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Assessment of Perioperative Blood Glucose Levels in Various Anaesthetic Techniques in Non-Diabetics Versus Diabetics Undergoing Lower Abdominal and Lower Limb Surgery

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ABSTRACT

Background: For many years, there has been a great deal of analysis and debate over the hormonal and metabolic response to anesthesia and surgery. The present study was conducted to assess perioperative blood glucose levels in various anaesthetic techniques in non-diabetics and diabetics.

Materials & Methods: 120 ASA grade I/ II subjects of both genders were divided into 2 groups of 60 each. Group I were diabetics and group II were non- diabetics. All were managed under either general anaesthesia, epidural anesthesia and spinal anesthesia. 5 ml of venous blood was taken and assessed for fasting blood sugar, random blood glucose and glycated hemoglobin level by an autoanalyzer (911 HITACHI AUTO ANALYSER)preoperatively, after intubation / after achieving T6 segment in regional anaesthesia cases followed by samples at 20, 40 and 60 minutes. Postoperatively two samples at 20, and 40 minutes.

Results: There were 10 males and 10 females, 11 males and 9 females and 8 males and 12 females in patients undergoing general anaesthesia, epidural anesthesia and spinal anesthesia respectively. The mean weight was 52.4 kgs, 56.1 kgs and 55.6 kgs in patients undergoing general anaesthesia, epidural anesthesia and spinal anesthesia respectively. The difference was non- significant (P> 0.05). The mean blood glucose level in group I was 114.2 mg/dl and in group II was 88.6 mg/dl under general anesthesia. The mean blood glucose level in group I was 124.6 mg/dl and in group II was 94.2 mg/dl under epidural anesthesia. The mean blood glucose level in group I was 112.8 mg/dl and in group II was 96.4 mg/dl under spinal anesthesia. The difference was significant (P< 0.05). The mean blood glucose rise in group I and group II was 40.2% and 31.5% under general anaesthesia, 19.4% and 14.2% under epidural anesthesia and 11.2% and 7.2% under spinal anesthesia. The difference was significant (P< 0.05).

Conclusion: The degree of rising of blood sugar due to surgical stress is highest in general anaesthesia as compared to other techniques and still higher in controlled diabetics as compared to non diabetics.. When feasible, localized treatments can reduce a diabetic's response to surgical stress. It may not be necessary to follow an intraoperative insulin regimen for every operation; rather, it relies more on how long and how severe the procedure is.

Keywords: *diabetic, epidural anesthesia, stress*

1. INTRODUCTION

For many years, there has been a great deal of analysis and debate over the hormonal and metabolic response to anaesthesia and surgery. Anabolism and catabolism are perfectly balanced in a healthy individual.[1] A stress response brought on by surgery causes a number of hormonal and metabolic alterations. The development of the stress response, which can be quantified as a hyperglycemic reaction or a change in catecholamines to various forms of surgery and anesthesia, is largely influenced by hormonal interactions.[2]

Inadequate glycaemic management in surgical patients may have an impact on perioperative morbidity and death. Numerous studies have looked into how different anesthetic generations affect the metabolism of fat, nitrogen, and carbohydrates. Elevated blood sugar during anesthesia is undoubtedly the most well-known clinical metabolic abnormality. This could begin as early as premedication or anesthesia induction, and depending on the type of surgery and the range of anesthetics used, its severity could change.[3]

Numerous inhaled and intravenous anesthetics have been shown to produce clinically significant hyperglycemic conditions. With different anesthetic drugs and procedures, the hyperglycaemic reaction varies greatly. Hyperglycemia is not only brought on by the stress of surgery and anesthesia; it is also influenced by other factors, such as the patient's condition or any co-existing illnesses.[4] Diabetes is a powerful pillar that contributes to many of the other issues. The catabolic consequences exacerbate the patient's absolute or relative insulin deficit and may cause metabolic decompensation.[5] Numerous difficulties have arisen when a diabetic patient has had surgery. which eventually lead to cardiac arrest and include ketosis, academia, and electrolyte imbalance. Perioperative blood sugar control was the major component of anaesthetic care that may need more stringent control. Diabetic patients have a 50% chance of undergoing surgery at some time during their life.[6] The present study was conducted to assess perioperative blood glucose levels in various anaesthetic techniques in non-diabetics and diabetics.

2. MATERIALS & METHODS

The study was carried out on 120 patients

Inclusion criteria:

120 ASA grade I/ II subjects of both genders posted for procedures (lower limb and lower abdominal surgeries) lasting 60-90 minutes. All gave their written consent to participate in the study.

Exclusion criteria: Patients with an ASA score of 3 or 4. Surgical procedures that take longer than 2 hours.Patients with uncontrolled diabetes and sugar less than 60mg/dL were not included in the study.

Data such as name, age, gender etc. was recorded. They were divided into 2 groups of 60 each. Group I were diabetics and group II were non- diabetics. All were managed under either general anaesthesia, epidural anesthesia and spinal anesthesia.

