

FLUID THERAPY IN CATTLE

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Tim Potter discusses the importance of hydration, and outlines analysis methods and protocols for treatment, including nasogastric administration

Fluid therapy in ruminants is often viewed as difficult and time consuming due to the volumes required and the time involved for administration and monitoring.

For this reason, it is often neglected in cattle – despite the fact that appropriate fluid therapy would greatly improve outcomes in a number of commonly encountered clinical situations.

The most usual indication for fluid therapy in adult ruminants is to correct dehydration from any number of primary conditions (such as toxic mastitis and metritis). However, it should be remembered that the majority of sick animals will exhibit some degree of dehydration due to increased fluid losses or reduced intakes.

It is important for the clinician to be able to recognise the signs of dehydration and the difference between dehydration and hypovolaemia.

Hypovolaemia is defined as loss of fluid volume from the intravascular space, whereas dehydration is loss of fluid from the interstitial space.

A thorough clinical examination is the key to differentiating between these two states. The markers for identification of dehydration are fairly crude – as vets, the minimum degree of dehydration we can detect is five per cent, and animals are usually nearly dead by the time they are 15 per cent dehydrated.

Eyeball recession and skintent duration are the most accurate indicators of dehydration in neonatal calves (Constable et al, 1998).

While no similar study has been conducted in adult animals, eyeball recession and duration of skin tent are still used to estimate the extent of dehydration. The skin tent test is performed by pinching an area of skin, usually over the eyelids or neck, and estimating the time it takes to return to its normal position.

Clinical signs indicative of hypovolaemia are vague, but include increased heart rate, cold extremities, increased capillary refill time and decreased urine output due to decreased renal perfusion. Common haematological and biochemical markers of hypovolaemia are increased packed cell volume and total protein due to haemoconcentration, increased creatinine (in the absence of renal disease) and increased blood lactate concentrations.

When treating dehydration in cattle, the focus is often on correcting the identified degree of dehydration, but consideration must also be given to an animal's maintenance fluid requirements.

A healthy, non-lactating, adult Holstein cow has a minimum water requirement of approximately 50ml/kg/per day.

This requirement is more than doubled in an animal at peak lactation, although in sick animals the requirement for milk production will be significantly reduced.

Having identified the volume of fluid required to correct the deficit and provide for any ongoing losses, it is important to select the appropriate fluid type and route of administration.

Roussel et al (1998) examined the blood gas and serum electrolyte analyses of more than 500 cattle older than one month of age. In this study, 60 per cent of dehydrated animals had a normal blood pH, with most of the remaining cattle exhibiting a metabolic alkalosis.

Adult ruminants rarely develop metabolic acidosis – therefore, IV or oral alkalinising fluids (such as lactated Ringer's solution and sodium bicarbonate) are rarely indicated in adult ruminants, except in specific clinical situations, such as grain overload, kidney disease or cases of choke, in which excessive salivation leads to bicarbonate loss and metabolic acidosis.

Important

Oral electrolyte solutions have classically been used to replace fluid losses and correct electrolyte abnormalities in adult ruminants because they are affordable and easy to administer on farm.

Most dehydrated cattle have either a normal blood pH or a metabolic alkalosis; therefore, it is important to choose an oral electrolyte solution that does not contain bicarbonate, acetate or

propionate, and is, therefore, not alkalinising. The majority of commercially available rehydration therapies for calves are unsuitable for use in adults, as they are designed for treating metabolic acidosis and thus contain metabolisable bases.

Metabolic alkalosis of cattle can be corrected by providing extracellular anions in relative excess to cations. In practice, this is accomplished with chloriderich, high-potassium solutions. It is possible to prepare a slightly acidifying oral rehydration solution using readily available components ([Table 2](#)).

Feed-grade salts can be weighed out, combined and stored in individual plastic bags ready for use on farm. The addition of further additives, such as direct-fed microbial preparations and rumen stimulants, is possible, and in recently calved animals calcium supplements or propylene glycol may also be used. While oral fluids are relatively cost-effective and easy to administer, they should be reserved for animals that are able to stand and have a degree of gastrointestinal function. It should be remembered that fluid absorption from the gastrointestinal tract is likely to be limited when there is compromise to tissue perfusion (moderate to severe hypovolaemia). In animals with severe dehydration and those exhibiting signs of systemic toxemia, IV fluids are more likely to be successful.

IV fluids can be administered via a needle and flutter valve, but these can often only be used for short periods before a haematoma forms. The placement of a jugular catheter is a simple procedure and will facilitate fluid administration. To allow appropriate fluid rates to be delivered, it is necessary to use 10G to 14G catheters in an adult cow.

Due to the potential costs and time needed to administer the required volumes of isotonic fluids, hypertonic saline is frequently used to rapidly expand the plasma volume. It can be life-saving in severely hypovolaemic/endotoxaemic animals and should be administered as a bolus at 4ml/kg – in effect, 2.3L to 3L for a 600kg to 700kg cow.

The main force for water movement across the rumen wall is the gradient of osmolality between ruminal fluid (which is normally isotonic to plasma) and blood-perfusing ruminal epithelium. With the IV administration of hypertonic saline solution, plasma osmolality in adult ruminants is increased. The concurrent oral administration of water or hypotonic fluids results in reduced rumen osmolality.

The increase in osmolar gradient across the rumen wall following this combined treatment is, in part, responsible for the movement of water from the rumen into the extracellular space, thereby expanding the plasma volume and correcting dehydration. Immediately after administration of hypertonic saline, cattle must be provided with access to fresh water. Most will drink 20L to 40L over the following 10 minutes.

Cattle that do not drink water should have it delivered by orogastric administration into their rumen (or by IV administration of isotonic fluids). Administration of hypertonic saline alone without

providing the cow fresh water to drink or administration of ororuminal water is ineffective.

Combined use of hypertonic saline solution with oral fluids should be considered in order to produce far superior resuscitation in the toxic cow than oral fluids alone.

Time and staffing pressures on farm, coupled with the perception of cost, can lead to the use of inadequate volumes and inappropriate rates of fluid administration. Fluid therapy if administered rapidly and aggressively is extremely valuable.

Whether the intervention is IV or oral, the focus should always be on administering the appropriate volume to correct dehydration as the renal function that is restored with rehydration is usually effective in normalising subtle electrolyte disturbances.

References

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- Roussel A J, Cohen N D, Holland P S et al (1998). Alterations in acidbase balance and serum electrolyte concentrations in cattle: 632 cases (1984–1994), *J Am Vet Med Assoc* **212**: 1,769-1,775.