Research and Reviews Journal of Zoological Sciences

e-ISSN: 2321-6190
p-ISSN: 2347-2294

Canine Distemper Virus in Animals-A Review

Vahini K*

Department of Pharmacology, Vivekananda College, Hyderabad, India

Review Article

Received: 15/08/2016
Revised: 20/08/2016
Accepted: 26/08/2016

***For Correspondence**

Vahini K, Department of Pharmacology, Hyderabad, India, Tel: 917799225609

E-mail: pravalika.kv@gmail.com

Keywords: Canine distemper; Sickness; Antibody; Immunization; Veterinarian

ABSTRACT

Canine distemper infection is caused an individual from the sort Morbillivirus in the family Paramyxoviridae. Canine distemper has been recorded in household pooches for a considerable length of time. It is currently perceived as an overall issue of carnivores and has the second most elevated casualty rate of any irresistible sickness, after rabies, in residential mutts. The significance of this malady in nondomestic creatures has gotten to be apparent with antibody prompted diseases in an assortment of animal varieties and substantial scale pandemics in hostage and free-extending felids. To date, canine distemper has been accounted for in all groups of earthbound carnivores: Canidae, Felidae, Hyaenidae, Mustelidae, Procyonidae, Ursidae, and Viverridae. Veterinarians, incorporating those working with nondomestic carnivores, ought to be acquainted with the clinical signs, determination, and clinical administration of this malady.

INTRODUCTION

Canine distemper is a viral sickness that influences a wide assortment of creature families, including household and wild types of dogs, foxes, pandas, wolves, ferrets, skunks, raccoons, and extensive felines, and also pinnipeds, a few primates, and an assortment of different animal groups [1-3]. It was for quite some time trusted that creatures in the family Felidae, including numerous types of huge feline and in addition household felines, were impervious to canine distemper, until a few analysts reported the commonness of CDV contamination in extensive felids [4]. It is presently realized that both vast Felidae and household felines can be contaminated, ordinarily through close lodging with pooches or potentially blood transfusion from tainted felines, yet such diseases give off an impression of being self-restricting and to a great extent without side effects [5,6].

DISCUSSION

In canines, distemper impacts a few body frameworks, including the gastrointestinal and respiratory tracts and the spinal rope and cerebrum, with basic manifestations that incorporate high fever, eye irritation and eye/nose release, worked breathing and hacking, spewing and loose bowels, loss of hunger and dormancy, and solidifying of nose and footpads. The viral contamination can be joined by optional bacterial diseases and can display possible genuine neurological indications [7-10].

The *in vitro* immunosuppressive impacts of canine distemper infection (CDV) disease in gnotobiotic puppies was concentrated on by co-culture of lymphocytes from those pooches with uninfected responder canine lymphocytes. Lymphocytes from viremic pooches smothered the phytomitogen reactions of responder puppies [11-15]. Cell suitability and aggregate cells/ml in culture stayed at or close control levels. The nearness of immunofluorescence (IF) positive syncytial cells in co-societies were noted and their numbers were expanded in societies containing pokeweed mitogen. Lymphocytes from nonviremic mutts likewise stifled the phytomitogen reactions of responder puppies [16,17]. This impact was not reliant on the nearness of viral antigen by IF and was repealed by pre-hatching of the silencer cell populace *in vitro* for 48 hour. preceding use in the silencer measure. In this way, disease with CDV brings about both infection ward and infection autonomous immunosuppression [18-25].

e-ISSN: 2321-6190
p-ISSN: 2347-2294

Albeit critical creature enduring brought about by preventable sicknesses is regularly found in creating nations, reports of this are rare. This report depicts avoidable creature enduring attributable to a speculated canine distemper (CD) flare-up in unvaccinated puppies possessed by low-wage families in Mozambique that murdered around 200 creatures [26-30]. Influenced dogs displayed clinical signs, and gross and infinitesimal sores good with CD. Immunohistochemical recoloring affirmed the nearness of canine distemper infection (CDV) in the kidney of one puppy from the companion. This brief correspondence again delineates that huge episodes of CDV in unvaccinated mutts happen and that expansive scale avoidable enduring and dangers to the strength of pooches and wild canines proceed. Mass immunization bolstered by government and non-government associations is suggested [31-36].

