Clinical and Laboratory Examinations of Diarrhea and Dehydration in Newborn Friesian Calves with Special Reference to Therapy with Hypertonic and Isotonic Solution

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Abstract: This study was carried on 61 calves from different farms at Sharkia governorate. From these calves 25(healthy control calves) and 36 diarrheic dehydrated calves were used for this study. The calves had normal body temperature. The clinical signs of the diseased calves included a whitisg to yellowish diarrhea with foetid odour and highly moisture percent of faeces. Moderate and severe dehydration were recorded including varying degree of dryness of skin, sunked eyes, recumbency, sometimes coma and death occurred. 18 calves showed hyperpnea with standing position but need help to stand (moderate degree of dehydration and clinical acidosis). Other 18 calves showed lrecombency, a decrease of heart beats and respiratory rates (severe degree of dehydration and clinical acidosis). **Blood analysis of diseased calves** showed acidemia as well as a significant increase in erythrocytic count, haemoglobin content and packed cell volume with a non significant variation in Leucocytic count. **Serum analysis** showed an increase of the total protein, total solids, a significant increase of serum urea nitrogen and creatinine as well as hyponatremia, hypocholoremia and hyperkalamia. **Thereapeutic trials:** Antidiarrheal drugs as well as isotonic solution in moderate dehydration and hypertonic together with isotonic in severe dehydration were used for treatment. It could be concluded that diarrhea and dehydration in calves has a harmful effect on general health condition, gastrointestinal tract, body fluid, blood, serum and faecal contents. Hypertonic together with isotonic solution and antidiarrheic drugs safe the animal life and control this problem.

[Abdel Khalek R. El-sheikh, Hayam M. Samy Morsy, Tarek H. Allam Abbas and Wafaa M. Abdelrazik. **Clinical and Laboratory Examinations of Diarrhea and Dehydration in Newborn Friesian Calves with Special Reference to Therapy with Hypertonic and Isotonic Solution.** *Life Sci J* 2012; 9(4):181-184]. (ISSN: 1097-8135). http://www.lifesciencesite.com. 26

Key words: Calves, Diarrhoea, Dehydration, blood, serum, hypertonic, isotonic solution.

1. Introduction

Diarrhea and enteritis syndromes represent the most serious digestive problems among the newborn calves causing economic losses to producers due to high morbidity and mortality rate, moreover, the causes of diarrhea are multifactorial included interaction between: calf, environment, nutrition and infectious agents (Don Hudson & Gene White, 2009). It causes varying degree of dehydration, gastroenteritis, body fluid loss and various body fluid changes (Roy1980, El-Sheikh 1987, , El-Sheikh *et al.,* 2004, Radostitis *et al.,* 2007and Smith, 2009*)* so that this work was designed to evaluate the effect of diarrhea and dehydration on general health condition, body fluids, haematological picture and serum contents with special reference to fluid therapy with hypertonic and isotoic solution.

2. Material And Methods

This study was carried on 61 calves from different farms at Sharkia governorate. The calves aged from birth to 45 days and weighted from 24-50 kg. They were with normal body temperature and free from parasite. From these calves 25(healthy control calves) and 36 diarrheic calves with different Degrees of dehydration (Table 1) were used for this study.

Blood analysis: Total erythrocyte and leucocytic count, packed cell volume (PCV %), haemoglobin content (g/100 ml) were done according to Coles (1986). Blood pH was done by digital pH meter model 201.

Serum analysis: Determination of serum total protein (Henry, 1974), urea nitrogen (Tietz, 1990), creatinine (Henry, 1974) and chlorides (Kaplan and Pesce, 1996) were determined. Also, Serum sodium and potassium were determined by using flame photometer according method described by Hawk (1965).For determination of total serum solids: Serum sample (W1) was dessicated in glass dish at 107 oc till obtaining constant weight giving Dry matter DM (W2), then moisture content=(W1-W2), The DM%=(W2 divided by W1)x 100, The moisture %=100-DM%. Also, The DM and Moisture % of faeces was done by the previous method but usig faecal sample instead of seum sample.

Lines of treatment: Avoid suckling in the first day then gradually introduced, in addition to Kaopectin® (antidiarrheal drug produced by Idpco Animal Health. It contains kaolin, pectin, peppermint oil, lemon oil, electrolytes and others, Each diseased calf received 100 ml of kaopectin® daily for three successive days or till recovery).

Fluid therapy for moderated diarrheic dehydrated calves included: Normal saline 0.9 %, Glucose 5 %, sodium bicarbonate 2.6%: 500 ml of each intravenous, may be repeated every 12 hour when necessary.

Fluid therapy for severe diarrhoeic dehydrated calves included: Glucose 5 % (500-1000ml), saline solution 7% (25 ml), sodium bicarbonate 8.2% (25 ml) injected slowly intravenous for each calf, may be repeated every 12 hour when necessary.

