HAEMATLOGICAL STUDIES AND ESTIMATION OF ELECTROLYTES IN DOGS EXHIBITING DIARRHOEAL SIGNS

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ABSTRACT

This project was designed to study the haematological values and the serum electrolytes (sodium, potassium and chloride) levels in the dogs exhibiting diarrhoeal sings. One hundred dogs showing diarrhoal sings were selected from Dog Hospital, College of Veterinary Sciences, Lahore while ten healthy dogs were also used as control group. Tentative diagnosis of cause of diarrhoea was tried to establish in each animal of experimental group. Blood samples were collected from all the animals of both groups. The values of haematological parameters (TEC, PCV, ESR and Hb) and serum electrolytes (sodium, potassium and chloride) were determined on all blood samples. The changes in blood values of each case were correlated with its tentative diagnosis. The conditions observed were parvo virus infection, parasitic infestation, mixed infection, canine distemper and dietary distrubance. These conditions of experimental dogs were named as groups A, B, C, D and E, respectively and group F acted as control. Haematological values (TEC and PCV) of groups A, B, C, D and E were significantly different ($P < 0.001$) from means of control group. The mean values of erythrocyte sedimentation rate of groups A, B, C, D and E were not significantly different from each other but were significantly different ($P < 0.001$) from means of groups D and E. The mean values of serum sodium of groups A, C and D were not significantly different from each other but were significantly different ($P < 0.001$) from the mean values of groups B, E and F. There was non-significant difference among the mean values of serum potassium level of groups A, B, C, E and F. All the dogs of experimental groups exhibited macrocytic normochromic anaemia.

INTRODUCTION

As in other animals diarrhoea in dogs occurs frequently under the circumstances prevailing in Pakistan. Diarrhoea may result from any of the following closely related pathogenic mechanisms: interruption of normal cell transport processes, decrease in the surface area available for absorption by shortening of the bowel, increase in tentestinal motility, presence in the intestine of large amounts of un-absorable osmotically active molecules and abnormal increase in gastric or intestinal permeability leading to increased secretion of water and electrolyts (Henry *et al.*, 1978).

The study was carried out with objectives to study the changes in blood picture and to determine levels of electrolytes (sodium, potassium and chloride) in dogs showing clinical signs of diarrhoea and also to elucidate a relationship between these levels and suspected disease etiological agents. It is hoped that in future the results of this study will contribute a lot to the clinicians while prescribing electrolytes preparations to dogs exhibiting diarrhoeal signs of different origin.

MATERIALS AND METHODS

Experimental Animals

One hundred dogs exhibiting diarrhoeal signs were selected for this study from Dog Hospital, College of Veterinary Sciences, Lahore from July, 1996 to November, 1996. Their ages, sex, breeds and case histories were recorded and clinical examination especially skin elasticity test described by Robert (1996) was conducted and tentative diagnosis of cause of diarrhoea was tried to be established for each case.

Control Animals

Ten healthy dogs were taken as control group.

Collection of Faecal Samples

Faeces of the dogs, showing diarrhoeal signs, were collected.

Collection of Blood Samples

Blood samples from all the dogs (experimental and control) were collected from cephaiic vein. Each blood sample was divided into two parts. Anticoagulant

(EDTA) was mixed in half blood sample and other half of the sample was used for serum collection. Serum was separated and stored at -20°C. The following studies were conducted on each case:

Faecal Examination

The faecal samples were examined by direct smear method (Maff and Adas, 1986) for parasites.

Haematological Parameters

The values of total erythrocytic count (TEC), packed cell volume (PCV), erythrocytic sedimentation rate (ESR) and haemoglobin (Hb) were determined as per the methods described by Coles (1980).

The values of mean corpuscular volume (MCV), mean corpuscular hemoglobin, (MCH) and mean corpuscular hemoglobin concentration (MCHC) were computed as per the formulae described by Bush (1975).

Determination of Serum Electrolytes

The electrolytes (sodium, potassium and chloride) level was estimated for each serum sample on spectrophotometer by using commercially available kits (BID-Diagnostic for sodium; potassium and chloride, Germany and Human, Germany) as described by Coles (1980).

RESULTS

Clinically a tentative diagnosis was established for each case and on the basis of history and clinical picture, five different conditions were observed: Parvo-virus infection, parasitic infestation, mixed infection, dietary disturbances and canine distemper (Tabe 1).

Clinical Picture of Different Conditions

Parvo-Virus Infection

The age of the dogs affected with parvo virus infection ranged from 5 to 20 weeks. The observed clinical signs included anorexia, depression, vomiting and watery bloody diarrhoea. All the cases observed were un-vaccinated dogs.

Parasitic Infestation

The age of the dogs affected with parasites ranged from 3 months to 1 year. The clinical sings noted were, watery diarrhoea of greenish, brownish and yellowish colour, weakness, while temperature was within the normal range.

Mixed Infection

All age groups of animals were affected with this type of infection. Recorded clinical picture was high temperature, i.e., upto 105°F in most of the cases, diarrhoea of variable consistencies and colours that was soft to watery and yellowish and tan colour, salivation, depression and anorexia.