TREATMENT

Distemper is a summed up confusion of pooches for which no effective restorative operator is known. The illness has so far been controlled just by preventive means, utilizing an antibody of some sort. Numerous such immunizations have been created and utilized, with differing degrees of adequacy. The slaughtered infection immunizations are sheltered, yet low in antigenicity, so that numerous vaccinations are vital for successful insurance [37-40].

Attenuated virus antibodies are likewise outstanding, yet in such immunizations it has been difficult to maintain a strategic distance from either of the differentiating issues of a weakening level so serious as to result in low antigenicity and a constriction level so mellow as to bring about dynamic illness upon vaccination [41-44]. Besides, the constricted infection immunizations, particularly those delivered by serial section through chick developing life or other creature tissue, have usually included superfluous materials harming to the subject [45-48].

In one part of the present innovation, an antibody is created by taking after method: Virulent distemper infection is vaccinated into a solid canine. After the puppy has created clinical indications normal for canine distemper, it is relinquished and the kidney tissues are evacuated and trypsin zed [49-53]. The tainted cells discharged in this way are brooded at development temperature (around 37°C.) for around five to ten days in an ordinary development medium, for example, Earles arrangement until a monolayer tissue culture of puppy kidney cells is acquired [54-58]. Toward the end of the development time frame, the way of life is worried by cooling beneath development temperature, ideally to around normal room temperature (20-30°C.), where it is kept up for around one to around twenty hours or all the more, ideally around 6 to 12 hours [59-63].

The supernatant fluid is then pulled back, and is utilized to vaccinate another monolayer puppy kidney tissue culture from a solid canine, which is brooded and worried by same strategy. Serial entry of the infection through typical monolayer canine kidney tissue societies is hence proceeded for or more entries, toward the end of which time it is found that the infection is constricted to such a degree as to be totally avirulent [64-69]. The subsequent lessened culture is utilized as seed for developing constricted infection in amount, utilizing monolayer canine kidney tissue societies for this reason, and the weakened infection is made into an antibody by routine techniques, reasonably by weakening with a balancing out menstruum and stop drying [70-74]. Distemper is generally found in youthful puppies somewhere around 3 and 6 months of age yet can infrequently be found in more youthful or more seasoned pets. While it is basically a sickness of puppies, it can likewise be seen in different creatures, including ferrets, coyotes, foxes, raccoons and skunks [75-79]. The ailment spreads in a vaporized like way-through contaminated beads of body emissions from the nose, eye or mouth.

ANTICIPATING CANINE DISTEMPER

Note that canine distemper is preventable with the proper immunization plan. Your puppy ought to be inoculated at 6 to 8 weeks of age and after that each three to four weeks until your pet is 16 to 20 weeks of age [80-82]. This is then trailed by a supporter immunization one year later, and afterward every one to three years in grown-up puppies or as dictated by your veterinarian. Canine distemper is generally transmitted through contact with respiratory discharges. Yet, contact with fecal material and the pee of tainted puppies or things they have sullied can likewise bring about disease. Canine distemper is an infectious and genuine viral sickness with no known cure [83-85]. The illness influences canines, and certain types of untamed life, for example, raccoons, wolves, foxes, and skunks. The normal house pet, the ferret, is likewise a bearer of this infection. The two ailments are so comparative, actually, that it is conjectured by therapeutic history specialists and pathologists that the measles infection may have transformed sooner or later and spread to mutts [86-92]. In view of this nearby connection between the two, people can be contaminated with the canine distemper infection.

