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Research Article

Epidemiological Inspection of Canine Parvoviral Enteritis at Teaching Veterinary Hospital in Chattogram, Bangladesh

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Abstract

A descriptive epidemiological study followed by a case-control study was conducted using a 5-year data set (January 2013- November 2018) at Teaching Veterinary Hospital (TVH), Chattogram Veterinary and Animal Sciences University (CVASU). Epidemiological data were collected and analyzed by STATA-IC-13 software to estimate the proportionate prevalence of parvoviral enteritis, determine associated risk factors, and describe drug prescription patterns. The proportionate prevalence of parvoviral enteritis was 5.8% (N=568). The proportionate prevalence of parvoviral enteritis was higher in 2016 (21.3%) and spring (February-March) (13.1%). The significant risk factors determined for parvoviral enteritis were winter (OR=4.8, 95% CI: 1.5-14.8), young age (OR=4.5, 95% CI: 2.0-9.9), local breeds (OR=3.7, 95% CI: 1.7-8.1), non-vaccination status (OR=3.5, 95% CI: 1.2-9.7) and male (OR=1.3, 95% CI: 0.5-2.8) ($p \leq 0.05$) Ceftriaxone (51.5%), Cholera saline (66.7%), Ondansetron (45.5%) and Ranitidine (46%) were mostly prescribed drugs for the supportive treatment of parvoviral enteritis. This study provides basic epidemiological aspects of canine parvoviral enteritis at TVH of CVASU, Bangladesh. However, modifying identified risk factors such as ensuring vaccination of young puppies, special care during spring, proper therapeutic management, and effective control measures can reduce the level of the occurrence of parvoviral enteritis in dogs.

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Bangladeş, Chattogram Veteriner Hekimliği Eğitim Hastanesinde Köpek Parvoviral Enteritititisinin Epidemiyolojik İncelemesi

Özet

Chattogram Veteriner ve Hayvan Bilimleri Üniversitesi (CVASU) Veteriner Hekimliği Eğitim Hastanesi'nde (TVH), tanımlayıcı epidemiyolojik bir çalışma olan vaka-kontrol araştırması, 5 yıllık bir veri seti (Ocak 2013 - Kasım 2018) kullanılarak gerçekleştirildi. Parvoviral enteritin prevalansını, ilişkili risk faktörlerini ve reçete tiplerini ortaya koymak için epidemiyolojik veriler toplanarak STATA-IC-13 yazılımı ile analiz edildi. Orantılı parvoviral enterit prevalansı % 5,8 (N = 568) olarak hesaplandı. Orantılı parvoviral enterit prevalansı 2016 (% 21,3) ve ilkbaharda (Şubat-Mart) (% 13,1) daha yüksekti. Parvoviral enterit için önemli risk faktörleri; kış mevsimi (OR = 4.8,% 95 CI: 1.5-14.8), genç yaş (OR = 4.5,% 95 CI: 2.0-9.9), yerli ırklar (OR = 3.7,% 95 CI : 1.78.1), aşısız olma (OR = 3.5,% 95 CI: 1.2-9.7) ve erkek cinsiyeti (OR = 1.3,% 95 CI: 0.5-2.8) olarak belirlendi ($p \leq 0.05$).Ceftriaxone (% 51.5), Cholera saline (% 66.7), Ondansetron (% 45.5) ve Ranitidin (% 46) parvoviral enteritin destek tedavisi için en çok reçete edilen ilaçlardı. Bu çalışma, Bangladeş'teki CVASU TVH'de köpek parvoviral enteritinin temel epidemiyolojik durumunu ortaya koymaktadır. Bununla birlikte, yavru köpeklerin aşılanması, ilkbahar boyunca daha özenli yaklaşım gösterilmesi, uygun tedavi yönetiminin gerçekleştirilmesi ve etkili kontrol önlemlerinin alınması gibi bilinen risk faktörlerinin modifiye edilmesiyle, köpeklerde parvoviral enterit oluşma düzeyini azaltabilir.

