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Local Anesthetics with Vasoconstrictors in Hypertensive Patients Undergoing Dental Extraction Procedures: A Serial Case Report

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ABSTRACT

Background: Systemic absorption of vasoconstrictors and adverse cardiac effects are reasons for not using vasoconstrictors in hypertensive patients. However, several recent studies reported that the use of local anesthetics with vasoconstrictors in hypertensive patients doesn't cause a statistically significant increase in blood pressure and heart rate. The objective of the study is to evaluate the preoperative, intraoperative and postoperative blood pressure, heart rate and peripheral oxygen saturation in hypertensive patient who undergoing dental extraction procedures with local anesthetics with vasoconstrictors. **Case presentation:** We reported three serial cases of male patients (40, 45, 47 years old) undergoing radices lower posterior tooth extracted, with blood pressures 143/88mmHg, 140/86mmHg and 142/86 mmHg. The patient underwent extraction under infiltration local anesthetics with vasoconstrictors (epinephrine). All patient's blood pressure increased 1-3 points intraoperative and decreased again postoperative. The patient's heart rate also increased 10-25 times per minute intraoperative. The decrease in oxygen saturation (2%) only occurred in one patient, intraoperative. **Conclusion:** The slight hemodynamic changes in these three patients indicate that the use of local anesthetics with vasoconstrictors in hypertensive patients undergoing dental extraction procedures is relatively safe.

1. Introduction

The exponential rise in life expectancy and the polymorbid states have led to an increase in the number of high-risk patients in routine dental practice.¹ In 2021, the Yogyakarta Special Region is the province with the highest life expectancy in Indonesia. Life expectancy in Yogyakarta Special Region in 2022 will actually increase from 2021.² With this high life expectancy, the number of people at high risk will increase, one of which is hypertension. The prevalence of hypertension in the Yogyakarta Special Region, according to Riskesdas 2018, is 11.01% or higher when compared to the national figure (8.8%). Yogyakarta Special Region is in 4th place as a province in Indonesia with high cases of hypertension. Hypertension has always been included in the top 10

diseases as well as the top 10 causes of death in the Special Region of Yogyakarta for the last five years. Hypertension is one of the high-risk groups for routine dental procedures. Hypertensive patients are one of the most frequently encountered patients undergoing exodontia.³ Chances of cardiovascular complications should be anticipated in these patients during tooth extraction which necessitates the need for a well-equipped dental set up. Extraction in hypertensive patients requires a special approach, one of which is anesthesia. Local anesthetics combined with vasoconstrictors can increase the duration of the anesthetic effect, reduce systemic toxicity, and optimize soft tissue hemostasis.⁴ However, despite the beneficial properties of vasoconstrictors when combined with local anesthetics, dentists are

concerned about the adverse effects associated with vasoconstrictors, especially with epinephrine, which is the most widely used vasoconstrictor in dentistry.⁵

Some dentists choose to use local anesthesia without vasoconstrictors in hypertensive patients to prevent complications of tooth extraction.⁶ Some literature reports that the use of vasoconstrictors in heart patients can have adverse effects on the heart. The hemodynamic and cardiovascular changes caused by epinephrine administration have led to its use in hypertensive patients.⁷ However, some literature reports that the use of epinephrine in local anesthesia does not have a significant role in changing blood pressure and heart rate in hypertensive patients (A systematic review also reports that the use of epinephrine (in low doses) does not change the risk of arrhythmias, ST segment depression, flat arterial pressure -mean, systolic and diastolic blood pressure and heart rate, thus demonstrating the safety of its use for these outcomes in adult patients on some types of epinephrine.⁸ The cardiovascular changes caused by the administration of exogenous epinephrine make its use a controversy among hypertensive individuals. Monitoring the patient's heart rate, blood pressure, and peripheral oxygen saturation (SpO₂) preoperative, intraoperative, and postoperative increases the safety factor, leading to a more relaxed surgical atmosphere, and helps relieve dental anxiety in the patient to a certain extent, too. There is a lack of evidence comparing the hemodynamic changes in hypertensive patients undergoing dental extraction procedures with local anesthetics with vasoconstrictors in Indonesia. The objective of this serial case report is to evaluate the preoperative, intraoperative and postoperative for blood pressure, heart rate and peripheral oxygen saturation in hypertensive patients who are undergoing dental extraction procedures with local anesthetics with vasoconstrictors.

