Therapeutic Approach to the Diarrheic Calf

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The therapeutic approach to the diarrheic calf is determined by the historical and physical findings. Calves that are weak and have poor suck reflexes are usually treated with intravenous fluids. Oral fluids are used for calves that can still suck; they are particularly useful for on the farm therapy.

Physical Examination and History Taking

The calf's age is helpful in determining the degree of acidosis[1] and in differentiating collapse due to colisepticemia from that produced by dehydration and acidosis. Calves presented in the first two weeks of life may have colisepticemia, these calves are often recumbent, have a low grade diarrhea, and mild dehydration. Endotoxemia and meningitis, not dehydration or acidosis, are responsible for the calf's collapsed state. The presence of signs of unveitis, meningitis (neck rigidity, hyperesthesia), or joint involvment helps confirm the diagnosis of septicemia. In many calves the navel is the initial portal of entry of infection and signs of a wet, smelly painful navel should raise one's suspicion that septicemia may be present.

Intercurrent infections are common in diarrheic calves presented to veterinarians. The main problems to look for are pneumonia, omphalophlebitis and joint ill. Rectal temperature is not helpful in determining the presence of intercurrent disease but careful physical examination can help detect these problems.

The calf's demeanour, ability to stand and strength of suck reflex should be determined to form on overall assessment of the calf's level of depression. Dehydration is easily measured from skin tent and eyeball sunkeness. Body condition can be determined by inspection of muscle mass. The veterinarian can then decide how much of the calf's depressed state is explained by dehydration and hypothermia. Unexplained depression in calves over 8 days of age is usually due to acidosis. Occasionally, however, endotoxemia from salmonellosis in dairy calves and hypoglycemia in emaciated calves may be responsible.

Therapeutic Plan

Calves that are recumbent and have no suck reflex usually require intravenous therapy if they are to make a rapid recovery. The main principles of therapy are to provide enough fluid to correct dehydration, to warm the fluids if the calf is hypothermic and to correct acidosis. Correcting dehydration poses no challenges, standard physical assessment of dehydration tends to overestimate fluid requirements[1] and the excess is either used by the calf to meet ongoing losses or is excreted through the kidneys. If the calf is hypothermic it is important to warm the fluids, this can be done by running a long length of intravenous tubing through a bucket of very hot water on the way to the calf. The major problems in the treatment of diarrheic calves are to correctly assess the severity of acidosis and to calculate the calf's bicarbonate requirements. It is important to remember that calves have much more body water than adult cattle and in consequence correcting acid-base imbalances on the basis of formulas used for adult animals will seriously underestimate bicarbonate requirements. Instead bicarbonate requirements for calve should be estimated by using a value of 0.5, rather than 0.3, for the volume of distribution of bicarbonate.[2]

Some calves have a severe acidosis and give only a partial responses to rehydration therapy unless the acidosis is also corrected. Diarrheic calves 8 days of age and older tend to be nearly twice as acidotic as younger calves and this, together with the calf's demeanour, aids in the estimation of the severity of acidosis, Table I. There is a fair amount of variation within each subgroup and the clinician can make an even better assessment of the likely level of acidosis if he adjusts these mean values by allowing for the contribution of dehydration, hypothermia and septicemic or bacteremic infections to the calf's condition.

Table I. Severity of acidosis, as measured by venous blood base excess values, in 124 diarrheic calves presented at the Western College of Veterinary Medicine for therapy.

Stage	Age	
	<8 Days	> 8 Days
Alert, standing, strong suck	2.1±6.6*	-7.0±7.4
Weak, weak suck	-4.9±7.3	-10.8±6.9
Sternal recumbency	-12.1±8.4	-16.3±8.3
Lateral recumbency	-12.7±9.8	-20.3±10.1

*Values are mmol/L. mean ± standard deviation.

These values can then be used to calculate bicarbonate requirements using the formula:

Bicarbonate, mmol = Body Weight, kg x 0.5 x Base Deficit

If isotonic solutions of sodium bicarbonate (13g sodium bicarbonate/L) are used to correct acidosis then the number of liters of sodium bicarbonate solution to be use can be calculated by dividing the number of mmol by 150. The sodium bicarbonate solution is brought up to the volume required to correct dehydration by mixing with saline and the whole amount infused into the calf over a period of at least 4 hours. Calves under a week of age are often only mildly or moderately acidotic and these calves often respond well to rehydration with balanced electrolyte solutions such as Lactated Ringers or Ionalyte (Rogar/STB). Lactate and acetate are poorly metabolized in calves which are more than 8% dehydrated and they are less effective alkalizing agents in these circumstances.[3] Calves which are more than 8% dehydrated and which have moderate or severe acidosis (pH < 7.2) are best treated with sodium bicarbonate as this gives a consistent alkalizing effect. A guide to fluid therapy requirements by age and depression status is shown in Table II.

