

The Difference in Blood Pressure Using the Open Extraction Method Before and After Local Anesthesia with Lidocaine + Adrenaline 1:80,000 at RSGM Nala Husada

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ABSTRACT

Background: Local anesthesia is the first step before open method extraction. The local anesthesia contains 2% lidocaine and adrenaline in a 1:80,000 ratio to extend its duration and reduce the risk of toxicity. However, the use of vasoconstrictors may lead to a spike in blood pressure. **Objective:** To determine the difference in blood pressure before and after the administration of lidocaine + adrenaline in a 1:80,000 ratio for open method extraction at RSGM Nala Husada Surabaya. **Materials and Methods:** Blood pressure was measured before and after the administration of local anesthesia containing lidocaine + adrenaline in a 1:80,000 ratio for open method extraction, following the inclusion criteria with a sample size of 21. Blood pressure was measured using an "Omron HEM-FL31" digital sphygmomanometer. Data analysis was performed using a paired t-test. **Results:** The paired t-test results showed a significant difference in systolic blood pressure ($p < 0.05$), but no significant difference in diastolic blood pressure ($p > 0.05$) before and after the administration of local anesthesia for open method extraction patients. The systolic blood pressure showed the highest value after the administration of local anesthesia (122.95 ± 14.59). **Conclusion:** Blood pressure showed a significant difference before and after the administration of local anesthesia containing lidocaine + adrenaline in a 1:80,000 ratio for open method extraction at RSGM Nala Husada Surabaya.

Keywords: Blood Pressure, Lidocaine + Adrenaline 1:80,000, Open Method Extraction

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INTRODUCTION

One of the most common dental treatments performed in oral surgery is tooth extraction. Tooth extraction is the process of removing a tooth from its socket when it cannot be treated with endodontics or other dental procedures.¹ Tooth extraction can also be defined as a procedure for removing a tooth from its alveolar bone socket. This procedure is performed using forceps, a dental elevator, and, in some cases, surgical techniques. There are two types of tooth extractions: the closed method (simple technique) and the open method (surgical technique). Surgical extraction involves removing a tooth through a surgical process, which may include cutting the tooth or bone.² Before performing a tooth extraction using the open method (surgical technique), local anesthesia must be administered to the patient.

The local anesthesia used in dental procedures is typically a combination of lidocaine 2% and adrenaline 1:80,000. Local anesthesia is one of the most commonly used materials in dentistry. Dentists use local anesthesia to eliminate pain during dental treatments. Local anesthesia is divided into two groups: esters and amides. Examples of ester-based local anesthetics include cocaine, procaine, 2-chloroprocaine, tetracaine, and benzocaine. Amide-based local anesthetics include lidocaine, etidocaine, mepivacaine, bupivacaine, prilocaine, and articaine.³ Amide-based local anesthetics are the most commonly used materials in dentistry. Lidocaine, an amide-based local anesthetic, easily diffuses through lipid-rich interstitial tissues and nerves. It has a short onset time of approximately 2 to 5 minutes and a moderate duration of action.⁴ Local anesthesia is often combined with adrenaline, which acts as a vasoconstrictor. Vasoconstrictive agents are used to narrow blood vessels, counteract the vasodilatory effects of local anesthesia, prolong its duration, reduce systemic absorption and toxicity, and provide a blood-free surgical field.⁵

Understanding the pharmacokinetics and potential adverse effects of local anesthesia is crucial for preventing complications and achieving the desired outcomes. However, due to its short onset time, the toxic symptoms that arise are temporary and typically resolve quickly, returning to normal.⁴ The addition of adrenaline to lidocaine may lead to undesirable side effects, such as increased blood pressure, hypotension, chest pain, arrhythmia, tachycardia, and even heart attack. The cardiovascular side effects of local anesthesia are closely related to the concentration of the anesthetic agent in the bloodstream and are dose-dependent.⁵

