

Evaluation of Haemodynamic Changes in Hypertensive Patients During Tooth Extraction Under Local Anaesthesia

MO Ogunlewe¹, O James², J NA Ajuluchukwu³, AL Ladeinde¹, WL Adeyemo¹, OM Gbotolorun¹

ABSTRACT

Objective: This study was conducted to determine the changes in blood pressure and the pulse rate of patients with controlled hypertension having dental extraction under local anaesthesia utilizing 2% lignocaine with adrenaline, and to evaluate whether these changes in blood pressure were attributable to addition of adrenaline.

Methods: This prospective study was carried out in 33 consecutive hypertensive patients who presented at the exodontia clinic of the Department of Oral and Maxillofacial Surgery, Lagos University Teaching Hospital (LUTH), Idi-Araba, Lagos, from December 2004 to August 2005 for intra-alveolar tooth extraction. Patients were randomly allocated to two groups according to the type of anaesthetic solution employed. Group A had tooth extraction done under 2% lignocaine with 1:80 000 adrenaline while group B had tooth extraction done under 2% lignocaine without vasoconstrictor (plain lignocaine). One tooth was extracted from each patient.

Blood pressure and pulse rate measurements were recorded in the waiting room before surgery, in the surgery after local anaesthetic injection, during tooth extraction and 15 minutes after tooth extraction.

Results: The sample consisted of 20 females and 13 males age range 24 to 75 years (mean \pm SD = 50.1 \pm 11.7 years). There was no statistically significant difference between the systolic and diastolic blood pressure and pulse rate in the two groups after administration of local anaesthesia. However, the highest alteration in parameters was observed during tooth extraction in the two groups.

Conclusion: The haemodynamic changes induced by injecting 2% lignocaine with adrenaline in patients with controlled hypertension during tooth extraction is within normal range and is not different from that induced by 2% lignocaine without adrenaline. We consider it essential that all precautions to prevent inadvertent intravascular injection be undertaken by the care provider.

Keywords: Adrenaline, controlled hypertension, haemodynamic changes, tooth extraction.

Evaluación de los Cambios Hemodinámicos en Pacientes Hipertensos Durante la Extracción Dental con Anestesia Local

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RESUMEN

Objetivo: Este estudio fue dirigido para determinar los cambios en la tensión arterial y la tasa de pulso de pacientes con hipertensión controlada, a quienes se les realiza una extracción dental bajo las condiciones de la anestesia local, utilizando lidocaína al 2% con adrenalina, y evaluar si estos cambios en la tensión arterial eran atribuibles a la adición de adrenalina.

Método: Este estudio prospectivo se llevó a cabo en 33 pacientes hipertensos consecutivos que acudieron a la clínica de exodoncia del Departamento de Cirugía Oral y Maxilofacial del Hospital Docente Universitario (LUTH), Idi-Araba, Lagos, desde diciembre 2004 a agosto 2005, para extracciones intra-alveolares. Los pacientes fueron colocados de forma aleatoria en dos grupos, según el tipo de solución anestésica empleada. Al grupo A se le realizó la extracción con lidocaína al 2% con 1:80 000 adrenalina, mientras que al grupo B se le realizó la extracción con lidocaína al 2% sin

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vasoconstrictor (*lidocaína pura*). A cada paciente se le extrajo una pieza. Mediciones de la presión arterial y el pulso fueron realizadas en el salón de espera antes de la cirugía, en la cirugía tras la inyección con la anestesia local, durante la extracción del diente, y 15 minutos después de la extracción.

Resultados: La muestra consistió en 20 hembras y 13 varones cuyo rango de edad fluctuó de 24 a 75 años (\pm SD media = 50.1 ± 11.7 años). No hubo diferencia estadísticamente significativa alguna entre la tensión arterial sistólica y la diastólica, ni con respecto a la tasa del pulso en los dos grupos luego de la administración de la anestesia local. Sin embargo, la alteración más alta de los parámetros se observó durante la extracción en los dos grupos.