Table II. Suggested approach to correction of acidosis in diarrheic calves.

Status	Age	
	<8 Days	>8 Days
Alert, standing, strong suck	Oral	Oral (with alkalizng agent)
Weak, weak suck	Oral (Alkalizing agent) Lactated Ringers* Ionalyte*+	1L Sodium Bicarbonate#
Sternal recumbency	1 L Sodium Bicarbonate# Ionalyte*+	2L Sodium Bicarbonate#
Lateral recumbency	1 L Sodium Bicarbonate#	3L Sodium Bicarbonate#

* Give sufficient volume intravenously to correct dehydration

Add saline to intravenous fluids so that sufficient total volume is given to correct dehydration.

\+ Ionalyte is manufactured by Rogar STB and contains 55 mmol of acetate/L.

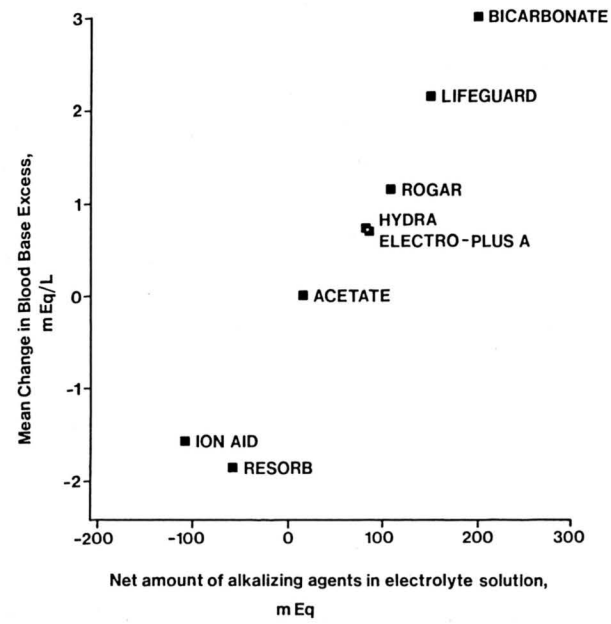
The only other agent that may be required in the intravenous fluids is glucose. Severe hypoglycemia is rare in calves but it is a particular problem in emaciated animals. Calves in poor condition should have dextrose added to their drip to a final concentration of 3-5%.

Oral Therapy

Oral therapy works well in calves which still have a suck reflex . Fluids can be administered from a bottle or by intubation. Intubation is more rapid and especially convenient in calves which have not been trained to drink from a bottle. The fluid is deposited in the rumen and usually rapidly passes into the abomasum and intestines. If ileus is present, however, the fluids will pool in the rumen, rehydration will be slow and bloat may develop.

There are a variety of different electrolyte products on the market and these are suited to different purposes. One type of oral product to avoid altogether is the 'mineral booster' type; these usually contain too little electrolyte (< 10g electrolytes/L) to be therapeutically useful in diarrheic calves. Electrolyte preparations designed for therapy of diarrheic calves differ widely in their energy contents and their ability to correct acidosis. Mildly affected calve can be supplemented with oral electrolytes to prevent the development of dehydration, if these calve are still bright, and milk feeding is continued, a product which contains no bicarbonate will give the best growth response. Calves that are more severely depressed and which refuse milk should be fed oral electrolytes that contain alkalizing agents. These give the most rapid correction of acidosis and speed return to a normal demenour[4]. At the present time most products that have strong alkalizing actions contain bicarbonate[5] (Fig. 1), bicarbonate interferes with milk digestion and so these products are best used together with withdrawal of milk.

Figure. Relationship between the alkalizing activity of various oral electrolyte solutions and their net content of acid or alkali. Alkalizing ability is measured as the mean change in venous blood base excess in the 8 hour period following oral administration of 1 treatment (approximately 2L) of the product. Lifeguard is manufactured by Norden Laboratories, Rogar is Rogar STB's oral electrolyte powder, Hydra is manufactured by Vetrepharm, Electro-Plus A by Pitman-Moore, Ion Aid by Syntex and Resorb by Beecham. Bicarbonate and Acetate are experimental solutions.



Milk is often withdrawn from diarrheic calves and this may improve demeanor; long term deprivation results in cachexia. To avoid this problem we recommend that milk be withheld for a maximum of 3 days. Calves that are still diarrheic after 3 days can either be refed milk along with a non-bicarbonate containing electrolyte solution or be switched to high energy oral electrolytes. High energy products need to be fed 3 times a day (total daily fluid intake at least 6L) and still provide only about 75% of maintenance energy requirements.

References

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