

Effect on blood pressure and pulse rate after administration of an epinephrine containing dental local anaesthetic in hypertensive patients

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Abstract

Objective: To document safety for use, through recording changes in blood pressure and pulse rate, after administering 3.6 ml of a 2% lignocaine with 1:100,000 epinephrine dental local anaesthetic in a group of hypertensive patients.

Methodology: The present study was conducted at Shaikh Zayed Medical Complex, Lahore, from May to December 2008, using a convenience sampling technique. The first 60 walk-in patients in the dental outpatient department planned for tooth extraction were enrolled in the study. Out of these 60 patients, 10 had pre-hypertension (BP = 130/90), 10 had stage 1 hypertension (BP=140-159/90-99) and 10 study subjects were suffering from stage 2 hypertension (BP=160-179/100-109). Thirty age and sex matched normo-tensive patients requiring tooth extraction acted as the control group. All patients were administered two cartridges each of 1.8 ml of dental local anaesthesia containing 2% Lignocaine with 1:100,000 epinephrine. Blood pressure and pulse rate (PR) were the risk indicators that were measured thrice; pre-injection, 2 minutes and 5 minutes after injection.

Results: A decrease in systolic in stage 2 hypertension patients after 2 and 5 minutes of injections was noted. The diastolic BP (DBP) fell in all the groups after injections. Mean pulse rate increased from three to four beats per minute in all groups except in stage 2 hypertension patients where it slightly decreased.

Conclusion: Epinephrine containing dental local anaesthesia decreased systolic blood pressure in stage 2 hypertension patients included in this study. There was an observed decrease of 21mm Hg in systolic blood pressure hypertension patients but with no adverse effects.

Keywords: Epinephrine, Lignocaine, Hypertension, Lahore, Pakistan (JPMA 61: 1088; 2011).

Introduction

Hypertension (HTN) is one of the most frequently encountered systemic diseases in patients visiting the dental clinic due to high prevalence of the disease worldwide.¹ In Pakistan alone one in five adults above the age of 15 years suffers from HTN.² Dental treatment protocols for hypertensive patients are not much affected if their hypertension is controlled but modifications are advised when patients present with uncontrolled hypertension.³ Use of dental local anaesthesia with epinephrine in these patients is considered risky because of the beta-1 effects of epinephrine on the heart and beta-2 effect on skeletal muscle blood vessels which might result in increase in blood pressure and pulse rate.⁴ Incorporating a vasoconstrictor like epinephrine in local anaesthetic solution increases the depth and duration of anaesthesia and reduces bleeding in the operative field.⁴ The efficacy and potency of epinephrine containing dental local anaesthesia is clearly superior to a plain anaesthetic solution i.e. without a vasoconstrictor.⁴

Studies that have been conducted in the past regarding

safe use of dental local anaesthesia containing epinephrine in hypertensive patients, found the use of two 1.8ml cartridges of lignocaine containing 1:100,000 epinephrine (0.036 mg) as safe in controlling hypertension and stage 1 hypertension (HTN-1) (BP 159/99) patients.^{5,6} However, evidence is lacking regarding the use of this solution in stage 2 hypertension (HTN-2) patients (BP > 160/100mmHg). Some researchers caution against the use of the solution^{7,8} while other researchers suggest it can be given with appropriate precautions and monitoring.^{4,9} A pilot study, to evaluate the safety of two cartridges of 2% lignocaine with 1:100,000 epinephrine, in HTN-1 and HTN-2 patients was conducted at Shaikh Zayed Medical Complex (SZMC), Lahore, Pakistan, in order to collect more evidence on this controversial issue.

Methodology

This study was conducted at the dental outpatient department of Sheikh Zayed Medical Complex (SZMC), Lahore, Pakistan. This department receives an average of 60 patients a day, requiring a variety of dental procedures. Study subjects comprised of normal, pre-hypertensive and

hypertensive patients visiting the dental outdoor of the hospital for tooth extraction. Patients taking β -blockers were not included in the study as these are shown to interact with epinephrine.¹⁰ Subjects diagnosed with any cardiovascular disorder except for hypertension were also excluded.

Hospital's ethical committee provided the ethical approval for this study. Informed consent was obtained from all study subjects by ensuring confidentiality and explaining the risks-benefits involved. [As no life threatening events have been reported with the use of two cartridges of dental local anaesthesia in hypertensive patients^{5,6} and as the study was being conducted in a tertiary care centre with a cardiologist present at the time of administration of injection main ethical concerns were addressed].