Anahtar kelimeler: *Parvoviral enterit, Epidemiyoloji, İlaçlar, Yaş, Chattogram*

Introduction

Companion animals like dogs and cats play an important role in societies by providing physical, social, and emotional satisfaction to the people (Robertson et al., 2000). In view of the need of dogs in these above aspects, it is necessary to study the various diseases and disease conditions that are producing high morbidity and mortality. Among the viral diseases of dogs, the predominantly occurring diseases include canine parvoviral enteritis, canine distemper, coronavirus infection, canine hepatitis, canine para-influenza and rabies. Canine parvoviral enteritis is a highly infectious disease of dogs of great concern to pet owners, practicing veterinarians, and scientists due to its high morbidity and mortality rates (Bargujar et al., 2011). However,

systematic epidemiological studies on canine parvoviral enteritis are not enough in Bangladesh.

Canine parvoviral (CPV) enteritis is caused by the virus strains CPV2a, CPV2b, and CPV2c belonging to parvovirus type 2 (CPV-2), and Protoparvovirus type 1 species. Protoparvovirus genus and Parvoviridae family emerged in the 1970s (Decaro and Buonavoglia, 2012; Ortega et al., 2017).

The virus spreads via fecal-oral route through contact with infected faeces or contaminated surfaces and indirectly by contact with contaminated fomites such as clothing, hospital benches and tables, food pans and kennel floors (Foster and Smith, 2011; Hoelzer et al., 2008). This virus causes high morbidity (100%) and frequent mortality up to 10% in adult dogs and 91% in pups (Pandya et al., 2017). Previous studies show that CPV enteritis has a 13.9-42% proportionate prevalence in Bangladesh (Islam et al., 2014; Sen et al., 2016; Hasan et al., 2018; Roy et al., 2018).

Clinical signs of CPV enteritis include fever, anorexia, lethargy, depression, vomiting, mucoid to hemorrhagic diarrhea, and sometimes leukopenia (Prittie, 2004; Markovich et al., 2012). Myocarditis, an acute form, may be seen in neonatal puppies after weeks of infection (Sime et al., 2015). Due to large fluid and protein losses through the gastrointestinal tract, dehydration and hypovolemic shock often develop rapidly (Prittie, 2004).

The significant risk factors include immature dogs less than 6 months old (OR=3.5), unvaccinated puppies (OR=12.7), male dogs (OR=2), breeds (Doberman pinschers, Rottweilers, English Springer Spaniels, Alsatians and indigenous dogs), and seasons like rainy and autumn (July-September, OR=3) (Glickman et al., 1985; Houston et al; 1996).

The main prevention and control measure for the disease is vaccination and vigilant disinfection (Mylonakis et al., 2016). Treatment is mainly vigorous supportive management by effectively and adequately replacing lost fluid using poly ionic isotonic dextrose solution, normal saline, lactated ringers' solution given intravenously, in less severe cases subcutaneously or orally (Foster and Smith 2011; Nwoha,2011). Administration of broad-spectrum antibiotics such as cefixime, metronidazole, ticarcillin-clavulanate or enrofloxacin with adequate amount of vitamin B complexes, iron dextrans, antiemetics, analgesics, enteral nutritional support, and anthelmintics are indicated for treatment (Ettinger et al., 1995; Foster and Smith 2011; Mylonakis et al., 2016). Once an infected dog recovers from the disease, it becomes immune for life (Foster and Smith, 2011).

As previously described, Canine parvoviral enteritis causes high morbidity and mortality in dogs and limited studies have previously been conducted in Bangladesh. Therefore, the present research work was undertaken to i) estimate the proportionate prevalence of parvoviral enteritis in dogs, ii) identify risk factors associated with parvoviral enteritis, and iii) describe drug prescription pattern against parvoviral enteritis in Teaching Veterinary Hospital, Chattogram Veterinary and Animal Sciences University, Bangladesh.

Materials and methods

Study design and clinical cases

A hospital based descriptive epidemiological study was conducted on different clinical cases of dogs presented at TVH of CVASU, Bangladesh from January 2013 to November 2018. A total of 617 cases were extracted from the paper-based recording system in TVH of which 568 cases were clinically diagnosed by registered and experienced pet veterinarians or clinical faculty of CVASU. The Diagnosis of 49 cases was inconclusive, so they were considered for the present study. However, 248 of 519 (568-49) cases had no missing information which was therefore used for conducting a case-control study as well. All 33 parvoviral enteritis cases without any missing information and randomly selected 142 non-parvo enteritis cases (1 case per 4 controls) (N=215) were considered for the case-control study. The distribution of cases and controls are presented in Figure 1. The figure was produced by spatial data from the online portfolio GPS Geoplaner (http://www.geoplaner.com) and analysis of spatial data was done by using QGIS software version 2.18.13 (http://qgis.org/downloads/).