2. Case Presentation

Case 1

A 40-year-old man came to the Dental Hospital of Universitas Muhammadiyah Yogyakarta with

complaints of large caries in his lower right back tooth and wanted it extracted. This extraction was the first extraction for the patients, and they didn't experience anxiety. Objective examination showed that there was a residual root of the tooth (46) percussion - and palpation -. Vital sign examination showed blood pressure 143/88mmHg, heart rate: 82 x/minute, respiration: 20 x/minute, temperature 36.8°C and SpO₂: 97%. The patient has been diagnosed with hypertension and regularly takes antihypertensive medication. There is no family history of hypertension. Treatment plan: extraction under infiltration local anesthetics with vasoconstrictors (epinephrine).

Case 2

A 45-year-old man came to the Dental Hospital of Universitas Muhammadiyah Yogyakarta with complaints of radices in his lower right back tooth and wanted it extracted. This extraction was the first extraction for the patients, and they didn't experience anxiety. Objective examination showed that there were remaining roots of the tooth (47) with percussion (-) and palpation (-). Vital sign examination showed blood pressure 140/86mmHg, heart rate: 80x/minute, respiration: 19x/minute, temperature 37°C and SpO₂: 97%. There is no family history of hypertension. Treatment plan: extraction under infiltration local anesthetics with vasoconstrictors (epinephrine).

Case 3

A 47-year-old man came to the Dental Hospital of Universitas Muhammadiyah Yogyakarta with complaints of radices in his lower left back tooth and wanted it extracted. This extraction was the first extraction for the patient, and they didn't experience anxiety. Objective examination showed that there were radices of tooth 36 with percussion (-) and palpation (-). Vital sign examination showed blood pressure 142/86 mmHg, heart rate: 77x/minute, respiration: 20x/minute, temperature 37°C and SpO₂: 98%. There is no family history of hypertension. Treatment plan: extraction under infiltration local anesthetics with vasoconstrictors (epinephrine).

All patients underwent extraction under infiltration anesthesia with pehacain® anesthetic solution, each ml of which contains Lidocaine HCl 20 mg and Adrenaline 0.0125 mg. Anesthesia is done with 1 cc on the buccal side and 1 cc on the lingual side. Extraction and anesthesia in the third patient were performed by a different operator. Blood pressure, p heart rate, and oxygen levels were measured before anesthesia, during extraction, and after extraction. Blood pressure

measurements were carried out using a OneMed® manual blood pressure monitor. Oxygen level monitoring was carried out using an Omron® oximeter. Blood pressure, heart rate, and oxygen levels were monitored 3 times: 1. Preoperative is carried out just before anesthesia; 2. Intraoperatively carried out after one tooth root has been removed; 3. Post-operation is carried out at some point after all the tooth roots have been removed and the sockets have been cleaned.

Table 1. Blood pressure, heart rate, and peripheral oxygen saturation of the patient.

No.	Blood pressure			Heart rate			Peripheral oxygen saturation		
	Pre operative	Intra operative	Post operative	Pre operative	Intra operative	Post operative	Pre operative	Intra operative	Post operative
1	143/88 mmHg	145/89 mmHg	140/86 mmHg	82 x/minute	100 x/minute	88 x/minute	97%	97%	99%
2	140/86 mmHg	142/88 mmHg	139/86 mmHg	80 x/minute	98 x/minute	90 x/minute	97%	97%	97%
3	142/86 mmHg	145/88 mmHg	140/88 mmHg	77 x/minute	90 x/minute	81 x/minute	98%	96%	97%

