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Clinical signs and haemato-biochemical changes of canine parvovirus gastroenteritis

Hemali A Patel, Neha Rao and Nitin R Patel

Abstract
All the 145 dogs had the signs of dullness, diarrhoea, vomition, dehydration and loss of appetite. The immunochromatography test kit identified 70.00% samples as CPV positive, while PCR identified 80.00% samples as positive. The immunochromatography test had a sensitivity 87.50% and specificity 100% when compared to the PCR results. The two tests had a 90.91% overall agreement. The immunochromatography test had a sensitivity 87.50% and specificity 100% when compared to the PCR results. The two tests had a 90.91% overall agreement. Haematological examination of group B revealed significantly increased WBC, lymphocytes and platelets count, group C revealed significantly increased WBC, lymphocytes, platelets count, group D revealed significantly increased WBC and lymphocytes and group E revealed significantly increased lymphocytes and significantly decreased neutrophils on day 5 in comparison to day 0 values. Serum biochemistry examinations of group B revealed no significant difference in the values of any of the parameters, group C revealed highly significant increase in blood glucose, group D revealed significantly increased serum total protein, albumin and globulin, group E revealed significantly increased albumin and significantly decreased ALT on day 5 as compared to day 0 values.

Keywords: CPV, clinical signs, immunochromatography, PCR, haemato-biochemistry

Introduction
Haemorrhagic gastroenteritis (HGE) in dogs is a life-threatening condition. HGE is a severe form of diarrhoea that affects dogs of all breeds and ages, though small breeds are more likely to be affected than large breeds (Kumar *et al.*, 2014) [14]. The severity of clinical symptoms varies depending on the animal's age, maternal immunity, immune response status and virus strain virulence (Awad, *et al.*, 2019) [3]. Symptoms of CPV-2 infection include acute haemorrhagic enteritis and myocarditis. Enteritis in dogs can accompany with fever, depression, loss of appetite, lethargy, vomiting and severe mucoid or bloody diarrhoea (Albaz *et al.*, 2015; Khare *et al.*, 2019) [2, 8].
Haematological results included neutrophilia, lymphopenia and leucopenia. The majority of electrolyte abnormalities are caused by gastrointestinal diseases, with sodium, potassium, calcium and phosphorus being the most common. In CPV gastroenteritis, an increase in serum alanine aminotransferase, aspartate aminotransferase and alkaline phosphatase has been seen (Jacob *et al.*, 1980) [7].
Serological tests for CPV detection include ELISA, haemagglutination, slide inhibition test, slide agglutination test, immunochromatographic strip test and PCR and its variants such as nested PCR, insulate isothermal PCR and real-time PCR in the current days. LAMP (Loop-Mediated Isothermal Amplification) and Biosensors are two of the quickest testing. The immune-chromatographic strip, on the other hand, is the most often utilized (Khatri *et al.*, 2017) [9].

Material Methods

2.1 Clinical Signs
Clinical signs like anorexia, Colour of vomition (watery/whitish/yellowish), Diarrhoea (Haemorrhagic/non haemorrhagic), Dehydration (mild/moderate/severe), pyrexia, colour of mucous membrane (normal pink colour/pale/congested) and body condition (Nnormal/emaciated).

Diagnostic Methods

A total 60 faecal samples were collected using sterile swabs from diarrhoeic dogs reported to Veterinary Clinical Complex, Anand, Gujarat with clinical signs of dullness, diarrhea or haemorrhagic diarrhoea, vomition, dehydration and loss of appetite. Sterile swabs used for Immunochromatography kit test and stored in phosphate buffer saline (pH=7.2), vortexed, and stored at -20°C until further use. The viral DNA was extracted by boiling method. Samples suspended in 100 µL milli Q water were boiled for 15 minutes. Centrifugation was employed to remove the cell debris and 5 µl of the supernatant was employed as a template DNA and then they were examined for the presence of CPV DNA using traditional PCR using published primers.