High blood pressure or High blood pressure, or hypertension, is a common disease with a high prevalence in Indonesia. According to data from the World Health Organization (WHO), hypertension affects approximately 22% of the global population. The results of the 2018 Riskesdas in Indonesia revealed that 34.1% of the population aged 18 years and older suffered from hypertension. The prevalence of hypertension increases significantly among individuals aged 60 years and older.⁶ Hypertension is characterized by an increase in both systolic and diastolic blood pressure. Systolic blood pressure refers to the pressure exerted on the arteries when the left ventricle of the heart contracts, representing the top value in a blood pressure reading. Diastolic blood pressure, on the other hand, is the pressure when the heart relaxes, representing the bottom value.⁷

The condition of a patient who remains conscious during dental treatment can lead to anxiety and pain. The rise in blood pressure during the open-method extraction process may be triggered by the pain stimulus during anesthesia administration and the effects of the vasoconstrictor present in the anesthetic agent.² Blood pressure can increase due to several factors, such as an imbalanced diet, lack of physical activity, physiological stress, anxiety, or pain. Dental treatments, in particular, can induce anxiety and pain, which may contribute to

elevated blood pressure.² It is crucial for dentists to exercise caution when selecting and administering local anesthesia and to ensure the appropriate use of lidocaine. Administering local anesthesia with an incorrect dose or concentration of the anesthetic solution can lead to systemic complications. Additionally, the use of adrenaline is contraindicated in cardiovascular patients, as it can elevate both blood pressure and heart rate.⁸

Previous research has shown that the administration of lidocaine mixed with adrenaline 1:80,000 as a local anesthetic during the closed-method extraction process did not significantly alter blood pressure.⁹ According to Ketabi's (2012) study, the administration of a single cartridge of local anesthetic containing lidocaine + adrenaline 1:80,000 slightly increased blood pressure and pulse rate. However, this minor increase was neither clinically nor medically significant. Nevertheless, the use of lidocaine + adrenaline 1:80,000 may be contraindicated in patients who have undergone heart transplants. Uchiyama's (2018) study found that the use of 2% lidocaine with adrenaline 1:80,000 for inferior alveolar nerve blocks is safe for patients without systemic diseases. However, further investigation is required for patients with cardiovascular issues.

Based on the background above, this study aims to determine the effect of 2% lidocaine+adrenaline 1:80,000 as a local anesthetic on patients undergoing open-method extraction.

MATERIALS AND METHODS

This study is an analytical observational study employing a cross-sectional method. The population of this study consists of all patients who underwent open method extraction with local anesthesia using lidocaine 2% + adrenaline 1:80,000 at RSGM Nala Husada Surabaya during the period of September to October 2022. The sample size for this study is 21 participants, selected using a simple random sampling

technique based on predetermined inclusion and exclusion criteria.

Sample Criteria

The sample criteria for this study included patients aged 18-50 years who were scheduled to undergo open-method tooth extraction with local anesthesia using lidocaine+adrenaline 1:80,000. Participants were required to have no immunocompromised conditions and to exhibit either normotension or prehypertension.

The collected data will be processed and analyzed using SPSS version 27. Initially, the data will be analyzed descriptively, followed by a normality test using the Shapiro-Wilk method. Subsequently, a homogeneity test will be conducted using Levene's Test. The data were found to be normally distributed and homogeneous.

For normally distributed and homogeneous data, a paired t-test will be performed to compare blood pressure before and after the administration of local anesthesia in patients undergoing open-method tooth extraction. The results of the study will then be derived and interpreted.

RESULTS

After measuring blood pressure, a descriptive analysis of the data from 21 samples was conducted.

