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Systemic Effects of Local Anesthesia on Hypertensive Patients During Tooth Extraction

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ABSTRACT

Objective: To examine the effect of injecting Epinephrine containing local anesthetic on the blood pressure and pulse rate of hypertensive patients in comparison to normotensive patients.
Study Design: Quasi-experimental study.
Place and Duration of Study: Tertiary care dental hospital, Rawalpindi, Pakistan, from May to Oct 2024.
Methodology: A total of 92 participants were sampled through consecutive purposive sampling technique. The patients distributed into Group-A were Hypertensive (blood pressure ≥140/90 mmHg), and in Group-B (control group) were Normotensive (with blood pressure ranging from <120-139/80-89 mmHg). The changes in blood pressure and pulse rate were evaluated at baseline, 2 minutes after anesthesia administration, 5 minutes after anesthesia administration, and after tooth extraction. SPSS was used for statistically analyzing the differences in blood pressure and pulse rate changes in both groups.
Results: Significant differences were observed between all-time points in both groups for pulse rate and blood pressure, systolic and diastolic ($p < 0.001$). However, the overall mean change in systolic blood pressure between the two groups (4.29 ± 0.67 in Group-A and 4.68 ± 1.22 in Group-B) did not differ statistically significantly ($p = 0.065$). Additionally, there was no significant difference in the mean pulse rate between the two groups overall ($p = 0.921$).
Conclusion: The Epinephrine-anesthetics with a dose of 2% Lignocaine with 1:100,000 Epinephrine (0.036mg) are generally safe for administering during dental procedures in hypertensive patients.

Keywords: Anesthesia, Blood Pressure, Epinephrine, Hypertension, Normotension.

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INTRODUCTION

Hypertension is a significant risk factor for cardiovascular diseases (CVDs) and a widely reported public health concern, with a prevalence of about 1.28 billion adults between the ages of 30–79 years around the world, as estimated by the World Health Organization (WHO).[1,2] Hypertension rates in Pakistan, particularly in urban areas, are high (between 26% to 33%).[3] This high prevalence is particularly concerning to oral health care providers, as patients on hypertensive medications are commonly seeking and receiving common dental treatment that uses local anesthesia.[3,4] Experience slowly permeated using vasoconstrictors like epinephrine along with local anesthetics to allow for a longer duration of anesthesia, less blood loss during surgery, and a lesser systemic absorption.[5] The downside is their sympathomimetic properties, which are contraindicated in hypertensive patients, leading to an increase in blood pressure, arrhythmias, and other cardiovascular problems in patients receiving dental treatment.[6]

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Literature has reported how local anesthetics with epinephrine systemically affect patients with hypertension. In hypertensive patients, Al-ghareeb *et al.*, reported that injections of 2% Lignocaine with 1:100,000 Epinephrine increased blood pressure (systolic) from 151.77±11.24 mmHg to 159.42±12.67 mmHg and pulse rate from 85.51±7.08 to 90.45±8.43 beats per minute, a clinically significant change.[7] Zang *et al.*, reported that hypertensive surgical patients had an average rise of 10.45 mmHg in systolic blood pressure after anesthesia.[8] Hu *et al.*, showed that infiltration of local anesthesia (LA) with epinephrine for dental extraction could result in an average increment of 7-12 mmHg of blood pressure (Systolic and Diastolic) and a rise in pulse rate up to 9 beats per minute.[9] More recently, Silvestre *et al.*, indicated that adrenaline-containing LA produced statistically significant variations in both blood pressure and blood glucose levels, highlighting the significance of caution, particularly with comorbidities.[10]

In light of these studies, an evident gap continues to exist regarding clinical adherence to evidence-based protocols and dosage recommendations in the dental healthcare environment. Although the literature supports a quantifiable physiological effect due to the

use of vasoconstrictor-containing LA among hypertensive patients, overall national data assessing real-life implications in regional dental practice is limited. This research aims to assess the systemic impact i.e., alteration in pulse rate (PR) and blood pressure (BP), of giving local anesthesia with a vasoconstrictor in patients who are hypertensive and will undergo tooth extraction.

METHODOLOGY

This quasi-experimental study took place at a tertiary care dental hospital, Rawalpindi, Pakistan, from May to Oct 2024. A consecutive purposive sampling technique was conducted to sample the participants. This study was ethically approved by the Institutional Review Board (Ref No.918/Trg dated 8 Jan 2023). Sample size was estimated with the help of the Open Epi online calculator (Version 3.01) for comparison of two independent means between hypertensive and normotensive groups. Using the reported mean systolic blood pressure values and standard deviations for each group, a calculated effect size of 0.93 for systolic blood pressure following local anesthesia with Epinephrine given by Chaudhry *et al.*, was used.[11] With 95% confidence level, 80% power, and a two-tailed significance level of 0.05, the sample size required was determined to be 46 patients per arm with a total of 92 patients for the trial.

