Original Research Article

Hemodynamic Changes during Tooth Extraction- a Clinical based observational Study

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Abstract

Aims and objective: Evaluation of Hemodynamic Changes Caused During Dental Extractions.**Material and methods**: The study included 200 patients who underwent dental extraction at Department of Dentistry, Anugrah Narayan Magadh Medical College and Hospital, Gaya, Bihar, India. The patients indicated for tooth extraction under local Anesthesia and age between 17-60 years were included in this study. The SpO2 was recorded using a non-invasive GIBSON infrared digital pulse oximeter placed on the patient's index finger. Change in Heart Rate (HR), Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) during Dental Extraction from the baseline was measured and recorded. **Results**: The study included 200 patients with mean age of 43.2 ± 3.2 years. Among them, there were 80 men and 120 women. Baseline pulse rate (mean ± S.D) of patients before the procedure was 84.1±10 beats/min which has risen to 89.1±09 beats/min after administration of local anesthesia and reduced to 85.8 ± 16 beats/min, 5 minutes after the dental extraction. Mean Percentage Oxygen saturation in patients before procedure was 97.3± 2.2%, which slightly increased to 97.8 ± 1.1% after injecting local anesthesia and then reduced back to 96.9 ±2.1% after completion of the procedure. After injecting local anesthesia, the mean systolic blood pressure was 131± 11 mm Hg. However, diastolic blood pressure did not change significantly during the entire treatment period (baseline= 80 ± 3 mm Hg, post-anesthetic= 81.2 ± 10 mm Hg and postextraction= 82.4 ± 9.2 mm Hg). There was slight reduction of mean SPO2 by 0.4% after the injection of local anesthesia and there was overall decrease of 0.20% after extraction which is certainly not significant. Administration of local anesthesia caused mean rise in Pulse rate of 5/min but decreased by 2/min after completion of extraction. ($p < 0.001$). **Conclusion:**Based on the results obtained from the study it can be concluded that dental surgery using local anesthesia caused significant increases in systolic blood pressure and pulse rate, and the increase in systolic blood pressure was greater in middle-aged and older patients.

Keywords: Autonomic Nervous system, Yoga, Heart Rate, Blood Pressure.

Introduction

Safe and effective control of intraoperative pain is an intrinsic and important part of clinical dental practice[1,2].Thisiscommonlyachievedwiththeuseoflocal anesthetics, which are pharmacological agents that cause reversible interruption in the conduction of a nerve impulse to an anatomic part of the body.[1-4] The successful provision of many dental treatments including tooth extraction, therefore, depends on achieving excellent perioperative local anesthesia [5,6].

The vasoconstrictors andlocal anesthetics commonly used in oral surgery can induce hemodynamic changes during tooth extraction in the same way as other factors such as patient anxiety or stress[6,7].The adrenaline added to the anesthetic solution is used in oral surgery to increase the potency and duration of anesthesia, reduce the plasma concentrations of the anesthetic, and

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improve the local control of bleeding [1,2,8]. Adrenaline containing local anesthetic has been criticized due tothe risk of possible massive systemic absorption of the drug, resulting in undesirable cardiovascular effects [9,10].This risk is more likely in patients with cardiovascular disease and hypertension; an increase in blood pressure (BP) has also been reported after the injection of anesthetics even innormotensive patients[5,11]. Itisalso widely claimed that the use of local anesthetics with adrenaline predisposes to undesirable cardiovascular changes that may result in life-threatening medical complications, representing a risk to patients with heart disease, especially those previously undiagnosed[11]. The possibility of dental extraction as a risk factor for altered blood pressure, SpO2 and pulse rate remains unknown. It is a question whether dental extraction could cause a significant change in blood pressure which in combination with psychologic and physical stress, painful stimuli, and the action of catecholamines present in local anesthetic solutions, that could cause harm or even death to the patient if not managed properly[12,13]. The purpose of the present study was to compare the incidence and extent of changes in blood pressure, pulse rate and oxygen saturation alteration after administration of local anesthesia and after extraction using local anesthesia with adrenaline.

