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Research Article

Predictors of the Duration of Management and Clinical Outcomes in Dogs with Acute Gastroenteritis

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Abstract

Canine gastroenteritis represents one of the major presenting disorders in canine practice with challenges in its diagnosis and management. Its prognosis is reliant on the aetiology, severity of gastroenteritis, and response to treatment. Knowledge of factors influencing the course of this disorder is essential. This study evaluates prognosticators that can be utilised in predicting the clinical outcome and duration of management for dogs presenting with gastroenteritis. To achieve this, the clinical pathology profile of 104 dogs with gastroenteritis managed on outpatient was assayed using standard procedures. Data analysis was conducted using descriptive, Pearson's correlation, and logistic regression model at $\alpha^{0.05}$ significance level. Haematological changes noted before treatment were anaemia, monocytopaenia, lymphocytosis, leukopaenia, neutropaenia, thrombocytopaenia, pancytopaenia, hyperfibrinogenaemia, and hypofibrinogenaemia. Biochemical changes were azotaemia, mild hyperglycaemia, hyperglobulinaemia, hyponatraemia, elevated albumin/globulin ratio, alanine aminotransferase, and alkaline phosphatase, hypercreatinaemia, hyperproteinaemia, hyperalbuminaemia, hypoalbuminaemia, hypokalaemia, hypercalcaemia, hypochloraemia, decreased aspartate aminotransferase and hypoproteinaemia. Reduction in the three blood cellular components ($pancytopaenia: OR = 0.2$) or leukopaenia ($OR = 3.5$) prolonged duration of management by a day above the median duration of five days. Similarly, leukopaenia ($OR = 0.1$), hypoalbuminaemia ($OR = 7.1$), and colic ($OR = 0.01$) were associated with a poor prognosis. Leukopaenia was the only clinicopathologic abnormality that influenced both the duration of management and clinical outcome. The progression of gastroenteritis may not be determined by its cause but the presence of colic, hypoalbuminaemia ($serum\ albumin\ conc. \leq 20mg/dL$), leukopaenia ($WBC \leq 4{,}500\ cells/L$), and pancytopaenia before treatment may predict clinical outcome and the duration of management for dogs presenting with gastroenteritis.

Keywords: Canine Practice; Sampling; Logistic Regression; Biomarkers; Prognosis; Outpatient.

Introduction

The functions of the digestive system include food digestion and absorption, toxins neutralisation and elimination of wastes products from the body. Gastroenteritis is one of the important disorders of the gastrointestinal tract which has caused high morbidity and several deaths of dogs in Nigeria [1-3]. Gastroenteritis represents one of the major presenting disorders in canine practice with challenges in its diagnosis and management [4]. The aetiologies are multifactorial and can be viral, bacterial, or protozoan, non-infectious, and systemic non-gastrointestinal diseases. Its management involves symptomatic treatment, rehydration, or prevention of dehydration, and/or management of secondary bacterial infections. Clinical pathological assessment

is useful in establishing differential diagnoses, assessing response to treatment, and setting prognosis [5,6]. Good knowledge of the several biomarkers and predictors of the progression of a disease is relevant for establishing appropriate treatment and identification of patients that are critically ill [7]. Biomarkers are the several numbers of objective normal or abnormal findings observed from a patient under physical or clinical examination, indicating functional physiology or pathological status. Meaning clinicians must be able to repeatedly measure such clinical findings correctly and consistently [8].There are reports of marked alterations in the clinicopathologic indices of patients with gastroenteritis, with electrolyte imbalance and dehydration as the most common [5,9,10]. Expanding knowledge and effective prognostication can be beneficial in managing this disorder. This study was conducted to assess clinical pathologic profiles of Nigerian dogs with gastroenteritis, and their usefulness in diagnosis and prognostication. We hypothesized that regardless of the aetiology involved, changes in clinical pathology profiles of dogs with gastroenteritis at presentation are useful in predicting outcome and duration of management.