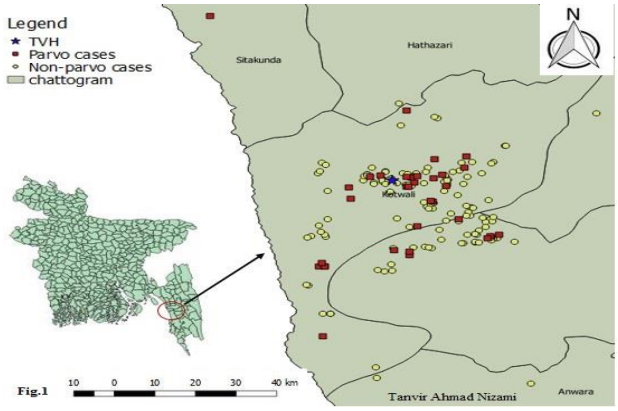

Figure 1. Distribution cases (parvoviral enteritis) and controls (non-parvo enteritis) in Chattogram Metropolitan area

Definition of case and control

An individual dog with the clinical signs of severe vomiting, diarrhoea, foul smelly dark faeces and fever or hypothermia along with the duration of illness of 3 to 7 days were defined as a parvoviral enteritis case (Foster and Smith, 2011). An individual dog without the above mentioned signs of parvoviral enteritis was treated as a control.

Use of epidemiological data

Date of administration, source, breed, age, sex, weight, temperature, deworming, and vaccination status (combined vaccine of canine distemper, canine adenoviruses, canine parvovirus, para-influenza type-2, Leptospira canicola, Leptospira icterohaemorrhagiae, and rabies) of parvoviral and non-parvoviral cases were used for the study. Clinical diagnostic information of each dog (parvoviral enteritis or not) was recorded. Prescribed drugs against each patient (parvoviral enteritis) were obtained to assess their pattern of uses.

Statistical evaluation

The extracted data as required from the hospital paper-based recording system were entered into Microsoft Excel 2010 spreadsheet. Data were then cleaned for errors and inconsistencies, sorted, coded and checked for integrity in MS Excel 2010. Afterward, data were exported to STATA-IC-13 (Statacorp, 4905, Lakeway Drive, College station, Texas, USA) for conducting the statistical analysis.

Descriptive analysis

Cases were grouped according to the classes of diseases or disease conditions and then the proportionate prevalence was calculated for each item by using the total number of cases under each item (Numerator) divided by the total number of cases (Denominator), irrespective of classes. Distribution of parvoviral enteritis cases in dogs by year, season and month were also computed. Descriptive statistics on clinical signs of parvoviral enteritis cases in dogs along with prescribed drugs were performed. The results were expressed in frequency numbers and percentages.

Risk factor analysis

Univariable chi-square test was performed to evaluate the association between the binary response variable of parvoviral enteritis case (yes/no) and six independent variables: year classed in terms of three categories (2013-14/2015-16/2017-18), season counted as three categories (summer, monsoon and winter), breed of dog (local/exotic breed), sex (male/female), age as measured in terms of two categories (≤4/>4 months) and status of vaccination (yes/no). Individual variable was categorized to make enough frequency number of each class for increasing power of the statistical test. Univariable logistic regression was conducted to assess the effect of each of the aforementioned six independent variables on the occurrence of parvoviral enteritis cases (yes/no) (Dohoo et al., 2003). Likelihood ratio test (Wald test) with the p value 0.05 or less was used to identify the factor as significant. Multivariate logistic regression was not considered because of variables were highly correlated with each other (Chi-square test, $p \leq 0.05$). The results were presented as odds ratio (OR), 95% confidence interval and p value.

Results

Prevalence of canine parvoviral enteritis cases at Teaching Veterinary Hospital

The proportionate prevalence (PP) of parvoviral enteritis at TVH was 5.8% (N=568) (Suppl. Table 1)

Suppl. Table 1. Prevalence of clinical dog diseases or disease conditions registered at Teaching Veterinary Hospital, Chattogram Veterinary and Animal Sciences University, Bangladesh (2013-2018) (N=568)

Diseases or disease condition	No. of cases	%
Parvoviral enteritis	33	5.8
Other diseases or disease condition	535	94.2

Distribution of parvoviral enteritis cases in dogs at Teaching Veterinary Hospital

The PP of parvoviral enteritis was higher in 2016 (21.3%) followed by 2017 (14.6%) and 2014 (6.9%) (Table 1). Spring (13.1%) had higher PP of parvoviral enteritis followed by winter (7.8%), Monsoon (4.4%) and late autumn (4.3%) (Table 2).

