EQUINE ON-FARM FLUID THERAPY

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INTRODUCTION

Fluid therapy in horses is a critical therapeutic component for many clinical diseases that veterinarians face daily. Administering fluid therapy in a field setting can be a challenge for patient, client, financial, and logistical reasons; however, it can be a valuable service that can significantly improve clinical outcome. Whether you identify enteral or intravenous fluid therapy (IVFT), or a combination of both, as the most clinically appropriate delivery method for the patient, performing on-farm fluid therapy is worth overcoming the challenges.

Fluid therapy on the farm is frequently met with a number of roadblocks that include cost (particularly for IVFT), equipment (e.g., for IVFT, having an adequate amount of fluids in your vehicle, catheter supplies delivery lines, ability to hang bags), personnel to monitor the horse and to ensure safe delivery of either enteral fluid therapy (EFT) or IVFT, time in the day for the veterinarian to be reassessing the horse appropriately, and others. Overcoming these roadblocks is not always easy, but some can be eliminated through thoughtful planning of the fluid therapy to maximize the clinical outcome while simultaneously meeting the needs of the patient, client, and veterinarian's time. Ultimately, it is the author's opinion that knowing your options and

developing a thoughtful fluid therapy plan with the patient, client, and your time in mind, makes on-farm fluid possible and effective.

DEVELOPING A FLUID THERAPY PLAN

Common indications for administration of fluids on the farm include dehydration, heat exhaustion, esophageal obstruction, any gastrointestinal disease, hemorrhage, dysphagia, and many others. Of course, there are many other indications for fluid therapy that may be associated with referral to a hospital; however, the reality of ambulatory practice-life is that referral is not always an option for clients, so more aggressive or prolonged therapy may need to be delivered to the horse on the farm.

The goals of fluid administration include restoration and maintenance of hydration (this is far and away the most common reason for fluid therapy in the field setting), correction of electrolyte and acid/base abnormalities, diuresis and minimizing adverse effects of nephrotoxic drugs/toxic metabolic by-products, improvement of cardiovascular parameters, *et cetera*. In practice, the author considers this list of goals, identifies the primary goal of fluid therapy in the patient and then assesses the following steps to solidify a fluid treatment plan: volume, type, route, rate, and reassessment. Lastly, after creating the plan, modifications are considered to account for the owner's budget, patient compliance, ability of personnel to monitor, duration that therapy is needed, and logistics to ensure it is feasible.

Volume

The author considers the first step in creating a plan to be identifying the volume needed to meet

the goal (e.g., restore and/or maintain hydration) as the volume to be delivered will impact the type given, the route of administration, and whether or not it can be accomplished in a reasonable time frame. When determining the volume, the veterinarian must consider the volume to restore hydration, to account of maintenance needs, and to account of ongoing losses. Performing the calculations is critical to ensure that the patient is not fluid overloaded (particularly in a foal) or given an inadequate amount. In the author's experience, fluid overloading an adult horse that has normal cardiopulmonary and renal function is difficult to do; however, fluid overloading a foal is valid concern as it is much easier to give too much. Similarly, when considering a sick, dehydrated patient, being able to give any amount of fluids in the field is likely better than giving none; however, the author finds this to be a common area where fluid therapy protocols could be improved to ensure that the horse is receiving a significant amount to meet the calculated, clinical goal. For example, if a 500 kg, 5% dehydrated horse needs 55 liters of intravenous fluid therapy to ensure restoration and maintenance of hydration, giving 5 liters is better than no fluid, but giving at least the deficit of 25 liters is going to make a much more significant clinical impact.