Ethical Considerations

This study received approval from the University of Ibadan Animal Care and Use Research Ethics Committee (*protocol number UI – ACUREC / App* / 03 / 2017 / 007) and consent from the dog owners and the management of the veterinary clinics sampled.

Materials and Methods

Sampling

A total of 104 client-owned dogs were sampled from five selected veterinary clinics in Nigeria, using a non-probability haphazard sampling method. Only cases with gastroenteritis that have not been treated before presentation, and were screened for Canine Parvovirus (CPV), Coronavirus (CCoV), *Giardia,* intestinal parasites were eligible for inclusion in the study. Demographic and qualitative data collected were breed, age, sex, husbandry practice, anaemia, anorexia, fever, depression/lethargy, dehydration, abdominal pains, body condition score, worming history, vaccination history, co-infection, diagnosis, faecal consistency (formed, watery, bloody, mucoid), frequency/duration of diarrhoea, frequency/duration of vomiting, the Duration of Management (DOM) and outcome (Death, Euthanasia, or Recovery). The DOM was defined as a difference in the number of days between first presentation and recovery or discharge. Qualitative data, blood samples for haematology and biochemical tests, as well as faecal samples, were collected once from each patient at initial presentation. The dogs were managed as out-patients and treatment were given based on the assessed need of each patient.

Laboratory Analyses

The dogs were screened first for CCoV, CPV, and *Giardia* using on-the-spot immunoassay kits (SensPERT® VetAll Laboratories, Korea). Coprological techniques for laboratory screening of endoparasites were done as described by Urquhart et al. [11]. Blood samples for haematology and serum chemistry were analysed using commercial kits and standard procedures (Randox Laboratories Ltd, UK).

Data Handling and Statistical Analysis

The dogs $(N=104)$ were grouped based on responses to treatment: survivors $(n=70)$ and non-survivors $(n=34)$. To ascertain the strength of the associations and predictive ability of the covariates influencing the prognosis and the DOM (below or above the median duration), biochemical and haematological indices were coded as being either within or outside the normal reference limits. Also, qualitative variables were classified as either present or absent, vaccinated or nonvaccinated, dewormed or non-dewormed, viral, or other diseases, etc. The hematologic and biochemical variables were presented as a mean ± standard error of the mean. Descriptive statistics, Pearson's correlation, and logistic regression were used in analysing the data. Pearson's correlation was performed and variables demonstrating significant correlation with DOM and clinical outcomes were selected and further analysed by logistic regression model using the enter method. Hosmer-Lemeshow χ^2 test, the omnibus test of model coefficients, and Nagelkerke's pseudo-R^2 were performed to ensure the final model was well fitted. All Statistical analyses were performed with SPSS (*v*20, *IBM*) for Windows and evaluated at $p<0.05$ significance level.

Results

Table 1 summarises the characteristics of the sampled dogs. The patients $(N=104)$ studied comprised of Alsatians $(n_1=29)$, Boerboels $(n_2=20)$, Rottweilers $(n_3=20)$, Crossbreeds $(n_4=18)$, Caucasia $(n_5=11)$, and other least represented dog breeds $(n_6=6)$. The dogs aged 7.7 months $(95\%\ CI\ =\ 5.7-9.7)$. Eighty dogs were ≤6 months old and were mostly males (57). The dogs had fair (39) and emaciated (42) body condition scores. Ninety-seven were restricted dogs, while 7 strayed. Gastroenteritis was more prevalent in restricted dogs (97 *cases*) than stray dogs (7 *cases*). More than 50% of the dogs (56) were dewormed within the last 3 months before the illness. Diseases detected were majorly viral (93) and non-viral (11). Two-third (70) of the patients survived, whereas one-third (34) died. Two-third (70) received at least a dose of the DHLPP vaccine, while one-third was unvaccinated. Clinicopathologic changes and variables influencing DOM and outcomes are presented in Tables 2–6.

Table 1: Characteristics of dogs with acute gastroenteritis.

