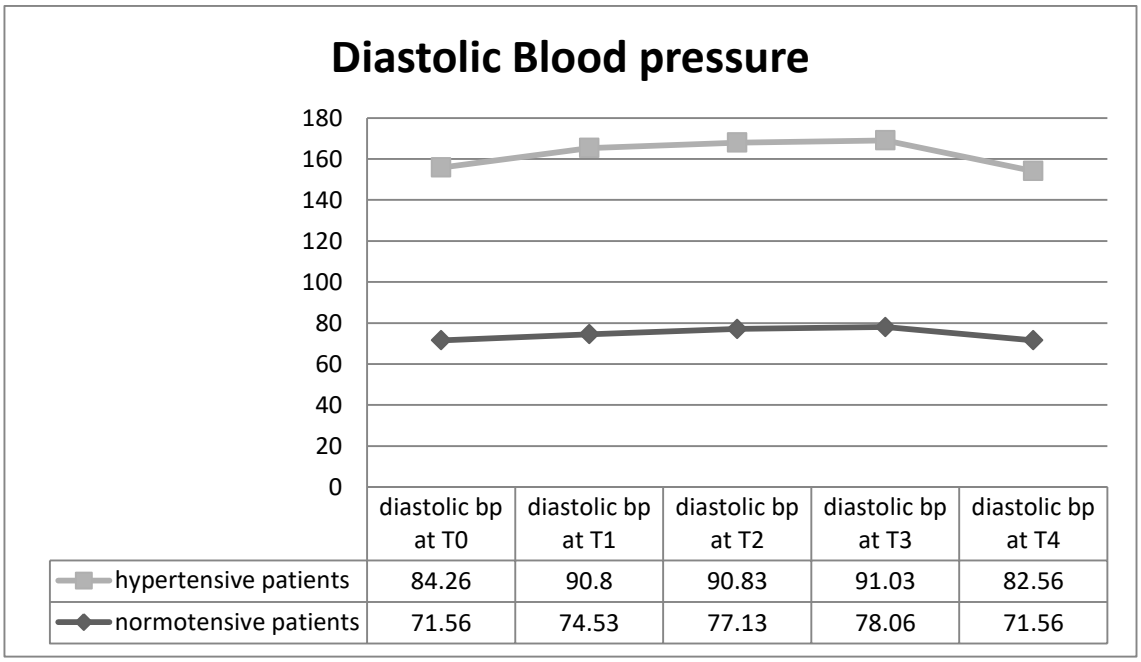

Figure 1: Diastolic Blood pressure of normotensive and hypertensive patients at five different time intervals.

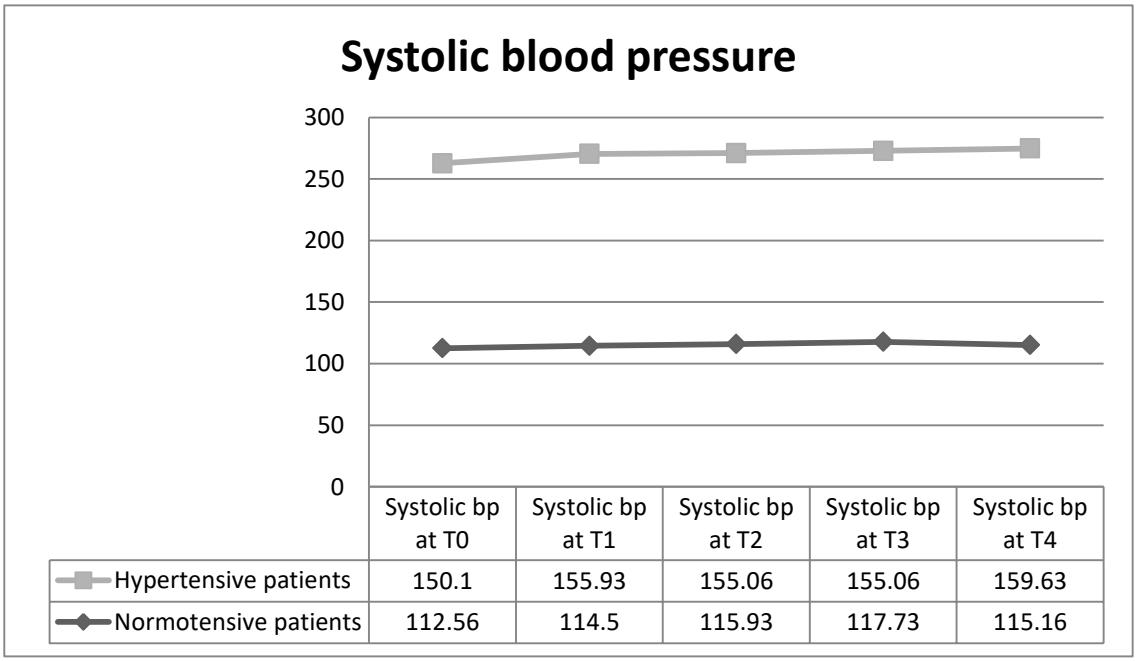

Figure 2: Systolic Blood pressure of normotensive and hypertensive patients at five different time intervals.