Diabetic patients were placed on a no insulin, no glucose regimen to see how their blood sugar fluctuated. Premedication was done with inj. Fentanyl (2mcg/kg) and glycopyrrolate, induction with inj. propofol (2mg/kg), intubating dose of vecuronium, and maintenance with vecuronium, nitrous oxide, oxygen (in ratio 5:3 Lit/min) and inhalational agent(isoflurane) were given to both groups of patients undergoing general anesthesia. Diclofenac sodium, administered intramuscularly, was used to supplement postoperative analgesia. Co-loading with normal saline (10 ml/kg) was performed in both groups of patients receiving regional techniques.

Epidural anaesthesia was provided under strict aseptic conditions in the left lateral position in the L4–L5 space, using Lidocaine 1.5 percent by loss of resistance technique. The spinal technique was performed at the L4–L5 space in patients undergoing strict aseptic conditions, and 0.5 percent Bupivacaine (heavy) was administereto reach a T6 sensory level.

5 ml of venous blood was taken and assessed for fasting blood sugar, random blood glucose and glycated hemoglobin level by an autoanalyzer (911 HITACHI AUTO ANALYSER)preoperatively,after intubation / after achieving T6 segment in regional anaesthesia cases followed by samples at 20, 40 and 60 minutes. Postoperatively two samples at 20, and 40 minutes. Samples were sent for analysis immediately after collection (within 10 – 15 minutes).Results thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

Results

Table: Ia Demographic data in group I patients

Groups	Mean Weight (Kgs)	M:F	P value
general anaesthesia	52.4	10:10	0.56
epidural anesthesia	56.1	11:9	0.73
spinal anesthesia	55.6	8:12	0.81

Table I shows that there were 10 males and 10 females, 11 males and 9 females and 8 males and 12 females in patients undergoing general anaesthesia, epidural anesthesia and spinal anesthesia respectively. The mean weight was 52.4 kgs, 56.1 kgs and 55.6 kgs in patients undergoing general anaesthesia, epidural anesthesia and spinal anesthesia respectively. The difference was non- significant (P> 0.05).

Table: Ia Demographic data in group II patients

Groups	Mean Weight (Kgs)	M:F	P value
general anaesthesia	50.2	9:11	P> 0.05
epidural anesthesia	55.2	7:13	P> 0.05
spinal anesthesia	53.5	10:10	P> 0.05

Table: II Preoperative blood sugar values in both groups

Groups	Group I	Group II	P value
general anaesthesia	114.2	88.6	0.05
epidural anesthesia	124.6	94.2	
spinal anesthesia	112.8	96.4	

Table II, graph I shows that the mean blood glucose level in group I was 114.2 mg/dl and in group II was 88.6 mg/dl under general anesthesia. The mean blood glucose level in group I was 124.6 mg/dl and in group II was 94.2 mg/dl under epidural anesthesia. The mean blood glucose level in group I was 112.8 mg/dl and in group II was 96.4 mg/dl under spinal anesthesia. The difference was significant (P< 0.05).

Graph: I Preoperative blood sugar values in both groups

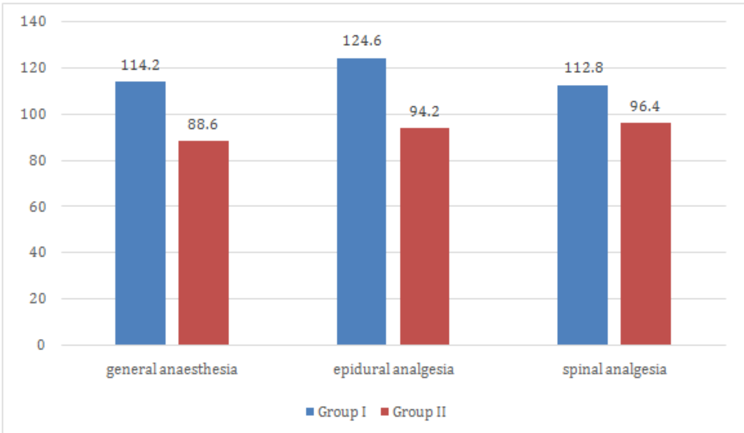

Table 3: Rise in blood sugar level (% increased) at various time intervals – in non-diabetics and diabetics.