Conclusión: Los cambios hemodinámicos inducidos por la inyección de lidocaína al 2% con adrenalina en los pacientes con hipertensión controlada durante la extracción, están dentro del rango normal y no son distintos de los inducidos mediante lidocaína al 2% sin adrenalina. Se considera fundamental que los profesionales de la salud tomen todas las precauciones para prevenir inyecciones intravasculares inadvertidas.

Palabras claves: Adrenalina, hipertensión controlada, cambios hemodinámicos, extracción dental

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INTRODUCTION

Adrenaline is a biological preparation of great clinical and theoretical importance and it is the main vasoconstrictor used in dental practice today (1–3). The value of such vasoconstrictors to retard anaesthetic absorption, thereby both decreasing local anaesthetic systemic toxicity and increasing its activity at the site of deposition is the rationale for its use (1–4). Additionally, local control of bleeding can be very advantageous (5, 6). Despite these benefits, its use has been limited by a fear of systemic absorption and the induction of adverse cardiac effects especially in patients with cardiovascular diseases (7, 8). Since adrenaline generally has been regarded as a pressor substance, it has been implicated as possibly of aetiological importance in certain clinical cases of hypertension (9, 10).

Hypertension represents one of the most common medical histories obtained from the patients who visit dental clinics, hence hypertensive patients constitute an important risk group in dental treatment (1, 9). The clinical impact of cardiovascular and haemodynamic changes caused by the introduction of exogenous adrenaline makes its use among hypertensive individuals a controversial subject in dentistry (10–14). General contraindication to vasoconstrictors are well documented (5–7, 9, 10), but one criticism regarding the current guidelines is their vagueness and ambiguity for patients with cardiovascular disorders (1).

The purpose of this study was to evaluate the changes in blood pressure and the pulse rate of patients undergoing dental extraction under local anaesthesia with 2% lignocaine and controlled hypertension, and to evaluate whether these variations are attributable to addition of adrenaline.

MATERIAL AND METHODS

This prospective study was conducted at the exodontia clinic of the Department of Oral and Maxillofacial Surgery, Lagos

University Teaching Hospital, Idi-Araba, Lagos, Nigeria from December 2004 to August 2005 after approval from the Research and Ethics Committee of the hospital was obtained. Patients included in this study were 33 patients (20 females and 13 males) 24–75 years of age (mean age = 50.1 ± 11.7 years) who presented at the clinic for intra-alveolar tooth extraction. All the patients had a history of medically diagnosed high blood pressure and have the blood pressure presently controlled with antihypertensive medication. Patients with any other current medical problems or history of other medical problems, or current history of using any other medications for the treatment of cardiovascular related disease apart from anti-hypertensive drugs were excluded from the study.

Patients were randomly allocated into two groups (Group A or Group B) according to the type of anaesthetic solution employed. Fourteen patients in Group A had their tooth extraction done under 2% lignocaine with 1:80 000 adrenaline while 19 in group B had their tooth extraction done under 2% lignocaine without the vasoconstrictor (adrenaline). Only one tooth was extracted for each patient and two 1.8 mls cartridges of local anaesthetic solution injected using an aspirating dental syringe. All extractions were performed by Oral surgery resident doctors while the haemodynamic readings were taken by another surgeon. Systolic blood pressure (SBP), Diastolic blood pressure (DBP) and Pulse rate (PR) measurements were recorded with a pre-calibrated non-invasive electronic digital blood pressure monitor (Mark of Fitness® model MF-61, Mark of Fitness Inc, Shrewsbury, NJ077702, Japan). Readings were taken in the waiting room before surgery, in the surgery 3–6 minutes after local anaesthetic injection, during tooth extraction and 15 minutes after tooth extraction.