Convenience sampling was done and first 60 walk-in patients in the dental outpatient department for tooth extraction were enrolled in the study. Out of these 60, ten included patients with pre-hypertension i.e. blood pressure of 130/90, ten patients each with stage 1 and stage 2 HTN with blood pressures ranging from 140-159/90-99 and 160-179/100-109 respectively. Thirty age and sex matched normotensive patients also coming for tooth extraction to the dental outdoor were enrolled as controls for the above group.

Two cartridges (each of 1.8 ml) of local anaesthetic injection containing 2% lignocaine with 1:100,000 epinephrine were administered to each of the patients by the same dentist. Aspiration was done prior to injecting the anaesthetic both for infiltration and regional block to avoid direct entry of needle into a vessel. Blood pressure and pulse rate were recorded as risk indicators which were measured thrice; first before the injections, then 2 minutes after injection and 5 minutes after injection without any further intervention during this period of time.

Blood pressure was measured with a conventional calibrated sphygmamometer and pulse rate was determined by manual palpation of the radial artery by the principal author. A cardiologist was on-call throughout the procedure and emergency equipment was arranged during the procedure. The study was conducted in a tertiary care setting so that any emergency after the local anaesthetic could be managed timely and efficiently.

Descriptive and analytical statistics including ANOVA for the data were performed using the SPSS software Version. P-value of < 0.05 was considered significant.

Results

Mean ages of pre-hypertension, HTN-1 and HTN-2 patients were 52.6 ± 11.07 , 49.33 ± 5.85 and 59.16 ± 12.0 years respectively as compared to 48.43 ± 11.04 years for the

Table: Mean blood pressure ($\pm$ SD) and pulse rate before and after administration of the test dose (injections) of dental local anaesthesia containing epinephrine.

	Before injection	2 minutes injection	5 minutes injection
Control Group (normo-tensive) patients (n=30)			
Systolic BP	112.04 $\pm$ 7.01	114.54 $\pm$ 9.75	112.04 $\pm$ 12.86
Diastolic BP	74.09 $\pm$ 7.17	71.93 $\pm$ 8.08	70.11 $\pm$ 8.38
Pulse rate	81.72 $\pm$ 13.74	82.63 $\pm$ 11.37	83.43 $\pm$ 10.71
Pre-hypertensive patients (n=10)			
Systolic BP	130.0 $\pm$ 0.00	136.66 $\pm$ 10.0	133.33 $\pm$ 11.08
Diastolic BP	84.44 $\pm$ 5.27	85.55 $\pm$ 7.26	81.66 $\pm$ 9.35
Pulse rate	82.66 $\pm$ 10.19	84.88 $\pm$ 11.92	84.88 $\pm$ 10.63
HTN-1 patients(n=10)			
Systolic BP	140.0 $\pm$ 2.10	145.0 $\pm$ 5.0	136.66 $\pm$ 5.77
Diastolic BP	83.33 $\pm$ 5.77	83.33 $\pm$ 5.77	80.0 $\pm$ 0.00
Pulse rate	90.0 $\pm$ 10.0	92.0 $\pm$ 12.13	92.66 $\pm$ 16.58
HTN-2 patients (n=10)			
Systolic BP*	165.0 $\pm$ 8.36	151.6 $\pm$ 16.02	143.3 $\pm$ 17.51
Diastolic BP*	81.66 $\pm$ 9.83	81.66 $\pm$ 11.69	75.0 $\pm$ 10.48
Pulse rate	84.5 $\pm$ 8.75	82.0 $\pm$ 5.6	83.6 $\pm$ 7.34

P value $\leq$ 0.01. HTN-1: Stage 1 hypertension. HTN-2: Stage 2 hypertension.

normo-tensive patients comprising the control group. Male to female ratio in the case group was 1.3:1 while in the control group this ratio was 1:1.

Mean systolic blood pressure (SBP) increased in all the groups after two minutes of local anaesthetic injections except in HTN patients. After 5 minutes of injections SBP returned to baseline in all groups and fell further in HTN-2 patients. The overall fall in SBP in HTN-2 patients was 21mm Hg which is highly significant both statistically and clinically.

