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Assessment of blood glucose levels under general anaesthesia in diabetic patients

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Abstract
Surgery conveys a stress reaction resulting in numerous biochemical and hormonal changes. Hormonal interaction is the key role, in the development of stress response, which has been projected as hyperglycemic response. The aim of the study is to demonstrate that well well-adjustedanesthesia in controlled diabetic mellitus patients; the rise of blood sugar is not significant when compared to non-diabetic patients.

First fasting blood sugar levels were assessed pre operatively by glucometer with glucose oxidase strip by standard capillary method. The blood glucose levels were monitored at Preoperative, 5 mins after intubation, 30 mins after intubation and 5 mins after Extubation stages.

This study gives an understanding into conquest of stress response of surgery by using various anaesthetic drugs in general anaesthesia. This information allows us to choose on the use of various anesthetic drugs, which will better control the surgical stress and reductions the morbidity in patients subjected to various degrees of surgeries.

Keywords: blood glucose, diabetes, hypoglycemia, muscle relaxant, stress response

Introduction

Diabetes mellitus (DM), commonly referred to as diabetes, is a group of metabolic disorders in which there are high blood sugar levels over a prolonged period [1]. Symptoms of high blood sugar include frequent urination, increased thirst, and increased hunger [2]. If left untreated, diabetes can cause many complications. Acute complications can include diabetic ketoacidosis, hyperosmolar hyperglycemic state, or death. Serious long-term complications include cardiovascular disease, stroke, chronic kidney disease, foot ulcers, and damage to the eyes [2].

Diabetes is due to either the pancreas not producing enough insulin or the cells of the body not responding properly to the insulin produced [8]. There are three main types of diabetes mellitus [2]

- Type 1 DM results from the pancreas's failure to produce enough insulin [2]. This form was previously referred to as "insulin-dependent diabetes mellitus" (IDDM) or "juvenile diabetes" [2]. The cause is unknown [2].
- Type 2 DM begins with insulin resistance, a condition in which cells fail to respond to insulin properly [2]. As the disease progresses a lack of insulin may also develop [3]. This form was previously referred to as "non-insulin-dependent diabetes mellitus" (NIDDM) or "adult-onset diabetes" [2]. The most common cause is excessive body weight and not enough exercise [2].
- Gestational diabetes is the third main form and occurs when pregnant women without a previous history of diabetes develop high blood sugar levels [2].

In humans, glucose is the primary source of energy and is critical for normal function in a number of tissues, particularly the human brain which consumes approximately 60% of blood glucose in fasted, sedentary individuals. Glucose can be transported from the intestines or liver to other tissues in the body via the bloodstream; its uptake by cells is regulated in part by the hormone insulin, which is produced by the pancreas [4]. Glucose levels are usually lowest in the morning, before the first meal of the day, and rise after meals for an hour or two by a few millimoles. Blood sugar levels outside the normal range may be an indicator of a medical condition. A persistently high level is referred to as hyperglycemia; low levels are referred to as hypoglycemia. Diabetes mellitus is characterized by persistent hyperglycemia from any of several causes, and is the most prominent disease related to failure of blood sugar regulation. There are different methods of testing and measuring blood sugar levels.

Normal value ranges may vary slightly among different laboratories. Many factors affect a person's blood sugar level. The body's homeostatic mechanism of blood sugar regulation (known as glucose homeostasis), when operating normally, restores the blood sugar level to a narrow range of about 4.4 to 6.1 mmol/L (79.2 to 110 mg/dL) (as measured by a fasting blood glucose test) [5].

The normal blood glucose level (tested while fasting) for non-diabetics, should be between 3.9 and 5.5 mmol/L (70 to 100 mg/dL). The mean normal blood glucose level in humans isabout 5.5 mmol/L (100 mg/dL); however, this level fluctuates throughout the day. Blood sugar levels for those without diabetes and who are not fasting should be below 6.9 mmol/L (125 mg/dL). The blood glucose target range for diabetics, according to the American Diabetes Association, should be 5.0–7.2 mmol/l (90–130 mg/dL) before meals, and less than 10 mmol/L (180 mg/dL) after meals (as measured by a blood glucose monitor) [6].

Despite widely variable intervals between meals or the occasional consumption of meals with a substantial carbohydrate load, human blood glucose levels tend to remain within the normal range. However, shortly after eating, the blood glucose level may rise, in non-diabetics, temporarily up to 7.8 mmol/L (140 mg/dL) or slightly more. For people with diabetes maintaining 'tight diabetes control', the American

Diabetes Association recommends a post-meal glucose level of less than 10 mmol/L (180 mg/dL) and a fasting plasma glucose of 3.9 to 7.2 mmol/L (70–130 mg/dL) [7].