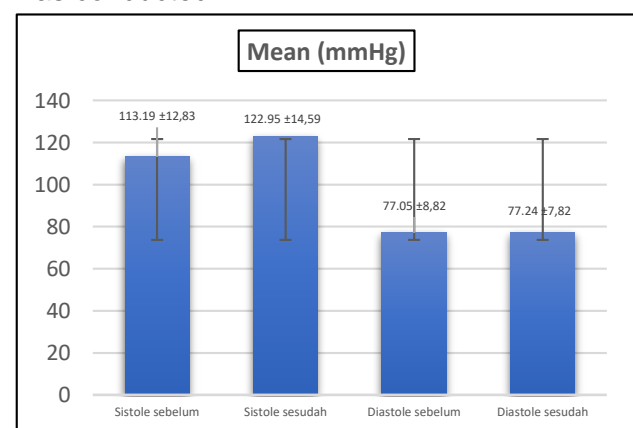


Figure 1. Graph of Descriptive Test Results for Blood Pressure

The lowest systolic blood pressure recorded before anesthesia during open-method extraction was 89 mmHg, while after anesthesia was 97 mmHg. The lowest diastolic blood pressure before anesthesia was 60 mmHg, whereas after anesthesia was 63 mmHg. The highest systolic blood pressure values observed were 134 mmHg before anesthesia and 149 mmHg after anesthesia. Similarly, the highest diastolic blood pressure values were 92 mmHg before anesthesia and 88 mmHg after anesthesia. Figure 1 showed the mean and standard deviation values for systolic blood pressure before anesthesia (113.19 ± 12.83 mmHg), and after anesthesia (122.95 ± 14.59 mmHg). The mean and standard deviation values for diastolic blood pressure before anesthesia were 77.05 ± 8.82 mmHg and 77.24 ± 7.82 mmHg after anesthesia.

Table 1. Results of Normality Test of Blood Pressure

	Sig.
Systole before	.281
Systole after	.214
Diastole before	.775
Diastole after	.264

* $p > 0,05$

Based on Table 1, the normality test results before and after the administration of local anesthesia in open-method tooth extraction show significance values greater than 0.05. Therefore, it can be concluded that the data are normally distributed, and the homogeneity test, specifically the Levene Test, is subsequently conducted.

Table 2. Results of Blood Pressure Homogeneity Test

	Sig.
Systolic Blood Pressure	.445
Diastolic Blood Pressure	.482

* $p < 0,05$

Based on Table 2, the significance value obtained is greater than 0.05 for the data collected before and after the administration of local anesthesia in open-method tooth extraction. This indicates that the data is homogeneous, meaning that the variations in the data are consistent. Following this, a paired t-test will be conducted to examine potential differences.

Table 3. Paired T-test Hypothesis Test

	Sig.
Systolic Blood Pressure	.000
Diastolic Blood Pressure	.882

* $p < 0,05$

Based on Table 3, the results of the paired t-test for systolic blood pressure revealed a significance value of 0.000 ($p < 0.05$), indicating a statistically significant difference. In contrast, the results for diastolic blood pressure showed a value of 0.882 ($p > 0.05$), suggesting no significant difference before and after the administration of lidocaine + adrenaline in a 1:80,000 ratio for open method extraction.

DISCUSSION

The open method of tooth extraction involves a surgical approach that requires cutting either the tooth or the bone. This technique follows several key principles, including flap preparation, bone removal, tooth sectioning, tooth extraction, bone leveling, curettage, and suturing.¹⁰ Before performing the open method extraction, local anesthesia is administered, typically using lidocaine, a type of local anesthetic from the amide group. To enhance its effectiveness, a vasoconstrictor such as adrenaline is often added to the local anesthetic. This combination helps constrict blood vessels, counteracting the vasodilation effects of the anesthetic. As a result, it creates a blood-free surgical field, reduces systemic

absorption of the anesthetic, and minimizes the risk of toxicity.⁵

However, despite these precautions, this study observed an increase in blood pressure, which contrasts with the findings of previous studies. Anxiety experienced by patients due to the open method extraction is one factor that can elevate blood pressure. This occurs because when patients are aware that open method extraction will be performed, endogenous catecholamines (epinephrine/norepinephrine) may be released due to the psychological stress they experience, leading to fear. The presence of catecholamines can trigger a rise in blood pressure.¹¹

This study was conducted to determine the increase in blood pressure in patients undergoing open method extraction before and after using local anesthesia lidocaine + adrenaline 1:80,000. Blood pressure measurements can be utilized if there is an excessive increase that can endanger the open method extraction process. Blood pressure measurements were taken before the administration of local anesthesia and three to five minutes after the administration, as lidocaine has a short onset time of 2-5 minutes. The researcher conducted an observational analytic study with a sample size of 21 data to determine changes in blood pressure in patients undergoing open method extraction before and after using local anesthesia lidocaine + adrenaline 1:80,000.