Variables	Category	Total	
		Frequency (n)	Percentage (%)
Breed	Alsatian	29	27.9
	Boerboel	20	19.2
	Rottweiler	20	19.2
	Crosses	18	17.3
	Caucasian	11	10.6
	Others [c]	6	5.6
Age [a]	0–6 months	80	76.9
	7–11 months	17	16.3
	≥12 months	7	6.7
Sex	Male	57	54.8
	Female	47	45.2
Body score [b]	Good	23	22.1
	Fair	39	37.5
	Emaciated	42	40.4
Lifestyle	Restricted	97	93.3
	Strays	7	6.7
Worming history	Not dewormed	48	46.2
	Dewormed	56	53.8
DHLPP vaccination history	Unvaccinated	34	32.7
	Vaccinated	70	67.3
Diagnosis	Viral diseases	93	89.4
	Helminthosis	5	4.8
	Hepatic diseases	1	0.9
	Colitis/gastritis	3	2.9
	Undetermined	2	1.9
Treatment outcome	Survived	70	67.3
	Died	34	32.7
	Grand total (N)	**104**	**100**

[a]Mean age of the dogs (7.7 months, median = 4 months, CI = 5.7–9.7).

[b]Mean weight of the dogs (13.5kg, CI = 11.9–15.2); Average number of dogs per household (2.3±0.3; CI = 1.9–2.7).

[c]Others (least represented breeds = Great Dane, Bullmastiff, Lhasa Apso, Pitbull, Doberman, and Indigenous).

Table 2: Clinical signs recorded in dogs with acute gastroenteritis.

Clinical signs	Sub-category	Frequency (n)	Percentage (%)
Anorexia	-	92	88.5
Abdominal pain	-	10	9.6
Dehydration	-	68	65.4
Depression	-	60	57.7
Diarrhoea		100	96.1
	Bloody	69	66.3
	Watery or mucoid	31	29.8
Lethargy	-	34	32.7
Fever	-	31	29.8
Mucosa pallor	-	48	46.2

Vomiting	-	75	72.1
Faecal consistency	Watery without solid	89	85.6
	Sloppy and mushy	7	6.7
	Soft stool	7	6.7
Tick infestation	-	25	24.0

The mean rectal temperature (39.4°C, CI = 39.2-39.6°C); Mean respiratory rate (44.6 breaths/min, CI = 36.9–52.4); Mean heart rate (135.7±6.5 beats/min, CI = 123-148.5); Mean diarrhoea episode (3.1±0.3, median = 2; CI = 2.6–3.6 times); Mean vomiting episodes (2.4±0.3, median = 1, CI = 3.0-1.8 times); Mean duration of diarrhoea (3.7±0.3, median = 3, CI = 3.2-4.2 days); Mean duration of clinic signs before presentation (3.3±0.3, median = 3, CI = 2.8-3.9 days); mean duration of management (5.3±0.3, median 5, CI = 4.8-5.9).

Table 3: Haematologic changes in dogs with acute gastroenteritis.