Table 1: Primers used for amplification of target VP2 gene fragment of viral DNA

Name of the target organism	Primer Sequence (5'-3')		Size of amplified products (bp)	References
VP2 gene of Canine Parvovirus	(F)	TCCAGCAGCTATGAGATC	747	Sakulwira *et al.* (2003)
	(R)	GATCTGTTGGTAGCAATAC		

A total 5 µL of DNA sample containing 30 ng/µl concentration was used as a template for PCR reaction. 6.25 µl of PCR master mix (2X concentration), 1 µL forward and reverse primer and 5.5 µL nuclease free water. Cyclic conditions for CPV VP2 gene primer included one cycle of initial denaturation at 94 °C for 5 min, followed by 35 cycles of denaturation at 94 °C for 30 sec., annealing at 58 °C for 15 sec. and extension at 72 °C for 1 min. The PCR products were analyzed in 2% agarose gel electrophoresis and visualized using UV trans-illuminator or Gel Documentation System.

Haemato-biochmical analysis

Five ml of blood was collected aseptically from cephalic/ sephanous vein of which 2 ml blood was transferred in sterile K3EDTA vacutainers for heamatological analysis and 3 ml was transferred in sterile clot activator vial for separation of the serum for biochemical studies. Alterations in the values were observed by using auto analyzer on day 0 and day 5. Blood samples were also collected from dogs of healthy control group on day 0 for haemato-biochemical analysis and comparing the findings with CPV positive dogs.

Protocols for treatment groups

Group A: Healthy control dogs (n=6) presented at VCC for routine vaccination.

Group B: CPV positive dogs (n=8) treated with ceftriaxone tazobactam @ 20 mg/kg OID I/V, metronidazole @ 20 mg/kg OID I/V, 5% DNS and RL according to % dehydration, ethamsylate @ 250-500 mg total dose OID I/V, vitamin B complex @ 1 ml total dose OID I/V, vitamin C @ 20 mg/kg OID I/V and ondansetron @ 0.5 mg/kg BW OID S/C.

Group C: CPV positive dogs (n=8) treated as in Group B plus honey @ 2 ml total dose BID on tongue given as an adjuvant.

Group D: CPV positive dogs (n=8) treated as in Group B plus N-acetyl cysteine (NAC) @ 70 mg/kg b.wt., OID, I/V given as an adjuvant.

Group E: CPV positive dogs (n=8) treated as in Group B plus glutamine powder @ 0.5 gm/kg b.wt., OID, P.O. given as an adjuvant.

Statistical analysis

The data obtained through haemato-biochemical examinations in the research work were statistically analyzed and clinical variants were subjected to one way analysis of variance (ANOVA), paired t-test by employing SPSS software 21.0. The p values >0.05 were considered as non-significant, <0.05 were considered as significant and <0.01 were considered as highly significant.

To compare the sensitivity, specificity and overall agreement between the viral detection assays, *viz.*, immunochromatography assay test kit and Polymerase chain reaction.

Results and Discussions

3.1 Clinical signs

All the 145 dogs had the signs of dullness, diarrhoea, vomition, dehydration and loss of appetite. Vomition was observed in all 145 (100%) CPV affected dogs. Vomition was watery in 49.66% (72/145) dogs, whitish in 37.24% (54/145) and yellowish in 13.10% (19/145) dogs. Haemorrhagic diarrhoea was observed in 89.66% (130/145) dogs and non-haemorrhagic diarrhea was observed in 10.34% (15/145) dogs. The degree of dehydration was mild (4-6%), moderate (6- 8%) and severe (8-10%) in 10.34% (15/3145), 80.69% (117/145) and 8.96% (13/145) dogs, respectively. Pyrexia (>102.5◦F) was recorded in 3.45% (5/145) dogs, 24.89% (39/145) dogs had a slightly subnormal temperature and 69.66% (101/145) dogs had a normal temperature. The conjunctival mucous membrane was congested in 40.69% (59/145) dogs and pale in 59.31% (86/145) dogs. Dullness was observed in all (100%, 145/145) dogs. Loss of body condition was observed in 28.28% (128/145) dogs and 11.72% (17/145) dogs were normal.

