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Research article

ANALYSIS OF PERI-OPERATIVE BLOOD SUGAR LEVELS IN VARIOUS ANESTHETIC APPROACHES IN NON-DIABETIC AND DIABETIC PATIENTS: COMPARATIVE STUDY FROM CENTRAL INDIA

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ABSTRACT

Surgical procedures cause a stress response, which results in biochemical and hormonal changes. Elevated blood sugar is the most well-known metabolic disorder. Inadequate glycemic regulation affects perioperative morbidity and mortality. The hyperglycemic reaction varies depending on the anesthetic agent and technique used. The study's aim is to compare non-diabetics and diabetics in terms of the degree to which blood sugar levels rise as a measure of stress during anesthesia and surgery under different anesthetic techniques (controlled). Ninety adult patients (30 to 55 years old) underwent various elective surgeries lasting 60 to 90 minutes under three anesthetic techniques (general (GA), epidural (EA), and spinal (SA)) at a tertiary healthcare center in Central India. 45 of the patients were not diabetic and 45 were diabetics under care. Blood sugar levels were compared between three techniques in each group and between similar techniques in both groups. Blood sugar fluctuation is less with regional techniques and much less with spinal analgesia in diabetics and non-diabetics. Wherever possible, regional techniques can reduce a diabetic's response to surgical stress. The need for an intraoperative insulin regimen may not be required in all procedures, but it is more dependent on the length and severity of the procedure. Glycemic regulation is easier in spinal anesthesia than in general anesthesia since the stress response to surgery is comparatively lower. Where necessary, we prefer spinal anesthesia to epidural and general anesthesia for minimizing surgical stress response.

KEYWORDS: Diabetic patients, spinal anesthesia, general anesthesia, Glycaemia, Blood Sugar

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INTRODUCTION

For decades, the metabolic and hormonal responses to anesthetics and surgery have been the focus of extensive research and debate. Anabolism and catabolism are finely balanced in a healthy person.[1] surgical procedures cause a stress response, which results in biochemical and hormonal changes. Hormonal interplay plays a crucial role in the evolution of stress response, which can be measured as a hyperglycemic response or a change in catecholamine levels in response to various forms of surgery and anesthesia. Inadequate glycemic control in surgical patients can affect perioperative morbidity and mortality. [2]

The effects of different generations of anesthetics on nitrogen, carbohydrate, and fat metabolism have been studied extensively. During anesthesia, the most well-known clinical metabolic disturbance is undoubtedly elevated blood sugar.[3] this can happen as early as during premedication or anesthesia induction, and the severity varies depending on the anesthetics used and the type of operation. With various inhalation and intravenous anesthetics, clinically important hyperglycemic states have been reported. The hyperglycemic reaction to various anesthetic agents and techniques varies greatly.[4] other factors, such as the patient's state of co-existing illnesses, play a role in the genesis of hyperglycemia, in addition to the stress of surgery and anesthesia. Among the many contributing factors, 'Diabetes' stands out as a powerful.

Pillar. The catabolic effects exacerbate the patient's total insulin deficiency, possibly leading to metabolic decompensation. Surgical stress on a diabetic patient has resulted in a variety of complications, including ketosis, academia, electrolyte deficiency, and cardiac arrest. Hyperglycemia seems to worsen ischemic brain damage in both animal and human studies. Furthermore, hyperglycemia obstructs leukocyte chemotaxis and phagocytosis. When plasma glucose levels are greater than 200 mg%, there is evidence of reduced wound strength and wound healing.[3,5]

Adequate perioperative glycemic control, especially in diabetic patients, is a challenge. The data shows that at one year, patients who had noncardiac surgery had a 24 percent mortality rate. The main predictors of increased perioperative mortality were ischemic heart disease, urgent surgery, a higher American Society of Anesthesiologists (ASA) physical status ranking, and hyperglycemia.[6] the major component of anesthetic treatment that could need more strict monitoring was perioperative blood sugar control. Patients with diabetes have a 50% risk of having surgery at some point in their lives. It's a difficult issue to adapt a diabetic patient's therapeutic regimen to accommodate a surgical procedure. Unfortunately, there is no consensus about the best way to deal with the metabolic changes that arise during surgery in diabetic patients.

