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Disease control policies for stray and pet animals: Need for implementation in India

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Abstract

Every year millions of pet dogs and cats become ill from a variety of deadly pathogens. Even, stray dogs poses the highest risk. They are under most susceptible population for zoonotic diseases transmission. The culture of having pet in every household becomes more common and increasing in near future. The close tie between human and pet is critically the most risk engagement of cultivation of different diseases. Because of increasing adoption of pet, state animal department and Government of India need to actively, review the statewide situation and should take highest priority of making the policies and implement it for better regulation purpose and content the diseases spread among the pet population as well as to check zoonotic transmission. The present review discussed the different epidemiological data of diseases outbreaks, zoonotic and emerging diseases and the possible policies that need to be in action by implementing it.

Introduction

Veterinary medicine is a vital part of public health, agriculture, and food security. It is essential for protecting the health of humans and animals in the state. This article provides an overview of the prevalence of dog diseases in India and the corresponding management options. It is estimated that 15 million dog bites occur annually in India, resulting in 20,000 fatalities from rabies and other infections. People of India keep dogs as pets, and many stray animals are cared after by compassionate neighbors. Dogs in India and the rest of the world are susceptible to a wide variety of infectious diseases, however certain hazardous ailments are more prevalent. Canine rabies, canine leptospirosis, canine babesiosis, canine parvovirus infection, canine gastroenteritis, and canine distemper virus infection are among these disorders. Infectious diseases that infect dogs pose a grave risk to the health of both dogs and the human population as a whole. Despite major advances in veterinary research in recent years, infectious diseases continue to pose a significant hazard to canine populations and zoonotic transmission. Many ailments have a detrimental impact on the health of dogs, and many of them are fatal. In India, canine infectious illnesses are frequent for a variety of reasons. High population density, poor hygiene, inadequate immunization, and a lack of understanding about zoonotic diseases among pet owners and the general public are some of

these contributing factors. Some pet sickness outbreaks are preventable and treatable, but they can also be lethal. As a result of climatically favorable conditions, a large number of diseases have been documented in the dog population. Despite vaccination, several bacterial, viral, protozoal, and fungal diseases are regularly reported. Stray dogs are more susceptible to fatal infections, including canine distemper and rabies, due to their lack of vaccination. In Chhattisgarh state, India, Polak *et al.* (2018) performed research in the rural Phendeyling Tibetan Refugee Settlement of Mainpat and nearby Indian villages. Adenovirus (62%), Hemotropic Mycoplasmas (37%), Parvovirus (92%), Distemper virus (77%), Toxoplasma gondii (76%), Anaplasma spp. (21%), Dirofilaria immitis (15%), Ehrlichia spp. (13%), Babesia spp. (13%), and Leptospira interrogans (11%) were identified as prevalent, whereas Leishmania donovani Except for Babesia spp., which was more prevalent in stray dogs (30%) than in domestic dogs (8%; P=0.03), there was no noticeable variation in the prevalence of infectious illnesses between dog groups. The incidence of virus-neutralizing antibodies against the rabies virus was equal in both stray (9%) and pet (7%) dogs. Only two of the five dogs with documented rabies vaccines had neutralizing antibodies. In this dog community, infectious diseases of canine and zoonotic relevance were prevalent regardless of ownership status. Antibodies against the highly pathogenic parvovirus and distemper virus revealed widespread infection, despite the fact that immunization is relatively uncommon. Toxoplasmosis is prevalent in dogs, although it is not a zoonotic hazard until dogs are consumed. Many vector-borne diseases were discovered, the majority of which have a minimal zoonotic potential but can cause severe damage to dogs. Even if the owner believed their dog had been vaccinated, the majority of canines lacked documentation of rabies protection. Hence, instituting a continuous program of spaying and neutering dogs alongside immunizations and parasite control in India will be beneficial for both canine welfare and public health. There is no government regulation or social system in place that addresses the annual vaccination of strays. To avoid the worst-case situation in India, dog owners must vaccinate their pets annually (Desai *et al*., 2021). In order to effectively prevent and manage these diseases, it is essential to comprehend their epidemiology, clinical signs, and management. The purpose of this page is to provide a summary of the most frequently reported canine diseases in India. This overview will include the etiologies of the diseases, clinical symptoms, diagnostic procedures, accessible therapies, and some preventative strategies.

Canine Distemper (CD)

The canine distemper virus is a virulent and highly contagious disease (Desai *et al*., 2021). CD has also been observed in foxes, skunks, raccoons, black-footed ferrets, and lions, among other wild animal species (Appel and Sumners, 1995). The CDV belongs to the family Paramyxoviridae, subfamily Paramyxovirinae, genus Morbillivirus, and order Mononegavirales. (Desai *et al*., 2021). It is an encased, single-stranded, non-segmented, negative sense RNA between 150 and 300 nm in length. (Murphy *et al.*, 1999). Seven structural proteins constitute the CDV genome (Joshi *et al*., 2022a). The virus is comparatively unstable and is transmitted through aerosols or direct touch. Due to the waning of maternally acquired immunity at this age, CDV infection is most prevalent in young puppies, often between 3 and 6 months of age (Quinn *et al*., 2011). CDV often develops in the winter and mostly affects unvaccinated puppies and dogs. (Desai *et al*., 2021). The virus replicates mostly in the upper respiratory tract and then spreads to the tonsils and bronchial lymph nodes before reaching the ophthalmic, brain, lymphoid, urinary bladder, respiratory, and gastrointestinal tracts (Pardo *et al*., 2005). Viruses can remain for two to three months in recovered dogs (Beniam and Moges, 2019). Pyrexia is the initial clinical sign of the disease. Although pyrexia is biphasic, the initial temperature increase is often imperceptible. During the second stage of fever, oculo-nasal discharge, pharyngitis, and tonsillar enlargement are observed (Quinn *et al*., 2011). Chronic distemper encephalitis, also known as old dog encephalitis, is distinguished by ataxia and chorea, as well as persistent head pressing. (Kahn and Line, 2010). Thymic atrophy is one of the most common postmortem indications of CDV

(Kahn and Line, 2010). For the identification of CDV RNA in clinical samples, one-step, nested, and real-time RT-PCR, as well as lateral flow analysis, are sensitive molecular approaches. Epidemiological reports of canine disease in India are displayed in Table1.

