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Inadvertent Methylergonovine Administration to a Neonate

Authors' Contribution:
Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
Literature Search F
Funds Collection G

EF 1 Bryan M. Corbett
EF 1 Charles O'Connell
EF 2 Mallory A. Boutin
EF 2 Nabil I. Fatayerji
EF 2 Charles W. Sauer

1 Department of Emergency Medicine, University of California, San Diego, CA, U.S.A.
2 Department of Pediatrics, University of California, San Diego, CA, U.S.A.

Corresponding Author: Charles W. Sauer, e-mail: csauer@ucsd.edu
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Patient: Male, Newborn
Final Diagnosis: Accidental methylergonovine poisoning
Symptoms: Respiratory distress
Medication: —
Clinical Procedure: —
Specialty: Pediatrics and Neonatology

Objective: Diagnostic/therapeutic accidents

Background: Methylergonovine is an ergot alkaloid used to treat post-partum hemorrhage secondary to uterine atony. Mistaking methylergonovine for vitamin K with accidental administration to the neonate is a rare iatrogenic illness occurring almost exclusively in the delivery room setting. Complications of ergot alkaloids in neonates include respiratory depression, seizures, and death.

Case Report: A term infant was inadvertently given 0.1 mg of methylergonovine intramuscularly in the right thigh. The error was only noted when the vial of medication was scanned, after administration, identifying it as methylergonovine rather than vitamin K. The local poison center was notified, and the infant was transferred to the neonatal intensive care unit for observation. Two hours after transfer, the infant was noted to have oxygen desaturations and required oxygen via nasal cannula. Supplemental oxygen was continued for 4 hours until the neonate was able to maintain normal oxygen saturations in room air. Feeding was started by 10 hours of life, and the infant was discharged home in good condition after a 72-hour stay without further complications.

Conclusions: Because of the potential for serious adverse events, vigilance is required to prevent accidental administration of methylergonovine to the neonate as a result of possible confusion with vitamin K in the early post-partum period.

MeSH Keywords: Infant, Newborn • Intensive Care, Neonatal • Methylergonovine • Poisoning • Vitamin K

Full-text PDF: http://www.amjcaserep.com/abstract/index/idArt/900263

Background

Methylergonovine is an ergot amine alkaloid used to treat post-partum uterine atony. Phytonadione (vitamin K1) is used to prevent vitamin K deficiency bleeding in the newborn. When administered, both are usually given soon after birth. Prior reports exist of mistaking methylergonovine for vitamin K with subsequent parenteral administration to the neonate; however, these events are rare. While rare, such events are potentially serious as deaths have been reported in the past [1]. A 12-year review of pediatric ergot exposures from 1997 to 2008 using the California Poison Control System database identified only two neonates exposed to methylergonovine in such fashion [2]. Here, we report such a case of mistaking methylergonovine for vitamin K with subsequent inadvertent intramuscular administration to a neonate.

Case Report

Our infant was born via vaginal delivery at 37+5/7 weeks' gestational age to a 31-year-old woman who had normal prenatal laboratory values. The pregnancy and the delivery were uncomplicated. The infant had an Apgar score of 9 at 1 minute and 9 at 5 minutes after birth. The infant was born just prior to the nursing change of shift. The nurse who attended the delivery had not yet given the infant his vitamin K shot. She signed out to the oncoming nurse that this medication was due and that the vial was on the counter in the delivery room.

The incoming nurse took the medication, which was in a prefilled color-coded vial. She drew up 0.5 mL of the solution and injected it intramuscularly into the infant's right thigh. She thought she had given 1 mg of vitamin K. The vitamin K vial used at this hospital has 1 mg per 0.5 mL. She then scanned the vial using a bedside scanner. The scanner indicated that this was the wrong medicine. When she looked at the vial, she realized that it contained methylergonovine 0.2 mg per mL, which was also in a prefilled color-coded vial (Figure 1). She therefore had injected the infant with 0.1 mg of methylergonovine, which is ½ the normal adult dose.