- Treatment for Canine Distemper
- Since there's no cure for distemper, treatment is steady.
- Give a spotless, warm, without draft environment.
- Keep eyes and nose clear of release.

e-ISSN: 2321-6190
p-ISSN: 2347-2294

- Give anti-emetics (hostile to queasiness and against regurgitating drugs) if there is heaving.
- Give anti-diarrheals for looseness of the bowels.
- Screen nearly for lack of hydration. Puppies without a hunger that are encountering retching and looseness of the bowels may require intravenous rehydration treatment.
- Anti-toxins or bronchodilators are recommended for pneumonia.
- Anticonvulsants may mostly control seizures. Numerous veterinarians recommend them before seizures begin.
- Myoclonus is untreatable (and irreversible).
- Puppies that recuperate yet have hypoplasia (un enameled teeth that dissolve rapidly) can have the lacquer reestablished to avert facilitate tooth rot.

Glucocorticoid treatment can now and again help visual impairment because of optic neuritis (irritation of the optic nerve). This may help in the short term, however glucocorticoids debilitate the safe framework and may exacerbate manifestations. There are a few unique sorts of distemper antibodies accessible, each with points of interest and impediments. Pet proprietors ought to talk about the different alternatives with their veterinarians [93-97]. The two most normal antibodies are canine tissue culture-adjusted immunizations and chick developing life adjusted immunizations.

Canine tissue culture-adjusted immunizations (e.g., Rockborn strain) are about 100% viable; they can once in a while cause deadly encephalitis (swelling of the mind) 1 to 2 weeks after inoculation. This kind of immunization is particularly dangerous in canines with debilitated safe frameworks. Chick fetus adjusted antibodies (e.g., Onderstepoort and Lederle strain) are more secure than the Rockborn strain however are just around 80% compelling [98-100].

CONCLUSION

Most puppies are conceived with their mom's antibodies to CDV, which keeps them from getting to be tainted if presented to the infection. They start to lose their maternal insurance somewhere around 6 and 12 weeks of age, which is when puppies ought to be immunized. A few immunizations ought to be directed amid this period. Puppies ought to be revaccinated yearly from there on.The best counteractive action against canine distemper is inoculation. Immunization functions admirably even in creatures that have as of now been presented to the infection-on the off chance that it is directed inside 4 days of introduction. Introduction to CDV through immunization prompts durable, yet not changeless, insusceptibility. Puppies ought to get yearly immunizations to guarantee assurance.

REFERENCES

1. Wilson MR, et al. Multiplexed metagenomic deep sequencing to analyze the composition of high-priority pathogen reagents. MSystems. 2016;19:e00058-e00016.
2. Peper ST, et al. Utility of two modified-live virus canine distemper vaccines in wild-caught fishers (Martes pennanti). Vet Q. 2016;36:197-202.
3. Cheng S, et al. A new immunoassay of serum antibodies against Peste des petits ruminants virus using quantum dots and a lateral-flow test strip. Anal Bioanal Chem. 2016.
4. Logan N, et al. Enhanced immunosurveillance for animal morbilliviruses using vesicular stomatitis virus (VSV) pseudotypes. Vaccine. 2016;34:5736-5743.
5. Liu PC, et al. Application of xenogeneic anti-canine distemper virus antibodies in treatment of canine distemper puppies. J Small Anim Pract. 2016;57:626-630.
6. Chaber AL, et al. Serosurvey for Selected Viral Pathogens among Sympatric Species of the African Large Predator Guild in Northern Botswana. J Wildl Dis. 2016.
7. Ethier DM, et al. The Occurrence of Pathogens in an Endangered Population of American Badgers (Taxidea taxus jacksoni) in Ontario, Canada. J Wildl Dis. 2016.
8. Nguyen DV, et al. Isolation and phylogenetic analysis of canine distemper virus among domestic dogs in Vietnam. J Vet Med Sci. 2016.
9. Fontoura DBR, et al. Morbillivirus Experimental Animal Models: Measles Virus Pathogenesis Insights from Canine Distemper Virus. Viruses. 2016;11:10.