The maintenance fluid requirement for adult horses is approximately 60 mL/kg/day. This accounts for intake and urinary, fecal, and metabolic water loss. NOTE: this maintenance requirement reflects what the horse needs to drink each day to stay euhydrated, so it is the same rate used when developing a plan for IVFT or EFT. Maintenance rates are increased for neonatal patients, mares that are lactating, or horses in heavy work in hot/humid weather conditions. Calculating the maintenance rate for a 500 kg horse: (60 mL) x (500 kg) = 30,000 mL or 30 L per day. Dehydration is a reflection of the percentage of body weight lost due to fluid loss. This

loss of fluid needs to be replaced if the horse will not or cannot replace it on its own. Dehydration is assessed by the physical examination/patient's perfusion parameters (Table 1). Dehydration of less than 5% is not clinically detectable and dehydration of greater than 15% is not compatible with life. Calculating the volume for restoration of 10% dehydration in a 500 kg horse is based on multiplying the body weight in kilograms times the % dehydration: (500 kg) x (10 %) = 50 L. Estimating/assessing ongoing losses is centered on considering the clinical conditions rather than the inconsequential losses (feces, urine, sweat, and condensation of breathing). NOTE: these losses from normal biological processes are accounted for by the animal's daily maintenance fluid needs. SO, these insensible losses are not factored into the fluid plan IF the animal has normal consistency to the feces, normal volume of urine, or is not sweating profusely. Most commonly, ongoing losses that need to be factored into the fluid plan are associated with the presence of large volumes of diarrhea or enterogastric reflux, loss of fluid into a third space as with peritoneal or pleural effusion, or loss of fluid in the form of hemorrhage or polyuria. Volumes of enterogastric reflux can be quantified and replaced (e.g., if a horse is losing 4 liters of reflux every 3 hours, then 32 L of fluid would need to be accounted for in the daily fluid plan). Volumes of diarrhea must be observed and estimated. If pleural or peritoneal fluid is drained from the body cavity, that volume can also be accounted for in the daily fluid plan.

Once you have assessed the patient and calculated the volume required for maintenance, restoration of hydration, and ongoing losses, these volumes are added together and used during a 24-hour treatment period typically; however, this can be modified for the period you plan to be on the farm. In the example of a 500 kg horse that is 10% dehydrated and is losing

approximately 4 liters of reflux every 3 hours, the horse would require 112 L over 24 hours. This is unlikely to be a feasible endeavor in the field and may require referral to a hospital; however if the client is willing to pay for your time, even that high volume of fluid can be delivered.

Type

Determining the type of fluid to be administered in the field is usually uncomplicated: give what you have available, which is frequently isotonic crystalloids for IVT and tap water for EFT. However, the fluid can certainly be modified as needed for each clinical situation by adjusting the electrolyte composition or providing dextrose, for example. Polyionic fluids labeled as 'replacement or resuscitation' fluids (Lactated Ringer's solution, Normosol-R®, Vetivex®, or Plasma-Lyte-A® for example) are generally the safest fluids for IV administration and are appropriate for many clinical conditions faced by veterinarians on the farm. In severely poorly perfused horses, hypertonic saline (7% NaCl) can be given to promote fluid shifts into the vasculature from the tissues; however, it's practicality in the field setting should be assessed since large-volume administration of isotonic, polyionic fluids must follow hypertonic saline administration and this can't always be achieved in the field.

Route

The primary routes of fluid administration in the field setting include either the intravenous or enteral route. Determining the route of fluid administration is directly tied to the horse's clinical condition and whether or not the gastrointestinal (GI) tract is functioning normally, as well as the volume that needs to be delivered. If the GI tract is not functioning, enteral administration of fluids is not safe/appropriate. Similarly, if the GI tract is functioning but the horse is in

hypovolemic shock, intravenous fluid administration will be more effective/appropriate. The route of administration is also profoundly impacted by cost of administration. Intravenous fluid therapy is considerably more expensive than enteral fluid therapy, so the client's budget must certainly be considered.

