COMPARISON OF GLYCEMIC EFFECT OF ADRENALIN CONTAINING LOCAL ANESTHETIC IN DIABETIC AND NON-DIABETIC PATIENTS UNDERGOING MINOR ORAL SURGICAL PROCEDURE

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ABSTRACT

AIM

To compare the changes in blood glucose level associated with administration of adrenaline containing local anesthetic in diabetic and non-diabetic patients undergoing minor oral surgical procedures.

METHODS AND MATERIAL

The study included 150 well controlled diabetic patients and 150 non-diabetic healthy patients in age group of 40-60 years who underwent minor oral surgical procedures (trans alveolar extractions, alveoplasty and flap surgeries). Patients in both the group were administered 1.8ml of local anesthetic agent containing 1:100,000 adrenaline for inferior alveolar nerve block and 0.2 ml of anesthetic agent for long buccal nerve block. Blood glucose levels were assessed and compared during pre-operative and one hour post-operative period.

STATISTICAL ANALYSIS

The comparison of the random blood sugar levels preop and postop in both the groups were compared using paired t test and RBS levels between two groups were analysed using unpaired t test. P value less than 0.05 was considered statistically significant.

RESULTS

No statistically significant change in post-operative blood glucose level was noted between the diabetic and non-diabetic patients.

CONCLUSION

The study concluded that it is safe to administer local anesthetic containing 1:100,000 adrenaline in smaller volumes to well controlled diabetic patients.

KEYWORDS

Adrenalin, Glycemic Effect, Diabetic Patient, Minor Oral Surgical Procedure.

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INTRODUCTION: Effective control of pain during dental treatment has been one of the most important pre requisite for practice of painless dentistry. Dentists for performing minor oral surgical procedures hence use local anaesthetic agents more commonly. A variety of agents is available which provide rapid onset and adequate duration of surgical anaesthesia.

Lignocaine is the most frequently used local anaesthetic and is the gold standard for comparison against the newer ones.

The latency of lignocaine varies from 2-3 minutes, with an approximate duration of anaesthetic effect for 2% solutions with epinephrine 1:100,000 as vasoconstrictor of 85 minutes at pulp level, and 190 minutes in soft tissues. Proven efficacy, low allergenicity, and minimal toxicity through clinical use and research have confirmed the value and safety of this drug. It is an amide anaesthetic with a short onset of action and an intermediate duration of

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anaesthesia when associated with adrenaline. Adrenalin promote longer lasting anaesthesia, diminish the toxic effects by delaying absorption, and reduce blood loss in surgical procedures.[1]

Type 2 diabetes mellitus is the one common systemic condition encountered in routine dental practice. Uncontrolled Type 2 diabetes mellitus patients should not continue with surgical procedures and patients with well controlled blood sugar levels can be treated but with utmost care. Plasma levels of glucose have been reported to be affected following dental local anaesthetic injections of adrenaline containing solutions. Whether this effect is observed as a fall or rise in blood glucose levels is a subject of controversy, especially when it comes to diabetic patients since they have an altered glucose homeostatic mechanism.[2]

Adrenaline being a catecholamine is involved in integrated metabolic alterations that affect carbohydrates, proteins and lipids.[3] Hyperglycaemias may result from both direct and indirect action of adrenaline.[4] Indirect hyperglycaemic actions include suppression of insulin secretion. Direct hyperglycaemic actions result from stimulation of hepatic glucose release and limitation of glucose utilisation.[5] A physiological rise in adrenaline level can stimulate both glycogenolysis and gluconeogenesis.[6] An increase in blood glucose level due to vasoconstrictors used with local anaesthetics may be insignificant in normal patients, but can be relevant in diabetic patients.

The purpose of the study was to compare the changes in blood glucose level in well controlled diabetic and non-diabetic patients administered with local anaesthetic agent containing 1:1,00,000 adrenaline for undergoing minor oral surgical procedures.

MATERIALS AND METHODS: 150 patients with known type 2 diabetes mellitus (well controlled) and 150 non diabetic healthy patients in the age group of 40-60 years requiring minor oral surgical procedures and who were willing to participate were taken up for the study after obtaining written consent.