In this case, both the outgoing and incoming nurses acted against hospital procedures. The outgoing nurse routinely took a vial of methylergonovine with her to deliveries in case she would need to emergently administer this medicine to the mother in order to stop post-partum hemorrhage. Per hospital procedure, this vial of medicine should not have been left in the patient room. Additionally, hospital procedure is to scan medication vials prior to administration, not after as happened here.

The infant was brought to the neonatal intensive care unit (NICU), and poison control was notified. The infant's vital signs

Figure 1. The vitamin K and methylergonovine medications came in color-coded prefilled vials, but note the small type and the similarities in the size and shape of the vials.

on admission were all within normal limits for a term newborn and included a temperature of 98.6 degrees Fahrenheit, heart rate of 156 beats per minute, blood pressure of 82/36 millimeters of mercury with a mean arterial pressure of 49 millimeters of mercury, and respiratory rate of 52 breaths per minute. The infant was started on intravenous (IV) fluids for hydration and monitored for signs of toxicity. A correct dose of 1 mg of vitamin K administered intramuscularly was given on NICU admission. After two hours in the NICU, the infant was noted to have oxygen desaturations in the low 80's, prompting the administration of 2-liter flow nasal cannula with 30% oxygen, which normalized the infant's oxygen saturation. The infant was able to wean off the nasal cannula after four hours. Feeds were started by 10 hours of life, and IV fluids were weaned off by 48 hours of life. The infant's laboratory workup included serial complete blood counts, electrolyte panels, bilirubin levels, blood urea nitrogen levels, creatinine levels, and glucose levels, which all remained within normal newborn limits. No other signs or symptoms or abnormalities of vital signs were noted, and the infant was discharged from the NICU after 72 hours. At that time the infant was feeding well, was breathing normally, was not noted to have any seizures, and had a normal neurologic exam, normal urine output, normal electrolytes, normal blood urea nitrogen level, and normal creatinine level.

Discussion

Ergot alkaloids possess mixed agonist and antagonist properties at serotonin, dopamine, and adrenergic receptors [3,4]. The ergot alkaloids are divided into three classes: amine alkaloids,

amino acid alkaloids, and dihydrogenated amino acid alkaloids. Methylergonovine and ergonovine belong to the amine alkaloid class and possess relatively specific utero-tonic activity [1]. Currently, methylergonovine is the ergot most commonly used for post-partum uterine atony, though most early reports of neonatal ergotism were a result of ergonovine exposure [1,5–8]. Regardless, the clinical presentation of neonatal ergotism caused by methylergonovine and that caused by ergonovine are essentially identical.

Typical presentation includes respiratory depression or distress, cyanosis, pallor, decreased capillary refill, oliguria, and seizures [1,5–7,9–12]. Respiratory depression is the most common and immediately life-threatening manifestation, presenting in up to 55% of cases within six hours of intramuscular (IM) administration [1,9].

Management of neonatal ergotism is generally supportive. Particular attention is owed to the child's respiratory status. Some cases can be adequately treated with oxygen via nasal cannula, as in our case, whereas others require prolonged intubation and mechanical ventilation [1,10].

Several pharmacologic treatments have been described for neonatal ergotism, including naloxone, nitroprusside, midazolam, phenytoin, and phenobarbitone. Naloxone was selected for treatment given the relative structural similarity between morphine and methylergonovine and was reported to reverse the respiratory depression caused by ergots [11]. Bangh et al. describe the use of a nitroprusside infusion in a neonate who received 0.18 mg of IM methylergonovine with subsequent improvement in capillary refill and respiratory status, although these improvements were not described further [1]. Another case, reported in Aeby et al.'s review, received nitroprusside for treatment and ultimately was discharged in good health, but no specifics about the response to nitroprusside were discussed [10]. Dargaville and Campbell report five neonates treated with nitroprusside, two for hypertension and three for peripheral cyanosis. All patients had significant drops in blood pressure after administration, and several had the infusion temporarily stopped secondary to hypotension [8]. Phenobarbitone, midazolam, and phenytoin have been used to treat ergot-induced seizures [8,9]. In the case series of Bas et al., nine patients had seizures and all were given phenobarbitone with abatement of seizures by 48 hours in 7 patients and by 72 hours in the remaining 2 patients [9]. Dargaville and Campbell also report the use of all three of these agents in the treatment of ergot-induced seizures in multiple patients with minimal improvement [8].