Surgery is normally associated with an increased stress response, which includes increased pituitary hormone secretion and sympathetic nervous system activation. Surgery induces a decrease in insulin sensitivity, which leads to hyperglycemia, which is proportional to the procedure's duration and technique.[7] this research aims to gain a better understanding of the hyperglycemic variations that occur in diabetics during anesthesia and surgery in relation to non-diabetic patients. The aim of the research is to compare non-diabetics and diabetics in terms of the degree to which blood sugar levels rise as a measure of stress during anesthesia and surgery under different anesthetic techniques (controlled).

MATERIAL AND METHODS

The research evaluated the degree of blood sugar rise intraoperatively and postoperatively in diabetic and non-diabetic patients during anesthesia and surgery using three anesthetic techniques (General Anesthesia, Epidural, and Spinal Anesthesia). Blood sugar levels were compared between the three techniques in each group and between similar techniques in both groups. Ninety (90) participants, both sexes, aged 30 to 55, were enrolled in the study and underwent a variety of elective surgical procedures lasting 60 to 90 minutes. There were 45 patients who were not diabetic and 45 who were diabetics under care. Patients in the study were from ASA grades I and II, and informed consent was obtained prior to the study. Laparotomies, thyroidectomies, hysterectomy, and lower limb orthopedic operations were all performed on the patients. Pre-operatively, both patients were evaluated and investigated to rule out other systemic diseases. Insulin and anti-diabetic drugs were prohibited in diabetics starting at midnight the night before the procedure.

Inclusion criteria

Patients undertaking an ASA Grade - 1 or 2 elective surgical procedures lasting 60-90 minutes with informed consent.

Exclusion criteria

Patients with an ASA score of 3 or 4 Patient with a blood sugar level of less than 60 mg/dL. Diabetes that is uncontrolled, surgical procedures that take longer than 2 hours. the study was undertaken in six group of fifteen patients in each group and then categorized as

In Non-Diabetic Patients

Group I General anesthesia, Group II Epidural analgesia, Group III Spinal analgesia.

Regular saline was used as a repair fluid after obtaining intravenous access prior to surgery. Diabetic patients were placed on a no insulin, no glucose regimen to see how their blood sugar fluctuated. Premedication with inj. Fentanyl (2g/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 were given to both groups of patients undergoing general anesthesia. Diclofenac sodium, administered intramuscularly, was used to supplement postoperative analgesia. Co-loading with standard saline (10 ml/kg) was performed in both groups of patients receiving regional techniques. Continuous epidural analgesia 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 and analgesia retained at T4 technique in patients undergoing epidural technique. The spinal technique was performed at the L4–L5 space in patients undergoing strict aseptic conditions, and 0.5 percent Bupivacaine (heavy) was administered. It was possible to reach a T4 level of analgesia.

Monitoring

Non-invasive blood pressure monitors were used to monitor patients prior to surgery and during the operation. Pulse oximeter: During the procedure, all patients' pulse rates, blood pressure, and oxygen saturation were controlled. Venous blood samples (2 ml) were collected into disposable syringes and transferred into sterile bottles (with added NaF + EDTA to avoid glycolysis and coagulation) to estimate blood glucose levels. At the following intervals, seven samples were obtained from each patient. Preoperatively – fasting blood sugar. After intubation / after achieving T4 segment in regional analgesia 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) and analyzed by an auto analyzer (911 Hitachi auto analyser). The results were studied statistically. The data was analyzed using Statistical Software SPSS statistics

RESULTS

Table 1: Demographic data showing age, weight and sex in three groups in diabetic patients

Group	Age (Yrs.)	Mean± SD	Wt. (Kgs)	Mean± SD	Sex Ratio (M:F)
General Anesthesia	31-58	43.43±6.40	48-60	52.26±6 .80	7:8
Epidural Anesthesia	36-52	44.66 ±5.10	42-62	56.40±6 .30	11:4
Spinal Anesthesia	31-54	44.33±5.24	44-72	55.80±4 .35	6:9

The demographic data were comparable without any statistical significance p>0.05.

