Effects of rehydration solution on hematological and biochemical parameters in induced buffalo neonatal calf diarrhea

A. Khan, T. Zaman

Department of Veterinary Pathology, University of Agriculture, Faisalabad, Pakistan

Corresponding author: A. Khan, Department of Veterinary Pathology, University of Agriculture, Faisalabad, Pakistan - Tel. +9241 9200161-3119 - Fax: +9241 9200764 - Email: ahrar1122@yahoo.com

ABSTRACT: Experimentally diarrhoea with enteropathogenic E. coli was induced in 18 buffalo calves (a week old) which were divided into three equal groups while 4th group of six calves served as uninfected, untreated control. All the calves were monitored twice daily. Diarrhea developed in all treatment groups within 2-6 hours post infection. Twenty four hours after the on-set of diarrhea, neonates of Group (G)-1 was treated with antibiotic (Kanamycin®, Farvet Laboratories, Holland @ 10 mg/kg b.wt I/M) plus rehydration solution (sodium chloride-10g, potassium chloride-4g, sodium bicarbonate-20g, glucose-50g and water-4 litres @ 250–500 ml/day/I/V), G-2 with antibiotic and G-3 with rehydration solution. Diarrheic contents varied from semi solid to watery in consistency, yellowish to greenish yellow colour with blood or mucous and frequency of defecation was 6-10 times/day. Dehydration was mild (4-5%) in G-1, moderate (6-9%) in G-3 and severe (10-12%) in G-2 calves. Most severe signs of dehydration appeared in G-2 calves. Neonates in this group showed severe dryness of cornea, loss of suckling reflex, sunken eyes, dry mucous membranes and cold extremities. Temperature was significantly high in G-3 calves than G-1, G-2 and control calves. Pulse and respiration rates were low in all treatment groups than the control group. Total erythrocytic counts and hematocrit were high (P<0.05) in G-2 calves. Calves treated with Kanamycin showed crenated erythrocytes in the blood smears. Leukocytosis mainly due to neutrophilia was observed in all the treated calves than the control group. Serum total protein and globulin were low (P<0.05) in control calves than all treatment groups. Albumin was high in G-2 calves than calves of G-1, G-3 and control group. Immunglobulins were high (P<0.05) in G-2 calves than G-1, G-3 and control calves.

Key words: Neonatal calf diarrhea, Enteropathogenetic E. coli, Hematology, Proteins, Immunoglobulins.

INTRODUCTION - Mortality in buffalo neonatal calves in Pakistan has been reported to be 11.0 % mainly (23.7 to 63.0%) due to diarrhea (Khan and Khan, 1996; Zaman et al., 2006) caused by enteropathogenic E. coli (Hafiz et al., 1994; Khan and Khan, 1997). Regardless of the cause, acute enteric infections are characterised by the rapid development of dehydration and electrolytes imbalance which are believed to be responsible for many of the clinical signs (emaciation, weakness, turgor of the skin, sunken eyes), extreme metabolic acidosis, hemoconcentration and hypofunction of kidneys and liver (Maach et al.,
Various experimental studies had been carried out throughout the world to treat the diarrheic cow neonates (Brooks et al., 1997), however, information regarding treatment of NCD in buffalo calves is sparse. This paper describes the findings regarding clinical and hematological observations along with proteins and immunoglobulin concentrations recorded during and after treatment trials by inducing NCD in buffalo neonatal calves.

**MATERIAL AND METHODS** - Diarrhea with enteropathogenic E. coli (1010 CFU in 2 mL broth culture to each calf orally) was induced in 18 a-week old buffalo calves which were divided into three equal groups while 4th group of six calves served as uninfected, untreated control. Calves were monitored twice daily and 24 hours after the onset of diarrhea, neonates of Group (G)-1 was treated with antibiotic (Kanamycin®, Farvet Laboratories, Holland @ 10 mg/kg b.wt I/M) plus rehydration solution (sodium chloride-10g, potassium chloride-4g, sodium bicarbonate-20g, glucose-50g and water-4 litres @ 250–500 ml/day/I/V), G-2 with antibiotic and G-3 with rehydration solution. Rectal temperature, pulse rate, respiratory rate, general body condition, consistency and color of feces and frequency of diarrhea were recorded and dehydration was assessed on the basis of clinical signs (Fredrick, 1985) and was divided into mild (4-5%), moderate (6-9%) and severe (10-12%). Blood sample pre and post infection for 6 days from each calf was collected for hematological and biochemical studies. Data collected were analysed by ANOVA technique and regression coefficient.

**RESULTS AND CONCLUSIONS** - Diarrhea developed in all treatment groups within 2-6 hours post infection (PI) and contents varied from semisolid to watery with yellowish to greenish yellow color mixed with blood flakes or mucus. The frequency of defecation varied from 6 -10 times/day. Mean values of temperature were higher (P<0.05) in G-3 calves than G-1, G-2 and control calves. On day-2 PI pulse rate was significantly higher in G-1 (59.17±3.20/min) calves, followed by control (57.33±1.80/min), G-3 (56.00±2.10/min) and G-2 (46.00±2.40/min) calves. Mean pulse and respiration rate differ non-significantly between groups. Signs appeared in G-3 calves were of higher degree as compared to G-1 neonates (mild dehydration, 4-5%), however, most severe forms of signs appeared with severe dehydration (10-12%) in G-2 calves treated with antibiotic (Kanamycin) alone. Neonates in this group showed severe dryness of cornea, loss of suckling reflexes, sunken eyes, dry mucous membranes and cold extremities. They were recumbent and mostly were in the form of coma. In G-2, two calves died. Recovery in G-1 (Rehydration solution + Kanamycin) started from the 3rd day with restoration of all physical parameters. In G-2, recovery started from 5th day. In calves treated with rehydration solution (G-3), recovery pattern was quicker as compared to G-2 calves.

