Clinical Article

Delayed Intestinal Transit and Arrhythmias Due to Iatrogenic Neonatal Hypermagnesemia

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Abstract

We report a neonate with delayed intestinal transit, transient arrhythmias and hypermagnesemia due to a calculation error when administering magnesium sulfate for hypomagnesemia. This report of iatrogenic hypermagnesemia due to medication calculation error has not been described before in neonates, nor its clinical presentation as delayed intestinal transit in an otherwise well infant. The different causes of neonatal hypermagnesemia, its complications as well as the modalities of therapy are reviewed. ***Int Pediatr. 2002;17(3):154-155.***

Key words: Arrhythmia, gastrointestinal transit, iatrogenic disease, intestinal pseudo-obstruction, magnesium, medication errors, neonate

Introduction

Unlike neonatal hypomagnesemia, hypermagnesemia is a less well known entity, affecting mainly infants born to mothers treated with intravenous magnesium sulfate for pre-eclampsia.[1,2] Other causes are rare, and unlike in adults, iatrogenic hypermagnesemia due to medication calculation error has not been described in neonates, nor its clinical presentation as delayed intestinal transit in an otherwise well infant. We report a neonate with delayed intestinal transit, transient arrhythmias and hypermagnesemia due to a calculation error when administering magnesium sulfate for hypomagnesemia.

Case Report

A female infant was delivered at 35 weeks of gestation by emergency cesarean section for abruptio placenta. She weighed 1790 grams, and Apgar scores were 7 and 9 at 1 and 5 minutes. Blood gases, serum glucose, calcium, electrolytes and blood count remained within normal range, but the infant required one intramuscular injection of magnesium sulfate for a serum magnesium of 1.3 mg/dL (0.5 mmol/L), prior to transfer to our hospital at the age of 4 hours.

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The infant developed increased gastric residue with mild abdominal distension and delayed passage of meconium for several days, but remained otherwise well. There was no abdominal tenderness, redness or crepitations, but bowel sounds were reduced. Abdominal x-ray showed mild loops distension but there were no air-fluid levels, pneumatosis or perforation. Abdominal ultrasound ruled out pyloric stenosis, upper gastrointestinal series was normal and barium enema was not suggestive of Hirshprung's disease. Blood gases, serum calcium, creatinine, blood urea nitrogen, electrolytes, thyroxine and thyrotropin levels were normal. On day 3, the infant developed few episodes of premature ventricular contractions which resolved spontaneously over few days. Cardiac evaluation, echocardiography and a Holter monitoring were all normal. Serum magnesium level on day 4 was 3.3 mg/dL (1.5 mmol/L).

The referring hospital was contacted and confirmed there was no history of magnesium sulfate therapy for her mother before delivery. A review of the neonatal medication chart showed that, although the infant was prescribed a dose of 0.8 mEq of magnesium (equivalent to 0.4 mmol of Mg or 0.2 ml of 50% magnesium sulfate) intramuscularly prior to the transfer, the injected dose was 0.8 ml (instead of 0.8 mEq) of 50% magnesium sulfate, or four times the prescribed dose. Renal function and serum calcium remained normal, no serious arrhythmias or cardiovascular instability occurred and serum magnesium levels progressively declined over a 10-day period. Regular passage of stools and a normal feeding pattern were well established by the end of the second week. The infant has remained well since.

Discussion

Magnesium (Mg) is the organism's second most abundant intracellular cation and the main divalent intracellular cation. It is a cofactor in more than 300 enzymatic reactions which affect the energetic metabolism, and the synthesis of proteins and nucleic acids. Neonatal hypomagnesemia is not uncommon and is treated with a parenteral dose of 0.1 ml/kg of 50% magnesium sulfate USP (approx. 0.2 mmol/kg or 0.4 mEq/kg).

Neonatal hypermagnesemia is a less known entity.[1,2] The commonest cause is intravenous magnesium sulfate

of pre-eclamptic mothers. Serum concentrations remain elevated for the first 72 hours of life as the renal elimination is slower in immature kidneys. Impairment of neuromuscular transmission with hypotonia, as well as neurobehavioral changes are found in affected infants.[3] Hypermagnesemia may also result from birth asphyxia, magnesium sulfate enema, or antacid administration and renal failure is a risk factor.[4,5] Unlike in adults, iatrogenic hypermagnesemia due to medication error has not been reported in the newborn.

In adults with renal impairment, magnesium levels of 4 mg/dL (1.8 mmol/L) may lead to respiratory depression and hyporeflexia, levels of 6 to 8 mg/dL (2.6 to 3.5 mmol/L) may result in respiratory depression and ECG changes, and levels over 12 mg/dL (5.2 mmol/L) are associated with cardiac arrest. Such correlation between symptoms and serum levels has not been found in neonates.[2] A possible explanation is that symptoms are related to tissue concentration of Mg which does not correlate with serum levels.

Although paralytic ileus has been reported in affected adults, delayed neonatal intestinal transit has not been reported, but meconium-plug syndrome and neonatal intestinal perforation have been described.[6-9] Magnesium may decrease intestinal peristalsis by directly affecting smooth muscle cells or by depressing the excitability of muscle nerve fibers. The effect on the central nervous system includes sleep abnormalities, respiratory depression and apnea.

Hypermagnesemia usually improves after 36 h of conservative management which includes intravenous infusions of glucose and saline with calcium supplementation. When symptoms are severe, ventilatory support, exchange transfusion or dialysis may be required.[2,10] As aminoglycosides may potentiate the neuromuscular manifestations of hypermagnesemia, they should not be used.

Hypermagnesemia needs to be considered in neonates with delayed passage of meconium or significant gastric residues. The possibility of iatrogenic medication error needs to be considered especially when no other known factors are present. The careful calculation and administration the prescribed dose of magnesium sulfate for neonatal hypomagnesemia cannot be overemphasized when considering the variety of units of measurement used in written orders and on drug labels.

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