Effect of General Anesthesia versus Spinal Anesthesia on Blood Sugar Level in Non-Diabetes Patient in Cesarean Section

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Abstract

Introduction: The is study compared the effects of spinal and general anesthesia on changes in blood glucose concentrations during cesarean section in nondiabetic patients. **Patients and methods**: 40 pregnant women scheduled for the elective cesarean section at Babylon Hospital and Al Sadiq teaching hospital between 1st of December ,2023 to 1 march 2024 . patients were electively allocated to two groups (S and G). Group S included patients who chose spinal anesthesia, and group G included patients who chose general anesthesia. **Results**: The results show there is a significant proportional increase in mean blood glucose concentrations with glucose-check timing (5 minutes before induction, 5 minutes after induction, 5 minutes before the end of surgery, and 30 minutes after the end of surgery), and this increase is significantly much greater in general anesthesia than it is in spinal anesthesia. **Conclusion**: The effect of general anesthesia on blood glucose concentrations was significantly greater than the effect of spinal anesthesia, which indicates that the hormonal stress response is much greater in general anesthesia than in spinal anesthesia.

Key words: General Anesthesia, Spinal Anesthesia, Diabetic Mellites, Cesarean Section.

Introduction

The History of Anesthesia The specialty of anesthesia began in the mid nineteenth century and became firmly established in the following century. Ancient civilizations had used opium poppy, coca leaves, mandrake root, alcohol, and even phlebotomy (to the point of unconsciousness) to allow surgeons to operate. Ancient Egyptians used the combination of opium poppy (containing morphine) and hyoscyamus (containing scopolamine) for this purpose. A similar combination, morphine and scopolamine, was widely used for premedication until recent times. What passed for regional anesthesia in ancient times consisted of compression of nerve trunks (nerve ischemia) or the application of cold (cryoanalgesia) (**Bucklin, J. L., et al.,2005**).

The Incas may have practiced local anesthesia as their surgeons chewed coca leaves and applied them to operative wounds, particularly prior to trephining for headache. The evolution of modern surgery was hampered not only by a poor understanding of disease processes, anatomy, and surgical asepsis but also by the lack of reliable and safe anesthetic techniques. These techniques evolved first with inhalation anesthesia, followed by local and regional anesthesia, intravenous anesthesia, and neuromuscular blockers. The development of surgical anesthesia is considered one of the most important discoveries in human history, and it was introduced to practice without a supporting randomized clinical trial **(T. Heng Sia., et al.,2005; M. Turina, F. N., et al.,2006; S. Behdad, A., et al.,2014; F. Amiri, A., et al.,2014).** Glucose is a monosaccharide and is the primary metabolite for energy production in the body. Complex carbohydrates are ultimately broken down in the digestive system into glucose and other monosaccharides, such as fructose or galactose, prior to absorption in the small intestine; of note, insulin is not required for the uptake of glucose by the intestinal cells. Glucose is transported into the cells by an active, energy requiring process that involves a specific transport protein and requires a concurrent uptake of sodium ions **(Gottschalk, B., et al., 2014).** In the blood circulation, the concentration of glucose is tightly regulated by hormones such as insulin, cortisol, and glucagon, which regulate glucose entry into cells and affect various metabolic processes such as glycolysis, gluconeogenesis, and glycogenolysis **(R. Lattermann., et al.,2002; T. A. Raju., et al.,2002; Schricker, R., et al.,2002).** To compare the effects of general and spinal anesthesia on level of blood sugar in non-diabetic mellites patient in Cesarean Section **(F. F. Horber., et al.,1999)**.

Methods

After obtaining formal approval from the ethics committee, a prospective comparative study included 40 pregnant women scheduled for the elective cesarean section at Babylon Hospital and Al Sadiq teaching hospital between 1st of December ,2023 to 1 march 2024. Written informed consents for participation in the study were obtained from all patients.

All the criteria for inclusion in this study were female patients who were scheduled for elective cesarean section, above 18 years of age, and fasting time preoperatively between 8 and 12 hours. Exclusion criteria patients with diabetes mellitus type 1, diabetes mellitus type 2, gestational diabetes, chronic advanced renal disease, heart failure, ischemic heart disease, eclampsia, preeclampsia, and psychiatric disorders were excluded. All patients with failed spinal anesthesia and those who had converted to general anesthesia from spinal anesthesia were excluded. On arrival at the operating theater, two intravenous access sites were prepared. For all participants in the study, standard monitoring of blood pressure, three-lead electrocardiogram, and pulse oximetry oxygen saturation were conducted and continuously monitored during the intraoperative period in the operating theater and during the postoperative period in the post anesthesia care unit. (**e** patients were electively allocated to two groups (S and G).