Statistical analysis:

The obtained data were analyzed by univariate analysis of variance according to *Snedecor and Cochran (1969)*. For Mean separations, Least Significant Differences (LSD) and Duncan Multiple Range Test were used. Probability $\leq$ 0.05 considered significant.

3. Results:

Clinical findings: The diseased calves were suffered from diarrhea which varied from whitish to yellowish in color, offensive to foetid or unpleaseant odour, soft to watery in consistency with highly moisture percent. The faces which soiled the buttock and tail may be tinged with mucous with or without tenesemus. The temperature was normal, while pulse and respiration rates were increased (Table 1).

Dehydration and clinical metabolic acidosis were represented with a moderate to a severe degree. They were the most serious complication of diarrhea.

Dehydration was manifested by varying degree of dryness of skin, sunken eyes, loss of body weight, recumbency, sometimes coma and death occurred in non treated cases. While acidosis were manifested clinically by increased respiration, loss of condition and weakness which varied from standing position with dullness, depression and inappetence to complete anorexia.

Eighteen calves were found in standing position or need assistance to stand. These calves were dull, depressed, decreased or no appetite, increased respiratory rate, slight degree of sunken eyes and dryness of skin which persist for 5-10 seconds (Moderate degree of dehydration). Other18 calves were found recumbant with complete loss of suckling reflex, increase of respiratory rate as well as clear sunken eyes and dryness of skin which persist for 10-15 seconds *(Severe degree of dehydration).*

Blood examinations of diseased calves revealed a significant increases of RBCs. count, PCV%, Hb content with non significant increases of WBCs.

Serum of the diseased calves showed a significant increase in the level of serum total protein and serum total solids, a highly significant increase of SUN and a significantly increases of serum creatinine.

Serum electrolyte of diseased calves reveals a highly significant decrease of serum sodium, a significant decrease of chloride meanwhile the serum potassium level was significantly increased.

From all examined calves three of diseased calves were dead after severe dehydration, coma, circulatory failure, subnormal body temperature as well as delayed and incorrect therapy.

Table (1): Clinical findings of different degree of dehydrated diarrheic calves

Items	Control(25 Cases)	Moderate (18 Cases)	Severe (18 Cases)
Skin elasticity/seconds	Less than 2 Sec	4-6 Seconds	More than 10 Sec
Eye ball appearance	Normal	Moderate sunked	Deeply sunked
Capillary refilling time	Less than 2 Sec	2-6 Sec	2-6 Sec
Distention of jugular vein	Good	Good	Collapse
Scleral blood vessel	Filled with blood	Filled	Empty
Congunctival muc. membran	Bright red colour	Pale	Pale & dry
Rectal body temperature	38.5-40	39-40.5	36-38
Extremities temperature	Normal	Warm	Cold extremities
Heart rates beat/minute	85-100	120-140	50-88 bradycardia(Weak, irregular)
Respiratory rates/min	25-36	33-53	40-70 irregular
Corneal & anal reflexes	Good	Sluggish	Very Sluggish or absent
Suckling reflexes	Normal	Weak	Weak or absent
Dry matter % of faeces	More 28.53+-0.27^{c}	11.07+-0.04^{b}	7.13+-0.13^{a}
Moisture % of faeces	Less than71.97	88.98	92.87
Calf demeanur	Stand	Stand with assistant	Sternal or lateral recumbency
Mental condition	Normal	Lethargy	Coma & or Convulsion
Body condition	Good	Good to moderate	Poor

Table (2): Blood and serum contents of 15 healthy control calves and calves suffering from moderate (15 cases) and severe (15 cases) dehydration and dietetic diarrhea, before and after treatment.

