

This scenario was based on a real case concerning nitrates in private well water. Instructions for accessing this case will be given at the end of this scenario.

Courtney Phillips was breastfed from birth with the addition of some formula supplement.

Courtney's mother, Cindy, noticed occasional blue coloring in the baby's nails and fingertips and decided to talk to her pediatric health care provider about the blue coloring at Courtney's next well baby visit.

After examining her, the doctor thought the color changing was acrocyanosis and determined that Courtney was normal.

As time passed, Courtney's mother was concerned that Courtney wasn't thriving and thought it was related to her breastfeeding. She began giving Courtney progressively more formula made with well water, the family's water source.

When Courtney was two months old, her mom went to her regular drugstore to pick up a prescription. While there, the pharmacist commented on Courtney's color.

Also at two months, Courtney developed progressively more severe vomiting and diarrhea. This prompted her mother to discontinue breastfeeding entirely and replace completely with formula feeding.

Courtney's condition quickly worsened.

At two and a half months Courtney dies.

Why?

The well water Mrs. Phillips was using to make formula for Courtney had levels of nitrates fifteen fold higher than the EPA safe standards. Although her older sibling and parents were also drinking the same water, Courtney was the only one who became ill. Many differences between infants and older children or adults contributed to this infant's special vulnerability.

In order to prevent similar circumstances, it's important to understand how nitrates are converted to nitrites in the body causing one to develop methemoglobinemia.

The situation includes:

A single food source. Progressively, as her mother shifted from nursing to only bottle feedings, Courtney had only a single food source - the formula. And concurrently a single source of water. The parents and her sibling drank juices, sodas, bottled water, as well as water at work and outside the home.

Match that with higher fluid intake for her body weight, which is typical of infants. The results are a much higher exposure to the nitrates.

In the GI tract nitrates are converted to nitrites by bacterial flora. In infants, there is a relative overgrowth of this flora related to a higher gastric pH. This results in a more efficient conversion of nitrates to nitrites which are absorbed and cause methemoglobinemia.

Courtney had a substantial proportion of fetal hemoglobin, which was more readily oxidized to methemoglobin, with reduced oxygen carrying capacity.

And the last difference is that the infant's ability to convert methemoglobinemia back to normal hemoglobin is also reduced. We all have an enzyme called methemoglobin reductase that converts methemoglobin back to normal hemoglobin, but in the infant, the activity of this enzyme is reduced compared to children and adults.

These factors work in concert to produce a unique susceptibility in infants less than four months of age.

We will discuss the unique vulnerabilities of children in the next section of this training.

Your Pediatric Environmental Health Toolkit contains guidance for your patients on nitrates and well water.

The real case for this scenario is located in the Environmental Health Perspectives Review article found on the links page at the end of this module section. The case is located in the article's references titled Methemoglobinemia: is it coming back to haunt us?

This concludes this scenario. Click on the next arrow located in the bottom right hand corner of this screen to proceed to the next screen in the training module.