

Remifentanil and delayed tracheal intubation improve the control of blood glucose during general anesthesia in children with congenital hyperinsulinism undergoing a vascular interventional radiology procedure.

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Introduction: Congenital hyperinsulinism (CHI), the most frequent cause of persistent, severe hypoglycemia in infancy, is amenable to surgical resection of focal hypersecreting pancreatic lesions, but localization of such tumors is difficult if < 2cms in diameter. (1) The most sensitive and specific technique is the arterial stimulation and venous sampling (ASVS) test where the diagnosis is established if a >2-fold rise in insulin levels in pancreatic veins occurs following selective arterial injections of calcium. (2) In pediatric patients this test is performed under general anesthesia, but catecholamine secretion during stress can cause a marked variability in blood glucose levels under anesthesia. Wide changes in the glucose levels during ASVS can induce insulin secretion from normal pancreatic tissue, making it difficult to interpret test data. (3) While deep anesthesia can minimize blood glucose changes, such techniques can prolong emergence and cause cardiovascular depression. We devised a protocol for managing patients undergoing ASVS based on published literature on glucose metabolism during anesthesia. This protocol was anchored on 2 interventions – (1) the use of remifentanil infusions during a low dose (< 1 MAC) potent inhalation agent administration and (2) delaying tracheal intubation for 10 minutes after induction to achieve a satisfactory depth of anesthesia. This retrospective study examined the effect of these interventions on blood glucose levels in anesthetized children undergoing ASVS testing.

Methods: With IRB approval, we obtained data from 69 medical records of 68 children who underwent ASVS test procedures under general anesthesia. Demographic data, anesthetic drugs, doses, anesthetic interventions were recorded. In addition, we noted the time and details of any adjustments of glucose infusion rates and administration of insulin, along with all blood glucose levels. Patients were divided into 2 groups – those who did or did not receive remifentanil infusions. In addition, changes in blood glucose values from preintubation levels were compared in patients who underwent tracheal intubation 10 mins after induction versus earlier intubation. $P < 0.05$ was considered statistically significant.

Results: There were 30 males and 38 females, mean age of 11.5 ± 21.2 months and weight 6.5 ± 2.9 kg. Remifentanil infusions were used on 42 occasions. The mean blood glucose readings during ASVS testing were lower in the remifentanil group (80 ± 19 vs 100 ± 43 mg/dl, $p=0.01$). The percentage change in glucose values from preintubation baseline values were greater in patients who underwent early tracheal intubation compared to those in whom tracheal intubation was delayed 10 mins or more after induction ($32.2 \pm 50.9\%$ vs. $4.8 \pm 23.6\%$, $P = 0.0089$). The choice of IV drug for induction of anesthesia (propofol or pentothal) and the inhalation agent for maintenance of anesthesia (sevoflurane, desflurane or isoflurane) did not cause significant differences in the mean blood glucose levels during the ASVS test.

Five patients received a single dose of 1 ml/kg of bupivacaine 0.25% with epinephrine 1:200,000 in the caudal epidural space. There were no significant differences in glucose levels in these patients compared to those not receiving caudal epidural local anesthetics. There were no clinically important cardiovascular changes requiring drug intervention therapy during ASVS testing in any patient. There were also no significant differences in the time from the end of the procedure to tracheal extubation in patients who did or did not receive remifentanil infusions during anesthesia.

Discussion: The control of post-induction blood glucose is more critical for ASVS than for most procedures. The most important anesthetic interventions that helped maintain stability of the blood glucose were the concomitant use of remifentanil infusion and delaying tracheal intubation for 10 mins after induction. We speculate that the use of remifentanil blunted stress response, while avoiding prolonged sedation and respiratory depression post-procedure. We recognize that retrospective studies such as this one have major limitations, as factors other than the interventions mentioned above may have been responsible for the results. However, within these limitations, we feel this anesthetic protocol is useful for managing pediatric patients undergoing general anesthesia during ASVS testing for hyperinsulinism.

References:

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