Hypernatraemia: balancing is challenging

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As internists we like to think of ourselves as physicians with knowledge of disturbances of the milieu intérieur. Indeed, other specialties often call us for help when they are confronted with fluid and electrolyte disorders. The unrivalled number one of your electrolyte consults will undoubtedly be hypernatraemia. For example, hypernatraemia may arise in the postoperative period due to the combination of inappropriate vasopressin release and hypotonic intravenous fluids. In fact, one of the first reports on acute hypernatraemia was in women undergoing elective surgery in whom the combination of postoperative vasopressin release and hypotonic fluids led to tragic neurological outcomes. It is quite striking to see that the physicians at that time did not link the neurological symptoms to acute hypernatraemia. Instead of immediately infusing hypertonic saline, they pursued additional diagnostic tests such as lumbar punctures, CT and MRI scans. These iatrogenic catastrophes have served as caveat that even simple infusion fluids may turn into deadly weapons when applied inappropriately.

Of note, even isotonic intravenous fluids can cause hypernatraemia, for example in the syndrome of inappropriate antidiuretic hormone secretion, although this is less common. Fortunately, based on cautionary tales like these, hypotonic intravenous fluids have largely been banned as maintenance fluids in adult medicine. Surprisingly, however, this has not been the case in paediatrics, where caloric intake rather than toxicity has traditionally dictated the composition of maintenance fluids. Maintenance intravenous fluids in sick children were therefore largely composed of glucose in half-normal saline (i.e., 5% dextrose in 0.45% NaCl). This type of intravenous fluids is hypotonic to begin with, but will become even more hypotonic when glucose is metabolised to carbon dioxide and water. These physiology-based suspicions were recently confirmed by solid evidence from a randomised and blinded clinical trial. Almost 700 acutely ill children who required maintenance intravenous fluids longer than six hours were randomised to receive half-normal saline or Plasma-lyte. Plasma-lyte is one of the new and commercially available balanced fluids with a sodium chloride concentration similar to plasma and the presence of buffers. Hypernatraemia and epileptic seizures were significantly more common in the hypotonic arm of the trial, although the latter outcome was only borderline significant. A recent review on intravenous maintenance fluids in the New England Journal of Medicine also focused on indications for maintenance intravenous fluids while preventing hypernatraemia. According to the algorithm presented in this review, Americans, unlike Europeans, still favour glucose in their maintenance fluids, but do so in 0.9% NaCl to prevent hypotonicity. We believe that the addition of glucose to intravenous fluids will only increase the risk of hyperglycaemia without offering substantial nutritional support, although large studies are lacking. Perhaps Americans prefer their intravenous fluids to resemble high-sugar soda beverages?

In contrast to hyponatraemia, hypernatraemia is less common. We expect that most of you will regard hypernatraemia as a simple clinical problem: uncompensated water loss. Treatment: just add water. Indeed, we are all familiar with nursing home residents who are admitted with a serum sodium of 170 mmol/l because fever secondary to a urinary tract infection has made them somnolent and even less capable to express thirst or reach the tap. However, in the intensive care, up to half of patients actually have a positive fluid balance during the development of hypernatraemia. This implies that, in these patients, hypernatraemia must be due to a positive sodium rather than a negative water balance. How can this be? Most studies that addressed this question identified factors that impair the urinary concentrating mechanisms, including acute kidney injury, loop diuretics, mannitol, hyperglycaemia, hypercalcaemia, or hypokalaemia. If the excretion of hypotonic urine is subsequently matched with isotonic intravenous fluids, hypernatraemia with a positive fluid balance may ensue. The article on hypernatraemia in this issue suggests that hypernatraemia due to a positive sodium balance is also occurring on our internal...
DISCLOSURES

None.

REFERENCES