Material and methods

The study included 200 patients who underwent dental extraction at Department of Dentistry, Anugrah Narayan Magadh Medical College and Hospital, Gaya, Bihar, India. The patients indicated for tooth extraction under local anesthesia and age between 17-60 years were include in this study.Patients with disease like hypertension, diabetes, and bleeding disorders,history of cardiac surgery, smokers, alcoholics, and drug abusers, pregnant patients,were exclude from study.The details of the study were explained to the patients and written informed consent was obtained. The parameters of the study involved measurement of Change in Peripheral Oxygen Saturation (SpO2), during Dental Extraction from the baseline SpO2 (Time Frame: Baseline, 5-min postanesthesia injection and 5-min postextraction). The SpO2 was recorded using a non-invasive GIBSON infrared digital pulse oximeter placed on the patient's index finger. Change in Heart Rate (HR) during Dental Extraction was recorded using a non-invasive GIBSON infrared digital pulse oximeter placed on the patient's left index finger. Change in Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) during Dental Extraction from the baseline was measured utilizing the analog sphygmomanometer and stethoscope and recorded in mm Hg. The patients were kept in a supine position for 10 min after which blood pressure, oxygen saturation and pulse rate were measured and were defined as the Baseline values. Local anesthesia was administered after a control period of at least 10 min. Lidocaine, 2% with epinephrine (1:80,000), was used as an anesthetic for all of the patients. 5 minutes following local anesthesia injection blood pressure, oxygen saturation and pulse rate were again recorded in the similar manner. Surgery was begun 10 min after injection of the local anesthetic. After surgery, the patients were kept in a supine position during the recovery period. 5 minutes following completion of dental extraction blood pressure, oxygen saturation and pulse rate were recorded in the similar manner. All procedures (local anesthesia administration andtooth extraction) were performed by the same operator and the parameters were also recorded by the same personnel for all patients.

Results

All values were expressed as the mean±SD. To analyze the effects of local anesthesia and tooth extraction on blood pressure, percentage oxygen saturation and heart rate variability, a ‘paired t test’ was used to determine means which were significantly different from the baseline values. p value of 0.05 was considered statistically significant. The study included 200 patients with mean age of 43.2 ± 3.2 years. Among them, there were 80 men and 120 women. Baseline pulse rate (mean ± S.D) of patients before the procedure was 84.1±10 beats/min which has risen to 89.1±09 beats/min after administration of local anesthesia and reduced to 85.8±16 beats/min, 5 minutes after the dental extraction. (Table2) Mean Percentage Oxygen saturation in patients before procedure was 97.3± 2.2%, which slightly increased to 97.8 ± 1.1% after injecting local anesthesia and then reduced back to 96.9 ±2.1% after completion of the procedure. (Table3) The average baseline systolic blood pressure for all of the patients were 126 ± 22 mm Hg. Administration of local anesthetics and tooth extraction caused increases in both systolic blood pressure and pulse rate, and the peak systolic blood pressure occurred after tooth extraction (133 ± 29 mm Hg). After injecting local anesthesia, the mean systolic blood pressure was 131± 11 mm Hg. (table 3) However, diastolic blood pressure did not change significantly during the entire treatment period (baseline= 80 ± 3 mm Hg, post-anesthetic= 81.2 ± 10 mm Hg and post-extraction= 82.4 ± 9.2 mm Hg).

Middle-aged and older patients had higher blood pressures and lower pulse rates compared with young patients. There was slight reduction of mean SPO2 by 0.4% after the injection of local anesthesia and there was overall decrease of 0.20% after extraction which is certainly not significant. Administration of local anesthesia caused mean rise in Pulse rate of 5/min but decreased by 2/min after completion of extraction. (p <0.001). Evaluation of pre anesthesia, post anesthesia and postextraction pulse rate shows no significant change in pulse rate in 5.7 per cent of the patients studied and 89.5 per cent of the patient had an increase in pulse rate post-extraction. Whereas significant increase in blood pressure was seen in 64% patients after administration of local anesthesia and in 73.5% patients after dental extraction. (p < 0.001).

