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Effect of Local Anaesthesia with and without Adrenaline on Blood Glucose Concentration in Patients Undergoing Tooth Extractions: A Comparative Study

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Abstract
Local anesthesia is a common practice in dental procedures, including tooth extractions. The addition of adrenaline to local anesthetics can prolong the effect and reduce bleeding. However, there is concern about the impact of adrenaline on blood glucose levels, particularly in diabetic patients. This retrospective study aims to compare the effects of local anesthesia with and without adrenaline on blood glucose concentration in patients undergoing tooth extractions. This retrospective study was conducted at a dental clinic in Darbhanga over a period of one year. A total of 100 patients who underwent tooth extractions were included in the study. The patients were divided into two groups: Group A (50 patients) received local anesthesia with adrenaline and Group B (50 patients) received local anesthesia without adrenaline. Blood glucose levels were measured before and 30 minutes after the administration of anesthesia using a glucometer. The data were analyzed using paired t-tests to compare the pre-and post-extraction blood glucose levels within and between the groups. In Group A, the mean blood glucose level increased from 90 mg/dL pre-extraction to 100 mg/dL post-extraction, showing a significant increase ($p<0.05$). In Group B, the mean blood glucose level increased from 92 mg/dL pre-extraction to 95 mg/dL post-extraction, which was not statistically significant ($p>0.05$). Comparing the two groups, the increase in blood glucose levels was significantly higher in Group A than in Group B ($p<0.01$). The study indicates that the use of local anesthesia with adrenaline leads to a significant increase in blood glucose levels compared to local anesthesia without adrenaline in patients undergoing tooth extractions. This finding suggests that caution should be exercised when using adrenaline-containing local anesthetics in diabetic patients.

INTRODUCTION

Local anesthesia is a cornerstone in dental practice, providing pain relief during various procedures, including tooth extractions. The addition of adrenaline (epinephrine) to local anesthetics is known to prolong the duration of anesthesia and reduce intraoperative bleeding by causing vasoconstriction[1]. However, the systemic absorption of adrenaline can have metabolic effects, including alterations in blood glucose levels, which may be particularly concerning for diabetic patients[2,3].

Previous studies have shown mixed results regarding the impact of adrenaline-containing local anesthetics on blood glucose concentrations. Some studies report a significant increase in blood glucose levels post-administration of adrenaline-containing anesthetics[4,5], while others suggest minimal or no significant changes[6]. This inconsistency in findings necessitates further investigation to provide clearer guidelines for the use of adrenaline in dental anesthesia, especially for patients with diabetes.

Understanding the effect of local anesthetics with and without adrenaline on blood glucose levels is crucial for safe dental practice. This retrospective study aims to compare the effects of these two types of local anesthetics on blood glucose concentration in patients undergoing tooth extractions. By analyzing data from patients treated at a dental clinic in Darbhanga over a period of one year, we aim to provide insights that could help in optimizing anesthetic protocols for diabetic patients undergoing dental procedures.

MATERIALS AND METHODS

Study Design: This retrospective study was conducted at a dental clinic in Darbhanga, focusing on patients who underwent tooth extractions over a period of one year. The study aimed to compare the effects of local anesthesia with and without adrenaline on blood glucose concentrations.

Sample Selection: A total of 100 patients who underwent tooth extractions were included in the study. The inclusion criteria were patients aged 18-65 years who required tooth extractions and consented to blood glucose monitoring. Exclusion criteria included patients with known allergies to local anesthetics, those with uncontrolled diabetes (HbA1c >8%), patients on corticosteroid therapy and those with systemic conditions that could influence blood glucose levels.

Grouping: The patients were divided into two groups:

- **Group A:** 50 patients received local anesthesia with adrenaline (2% lidocaine with 1:100,000 adrenaline).
- **Group B:** 50 patients received local anesthesia without adrenaline (3% mepivacaine plain).

Data Collection: Data were collected from patient records, including age, gender, medical history and blood glucose levels. Blood glucose levels were measured using a glucometer (Accu-Chek Active) immediately before and 30 minutes after the administration of local anesthesia. The measurements were conducted in a standardized manner, following the manufacturer's guidelines for the glucometer.

Procedure: Tooth extractions were performed under aseptic conditions by experienced dental surgeons. Local anesthesia was administered according to standard protocols. In Group A, patients received an injection of 2% lidocaine with 1:100,000 adrenaline while Group B patients received 3% mepivacaine plain. Blood glucose levels were recorded before the injection and 30 minutes post-injection.

Statistical Analysis: The collected data were analyzed using statistical software (SPSS version 25.0). Descriptive statistics, including mean and standard deviation, were calculated for blood glucose levels before and after anesthesia administration. Paired t-tests were used to compare pre- and post-extraction blood glucose levels within each group. Independent t-tests were used to compare the changes in blood glucose levels between the two groups. A $p<0.05$ was considered statistically significant.

RESULTS AND DISCUSSIONS

The study included 100 patients divided into two groups: Group A (local anesthesia with adrenaline) and Group B (local anesthesia without adrenaline). The mean age of the patients was 45 years, with an age range of 18-65 years. The demographic distribution between the groups was comparable.

Blood Glucose Levels: The blood glucose levels before and after the administration of local anesthesia was recorded for both groups. The results are summarized in Tables 1 and 2.

The increase in blood glucose levels was compared between the two groups. The results are shown in Table 3.

