Original Research Article

To study the effect of using ringer's lactate with or without addition of dextrose on intra-operative blood sugar levels in Pediatric age group undergoing surgeries

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Abstract

Background: General anesthesia without supplemental regional anesthesia might result in elevated blood sugar levels secondary to the stress response of anesthesia and surgery. Increased levels of cortisol and catecholamines augment glucose production because of increased hepatic glycogenolysis and gluconeogenesis along with reduced peripheral utilization of glucose. Hence, there exists a high possibility that supplementing dextrose intraoperatively without regular blood sugar estimation might result in hyperglycemic episodes which can lead to osmotic diuresis, impairment of neurological outcome, and risk of hypoxic episodes under anesthesia.

Aim: To compare the effect of using Ringer's lactate with or without the addition of 1% dextrose on intra-operative blood sugar levels in the pediatric age group undergoing surgeries.

Methods and methods: 44 pediatric age group patients, male patients undergoing circumcision for phimosis under I.V sedation with caudal block were chosen and divided into two groups randomly into Group A and Group B. Group A received 1% dextrose RL and Group B received RL without the addition of dextrose as intra-operative maintenance fluid. Along with basic parameters like heart rate and oxygen saturation, capillary blood glucose was also measured preoperatively just before induction and after the end of procedure postoperatively.

Results: Preoperative and post-operative blood sugar values were compared. No significant hypoglycemia was developed in patients who had received only RL. And patients who received 1% Dextrose RL as intra-operative fluid had not developed significant hyperglycemia.

Conclusion: Even with patients received only RL without dextrose as intraoperative fluid there is no significant hypoglycemia. So, the addition of dextrose is not mandatory in patients undergoing short surgeries provided their preoperative sugar level is not less than 80 mg/dl.

Key words

Dextrose, Ringers' Lactate, Hypoglycemia, Hyperglycemia, Capillary blood glucose (CBG).

Introduction

In general practice, in pediatric patients undergoing surgeries there is a routine practice of adding dextrose to avoid intra-operative hypoglycemia. The 2nd Congress of European society for pediatric anesthesiology in 2010 has recommended that intraoperative fluid for the pediatric age group should have an osmolarity close to physiological range and addition of 1%-2.5%dextrose instead of 5% glucose to avoid hypoglycemia, lipolysis or hyperglycemia and But pediatric patients while undergoing surgeries generally results in elevation of blood sugar level secondary due to stress response of anesthesia and surgery [1]. This is due to increased levels of cortical and catecholamines which augment glucose production because of hepatic glycogenolysis and gluconeogenesis along with reduced peripheral utilization of glucose [2]. Children are capable of mounting a substantial neuroendocrine response to both surgical stress and decreased glucose supply. This manifests as a rise in cortisol, glucagon, catecholamines, and vasopressin, along with fall in insulin [3]. The result is a rise in blood glucose concentration through gluconeogenesis, fat mobilization, and protein catabolism. However, such compensation occurs at the expense of valuable energy reserves, namely, glycogen, fat, and proteins [4]. Any fluid used intraoperatively should aim at keeping this stress response to a minimum by providing adequate glucose to suppress gluconeogenesis and fat mobilization. At the same time, it should maintain normal plasma osmolarity, electrolyte balance, and hemodynamic stability [5]. The major concerns regarding neonatal fluid management are hypoglycemia, hyperglycemia, hyponatremia, and volume overload. Hence there is a possibility that supplementing dextrose as intra-operative fluid with regular monitoring of blood sugar might result in a hyperglycaemic episode which can lead to osmotic dieresis, impairment of neurological outcome and risk of hypoxic episodes under anesthesia [6].