Canine Distemper

The dogs affected with canine distemper belonged to 3 months to 1 year age groups. Clinical signs observed were, high temperature, diarrhoea, vomiting, discharge from the eyes and the nose, depression, extreme weakness and dehydration. All affected dogs were unvaccinated.

Dietary Disturbances

Dietary distrubances were also recorded in dogs from 4 weeks to 4 years of age. The clinical findings included, diarrhoea of watery in nature, occasionally bloody, without high temperature. In these cases the history of change in feed prior to diarrhoea was noted.

Faecal Examination

Faecal samples from experimental dogs were collected and examined for parasitic infestation. It was found that 33 dogs of groups B and 17 dogs of group C were positive for parasitic infestation. The prevalence and type of parasitic infestation was as follows: 30 were positive for *Ancylostoma caninum* while 20 were positive for *Toxocara canis* infestation.

Haematological and Biochemical Studies

The mean values of TEC, PCV, ESR and Hb of experimental and control dogs are given in Table 2. The mean values of MCV, MCH and MCHC of experimental and control dogs are given in Table 3. The mean values of Na, K and Cl in serum of the experimental and control dogs are given in Table 4.

DISCUSSION

The Parvo-virus infection was prevalent in unvaccinated dogs who fell in the age range of 1-4 months. The clinical findings such as, anorexia, depression, vomiting and watery bloody diarrhoea are in complete agreement while the distribution of age is in partial fulfilment with the findings of Hirasawa *et al.* (1987), Schwendenwein *et al.* (1988), and Dahalgard (1989). The decrease in haematological values, i.e., TEC, PCV and Hb suggest that vascular epithelium of the intestine might be damaged while decrease in the ESR value indicated the presence of large number of

reticulocytes in the blood samples hindering rouliaux formation. Dacie and Lewis (1968) believed that the effect of anaemia on ESR was irregular. Type of anaemia was macrocytic normochromic due to increasing values of MCV, MCH and MCHC. Jain (1986) reported that a true hyperchromic state did not exist so increase in MCHC is designated as hypochromic or normochromic. There was also a decrease in the values of Na, K and Cl. Carlyle (1967) observed decrease in electrolytes with dehydration. Doxy and Nathan (1989) also noted hypokalemia in diarrhoea. This may be due to increased luminal osmotic pressure in the small intestine and deficiency of enzymes leading to un-absorbed material.

The parasitic infestation was confirmed by the presence of *Ancylostoma caninum* and *Toxocara canis* species of parasites. Solusby (1982), Okaeme (1985) and Emde (1988) also reported the same species responsible for diarhoea in dogs. The significant decrease in the mean values of TEC, PCV and ESR as compared to the control group may be due to the increased capacity for sucking blood in the intestine by mature and immature *Ancylostoma caninum*. The type of anaemia was macrocytic normochromic due to an increase in the mean values of MCV, MCH and MCHC. Mean electrolytes values were also decreased and it may either be due to un-absorbed material in the intestine or may be due to mechenical obstruction and massive sloughing of intestinal epithelial cells.

Ehrensperger and Pospichil (1989) recorded mixed infection in dogs. Grunsell (1967) also advocated that bacteria could have primary or secondary role in causing diarrhoea and the clinical sings like high temperature, sneezing, coughing and diarrhoea are in line with the clinical findings of this study. Significant decrease in the mean values of TEC, ESR, PCV and Hb suggest that the infection had either an effect on the haematopiotic system of the host or the permeability of vascular epithelium. Increased values of MCV, MCH and MCHC showed macrocytic normochromic type of anaemia and it may be due to some sort of liver disease. The levels of electrolytes were also decreased. According to Wilson and Green (1986) acute diarrhoea in horses was characterized by hyponatraemia and hypochloridaemia.

The clinical findings of dogs suffering from canine distemper observed in this study differ from the clinical signs described by Blixenkrone-Moller *et al.* (1989) due to the absence of any nervous signs which suggests the presence of canine distemper at an early phase. A significant decrease in the mean values of PCV, TEC and Hb may be due to the effect of canine distemper virus on haematopiotic system and an increase in the value of ESR showed an increased tendency for the RBC's to aggregate into the rouleaux. Mean values of MCV, MCH and MCHC were increased due to the fact that dogs may have leukaemia. Decrease in the mean values of electrolytes may be due to the fact that virus destroys the absorptive cells and there is loss of enzymes responsible for the digestion of disaccharides and the loss of differentiated cells diminishes glucose, sodium carrier and sodium, potassium, ATP-ase activites. This leads to loss of sodium, potassium, chlorides, bicarbonate and water and the development of acidosis.

