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Review Article

REVIEW ON EFFECTS OF HYPERTONIC SODIUM BICARBONATE WITH AND WITHOUT LACTETE RINGER SOLUTION ON POTASSIUM COMPENSATION, REHYDRATION STATUS, ENDOCRINAL RESPONSE AND ACIDE-BASE BALANCE IN CALVES WITH METABOLIC ACIDOSIS

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Abstract: Dehydration in neonatal calves with diarrhea caused by metabolic acidosis is a common cause of death. Severely dehydrated calves that are unable to suckle need intravenous fluids for effective resuscitation. The aim of fluid therapy in metabolic acidosis is to replace the water and electrolytes that are lost in the scour. The solutions must have adequate buffers to correct the acidosis, and adequate energy for absorption of fluids from the intestines. Different brands are available, however it is very important to realise that not all electrolyte products on the market fit these criteria, in fact many are far from it. Some researchers claim that LR has a better clinical correction than NaCl, illustrated by more rapid physiological correction, showing that mixed metabolic acidosis was corrected quicker and more appropriately with this treatment. Moreover, hyperosmolality and hypernatremic states were also corrected with both solutions, but more quickly with LR. Hypertonic sodium bicarbonate solutions (1.3-8.4%) are also used in the treatment of metbolic acidosis in calves. Main questions are that how much fluid does a calf lose when it is scouring? What type of fluid is the best? Can I mix the electrolytes with the milk? Aims of this review are find out the correct answers to these questions.

Key words: Metabolic Acidosis, Calves, Sodium Bicarbonate, Lactate Ringer Solution, Acide-Base Balance, Endocrin Response

Introduction: Neonatal calf diarrhea is caused by infectious and non-infectious causes, which cause damage to the intestinal mucus leading to diarrhea, leading to abnormal permeability, abnormal motility, hypersecretion, and changes in ion transport (1,2,3,4).

Fluid, electrolyte and nutrient deficiencies are crucial to preserve diarrhea in the ice (1). Dehydration due to diarrhea in the ice is the result of fluid loss from the extracellular compartment. The resulting fluid loss is compensated by the passage of the intracellular fluid to the extracellular fluid, i.e.,

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the plasma. If Na + ions lost by feces in diarrhea can not be compensated, the amount of body fluids decreases. Thus dehydration and hypovolemic shock develop in advanced conditions (5). A significant amount of total Na^+, K^+, Cl^- and HCO3- is lost with dısk and the pH of this electrolyte balance disorder resulting in diarrhea is low (6,7,8) . In the case of diarrhea, plasma K^+ ions increase in the extracellular fluid, but decrease in the cell disrupts the potential of the cell membranes and this is the main cause of death, particularly by affecting myocardium (3,4). If losses continue to increase and become uncompensated, systemic effects of dehydration and metabolic acidosis are formed (7,9). *The measurement of blood gases is very important in terms of understanding the condition and severity of the disease. Blood gas parameters; PaO_2, oxygenation; $PaCO_2$, alveolar ventilation; PaO_2 and $PaCO_2$ together, gas exchange; pH, $PaCO_2$ and HCO_3^- are very valuable parameters in determining acidosis and alkalosis status (7,10,11).*

In cases of acidosis, the oxygen-binding capacity of the hemoglobin decreases and tissue causes hypoxia (12). Clinical respiratory system problems and high respiratory frequencies obtained in this study can be considered as a sign of this. Özcan and Akgül (13) reported that clinical signs of icteric growth in mild, moderate and severely dehydrated diarrhea were reported in 8.4% NaHCO3, 0.9% NaCl and 5% dextrose in appropriate amounts and times. The same researchers also reported that dehydration-related increases in blood parameters such as HTC, HB in diarrheal calves were significantly decreased following fluid treatment. Similar opinions reported that the haematological findings including HB level were the same for some researchers (14,15).

Abdalmalek (16) reports that TP and ALB levels decrease in Escherichia coli, corona and rotavirus-infected diarrhea, while the levels of urea decrease, but the levels of GLU increase. In cases of diarrhea, a loss of normocyclic anion is developing and it is reported that lactic acidosis is always present in the cases and high blood LACT level due to it can not be detected (17).

Higher blood serum BUN/creatinine ratio than 20/1 indicates prerenal azoemia and lack of perfusion (18). UREA and CREA rates were high in diarrhea cases and the presence of metabolic acidosis was also a problem in kidney buffer mechanisms and that TP and ALB levels at the beginning of diarrhea increased after treatment (13) researchers are available.

It has been reported that there is no significant difference between the effects of serum physiologic (SF) and Lactated Ringer's Solution (LR) on pH, as the blood pH is significantly lowered before treatment of diarrhea and rapidly rises to normal after treatment (15). In acute diarrheal children, SF and LR have been reported to show no significant difference in therapeutic effect on blood pH (19).

It has been reported that low TCO2 levels are indicative of metabolic or respiratory acidosis, the differential can be determined by the change in HCO3- concentration, and the low concentration of HCO3- can only indicate metabolic acidosis (20). In another study (15), it was reported that LR is more effective than SF at normalizing serum HCO3- levels when compared to SF, while emphasizing the fact that HCO3- levels are accompanied by decreased TCO2 levels, proving that the case is metabolic acidosis.

Metabolic acidosis develops in diarrheal frogs as a response to intracellular K + extracellular space, extracellular H +, Na +, and Cl- into the intracellular space. As a result of these transitions, blood K + level increases and Na + level decreases (21). Higher K +, lower Na + and Cl- levels in pre-treatment groups in diarrheal calves are also supported by other investigators who are known to have been prescribed (7,13)

Serum physiologic and LR are both crystalloid fluids and are widely used for the reconstitution of liquid electrolyte balance (22,23). However, it has been reported that LR, which has better effects on heart and acid-base balance and oxygen excretion, is more compatible with body fluids (15) when compared to NaCl with high Na + and Cl- levels and 5.0 pH.

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