Avoiding common problems associated with intravenous fluid therapy

Alexander D Franke

To the Editor: A recent review of medical textbooks found that the topic of intravenous fluid therapy is poorly covered.[1] Hence, the recent article by Hilton and colleagues provides interesting hypothetical examples of the risk of hypovolaemia and hypervolaemia, as well as imbalances in fluid tonicity, in patients receiving intravenous fluid therapy.[2] In particular, the authors recommend the use of intravenous 0.9% saline, as it is reportedly isotonic and hence avoids potential imbalances in serum sodium concentration.

However, Hilton and colleagues discuss only tonicity as the determining factor when selecting the type of fluid to give patients. They do not mention that 0.9% saline, also known as "normal" saline, distorts fluid, electrolyte and acid–base balance, despite being isotonic. In healthy subjects, 25% more volume is retained 6 hours after infusion of 2 L of 0.9% saline compared with 2 L of Hartmann's solution.[3] Infusion of 0.9% saline also results in hyperchloraemia, which decreases glomerular filtration rate, and is not seen with infusion of Hartmann's solution.[3]

Certainly, the most important side effect of 0.9% saline infusion is metabolic acidosis, caused (according to the Stewart approach) by a reduction in the strong ion difference.[4] Using the Stewart approach once again, Hartmann's solution is "balanced", ensuring the eradication of infusion-related metabolic acidosis.[4]

Although tonicity is important in considering the appropriate intravenous fluid therapy, it should not take precedence in the choice of therapy. Such an approach ignores the volume, electrolyte and acid–base disturbances induced by 0.9% saline infusions.

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1 Chawla G, Drummond GB. Textbook coverage of a common topic: fluid management of patients after surgery. *Med Educ* 2008; 42: 613-618.
2 Hilton AK, Pellegrino VA, Scheinkestel CD. Avoiding common problems associated with intravenous fluid therapy. *Med J Aust* 2008; 189: 509-513.
3 Awad S, Allison SP, Lobo DN. The history of 0.9% saline. *Clin Nutr* 2008; 27: 179-188.
4 Morgan TJ. The meaning of acid–base abnormalities in the intensive care unit: part III — effects of fluid administration. *Crit Care* 2005; 9: 204-211. ❑

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In reply: Franke presents some well known problems associated with intravenous administration of large volumes of 0.9% NaCl, particularly its relatively slow elimination (as compared with Hartmann's solution), and hyperchloraemic acidosis.[1] In isolation, we do not dispute these facts. However, 0.9% NaCl is not unique in having problems — no intravenous fluid therapy is without risk, especially when given in excessive volume, or when the composition is inappropriate for the patient's needs.

It is also important to distinguish maintenance therapy from resuscitation. For postoperative maintenance therapy, we advocate a conservative approach with initial use of minimal volumes of isotonic fluids, to decrease the risk of common complications such as postoperative fluid retention, impaired respiratory function, and prolonged bowel dysmotility. We encourage close monitoring of volume and electrolyte status, and do not exclude the later use of hypotonic fluids.[2]

Disorders of volume and tonicity (hypo- or hypernatraemia) are the most common serious problems associated with intravenous fluid therapy. The approach we recommend follows the priorities of the kidney: restoration of volume, restoration of tonicity, and restoration of acid–base balance, in that order. If the patient's requirements for fluid volume and tonicity are met, and tissue perfusion and gas exchange restored, then significant morbidity or death is unlikely to be a direct consequence of isolated 0.9% NaCl-induced hyperchloraemic acidosis.

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1 Awad S, Allison, SP, Lobo DN. The history of 0.9% saline. *Clin Nutr* 2008; 27: 179-188.
2 Hilton AK, Pellegrino VA, Scheinkestel CD. Avoiding common problems associated with intravenous fluid therapy. *Med J Aust* 2008; 189: 509-513. ❑