Table 1: Demographic distribution of patients

Parameters	N=200	%
Age (Mean±SD)	43.2 ± 3.2	
Gender		
Male	80	40
Female	120	60

Test applied: One-way ANOVA

Table2: Pulse rate of patients

Pulse rate	**Baseline**	**After administration of local anesthesia**	**5 min after the extraction**
	84.1±10 beats/min	89.1±09 beats/min	85.8±16 beats/min
p-value	<0.05		

Test applied: One-way ANOVA

Table 3: Percentage Oxygen saturation of patients

Oxygen saturation	**Baseline**	**After administration of localanesthesia**	**5 min after the extraction**
	97.3± 2.2%,	97.8 ± 1.1%	96.9 ±2.1%
p-value	>0.05		

Test applied: One-way ANOVA

Table 4: Systolic blood pressure of patients

	Baseline	**After administration of local anesthesia**	**5 min after the extraction**	**p-value**
SBP	126 ± 22 mm Hg	133 ± 29 mm Hg	131± 11 mm Hg	<0.05
DBP	80 ± 3 mm Hg	81.2 ± 10 mm Hg	82.4 ± 9.2 mm Hg	<0.05

Test applied: One-way ANOVA

Discussion

Many patients who visit dental clinics have systemic diseases such as hypertension, ischemic heart disease, and other atherosclerotic diseases. In one study, 64% of the elderly patients who visited the dental clinic were found to have one or more systemic diseases, and among them hypertension was the most frequent systemic disease, occurring in 30% of the patients.[14] Furthermore, cardiovascular accidents caused by hypertension during dental surgery have also been reported.[15] It is therefore important to determine the responses of blood pressure and sympathetic outflow during dental surgery. Kohler-Knoll et al.[16] have demonstrated that catecholamines present in local anesthetics causes increase in blood pressure. However, studies conducted by Davenport et al.[17] and Salonen et al.[18] did not show such an increase The sympathetic nervous system activity tends to increase during dental surgery, as a result of painful stimuli, psychological stress or the epinephrine contained in the local anesthetic. This increased sympathetic activity would therefore increase the blood pressure and pulse rate and can also affect oxygen saturation.[19] In the present study, both systolic blood pressure and pulse rate increased significantly during the dental surgery, resulting in an increase in the rate-pressure product. The middle-aged and older patients had a greater increase in blood pressure after dental extraction, which can be due to enhanced sympathetic activity or may be due to the atherosclerotic changes and augmented vascular reactivity in older patients. Plasma epinephrine concentrations remain high 30 min after its administration with local anesthesia. Therefore, the combined effects of factors including painful stimuli and psychological stress and the direct effect of epinephrine contained in the local anesthetics might elicit a greater sympathetic response. Bible et al.[20] conducted a metaanalysis which concluded that local anesthetics like lidocaine with epinephrine tend to increase the systolic blood pressure and also heart rate.

These findings are consistent with our results. Salonen and colleagues showed that the use of Lidocaine in combination with epinephrine caused a significant increase in heart rate of the patients which are comparable and consistent with our findings.[18] The present study showed that injection of lidocaine caused reduction of pulse rate. This may be attributed to vasodilative effect of Lidocaine. There was no major change in oxygen saturation alteration during LA administration. Many previous studies showed SpO2 values remained constant throughout dental surgery, regardless of the anesthetic combination involved.[19] Pulse rate and oxygen saturation vary in anxious patients. Any major fluctuation in these variables which is noted early, may alert us to prevent any medical emergency during routine dental procedures.

Conclusion

Based on the results obtained from the study it can be concluded that dental surgery using local anesthesia caused significant increases in systolic blood pressure and pulse rate, and the increase in systolic blood pressure was greater in middle-aged and older patients. Changes in oxygen saturation was not clinically significant and usually varies in anxious patients.

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