Saline or Hartmann's solution: is it still a controversy?

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Anaesthetists and other clinicians have long debated the relative merits of using Hartmann's (or lactated Ringer's) solution instead of normal saline during operations. Until recently there have only been case reports that have highlighted the possibility of a 'dilutional acidosis' occurring when saline was used to replace massive blood loss. Anaesthetists' practice was based on the premise that:

1. Whichever fluid you used wouldn't make a difference
2. It makes sense to use Hartmann's if replacing blood with a synthetic fluid, as we may as well make it as similar to blood as we can.

However, several new studies suggest that use of saline may be associated with the development of a metabolic acidosis, a coagulopathy that can lead to greater use of blood products and poorer renal function.

HYPERCHLORAEMIC METABOLIC ACIDOSIS

A blinded crossover study where volunteers were given either 50 ml/kg Hartmann's or saline over 1 hour (Williams et al, 1999) (n=18) showed that saline infusion leads to a metabolic acidosis not seen with Hartmann's. In the study by Wilkes et al (2001), 47 elderly patients having major surgery were randomly allocated to one of two groups. Patients in the balanced fluid group received Hartmann's solution and 6% hetastarch in a formulation like Hartmann's (Hextend®, BioTime, Berkeley, California), while patients in the saline group were given saline and 6% hetastarch in saline (Hespan®, Abbott Laboratories, North Chicago, Illinois). Two-thirds of the patients in the saline group but none in the Hartmann's group developed postoperative hyperchloraemic metabolic acidosis (P=0.0001). Other studies have confirmed these findings.

While the consequences of this metabolic acidosis remain controversial, confusion between a hyperchloraemic metabolic acidosis and one resulting from end-organ hypoperfusion, cellular hypoxaemia and lactic acidosis may result in incorrect treatment. The patient may be given further boluses of saline containing colloids and/or inotropes in an attempt to maximize tissue perfusion. If the metabolic acidosis has resulted from saline-based fluids (including most colloids in the UK), the acidosis would be made worse, not better.

BLOOD PRODUCTS AND COAGULATION

In a study of patients undergoing surgery, Gan et al (1999) (n=120) gave one group Hespan® and the other Hextend®: the Hextend group had less blood loss than the Hespan patients. Similarly, Waters et al (2001) (n=66) gave patients undergoing abdominal aortic aneurysm repair either saline or Hartmann's solution – the saline group received significantly more blood products (P=0.02).

RENAL FUNCTION

One study, published in abstract form (Bennett-Guerrero et al, 2001) (n=200), randomized cardiac surgical patients to receive either saline- or Hartmann's-based fluids and found all indices of renal function were worse in the saline-based groups. Interestingly all 6 patients requiring postoperative haemodialysis had received saline. Williams et al (1999) found that the time to first urination was longer with saline compared with Hartmann's. Other studies have found a non-significant trend to more urine formation in the Hartmann's group, consistent with both thromboelastography ex-vivo data and animal models.

In all, these studies suggest that use of saline-based fluids is associated with a hyperchloraemic metabolic acidosis and haemostatic defects. While more clinical work is needed to evaluate the significance of these findings, for the time being, in most clinical scenarios, balanced solutions such as Hartmann's solution should be used in preference to saline-based fluids. HM

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