Materials and methods

An interventional single-blinded randomized control study was done. Government Stanley Medical College Hospital, Chennai, Tamil Nadu (January 2019). 44 ASA PS 1 and 2 patients were selected for study based on inclusion and exclusion criteria. Patients were randomized into two groups Group A and Group B. In order to avoid the difference of stress response to different surgeries and durational variations, patients of the same surgical condition and the same method of anesthesia was chosen. So 44 male pediatric patients of age group between 1 to 10 years of surgical condition Phimosis for circumcision were chosen. All patients were given I.V sedation with Caudal block based on their body weight. Patients were kept fasting 6hr for solid food, 4 hours for breast milk and 2 hours for clear fluids. Preoperative blood sugar (capillary blood glucose) was measured by a standard glucose meter, also baseline values of heart rate and saturation were recorded just before induction. After securing i.v. access, intraoperative fluid administered depending upon their group. I.V fluid administered according to their based on Holliday and Segar formula. All patients with group A were administered 1% Dextrose RL and group B were administered RL. Patients with preoperative blood sugar less than 70mg/dl were not taken into study. Postoperative blood sugar along with vitals was recorded.

Statistical analysis

All data were collected and presented as the mean and standard deviation for quantitative

variables and percentages for qualitative variables. Independent T-Test was used to find out any difference in mean values between groups, paired T-test for comparing means within the groups and chi-square test was done to find out the association between two categorical variables. P<0.05 was considered significant. Data were entered in MS Excel and analysis was done using SPSS 16.0 version.

Results

Basic parameters including heart rate, saturation along with preoperative capillary blood glucose and postoperative blood glucose were recorded in 44 patients who undergone circumcision under i.v. sedation with caudal block and they were divided into two groups randomly. Group A (n =22, received dextrose RL) and Group B (n=22, received RL).

Table - 1: Baseline data – demographic profile.

PARAMETER	GROUP A (N=22) MEAN ± SD	GROUP B (N=22) MEAN ± SD	P VALUE
AGE	3.34±2.09	3.82± 2.24	0.469*
WEIGHT	13.36 ± 5.42	13.09 ± 2.99	0.837*
ASA 1/2	10/12	11/11	0.763**

Table - 2: Blood sugar levels.

BLOOD SUGAR	GROUP A (N=22) MEAN ± SD	GROUP B (N=22) MEAN ± SD	P-VALUE
PREOPERATIVE	107.05±10.71	108.05± 10.55	0.756*
POSTOPERATIVE	116.73 ±10.78	107.18 ± 7.92	**0.002***
P VALUE (PAIRED T TEST)	**<0.001**	0.576	

Graph – 1: Correlation of pre and post-operative blood sugar curve.