Table 1. Distribution of parvoviral enteritis cases in dogs registered at Teaching Veterinary Hospital, Chattogram Veterinary and Animal Sciences University (2013-2018) by year (N=568)

Year	No of total cases	Number of parvo cases	% of parvo cases
2013	50	1	2.0
2014	158	4	6.9
2015	141	2	1.4
2016	61	13	21.3
2017	41	6	14.6
2018	117	7	6.0
Total	568	33	5.8

Table 2. Distribution of parvoviral enteritis cases in dogs registered at Teaching Veterinary Hospital, Chattogram Veterinary and Animal Sciences University (2013-2018) by Season (N=568)

Season	No of total cases	Number of parvo cases	% of parvo cases
Summer (April-May))	30	0	0.0
Monsoon (June-July)	91	4	4.4
Autumn (August-September)	127	1	0.8
Late Autumn (October-November)	94	4	4.3
Winter (December-January)	104	8	7.8
Spring (February-March)	122	16	13.1

Risk factor analysis for parvoviral enteritis in dogs

Univariable analysis

The proportion of parvoviral enteritis cases significantly varied between the categories of each of the following factors: year, season, breed, age and vaccination status ($p \leq 0.05$) (Table 3)

Table 3. Univariable association between parvoviral enteritis cases and the selected factors

Factor	Category	Parvoviral enteritis cases		
		Yes (%)	No	*p*
Year	2013-14	5 (8.5)	54	0.034
	2015-16	15 (26.8)	41	
	2017-18	13 (21.7)	47	
Season	Summer	6 (18.2)	45	0.003
	Monsoon	4 (12.1)	44	
	Winter	23 (29.5)	53	
Breed	Local	21 (31.3)	46	0.001
	Others	12 (11.1)	96	
Sex	Male	22 (20.2)	87	0.564
	Female	11 (16.7)	55	
Age (Months)	0.1-4	21 (34.4)	40	<0.001
	4.1-156	12 (10.5)	102	
Vaccination	Yes	5 (8.3)	55	0.010
	No	28 (24.4)	87	

P = Probability

Univariate logistic regression

The magnitude of parvoviral enteritis in 2015-16 was 5.3 (95% CI: 1.6-16.9) times and 2017-18 was 3.7 (95% CI: 1.1-12.2) times higher odds than that of 2013-14. Winter season had 4.8 times (95% CI: 1.5-14.8) greater odds of parvoviral enteritis compared with monsoon season. Dogs aged less than 4 months had 4.5 (95% CI: 2.0-9.9) times higher odds of parvoviral enteritis compared with dogs aged between 7 months and 13 years. Local breed had 3.7 (95% CI: 1.7-8.1) times greater odds of parvoviral enteritis than other breeds. Non-vaccinated dogs had 3.5 (95% CI: 1.2-9.7) greater odds of parvoviral enteritis than the vaccinated individuals (Table 4)

Table 4. Univariate logistic regression to identify risk factors associated with the binary response variable of parvoviral enteritis in dog

Factor	Category	OR	95% CI	*P*
Year	2013-2014	1.0		
	2015-2016	5.3	1.6, 16.9	0.005
	2017-2018	3.7	1.1, 12.2	0.03
Season	Monsoon	1.0		
	Summer	1.5	0.3, 5.6	0.573
	Winter	4.8	1.5, 14.8	0.007
Age(month)	4.1-156	1.0		
	0.1-4	4.5	2.0, 9.9	≤0.001
Breed	Others	1.0		
	Local	3.7	1.7, 8.1	0.001
Vaccination	Yes	1.0		
	No	3.5	1.2, 9.7	0.014
Sex	Female	1.0		
	Male	1.3	0.5, 2.8	0.565

OR = Odd ratio; *P* = Probability

Pattern of drug prescribed for parvoviral enteritis cases at Teaching Veterinary Hospital of Chattogram Veterinary and Animal Sciences University

Ceftriaxone (51.5%) was used most frequently for treatment. Besides, cholera saline (66.7%) and Ondansetron (45.5%) were mostly prescribed as fluid therapy and anti-emetics, respectively. In 45.5% of cases, ranitidine was also prescribed. The more details of drug prescribed against parvoviral enteritis cases are presented in Suppl. Table 2.