Defective diet and abrupt weaning were the main causes of diarrhoea found in this study and these observations were also recorded by Cardini *et al.* (1977) and Hill and Penny (1973). Values of TEC and PCV were decreased while that of ESR increased and mean value of Hb remained within the normal range. Macrocytic normochromic was the type of anaemia owing to the increased values of MCV, MCH and MCHC. It might be due to the deficiencies of vitamin B_{12}, foliate and iron. Mean values of serum electrolytes were also decreased with a rising blood pH, a rise in potassium and falling sodium levels. Coles (1980) described that prolonged vomiting led to an increase in blood pH and plasma bicarbonate levels with a decrease in serum potassium and chloride values. The findings of this study and the findings of above workers showed that changes in electrolytes levels are quite similar in dehydrated cases either due to diarrhoea or vomiting.

When mean haematological values of all the groups were carefully observed, it was noted that group D, i.e., group designated as canine destemper, showed a significant decrease in the mean values of TEC, PCV and Hb as compared to the remaining groups while the values of ESR increased in this group as compared to all the other groups. In such a situation clinician ought to consider the option of prescribing iron preparation along with other symptomatic treatment to retain the lost health of the dog. And when mean values of serum biochemical substances of all the groups were compared it was observed that group D, designated as canine distemper, showed significant decrease in the mean values of sodium, potassium and chloride, as compared other groups. So in this case clinician should opt for the fluid therapy which contains a good proportion of electrolytes in it rather than recommending only 5 and 25% dextrose.

The above given recommendations are based on limited samples. So it is suggested that in future these recommended measures may be tried on a large population of dogs suffering from diarrhoea for their conformation.

Table 1 Tentative Diagnosis of the experimental dogs

Groups	Name Of The Condition	Affected Animals Out Of 100
A	Parvo-virus Infection	33
B	Parasitic Infestation	33
C	Mixed Infection	17
D	Canine Distemper	10
E	Dietary Disturbance	7

Table 2: Mean ± SE hematological values of dogs suffering from diarrhoea of various groups

GROUPS	TEC (10^6cu.mm)	PCV (%)	ESR (mm/hr)	Hb cone. (g/dl)
A	353.818 ± 14.44^{b}	28.412 ± 1.01^{bc}	1.879 ± 0.82^{c}	11.997 ± 0.45^{a}
B	369.667 ± 14.44^{b}	31.970 ± 1.01^{b}	2.66 ± 0.82^{c}	13.133 ± 0.45^{a}
C	275.529 ± 20.11^{b}	28.000 ± 1.41^{bc}	2.894 ± 1.14^{c}	11.565 ± 0.62^{a}
D	178.500 ± 26.23^{c}	24.790 ± 1.84^{c}	23.450 ± 1.48^{a}	10.480 ± 0.81^{a}
E	344.857 ± 31.35^{b}	28.571 ± 2.20^{bc}	10.571 ± 1.77^{b}	13.129 ± 0.97^{a}
F	544.100 ± 26.30^{a}	40.400 ± 1.84^{a}	4.020 ± 1.48^{c}	13.000 ± 0.81^{a}

TEC = Total erythrocyte count
PCV = Packed cell volume
ESR = Erythrocyte sedimentation rate
Hb = Haemoglobin
The mean values in each column with different letters differ significantly ($P < 0.001$).

Table 3: Mean ±SE values of erythrocyte indices of dogs suffering from diarrhoea with various groups

GROUPS	MCV (um^3)	MCH (pg)	MCHC (%)
A	84.029 ± 4.16^{bc}	35.328 ± 1.52^{b}	42.962 ± 1.18^{a}
B	89.855 ± 4.16^{bc}	36.900 ± 1.52^{b}	41.268 ± 1.18^{a}
C	106.141 ± 5.80^{b}	42.285 ± 2.12^{b}	41.598 ± 1.64^{a}
D	150.121 ± 7.56^{a}	62.333 ± 2.76^{a}	42.285 ± 2.14^{a}
E	83.586 ± 9.03^{bc}	38.813 ± 3.33^{b}	46.314 ± 2.55^{a}
F	74.448 ± 7.56^{c}	23.934 ± 2.76^{c}	32.578 ± 2.14^{b}

MCV = Mean corpuscular volume
MCHC = Mean corpuscular Haemoglobin
MCHC = Mean corpuscular haemoglobin concentration
The mean values in each column carrying the same superscripts are not significantly different from each other ($P > 0{,}001$).

Table 4: Electrolytes levels (mean ± SE) in serum of dogs suffering from diarrhoea in various groups

GROUPS	Sodium (mmol/1)	Potassium (mmol/1)	Chloride (mmol/1)
A	128.436 ± 1.49^{b}	3.530 ± 0.16^{ab}	91.883 ± 1.72^{bcd}
B	139.070 ± 1.49^{a}	3.824 ± 0.16^{ab}	98.570 ± 1.72^{abc}
C	127.876 ± 2.08^{b}	3.481 ± 0.22^{ab}	88.788 ± 2.39^{cd}
D	123.300 ± 2.71^{b}	3.162 ± 0.29^{b}	87.208 ± 3.12^{d}
E	139.714 ± 3.24^{a}	4.121 ± 0.34^{ab}	101.286 ± 3.72^{ab}
F	144.780 ± 2.71^{a}	4.330 ± 0.29^{a}	107.600 ± 3.12^{a}

The mean values in each carrying the same superscripts are not significantly different from each other ($P > 0.001$).

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