3. Discussion

Adrenaline is the principal vasoconstrictor being used in local anesthetic solutions. The localized vasodilator effects of lidocaine in subcutaneous and submucosal vessels are counteracted by adrenaline, which causes vasoconstriction in the surrounding tissues. This vasoconstriction of tissues decreases the bleeding at the surgical site and increases the efficacy of anesthesia while reducing the plasma concentration of the anesthetic agent being used and, therefore, decreases systemic toxicity.⁹ Furthermore, bleeding control can be very useful as it improves visibility and access at surgical sites.¹⁰ Many dentists do not use Local Anaesthetics with Vasoconstrictors in hypertensive patients and patients having cardiac complications. The systemic absorption of epinephrine and its adverse cardiac effects thereafter limits its use in such patients.¹¹ Vasoconstrictors cause the arterial plasma epinephrine concentration to double, but it was also associated with cardiovascular stability in young, healthy patients. Many investigators have concluded that local anesthetic solutions containing epinephrine are usually well tolerated by patients with

mild and moderate degrees of cardiovascular disease.¹²

Patients considered hypertensive in this study were those previously diagnosed by a doctor and whose blood pressure was currently well controlled with antihypertensive medication at the time this study was conducted. According to the American Heart Association (AHA) classification (2017), these three patients fall into the hypertension category. All patients' blood pressure (systolic and diastolic) increased 1-3 points intraoperatively and decreased again postoperatively. This is in accordance with the results of previous studies, which showed a slight increase in systolic after administration of local anesthetic agents containing adrenaline.¹³ Other studies also prove that there is an increase in systolic and diastolic pressure, but statistically, not significant.¹⁴

Vasoconstrictors cause several hemodynamic changes that may occur through direct action on the heart muscle or through stimulation of the autonomic innervation of the heart. This effect can cause an increase in heart rate, an increase in the force of heart

contractions, and, ultimately, an increase in blood pressure. This effect depends on the concentration of the vasoconstrictor used.¹⁵ Systolic and diastolic blood pressure experience a slight increase after administration of anesthesia (during extraction); apart from being caused by the administration of vasoconstrictors, this can be associated with the release of endogenous catecholamines due to pain, anxiety, and stress due to tooth extraction procedures. The increase in blood pressure in these three cases was proven by a decrease in blood pressure after the tooth was successfully extracted. However, the increase in blood pressure was only slight; this is in accordance with previous research, which concluded that local anesthetic solutions containing epinephrine are usually well tolerated by patients with mild and moderate cardiovascular disease.¹⁶

The patient's heart rate also increased 10-25 times per minute intraoperatively and decreased postoperatively. This increase in intraoperative pulse rate is in accordance with previous studies.¹ Epinephrine combined with local anesthetics is associated with cardiovascular stability in young, healthy patients, and increases in plasma epinephrine are due to the rapid absorption of exogenous epinephrine. Previous research in a Spanish population found significant changes in heart rate and blood pressure due to problems related to anxiety and fear.¹⁷ Other studies reported changes in heart rate were affected by pain, individual factors such as age, gender, hypertension, previous experience with dental treatments, and psychological response. This is related to the decline in pulse rate again after extraction, where pain and psychological factors have decreased.

The peripheral oxygen saturation remained almost unchanged in all patients. Similar results were obtained before that did not observe any significant differences in oxygen saturation.¹⁶ Only one patient experienced a decrease in SpO₂ during extraction (intraoperative). This is in accordance with previous studies which reported a slight decrease in SpO₂ in dental extractions, although the decrease only proved

statistically significant in the tooth extraction group following infiltration of the local anesthetic with vasoconstrictor and was independent of whether the patient had arterial hypertension or not.¹⁹ Previous studies have also evidenced a decrease in SpO₂ during dental treatment.²⁰ This phenomenon could be related to a degree of hypoventilation produced by prolonged patient placement in the supine position during dental treatment or to patient air inhalation difficulties caused by intraoral manipulations. The statistically insignificant decrease in intraoperative and the subsequent increase in postoperative SpO₂ indicate that these hemodynamic changes are not cause for concern. Although it is still very early and requires further research, the slight hemodynamic changes in these three patients indicate that the use of local anesthetics with vasoconstrictors in hypertensive patients undergoing dental extraction procedures is relatively safe. This is good news because the use of local anesthetics with vasoconstrictors undergoing dental extraction has several advantages, namely controlling bleeding and increasing the duration and potency of anesthesia.

4. Conclusion

The slight hemodynamic changes in these three patients indicate that using local anesthetics with vasoconstrictors in hypertensive patients undergoing dental extraction procedures is relatively safe. The patient's blood pressure and heart rate slightly increase intraoperative and decrease again postoperative. A decrease in peripheral oxygen saturation occurred in one patient postoperatively, but it was still within normal limits.

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