Table 2: Preoperative blood sugar values (mg/dl) in non-diabetic and diabetic patients

Group	Non-Diabetic (Mean ± SD)	Diabetic (Mean ± SD)
General Anesthesia	89.30 ± 19.23	112.40 ± 15.52
Epidural Anesthesia	94.26 ± 16.40	121.52 ± 13.32
Spinal Anesthesia	95.23 ±14.36	113.00 ± 10.40

The data were comparable without statistical significance (p>0.05)

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	0.04 %	13.17 %	25.42 %	32.23 %	42.20 %	42.38 %
	D	0.24 %	14.41 %	25.82 %	39.26 %	39.32 %	40.80 %
EA	ND	0.42 %	5.12 %	7.43 %	13.28 %	16.54 %	14.48 %
	D	-0.02 %	6.43 %	12.46 %	18.27 %	19.30 %	19.56 %
SA	ND	1.46 %	1.68 %	3.43 %	6.34 %	7.38 %	6.23 %
	D	-1.3 %	3.36 %	7.42 %	10.25 %	10.40 %	9.36 %

Table 4: Trends of blood sugar levels (mg/dl) at various time intervals in non-diabetics

	00 minute	20 minute	40 minute	60 minute	20 minute post OP	40 minute post OP
GA	89.33	102.66	113.23	119.8	127.53	126.43
EA	93.46	98.33	101.33	106.13	108.26	107.43
SA	94.366	96.43	99.4	101.66	102.43	101.36

Table 5: Rise in blood sugar level (% increased) at various time intervals – diabetics

	00 minute	20 minutes	40 minutes	60 minutes	20 minutes Post OP	40 minutes Post OP
GA	0.12	13.68	25.4	32.23	42.8	42.34
EA	0.42	5.12	7.43	13.28	16.54	14.48
SA	1.46	1.17	3.43	6.34	7.41	6.23

The above table 3, 4, 5 showed results show an increase blood sugar by 42 % at the end of surgery in GA, whereas by 14% increase in epidural and 6 % increase in Spinal Analgesia. The blood sugar levels continued to rise up to 20 minutes postoperatively in all techniques.

Table 6: Trends of blood sugar levels (mg/dl) at various time intervals in diabetics groups

	00 minute	20 minutes	40 minutes	60 minutes	20 minutes Post OP	40 minutes Post OP
GA	112.46	128.26	139.26	154.43	155.26	157.25
EA	121.12	129.26	136.8	143.52	144.34	144.66
SA	111.4	117.28	121.26	124.43	125.4	123.8

Table 7: Rise in blood sugar level (% increased) at various time intervals – diabetics

	00 minute	20 minutes	40 minutes	60 minutes	20 minutes Post OP	40 minutes Post OP
GA	0.24 %	14.41 %	25.82 %	39.26 %	39.12 %	40.8 %
EA	-0.02 %	6.45 %	12.46 %	18.26 %	19.12 %	19.56 %
SA	-1.12 %	3.36 %	7.42 %	10.10 %	10.14 %	9.38 %

Table 6 and 7 shows: The above results show an increase in blood sugar by 40 % at end of surgery in the GA group, 19 % rise in the epidural group and 9 % rise in the spinal group. The blood levels continued to rise postoperatively up to 40 mts in GA and up to 20 mts in epidural and spinal analgesia.

Table 8: Comparison of blood sugar rise (%) between non-diabetics and diabetics at end of surgery (60 minutes)

Group	Non-Diabetic	Diabetic
GA	32.23 ±21.23	39.26 ± 13.40
EP	13.28 ± 7.62	18.27 ± 5.43
SA	6.34 ± 2.14	10.25 ± 1.34

The above table no 8 showed results show a 7 % risk of blood sugar in diabetics under GA when compared with the non-diabetic group. The diabetic epidural group shows a rise of 5 % over non-diabetic while the diabetic spinal group shows 4 % rise over a non-diabetic spinal group.