Inclusion Criteria: Both normotensive and hypertensive patients requiring tooth extractions, irrespective of gender, in the age range of 35-65 years, not suffering from any debilitating disease or syndrome were included in the study.

Exclusion Criteria: Patients diagnosed with any cardiovascular disease or taking beta blockers. The patients with systolic BP over 200 mmHg and diastolic BP over 110 mmHg were not included to avoid any future medical emergencies.

All patients reporting to oral and maxillofacial surgery department, fulfilling the criteria, were briefed in detail about the procedure and associated risks. Informed consent was taken and a data collection form was filled out by the participants included in the study. According to the 2023 European Society of Hypertension (ESH) Guidelines the patients were characterized as either Normotensive (with BP ranging from 'optimal' i.e. <120/80 mmHg and 'Normal' i.e. 120-129/80-84 mmHg to 'High-Normal' i.e. 130-139/85-89 mmHg) or Hypertensive (≥140/90 mmHg blood pressure).[12] The patients were divided into 2 groups of 46 participants each;

Group-A: Hypertensive patients given 2% Lignocaine with 1:100,000 Epinephrine (vasoconstrictor)

Group-B: Normotensive patients given 2% Lignocaine with 1:100,000 Epinephrine (vasoconstrictor) Data was collected and analyzed under the supervision of an oral and maxillofacial surgeon. In both groups, two cartridges (3.6ml) of local anesthesia injection, having 2% Lignocaine with 1:100,000 Epinephrine (0.036mg) was given. All the patients went through a uniform surgical technique to promote homogeneity. Simple extraction was carried out with a straight elevator in order to luxate the tooth, and then forceps were applied to extract the tooth from the socket. Special attention was taken to avoid trauma to the surrounding tissues. The evaluating clinician then measured the blood pressure and pulse rate at four different time intervals. The first reading was taken on the dental chair in a relaxed position (baseline), the second 2 minutes after administration of local anesthesia injection, third following 5 minutes of local anesthesia injection, and the fourth one after 15 minutes of extraction. The blood pressure was measured using a sphygmomanometer (Yamasu Aneroid 500 Model) and the pulse rate using the standard palpation method of the radial artery. The groups were also further subdivided based on the age of the patients to study the relationship of hypertension with age. The further subdivision into 2 groups was: middle-aged adults (35-55) and old-age adults (56-65).

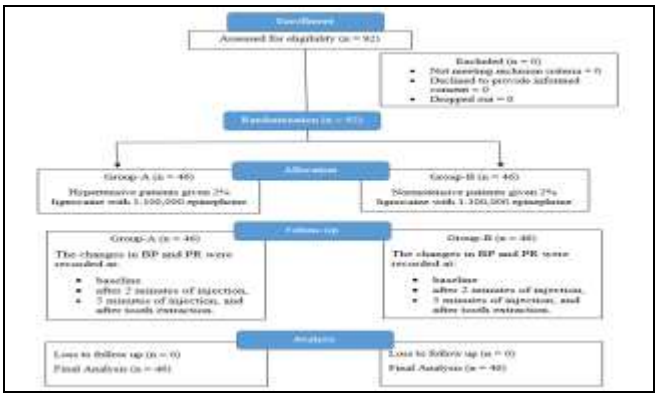

Figure 1: Patient flow diagram

The descriptive statistics for all the variables were assessed using Statistical Package for Social Sciences (SPSS) version 27. The normality of data was assessed by the Shapiro-Wilk test, and all variables followed a normal distribution. ANOVA was conducted to analyze the statistical difference between all-time points for systolic BP, diastolic BP, and pulse rate.

Comparison of the overall mean change in systolic BP, diastolic BP, and PR between both groups was done through an independent samples t-test. p value ≤ 0.05 was considered statistically significant.

RESULTS

A total of 92 patients were included in the study, with 46 hypertensive patients in Group-A and 46 normotensive patients in Group-B. The mean age was 44.43 ± 12.93 years in Group-A and 46.91±13.11 years in Group-B. Table-I presents the age distribution of the patient population, stratified into middle-aged (35–55 years) and older adults (56–65 years), along with their respective gender proportions across Group-A and Group-B.