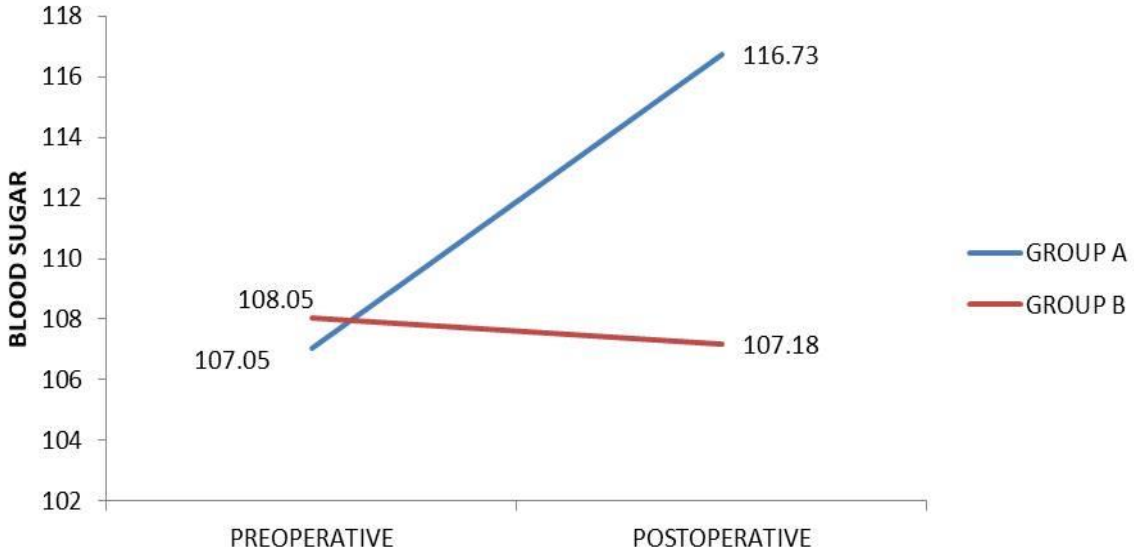

Table - 1 shows that there were no significant change in demographic profile like age (p=0.469), weight (p=0.837), ASA status (p=0.763).

Table - 2 shows that the mean preoperative blood sugar for Group A was 107.05± 10.71 and post-operative blood sugar for group A was 116.73 ± 10.78. The mean Preoperative blood sugar for Group B was 108.05±10.55 and post-

operative blood sugar was 107.18±7.92. While comparing blood sugar within the group, postoperative blood sugar was significantly higher in group A (P<0.001) but not hyperglycemia while in Group B, Postoperative blood sugar when compared to preoperative blood was slightly reduced but not statistically significant (p=0.576) and not hypoglycemia.

Graph - 1 shows that preoperative blood sugar was slightly higher in group B, but not statistically significant (p=0.756). Post-operative blood sugar was significantly higher among the group compared to group B (p=0.002).

Discussion

Fluid management of the pediatric surgical patient is a critical element in the care of infants and children who are sensitive to small degrees of dehydration. Complex surgical procedures are often associated with rapid changes in fluid requirements necessitating frequent assessment and modifications of fluid therapy [7]. In the operating room, the fluid requirements may rapidly change during the conduct of anesthesia and surgery, coincident with changes in temperature, metabolism and fluid volume shifts. The trauma, hemorrhage and tissue exposure associated with surgery shifts body fluids between compartments, necessitating fluid replacement with solutions that compensate for energy, water, protein and electrolyte losses [8]. The anesthesiologist must determine the nature and magnitude of these losses and be alert both to the obvious fluid losses of serum and urine and to hidden fluid losses, which can occur, with insensible loss and third space loss of fluid. Using ringer lactate without the addition of dextrose as maintenance fluid in pediatric age group undergoing surgeries did not result in significant hypoglycaemia [9]. Also using 1%dextrose RL as intra-operative maintenance resulted in a slight elevation of blood sugar level but not significant hyperglycemia. Several studies have shown that the use of RL alone as intra-operative maintenance fluid did not result in hypoglycaemia [10]. It also showed that dextrose RL (either 1% or 2%) though resulted in an increase in intra-operative blood sugar level, did not cause hyperglycemia [11]. So this provides an additional level of safety against hypoglycemia. Some studies show that intraoperative maintenance fluid of concentration of 1% to 2.5% dextrose containing isotonic fluids has been proven to be beneficial by reducing the incidence of postoperative hypoglycemia as well as hyperglycemia. Studies which had been conducted with comparing 1% dextrose RL and 2% dextrose RL as intra-operative maintenance fluid showed results of significant hyperglycemia with 2% dextrose RL [12]. But with a concentration of 1% dextrose RL, there is no such hyperglycemia was seen and only near normal blood sugar values were noted. In our study, in both groups of patients, there was no significant hypoglycemia or hyperglycemia. Group B who had received only RL as intra-operative maintenance fluid, there is a mild decrease in blood sugar level but not significant. As well as in group A who had received 1% dextrose RL as intra-operative maintenance fluid, there was the mild elevation of the blood sugar level, but not significant [13, 14, 15].

Conclusion

There is no significant hypoglycemia produced in patients who had received ringer lactate as their intra-operative maintenance fluid as well as no significant hyperglycemia was produced with 1% dextrose RL. So either RL or low concentration of dextrose containing isotonic fluid like 1% dextrose RL can be used as intra-operative maintenance fluid in pediatric age group patients.

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