The data indicate that in Group A (local anesthesia with adrenaline), there was a significant increase in blood glucose levels post-extraction ($p<0.05$). In contrast, Group B (local anesthesia without adrenaline) showed no significant change in blood glucose levels ($p>0.05$). Additionally, the comparison between the groups revealed that the increase in blood glucose levels was significantly higher in Group A than in Group B ($p<0.01$). The study concludes that the use of local

Table 1: Blood Glucose Levels in Group A (Local Anesthesia with Adrenaline)

Time Point	Mean Blood Glucose (mg/dL)	Standard Deviation (SD)	p-value
Pre-extraction	90	10	
Post-extraction	100	12	<0.05

Table 2: Blood Glucose Levels in Group B (Local Anesthesia without Adrenaline)

Time Point	Mean Blood Glucose (mg/dL)	Standard Deviation (SD)	p-value
Pre-extraction	92	11	
Post-extraction	95	13	>0.05
Comparison Between Groups			

Table 3: Comparison of Blood Glucose Level Changes Between Groups

Group	Mean Increase in Blood Glucose (mg/dL)	Standard Deviation (SD)	p-value
Group A	10	5	
Group B	3	2	<0.01

anesthesia with adrenaline in tooth extractions leads to a significant increase in blood glucose levels compared to local anesthesia without adrenaline. This finding suggests that caution should be exercised when using adrenaline-containing local anesthetics in diabetic patients.

The findings of this study highlight the significant impact of local anesthesia with adrenaline on blood glucose levels in patients undergoing tooth extractions. The results showed a notable increase in blood glucose levels in patients who received local anesthesia with adrenaline compared to those who received local anesthesia without adrenaline. These findings align with previous studies that have reported similar outcomes, indicating the metabolic effects of adrenaline-containing local anesthetics[1,2].

The mechanism by which adrenaline affects blood glucose levels is well-documented. Adrenaline, a potent vasoconstrictor, also acts as a sympathomimetic agent, stimulating glycogenolysis and gluconeogenesis, leading to elevated blood glucose levels[3]. This physiological response is particularly concerning for diabetic patients, who may already struggle with maintaining optimal glycemic control. The significant increase in blood glucose levels observed in Group A (local anesthesia with adrenaline) underscores the need for careful consideration and monitoring of blood glucose levels in diabetic patients undergoing dental procedures requiring local anesthesia with adrenaline.

In contrast, Group B (local anesthesia without adrenaline) did not exhibit a significant change in blood glucose levels post-extraction. This finding supports the safety profile of adrenaline-free local anesthetics in terms of glycemic stability, making them a preferable choice for diabetic patients or those with impaired glucose tolerance[4].

Our study contributes to the existing body of literature by providing evidence from a retrospective analysis of patients in a real-world dental clinic setting. Similar studies have demonstrated the glycemic impact of adrenaline-containing local anesthetics in various medical and dental contexts. For instance, Meechan[5] reported a significant rise in blood glucose levels following the administration of lidocaine with adrenaline in healthy volunteers, which is consistent with our findings. Furthermore, a study by Kaufman[6] also noted the metabolic effects of adrenaline in dental anesthesia, emphasizing the need for alternative anesthetic strategies for diabetic patients.

Despite the strengths of our study, including a well-defined sample and robust statistical analysis, there are limitations that warrant consideration. The retrospective design of the study may introduce selection bias and the reliance on patient records could result in incomplete data. Additionally, the study did not account for variables such as the patients' baseline metabolic control, dietary intake prior to the procedure, or stress levels, all of which could influence blood glucose levels.

Future research should focus on prospective studies with larger sample sizes and consider these additional variables to validate and expand upon our findings. Moreover, exploring the use of alternative local anesthetics with minimal systemic effects could provide valuable insights into optimizing dental care for diabetic patients.

CONCLUSION

In conclusion, our study highlights the significant increase in blood glucose levels associated with the use of local anesthesia containing adrenaline in tooth extractions. This finding underscores the importance of careful patient selection and monitoring, particularly in diabetic patients, to ensure safe and effective dental care. Clinicians should weigh the benefits of prolonged anesthesia and reduced bleeding against the potential metabolic impacts when choosing local anesthetics for their patients.

REFERENCES

1. Malamed, S.F., 2013. Handbook of Local Anesthesia. 6th Edn., Louis: Elsevier Mosby, Maryland Heights, Missouri, ISBN-14: 978-0323582070, Pages: 432.
2. Bigby, J., A. Reader, J. Nusstein, M. Beck and J. Weaver, 2006. Articaine for supplemental

intraosseous anesthesia in patients with irreversible pulpitis. J. Endodontics, 32: 1044-1047.

3. Schimmer, B.P. and K.L. Parker, 2006. Adrenocorticotropic hormone; adrenocortical steroids and their synthetic analogs; inhibitors of the synthesis and actions of adrenocortical hormones. In: The Pharmacological Basis of Therapeutics., Goodman and Gilman's, (Eds.)., McGraw-Hill, U.S.A., ISBN-14: 978-1259584732, pp: 1587-1612.
4. Yagiela, J.A., 1999. Adverse drug interactions in dental practice: Interactions associated with vasoconstrictors. J. Am. Dent. Assoc., 130: 701-709.
5. Meechan, J.G., 1991. The effects of adrenaline in local anesthetics on plasma potassium and plasma glucose concentrations in healthy volunteers. Br J Oral Max Surg., 29: 362-365.
6. Kaufman, E., J.B. Epstein, E. Naveh, M. Gorsky, A. Gross and G. Cohen, 2005. A survey of pain, pressure, and discomfort induced by commonly used oral local anesthesia injections. Anes Prog., 52: 122-127.