Table-I: Demographic characteristics of study participants (n =92)

Variables	Group-A (n = 46)	Group-B (n = 46)
Age n (%)		
Middle Age (35-55 years)	37(80.4%)	33(71.7%)
Old Age (56-65 years)	9(19.5%)	13(28.2%)
Gender n (%)		
Male	26(56.5%)	29(63%)
Female	20(43.5%)	17(37%)

Both hypertensive (Group-A, Table-II) and normotensive (Group-B, Table III) patients demonstrated statistically significant alterations in systolic and diastolic blood pressure and pulse rate after local anesthesia administration ($p < 0.001$).

In Group-A (Table II), systolic BP rose from 139.04±1.03 to 147.19±1.69 mmHg, diastolic BP from 86.76±1.66 to 96.26±2.00 mmHg, and pulse rate from 86.5±1.63 to 91.09±1.96 bpm, then returned close to baseline after extraction.

In Group-B (Table III), systolic BP increased from 112.80±1.05 to 119.46±0.96 mmHg, diastolic BP from 79.28±1.11 to 88.46±0.96 mmHg, and pulse rate from 81.48±0.98 to 85.83±2.19 bpm, again coming back to near baseline values following extraction.

The total mean change in systolic BP was similar in both groups (4.29±0.67 mmHg in Group-A and 4.68±1.22 mmHg in Group-B) with no significant difference (p=0.065). Similarly, no statistically significant variation was observed in the total mean change in diastolic BP among the groups, with a p-value of 0.174. The change in mean pulse rate was also similar across the two groups, with no statistically significant difference observed (p=0.921) (Table-IV).

DISCUSSION

The current study evaluated the systemic effects of 2% Lignocaine with 1:100,000 Epinephrine (0.036mg) on hypertensive and normotensive patients who underwent dental extraction. Systolic BP, diastolic BP, and pulse rate revealed an increase after the administration of anesthesia at two minutes, only to return to near baseline post-extraction in both patient groups. Notably, intergroup differences in mean hemodynamic change were statistically not significant, indicating a similar physiological response to local anesthesia between hypertensive patients with well-controlled hypertension and normotensive subjects.

The results of this study align with the available literature. Specifically, the average rise in Systolic BP two minutes after anesthetic injection was 8.15 mmHg in hypertensive patients and 4.29 mmHg in normotensive subjects. This finding corresponds to the one by Rehman *et al.,* who documented a mean rise in Systolic BP of 7.0 mmHg in hypertensive patients after lignocaine with epinephrine administration.[13] Likewise, Tirupathi *et al.,* measured typical systolic BP rises between 5 and 10 mmHg in hypertensive and normotensive patients that closely resemble the 4.68 mmHg (normotensive) and 8.15 mmHg (hypertensive) rise documented in the current study.[14]

With regard to diastolic blood pressure, this study recorded a mean rise of 4.34 mmHg in the hypertensive and 4.52 mmHg in the normotensive group. These findings are in congruence with Ali *et al.,* who recorded a mean rise in diastolic BP of 3.9 mmHg following injection.[15] Conversely, Noor *et al.,* found higher fluctuations in diastolic BP, reaching 6.5 mmHg in hypertensive patients, that were most probably due to increased anxiety and enrollment of patients with poor blood pressure control—factors that were kept constant in the present study by the enrollment of only well-controlled hypertensive subjects.[16] Pulse rate changes noted in the current study were also consistent with earlier published results. A mean rise of 5.67 beats per minute (bpm) in hypertensive and 6.13 beats per minute in normotensive subjects was noted two minutes after injection. These values are similar to those of Kusumastuti et al., who reported a rise of about 6.5 bpm, and Seminario-Amez *et al.,* who highlighted that such temporary increases are within physiological ranges and carry little cardiovascular risk when proper protocols are in place.[17,18]

Table-II: Changes in hemodynamic parameters after local anesthesia (2% Lignocaine with Epinephrine 1:100,000) in hypertensive patients (Group-A) (n=46)

Factors	Baseline (Mean ± SD)	2 minutes post-injection (Mean ± SD)	5 minutes post-injection (Mean ± SD)	Post extraction (Mean ± SD)	*p* -Value
Systolic BP (mmHg)	139.04 ± 1.03	147.19 ± 1.69	142.67 ± 1.05	140.15 ± 1.07	< 0.001
Diastolic BP (mmHg)	86.76 ± 1.66	96.26 ± 2.00	93.04 ± 2.09	91.37 ± 2.23	< 0.001
Pulse Rate (bpm)	86.5 ± 1.63	91.09 ± 1.96	88.59 ± 1.92	86.96 ± 1.94	< 0.001