Data analysis was done using the Statistical Package for Social Sciences, SPSS® for Windows, version 11.0 (SPSS

Inc, Chicago, IL) statistical software package. Paired-sample t test was used to analyse the variation in parameters within the groups while independent-sample t test was used to compare the means of the two groups. To compare the frequency between the groups, a chi-square test was used. The critical level of significance was set at $p < 0.05$.

RESULT

Fourteen of the patients were in group A and 19 in group B. The relationship between the mean haemodynamic readings in groups A (2% lignocaine + adrenaline 1:80 000) and group B (plain 2% lignocaine) is shown Table 1. The trends in the

Table 1: Classification of Blood Pressure²¹

Category	Systolic (mm Hg)	Diastolic BP (mm Hg)
Optimal BP	< 120	< 80
Normal BP	< 130	< 85
High-normal BP	130–139	85–89
Grade 1 hypertension (mild)	140–159	90–99
Subgroup: borderline	140–149	90–94
Grade 2 hypertension (moderate)	160–179	100–109
Grade 3 Hypertension (severe)	≥ 180	≥ 110
Isolated systolic hypertension: Subgroup borderline	≥ 140	< 90
	140–149	< 90

C When a patient's systolic and diastolic blood pressures fall into different categories, the higher category should apply.

fluctuations of SBP over time in the two groups are demonstrated by the slopes of the graph of Fig. 1. The alteration

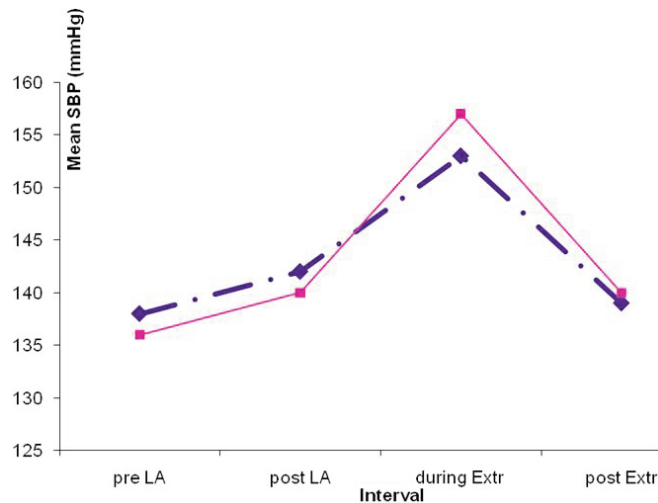


Fig. 1: Comparison of the effects of Lignocaine with adrenaline (broken lines) and without adrenaline (solid lines) on the Mean systolic blood pressure in hypertensive patients. LA = local anesthesia; Extr = Extraction.

follow the same pattern in both groups: SBP increased steadily from the base line value of 138.4 mmHg in group A and 136.6 mmHg in group B following local anaesthetic in-

jection to 142.4 mmHg and 140.5 mmHg respectively. There was a sharp increase in SBP from the post local anaesthesia period which peaked during extraction (153 mmHg in group A and 157 mmHg in group B), giving a sharper slope for group B. The peak was significantly higher in group B ($p < 0.05$). After extraction, SBP dropped sharply in the two groups to almost the pre-anaesthetic level.

Following the administration of local anaesthetic, there was a slight increase in mean DBP in group A but a decrease was observed in group B (Fig. 2). During extraction how-