Abnormality observed	No. of patients n (%)	Observed range (mean)	[b]Reference range
Anaemia (PCV, %)	49 (47.1)	26–28.9	35 – 57
Haemoconcentration (PCV, %)	1 (0.9)	---	35 – 57
Low Hb (g/dL)	41 (39.4)	8.8–10	11.9 – 18.9
Low RBC (µL)	25 (24.0)	3.8–4.5	4.95 – 7.87
High RBC (µL)	9 (8.6)	8.5–8.8	4.95 – 7.87
Low MCV (fL)	60 (57.7)	60.1–61.3	66 – 77
Low MCH (pg)	59 (56.7)	19.5–20	21 – 26.2
Low MCHC (g/dL)	13 (12.5)	28.8–31.2	32 – 36.3
Leukopaenia (µL)	32 (30.8)	3.4–4	5 – 14.1
Leucocytosis (µL)	10 (9.6)	15.9–28.8	5 – 14.1
Thrombocytopaenia (µL)	49 (47.1)	122.7–150.5	211 – 621
Thrombocytosis (µL)	1 (0.9)	---	211 – 621
Neutropaenia (%)	28 (26.9)	40.4–47.8	58 – 85
Neutrophilia (%)	8 (7.7)	86.4–91.4	58 – 85
Lymphopenia (%)	7 (6.7)	4.5–6.1	8 – 21
Lymphocytosis (%)	55 (52.9)	34.2–40.6	8 – 21
Monocytopenia (%)	15 (14.4)	0.2–0.7	2 – 10
Monocytosis (%)	3 (2.8)	10–14	2 – 10
Eosinophilia (%)	1 (0.9)	---	0 – 9
Pancytopaenia [a]	29 (27.9)	PCV 26.4–31.1;	35 – 57
		WBC 4.3–5.5	5.0 – 14.1
		PLT 109.9–143.9	211 – 621
Hypofibrinogenemia (mg/dL)	16 (15.4)	---	150 – 300
Hyperfibrinogenaemia(mg/dL)	20 (19.2)	446.4–513.7	150 – 300

[a]Pancytopaenia was defined as the combination of low haematocrit (PCV, <37% for dogs older than five months or <30% for dogs younger than five months), white blood cell counts (WBC, $<6\times10^3$/L) and platelets ($<200\times10^3$/L) counts [12].

[b]Reference range [13].

Table 4: Serum biochemical changes in dogs with acute gastroenteritis.

Abnormality	No. of patients (n, %)	Observed range (mean)	[a] Reference range
Hypoproteinaemia (g/dL)	9 (8.7)	4.6–5.1	5.4 – 7.5
Hyperproteinaemia (g/dL)	35 (33.7)	8–8.3	5.4 – 7.5
Hypoalbuminaemia (g/dL)	39 (37.5)	1.6–1.8	2.3 – 3.1
Hyperalbuminemia (g/dL)	17 (16.3)	3.5–3.8	2.3 – 3.1
Hypoglobulinaemia (g/dL)	2 (1.9)	2.3–2.7	2.7 – 4.4

Hyperglobulinaemia (g/dL)	69 (66.3)	4.9–5.0	2.7 – 4.4
Raised A/G ratio	58 (55.8)	2.3–2.7	0.8 – 1.7
Hyperglycaemia (mg/dL)	29 (27.9)	137–139.8	76 – 119
Hypercreatinaemia (mg/dL)	47 (45.2)	2.1–2.2	0.5 – 1.7
Azotaemia (mg/dL)	78 (75)	37.4–39.8	8 – 28
Raised Urea/Creatinine ratio	6 (5.8)	26.4–34.7	4 – 27
Raised ALP (u/L)	57 (54.8)	122.8–126.2	1 – 114
Raised ALT (u/L)	75 (72.1)	118.4–121.4	10 – 109
Low AST (u/L)	10 (9.6)	11.4–12	13 – 15
Raised AST (u/L)	2 (1.9)	---	13 – 15
Hypokalaemia (mEq/L)	27 (26.0)	3.4–3.6	3.9 – 5.7
Hyperkalaemia (mEq/L)	1(0.9)	---	3.9 – 5.7
Hyponatraemia (mEq/L)	64 (61.5)	134.5–136.7	142 – 152
Hypercalcaemia (mEq/L)	26 (25.0)	12.5–12.8	9.1 – 11.7
Low Na/K ratio	1 (0.9)	---	25 – 40
Raised Na/K ratio	8 (7.7)	42.4–43.6	25 – 40
Hypochloraemia (mEq/L)	19 (18.3)	104.7–107.4	110 – 124
Hyperchloremia (mEq/L)	4 (3.8)	124.8–126.7	110 – 124

Tp = total proteins; Alb = albumin; Glb = globulin; A/G ratio = albumin to globulin ratio; BUN = blood urea nitrogen; ALP = alkaline phosphatase, ALT = alanine aminotransferase; AST = aspartate transaminase; Crt. = creatinine; aReference range [13].