Items	Control calves	Moderate diarrhoeic dehydrated calves		Severe diarrhoeic dehydrated calves	
		Before treatment	After treatment	Before treatment	After treatment
RBCs million/Cu mm	7.44±.03[a]	7.99±.03[b]	7.54±.03[a]	10.15±26[c]	7. 7±.04[ab]
WBCs Thousand/Cu mm	7.64±.05[a]	7. 91±.03[b]	7.60±.02[a]	7. 96±.03[b]	7.64±.03[a]
Hb gm/dl	9.77±.17[a]	10.7±.20[b]	9.57±.11[a]	10.90±.29[b]	9.60±.10[a]
PCV %	33.53±.60[a]	43.07±.64[c]	36.40±.59[b]	51.73±.76[d]	36.73±.63[b]
Blood pH	7.41±.007[c]	7.24±.01[b]	7.38±.007[c]	7.13±.03[a]	7.41±.003[c]
Total serum protein g/dl	6.33±.06[a]	6.8±.05[b]	6. 4±.02[a]	8.12±.06[c]	6.76±.05[b]
Total serum solid g/dl	3.14±.06[a]	5.20±.07[b]	3.25±.03[a]	6.17±.07[c]	3.31±.04[a]
Serum urea nitrogen mg/dl	30.27±.83[a]	37.10±.36[c]	33.80±.38[b]	37.60±.41[c]	34.87±.24[b]
Serum creatinine mg/dl	1.64±.03[a]	2.64±.08[b]	1.62±.03[a]	3.00±.04[b]	1.63±.02[a]
Serum sodium m.Eq./L.	134.07±.41[c]	117.67±.55[a]	128.33±.45[b]	116.87±.27[a]	129.00±.48[b]
Serum potassium m.Eq./L.	5.44±.03[a]	6.43±.05[c]	5.69±.03[b]	7.21±.06[d]	5.70±.03[b]
Serum chloride m.Eq./L.	90.60±.65[c]	71.93±.358[b]	91.00±.218[c]	69.13±.60[a]	90.00±.49[c]

4. Discussion

The observed clinical signs of diarrhea may be attributed to dietetic errors, suckling managements, fermentation of milk and formation of lactic acidosis causing irritation of the mucosa of the gastrointestinal tract leading to maldigestion, malabsorption, hyperperistaltic and rapid passage of gastrointestinal contents resulting in a significant decreases of DM% and a Significant increases of moisture % of the faeces (Table 1), Moreover, the increased respiratory rates with labored respiration may be attributed to the decrease of blood pH(Table 2) that stimulated respiratory centers in the medulla oblongata, leading to increase in the depth and rate of respiration (hyperpnoea) to eliminate the excess of carbon dioxide(El-Sheikh 1987, Radostitis *et al.,* 2000*)* Elsheikh *et al.,* 2004. Radostits *et al.,* 2007, and Smith, 2009). They attributed dehydration and acidosis to loss of body fluids and electrolytes included bicarbonate, sodium, potassium and chlorides in faeces. The acidosis was manifested clinically by hyperventilation and increase the respiratory rates.

The recorded tachycardia at the early stage of diarrhea(with moderate dehydration) and bradycardia with cardiac arrythemia at severe diarrhea and dehydration agree with Radostitis *et al.* (2000). They attributed tachycardia at the early stage to an increase in the heart rate to maintain the circulation, meanwhile at late stage the higher concentration of potassium in blood resulted in bradycardia and cardiac arrythemia or even death.

The increases of Hb, PCVand serum total solids (Table 2) may be attributed to dehydration and the reduction of water content in the vascular space (Coles, 1986, Radostitis *et al.,* 2000).

The recorded metabolic acidosis (Table 2) attributed by El-Sheikh (1987) to: 1.Excessive loss of bicarbonate in faeces. 2.Excessive production of lactic acid in body tissue by anaerobic glycolysis. 3, Organic acid production by abnormal gut flora. 4.Limitation of renal excretion of hydrogen ion.

The slight increase in serum total protein and the significant increases of total serum solids may be attributed to the excessive loss of body fluids and concentration of some blood component. However, the protein loss by catabolism or by leakage into intestinal lumen was lowered in diseased calf *(*Scott *et al.*, 2004*)*

The elevation in both serum urea nitrogen and creatinine levels in enteric calves was previously reported by El sheikh(1987) and Deshpande *et al.* (1993). Furthermore, the serum urea nitrogen and creatinine levels were increased in severe than moderate dehydrated diarrheic calves. This increase may be attributed to hypovolemia, reduced renal perfusion rate and function as well as increasing the catabolism of protein by increasing the degree of dehydration (Schlerka and Baumgartner, 1995).

The gradual decreases of serum sodium and chloride with gradual increases of serum potassium levels in diarrheic calves are supported by Kaneko *et al*.(1997) *and* Radostitis *et al.* (2000). *They* attributed this changs to the loss of sodium and chloride with intestinal secretion which associated with diarrhea. Tasker (1971) also added that the serum chlorides level usually follows sodium level because chloride was usually found in the form of sodium chloride. The increase of serum potassium level in diarrheic calves was attributed by Coles, 1986; Radostitis *et al.* (2000) and Scott *et al.* (2004) to:-1, Excessive excretion of K in scouring faeces17.5 times than normal. 2,Decrease renal tubular excreton of K. 3,The body made

compensatory mechanism by moving hydrogen ions in cases of metabolic acidosis and during catabolism into the intracellular fluids, this movement of hydrogen ions into cells would force the potassium ions to extracellular fluids resulted in hyperkalemia

An improvement of general health condition and most determined data in diseased calves was occured after treatment as a results of improved plasma expansion and restoration of normal fluid balance (Constable, 2002 and Smith, 2009):

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8/12/2012