Enteral fluid therapy is an excellent option for the field setting, particularly if large volumes are not needed. The primary consideration for fluid delivered by the enteral route is ensuring it can be tolerated (i.e., the horse must have a functional GI tract…the horse cannot be refluxing and the colon must be capable of absorbing the fluid). Fluids can be administered by slow, continuous rate infusion through a narrow bore, indwelling nasoesophageal tube or intermittently through a large-bore nasogastric (NG) tube by pump or funnel. Nasogastric tubes can be indwelling or intermittently passed/removed; however, if indwelling, monitoring of the tube placement/location is necessary to ensure safe delivery of fluids to the horse. Additionally, the volume administered should be closely monitored. The volume is limited based on the size of the horse's stomach. The stomach volume of an average-sized horse is approximately 12-16 liters. The amount of fluid administered at one time should not exceed 8-10 L in a 500 kg horse; the administration may be repeated every 30 minutes to few hours, after checking the stomach for reflux. Most horses will not tolerate large volumes too frequently and will develop enterogastric reflux. A recipe for isotonic enteral fluid therapy is available in Table 2.

Rate

Determining the rate of administration depends on the following: the severity of the fluid loss and the disease for which the horse is being treated, the type of fluid being administered (e.g.,

many severe electrolyte derangements have to be corrected at specific rates for safety), the route may dictate the rate, and the amount of time you have available on the farm. For the intravenous route, a safe average rate of fluid administration is 20 mL/kg/hr, increasing to 40-80 mL/kg/hr for horses in hypovolemic shock and decreasing to 2-3 mL/kg/hr for maintenance. Ultimately, the rate can be adjusted to meet the horse's clinical needs and your period on the farm, as long as the clinical conditions are considered. Remember that the rate is important in smaller patients, or patients with renal disease or cardiopulmonary disease, because they can be fluid overloaded. For enteral fluid therapy, the rate of administration is dictated by the stomach size and the horse's ability to tolerate the volume delivered to the stomach. As mentioned, the capacity of an average-sized adult stomach for safe administration of fluids is 8-10L; however, if the enteral route is to be intermittently utilized, the ideal volume/rate is 2-4 liters every 2-3 hours.

Reassessment

Reassessing the fluid plan and the patient's needs is another critical step in achieving a successful response to fluid administration. Patient monitoring should be done frequently to ensure that the fluids, by whichever route, are being delivered safely. Additionally, the patient's clinical response should be monitored to determine if adjustments need to be made in the volume, route, rate, or type of fluid. If the horse's clinical condition is changing rapidly, the fluid plan may need to change rapidly. If the horse is deteriorating and needs more than can be accomplished on the farm, referral may need to be considered. The horse should be monitored for adequate urine production/decreased ongoing losses in proportion to the hydration and volume of fluid administered, the perfusion parameters should be assessed frequently to ensure improvement, and clinicopathological data can be evaluated if available.

SUMMARY

Administering fluids to horses in the field setting is feasible and a clinically valuable endeavor when the logistics for the patient, client, and veterinarian are all considered. When approached in a step-by-step fashion, the delivery of fluids on the farm can provide a strong clinical benefit to the horse.

References upon request.

Table 1: Clinical findings used to assess perfusion:

Dehydration	% water loss	Clinical Signs
Mild	5-7%	Lethargy, dry mucous membranes, prolonged CRT, decreased urine production
Moderate	8-10%	As above; weak pulse, prolonged jugular filling, decreased skin turgor (prolonged skin tent), tachycardia
Severe	>10%	As above; cold extremities, +/- recumbency, depressed, sunken eyes

Table 2. Isotonic, enteral fluid recipe:

Supplement:	Amount:	Conversion:	Product:
Sodium chloride	5.27 g/L or 5.6 g/L	5 tbsp./15 L	Morton Salt®
Potassium chloride	0.37 g/L or 0.6 g/L	1.5 tsp./15 L	Morton Lite Salt®
Sodium bicarbonate	3.78 g/L or 3.4 g/L	3 tbsp./15 L	Arm & Hammer Baking Soda®