RCP Ten Top Tips for Intravenous Fluid Administration

Introduction

Assessment of daily fluid requirements and subsequent prescription and administration are essential daily tasks on most medical or surgical wards. They are complex tasks and require considerable clinical acumen. Unfortunately both under and over hydration, with significant associated morbidity and mortality, are common due to poor understanding of the basic principles of fluid management. Although well recognised by senior medical staff, the extent of the problem is difficult to quantify as it is often multifactorial and under-reported. Postoperatively, over hydration occurs in between 17-54% of patients and prolongs hospital stay, increases morbidity (e.g. pulmonary oedema) and has been estimated to contribute to about 9000 deaths annually in the USA. In addition, up to 50% of elderly patients have been documented to develop at least one fluid-related complication related to post-operative over hydration.

Key practical points

1. Determine whether an intravenous route for fluid administration is required (e.g. coma). When possible oral (or in some cases nasogastric) fluid administration is preferable.

2. Intravenous fluid administration should follow a thorough clinical assessment including biochemical and fluid balance review (e.g. input/output measurement, weight)

3. Intravenous fluid and/or electrolyte administration must be supervised by a senior clinician as inadequate or excessive therapy is associated with excess morbidity and mortality.

4. There are three main intravenous fluid regimens: (a) resuscitation; (b) maintenance or (c) maintenance with correction for complex on-going losses or fluid and electrolyte imbalance.

5. Fluid resuscitation regimens aim to restore haemodynamic stability and maintain tissue perfusion due to excessive fluid losses (e.g. haemorrhage, burns) or critical illness (e.g. sepsis, trauma).

6. Maintenance fluid regimens aim to replace the normal daily fluid and electrolyte losses including 25-35mls/kg of water and ~1mmol/kg NaCl and KCl.

7. Fluid regimes that address complex on-going fluid and electrolyte losses and correct previous fluid/electrolyte imbalance should be determined from measured fluid inputs/outputs and biochemical assessment of serum or 'lost' fluids. The normal fluid maintenance regime should be corrected for the additional (or reduced) fluid and electrolyte requirements.

8. Large volume fluid resuscitation is often associated with excessive electrolyte administration and may have physiological consequences (e.g. hyperchloraemic acidosis) or cause complications (e.g. pulmonary oedema, acute kidney injury).

9. Resuscitation to haemodynamic stability may be achieved with lower volumes of colloid, as compared to crystalloid fluids; but has no clear morbidity/mortality benefits.

10. Stop intravenous fluids as soon as oral (or nasogastric) intake is possible or when the patient is haemodynamically stable, to reduce associated complications (e.g. line sepsis)

RCP Top 10 tips for Intravenous Fluid Administration – Long version

1. Confirm that an intravenous route for fluid administration is required (e.g. coma, resuscitation). Whenever possible oral (and in some cases nasogastric) fluid administration is preferable as it reduces the complications associated with intravenous catheters including line sepsis, blood vessel trauma and extravascular fluid and electrolyte leakage with associated tissue damage (e.g. tissue necrosis due to high concentration potassium infusions).

2. All prescriptions for intravenous fluid administration should follow a thorough clinical assessment of the daily needs of an individual patient. Clinical assessment should include review of hourly fluid input (including feed), output (e.g. urine output, nasogastric drainage, diarrhoea), circulatory monitoring and daily measurements of serum (and occasionally urinary) electrolytes. This is particularly important in those with renal impairment, requiring on-going resuscitation, correction of complex ongoing fluid/electrolyte losses (e.g. ileal fistulae) or previously deranged fluid and electrolyte balance (e.g. post-resuscitation).

3. Assessment of fluid balance and subsequent fluid prescription is a complex and difficult task. It should not be delegated to the most junior member of the medical team. Intravenous fluid and/or electrolyte administration should always be supervised by a senior clinician to reduce associated morbidity and mortality.

4. There are three principle intravenous fluid regimens: (a) resuscitation; (b) maintenance and (c) maintenance with correction for complex on-going fluid/electrolyte losses (e.g. high or low ileal fistulae) or previous imbalance (e.g. excessive fluid and electrolyte administration during resuscitation).

   These regimes aim to achieve the principle goals of fluid administration, which are to:
   - Replace normal fluid and electrolyte losses
   - Replenish substantial deficits or ongoing losses
   - Provide additional resuscitation fluids to correct for the effects of underlying pathology
   - Maintain an adequate circulation to satisfy basic metabolic requirements
   - Aid temperature regulation (e.g. sweating)
   - Ensure removal of body waste (e.g. metabolic acids)
   - Ensure a stable cellular milieu to preserve normal cellular function
   - Avoid damaging oedema or dehydration.

5. Fluid resuscitation regimens aim to restore haemodynamic stability and maintain tissue perfusion following excessive fluid loss (e.g. haemorrhage, burns) or critical illness (e.g. sepsis, trauma). Although, to some extent, the fluid volume and electrolyte loads are a secondary consideration during resuscitation, subsequent correction of the resulting fluid and electrolyte imbalance will be required.

6. Maintenance fluid regimens aim to replace the normal daily fluid and electrolyte losses which are normally about 1.5-2.5 litres of water (25-35mls/kg/day), 70-150mmol NaCl (1-2mmol/kg/day) and 40-80mmol KCl (1mmol/kg/day).

7. On-going fluid and electrolyte losses (e.g. high output ileal fistulae, polyuric phase of acute kidney injury) and correction of previous fluid/electrolyte imbalance (e.g. post resuscitation) should be determined from measured fluid outputs and biochemical assessment of serum (and occasionally urine) and 'lost' fluids (e.g. ileal fistula output). The additional (or reduced) fluid requirements should be added to, or removed from, the normal daily maintenance requirements and electrolyte administration adjusted for the associated electrolyte imbalance.

8. Large volume fluid resuscitation is often associated with excessive electrolyte administration and associated physiological consequences (e.g. hyperchloraemic acidosis) and potential complications (e.g. pulmonary oedema, acute kidney injury).

9. It is generally believed that resuscitation to haemodynamic stability may be achieved with lower volumes of colloid, compared to crystalloid fluids. However, there is no evidence that colloid fluid resuscitation has any benefit on morbidity or mortality outcomes, is more expensive and may be associated with potential complications (e.g. allergy with gelatins, acute kidney injury with starches). Crystalloid fluids are therefore recommended as first line therapy for fluid resuscitation.

10. Stop intravenous fluid administration as soon as oral (or in some cases nasogastric) intake is possible, or when the patient is haemodynamically stable, to reduce associated complications (e.g. line sepsis).

Key references

1. NICE Intravenous fluid guideline (December 2013)
2. Powell-Tuck Jeremy, Gosling P, Lobo DN et al. British consensus guidelines on intravenous fluid therapy for adult surgical patients. www.bapen.org.uk/pdfs/bapen_pubs/giftasup.pdf
3. Callum KG, Gray AJG, Hoile RW, Ingram GS, Martin IC, Sherry KM, Whimster F. Extremes of age: The 1999 report of the national confidential enquiry into perioperative deaths. London, 1999.
4. Walsh SR, Walch CJ. Intravenous fluid associated morbidity in postoperative patients. Ann R Coll Surg Engl 2005;87:126-130.

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