e-ISSN: 2321-6190
p-ISSN: 2347-2294

10. Bauer KL, et al. Infectious disease and toxicological monitoring of stranded pacific harbor seals (phoca vitulina richardsi) in cook inlet as surrogates for monitoring endangered belugas (delphinapterus leucas). J Zoo Wildl Med. 2016;7:770-780.
11. McDermid KR, et al. Surveillance for Viral and Parasitic Pathogens in a Vulnerable African Lion (Panthera leo) Population in the Northern Tuli Game Reserve, Botswana. J Wildl Dis. 2016;26.
12. Necesankova M, et al. MYD88 and functionally related genes are associated with multiple infections in a model population of Kenyan village dogs. Mol Biol Rep. 2016.
13. Piewbang C, et al. Development and application of multiplex PCR assays for detection of virus-induced respiratory disease complex in dogs. J Vet Med Sci. 2016.
14. Bourg M, et al. Screening red foxes (Vulpes vulpes) for possible viral causes of encephalitis. Virol J. 2016;2:151.
15. Vilson A, et al. Immunoglobulins in dogs: correspondence and maturation in 15 litters of German shepherd dogs and their dams. Vet Rec Open. 2016;3:e000173.
16. Zacarias J, et al. Severe canine distemper outbreak in unvaccinated dogs in Mozambique. J S Afr Vet Assoc. 2016;87:e1-e2.
17. Decaro N, et al. Molecular surveillance of traditional and emerging pathogens associated with canine infectious respiratory disease. Vet Microbiol. 2016;192:21-25.
18. Monteiro FL, et al. Detection of respiratory viruses in shelter dogs maintained under varying environmental conditions. Braz J Microbiol. 2016;47:876-881.
19. Young DF, et al. Human IFIT1 Inhibits mRNA Translation of Rubulaviruses but Not Other Members of the Paramyxoviridae Family. J Virol. 2016;90:9446-9456.
20. Xiao J, et al. Diversified Anchoring Features the Peptide Presentation of DLA-88*50801: First Structural Insight into Domestic Dog MHC Class I. J Immunol. 2016;197:2306-2315.
21. Takenaka A, et al. Infectious Progression of Canine Distemper Virus from Circulating Cerebrospinal Fluid into the Central Nervous System. J Virol. 2016;90:9285-9292.
22. Feng N, et al. Canine distemper virus isolated from a monkey efficiently replicates on Vero cells expressing non-human primate SLAM receptors but not human SLAM receptor. BMC Vet Res. 2016;12:160.
23. Yang Y, et al. Identification and characterization of the toll-like receptor 8 gene in the Chinese raccoon dog (Nyctereutes procyonoides). Immunol Lett. 2016;178:50-60.
24. Liu F, et al. Evolutionary characteristics of morbilliviruses during serial passages in vitro: Gradual attenuation of virus virulence. Comp Immunol Microbiol Infect Dis. 2016;47:7-18.
25. Furtado MM, et al. Exposure of Free-Ranging Wild Carnivores and Domestic Dogs to Canine Distemper Virus and Parvovirus in the Cerrado of Central Brazil. Ecohealth. 2016;13:549-557.
26. Sadler RA, et al. Evaluation of two canine distemper virus vaccines in captive tigers (Panthera tigris). J Zoo Wildl Med. 2016;47:558-563.
27. Ramsay E, et al. Canine distemper virus antibody titers in domestic cats after delivery of a live attenuated virus vaccine. J Zoo Wildl Med. 2016;47:551-557.
28. Tong M, et al. Transcript profiling of Toll-like receptors mRNAs in selected tissues of mink (Neovison vison). J Microbiol Biotechnol. 2016.
29. Bergmann M, et al. Passive immunization in dogs and cats. Veterinary Surgeon of small pets. 2016;44:287-292.
30. Pope JP, et al. Characterization of a novel Canine distemper virus causing disease in wildlife. J Vet Diagn Invest. 2016;28:506-513.
31. Zhao Z, et al. Occurrence of canine parvovirus in dogs from Henan province of China in 2009-2014. BMC Vet Res. 2016;12:138.
32. Wyllie SE, et al. Epidemiology and clinical presentation of canine distemper disease in dogs and ferrets in Australia, 2006-2014. Aust Vet J. 2016;94:215-222.
33. Pinheiro AO, et al. Controversial results of therapy with mesenchymal stem cells in the acute phase of canine distemper disease. Genet Mol Res. 2016;15:2.
34. Feng N, et al. Fatal canine distemper virus infection of giant pandas in China. Sci Rep. 2016;6:27518.
35. Spitzbarth I, et al. Immunohistochemical and transcriptome analyses indicate complex breakdown of axonal transport mechanisms in canine distemper leukoencephalitis. Brain Behav. 2016;6:e00472.