DISCUSSION

Spinal anesthesia is a secure and widely used anesthesia procedure for a variety of procedures all over the world. In subjects undergoing spinal anesthesia, a number of factors lead to a drop in core body Temp. Tramadol Hydrochloride's opioid and non-opioid modes of action are believed to function in tandem on the central nervous system's descending inhibitory pathways (CNS).[7,8,9] Tramadol Hydrochloride's anti-shivering effect is due to its serotoninergic or noradrenergic activity. Dexmedetomidine lowers the shivering and vasoconstriction thresholds and is linked to a lower frequency of shivering.[10] Dexmedetomidine lowers the thresholds of vasoconstriction and shivering in a similar way. In terms of age, gender, and weight, the two Categories had similar demographic characteristics. In our research, we used a mercury thermometer to measure Temp. Near the axillary artery.[11,12,13] This was based on the findings of a study by Daniel L et al, who found that axillary Temp. s were a strong predictor of core body Temp. When the thermometer was positioned near the axillary artery. The mean Temp. at which subjects in our sample shivered after spinal anesthesia was 36.34 + 0.64 for Category (A) and 36.70 + 0.74 for Category (B). There was no discernible difference. The average Temp. at the time of shivering was 36.2°C in a study by Aditi Dhimar et al. Subjects in the Tramadol Hydrochloride Category shivered for 413.24 + 16.45 seconds after drug administration, while subjects in the Dexmeditomedine Category shivered for 205.10 + 18.6 seconds. The differences in findings were statistically important between the two Categories. All children stopped shivering within 5 minutes of receiving Dexmedetomidine, according to a report by Blaine E et al. The time it took for the impact to appear was 3.5 +/- 0.9 minutes, which was similar to our findings. Shivering regulation was 2.52 + 0.44 in the Dexmedetomidine Category and 5.92 + 0.81 in the Tramadol Hydrochloride Category, according to Mittal G et al. In our sample, the frequency of nausea and vomiting with Tramadol Hydrochloride was 20% and 25 %, respectively.

The findings are consistent with those of other Reddy V S et al. reports. The frequency of nausea and vomiting was 28 % and 20 %, respectively, in a report by Mittal G et al, which also happened in our study. Dexmedetomidine sedation ratings were Stage 2 in 36 (90%) subjects and Stage 3 in four (10 %) subjects. Our findings support the findings of Karaman et al, who found that by using a loading dose of 1 g/kg followed by a maintenance dose of 0.5 g/kg, intra-operative Dexmedetomidine infusion induced minimal sedation. The sedation scores in the Tramadol Hydrochloride category were Stage 2 in 32 (80%) subjects and Stage 1 in 8 (20%) subjects. In both categories, the number of subjects who were sedated did not vary significantly. In the absence of nausea and vomiting, the sedation provided by Dexmedetomidine is beneficial. The hemodynamic parameters were similar in both classes, which support Mittal G et al findings. Clonidine, the other agonist, is linked to a high rate of hypotension and bradycardia. Dexmedetomidine has an advantage in this regard because it produces less hemodynamic variation. In our analysis, only the Tramadol Hydrochloride Category had a recurrence rate of 10%. In their analysis, Mahesh Wari et al registered a similar recurrence rate with Tramadol Hydrochloride (8 %).

CONCLUSION

Glycemic regulation is easier in spinal anesthesia than in general anesthesia since the stress response to surgery is comparatively lower. Where necessary, we prefer spinal anesthesia to epidural and general anesthesia for minimizing surgical stress response. Other factors that can influence the stress response and blood glucose level were not addressed in

the report. As compared to a similar technique in the nondiabetic community, surgical tension is higher in the diabetic group in both techniques. Wherever possible, regional techniques can reduce a diabetic's response to surgical stress. The need for an intraoperative insulin regimen may not be required in all procedures, but it is more dependent on the length and severity of the procedure. Increased blood glucose levels in general anesthesia may be due to a blunting of the stress response during endotracheal intubation or pain during the intraoperative phase, which were not clarified in the research.

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