Mean values of total erythrocyte counts (TEC; ranged from 6.95 to 8.97 x 10 12/L), hemoglobin concentration (Hb conc; ranged from 11.55 to 14.58 g/dL), and hematocrit (ranged from 35.50 to 42.41 %) determined in calves of control and all treatment groups prior to and post infection and within each group at various days of infection differed non-significantly except Hb conc. which differed significantly (P<0.05) at day 4 and hematocrit which differed significantly (P<0.05) on all days PI between control and treatment groups except day 1 PI. In G-1 calves, none of the erythrogram parameters showed any correlation with each other. All the values of erythrogram were higher in G-2 calves indicating hemoconcentration. In G-3 calves, TEC showed positive correlation with Hb conc. (r = 0.352, P < 0.022) (r = 0.421,
P < 0.005) and negatively correlated in G-2, whereas hematocrit was positively correlated with G-3 and control group (r = 0.359, P < 0.019, r = 0.722, P < 0.000) and negatively with G-2 (r = -0.398, P < 0.009).

Total leukocyte counts (TLC) determined (varied from 11.78 to 12.91 x 10^9/L) in calves of control and all treatment groups differed significantly (P<0.05) in treatment groups than the control group at various days of experiment except at last two days of experiment i.e., at day 5 and 6 P.I. In calves within each treatment groups, values of TLC also differed significantly (P<0.05) at various days of PI than day 0 of infection. Mean values of neutrophils (ranged from 48.83 to 63.50%), lymphocytes (ranged from 29.82 to 45.85%), monocytes (ranged from 4.17 to 10.50%) and eosinophils (ranged from 2.80 to 3.65%) determined in calves of control and all treatment groups prior to and post infection differed non-significantly. Mean values of neutrophils, lymphocytes, monocytes and eosinophils within calves of control and treatment groups did not differ significantly at various days of PI than day 0 of experiment, however, neutrophils and lymphocytes in 2nd group showed increasing/decreasing trend in the experimental days respectively. Neutrophils were negatively correlated with lymphocytes in all the experimental groups (Figure 1).

Serum total proteins (STP; ranged from 7.23 to 11.87 g/dL), albumin (ranged from 3.21 to 4.28 g/dL) and globulin (ranged from 3.77 to 8.13 g/dL) determined in calves of control and treatment groups differed (P<0.05) in treatment groups at various days of experiment except day 1 P.I. Values of STP and globulin were lower (P<0.05) in control calves than all treatment groups, while these values did not differ between calves of G-2 and G-3 except globulin which differed at day 2 P.I. Values of albumin was higher (P<0.05) in G-3 calves than calves of G-1, G-2 and the control group at day 2 and day 3 and these values were also higher (P<0.05) in G-1, G-2 than calves of control and G-3 calves in last three days of P.I.

Values of immunoglobulins (ranged from 49.82 to 85.32 ZST units) were higher (P<0.05) in G-3 calves than G-1, G-2 and control calves while these values did not differ between calves of G-1, G-2 and control group except the last two days P.I. i.e., 5 and 6 day whereas these values were higher (P<0.05) in G-1 calves. Mean values of immunoglobulins within each group at various days of P.I. differ non-significantly than day 0 of infection. Immunoglobulins showed positive correlation with STP in all groups, with albumin in all groups except G-2 and with globulin only in G-1 calves. SPT was strongly and positively correlated with albumin and globulin in all groups. SPT did not show any correlation with albumin. Globulin showed positive correlation with immunoglobulin in control and G-3 calves (Figure 2).

Figure 1. Neutrophils are negatively correlated with lymphocytes in control and treated calves. Correlation is much strong in G-1 calves.
It was concluded from the present study on the basis of all the parameters studied that hemoconcentration and dehydration do occur in buffaloes due to diarrhea. Mild dehydration may be corrected by oral rehydration solution. In moderate and severe dehydration, rehydration solution (I/V) along with antibiotic is a better treatment for neonatal calf diarrhea in buffalo calves.

**REFERENCES** - *Brooks*, H.W., Mitchell, A.R., Wagstaff, A.J., White, D.G., 1996. Falsibility of faecal consistency as a criterion of success in the evaluation of oral fluid therapy for calf diarrhoea. Brit. Vet. J. 152:75-81. *Fredrick*, G.S., 1985. Oral electrolyte replacement solutions. Vet. Clinics North Am. Food Anim. Pr. 1:139 – 142. *Hafiz*, M.A.H., Khan, A., Khan, M.Z., Sabri, M.A., Naz, N.A., 1994. Bacteriology of neonatal calf diarrhoea. Buffalo J. 10:177-183. *Khan*, A., Khan, M.Z., 1996. Neonatal calf mortality in Pakistan. I: Prevalence and factors influencing mortality in buffalo and cow neonates. Buffalo J. 12:219-229. *Khan*, A., Khan, M.Z., 1997. Bacteria isolated from natural cases of buffalo and cow neonatal calf diarrhoea, pneumonia and pneumo-enteritis. Vet. Archiv. 67:161-167. *Maach*, L., Grunder, H.D., Boujija, A., 1992. Clinical and haematological investigation in newborn Holstein Friesian calves with diarrhoea in Morocco. Deutsche-Tierarztliche Wochenschrift. 99:133-140. *Zaman*, T., Khan, A., Akhtar, M.Z., 2006. Some of the risk factors of Nili-Ravi buffalo (*Bubalus bubalis*) neonatal calf mortality in Pakistan. Pakistan Vet. J. 26:121-125.