Inclusion Criteria:

A) For diabetic group:

1. Both male and female patients in age group of 40 – 60 years.
2. Known type 2 diabetes mellitus patients under medication and with random blood sugar (RBS) level in the range of 80-160 mm/dl who were on regular follow up by physician.
3. Written consent from the physician following physical examination for minor surgical procedures on the day of sampling.
4. Patients requiring (IANB) inferior alveolar nerve block with long buccal nerve block for performing minor oral surgical procedures in mandible only.

B) For non–diabetic group:

1. Patients with no history of any systemic illness.
2. Patients who were deemed medically fit from the physician by general physical examination, following routine blood check-up.
3. Patients requiring (IANB) inferior alveolar nerve block with long buccal nerve block for performing minor oral surgical procedures in mandible only.

Exclusion Criteria:

1. Patients with known systemic diseases other than diabetes in-group A.
2. Patients taking insulin injections.
3. Physically challenged patients and psychologically challenged patients.
4. Patients with known lignocaine or sulphur allergy.
5. Patients having infectious condition requiring minor surgical procedure.
6. Requirement of additional injection of local anaesthetic.

METHODOLOGY: All the patients are requested to obtain written consent from physician following general physical examination and routine blood check up on the day of procedure. Written consent for willingness is obtained both for study sampling and for procedure recorded. Detailed case history recorded for both the groups. Duration of illness, type of medication, frequency of follow up visits noted for group A. RBS (Random blood sugar test) done from haematology lab by obtaining intravenous blood.

First sample of intravenous blood was collected for blood glucose evaluation pre-operatively. 1.8ml of local anaesthetic was administered for IANB (inferior alveolar nerve block) and 0.2ml of local anaesthetic administered for long buccal nerve block immediately. Anaesthetic agent used was 2% lignocaine with 1:100,000 adrenaline. Required minor oral surgical procedure (which included trans alveolar extraction, alveoplasty and flap surgery) was performed. Second sample of intravenous blood collected exactly after 90 min of administering local anaesthesia for RBS (Random blood sugar level). Patients were prescribed antibiotics and analgesics as required.

STATISTICAL ANALYSIS: The random blood sugar of study subjects preoperative and postoperative were recorded and tabulated as mean±standard deviation. The comparison of the random blood sugar levels preop and postop in both the groups were compared using paired t test and RBS levels between two groups were analysed using unpaired t test. P value less than 0.05 was considered statistically significant.

The analysis was done using SPSS software version 17 of windows.

RESULTS:

	Non-Diabetic	Diabetic	Unpaired 'T' Test Value	p Value
Pre Op	98.71±10.996	129.30±15.851	-19.351	<0.001 (HS)
Post Op	98.74±11.064	129.42±18.395	-17.445	<0.001 (HS)
Paired 'T' Test Value	-0.097	-.268		
P Value	0.923(NS)	.789 (NS)		

Table 1: Showing the Random Blood Sugar Values (Expressed As Mean±Standard Deviation) of the Study Subjects Pre And Post Op.

Both the Study Groups, With Inferential Statistics performed Using 'T' Test

In this study no statistically significant change in the blood glucose level noted postoperatively in both the groups and when compared group A to Group B (p value set at <0.05).

DISCUSSION: Little and Fallace estimated that a dental practice serving an adult population of 2,000 people could expect to encounter about 40–70 people with diabetes, about half of whom will be unaware of their condition.[7] Increasing number of diabetic patients with change in food habits and their altered metabolic response makes such study a necessity.

Adrenaline containing local anaesthetics are widely used since adrenaline delays the absorption of lignocaine in to the circulation, there by prolonging the duration of anaesthesia and reducing the toxic effects.[8] Adrenaline is known to cause elevation of blood glucose level by increase in glycogenolysis in liver and muscle. It increase the amount of glucose released in to the circulation by liver and decreases the utilization of glucose by muscles.

