Equine Fluid Therapy and Intensive Care

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Fluid therapy is a life saving measure which forms an integral part of equine critical care especially in any condition that can lead to shock, including colic, diarrhoea, trauma, blood loss and severe infections. It is vital to determine when fluid therapy is indicated and what options you have to formulate a fluid plan which is both beneficial to the patient and financially viable for the owner.

Physiology

The body of an adult horse contains about 60% water which is divided into the extracellular (1/3) and intracellular spaces (2/3). In neonates the percentage of body weight made up of water is even higher (75-85%). The intravascular space only makes up 5% - 8 % of the horse's body weight (10% - 15% in foals). By 12 weeks of age the foal's water distribution more closely resembles the adult. Potassium and magnesium high intracellularly while sodium, chloride and bicarbonate are higher in the extracellular fluid (95% of the body's sodium). Low calcium and magnesium are common in horses with surgical colic or colitis.

1. Creating a fluid plan

Reasons for intravenous fluid administration

1. Treat hypovolemia
2. Hydration support
3. To correct acid base or electrolyte abnormalities

Are fluids required?

- History eg. Foal caught under fence for hours
- Physical examination - heart rate, mucous membranes, capillary refill time, skin turgor, temperature of the distal extremities and urine output. Laboratory assessment includes PCV/TP, creatinine, lactate and USG.

What route to use?

Intravenous vs. Enteral?
Intermittent or continuous?
Intravenous route typically used in patients with shock or blood loss for rapid volume expansion and stabilization while the enteral route is reserved for horses that have a functioning gastrointestinal tract and are systemically stable.

What fluids are needed?

Crystalloid fluids – most widely used for resuscitation because readily available, inexpensive and associated with less adverse reactions. Balanced ionic solutions such as Ringers lactate solution and Hartmanns are commonly used. Crystalloids are distributed to entire the extracellular fluid compartment within minutes which has a volume three times that of blood. Large volumes are therefore required for effective volume expansion.

Hypertonic saline - 7.2% saline. Expands vascular volume by redistribution of fluid from the interstitium and intracellular spaces. Each litre of hypertonic saline expands the blood

volume by approx 4.5L. Duration of effect short (1hr). Dosage 4ml/kg or 2l per 500kg horse as fast as possible. Must be followed by shock dose fluids.

Colloids – contain large molecules which are retained within the circulating blood stream eg. Plasma, hetastarch, dextrans. Disadvantages of expense and risk of adverse reactions. Redistribute to extracellular fluid compartment at much slower rate than crystalloids. Each litre expands volume by additional litre thereby increasing total fluid expansion by 2l. Dosage 10ml/kg or 5L per 500kg horse.

Fluid plan

- **Resuscitation**

Body weight (kg) x estimated dehydration (%) = volume of fluid to be administered (L)

What rate to use?
Foals - Fluid boluses of 20ml/kg over 10-20 min with re-evaluation of perfusion after each bolus can be used (Palmer,2004)
Adults - Fluid replacement - 10-20ml/kg/hr. Shock dose rate of 60-90 ml/kg or 35-45l per 500kg horse in first hour, therefore can only be done with pressure bags and pump. Rates up to 20-45ml/kg/hr tolerated well in adults (Seahorn and Seahorn,2003).It has been shown in dogs that a normal cardiovascular system tolerates up to 360ml/kg/hr with few ill effects – equals volume of 180l in an hour to a horse (Rose,1981) Maintain 10ml/kg/hr until calculated deficit reached then reassess and formulate plan. Rate of admin plasma – 2-4ml/kg/h (Seahorn and Seahorn, 2003)

How much to give?
Successful therapy results in improved pulse quality, warm extremities, low core to peripheral temperature gradient, return of gastrointestinal sounds, urine production, improved mental status and improved blood pressure. Return of adequate perfusion may take up to 200ml/kg during the first 1-2 hours of treatment.Laboratory assessment every 4-6 hours initially. Once stable- only need monitoring by means of laboratory every 12-24 hours (Seahorn and Seahorn, 2003)

- **Maintenance**

Use saline or a balanced electrolyte fluid, then add required electrolytes. Saline is typically reserved for patients with a sodium level less than 125mEq/l, in disease states such as high potassium, HYPP or renal failure. Long term fluids- need to add potassium, magnesium and calcium for maintenance.

Foals – up to 100ml/kg/day
Adults – 60ml/kg/day or 2ml/kg/hr

- **Ongoing losses**

Ongoing losses are typically estimated while the patient is monitored by means of PCV, lactate, heart rate, TP and blood gases.

2. Administering fluids

Oral administration – nasogastric tube or enteral feeding tube connected to fluid line.

Intravenous administration – intravenous catheters.

- Factors to consider in selecting the appropriate catheter: duration of action, desired rate, fluid viscosity, severity of signs and size of animal. Rate of flow directly proportional to diameter of catheter and inversely proportional to the length and viscosity of fluid.
- Sites – jugular, cephalic, lateral thoracic vein, saphenous.

- Materials - Teflon catheters must be changed every 3 days, while polyurethane catheters can last up to 2 weeks (Hardy, 2012)

3. Electrolyte supplementation

Calcium supplementation
Add 50-100ml 23% calcium gluconate to every 5L bag. Usually suffient to maintain normocalcaemia. In severe hyocalcaemia levels up to 500ml in 5L BES may be indicated. Refractory cases of hypocalcaemia may need magnesium supplementation (Hardy, 2012). Increase or decrease in plasma pH of 0.1U increases or decreases protein bound calcium by 0.12mg/dl (Seahorn and Seahorn, 2003).

Magnesium supplementation
Magnesium maintenance requirements –150mg/kg/day of magnesium sulphate (0.3ml/kg of a 50% solution provides daily requirement (Hardy,2012)

Potassium supplementation
No more than 0.5mEq/kg/hr. Practical - 20meq of potassium in form of potassium chloride per litre fluids (Hardy,2012)

Glucose supplementation
Hyperlipaemia and pregnant mares, needs to be given at 1-2mg/kg/min if used as a source of energy.

Neonates - Glucose used as form of energy supply. May be mobilizing faster than utilizing. Compromised neonates can have reduced utilization because of delayed insulin response and continued glucogenesis, or stress gluconeogenesis. SIRS can lead to hypermetabolism resulting in low glucose.

4. Protein support

When total protein less than 40mg/dl or albumin less than 20mg/dl. Plasma or alternative colloid. Colloids- use of hydroxyethyl starch increased colloid oncotic pressure for up to 6 hours, significant difference for up to 24 hours (Jones,2001)

5. Impactions

Oral vs. Intravenous therapy. Oral fluids have many advantages – direct to GI tract, reduced expense, lower accuracy required and stimulate colonic motility. Disadvantages – increased abdominal pain noted with large volumes, not an option if horse is refluxing.

Enteral fluids – 5.27g NaCl, 0.37g KCl and 3.78g sodium bicarbonate per litre

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