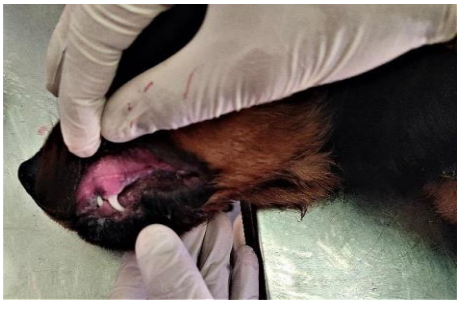


Fig 1: Normal mucous membrane of gums

Fig 2: Pale mucous membrane of gums

Fig 3: CPV affected dog with haemorrhagic diarrhoea

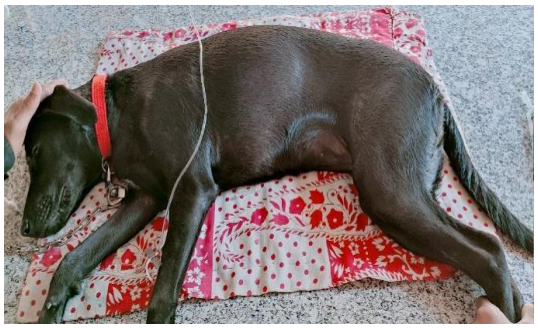


Fig 4: Dull and depressed dog

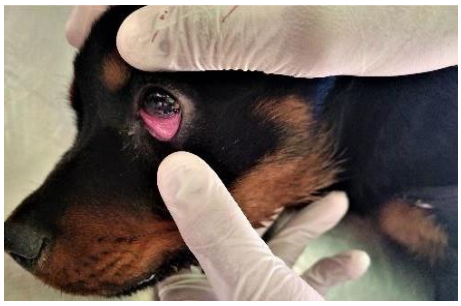


Fig 5: Normal mucous membrane of eye

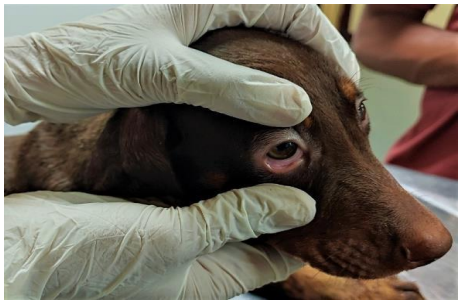


Fig 6: Pale mucous membrane of eye

Comparison of Lateral Flow Immunochromatography Antigen Test Kit with Polymerase Chain Reaction

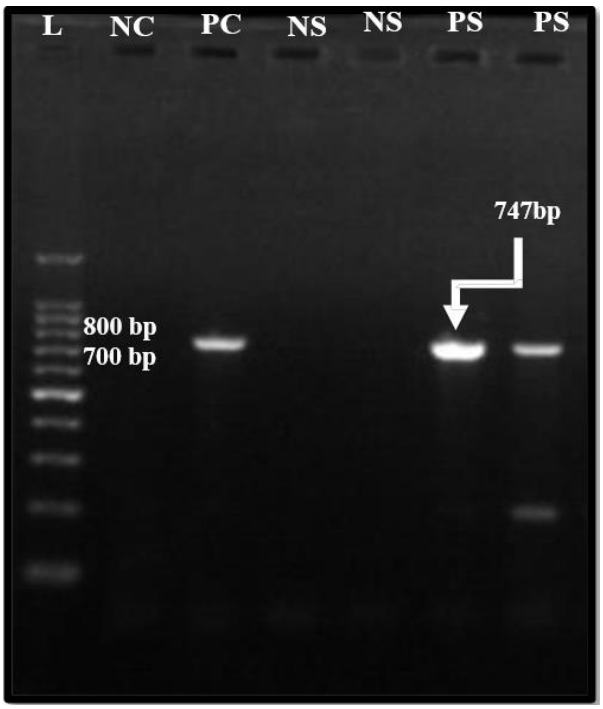
Table 2: Sensitivity and specificity of immunochromatography antigen test kit in comparison to a polymerase chain reaction

	Polymerase Chain Reaction			Sensitivity (%)	Specificity (%)	Overall agreement (%)
Rapid antigen test kit		Positive	Negative	87.50	100	90.91
	Positive	42	0			
	Negative	6	18			

For CPV detection, a total of 60 samples from suspected dogs were examined using an immunochromatography test kit and a polymerase chain reaction (PCR). The immunochromatography test kit identified 42 (70.00%) samples as CPV positive, while PCR identified 48 (80.00%) samples as positive. The immunochromatography test had a sensitivity 87.50% and specificity 100% when compared to the PCR results. The two tests had a 90.91% overall agreement. The immune-chromatography test found six samples negative that were positive by PCR.