A convenient form of vasoconstrictor solution comprises local analgesic and adrenaline in various concentrations from 1:80000–1:400000. During surgery, changes in plasma catecholamine exhibit the same trends as other hormonal changes involved in the neuroendocrine response to stress. Tolas, Pflug and Halter (1982) measured plasma catecholamine concentration following injection of adrenaline (18 µg) during posterior alveolar nerve block. In awake patients about to undergo dental extractions, they found that plasma adrenaline concentration had increased from 0.54 mmol ml^{-1} to 1.26 $mmol^{-1}$ at 3 minutes after injection.[9] In a separate study, Taylor, Achola and smith (1984) examined anaesthetized patients in whom 4 ml lignocaine with 1:200000 adrenaline was injected locally before rhinoplasty. They found a significant increase of 400% in circulating plasma adrenaline concentrations.[10] The question here would be whether the rise in the glucose levels is being caused by exogenous administration of epinephrine in the local anaesthetics that injected or is it because of a rise in body's endogenous secretion of adrenaline due to stress, and whether the amount of epinephrine in the dental local anaesthetic solution is enough to cause a systemic rise in blood glucose levels.

In this study totally 150 well controlled diabetic patients were included irrespective of gender, and history of medications in age group of 40-60 years. All of these are recorded before the procedure. 150 healthy patients of same age group were also selected as control. In all the patients 1.8ml of local anaesthetic was administered through IANB (inferior alveolar nerve block) and 0.2ml of local anaesthetic was administered through long buccal nerve block. Anaesthetic agent used was 2% lignocaine with 1:100,000 adrenaline. The pre-operative and post-operative blood glucose levels (after one hour), between the two groups were compared and statistically analysed for variables in significance of increased level of blood glucose level. The post op blood glucose level was recorded one hour after the injection of local anaesthetic agent. It is well established that endogenous secretion of Catecholamine's level increase drastically in relation to stress. Hence in this study to avoid overlapping effects of endogenous adrenaline to administered adrenaline containing anaesthesia, one hour post-operative blood sampling was done. Intension of one-hour post op sampling in this study was to avoid the stress, which patients may have experienced during injection and during performance of surgical procedure.

A study done by Meechan et al in 1991 on the effects of adrenaline–containing and adrenaline–free dental local anaesthetic solutions on blood glucose concentration in a group which was undergoing third molar surgery showed that results observed in both groups were similar: with a significant increase in blood glucose levels. Thus, although endogenous adrenaline would inevitably be released due to stress (and may be playing a role in increasing the blood glucose levels), the effect of exogenous epinephrine is also undoubtedly, very significant.

In our study, the concentration of adrenaline used was 1:100,000. Administration of L.A was in the form of nerve block. Although dose of adrenaline used and volume of solution was relatively small, absorption of adrenaline may be more rapid and complete from facial areas owing to the high vascularity of the region, which would result in elevated plasma adrenaline concentration in a short period. Studies have shown that the amounts of epinephrine contained in one to three cartridges of local anaesthetic may be enough to significantly increase the risk of complications like ketoacidosis in patients with unstable diabetes, and so should be avoided until their condition is brought under glycaemic control. Well-controlled diabetics better tolerate constrictors and have fewer episodes of hyperglycaemia than poorly controlled diabetics.

Using improved methods for measuring catecholamines, a number of investigators have shown that epinephrine injected during local anaesthesia markedly elevates the

resting plasma concentration of catecholamine. This in turn causes a rise in blood glucose levels. A meta–analysis of several studies using similar designs revealed that the mean resting venous plasma concentration of epinephrine is approximately doubled by the intra oral injection of single cartridge of 2% lidocaine with 1:100000 epinephrine, i.e 18 g epinephrine. Use of radiolabelled epinephrine demonstrated that the injected drug during is the source of increased epinephrine.[11]

Non-significant results in this study may be attributed to smaller volumes of the local anaesthetic agent used. Some studies mentioned earlier found a statistical increase in blood glucose level associated with adrenaline in local anaesthesia, which is contrary to our study. This can be explained as per study by Meechan JG. Where he states that "four dental local anaesthetic cartridges of 1:100,000 epinephrine must be administered to elicit increase blood glucose level".[1] Hence by this study it can be concluded that smaller volumes of local anaesthesia with adrenaline can be safely administered in well-controlled diabetic patients.

CONCLUSION: It is safe to administer local anaesthetic agent containing adrenaline of 1:100,000 in smaller volumes (single nerve block or infiltration) to well controlled diabetic patients without causing acute hyperglycaemia.

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