**mmHg – millimeter of mercury*
Bpm – beats per minute

Table-III. Changes in hemodynamic parameters after local anesthesia (2% Lignocaine with Epinephrine 1:100,000) in normotensive patients (Group-B) (n=46)

Factors	Baseline (Mean ± SD)	2 minutes post-injection (Mean ± SD)	5 minutes post-injection (Mean ± SD)	Post extraction (Mean ± SD)	*p* - Value
Systolic BP (mmHg)	112.80 ±1.05	119.46±0.96	117.71±1.11	115.28±0.91	< 0.001
Diastolic BP (mmHg)	79.28±1.11	88.46±0.96	86.78±0.89	83.78±0.89	< 0.001
Pulse Rate (bpm)	81.48±0.98	85.83±2.19	83.59±1.09	82.37±1.37	< 0.001

**mmHg – millimeter of mercury*
Bpm – beats per minute

Table-IV: Comparison of total mean changes in hemodynamic parameters between Group-A (hypertensive) and Group-B (control) (n=96)

Variables	Total Mean Change		*p* - Value
	Group-A (Mean ± SD) (n=96)	Group-B (Mean ± SD) (n=96)	
Systolic BP (mmHg)	4.29 ± 0.67	4.68 ± 1.22	0.065
Diastolic BP (mmHg)	6.80 ± 1.03	7.06 ± 0.77	0.174
Pulse Rate (bpm)	2.36 ± 0.79	2.45 ± 0.80	0.921

In addition, Siddiqui *et al.,* conducted a study in hypertensive patients in Pakistan and noted a systolic BP difference of about 6.5 mmHg and pulse rise of 5.8 bpm—results closely matching those of the current study.[19] Such inter-study similarities support the conclusion that the application of Epinephrine-containing local anesthetics, though inducing transient hemodynamic changes, is clinically safe in hypertensive patients with well-controlled blood pressure.

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LIMITATION OF STUDY

This study is subject to certain limitations. Patients taking beta-blockers,that might alter hemodynamic responses were excluded from the study, which may have resulted in underestimation of variability in actual clinical practice. Furthermore, anxiety levels, which can affect cardiovascular parameters, were not objectively measured or controlled for, providing a potential confounding variable.

Future research should involve larger and more varied patient groups, such as uncontrolled hypertensive patients and those on diverse antihypertensive regimens. Also, pain and anxiety measurement tools which are pre-validated can be included to differentiate between psychological effects and pharmacological impacts.

CONCLUSION

Administration of 2% Lignocaine with 1:100,000 Epinephrine resulted in transient, non-significant increases in Blood pressure and Pulse Rate among both hypertensive and normotensive patients undergoing dental extraction.

Conflict of Interest: None.

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Authors' Contribution

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

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

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

SZ & RT: 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.

