

STRAIGHT TOX

Hyponatremia: A case in point for Paracelsus

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Whenever I give a presentation to students or other lay-persons about forensic toxicology I first explain that toxicology is the study of poisons and their effects. The next thing I discuss is “**What constitutes a poison?**” This question leads to a discussion of Paracelsus and his profound words: *“Alle Ding' sind Gift und nichts ohn' Gift; allein die Dosis macht, dass ein Ding kein Gift ist.”* If your German is rusty, as is mine: “All things are poison and nothing is without poison, only the dose permits something not to be poisonous.” Forensic Toxicologists, being men (and women) of few words, we often shorten this to “Dose alone makes the poison.” For the incredulous folks in my audience, I always demonstrate this point with a discussion of hyponatremia, sometimes referred to as water intoxication. Now I know that water is not a drug, but it can be a poison. The point that Paracelsus and I wish to make is: Water = Good. A lot of water = Bad.

This point was brought home rather tragically to a Sacramento, California radio station. KDND 107.9, rather ironically referred to as “The End”, due to the sound of their call letters, staged a contest in which the contestants were to see how much water they could drink without going to the bathroom. The winner of the contest was to receive a Nintendo Wii video game system, thus the name of the contest was “Hold Your Wee for a Wii.” One of the contestants, 28 year old Jennifer Strange, placed second in the contest. After leaving the radio station, Ms. Strange reportedly called the supervisor of her job and stated that she was on her way home and that “her head hurt really bad.” Jennifer Strange’s mother later found her daughter’s body at her home in the Sacramento suburb of Rancho Cordova. The coroner ruled the death due to hyponatremia.^{1,2} It was later reported that she had consumed almost two gallons of water.



Hyponatremia is the condition in which serum sodium levels drop to a point such that the cells of the body start to swell from osmotic absorption of the excess water in the system. Hyponatremia is usually brought about by excessive loss of sodium through sweating or by the intake of excess water or both. This condition may result in

nausea, abdominal cramping, vomiting, headache, edema, muscle weakness and/or tremor, paralysis, disorientation, slowed breathing, seizures, coma, and death. Hyponatremia most often occurs in babies, the elderly, people with heart and liver problems, and marathon runners. As a runner who is now training for a marathon, I can tell you that the prevailing advice in marathon training manuals is to avoid dehydration during the race by hyperhydrating prior to the race and drinking at most of the fluid stations along the way. These fluid stations are often at each mile along the 26.2 mile course. This intake is coupled with the fact that a large quantity of salt is lost through sweating during the run. Most of the marathon runners afflicted with hyponatremia tend to be inexperienced runners who enter races to raise money for charity. The condition, for unknown reasons, tends to effect women runners more than men.³ Furthermore, in at least one study of seven runners suffering from hyponatremia, all had a history of using NSAID's.⁴ (Editor's note: Those of us who run long distances on a regular basis can tell you that almost all runners have a history of NSAID use!)

By far the most dangerous cases of hyponatremia, however, are those cases that come from the deliberate drinking of large quantities of water during hazing or stunts. A quick check of the internet yields several cases of death or injury to young people in this respect. On March 12, 2003 Walter Dean Jennings died of hyponatremia after being forced to drink large quantities of water during a fraternity hazing ritual at Plattsburgh State University of New York.⁵ Braylon Curry was in critical condition for several days following a November 2003 fraternity hazing at Southern Methodist University where he was forced to drink an unknown amount of water.⁶ Twenty one year old Matt Carrington died in February 2005 as a result of a fraternity hazing at California State University Chico where members kept him up all night, ordering him to do pushups, splashing him with cold water and forcing him to drink gallons of water.

One further aspect of hyponatremia which is of particular interest to toxicologists is the connection between hyponatremia and MDMA use. Users of MDMA are often engaged in the "rave" scene in which the participants dance for hours, many times in clandestine venues without the benefit of air conditioning. The exertion and elevated temperature can lead to dehydration; many ravers have been cautioned to drink large amounts of water to avoid this. As a result, there have been sporadic reports, chiefly on the internet, of accidental hyponatremia in MDMA users. One well-documented case is that of Leah Betts of Latchingdon in Essex, England. Upon her 18th birthday, Ms. Betts and her friends celebrated by using a MDMA, several alcoholic drinks and marijuana. Ms. Betts had taken MDMA on three to four occasions previously. At some point Ms. Betts reportedly began to wonder if something was wrong and if she might be having a heatstroke, although she was at home with friends and not dancing. Ms. Betts reportedly consumed 7 liters, almost two gallons, of water resulting in hyponatremia and cerebral edema. Although she was taken to the hospital and placed on a ventilator, the resulting brain damage was irreversible and she was pronounced dead a few days later.^{8,9} It has been suggested by some that MDMA causes hyponatremia by inappropriate antidiuretic

hormone secretion.¹⁰ If this is true, then this would exacerbate the problem, but in the case of Ms. Betts the ingestion of a large quantity of water was clearly the major factor.

Paracelsus is right, the dose alone makes the poison. The majority of those killed or injured by hyponatremia are young people, who have heard of the dangers of acute ethanol poisoning, but in the hubris of youth, do not realize that they can be harmed by simply drinking water. Let's get the word out to those who will listen.

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