Group S included patients who chose spinal anesthesia, and group G included patients who chose general anesthesia. For group S, spinal anesthesia was administered under aseptic conditions, at the level of L3-L4 or L4-L5 of the spinal column. Spinal anesthesia was performed with 2.3 ml of 0.5% heavy bupivacaine and 0.4 ml of 0.005% fentanyl using 25- or 27-gauge spinal needles; 100% O2 was administered through a simple face mask with a flow of 4 liters per minute.

For group G, after breathing oxygen for 3 minutes via a face mask, anesthesia was induced with 2–2.5 mg/kg propofol and 0.6 mg/kg rocuronium to facilitate tracheal intubation and with rapid sequence intubation using a regular 6.5 mm ID endotracheal tube. After delivery of the baby and cutting the umbilical cord, 3 μg/kg fentanyl was given. Before delivery of the baby, anesthesia was maintained with 0.7% isoflurane, and after delivery and cutting the umbilical cord, anesthesia was maintained with a propofol infusion at a rate of 150 μg/kg/ min and the inhaled anesthetic agents were discontinued. ETCO2 was maintained between 30 mmHg and 40 mmHg throughout the surgery. At the end of surgery, anesthetic maintenance was discontinued, and reversal of the neuromuscular blockade consisting of 2.5 mg of neostigmine and 1 mg of atropine was given intravenously (IV). the extubation of the trachea was performed when the patient was breathing spontaneously with a good tidal volume, fully awake, and could sustain head elevation for more than 5 seconds. Upon arrival at the operating theater.

Post-delivery of the baby, both groups received 10 IU oxytocin IV bolus and 20 IU oxytocin infusion over 1 hour. Both groups were given 2000–3000 ml crystalloids IV; half of the amount was 0.9% normal saline, and the other half was Ringer's lactate solution. For the group G, the blood glucose concentration (BGC) was obtained 5 minutes before induction (T1) and 5 minutes after induction (T2). For the group S, the BGC was obtained immediately before the injection of the local anesthetic agent (T1) and 5 minutes after the complete block (T2). For both groups, the blood glucose concentration was measured 5 minutes before the end of surgery, T3, and 30 minutes after the end of surgery in the post anesthesia.

Statistical Analysis

A sample size of 20 patients per group was required to achieve a power of 0.80 and alpha of 0.05 based on a hypothetical 25% increase in glucose concentration either at the end of surgery or after surgery. Mean age, weight, and fasting time were compared in group S and group G using the t-test. To test for statistically significant differences between the four blood glucose readings and their interaction with the type of anesthesia, repeated measures of analysis of variance were conducted and the results.

Statistical analyses were performed using SPSS for Windows version 18.0 (***SPSS Inc., Chicago, IL, USA***). All values were expressed as mean ± SD unless otherwise specified, and p values

Results

The two groups were statistically equivalent with regard to age, weight, and fasting duration, as indicated in Table 1, which shows the means, standard deviations, and t-test statistic for the difference between the mean values. Table 2 shows the means and standard deviations for the four glucose-check readings for the two groups. (e mean values for the general anesthesia group increased more rapidly than those in the spinal anesthesia group. According to Tables 1 and 2, there was a statistically significant difference in glucose-check readings with regard to time of readings and its interaction with type of anesthesia (*general anesthesia and spinal anesthesia*).

The results in Table 2 are shows the difference between the glucose-check readings according to glucose-check timing in both spinal anesthesia and general anesthesia and shows the difference in the effect of type of anesthesia (general anesthesia and spinal anesthesia) on blood glucose concentration. According to table 2, there is a significant proportional increase in mean blood glucose concentrations with glucose-check timing (5 minutes before induction, 5 minutes after induction, 5 minutes before the end of surgery, and 30 minutes after the end of surgery), and this increase is significantly much greater in general anesthesia than it is in spinal anesthesia.