The change in blood pressure in patients undergoing open-method extraction before and after the administration of local anesthesia (lidocaine + adrenaline 1:80,000) at RSGM Nala Husada was analyzed. The results of a paired t-test statistical analysis showed that the p-value for systolic blood pressure was 0.000 ($p < 0.05$), while the p-value for diastolic blood pressure was 0.882 ($p > 0.05$). Based on these findings, it can be concluded that there was a significant change in systolic blood pressure before and after the administration of local anesthesia, but no significant change in diastolic blood pressure.

The increase in blood pressure can be attributed to the effects of adrenaline, which acts on α and β adrenergic receptors. The narrowing of blood vessels, caused by the action of anesthesia on alpha adrenergic receptors in peripheral blood vessels, contributes to this rise. Additionally, local anesthesia affects beta adrenergic receptors, which can lead to an increase in heart rate and contractile force, further resulting in elevated blood pressure.¹²

Figure 1 presents the results of the study conducted on 21 samples, indicating an overall increase in the average systolic blood pressure following the administration of local anesthesia to patients, with an average rise of 9.76 mmHg. Systolic blood pressure showed a significant increase before and after the administration of local anesthesia. This increase was attributed to the effect of adrenaline on the β_1 receptors, which strengthens and accelerates the contraction of the heart muscle, thereby increasing cardiac output. Additionally, the activation of α receptors causes vasoconstriction and the contraction of blood vessel muscles, further contributing to the rise in blood pressure. The surge in adrenaline levels leads to more forceful contractions of the cardiac muscle.¹³

The inclusion of adrenaline in the local anesthetic agent resulted in a negligible increase in diastolic blood pressure, as it binds to β_2 receptors, inducing vasodilation and relaxation of the blood vessel muscles. Diastolic blood pressure is associated with the pressure in the arteries during the heart's relaxation phase between two heartbeats, and therefore, it does not increase significantly.¹⁵

Diastolic blood pressure can be influenced by various factors, including age, gender, and the consumption of carbohydrates, saturated fats, and unsaturated fats. Diastolic blood pressure tends to remain stable between the ages of 55 and 60, as blood vessels become stiffer with increasing age.¹⁶ Both medications and age can affect the mechanisms regulating diastolic blood pressure. Certain types of drugs, such as alpha blockers, can influence diastolic

blood pressure by inhibiting alpha receptors. Alpha blockers, including doxazosin, indoramin, and terazosin, are commonly used as antihypertensive medications. Additionally, the use of local anesthetics containing adrenaline is another example of a treatment that works by inhibiting alpha receptors.¹⁷

In this study, it remains unclear whether the increase in blood pressure in patients is caused by the effects of vasoconstrictor substances or psychological stress. Psychological stress can be assessed by measuring the patient's pulse rate and respiration rate before administering local anesthesia. Patients who experience stress or fear typically exhibit an elevated pulse rate. This measurement can serve as an indicator to determine whether an individual is experiencing psychological stress before undergoing the open method procedure. Several previous studies have demonstrated that pre-anesthesia can help reduce psychological stress in patients. Factors that may alleviate stress include social support, a healthy diet, relaxation techniques, spiritual practices, and humor.¹⁸ Patients are advised to avoid factors that could contribute to an increase in blood pressure, such as smoking, alcohol consumption, and excessive salt intake.¹⁶

One of the reasons why the patient did not experience a significant increase in blood pressure is that they remained calm. Psychologically, the patient had prepared their mind and emotions before undergoing the open-method extraction procedure. The calmness experienced by the patient originates from the amygdala in the brain. The amygdala is a brain structure that regulates thoughts and emotions, such as joy, sadness, and fear. Due to its role in fear conditioning, the amygdala can regulate the autonomic nervous system, thereby reducing the release of adrenaline from the sympathetic nerves.^{19,20}

CONCLUSIONS

There was a significant increase in systolic blood pressure and a non-significant increase in diastolic blood pressure. Based on the study results, the rise in blood pressure before and after the administration of lidocaine + adrenaline 1:80,000 is considered safe for performing the open method extraction procedure.

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