Table 5: Correlations of some studied variables with outcome and duration of management.

Variables	Correlation (R^2)	*p*–value
Clinical outcome		
White blood cells	0.44	<0.001 [a]
Albumin	-0.28	0.008 [a]
Anaemia	0.20	0.04 [b]
Mucosa pallor	0.22	0.026 [b]
Duration of management	-0.36	<0.001 [a]
Depression	0.22	0.023 [b]
Lethargy	0.21	0.03 [b]
Abdominal pain	0.33	0.001 [a]
Duration of management		
Packed cell volume	0.21	0.033 [b]
Haemoglobin	0.24	0.039 [b]
White blood cells	-0.24	0.015 [b]
Pancytopaenia	0.32	0.001 [a]
Total proteins	-0.26	0.015 [b]
Alkaline phosphatase	0.21	0.05 [b]
Sex	-0.23	0.017 [b]
Lifestyle	-0.20	0.038 [b]
Duration of diarrhoea	0.26	0.009 [a]

[a]Correlation was significant at the 0.01 level.

[b]Correlation was significant at the 0.05 level, N=104.

Table 6: Risk of poor prognosis and prolonged duration of management in the distinct groups compared to normal (OR =1).

Characteristics	OR (95%CI)	Albumin	WBC	Colic	Pancytopaenia
Clinical outcome	Crude	7.1 (1.8-28.6)	0.1 (0.02-0.4)	0.01 (0.0-0.1)	-
	p-value	0.006	0.002	0.001	-
Duration of management	Crude	-	3.5 (1.3-9.1)	-	0.2 (0.1-0.5)
	p-value		0.01		0.002

Note: CI = confidence interval. Changes in albumin concentration had increased likelihood with 7.1 times the odds of death for patients with hypoalbuminemia than patients without. Changes in total WBC and presence of colic had decreased likelihood and are 0.1 and 0.01 times respectively the odds of death for patients with leukopenia and colic than those without, all things being equal. Changes in WBC had increased likelihood with 3.5 times the odds of death for patients with leukopenia than patients without. The presence of pancytopenia had a decreased likelihood and has 0.2 times the odds of death for patients, all things being equal.

Discussion

This study assessed the importance of history taking, clinical examination, and clinical pathology profiles of dogs before treatment. This was to enable us to predict the duration of management and outcome in cases of canine gastroenteritis examined. Canine gastroenteritis was more prevalent in puppies below seven months, validating the report of Wells and Hepper [14]. Puppies are immunologically incompetent and maternally-derived antibodies wane early in life making them more vulnerable to infections [15]. The common clinical findings presented in Table 2 corroborate the reports of Castro, et al. [16]. Gastrointestinal inflammatory processes trigger anorexia, pyrexia, and weight loss by the release of inflammatory endogenous mediators, interleukin-1, and cachectin [17,18]. Haematologic changes recorded in Table 3 tally with findings from previous reports [6,19,20]. The microcytic hypochromic anaemia in this report may be linked to iron deficiency, following intestinal blood loss and inflammations from haemorrhagic gastroenteritis [21,22]. Neutrophilia may be due to immune system stimulation to control opportunistic bacteria during the onset of the disease. The later stages of viral infections are characterised by severe neutropaenia due to the destruction of immune cells and bacterial colonisation of the gut.