Hasan *et al.* (2016) [6], Navarro *et al.* (2020) [11] and Alam *et al.* (2021) [1] conducted similar investigations and concluded that polymerase chain reaction is more sensitive and specific than an immunochromatography test kit.

The low sensitivity of immunochromatography test was attributed to the low amount of virus shed in faeces during the later stages of the disease, as well as the presence of strong CPV antibody titers in the gut lumen, which might sequester most viral particles. When compared to older approaches, molecular methods such as PCR have shown to have higher sensitivity and specificity, but they require expensive equipment and reagents, are labor-intensive and require the expertise of specialized individuals (Desario *et al.*, 2005) [5].



L= Ladder, NC= Negative Control, PC= Positive Control, NS= Negative Sample, PS= Positive Sample

Fig 7: VP2 gene amplicon of CPV2 isolates

Comparison of haematological changes in therapeutic groups on day 0 and day 5
Group B

Table 3: Haematological changes in CPV affected dogs of group B on day 0 and day 5 of treatment (Mean ± SE)

Parameters	Healthy dogs		CPV, Group B (N=6)	
Hb (g/dl)	14.93±0.99	14.32±1.13	13.28±1.13	0.502
RBC (x106/µl)	7.15±0.47	7.80±0.38	7.40±0.57	0.590
WBC (x103/µl)	11.99±1.04	5.46±1.26	18.72±3.06*	0.011
Lymphocyte (%)	17.50±3.34	5.26±0.98	16.50±5.68*	0.046
Monocyte (%)	5.32±0.82	4.22±0.63	5.93±1.37	0.249
Neutrophils (%)	75.20±3.54	87.28±1.39	76.42±5.23	0.062
Eosinophils (%)	1.57±0.44	2.52±0.67	0.80±0.47	0.159
Basophils (%)	0.42±0.12	0.72±0.20	0.37±0.16	0.341
PCV (%)	48.32±3.82	49.89±3.22	47.53±4.06	0.630
Platelets count (x103/µl)	320.00±25.48	340±90.39	509.83±68.92*	0.047

**p<0.01 = highly significant, *p<0.05 = significant

In the present study, the mean values of WBC, lymphocytes and platelets count in group B were significantly (p<0.05) increased on day 5 of treatment in comparison to day 0. Schoeman *et al.* (2008) [15] suggested that leukopenia in CPV infection is attributable to the destruction of haematopoietic cells by the virus. On day 5 after treatment, there was improvement in WBC count due to therapy.

A decrease in lymphocyte count in CPV infected dogs was seen by Shah *et al.* (2013) [16], Tatiana *et al.* (2013) [17] and Salem (2014) [14], which is expected to improve on therapy. Cooper *et al.* (1979) [4] stated that this decrease is due to a compromised immune system and destruction of lymphoid tissues, which is improved after therapy.

Shah *et al.* (2013) [16] and Tatiana *et al.* (2013) [17] noted thrombocytopenia in CPV infected individuals. They stated that thrombocytopenia in parvovirus infected dogs may be due bone marrow suppression and destruction of the haematopoietic cells by virus. However, in the present study, there was no depression in platelets count in CPV affected dogs as compared to healthy control, but it along with WBCs on day 5 of treatment.

The mean values of Hb, RBC, lymphocytes, monocytes, neutrophils, eosinophils, basophils and PCV though did not differ significantly (p>0.05) from each other on day 5 in comparison to day 0, were improved toward normalcy when compared with the values of healthy control group.