REFERENCES

1. Wang YH, Wang DR, Liu JY, Pan J. Local anesthesia in oral and maxillofacial surgery: A review of current opinion. J Dent Sci 2021; 16(4): 1055-1065. https://doi:10.1016/j.jds.2020.12.003.
2. Guimaraes CC, Lopes LC, Bergamaschi C de C, Ramacciato JC, Silva TM, Araújo TO, et al. Local anesthetics combined with vasoconstrictors in patients with cardiovascular disease undergoing dental procedures: systematic review and meta-analysis. BMJ Open 2021; 11(7): e044357. https://doi.org/10.1136/bmjopen-2020-044357
3. Deol N, Alvarez G, Elrabi O, Chen G, Ferraro N. A comparative review of epinephrine and phenylephrine as vasoconstrictors in dental anesthesia: exploring the factors behind epinephrine's prevalence in the US. J Dent Anesth Pain Med 2023; 23(6): 293-302. https://doi:10.17245/jdapm.2023.23.6.293.
4. Matteo N, Verdino F, Potenza S, Pensa V, Martinelli A, D'Orto B. Management of the hypertensive patient in dentistry: narrative review. Oral & Implantology 2024; 16(1): 19–24. https://doi.org/10.11138/oi16119-24
5. Gupta K, Kumar S, Anand Kukkamalla M, Taneja V, Syed GA, Pullishery F, et al. Dental Management Considerations for Patients with Cardiovascular Disease-A Narrative Review. Rev Cardiovasc Med 2022; 23(8): 261.https://doi:10.31083/j.rcm2308261.
6. Ilyas M, Khan ZA, Khan I, Zamir A, Ijaz K, Kundi JA. The effect of local anesthesia (lidocaine 2%) with epinephrine (1:100,000) on blood pressure level of hypertensive patients reported to a tertiary care hospital, Peshawar, Pakistan. Biomed J Sci Tech Res 2017; 1(6): 1687–1691. https://doi:10.26717/BJSTR.2017.01.000513
7. Alghareeb Z, Alhaji K, Alhaddad B, Gaffar B. Assessment of Dental Anxiety and Hemodynamic Changes during Different Dental Procedures: A Report from Eastern Saudi Arabia. Eur J Dent 2022; 16(4): 833-840. https://doi:10.1055/s-0041-1740222.
8. Zhang D, Li S, Zhang R. Effects of dental anxiety and anesthesia on vital signs during tooth extraction. BMC Oral Health 2024; 24(1): 632. https://doi:10.1186/s12903-024-04404-5.
9. Hu JY, Zhou QM, Li WJ, Deng XL, Wang WY, Huang RL, et al. Effects of Preoperative Anxiety Status on Haemodynamic Changes during and after Tooth Extraction in Middle-aged and Elderly Patients with Hypertension: a Prospective Repeated-Measures Cohort Study. Chin J Dent Res 2021; 24(4): 267-274. https://doi:10.3290/j.cjdr.b2440843.
10. Silvestre FJ, Martinez-Herrera M, García-López B, Silvestre-Rangil J. Influence of anxiety and anesthetic vasoconstrictors upon hemodynamic parameters during dental procedures in controlled hypertensive and non-hypertensive patients. J Clin Exp Dent 2021; 13(2): e156-e164. https://doi:10.4317/jced.57232.
11. Chaudhry S, Iqbal HA, Izhar F, Mirza KM, Khan NF, Yasmeen R, et al. Effect on blood pressure and pulse rate after administration of an epinephrine-containing dental local anaesthetic in hypertensive patients. J Pak Med Assoc 2011; 61(11): 1088-1091.
12. Mancia G, Kreutz R, Brunström M, Burnier M, Grassi G, Januszewicz A, et al. 2023 ESH Guidelines for the management of arterial hypertension. The Task Force for the management of arterial hypertension of the European Society of Hypertension: Endorsed by the International Society of Hypertension (ISH) and the European Renal Association (ERA). J Hypertens 2023; 41(12): 1874-2071. https://doi:10.1097/HJH.0000000000003480.
13. Rehman I ur, Zeb M, Anwar MA, Khalid A, Tayyab TF, Siddique K et al. Effects of adrenaline-containing local anesthesia on blood pressure and blood glucose levels undergoing tooth extractions: a comparative study. Pak J Health Sci 2024; 5(6): 73–78. https://doi:10.54393/pjhs.v5i06.1581
14. Tirupathi SP, Afnan L, Alahari S, Challa R. Clonidine versus Adrenaline as an Adjunct to Lignocaine on Haemodynamic Parameters during Nerve Block for Third Molar Surgical Removal - A Systematic Review and Meta-Analysis. Ann Maxillofac Surg 2022; 12(2): 203-211. https://doi:10.4103/ams.ams_149_22.
15. Ali FM, Iryani GM, Bakri MM, Halawi S, Mashyakhi E, Darraj O. Evaluation of changes in Blood Pressure (BP) and Heart Rate (HR) among controlled Hypertensive and Normotensive Patients before and after receiving Dental Local Anesthesia (DLA) with Adrenaline: A Prospective Study. Biomed Pharmacol J 2022; 15(2): 757–766. https://dx.doi.org/10.13005/bpj/2413
16. Muhsin N, Abdulrazaq S. Hemodynamic changes following injection of local anesthesia with vasoconstrictor agent in controlled hypertensive patients. Bionatura 2023; 8: 1-8 https://doi.10.21931/RB/CSS/2023.08.03.38.
17. Rr. Pipiet Okti Kusumastiwi. Local Anesthetics with Vasoconstrictors in Hypertensive Patients Undergoing Dental Extraction Procedures: A Serial Case Report. Biosci Med 2024; 8(6): 4464–4469. https://doi.org/10.37275/bsm.v8i6.1004
18. Seminario-Amez M, González-Navarro B, Ayuso-Montero R, Jané-Salas E, López-López J. Use Of Local Anesthetics With A Vasoconstrictor Agent During Dental Treatment In Hypertensive And Coronary Disease Patients. A Systematic Review. J Evid Based Dent Pract 2021; 21(2): 101569. https://doi:10.1016/j.jebdp.2021.101569.
19. Siddiqui HK, Hussain A, Naseem F, Shafi, AM, Umaima Heyat. Systemic Effects Of Local Anaesthesia In Hypertensive Patients. Pak Oral Dent J 2017; 37(4): 538–542.