Suppl. Table 2. Patterns of drugs prescribed against parvoviral enteritis at Teaching Veterinary Hospital, Chattogram Veterinary and Animal Sciences University (N=33)

Drugs	Classes	n, Frequency numbers	%
Antibiotics/Sulphur drugs	Ceftriaxone	17	51.5
	Metronidazole	11	33.3
	Amoxicillin	4	12.1
	Oxytetracycline	1	3.0
Antihistaminic	Ranitidine	15	45.5
	Pheniramine maleate	1	3.0
Fluid therapy	Cholera saline	22	66.7
	Dextrose normal saline	8	24.2
	Oral rehydration solution	2	6.1
Steroid	Dexamethasone	4	12.1
Anti-emetics	Ondansetron	15	45.5

Discussion

The current study explored the proportionate prevalence, risk factors and drug use pattern of parvoviral enteritis in dogs admitted to TVH, CVASU. This section of the report has discussed important findings of the present study, their implications, limitations, conclusion, and recommendations.

This study estimated an overall proportionate prevalence of parvoviral enteritis 5.8%, which is lower than the estimates reported by many previous studies in Bangladesh (13.9% in Dhaka, 30% in Mymensingh and 42% in Chattogram) (Islam et al., 2014; Sen et al., 2016; Hasan et al., 2018; Roy et al., 2018). The variation is due to the lower number of parvoviral enteritis cases recorded in the hospital in contrast to the total number of cases at TVH. The variable prevalence of parvoviral enteritis was also reported in pet dogs of neighboring countries such as 22.7% in Pakistan, 40.9% in India, and 77-80.4% in Thailand (Umar et al., 2015; Behera et al., 2015). This discrepancy of the prevalence of parvoviral enteritis could be due to variation in dog management systems, time and geographical locations (Hiby and Hiby, 2017).

The proportionate prevalence of parvoviral enteritis was higher in recent years (2014, 2016 and 2017) in this study. This might be due to the increased capacity of TVH (diagnostic and veterinary experience) to diagnose the cases along with the increase number of cases presented in recent years. Recent climate changes (temperature, humidity, and rainfall) might have contributed to the more parvoviral enteritis (Clark et al., 2018).

Spring (February-March) had a higher proportionate prevalence of parvoviral enteritis (13.1%) than other seasons. Whereas, Roy et al. (2018) reported 17.5% in summer (April-May) and 12.1% in winter (December-January) in Dhaka city. However, there are variable reports of seasonal occurrence of parvoviral enteritis in pet dogs in the world. For example, the prevalence of parvoviral enteritis was documented to be higher in summer (June-September) in Pakistan (62%) (Umar et al., 2015) and winter (November-April, peak in January) in Nigeria (17.2% in January) (Shima et al., 2015). The season specific occurrence of parvoviral enteritis could also be related to diurnal temperature differences and changeable climates during these seasons. (Qi et al., 2020).

Winter (December-January) had contributed 4.8 times more odds of parvoviral enteritis compared with other seasons which disagree with the findings of Houston et al. (1996), reported monsoon and autumn seasons (July, August and September) together had 3 times more odds of parvoviral enteritis than other seasons.

Immature dogs (≤4 months) had a significantly higher risk of parvoviral enteritis (OR=4.5), consistent with Glickman et al. (1985) who also reported higher risk in immature dogs (≤6 months) (OR=3.5). Puppies are very susceptible to this disease due to the low level of maternal antibodies from the disease and vaccination reaction at the same time, leaving the puppies defenseless. Adult dogs are generally resistant to viruses that have been exposed earlier. Immunity to parvoviral enteritis is known to be long lasting except for immunosuppressive dogs (Akgul et al., 2019).

Local breeds had more risk of parvoviral enteritis (OR=3.7) than exotic breeds which disagree with Houston et al. (1996) and Glickman et al. (1985) reported higher risk in exotic breeds. Frequent occurrence in local breeds might be due to their high population density that increases the chances to spread the infection or poor vaccination schedule

being followed by the owners. No specific comments can be made on breed susceptibility as the population density of breeds varies from one geographical area to another (Behera et al., 2015).

