

PRACTICAL APPROACH TO THE TREATMENT OF CALF DIARRHEA IN THE FIELD

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Introduction

Calf scours or undifferentiated neonatal calf diarrhea in conjunction with respiratory disease are the most common causes of calf morbidity and mortality in beef and dairy operations. Calves from 1 to 30 days of age are usually more commonly affected and economic loss due to calf death, treatment, and additional labor could be considerable high for producers. Common risk factors for calf scours are dystocia, inadequate colostrum intake (failure in the transfer of passive immunity) and environmental imbalances (high moisture and high animal density) that lead to high pathogen build up and exposure shortly after birth. Common infectious agents associated with calf diarrhea such as enterotoxigenic *E. coli*, bovine rotavirus, bovine coronavirus, and *cryptosporidium parvum* are shed by dams around parturition and by older asymptomatic calves. Calves with diarrhea present with different degrees of dehydration, depression, posture abnormalities, and suckle reflex strength. Common electrolyte derangements include alterations in serum sodium, potassium, chloride, and bicarbonate. Additionally, in most cases calves with diarrhea develop metabolic acidosis. Dehydration, severe electrolyte abnormalities, and metabolic acidosis are the leading causes of death in calves with diarrhea and therefore should be addressed quickly before and during treatment. Although degree of dehydration can be easily estimated in the field without additional diagnostic tests, electrolyte imbalances and degree of metabolic acidosis cannot be as easily assessed in field conditions; however, a very thorough physical examination will allow the veterinarian estimate some of these electrolyte and metabolic imbalances and establish appropriate treatment in an efficient manner.

Assessing dehydration

Dehydration in calves can be evaluated by checking the moisture of the mucous membranes in the gums, skin turgor, and degree of enophthalmos or eye ball recession. Tacky or dry mucous membranes suggest dehydration. The turgor of the skin can be evaluated by tenting the skin and evaluating the time it takes to go back to normal position. A prolonged skin tent suggest dehydration. The eye ball recession can be evaluated subjectively measuring the distance between the frontal orbit and the eye ball with your thumb. Sunken eyes or an eye ball recession > 4 mm suggest dehydration. Parameters for assessing dehydration in calves are shown in table 1.

Table 1.
Evaluation of dehydration in calves with diarrhea by skin tent and eye ball recession

Parameter	Dehydration (% of body weight)			
	6% or less	8%	10%	12% or more
Skin Tent (neck) sec.	5	6	7	8
Eyeball recession mm	3	4	6	7

Adapted from Heller MC and Chigerwe M. Vet Clin North Am Food Animal Pract 2018; 34:101-117

Assessing metabolic acidosis and base deficit

Metabolic acidosis in calves usually has effects on the central nervous system. Therefore it is possible to estimate the degree of metabolic acidosis by assessing clinical signs such as mentation status, posture, presence or absence of suckle reflex, and presence or absence of palpebral reflex. As the degree of metabolic acidosis in calves with diarrhea increases, signs such as depression, abnormal posture (recumbency), absence of suckle reflex, and absence of palpebral reflex are more evident. For this reason is possible to use these above mentioned clinical signs to estimate the base deficit of calves with diarrhea (Table 2.). Although the most common

causes of metabolic acidosis in scouring calves are low serum sodium and absorption of D-Lactic acid from the intestines, usually correction of this metabolic condition requires the addition of an alkalinizing agent to the therapy irrespective of the route of administration. Depending on the route of administration, the type of alkalinizing agent might vary. When intravenous fluid therapy is selected, sodium bicarbonate offers the best alkalinizing option; however, when oral fluid therapy is selected other alkalinizing agents such as acetate or propionate are better alternatives than sodium bicarbonate.

Table 2.
Degree of base deficit estimated by clinical parameters of calves with diarrhea

Clinical parameters				Base deficit (mEq of HCO ₃)
Attitude	Posture	Suckle reflex	Palpebral Rfx.	
Alert	Standing	+	+	5-8
Lethargic /Depressed	Sternal	+/-	+	10-15
Obtunded	Lateral	-	-	15-20
Comatose	Lateral	-	-	>20

Adapted from Heller MC and Chigerwe M. Vet Clin North Am Food Animal Pract 2018; 34:101-117

Electrolyte abnormalities

Common electrolyte abnormalities in calves with diarrhea include hypoglycemia, hyponatremia, hypochloremia, hyperkalemia, and low bicarbonate; however, special care should be taken on calves with diarrhea that have been previously treated (repeatedly) by the owner at the farm with oral electrolytes, probiotics, nutritional mixes etc. as these calves usually present with a different type of electrolyte alterations compared with non-treated calves. Hyponatremia, hyperglycemia, and high bicarbonate levels are commonly found in diarrheic calves previously treated with oral electrolyte solutions or nutritional supplement mixes by producers. When addressing treatment of calves with diarrhea in field conditions (when possibilities of serum chemistry panel diagnostics are slim) an accurate history on previous treatments provided by owners should be obtained before developing a fluid therapy plan.

Selection of route of fluid administration

Selection of route of administration of fluids depends on degree of dehydration, presence or not of a strong suckle reflex, and degree of depression. Calves with advanced degrees of dehydration, depression, and with absence of suckle reflex will benefit from intravenous fluid therapy. In these cases, oral administration of fluids might sit in the forestomach and abomasum for longer time before making it to absorptive surface. In contrast, calves with mild dehydration and active suckle reflex can be treated with oral electrolytes.

