Intravenous fluids: the tale goes on

Intravenous fluid, along with supplementary oxygen, is arguably the commonest medical intervention for hospital inpatients, yet the prescribing practice is one of the most varied in existence. Like other medications, intravenous fluids have both beneficial and detrimental effects. However, the latter are frequently overlooked. Getting fluid administration wrong can have a lasting effect on patient health. In perioperative medicine, an evidence-based approach to fluid prescription reduces morbidity (Corcoran et al, 2012). In critically ill patients, this effect extends to a mortality signal (Perner et al, 2012). There has never been such an unsettled time in the tale of intravenous fluids, and the current speed at which evidence is appearing creates a challenge for clinicians to remain up to date with.

Concern with the use of hydroxyethyl starch

In May 2013, the National Clinical Guideline Centre, on behalf of the National Institute for Health and Care Excellence, released a draft of their guidelines titled 'Intravenous fluid therapy in adults in hospital' in an attempt to bring a calm to the storm (National Clinical Guideline Centre, 2013). Only a month after the release of this document, the use of hydroxyethyl starch, a commonly used colloid solution, was suspended in the UK by the Medicines and Healthcare products Regulatory Agency (Medicines and Healthcare products Regulatory Agency, 2013).

In October, a release from the European Medicines Agency's Pharmacovigilance Risk Assessment Committee decreed that: 'hydroxyethyl starch should no longer be used in patients with sepsis or burn injuries or in critically ill patients' but that 'hydroxyethyl starch could continue to be used in patients with hypovolaemia caused by acute blood loss where treatment with alternative infusions solutions known as "crystalloids" alone are not considered to be sufficient' (European Medicines Agency, 2013). Getting decisions such as these correct at a regulatory level is crucial to the wellbeing of patients receiving intravenous fluids. The implications of the latest in a series of large-scale studies looking at the effects of hydroxyethyl starch on outcome in critical illness, the Therapy in the Colloids Versus Crystalloids for the Resuscitation of the Critically Ill (CRISTAL) trial, are awaited (Annane et al, 2013).

Prescribing intravenous fluids

The decision-making process that should underlie the prescription of intravenous fluid is a more complex one than is commonly assumed. Intravenous fluid is often prescribed hurriedly, perhaps with less thought than it deserves, and often by the most junior clinicians in the hospital. A systematic approach to fluid prescribing is required if we are to reduce the iatrogenic harm associated with incorrect prescribing. Even experienced clinicians should contemplate a series of simple questions before any prescription:

- Is there a definite requirement for intravenous fluid?
- What type of fluid is required?
- How much fluid is required and how will I monitor this?
- When shall I stop giving intravenous fluids?

When there is a clear requirement for intravenous fluid it is then useful to clarify why, and categorizing this need can help decision making:

1. Essential maintenance of water and electrolyte requirements
2. Replacement of additional fluid and electrolyte losses (e.g. blood loss, excessive evaporation, dehydration, gastrointestinal losses)
3. Resuscitation of haemodynamic instability.

Additionally, fluid may be necessary to deliver intravenous drugs or additional electrolytes in some patients. These categories should be viewed as distinct requirements for which different fluid types may be necessary, using specific regimens for their titration. Simply prescribing one fluid in a variable volume according to a perceived need is inadequate; greater clarity and precision is required if we are to improve current standards of prescribing intravenous fluids.

Which fluid?

Which type of intravenous fluid to administer is perhaps associated with the greatest degree of controversy and a subject in which personal opinion frequently holds greater authority than currently available evidence. The type of fluid administered to a patient must be dictated by his or her discrete need at the time of prescription, and this need may change with time. Separate consideration should be given to water and electrolyte requirements; an initial assessment of both is necessary before prescription.

Crystalloid solutions (buffered and non-buffered) remain the fluid of choice for intravenous maintenance and replacement. However, the routine use of 0.9% saline has been questioned because of the dilutional metabolic acidosis and hyperchloraemia that they can induce (Morgan, 2005).

Balanced crystalloid solutions such as Ringer's lactate are now favoured, and solutions containing alternative metabolizable bases, such as acetate, are now available. The use of Plasma-Lyte, a balanced crystalloid containing acetate and gluconate, has been shown in a retrospective database analysis to be associated with less postoperative morbidity than 0.9% saline (Shaw et al, 2012). There may also still be a role for dextrose-containing solutions, which became unpopular following reports of dilutional hyponatraemia; they have the advantage of not overwhelming patients with excessive sodium (and chloride).

For a genuine resuscitation where a patient has identifiable haemodynamic compromise, the currently available evidence makes selecting the 'correct' fluid problematic. The age-old debate of crystalloid *vs* colloid is as heated today as it has ever been (Myburgh and Mythen, 2013). As we begin to understand more about the endothelial glycocalyx, the thin layer of glycoproteins and proteoglycans that lines blood vessels, and its role in fluid exchange within the microcirculation, the picture is likely to become clearer. Excessive intravenous fluid administration may damage the glycocalyx in such a way that membrane permeability may increase, leading to tissue oedema.

Use of human albumin solution

Suspension of use of hydroxyethyl starch, a fluid commonly used for resuscitation, by the Medicines and Healthcare products Regulatory Agency was based upon the findings of a number of recent trials and systematic reviews that showed no benefit over crystalloids and the possibility of harm (Perel et al, 2013). The latest Surviving Sepsis Campaign guidelines also advocate that patients should initially be resuscitated with a crystalloid and, if the desired response is not achieved, the next step should be human albumin solution (Dellinger et al, 2013). This represents a complete reversal of the advice that followed the 1998 Cochrane Injuries Group report that highlighted the possibility of increased harm when human albumin solution was given to critically ill patients. Despite the considerable amount of criticism that this report received, a dramatic reduction in the use of human albumin solution was reported in the UK following its publication (Roberts et al, 1999). Now human albumin solution may return to vogue 15 years after its public humiliation.

Conclusions

While the answer to what should be our first choice of intravenous fluid remains unclear, the recent focus on this subject has at least highlighted a number of situations where certain fluids should not be given. Patients have unique fluid requirements and, as with most other aspects of health care, an individualized approach to this important intervention should be used. Greater emphasis should be placed on the importance of understanding the physiology and evidence that underlies prescribing intravenous fluid from medical school to continuing practice development for consultants. Hospital level dissemination of evidence should be the responsibility of nominated leads that attend regular updates at a national level. It is likely that we shall see many more significant changes in this field, and implementation of best practice is the key to quality improvement in this and all other areas of health care. **BJHM**

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KEY POINTS

- Intravenous fluids can cause significant harm to patients if prescribed incorrectly.
- There is a rapidly changing evidence base that can be difficult for clinicians to keep up to speed with.
- Regulatory bodies around the world have voiced concern about the use of fluids containing hydroxyethyl starch, especially in critically ill patients.
- There needs to be a greater focus on training to ensure safe and evidence-based fluid prescribing.