Biochemical responses recorded in the dog patients revealed that about 75% of them were azotaemic; comparable to existing findings [23]. This is attributable to dehydrating gastroenteritis and pre-renal uraemia with a reduction in glomeruli filtration rate or catabolic breakdown of tissues in pyretic animals [24]. The sampled dogs had a temperature range of 39.2–39.6°C, suggestive of pyrexia due to bacterial infections. The high rates of hyperglobulinaemia, hypoalbuminaemia, increased A:G ratio, hyperalbuminemia, and hypoproteinaemia observed corroborated previous reports [25,26]. Changes in total proteins were related to a marked reduction in dietary intake, malabsorption, and protein-losing enteropathy [25,26] hepatic synthesis of acute-phase proteins by damaged GI tissue and inflammation [27], destruction of the intestinal villi by infectious pathogens or systemic inflammatory response syndrome (SIRS)-mediated increased vascular permeability [28]. Increased A:G ratio can be equated to an increase in albumin with a relative decrease in globulin concentration. The hyperglycaemia reported here may reflect dehydration, stress, or ketosis that interfered with glucose utilization by the patients. This hyperglycaemia is transient and resolved following rehydration. This has been described in children suffering from severe gastroenteritis [29] and dogs with viral enteritis. Elevation in liver enzymes (ALP, ALT, BUN, and creatinine) concurs with previous reports [9,30]. These changes could be triggered by dehydration, hepatic hypoxia secondary to severe hypovolaemia or absorption of toxic wastes [30,31] or the young age of the sampled dogs [32].

Low levels of AST in 9.6% of the dogs sampled is unexplainable. However, malabsorption and malfunctioning or damaged liver prevented the release of enough quantities into circulation. The dogs sampled had mostly hyponatraemia, hypokalaemia, hypochloraemia, raised Na: K ratio, and hypercalcaemia, corroborating the findings of previous studies. Disturbances in these electrolytes have been linked to vomiting and diarrhoea or failure of the colon to conserve potassium by the patients [33]. Metabolic, systemic, and parasitic diseases such as hypoadrenocorticism, pancreatic disease, pyometra, renal diseases are the established causes of low Na: K ratio in dogs [34]. Hypercalcaemia may be relative to hyperalbuminemia or dehydrating gastroenteritis. Biochemical changes such as hypoproteinaemia, hypoalbuminaemia, hypoglycaemia, and hyperglycaemia are associated with interactions between multiple factors such as malnutrition, septicaemia, stress-induced activation of catecholamines, hypocalcaemia, hypokalaemia, hyponatraemia, hypochloraemia, hypomagnesaemia, azotaemia, liver damage induced by hypoperfusion and SIRS [6,35,36].

In the correlation analysis, total leukocyte counts, mucosae pallor, depression, lethargy, abdominal pain, and anaemia correlated with clinical outcome (Table 5). However, only changes in albumin, total WBC count, and colic had the strongest tendencies to influence prognosis (Table 6). The odds of death for dogs with hypoalbuminaemia (serum albumin conc. ≤20mg/dL), leukopaenia (WBC≤4,500 cells/L), and presence of colic were 7.1, 0.1, and 0.01 times, respectively the odds of death for patients without these changes. Leukopaenia and hypoalbuminaemia reported here tally with similar studies. The finding of leukopaenia as a biomarker of poor prognosis corroborates existing published reports [37,38].

Some researchers argued that neutrophils are more prognostic than leukocytes, when there is severe neutropaenia leukopaenia ensues, hence leukopaenia alone ought not to form the sole criterion of prognosis [37,39]. In contrast to that claim, severe neutropaenia was not found to be prognostic [40,41]. Contrary to the finding reported here and that of Mason et al. [39], Glickman, et al. [42] also reported that leukopaenia is not a biomarker of poor prognosis. The finding of hypoalbuminaemia as a biomarker of poor prognosis in this study concurs with the report of Boag [43]. Association of colic with poor prognosis may suggest the severity of the disease, intussusceptions, inflammation of the gut mucosae, or secondary infections. Besides the findings reported here, lymphopenia, vomiting, depression, body weight, changes in blood glucose, sodium, and AST concentrations [44] and how severe the disease is [45] determine the clinical outcome. Variables that correlated with DOM in this investigation included changes in PCV, WBC, Hb, pancytopaenia, total proteins, ALP, sex of the dog, lifestyle, and duration of diarrhoea (Table 7). The odds of pancytopaenia and leukopenia to prolong DOM in dogs with gastroenteritis by at least a day above the median five days were 0.2 and 3.5 times, respectively. In contrast, vomiting, depression, lymphopaenia, and hypoalbuminaemia were reported to prolong the duration of hospitalisation [6,46].