Table 2: Mean, difference in mean and *p*-value of blood pressure and pulse of normotensive and hypertensive patients at five different time intervals.

		Mean	*Difference in Mean*	*p value*
Different in systolic bp at T0-T1	control hypertensive	6.6 13.7	11.3	.019
Different in systolic bp at T0-T2	control hypertensive	9.3 12.4	10.5	.2
Different in systolic bp at T0-T3	control hypertensive	8.7 13.0	10.6	.1
Different in systolic bp at T0-T4	control hypertensive	6.03 14.03	10.5	.007
Different in diastolicbp at T0-T1	control hypertensive	1.7 1.36	5.1	.866
Different in diastolic bp at T0-T2	control hypertensive	5.63 3.13	2.4	.000
Different in diastolic bp at T0-T3	control hypertensive	2.53 2.76	3.7	.004
Different in diastolic bp at T0-T4	control hypertensive	4.73 .56	2.3	.003
Different in pulse at T0-T1	control hypertensive	1.26 1.8	1.8	.6
Different in pulse at T0-T2	control hypertensive	.53 1.26	1.3	.4
Different in pulseat T0-T3	control hypertensive	.4 1.6	.96	.2
Different in pulse at T0-T4	Control Hypertensive	.46 .16	2.2	.5

Table-2 also shows that there is a significant difference in diastolic blood pressure at T2-T0 and T3-T0 which means that adrenaline takes more time to show significant effect on

diastolic blood pressure and also that diastolic blood pressure is more significantly affected by fear and anxiety of extraction than systolic blood pressure. There is no significant difference in mean of pulse rate at any time interval.

Discussion

Elevation in blood pressure can be influenced by many factors including psychosomatic and somatic tension, painful provocations, and effect of catecholamine in local anesthetics in both normotensive and hypertensive patients.[16]

In the present study, there is a no variance between the systolic blood pressure between group A and B after giving local anesthesia which is contradictory to Gungormus et al. who reported an increase in Systolic Blood Pressure of 4mmHg in hypertensive patients, receiving injections of lidocaine with 1:100,000 epinephrinein their systematic review of studies published till 2002.[17]

In the current study, there is no significant difference in diastolic blood pressure after giving local anesthesia in both groups at T0 and T1, but there was a statistical significant difference at T2 which signifies that during the extraction there was significant elevation in diastolic blood pressure. This difference is in accordance with Ezmek and Bible who also reported a statistically significant increase in diastolic pressure and accredited this changes to dental anxiety in the patients or delayed response of epinephrine on diastolic blood pressure.[18] Hemodynamic changes produced by emotional stress conceal the variations caused by exogenously active catecholamines. Fear, anxiety, and expectation or experience of pain, are superior stress factors in this situation.[19]

Previous researches have reported that injection of epinephrine as a vasoconstrictor in normotensive patients is related with transient effects but in uncontrolled hypertensive patients hemodynamic complications could develop which can lead to possible cardiovascular accidents[20] which is more emphasized by the results of current studies as it was noted that systolic blood pressure of hypertensive patients took more long to get back to normal after the extraction than the normotensive patients.

In the current study, all the extractions were performed in maxillary premolar area and the needle was aspirated in order to avoid intravascular injection. Some authors have suggested that changes in blood pressure can be dependent upon the dose of vasoconstrictor in injection. In this background, it can be assumed that significant variations can be anticipated if the solution is unintentionally injected into a blood vessel and procedure is not executed cautiously.[21]

The resting heart rate of hypertensive patients was significantly higher than normotensive patients but after giving local anesthesia or even during extraction there was no significant difference in pulse rate.

Hypertensive drugs like beta-blockers, monoamine oxidase inhibitors, tricyclic antidepressants and other sympathomimetics can interact with epinephrine and can give rise to clinically relevant interactions and complications.[22] The limitation of present study is that controlled hypertensive patients were included in sample but different groups, according to their type of antihypertensive drugs, were not made.

Use of epinephrine as vasoconstrictor in local anesthesia is thought to be safe in patients with controlled or stage 1 hypertensive patients however, data regarding use of these agents for patients with blood pressure is > 160/ 100 mmHg is still lacking.

Conflict of interest: None declared.

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