Fluid therapy plan and selection of type of fluids

The total volume of fluids a diarrheic calf should receive will depend on what is needed for maintenance (60 mL/Kg/day), what is lost for dehydration [%dehydration x BW (Kg)], and ongoing losses due to continuous diarrhea [1-2% BW (Kg)]. Fluid losses due to dehydration should be corrected during the first 4 hours. The fluid therapy plan should also target the correction of metabolic acidosis quickly during the first 2-4 hours. For this reason it is important to include alkalinizing agents early in the fluid therapy plan. If the decision is that intravenous fluid therapy is going to be used, isotonic or hypertonic sodium bicarbonate should be the first choice of fluids. To determine how many mEq of bicarbonate the calf needs this formula should be used: BW (Kg) X 0.6 X Base Deficit. Where BW is body weight and 0.6 is a constant of volume of distribution for young calves. Once the amount of bicarbonate needed by the calf is determined, the decision of using isotonic (1.3%, not commercially available) or hypertonic (8.4%) sodium bicarbonate should be made. While hypertonic sodium bicarbonate (1 mEq of bicarbonate/mL) will require much less volume to treat and will correct faster metabolic acidosis and hyperkalemia, it does not treat dehydration and isotonic intravenous or oral fluids should follow immediately after its administration; in contrast, isotonic sodium bicarbonate (0.156 mEq/mL) will aid in the correction of dehydration and metabolic acidosis at the same time but its effects might take a little bit longer. In

field conditions, is much more practical to rapidly place a temporary intravenous jugular catheter and administer hypertonic sodium bicarbonate (6.4 – 10 mL/Kg IV over 5-8 minutes following with 2 L of isotonic alkalizing oral electrolytes; however, especial care should be placed on using hypertonic sodium bicarbonate in calves with respiratory compromise (abnormal ventilation) as the risk of inducing respiratory acidosis is higher in these animals. Practical manners to make isotonic (1.3%) sodium bicarbonate solutions will be discussed in the presentation.

After correction of metabolic acidosis with sodium bicarbonate solutions, isotonic oral electrolytes or isotonic crystalloid polyionic fluids should continue for correction of total fluid deficit. In field settings, switching to oral electrolyte solutions is more practical. Total fluid loss due to dehydration should be corrected within the first 4 hours of therapy and the rest can be corrected during the next 20 hours so switching to 2 or 3 oral electrolyte feedings per day is easier for the producer at the same time that saves time to the veterinarian.

Other alternative to rapidly treat calves with diarrhea in the field is using clinical signs such as mentation and posture for selection of overall fluid therapy. Within this approach, calves that appear bright and standing should be treated with alkalizing oral electrolytes only. Calves with mild depression and standing but weak should receive 5 liters of 0.9% saline (NaCl) with added 250 mEq of hypertonic (8.4%) sodium bicarbonate intravenously and then be switched to alkalizing oral electrolytes. Calves with severe depression and unable to stand should receive 5 liters of 0.9% saline with added 500 mEq of hypertonic (8.4%) sodium bicarbonate and then switched to alkalizing oral electrolytes.

How to select adequate oral electrolyte solutions

Available of oral electrolyte solutions for the treatment of calf scours is varied and differences exist with respect to their quality and effectiveness. It is important that when deciding on an oral electrolyte product, the following requirements are met: 1) it must provide adequate amounts of sodium (90 to 130 mM/L). Lower sodium concentrations might not adequately correct dehydration and metabolic acidosis and higher sodium concentrations might cause hyponatremia and delay abomasal emptying rate. 2) It must provide agents that facilitate absorption of sodium and water in the intestine such as glucose, citrate, acetate, propionate, or glycine. 3) It must provide an alkalizing agent (>50 mM/L) such as acetate, propionate, or bicarbonate to correct metabolic acidosis. 4) It must provide energy, as most calves with diarrhea are in negative energy balance due to decreased nursing and impaired intestinal absorption of nutrients. Although bicarbonate is a highly effective alkalizing agent, when present in oral electrolyte solutions it might have some side effects that are undesirable in the treatment of calves with diarrhea. Feeding oral electrolyte products containing bicarbonate as the alkalizing agent has demonstrated to alkalize the abomasum and potentially increase bacterial colonization (coliforms) of the small intestine. Additionally, lowering abomasal pH might affect abomasal milk clotting, reduce milk digestibility, and lead to abomasal bloat. Other alkalizing agents such as acetate and propionate are equally effective in treating metabolic acidosis in calves with diarrhea without carrying the adverse effects of bicarbonate. It has been suggested that the ideal oral electrolyte solutions for calves with diarrhea should contain at least 50 mM/L of Acetate or propionate and have a strong ion difference of at least 60-80. Acetate and propionate facilitate sodium absorption, produce energy when metabolized, and do not alkalize the abomasum.

Supportive therapy

Nutritional support is on major importance for intestinal healing in cases of calf diarrhea. For this reason nursing or the administration of milk/milk replacer should continue in the face of calf scours. Decreasing the total volume of milk feeding to 50% of the normal volume or increasing the frequency of feeding of smaller volumes of milk usually prevents abomasal overloading and reduces risk of hyperosmolarity in the gut. If the calf is not nursing addition of dextrose to the fluid therapy should be considered a 2.5-5% dextrose solution is usually enough. Antibiotic and anti-inflammatory therapy is warranted in cases where septicemia or bacteremia are suspected.

-References available from author