Hypoglycemia Associated with Supraventricular Tachycardia in an Infant

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Although intraoperative hyperglycemia may be deleterious, especially in patients with increased risk of cerebral ischemia,¹ hypoglycemia can also cause dangerous central nervous system and cardiovascular effects.² We report the occurrence of hypoglycemia associated with supraventricular tachycardia causing hypotension in an infant with cyanotic congenital heart disease.

REPORT OF A CASE

A nine-month-old 5.6 kg male with cyanotic congenital heart disease was admitted for inguinal herniorrhaphy. The child was taking no medications and had never been in congestive heart failure, although he had manifested intermittent second-degree heart block in the past. Cardiac catheterization at three months of age demonstrated atresia of the right ventricle, an atrial septal defect, and a functional Blalock-Taussig shunt. Neither physical examination nor chest radiograph revealed any evidence of congestive heart failure. ECG showed first-degree atrioventricular block. Preoperative blood glucose was not measured. At 02:00 A.M. the morning of surgery, the patient was offered glucose containing liquids. At 08:00 A.M. an iv infusion of lactated Ringer’s solution was started and glycopyrrolate 0.02 mg/kg iv was injected. Anesthesia was induced with ketamine 0.4 mg/kg and atracurium 0.5 mg/kg iv and the trachea was intubated. Anesthesia was maintained with halothane 0.25–1.0% inspired, a ketamine infusion of 50 μg · kg⁻¹ · min⁻¹ and fentanyl 1.0 μg · kg⁻¹ · min⁻¹ iv. Oxygen saturations determined by pulse oximetry (S pog) ranged from 92% to 98%. Cardiac rhythm varied from sinus tachycardia with a rate of 170 beats/min to second-degree heart block with an atrial rate of 45 beats/min. Systolic blood pressure was maintained at 80 mmHg. A total of 30 ml/kg of lactated Ringer’s solution was administered. The ketamine infusion was discontinued 20 min prior to the end of surgery. Glycopyrrolate 0.007 mg/kg and neostigmine 0.04 mg/kg iv were administered, and the trachea was extubated. The child was transported breathing oxygen via mask at 6 l/min, which was continued throughout the recovery room course. On arrival in the recovery room at 10:10 A.M. the patient appeared well perfused with a sinus rhythm of 120 beats/min, arterial blood pressure of 80/50 mmHg, and respirations of 24 breaths/min. Ten minutes later ECG showed supraventricular tachycardia (SVT) with a rate of 250 beats/min, and the patient acutely developed pallor, diaphoresis, tachycardia, and poor peripheral perfusion. Arterial blood pressure fell to a palpable systolic of 55–50 mmHg; S pog was 90%. The rhythm alternated between sinus at 120 beats/min and paroxysms of SVT associated with hypotension and pallor, which each lasted 5–10 min. Ice was applied to the forehead to increase vaso tone, and a bolus of lactated Ringer’s iv 10 ml/kg was given. Because the child had manifested second-degree heart block intraoperatively, further therapy was discussed with his cardiologist. Two doses of 2 μg/kg digoxin iv were given over 20 min. Arterial blood gas obtained at 11:00 A.M. showed pH 7.35, PaO₂ 60 mmHg, PaCO₂ 26 mmHg, and base excess −8.6 mEq/L. Blood glucose drawn simultaneously was discovered to be 28 mg/dl. Dextrose (D₅₀W) 2 mg/kg was infused immediately. Within an hour of the administration of ice, fluid, digoxin, and dextrose, the SVT resolved and the patient subsequently did well.

DISCUSSION

Few clinical problems with perioperative hypoglycemia have been reported in children over one month of age.³ Recent studies show perioperative hypoglycemia is rare with an incidence of 0–0.5%.⁴⁻⁶ Investigators have lengthened fasting periods⁷ and limited intraoperative glucose administration⁵,⁹ without causing hypoglycemia. Nilsson et al.⁴ stated that intraoperative glucose administration is unnecessary for children over 2 weeks of age. Moreover, glucose administration can be hazardous. Sieber et al.¹ recommended that glucose be withheld whenever brain ischemia may occur intraoperatively. Because this patient’s right to left shunt increased his risk of sustaining brain ischemia either from profound hypoxemia or embolism, glucose was withheld.

Sieber et al.¹ recommended, “If one is anxious about intraoperative hypoglycemia, occasional glucose levels by capillary blood glucose analysis can be done.” Hypoglycemia in this child was unanticipated. The child was not kept NPO for a prolonged period of time. He did not have congestive heart failure or any other condition commonly associated with hypoglycemia.⁹ This child may have been predisposed to hypoglycemia by his heart disease, which caused both hypoxia and failure to thrive. Gacs et al.¹⁰ reported low glucose levels in cyanotic children who were neither in congestive heart failure nor malnourished, and proposed hypoxia impairs

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Received from the Anesthesia and Operative Service, Department of Surgery, Walter Reed Army Medical Center, Washington, DC. Accepted for publication June 30, 1988.

The opinions and assertions contained herein are the private views of the authors and are not to be construed as official or as reflecting the views of the Department of the Army.

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Key words: Anesthesia; pediatric; heart; arrhythmia; supraventricular tachycardia; Metabolism: hypoglycemia.
gluconeogenesis or glycogenolysis. Haymond et al.\textsuperscript{11} documented normal gluconeogenesis, glycogenolysis, and glucoregulatory hormones in two cyanotic children whose symptomatic hypoglycemia was associated with glycogen depletion. Glycogen depletion can occur in many disease states. Even in the absence of disease, children below the third percentile in weight were found by Payne and Ireland\textsuperscript{12} to have an increased risk of developing hypoglycemia in the perioperative period.

Hypoglycemia has not been a problem perioperatively because until recently glucose has been infused routinely. Studies withholding glucose\textsuperscript{4,5,8} have been done with children who were free of systemic disease. In the largest series\textsuperscript{8} blood glucose levels were measured preoperatively and several children were excluded from the study when they were found to have low levels. In these healthy children with normal fasting blood glucose,\textsuperscript{5} postoperative glucose levels fell in a significant number despite the stress of surgery.

Hypoglycemia has no pathognomonic signs. Although hypoglycemia could have caused this child's tachycardia, pallor, diaphoresis, and cardiovascular collapse,\textsuperscript{13} other possible etiologies included hypovolemia, hypervolemia, hypoxia, pain, sepsis, pulmonary embolism, and malignant hyperthermia. In the course of evaluating and treating the hemodynamically significant supraventricular tachycardia, hypoglycemia could have been overlooked. Undetected, hypoglycemia could have worsened his cardiovascular instability or caused brain damage.

In summary, we report this case to emphasize that perioperative hypoglycemia can occur and can be insidious or mimic other conditions. If glucose is withheld from children, a preoperative blood glucose should be checked. The stress of anesthesia and operation does not reliably maintain blood glucose in children. Thus, blood glucose levels should be followed throughout the perioperative period, with greater frequency in children with cyanotic congenital heart disease or failure to thrive.

REFERENCES