The actual amount of glucose in the blood and body fluids is very small. In a healthy adult male of 75 kg with a blood volume of 5 liters, a blood glucose level of 5.5 mmol/L (100 mg/dL) amounts to 5g, equivalent to about a teaspoonful of sugar [10]. Part of the reason why this amount is so small is that, to maintain an influx of glucose into cells, enzymes modify glucose by adding phosphate or other groups to it.

Surgery provides a stress response resulting in various biochemical and hormonal changes. Hormonal interplay is the key role, in the evolution of stress response, which has been estimated ashyperglycemic response. The aim of the study is to prove that well balanced anesthesia in controlled diabeticmellitus patients; the rise of blood sugar is not significant when compared to non-diabetic patients.

Methodology

The study was planned in the Department of Surgery in Lord Buddha Koshi Medical College and Hospital, Saharsa, From October 2015 to november 2016, The age group of the patients is ranges from 30 to 60 years. Total 50 patients were evaluated for the study. After taking informed written consent and approval of the Institutional Ethics Committee.

Following was the inclusion and Exclusion criteria of the study:

Inclusion Criteria

1. Age 30- 60 years
2. American Society of Anaesthesiologists I and II physical conditions patients.

Exclusion Criteria

1. Patients at particular risk of heart conditions, such as congenital disease
2. Pregnant/lactating females.

The patients were divided into two groups as

Group I: Non diabetic or Normal patients

Group II: Diabetic patients with controlled glucose level

First fasting blood sugar levels were assessed pre operatively by glucometer with glucose oxidase strip by standard capillary method. After securing intravenous access pre operatively normal saline was used as maintenance fluid diabetic patients were on no insulin, no glucose protocol for assessing variation in blood sugar.

Patient receiving general anaesthesia in either groups were given a standard regimen with glycopyrrolate 0.2 mg and Ondansetron 4mg and fentanyl 2mcg/kg as pre medication and induction with propofol2mg/kg, intubating dose of suxamethonium and maintenance with vecuronium, oxygen and nitrous oxide ratio of 2:4 lit/min reversal was done with neostigmine 0.05mg/kg and glycopyrrolate. Patient is extubated after throat suction.

Results & Discussion

The data from the both the study group was evaluated and presented as below.

Table 1: Glucose level at Different Condition

Glucose level	Group I (Non-diabetic or Normal patients)	Group II (Diabetic patients)
Preoperative	86 – 95 mg/dL	84 – 98 mg/dL
5 mins after intubation	87 -96 mg/dL	85 – 97 mg/dL
30 minsafter intubation	90-116 mg/dL	99 – 118 mg/dL
5 mins after Extubation	100 – 134 mg/dL	110 - 135 mg/dL

The blood glucose levels at the preoperative stage showed the normal levels. The blood glucose level after the intubation in the both the study groups. The sympathoadrenal stimulation as a consequence of surgery and anaesthesia is associated with severe metabolic changes simultaneous with these changes there is marked inhibition of insulin secretion. The results of the above study show that there is less stress response and mild increases in blood glucose levels in both the comparative groups, which is slightly higher in diabetic group but with in normal physiological range. There is not much variation in both the groups.

Attention has been drawn to the abnormal blood sugar response to large doses of sedatives and hypnotics by Hunter and Greenberg 1954 [8]. Some of the drugs used for anaesthetic pre medication act on the neural mechanism controlling ACTH secretion to increase the output of this hormone while others inhibit the secretion.

In the general anaesthesia group of non-diabetic and diabetic patients premedication was done with glycopyrrolate and fentanyl 2mcg/kg, induction with propofol 2 mg/kg. Tetsuhiro sakai, David O' Flaaharty *et al* (1995) showed that circulating cortisol was significantly suppressed by Propofol and completely abolished the response of circulating cortisol to surgery. In this study post intubation blood sugar levels showed a decrease of 1.064% in non-diabetic that is attributed to suppression of stress response of intubation by fentanyl and Propofol. Fentanyl can prevent ACTH release and attenuate pituitary–adrenal response to stress [9].

Conclusion

This study gives an understanding into conquest of stress response of surgery by using various anaesthetic drugs in general anaesthesia. This information allows us to choose on the use of various anesthetic drugs, which will better control the surgical stress and reductions the morbidity in patients subjected to various degrees of surgeries.

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