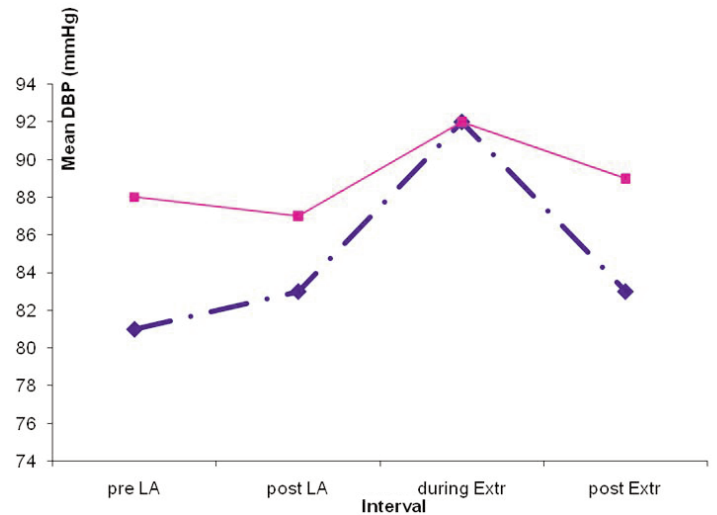


Fig. 2: Comparison of the effects of Lignocaine with adrenaline (broken lines) and without adrenaline (solid lines) on the Mean diastolic blood pressure in hypertensive patients. LA = local anesthesia; Extr = Extraction

ever, the DBP rose to the same peak value of 92 mmHg. These observed changes were however not statistically significant ($p > 0.05$). The mean DBP decreased towards the base line value after tooth extraction in both groups.

The variation of the PR in both study groups is shown in Fig. 3. A marginal increase was recorded after local

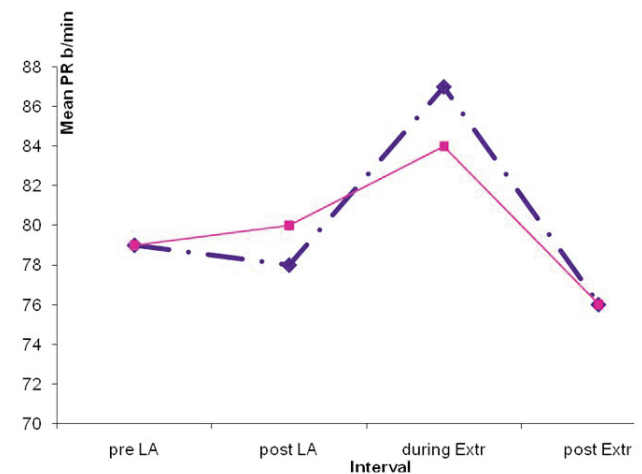


Fig. 3: Comparison of the effect of Lignocaine with adrenaline (broken lines) and without adrenaline (solid lines) on the Mean pulse rate in hypertensive patients. LA = local anesthesia; Extr = Extraction.

anaesthetic administration in group B, while the opposite was observed in group A. There was however a sharp rise from the post-anaesthetic value of 78 beats/min in the group A and 80 beats/min in group B to peak at values of 84 beats/min in the group A and 87 beats/min in group B during tooth extraction. This increase was statistically significant only in group A ($p < 0.05$). Both readings, however, fell to the same level which is slightly lower than the pre-anaesthetic value following extraction.

DISCUSSION

The lignocaine-adrenaline combination is the most widely used local anaesthetic solution in dental practice (2, 3). This combination is essential as adrenaline counteracts the known localized vasodilator effects of lignocaine in subcutaneous and submucosal vessels by causing vasoconstriction, thereby acting as a "chemical tourniquet" and thus decreasing the rate of systemic absorption from the site of injection and reducing the risk of anaesthetic toxicity (3). Vasoconstrictors such as adrenaline are therefore indispensable in achieving the excellent local anaesthesia perioperatively which is required to provide safe and effective control of intra-operative pain in daily clinical dental practice (3).

These vasoconstrictors, however, have been reported to influence blood pressure in the same way as other factors such as anxiety and stress (9). Many investigators have reported that adrenaline-containing local anaesthetic solutions are usually well tolerated by patients with mild and moderate degrees of cardiovascular disease (1, 6–17).