Group		00 minute	20 minutes	40 minutes	60 minutes	20 minutes Post OP	40 minutes Post OP
GA	ND	0.03%	13.27%	24.24%	31.50%	40.00%	42.33%
	D	0.14%	15.41%	26.66%	40.20%	39.34%	40.11%
EA	ND	0.40%	5.00%	7.23%	14.20%	15.64%	14.23%
	D	0.04%	5.30%	11.76%	19.40%	19.54%	19.66%
SA	ND	1.12%	1.55%	3.63%	7.20%	7.43%	5.22%
	D	1.20%	3.50%	7.80%	11.20%	10.50%	7.36%

Table III Blood sugar rise (%) between non- diabetics and diabetics at end of surgery (60 mts)

Groups	Group I	Group II	P value
general anaesthesia	40.2%	31.5%	0.05
epidural anesthesia	19.4%	14.2%	0.04
spinal anesthesia	11.2%	7.2%	0.05

Table III shows that mean blood glucose rise in group I and group II was 40.2% and 31.5% under general anaesthesia, 19.4% and 14.2% under epidural anesthesia and 11.2% and 7.2% under spinal anesthesia. The difference was significant (P< 0.05).

3. DISCUSSION

Studies on both humans and animals indicate that hyperglycemia makes ischemic brain injury worse. Furthermore, hyperglycemia disrupts the phagocytosis and leukocyte chemotaxis processes.[7] Data also suggests that when plasma glucose levels are higher than 200 mg%, wound strength and healing are compromised. It is true that maintaining adequate perioperative glycaemic control can be difficult, particularly for individuals with diabetes. According to the research, the one-year mortality rate for patients who had non-cardiac procedures was 24%.[8] The main predictors of higher perioperative mortality were hyperglycemia, ischemic heart disease, urgent surgery, and higher American Society of Anaesthesiologists (ASA) physical status scores.[9] Patients with diabetes are 50% likely to have surgery at some point in their lives. It is a difficult issue to modify a diabetic patient's treatment plan to allow for surgery. Regretfully, there remains disagreement on the best way to treat the metabolic alterations that diabetic patients experience during surgery.[10] Increased pituitary hormone release and sympathetic nervous system activation are hallmarks of the stress response that is typically linked to surgery. Hyperglycemia results from surgery itself, which lowers insulin sensitivity in proportion to the procedure's duration and method.[11] The present study was conducted to assess perioperative blood glucose levels in various anaesthetic techniques in non-diabetics and diabetics.

We found that there were 10 males and 10 females, 11 males and 9 females and 8 males and 12 females in patients undergoing general anaesthesia, epidural anesthesia and spinal anesthesia respectively. The mean weight was 52.4 kgs, 56.1 kgs and 55.6 kgs in patients undergoing general anaesthesia, epidural anesthesia and spinal anesthesia respectively. Koti et al[12] evaluated degree of rise of blood sugar levels as a measure of stress during anaesthesia and surgery, under various anaesthetic techniques between non-diabetics and diabetics (controlled). The study was conducted in ninety adult patients (30 to 55 years age), undergoing various elective surgeries of 60 to 90 minutes duration under three aesthetic techniques (General Anaesthesia (GA), Epidural (EA), and spinal Anaesthesia (SA)). 45 of these patients were not diabetic and 45 are controlled diabetics. Rise of blood sugar was compared among three techniques in each group and among similar techniques between both groups. For estimating blood glucose levels, preoperative,4 intraoperative and 2 postoperative venous blood samples were collected. In diabetics and non-diabetics, the blood sugar fluctuation is less with regional techniques and furthermore, less under SA.

We found that the mean blood glucose level in group I was 114.2 mg/dl and in group II was 88.6 mg/dl under general anesthesia. The mean blood glucose level in group I was 124.6 mg/dl and in group II was 94.2 mg/dl under epidural anesthesia. The mean blood glucose level in group I was 112.8 mg/dl and in group II was 96.4 mg/dl under spinal anesthesia. Hammond et al[13] stated that spinal anaesthesia does not increase the blood cortisol or adrenaline levels. The further decrease in diabetics could mean that regional techniques suppress stress responses far better in diabetics and should be practised wherever indicated. In this study post-intubation blood sugar values showed an increase of only 0.06% in non-diabetics this is attributed to suppression of stress response of intubation by fentanyl.

We found that mean blood glucose rise in group I and group II was 40.2% and 31.5% under general anaesthesia, 19.4% and 14.2% under epidural anesthesia and 11.2% and 7.2% under spinal anesthesia. In a study by Oyama T[14], the effects of spinal anaesthesia and surgery on carbohydrate and fat metabolism were studied in thirty patients by determining plasma concentrations of human growth hormone (HGH), insulin, blood glucose and free fatty acids (FFA). Hyperbaric spinal anaesthesia with lignocaine or quatacaiae alone and subsequent surgery did not influence the plasma HGH, insulin or FFA levels. Mean blood glucose levels were elevated significantly during spinal anaesthesia and surgery, but remained within the normal range.

The shortcoming of the study is small sample size.

4. CONCLUSION

We found that the degree of rising of blood sugar due to surgical stress is highest in general anesthesia and still higher in controlled diabetics. Therefore patients are advised spinal over general anesthesia. When feasible, localized treatments can reduce a diabetic's response to surgical stress. It may not be necessary to follow an intraoperative insulin regimen for every operation; rather, it relies more on how long and how severe the procedure is.

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