Unvaccinated dogs had a higher risk of parvoviral enteritis (OR=3.5), supported by Houston et al. (1996) who reported higher odds (OR=12.7) in unvaccinated dogs than vaccinated dogs. The higher risk of parvoviral enteritis in non-vaccinated dogs may be due to lack of protective immunity (Godsall et al., 2010).

Male dogs had an increased risk of parvoviral enteritis (OR=1.3) than females, which is consistent with Houston et al. (1996) and Glickman et al. (1985) who also reported higher risk in males than females (OR=2). Male dogs have high prevalence which might be due to more chance of exposure to certain behavioral patterns and selective preference of keeping male dogs by pet owners (Behera et al., 2015).

Although antibiotics don't work against any viral disease, these drugs were frequently used in this exploration. Ceftriaxone (in 51.5% cases) and metronidazole (in 33.3% cases) were the prescribed antibiotics to prevent endotoxaemia and secondary bacterial complications. A previous study also explored the antibiotic use in parvoviral enteritis cases (Macinitire, 2004) that suggests the following antibiotics: enrofloxacin, ticarcillin-clavulanate, metronidazole and cefixime. The use of antibiotics in parvoviral enteritis may save dog live by preventing secondary bacterial complications. But they also lead to antibiotic resistance (Llor and Bjerrum, 2014).

Cholera saline was given to 66.7% parvoviral enteritis cases in this study which is justified to replace lost electrolytes because of diarrhea and vomiting. Fluid therapy of 5% dextrose and 0.9% saline was given to a significant number of cases which was the rationale choice to replace lost of fluid and electrolytes. These treatment strategies are in line with Foster and Smith (2011) who said that the recovery of an infected puppy from parvoviral enteritis is dependent on effective and adequate fluid replacement. However, the use of lactated ringers' solution would have been better in replacing lost electrolytes (Nwoha, 2011).

Ondansetron was administered in 45.5% parvoviral cases. The serotonin receptor antagonists (Ondansetron or Dolasetron) may be used in cases of intractable vomiting (Prittie, 2004). However, metoclopramide and maropitant are also effective in reducing the frequency and severity of vomiting (Yalcin and Keser, 2017). Dexamethasone was administered in 12.1% cases. Glucocorticoids have anti-shock effects in all forms of shock, but they also impair the ability of the body to fight infection. So, it is better to avoid glucocorticoids in viral diseases (Aberdein and Singer, 2005; Tams, 2011).

The study was conducted only in TVH, CVASU and therefore the sample size of parvo enteritis cases was not big enough. Any statistical assumptions were not considered to calculate sample size for the case control study which is a limitation of the study. The cases and controls were recruited from the clinics only which limits the generality of findings. As some of the variables were highly correlated with each other (Chi-square test, $p \leq 0.05$), we were not able to conduct a multivariable logistic regression model to determine potential adjusted effect risk factors on the occurrence of parvoviral enteritis. Missing epidemiological information might have reduced overall study power which restricted the analysis data to conduct only univariable logistic regression as well. Diagnosis of parvoviral enteritis and other cases were mainly done based on history and clinico-epidemiological findings, and the cases were overseen by experienced veterinarians. However, the sensitivity and specificity of clinical-based diagnosis were not out of question. Although a structured record-keeping sheet from hospital-based recording system was used to obtain required epidemiological information we could not completely rule out the recall bias, for example, if the clients could not recall the exact date of deworming/vaccination.

In conclusion, the proportionate prevalence of parvoviral enteritis was 5.8%. The occurrence of parvoviral enteritis was more in recent years and winter months. The risk factors associated with parvoviral enteritis were young age, male, local breed, spring season and non-vaccinated dogs. Administration of fluids with supportive treatment is most important in parvoviral enteritis while broad spectrum antibiotics should be secondary concern. Although the occurrence of parvoviral enteritis is low in this study, modifying identified risk factors (e.g. maintaining vaccination schedule, special hygienic care of puppies, etc.) can reduce the level of parvoviral enteritis.

Statement of animal rights

As the study was conducted through clinico-epidemiological data collection, so there was no existence of animal ethical issues.

Conflict of interest

The authors declare that they have no conflict of interest.

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