Hypertension represents one of the most common medical condition obtained from the patients who visit dental clinics (13, 17). Hypertension can bring about complications such as paralysis, heart and renal problems and acute medical problems hence hypertensive patients constitute an important risk group in dental treatment (11–17). The other important problem is a sudden and dramatic increase in blood pressure that could lead to a life-threatening complication (1). For this reason, it is stated that local anaesthetics with vasoconstrictors should be avoided for the severe or uncontrolled hypertensive patients, although the effects of solutions with vasoconstrictors on blood pressure and pulse rate have been controversial. The controversies centred on the concentration and mode of use whether as an additive to local anaesthetics or in retraction cord during advanced restorative procedures (10). In this study, adrenaline was used as additive to 2% lignocaine in a concentration in 1:80 000.

Guideline on the definition of blood pressure have been given by WHO (Table 1). Patients that were considered hypertensive in this study were those who were previously diagnosed by a physician and have their blood pressure presently well controlled with antihypertensive medication at the time of this study. This group of patients belong to ASA II class in the American Society of Anaesthesiologist Physical Status classification.

It was observed in this study that there were no statistically significant changes in the SBP, DBP and PR response in the hypertensive subjects following administration of adrenaline-containing local anaesthetic (Fig. 1–3). This same result was obtained by Gungormus and Buyukkurt (1) and Meyer (18).

A steady but insignificant increase in the systolic blood pressure from the baseline value was observed in the hypertensive subjects after the administration of local anaesthesia, which is similar in both the lignocaine-adrenaline and plain lignocaine groups (Fig. 1). A similar finding was reported by Gungormus and Buyukkurt (1) in their study that showed no significant change in the blood pressure of hypertensive patients following administration of adrenaline-containing 2% articaine, though Matsumura *et al* (11) demonstrated that catecholamine present in local anaesthetics (2% lignocaine containing adrenaline 1:80 000) caused an increase in blood pressure and pulse rate. The hypertensive patients in this study failed to respond to a great extent to lignocaine-adrenaline than plain lignocaine injection, thus supporting the interpretation of Gombos *et al* (19) that reactivity to adrenaline is not increased in hypertension.

In the present study, there was a statistically significant increase in the SBP during tooth extraction when compared with the baseline reading (Fig. 1). This increase was significantly higher in the plain lignocaine group. It is possibly due to the fact that this group of patients had significant impaired pain control from less effective anaesthesia achieved with plain lignocaine. This would have predisposed to pain-related stress which has been reported (10, 19) to increase endogenous adrenaline release. The lignocaine-adrenaline group on the other hand showed less increase in the SBP possibly due to the more potent anaesthesia achieved in the group. Based on this finding, it may be said that it is beneficial to use local anaesthesia with vasoconstrictor for patients with controlled hypertension, provided all precautions to prevent inadvertent intravascular injection are undertaken by the care provider. The observed increase can further be attributed to factors such as psychological and physical stress, including that from painful stimuli, and patient anxiety since these level of increase was observed in both groups. The attenuation of stress with anxiolytics or sedation may be beneficial in reducing the cardiovascular response associated with patient anxiety, although in these cases dentist-mediated patient behavioural control appears to play a fundamental role (20, 21).

All the measured parameters in both groups A and B returned to the baseline measurement 15 minutes after the tooth extraction with no complication recorded. This is because adrenaline must have been eliminated from the system and the effect of stress and anxiety no longer present. This is in agreement with the findings of Abraham-Inpijn *et al* (17) that 10 minutes is sufficient for cardiovascular parameters to decrease to normal values after tooth extraction.

In conclusion, the results of this study show that two cartridges of local anaesthetic with adrenaline 1:80 000 may be used in patients with controlled hypertension. The observed haemodynamic changes are within normal range and are not different from that induced by 2% lignocaine without adrenaline. It is essential that all precautions to prevent inadvertent intravascular injection are undertaken by the care provider.

There may also be need for conscious sedation in these patients considering the shift in blood pressure and heart rate during tooth extraction which seems to be the most stressful period of the procedure.

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