Neonatal ergotism is a rare event, particularly in the United States. As previously mentioned, only two cases of parenteral ergot poisoning were reported to the California Poison Control System from 1997 to 2008. Since that time, only a single other case report of neonatal ergotism in the United States has been published to our knowledge [11].

Despite the paucity of recent cases, neonatal ergotism was first described in the medical literature as early as 1961 [1]. It is usually iatrogenic and due to the confusion of vitamin K with maternal ergot preparations with subsequent parenteral administration [1]. Because of the iatrogenic nature of this disease, attention is owed to minimizing it through further education and awareness. This is particularly important as this is not a benign disease process, and significant morbidity and mortality have been reported [1].

In order to prevent future exposures of this type, efforts must be made to minimize medication administration errors. Inpatient hospital errors are common, with medication errors being the most frequent type [13,14]. The use of a bar coding medication system is common in hospitals in the United States and has been shown to reduce errors [15]. However, errors can still occur with bar coding systems, especially when not used properly as was the situation in our case [16]. The nurse used the scanner after the medicine was administered. The error was not prevented by the scanner, but it did alert her that an error had been made. It is possible that in this case the medication misadministration might have gone undetected without the use of the scanner.

Various methods are available to measure ergot alkaloids. These are generally complex tests including gas and liquid chromatography coupled with ultraviolet or fluorescent detection, as well as liquid chromatography tandem mass spectrometry (LC-MS/MS), and are not available in real time to aid in diagnosis. More rapid, commercially available enzyme-linked immunoassays are available to test for ergot alkaloids; however, these are designed to test cereal grains or farm animals. Such assays are available for use on human tissues; however, they are designed to detect LSD and cross-reactivity with methylergonovine or ergot alkaloids (they have a similar structural backbone) used as uterotonics is unclear [17]. At this time, diagnosis of neonatal ergotism is based on history and the exclusion of other processes.

Besides the use of scanners, there are other strategies to reduce medication errors, including the use of color coding on labels and premixed medication solutions made by the manufacturer [18,19]. These can help reduce mislabeling errors and dosing errors. But if the label is not carefully read prior to administration, which is what occurred in our case, then medication administration errors are still possible [18,19].

In a hospital review of this incident, it became clear that the error occurred at both an individual and system-wide level.

While addressing human-level mistakes is important, and both personal and unit-wide education took place in the wake of this incident in order to reinforce the importance of existing policies, focusing only on the individual mistake is often ineffectual at preventing future errors [20]. Instead, changes need to occur at the systematic level. Given the extreme similarity of the vials for vitamin K and methylergonovine and the fact that they are often given in the same physical location and within several minutes of one another, the prime target for system-level change in this case is to address the packaging of the medications. In response to this incident, we have sent a letter to the United States Food and Drug Administration to lobby for packaging redesign in order to prevent this mistake from happening again in the future.

If an error is made, it is vital that it is disclosed to the patient's family immediately. Experts in bioethics advise that not only is there an ethical imperative for providers to disclose errors but also that simply sharing the information is not sufficient [21]. Providing a sincere, formal apology while expressing regret for the unanticipated outcome is necessary [22]. A sincere apology has been shown to confer psychological and physiological benefits to patients and their families by "subtracting insult from injury" [23–25]. In this case, both the physician and the nurse expressed regret to the family. The nurse left shortly after the incident, but on the following day the physician had a conference with the family to fully describe the error and how it happened. The infant's mother understood and accepted the situation readily, but the infant's father remained angry and upset for several days. After he had time to process the incident, he called and specifically asked to speak to the nurse to let her know that he had forgiven her.

Conclusions

Iatrogenic neonatal ergot poisoning occurred when the nurse administered ergot believing it to be vitamin K. As such, it is important to continue to highlight this disease in hopes of minimizing further exposure. Strict adherence to standardized procedures is mandatory for healthcare professionals, and repackaging of the medication in dissimilar containers should be required.

Conflict of interest

The authors declare no conflict of interest.

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