e-ISSN: 2321-6190
p-ISSN: 2347-2294

36. Watts DE and Benson AM. Prevalence of antibodies for selected canine pathogens among wolves (canis lupus) from the Alaska Peninsula, USA. J Wildl Dis. 2016;52:506-515.
37. Dong XY, et al. Detection and differentiation of wild-type and vaccine strains of canine distemper virus by a duplex reverse transcription polymerase chain reaction. Iran J Vet Res. 2015;16:172-175.
38. Gutierrez MM and Saenz JR. Diversity of susceptible hosts in canine distemper virus infection: a systematic review and data synthesis. BMC Vet Res. 2016;12:78.
39. Ellis J, et al. Serum antibody responses to vaccinal antigens in lean and obese geriatric dogs. Can Vet J. 2016;57:531-534.
40. Plattet P, et al. Measles Virus Fusion Protein: Structure, Function and Inhibition. Viruses. 2016;8:112.
41. Budaszewski DFR, et al. Influence of vaccine strains on the evolution of canine distemper virus. Infect Genet Evol. 2016;41:262-269.
42. McAloose D, et al. Post-mortem findings in southern right whales Eubalaena australis at Península Valdés, Argentina, 2003-2012. Dis Aquat Organ. 2016;119:17-36.
43. Fischer CD, et al. Phylogenetic analysis of canine distemper virus in South America clade 1 reveals unique molecular signatures of the local epidemic. Infect Genet Evol. 2016;41:135-141.
44. Park S, et al. Coinfection with Hepatozoon sp. and Canine Distemper Virus in a Yellow-throated Marten (Martes flavigula koreana) in Korea. J Wildl Dis. 2016;52:414-417.
45. Rakha GM, et al. Prevalence of common canine digestive problems compared with other health problems in teaching veterinary hospital, Faculty of Veterinary Medicine, Cairo University, Egypt. Vet World. 2015;8:403-411.
46. Avendaño R, et al. Canine Distemper Virus in Wild Felids of Costa Rica. J Wildl Dis. 2016;52:373-377.
47. Jenson WA. Author's response. J Vet Diagn Invest. 2015;27:664.
48. Wöhrer D, et al. Age-related presence of selected viral and bacterial pathogens in paraffin-embedded lung samples of dogs with pneumonia. Acta Vet Hung. 2016;64:103-115.
49. Namroodi S, et al. Detection of Arctic and European cluster of canine distemper virus in north and center of Iran. Vet Res Forum. 2015;6:199-204.
50. Zaccaria G, et al. Circovirus in domestic and wild carnivores: An important opportunistic agent? Virology. 2016;490:69-74.
51. Correction: Pathology in Practice: canine distemper virus infection in a puppy. J Am Vet Med Assoc. 2016;248:412.
52. Woodman S, et al. Structural characterisation of Toll-like receptor 1 (TLR1) and Toll-likereceptor 6 (TLR6) in elephant and harbor seals. Vet Immunol Immunopathol. 2016;169:10-14.
53. Curi NH, et al. Prevalence and risk factors for viral exposure in rural dogs around protected areas of the Atlantic forest. BMC Vet Res. 2016;12:21.
54. Sawatsky B, et al. Morbillivirus and henipavirus attachment protein cytoplasmic domains differently affect protein expression, fusion support and particle assembly. J Gen Virol. 2016;97:1066-1076.
55. Uhde AK, et al. Fatal nocardiosis in a dog caused by multiresistant Nocardia veterana. Vet Microbiol. 2016;183:78-84.
56. Wehrmeister EL, et al. Phocine distemper virus (PDV) seroprevalence as predictor for future outbreaks in harbour seals. Vet Microbiol. 2016;183:43-49.
57. Logan N, et al. Efficient generation of vesicular stomatitis virus (VSV)-pseudotypes bearing morbilliviral glycoproteins and their use in quantifying virus neutralising antibodies. Vaccine. 2016;34:814-822.
58. Diaz NM, et al. Dog overpopulation and burden of exposure to canine distemper virus and other pathogens on Santa Cruz Island, Galapagos. Prev Vet Med. 2016;123:128-137.
59. Gallie RR, et al. Adenovirus 2, Bordetella bronchiseptica, and Parainfluenza Molecular Diagnostic Assay Results in Puppies After vaccination with Modified Live Vaccines. J Vet Intern Med. 2016;30:164-166.
60. Riley MC and Wilkes RP. Sequencing of emerging canine distemper virus strain reveals new distinct genetic lineage in the United States associated with disease in wildlife and domestic canine populations. Virol J. 2015;12:219.
61. O'Regan SM, et al. Interspecific Contact and Competition May Affect the Strength and Direction of Disease-Diversity Relationships for Directly Transmitted Microparasites. Am Nat. 2015;186:480-494.
62. Fakri F, et al. VeroNectin-4 is a highly sensitive cell line that can be used for the isolation and titration of Peste des Petits Ruminants virus. J Virol Methods. 2016;228:135-139.