Group C

Table 4: Haematological changes in CPV affected dogs of group C on day 0 and day 5 of treatment (Mean ± SE)

Parameters	Healthy dogs		CPV, Group C (N=6)	
Hb (g/dl)	14.93±0.99	14.00±1.09	12.98±1.15	0.053
RBC (x106/µl)	7.15±0.47	6.65±0.50	6.50±0.14	0.763
WBC (x103/µl)	11.99±1.04	5.48±1.63	9.99±0.89*	0.023
Lymphocyte (%)	17.50±3.34	3.87±7.70	18.30±8.42*	0.018
Monocyte (%)	5.32±0.82	6.08±0.53	5.48±0.50	0.504
Neutrophils (%)	75.20±3.54	86.78±8.90	72.43±7.99*	0.014
Eosinophils (%)	1.57±0.44	2.53±0.85	1.07±0.46	0.208
Basophils (%)	0.42±0.12	0.73±0.23	0.48±0.21	0.481
PCV (%)	48.32±3.82	43.63±2.88	43.76±1.79	0.962
Platelets count (x103/µl)	320.00±25.48	264.17±63.96	439.00±29.94*	0.036

**p<0.01 = highly significant, *p<0.05 = significant

The mean values of WBC, lymphocytes and platelets count were significantly increased (p<0.05), whereas neutrophils were highly significantly decreased (P<0.01) on day 5 in comparison to day 0 values in group C treated with honey as adjuvant therapy. Roy *et al.* (2010) and Kumar *et al.* (2014) [14] mentioned that neutrophil count remained normal or slightly increased in acute cases of canine parvovirus infection. Ramprabhu *et al.* (2002) stated that leukogram of affected dogs revealed relative neutrophilia due to lymphopenia. These changes are expected to normalize with appropriate therapy. In the present study also, the post-treatment values were almost normalized in this group, except platelets count, which increased even beyond the value of normal healthy group.

The mean values of Hb, RBC, PCV, monocytes, eosinophils, and basophils were not different significantly (p>0.05) from each other on day 0 and day 5 of treatment, and in fact the values of Hb, RBC and PCV in group C were still non-significantly lower than in healthy control group.

Group D

Table 5: Haematological changes in CPV affected dogs of group D on day 0 and day 5 of treatment (Mean ± SE)

Parameters	Healthy dogs		CPV, Group D (N=6)	
Hb (g/dl)	14.93±0.99	14.73±2.03	12.55±1.05	0.270
RBC (x106/µl)	7.15±0.47	7.51±0.80	7.26±0.58	0.538
WBC (x103/µl)	11.99±1.04	4.50±0.98	12.88±1.37**	0.005
Lymphocyte (%)	17.50±3.34	6.28±1.20	19.85±4.78*	0.038
Monocyte (%)	5.32±0.82	4.88±0.54	4.18±0.98	0.624

Neutrophils (%)	75.20±3.54	86.73±1.75	74.58±4.36*	0.026
Eosinophils (%)	1.57±0.44	1.50±0.29	1.02±0.33	0.274
Basophils (%)	0.42±0.12	0.60±0.16	0.35±0.10	0.151
PCV (%)	48.32±3.82	47.01±5.22	41.88±2.53	0.296
Platelets count (x103/µl)	320.00±25.48	337.17±35.76	456.17±72.21	0.160

**p<0.01 = highly significant, *p<0.05 = significant

The mean values of WBCs and lymphocytes were increased and neutrophils were decreased significantly (p<0.05) on day 5 of treatment in comparison to day 0 in group D, and these were almost normal when compared with healthy control group.

The mean values of Hb, RBC, PCV, monocytes, eosinophils, basophils and platelets count did not differ significantly (p>0.05) from each other between day 0 and day 5 of treatment in group D, and in fact the Hb and PCV were still apparently lower with higher platelet count on day 5 of treatment than the 0 day value and even when compared with healthy control group.

Group E

Table 6: Haematological changes in CPV affected dogs of group E on day 0 and day 5 of treatment (Mean ± SE)

Parameters	Healthy dogs		CPV, Group E (N=6)	
Hb (g/dl)	14.93±0.99	13.47±1.30	12.38±1.21	0.079
RBC (x106/µl)	7.15±0.47	6.84±0.63	6.13±0.42	0.065
WBC (x103/µl)	11.99±1.04	9.02±1.40	12.73±3.84	0.445
Lymphocyte (%)	17.50±3.34	5.57±1.06	18.10±4.01*	0.016
Monocyte (%)	5.32±0.82	5.45±0.83	6.18±0.82	0.486
Neutrophils (%)	75.20±3.54	87.20±1.30	74.15±4.73*	0.018
Eosinophils (%)	1.57±0.44	0.98±0.25	1.00±0.38	0.953
Basophils (%)	0.42±0.12	0.47±0.09	0.34±0.12	0.380
PCV (%)	48.32±3.82	44.66±3.55	43.45±4.36	0.454
Platelets count (x103/µl)	320.00±25.48	475.83±93.58	270.33±26.59	0.064

