

Fluid Therapy for Adult Horses with Gastro-Intestinal Disease

ACVIM 2008

Gayle D. Hallowell, MA, VetMB, CertVA, DACVIM, MRCVS
Leicestershire, England

Problems Faced by the Colic Patient

1. Tachycardia primarily due to hypovolemia (lack of circulating volume in the intravascular space)
2. Hypovolemia
3. Endotoxemia or bacteremia
4. Acid-base and electrolyte disturbances

Approach to the Equine Patient with Signs of Colic

1. Perform a major body system assessment--this should only take a few minutes:
 - a. Assess mucous membrane colour and capillary refill time
 - b. Assess pulse quality
 - c. Assess heart rate and rhythm
 - d. Assess gastro-intestinal borborygmi
 - e. Temperature and extremities
2. Assess degree of hemoconcentration using packed cell volume (PCV) and total solids (TS). This is **not** always a reliable indicator on how hypovolemic an animal is however. Animals that have compromised intestine or peritonitis can have normal or low protein and still be hypovolemic and animals that have been bleeding may have low or normal PCV and TP and again be hypovolemic.
3. If available, measure acid-base, electrolytes and lactate. Lactate is produced in tissues that are producing energy anaerobically--i.e., not receiving enough oxygen or 'fuel'. In colic patients, this is usually due to a combination of hypovolemia and endotoxemia. The lactate concentration measured in the blood often underestimates the true increase, as it stays within the cells and capillaries until tissue perfusion is corrected. Usually colic patients have a metabolic acidosis, primarily due to increased blood lactate concentrations, sometimes accompanied by a respiratory alkalosis (often related to an increased respiratory rate due to pain). The most common electrolyte abnormalities seen in surgical colic patients are hypokalemia and hypomagnesemia. A small proportion of very sick colics are hypocalcemic also--there is some evidence however that we should not supplement calcium in these patients.¹⁻⁴ Horses with diarrhea often have decreased sodium and increased chloride concentrations. Creatinine concentrations may be increased in some colic patients. Often this is due to pre-renal failure--i.e., their kidneys are not being effectively perfused because they are hypovolemic--you could confirm this by collecting some urine before administering fluid therapy and it should be concentrated (SG >1.025), whereas horses with renal disease generally have isosthenuric urine (SG 1.008-1.012). Ongoing endotoxemia can lead to intrinsic renal disease.

How to Decide if a Colic Patient Requires Intravenous Fluids?

Intravenous fluid therapy is not required in every colic patient and is not without its drawbacks. These include thrombophlebitis, cost and development of electrolyte abnormalities. There is evidence that horses with pelvic flexure impactions should be treated with oral rather than intravenous fluids if they are not hypovolemic^{5,6} (Hallowell, in press). Although horses with spasmodic colic are often very painful, they are very rarely hypovolemic in the early stages.

Each patient should be assessed based upon what has been found on the major body system assessment. I believe catheters should be inserted and intravenous fluids administered if:

1. Mucous membranes are tacky and/or toxæmic and/or capillary refill time prolonged (more than 2 seconds)
2. Heart rate increased (? greater than 44 to 48 beats per minute if fits with other findings)
3. Decreased pulse quality
4. Increased skin tent (although this can be unreliable--eyelid best)
5. Packed cell volume greater than 40-45% (depending on the breed) and total solids greater than 75 g/L
6. Lactate concentrations > 2 mmol/L
7. Increased creatinine concentrations

What To Do Next

1. Place a jugular catheter aseptically. If you have decided that the horse needs intravenous fluids, make sure that you place an appropriately sized catheter. Practically, **12G catheters** are probably best; sometimes two catheters are required.
2. Now decide if the horse requires colloids or just crystalloids.

Pentastarch/hetastarch is an artificial colloid that can be given relatively rapidly to increase intravascular volume. Initially should be given at 4 ml/Kg (2 litres for a 500 Kg horse) and then followed (or be given concurrently) with crystalloids. It is quite expensive, but effective.^{7,8} It is quite viscous and administration using a pressure bag allows it to be administered more quickly.

Alternatively hypertonic saline can be administered (also at ~4 ml/kg). This acts like a colloid in that it draws fluid into the intravascular space from the tissues. This **must** be followed with crystalloids in order to replenish the fluid removed from the tissues. It does not appear to last as long as pentastarch/hetastarch in clinical patients.⁷

The crystalloids normally administered to colic patients are lactated Ringers' solution or Hartmann's (as they come in 5 litre bags). These are resuscitation fluids, so although they are commonly administered post-surgery as maintenance fluids, it should be remembered that they will cause electrolyte disturbances (especially hypokalemia and hypomagnesemia when horses aren't eating). An alternative to try and produce maintenance fluids would be to administer half 5% dextrose and half lactated Ringers (see table below)

So in hypovolemic colic patients, I would administer:

1. 4 ml/kg of pentastarch/hetastarch and/or hypertonic saline, followed by
2. 20 ml/kg of lactated Ringer's solution as a bolus (10 L to a 500 Kg horse). I would supplement fluids with potassium (20 ml of 13 mEq/5ml vial added to each 5 L bag of lactated Ringer's) and magnesium (10 ml of 20% MgSO₄

added to each bag of Hartmann's) if they were low at admission.

At this stage the body system assessment should be repeated. If parameters had significantly improved, the fluid rate should be decreased as appropriate (usually to 5 ml/kg/ hr) or take the horse to surgery. If parameters are still abnormal, then administration of a further 20 ml/kg lactated Ringer's solution as a bolus, if time allowed and then re-assess.