e-ISSN: 2321-6190
p-ISSN: 2347-2294

63. Romanutti C, et al. RT-PCR and sequence analysis of the full-length fusion protein of Canine Distemper Virus from domestic dogs. J Virol Methods. 2016;228:79-83.
64. Khosravi M, et al. Canine Distemper Virus Fusion Activation: Critical Role of Residue E123 of CD150/SLAM. J Virol. 2015;90:1622-1637.
65. Saliki J. Letter to the Editor. J Vet Diagn Invest. 2015;27:664.
66. Millán J, et al. Patterns of Exposure of Iberian Wolves (Canis lupus) to Canine Viruses in Human-Dominated Landscapes. Ecohealth. 2016;13:123-134.
67. Peper ST, et al. Low Titers of Canine Distemper Virus Antibody in Wild Fishers (Martes pennanti) in the Eastern USA. J Wildl Dis. 2016;52:150-153.
68. Yi L, et al. Identification of a novel canine distemper virus B-cell epitope using a monoclonal antibody against nucleocapsid protein. Virus Res. 2016;213:1-5.
69. Berguido FJ, et al. Specific detection of peste des petits ruminants virus antibodies in sheep and goat sera by the luciferase immunoprecipitation system. J Virol Methods. 2016;227:40-46.
70. Jensen LG, et al. Associations between biosecurity and outbreaks of canine distemper on Danish mink farms in 2012-2013. Acta Vet Scand. 2015;57:66.
71. Swati D, et al. Isolation and phylogenetic characterization of Canine distemper virus from India. Virus disease. 2015;26:133-140.
72. Kubiski SV, et al. Unusual Necrotizing Encephalitis in Raccoons and Skunks Concurrently Infected With Canine Distemper Virus and Sarcocystis sp. Vet Pathol. 2016;53:674-676.
73. Garcia JA, et al. Tumour necrosis factor-alpha-induced protein 8 (TNFAIP8) expression associated with cell survival and death in cancer cell lines infected with canine distemper virus. Vet Comp Oncol. 2015.
74. Jensen WA, et al. Use of serologic tests to predict resistance to Canine distemper virus-induced disease in vaccinated dogs. J Vet Diagn Invest. 2015;27:576-580.
75. Dombrowski E, et al. Blindness in a wild American black bear cub (Ursus americanus). Vet Ophthalmol. 2016;19:340-346.
76. Yi L and Cheng S (2015) Preparation and Identification of a Single-chain Variable Fragment Antibody Against Canine Distemper Virus. Monoclon Antib Immunodiagn Immunother. 2015;34:228-232.
77. Oleaga A, et al. Concomitance and interactions of pathogens in the Iberian wolf (Canis lupus). Res Vet Sci. 2015;101:22-27.
78. Cheng Y, et al. Isolation and sequence analysis of a canine distemper virus from a raccoon dog in Jilin Province, China. Virus Genes. 2015;51:298-301.
79. Zhao J, et al. Pathogenesis of canine distemper virus in experimentally infected raccoon dogs, foxes, and minks. Antiviral Res. 2015;122:1-11.
80. Ke GM, et al. Phylodynamic analysis of the canine distemper virus hemagglutinin gene. BMC Vet Res. 2015;11:164.
81. Lavan R and Knesl O. Prevalence of canine infectious respiratory pathogens in asymptomatic dogs presented at US animal shelters. J Small Anim Pract. 2015;56:572-576.
82. Willi B, et al. Clinical and molecular investigation of a canine distemper outbreak and vector-borne infections in a group of rescue dogs imported from Hungary to Switzerland. BMC Vet Res. 2015;11:154.
83. Hull NC, et al. Canine dysautonomia in a litter of Havanese puppies. J Vet Diagn Invest. 2015;27:627-631.
84. Kabak YB, et al. Immunohistochemical detection of autophagy-related microtubule-associated protein 1 light chain 3 (LC3) in the cerebellums of dogs naturally infected with canine distemper virus. Biotech Histochem. 2015;90:601-607.
85. Miura R, et al. Efficacy of Recombinant Canine Distemper Virus Expressing Leishmania Antigen against Leishmania Challenge in Dogs. PLoS Negl Trop Dis. 2015;9:e0003914.
86. Panzera Y, et al. Molecular phylogeography of canine distemper virus: Geographic origin and global spreading. Mol Phylogenet Evol. 2015;92:147-154.
87. Bogomolni A, et al. In Vitro Exposure of Harbor Seal Immune Cells to Aroclor 1260 Alters Phocine Distemper Virus Replication. Arch Environ Contam Toxicol. 2016;70:121-132.
88. Liao P, et al. Phylogenetic features of hemagglutin gene in canine distemper virus strains from different genetic lineages. Int J Clin Exp Med. 2015;8:6607-6612.
89. Robinson HS, et al. Mortality of Amur tigers: The more things change, the more they stay the same. Integr Zool. 2015;10:344-353.