Table (1): Age, weight, and fasting time of patients included in the study

Group G_{mean} ± Group $S_{mean±sd}$			$T_{.test}$	$P_{.value}$
Age (years)	29.7±5.2	28.9±6.6	–0.519	0.739
Weight (kg)	67.8±9.2	69.8±13.2	–0.682	0.623
Fasting time (hours)	9.9±1.3	9.4±1.8	–1.842	0.361

Table (2): Descriptive statistics for the mean blood glucose concentrations for spinal anesthesia and general anesthesia at different measurement times

Time Plan	Type of anesthesia	Mean	STD	NO.
5 min before induction	General anesthesia	75.3	15.31	20
	Spinal anesthesia	79.3	17.43	20
	Total	77.7	17.82	40
5 min after induction	General anesthesia	82.37	20.4	20
	Spinal anesthesia	76.2	16.27	20
	Total	79.4	19.48	40
5 min before the end of surgery	General anesthesia	118.31	18.3	20
	Spinal anesthesia	98.63	17.13	20
	Total	103.52	21.45	40
30 min after the end of surgery	General anesthesia	127.61	18.61	20
	Spinal anesthesia	87.72	16.98	20
	Total	102.38	22.71	40

Discussion

The is study compared the effects of spinal and general anesthesia on changes in blood glucose concentrations during cesarean section in nondiabetic patients. Although mean blood glucose concentrations showed a significant proportional increase during surgery in both groups, this effect was much more significant with general anesthesia than with spinal anesthesia. (Ese results indicate that spinal anesthesia is more effective than general anesthesia in attenuating the hyperglycemic response to surgery during cesarean section (**R. Lattermann., et al.,2001; T. Tanaka., et al.,2005**).

The area has been a great deal of interest in the potential beneficial effects of preservation of glucose homeostasis and early avoidance of stress-induced hyperglycemia in surgical patients by modification of the stress response **(O. Y. Cok., et al.,2011; H. Kehlet., et al.,1998)**. Acute hyperglycemia, a typical feature of the metabolic response to surgery, has been demonstrated to significantly compromise immune function and contributes to poor clinical outcome, **(Houghton, J., et al, 2007)**. The degree of this response was shown to be proportional to the severity and length of the surgical injury **(H. Jensen, P., et al.,2008; J. Lund., et al.,1996; J. H. Shaw., et al.,2001; Enquist, M. R., et al.,2009)**, and the magnitude of insulin resistance increased during surgery according to the degree of surgical injury turbinate. showed that short-term hyperglycemia is associated with increased risk of infection and mortality in critically ill patients related to a significant decrease in monocyte expression due to hyperglycemia and hyperinsulinemia. Treating hyperglycemia results in an increased risk of hypoglycemia and the risks associated with hypoglycemia, and thus avoidance of stress-induced hyperglycemia is preferable for treating deglycation. It has long been recognized that the type of anesthetic technique has an influence on hyperglycemic response to surgery **(G. Y. Gaudiest**

al.,2005; R. E. Anderson., et al.,2005; R. E. Anderson., et al.,2020; Apfelbaum JL., et al.,2012; Miller TE., et al.,2014). During surgery, stress-induced hyperglycemia is more pronounced with inhalation anesthesia. In animals, earlier studies revealed that inhalational anesthetics such as enflurane and halothane impaired glucose tolerance in dogs and that was related to inhibition of insulin secretion and decreased tissue insulin sensitivity **(Weiser TG, Haynes AB, et al., 2015)**. Other studies on isoflurane inhalational anesthetic demonstrated an increase in the plasma glucose concentration during anesthesia even without surgical stress related to impairment of glucose tolerance and stimulation of whole-body glucose production. Furthermore, the hyperglycemic stress response in patients undergoing major abdominal surgery under isoflurane general anesthesia could be related to an increase in endogenous glucose production accompanied by a decrease in glucose utilization **(Tanaka et al., 2019)**, showed that there was glucose intolerance and impairment of insulin secretion and glucose utilization during sevoflurane and isoflurane. As we mentioned previously, spinal anesthesia is the most common technique used to provide anesthesia for patients undergoing elective cesarean section due to the lower risk of maternal and fetal complications associated with spinal anesthesia than general anesthesia. (results of our study add more weight to the use of spinal anesthesia in the obstetric population since spinal anesthesia facilitates glycemic control in the perioperative period. this might be beneficial in reducing the incidence of previously mentioned complications associated with hyperglycemia and other maternal and fetal complications. therefore, these added benefits of spinal anesthesia over general anesthesia should be conveyed to patients during patient counseling about cesarean sections.

Conclusion

In conclusion, there was a significant proportional increase in mean blood glucose concentrations from glucose-check timing with both general anesthesia and spinal anesthesia. the effect of general anesthesia on blood glucose concentrations was significantly greater than the effect of spinal anesthesia, which indicates that the hormonal stress response is much greater in general anesthesia than in spinal anesthesia.

Recommendation

- More study with patients to non-diabetic mellites.
- Refer all patients to physician before surgery and after surgery.
- Advance more toward use of spinal anesthesia in caesarian section.

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