The mean diastolic blood pressure (DBP) fell in all the study subjects. The decrease in DBP was highest in HTN-2 patients. Mean pulse rate (PR) increased from three to four beats per minute in all groups but in HTN-2 patients decreased slightly.

Discussion

The limitations of the study are its small sample size and the limited outcome parameters used, however, the present investigation, to the best of our knowledge, was the first clinical trial to be done on the local population to observe the effect of epinephrine containing dental local anaesthesia in patients suffering from stage 2 hypertension.

Patients with HTN are considered high risk group when administering dental local anaesthesia containing a vasoconstrictor because of the potential to undergo epinephrine induced sudden dramatic increase in blood pressure leading to life-threatening hypertensive crisis.⁶ According to international guidelines the use of local anaesthesia containing epinephrine is safe in patients with controlled or stage 1 HTN.³ The data is lacking about the use of these agents in patients whose blood

pressure is $> 160/100$ mmHg.⁵

The present study noted a significant fall in DBP and SBP of patients with HTN from the time of administering injections up to five minutes. This fall in BP was statistically significant. Our results are similar to previous reports as far as fall in DBP is concerned^{5,6} but contradicts with most of the previous studies that have found an increase in SBP after dental local anaesthesia with epinephrine. A systematic review of all the relevant studies published till 2002 reported an increase in SBP of 4mmHg in hypertensive patients who received injections of lignocaine with 1:100,000 epinephrine.⁵ The decrease in SBP in hypertensive patients has been reported from Turkey but it is less than (5.21mm Hg) than observed in the present study i.e. 21mm Hg.⁶

Significant fall in SBP 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 0.06mg of epinephrine during periodontal surgery.¹¹ Takahashi et al compared the effect of different doses of epinephrine in volunteers. They observed a 4-5mmHg decrease in SBP after five minutes in a group that received 10µg of epinephrine in 2% lignocaine with a final volume of 4ml.¹² The SBP of the normal individuals in our study was similar to the baseline value after five minutes of injections.

This decrease in BP can be attributed to very small plasma concentration of epinephrine in dental local anaesthesia.¹³ The amount of epinephrine in two 1.8 ml cartridges of dental local anaesthetic injection is 0.036ml. This small plasma concentration is reported to have a predominant effect on cardiac β -2 receptors. This when combined with lignocaine, which itself is a cardiac depressant, results in decrease in BP in these patients.¹³ The change in SBP was observed without much change in pulse rate of these patients. This could be attributed to antagonism of sympathetic activity by negative feedback through presynaptic α 2 receptors and presoreceptor reflex, leading to minimal change in blood pressure.¹⁴

Local anaesthesia containing epinephrine is also given in patients undergoing sinus surgery and craniofacial surgical procedures. A study conducted to observe changes in haemodynamic parameters during functional endoscopic sinus surgery after local infiltration with and without epinephrine reported a significant fall in blood pressure after injection of lignocaine with 1:200,000 epinephrine as compared to other group that received a normal saline injection (placebo).¹⁴ Hanuman et al¹³ reported changes in haemodynamic parameters after scalp surgery using different concentrations of lignocaine and epinephrine. They concluded that lignocaine injected alone does not produce any significant change in haemodynamic parameters. Epinephrine when used

alone without lignocaine causes significant hypertension but the combination of lignocaine with epinephrine leads to decrease in BP. A study showed a decrease in SBP during Mohr's micrographic surgery after local anaesthesia and advised that the procedure should not be delayed in hypertensive patients having elevated blood pressure levels at the time of surgery.¹⁵

Cardiovascular disadvantages attributed to the use of epinephrine in hypertensive patients are negligible as compared to their benefits. Painful extraction in a hypertensive patient can result in increased stress which in turn can lead to over production of endogenous epinephrine by the body. This could prove far more dangerous for such patients. The present investigation provides evidence that the test dose (2 cartridges) of 2% lignocaine with 1/100,000 epinephrine as a dental local anaesthetic solution is likely to decrease SBP in HTN-2 patients.

Conclusion

Within the limitations of this study, a decrease in SBP was observed with the use two 1.8 ml cartridges of lignocaine with 1:100,000 epinephrine in patients suffering from stage 2 HTN. This decrease was not associated with adverse effects when observed changes in BP and PR noted among the patients of this study.

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