

Lethal Pediatric Hyponatremia Is Still a Threat

BY JEFF EVANS

The infrequent but potentially lethal problem of hyponatremia in hospitalized children can be prevented with safety checks, reminders, and education throughout various hospital areas, according to patient safety experts.

Two recent deaths of 6-year-old children who developed hyponatremia postoperatively illustrate how the lack of systems for preventing related errors and a lack of recognition of the condition continue to be a problem in hospitals.

Children who are recovering from surgery, taking certain medications, or fighting an acute illness such as meningitis that requires intravenous fluids may

have increased production of antidiuretic hormone (also called vasopressin), resulting in increased water retention. "It certainly speaks to all of the pediatric community that we be very careful with hypotonic intravenous fluids, especially D5W [dextrose 5% in water] and D5 quarter-normal saline," said Dr. Paul Hain, a pediatric hospitalist and associate chief of staff at the Monroe Carell Jr. Children's Hospital at Vanderbilt, Nashville, Tenn.

"Not only do we need systems redesign to help make it difficult to use these fluids inappropriately, but we also need physician education to make sure that folks understand the dangers of using these fluids in instances where they are not appropriate," Dr. Hain said in an interview.

In one of the two recently reported cases, a pharmacist incorrectly calculated an excessively high infusion rate of plain

D5W to give to a girl after outpatient tonsillectomy and adenoidectomy. Hyponatremic signs and symptoms—vomiting, lethargy, jerking movements, rigid extremities, and rolled-back eyes—were mistaken for a dystonic reaction to an antiemetic that had been administered, according to a report in a newsletter of the Institute for Safe Medication Practices (ISMP Medication Safety Alert! 2009 Aug. 13;14[16]).

Clinicians continued to follow the incorrect electronic medication administration record after the child vomited dark, bloody secretions. The patient's symptoms continued to worsen after she was admitted to a medical-surgical unit. A pediatrician who was consulted to manage the patient's seizures diagnosed hyponatremia and water intoxication. A lab study revealed a critically low sodium concentration of 107 mEq/L (the normal range is 135-147 mEq/L). The child later died of cerebral edema.

"Many hospitals, including my own, have taken the D5W and keep it only in the pharmacy, so it can't be readily accessed and can only be obtained by a physician's order that has to go all the way to the pharmacy and be checked," Dr. Hain said. Computerized order entry forms also could have been used to calculate the maintenance rate of saline infusion.

Dr. Shannon Phillips, the patient safety officer at the Cleveland Clinic, said that hypotonic intravenous fluids could be removed from the list of available options for pediatric patients in a computerized

order entry system. Alternatively, the order entry system could be set up to alert the prescriber and ask about the decision, referencing why hypotonic fluids or certain medications might be inappropriate. For additional layers of redundancy, alerts also could be sent to the pharmacist and the nurse who administers the fluid or medication.

Even when computerized order entry is not available, it's possible to develop care pathways and protocols for situations such as postoperative surgical care, said Dr. Phillips, a pediatric hospitalist at Cleveland Clinic Children's Hospital.

Protocols of this kind are equally helpful in large tertiary care centers such as the Cleveland Clinic and in community hospitals that have a small number of pediatric beds and medical teams primarily involved in adult care, she said in an interview.

The second case involved a boy on postoperative day 1 after surgery for coarctation of the aorta. He was prescribed furosemide for less-than-expected urine output despite having received several doses of ethacrynic acid (Edecrin). The next day, the boy was prescribed an infusion of sodium chloride for a low serum sodium level, but it is unclear if the infusion ever occurred because it was not documented in the patient's medication administration record.

The boy became less and less responsive, and despite repeated concerns expressed by his parents, nurses thought he was "simply sleeping soundly." New seizurelike activity—attributed by the nurses to the child to being fidgety from pain—and other symptoms of hyponatremia were not reported in a timely manner to the attending physician, who later recognized the problem during a routine assessment. By that point, it was

too late to prevent the child's death.

These cases also point to the benefits of safety systems such as "rapid-response teams that anyone in the medical care team, including the parents, can activate," and of having a group of hospitalists who are easily available for consultation, Dr. Hain said.

Studies that included children and adults have shown that within 1 week of surgery, more than 4% of all postoperative patients and 30% of patients treated in intensive care units develop clinically significant hyponatremia. ■



'We need systems redesign to help make it difficult to use these fluids inappropriately.'

DR. HAIN

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