Fluids in the Post-Operative Period

To decide on fluid rates in the post-operative period, repeat the major body system assessment and ideally PCV, TS, lactate concentrations and electrolytes. Some horses need a further bolus of crystalloids, whereas others can receive lower fluid rates of 3.75-5 ml/kg/hr. Some horses post-surgery, due to the degree of bowel compromise are hypoproteinemic and need plasma (or may benefit from plasma if endotoxemic even if their protein is normal). Occasionally further colloids are needed in the post-operative period (should not exceed 10 ml/kg/day pentastarch/hetastarch ideally). I would also supplement fluids with potassium and magnesium if they were low in the post-operative period or use home-made or commercial maintenance fluids. These electrolytes generally don't remain in the normal reference range without supplementation until feed is re-introduced.

Oral Fluid Therapy

There is evidence to suggest that the use of oral fluid therapy for the treatment of impactions may be more appropriate either on its own or in conjunction with intravenous fluids rather than intravenous fluids. It has been widely accepted that for intravenous fluid therapy to be effective at rehydrating colonic contents, a state of systemic overhydration is required; this state, combined with oral magnesium sulphate, which increases intraluminal osmolarity is thought to further promote ingesta hydration.^{9,10} This overhydration with intravenous fluid therapy has been shown to cause electrolyte derangements, haemodilution and excessive urination.⁵ There are various protocols that have been suggested. The author uses 1g/kg MgSO₄ initially in 6-8 L of water for a 1200lb horse followed by isotonic fluids made using NaCl granules and Lo Salt™. If 23ml of each (measured out in a syringe) are added to 6L of water the fluid is approximately isotonic. Six litres can then be administered from 0.5-2 hourly for 5 administrations. Thus can be repeated 8 hours later if required. Hourly administration appeared to offer the fastest resolution of simple large colonic impactions with fewest adverse effects (Hallowell, in press).

Fluid Therapy: PCV/TS and Reflux Volume

There is a trend to re-assess changes in fluid rate based upon PCV and TS rather than on major body system assessment findings. Firstly lactate concentrations and urine output are a much better assessment of tissue/organ perfusion in conjunction with physical examinations and the use of PCV/TS is totally inappropriate in cases which have hypoproteinemia; these animals require plasma and frequently more fluids not less. Another misconception is that reflux volume will be reduced if the fluid rate is reduced: this does in fact happen, but is detrimental to the cardiovascular and gastro-intestinal systems ultimately..... the reflux becomes more viscous and the animal hypovolemic--lactate concentrations increase first followed by heart rate, PCV and TS--this ultimately leads to a reduction in gut perfusion, which will worsen **not** improve gastro-intestinal motility.

Bicarbonate

There are many different opinions on the use of bicarbonate in patients with colic. The use of bicarbonate is contra-indicated in horses with lactic acidosis, but can be extremely useful for correction of low sodium as long as it is not done at too rapid a rate as can cause marked edema including in the brain. "The kidney is smarter than the smartest internist as long as it is effectively perfused"--I have

found this statement extremely true regarding the ability to manage acid-base balance in colic patients and physiologically the body can cope with acidosis far better than alkalosis. Formulae are available in various texts and are beyond the scope of these notes.

Parenteral Nutrition

Colics that have food withheld for greater than 72 hours should have bloodwork performed to check that they are not hyperlipidemic or hyperlipemic. A full discussion of this topic is beyond the scope of the lecture, but it should be noted that if energy supplementation is required in these patients either 50% glucose or partial or total parenteral nutrition. 5% dextrose provides free water, but such large quantities are required if an acceptable number of calories are administered that SEVERE electrolyte and acid-base disturbances will result. Thus 5% dextrose should only be used in these patients to reduce sodium administration/ provide free water. Always calculate what the energy requirements of a sick patient may be and what you are actually administering.

References

1. Malcolm DS, Zaloga GP, Holaday JW. *Crit Care Med* 1989;17:900-903.
2. Zaloga GP. *Crit Care Med* 1992;20:251-262.
3. hernow B, Zaloga G, McFadden E, et al. *Crit Care Med* 1982;10:848-851.
4. Todd JC, 3rd, Mollitt DL. *Crit Care Med* 1995;23:459-465.
5. Lopes MA, Walker BL, White NA, 2nd, et al. *T Equine Vet J* 2002;34:505-509.
6. Lopes MA, White NA, 2nd, Donaldson L, et al. *Am J Vet Res* 2004;65:695-704.
7. Hallowell GD, Corley KT. *J Vet Intern Med* 2006;20:980-986.
8. Pantaleon LG, Furr MO, McKenzie HC, 2nd, et al. *J Vet Intern Med* 2006;20:1422-1428.
9. White NA, 2nd, Dabareiner RM. *Vet Clin North Am Equine Pract* 1997;13:243-259.
10. Freeman DE, Ferrante PL, Palmer JE. *Am J Vet Res* 1992;53:1347-1353.

SPEAKER INFORMATION

(click the speaker's name to view other papers and abstracts submitted by this speaker)

Gayle Hallowell, MA, VetMB, CertVA, DACVIM, MRCVS
(/apputil/content/defaultadv1.aspx?pid=11262&authorId=13313)
Shepshed, Leicestershire, United Kingdom

URL: <https://www.vin.com/doc/?id=3866124> (<https://www.vin.com/doc/?id=3866124>).