Table 7: Treatment options used in the management of the canine gastroenteritis cases studied indicating the drug used, dosage, frequency, route of administration, and percentage of patients who received a particular treatment.

Prescriptions	Dose, frequency, and routes of administration	Notes
Antibacterials		
Metronidazole [a]	7.5mg/kg/daily, IV; Max.65mg/kg/day	Used in >80% of the cases
Gentamicin [b]	6mg/kg/day, IV	Used in >80% of the cases
Amoxicillin [c]	22mg/kg/day, IV	Used in >80% of the cases
Oxytetracycline 5%	1ml/5kg/day, IV, IM	Used in 19% of the cases
Sulphadimidine (333mg/100ml)	0.6mL/kg first day, subsequently 0.3mL daily for 3-4 days.	Used in 8% of the cases
Enrofloxacin	5-10mg/kg/day, IV	Used in 4% of the cases
Phthalylsulfathiazole (Thalazole®)	1tablet 3 times daily for at least 2 days, PO	Used in 3% of the cases
Antiemetics		
Metoclopramide [d]	1-2mg/kg/day IV, IM	Used in 50% of the cases
Antihemorrhagics		
Dicynone [Etamsylate 125mg/ml]	0.5-1mL stat, IM	Used in 20% of the cases
Vitamin K1	0.25-5mg/kg stat, IM	Used in 3% of the cases
Anthelmintics		
Ivermectin	0.2mg/kg stat, SC	Used in 14% of the cases
*Prazisam®, Caniverm®	1 tablet/10kg stat, PO	Used in 9% of the cases
Pyrantel pamoate [62.5 mg Tablet]	5-10mg/kg stat, PO	Used in 4% of the cases
Fluid therapy [e]		
5% Dextrose saline	44mL/kg/day, IV	Administered to all case
Lactated Ringer's solution	65mL/kg/day, IV	Administered to all case
Gastroprotectants		
Cimetidine	5-10mL/day, PO	Used in 3% of the cases
Immunomodulators		
Dexamethasone	0.2mg/kg/day, IM	Used in 2% of the cases
Prednisolone	2mg/kg/day, PO	Used in 1% of the cases
Vitamins and Minerals [f]		
B-complex	1-5mL/day, IM	Used in 90% of the cases
Multivitamins	1-5mL/day, IM	Used in 10% of the cases

*NOTE-Prazisam®: Fixed-dose formulary of anthelminthics containing praziquantel 50mg, pyrantel pamoate 144mg, and fenbendazole 500mg.

Caniverm®: Praziquantel 50mg, pyrantel pamoate 144mg, and fenbendazole 150mg. The dogs were prescribed [a, b, c, d, e, f] extensively. The treatment options were decided by the clinicians based on the need of the individual case. The median duration of treatment from reporting to discharge was 5 days.

Leukopaenia was the only clinical pathology at admission that significantly influenced both clinical outcomes and the DOM as opposed to previous findings [6,42]. Also, pancytopaenia significantly increased the DOM as opposed to reports that it influences poor clinical outcomes in many infectious diseases [47]. The pancytopenia dogs studied improved with treatment, making pancytopaenia a nonsignificant prognosticator of poor outcomes. Ultimately, Goddard, et al. reported that an accurate prognosis may be obtained 24 hours postadmission. But this report showed that changes in total leukocyte counts (specifically leukopaenia), reduction in the three blood cellular components (pancytopaenia), albumin (particularly hypoalbuminaemia) and presence of colic at presentation are prognostic for poor outcomes and prolonged DOM in dogs with gastroenteritis. Interestingly, the type of disease is not a good predictor of clinical outcome and DOM in this study. These findings may assist clinicians in recognizing canine gastroenteritis candidates with substantial risk, and rapid selection of appropriate treatment and intensive care measures.

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