**p<0.01 = highly significant and *p<0.05 = Significant.

The mean values of lymphocytes were significantly (p<0.05) increased and neutrophils were decreased on day 5 in comparison to day 0 in group E treated with glutamine powder as an adjuvant therapy.

The mean values of Hb, RBC, PCV, WBC, monocytes, eosinophils, basophils and platelets counts were neither influenced significantly by CPV infection, nor by the treatment with additional glutamine powder on day 5 in group E, and the values were more or less towards normal ones. However, the apparently lower values of Hb, PCV and platelet count noted still day 5 of treatment.

Comparison of serum biochemical changes in therapeutic groups on day 0 and day 5 of treatment

Group B

Table 7: Serum biochemical changes in CPV affected dogs of group B on day 0 and day 5 of treatment (Mean ± SE)

Parameters		CPV, Group B (N=6)		
	Healthy dogs (N=6)	Day 0	Day 5	'p' value
ALT (IU/L)	28.31±5.79	38.02±10.90	37.24±8.82	0.907
AST (IU/L)	20.68±3.43	26.49±1.52	29.06±7.09	0.671
Total protein (gm/dl)	5.24±0.07	3.89±0.55	4.60±0.62	0.711
Creatinine (mg/dl)	0.70±0.06	0.64±0.17	0.72±0.07	0.739
Albumin (gm/dl)	2.75±0.32	1.64±0.37	2.32±0.41	0.469
Globulin (gm/dl)	3.48±0.34	1.82±0.39	2.38±0.29	0.313
BUN (mg/dl)	5.74±2.80	20.81±3.40	19.46±4.28	0.725
Blood glucose (mg/dl)	113±3.49	90.88±3.66	92.56±7.61	0.903

**p<0.01 = highly significant, *p<0.05 = significant

None of the biochemical parameters differed significantly between day 0 and 5. The mean values of ALT, AST, total protein, creatinine, albumin, globulin, BUN and blood glucose in group B were not significantly (p>0.05) different from each other on day 0 and day 5 of treatment. The values of ALT, AST and BUN were apparently higher and proteins lower in CPV affected dogs both on day 0 and 5 as compared to values of normal healthy control group.

Group C

Table 8: Serum biochemical changes in CPV affected dogs of group C on day 0 and day 5 of treatment (Mean ± SE)

Parameters	Healthy dogs		CPV, Group C (N=6)	
ALT (IU/L)	28.31±5.79	43.94±10.04	39.88±8.46	0.129
AST (IU/L)	20.68±3.43	61.93±18.99	43.06±15.95	0.222
Total protein (gm/dl)	5.24±0.07	4.64±0.20	5.35±0.33	0.121
Creatinine (mg/dl)	0.70±0.06	0.46±0.04	0.81±0.32	0.354
Albumin (gm/dl)	2.75±0.32	2.41±0.18	2.84±0.20	0.275
Globulin (gm/dl)	3.48±0.34	2.22±0.10	2.51±0.29	0.373

BUN (mg/dl)	5.74±2.80	18.09±3.74	22.76±2.53	0.253
Blood glucose (mg/dl)	113±3.49	89.33±5.07	97.17±4.71**	0.001

**p<0.01 = highly significant, *p<0.05 = significant

The mean value of blood glucose was highly significantly (p<0.01) increased on day 5 in comparison with day 0. The decreased glucose level below normal in CPV affected dogs could be due to the progressive phase of the disease and anorexia.