e-ISSN: 2321-6190
p-ISSN: 2347-2294

90. Suzuki J, et al. Canine distemper virus infection among wildlife before and after the epidemic. J Vet Med Sci. 2015;77:1457-1463.
91. Di Sabatino D, et al. Canine distemper and endangered wildlife: Is it time for mandatory vaccination of dogs? Vaccine. 2015;33:6519.
92. Jankowski G, et al. Survey for infectious disease in the South American fur seal (arctocephalus australis) population at punta san juan, peru. J Zoo Wildl Med. 2015;46:246-254.
93. Han JI, et al. A multiplex quantitative real-time polymerase chain reaction panel for detecting neurologic pathogens in dogs with meningoencephalitis. J Vet Sci. 2015;16:341-347.
94. Jamett AG, et al. Epidemiology of canine distemper and canine parvovirus in domestic dogs in urban and rural areas of the Araucanía region in Chile. Vet Microbiol. 2015;178:260-264.
95. Chitwood MC, et al. Parasitology and serology of free-ranging coyotes (canis latrans) in north carolina, USA. J Wildl Dis. 2015;51:664-669.
96. Hardes K, et al. Novel Furin Inhibitors with Potent Anti-infectious Activity. Chem Med Chem. 2015;10:1218-1231.
97. Kamps AJ, et al. Evaluation of Trapper-Collected Nobuto Filter-Paper Blood Samples for Distemper and Parvovirus Antibody Detection in Coyotes (Canis latrans) and Raccoons (Procyon lotor). J Wildl Dis. 2015;51:724-728.
98. Yuan B, et al. Antibody study in canine distemper virus nucleocapsid protein gene-immunized mice. Genet Mol Res. 2015;14:3098-3105.
99. Ebert NA, et al. Sequential conformational changes in the morbillivirus attachment protein initiate the membrane fusion process. PLoS Pathog. 2015;11:e1004880.
100. Gilbert M, et al. Canine distemper virus as a threat to wild tigers in Russia and across their range. Integr Zool. 2015;4:329-343.