There was no significant (p>0.05) difference in the mean values of ALT (IU/L), AST (IU/L), total protein (gm/dl), creatinine (mg/dl), albumin (g/dl), globulin (gm/dl) and BUN (mg/dl) on day 5 of treatment in comparison to day 0. The values of ALT, AST decreased post-treatment compared to 0 day, yet they were much higher than those in healthy control group. The BUN and proteins on the contrary increased slightly on day 5 of treatment over day 0 values, and these were quite higher than in those in the healthy control group

Group D

Table 9: Serum biochemical changes in CPV affected dogs of group D on day 0 and day 5 of treatment (Mean ± SE)

Parameters	Healthy dogs		CPV, Group D (N=6)	
ALT (IU/L)	28.31±5.79	24.48±2.72	22.26±2.16	0.053
AST (IU/L)	20.68±3.43	11.56±2.38	12.80±1.63	0.377
Total protein (gm/dl)	5.24±0.07	4.60±0.40	6.15±0.22*	0.044
Creatinine (mg/dl)	0.70±0.06	0.64±0.05	0.64±0.06	0.979
Albumin (gm/dl)	2.75±0.32	2.12±0.12	2.58±0.12*	0.017
Globulin (gm/dl)	3.48±0.34	2.48±0.32	3.18±0.25*	0.047
BUN (mg/dl)	5.74±2.80	11.49±3.09	14.83±2.58	0.255
Blood glucose (mg/dl)	113±3.49	103.83±8.11	97.83±5.79	0.945

**p<0.01 = highly significant, *p<0.05 = significant

There was significant increase in Total protein, albumin and globulin. There was no significant (p>0.05) difference in the mean values of serum AST, ALT, creatinine, BUN and blood glucose in dogs of group D on day 0 and day 5. Moreover, the serum levels of enzymes and blood glucose were reduced and BUN increased insignificantly as compared to the values in healthy control group.

Group E

Table 10: Serum biochemical changes in CPV affected dogs of group E on day 0 and day 5 of treatment (Mean ± SE)

Parameters	Healthy dogs		CPV, Group E (N=6)	
ALT (IU/L)	28.31±5.79	30.62±1.22	24.91±2.53*	0.032
AST (IU/L)	20.68±3.43	27.38±3.27	21.93±3.05	0.094
Total protein (gm/dl)	5.24±0.07	5.29±0.28	5.68±0.10	0.327
Creatinine (mg/dl)	0.70±0.06	0.53±0.05	0.62±0.07	0.329
Albumin (gm/dl)	2.75±0.32	2.11±0.10	2.74±0.17*	0.041
Globulin (gm/dl)	3.48±0.34	3.17±0.30	2.94±0.18	0.645
BUN (mg/dl)	5.74±2.80	19.94±6.60	17.99±1.82	0.738
Blood glucose (mg/dl)	113±3.49	101.33±9.45	97.83±8.60	0.567

**p<0.01 = highly significant, *p<0.05 = significant

There was a decrease in both serum ALT and AST activity in dogs of group E on day 5 of treatment with significant (<0.05) difference only in ALT in comparison to day 0 values. The increased values of ALT might be due to alteration in the liver functioning and hepatic hypoxia. Shah *et al.* (2013) discovered comparable outcomes for ALT concentration in patients of CPV infection that gradually dropped after treatment consisting of fluid therapy and broad spectrum antibiotic. Kumar *et al.* (2014) [14] showed that increased ALT concentration of three dogs affected with CPV, decreased gradually after treating them with antibiotic ceftriaxone as a drug of choice. In our study, the total protein and albumin concentrations were also increased on day 5 than on day 0, with significant difference only in albumin. The values of serum creatinine, globulin, BUN and blood glucose however did not show appreciable variation between day 0 and 5 values, and BUN in particular was still much higher than in dogs of healthy control group.

Conclusions

All the 145 dogs had the signs of dullness, diarrhoea, vomition, dehydration and loss of appetite. The immunochromatography test had a sensitivity 87.50% and specificity 100% when compared to the PCR results. The two tests had a 90.91% overall agreement. Haematological examination of group B revealed significantly increased WBC, lymphocytes and platelets count, group C revealed significantly increased WBC, lymphocytes, platelets count, group D revealed significantly increased WBC and lymphocytes and group E revealed significantly increased lymphocytes and significantly decreased neutrophils on day 5 in comparison to day 0 values. Serum biochemistry examinations of group B revealed no significant difference in the values of any of the parameters, group C revealed highly significant increase in blood glucose, group D revealed significantly increased serum total protein, albumin and globulin, group E revealed significantly increased albumin and significantly decreased ALT on day 5 as compared to day 0 values.

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References

1. Alam S, Chowdhury Q, Roy S, Chowdhury M, Hasan M, Mamun M, *et al*. Molecular detection & phylogenetic analysis of Canine Parvovirus (CPV) in diarrhoeic pet dogs in Bangladesh. Veterinary and Animal Science. 2021;14:100224.
2. Albaz A, Sayed-Ahmed M, Younis E, Khodier M. Investigation of the antiviral effect of acyclovir on canine parvovirus infection. Pharmacy Pharmacology International Journal. 2015;2(2):14.
3. Awad R, Safwat AH. Successful treatment of canine parvovirus infection in naturally infected puppies. Asian Journal of Scientific Research. 2019;12(3):308-315.
4. Cooper BJ, Carmichael LE, Appel MJ, Greisen H. Canine parvoviral enteritis: Morphological lesions in naturally occurring parvovirus infection. The Cornell Veterinarian. 1979;69:134-144.
5. Desario C, Decaro N, Campolo M, Elia G, Martella V, Ricci D, *et al*. Clinical and virological findings in pups naturally infected by canine parvovirus type 2 glu-426 mutant. Journal of Veterinary Diagnostic and Investigation. 2005;17:133-138.
6. Hasan K, Rathnamma D, Narayanaswamy HD, Isloor S, Chandranaik BM, Kshama MA, *et al*. Comparative evaluation of lateral flow assay & PCR for detection of Canine parvovirus. Advancement of Animal & Veterinary Science. 2016;4(11): 580-583.
7. Jacob RM, Weiser MG, Kowalski JJ. Clinic pathogenic features of canine parvoviral enteritis. Journal of American Veterinary Medicine Association. 1980;16:809-813.
8. Khare DS, Gupta DK, Shukla PC, Das G, Tiwari A, Meena NS *et al*. Prevalence of canine parvovirus infection in dogs in Jabalpur (M.P.). Journal of Entomology and Zoology Studies. 2019;7(3):1495-1498.
9. Khatri R, Poonam, Mohan H, Minakshi, Pundir C. Epidemiology, pathogenesis, diagnosis and treatment of canine parvovirus disease in dogs: A mini review. Journal of Veterinary Science and Medical Diagnosis. 2017;2:1-7.
10. Kumar A, Nishant SS, Sapna B. Treatment of hemorrhagic gastroenteritis in dog. International *Journal* of Research and Review. 2014;1(12):193-194.
11. Navarro C. Detection of canine parvovirus in dogs by means polymerase chain reaction. American Journal of Biomedical Science Research. 2020;7(6):540-547.
12. Ramprabhu R, Prathaban S, Nambi AP, Dhanapalan P. Haemorrhagic gastroenteritis in dogs – a clinical profile. Indian Veterinary Journal. 2002;79:374-376.
13. Roy S, Roy M, Sagar KA. Haemato-biochemical and therapeutic studies of canine parvoviral infection. Intas Polivet. 2010;11(2):344-347.
14. Salem N. Canine viral diarrhea: Clinical, haematologic & biochemical alterations with particular reference to in clinic rapid diagnosis. Global Veterinarian. 2014;13:302-307.
15. Schoeman JP, Herrtage ME. Serum thyrotropin, thyroxine and free thyroxine concentrations as predictors of mortality in critically ill puppies with parvovirus infection: a model for human paediatric critical illness? Microbes Infect. 2008;10(2):203-207.
16. Shah SA, Sood NK, Wani N, Gupta K, Singh A. Haemato-biochemical changes in canine parvoviral infection. Indian Journal of Veterinary Pathology. 2013;37(2):131-133.
17. Tatiana X, Castro Rita de Cássia N, Cubel Garcia, Luciana PS, Gonçalves, Erika M, *et al*. Clinical, haematological and biochemical findings in puppies with coronavirus and parvovirus enteritis. The Canadian Veterinary Journal. 2013;54:885-888.