Table.1 Epidemiological reports of Canine disease from India (Kasondra *et al*., 2023)

Sr. No.	Diseases	Place	Positive	References
1	Canine parvoviral infection	Southern India	69/128 (53.90%)	Srinivas *et al*., 2013
		Maharashtra	>88%	Belsare *et al*., 2014
		Chennai, Tamilnadu	80/190 (42.10%)	Hasan *et al*., 2016
		Navsari, Gujarat	63/145 (43.44%)	Mehta *et al*., 2017
		Navsari, Gujarat	62.29%	Pandya *et al*., 2017
		South Gujarat, Gujarat	35/73 (47.94%)	Sharma *et al*., 2018
		Andhra Pradesh	234/342 (68.42%)	Kumari *et al*., 2019
		Jabalpur, M.P.	7.24%	Khare *et al*., 2019
		Navsari, Gujarat	37/109 (33.94%)	Desai *et al*., 2020[a]
		Navsari, Gujarat	34/50 (68%)	Mehta *et al*., 2020
		Anand, Gujarat	145/1540 (9.42%)	Patel *et al*., 2022
		Pantnagar, Uttarakhand	258/ 627 (41.15%)	Kalita *et al*., 2022
2	Canine distemper	Mumbai, Maharashtra	304/7791 (3.90%)	Kadaba, 2011
		Maharashtra	>72%	Belsare *et al*., 2014
		Mizoram	10/900 (1.11%)	Yama *et al*., 2020
		Navsari, Gujarat	14/18 (77.77%)	Desai *et al*., 2021
		Anand, Gujarat	08/12 (66.66%)	Joshi *et al*., 2022[b]
		Ahmedabad, Gujarat	07/09 (88.88%)	
		Vadodara, Gujarat	01/02 (50%)	
		Chennai, Tamilnadu	131/163	Devi *et al*., 2022
3	Rabies	Punjab	30/41	Gill *et al*., 2019
4	Canine corona viral infection	Navsari, Gujarat	05/109 (4.58%)	Desai *et al*., 2020[a]
5	Canine adenovirus	Maharashtra	71%	Belsare *et al*., 2014
6	Canine leptospirosis	Namakkal, Tamilnadu,	145/460 (31.52%)	Senthil *et al*., 2013
		Kerala	71.12 %	Ambily *et al*., 2013
		Navsari, Gujarat	26/56 (46.42%)	Desai *et al*., 2020[c]
7	Canine babesiosis	Gujarat	15.81%	Jadhav, 2015
		Ludhiana (Punjab)	16/214(7.47%)	Singh *et al*., 2014
		Anand and Surat, Gujarat	16/79 (20.25%)	Bilwal *et al*., 2017
		Junagadh, Gujarat	61/375 (16.27%)	Murabiya *et al*., 2018
	Babesia gibsoni	Chennai, Tamilnadu	837/3844 (21.77%)	Senthil and Chakravarthi, 2021
	Babesia canis	Chennai,	350/3844 (9.10%)	Senthil and

		Tamilnadu		Chakravarthi, 2021
8	*Ehrlichia canis*	Chennai, Tamilnadu	2167/3844 (56.37%)	Senthil and Chakravarthi, 2021
9	*Trypanosoma spp.*	Chennai, Tamilnadu	46/3844 (1.19%)	Senthil and Chakravarthi, 2021
10	*Microfilaria*	Chennai, Tamilnadu	45/3844 (1.12%)	Senthil and Chakravarthi, 2021
11	Hepatozoon infection	Junagadh, Gujarat, Gujarat	21/317 (6.62%)	Kumar *et al*., 2018
	Hepatozoan canis	Chennai, Tamilnadu	399/3844 (10.37%)	Senthil and Chakravarthi, 2021
12	Canine demodicosis	Ahmedabad, Gujarat	04/177 (02.26%)	Anikar *et al*., 2021
		Saurashtra region, Gujarat	23/430 (5.34%)	Satasiya *et al*., 2022
13	Canine pyoderma	Ahmedabad, Gujarat	09/177 (05.08%)	Anikar *et al*., 2021
14	Dermatophytosis		56/177 (31.64%)	
15	Canine scabies		05/177 (02.82%)	
16	Tick infestation		24/177 (13.56%)	
17	Cardia abnormalities	South Gujarat	56/6366 (0.88%)	Parmar *et al*., 2021

Rabies

Rabies is one of the most fatal viral diseases that can infect mammals, including humans, dogs, wolves, and domestic cats (Desai *et al.*, 2018b). The "One Health" principle must be adhered to in order to prevent this disease, as it is the most fatal for domesticated animals (Desai *et al*., 2018a). Increasing public awareness through education programs aids in the global eradication of rabies (Desai *et al*., 2018b). Rabies is one of the worst viral diseases that may infect mammals, including humans and dogs. Rabies is a deadly disease caused by exposure to the rabies virus.

Parvoviral infection in dogs

Canine parvovirus enteritis (PVE), which is caused by one of three strains of canine parvovirus type 2 (CPV-2; family Parvoviridae, Genus Parvovirus), is the most prevalent cause of disease and death in dogs worldwide (Desai *et al*., 2020a; Desai *et al*., 2020b). Parvovirus only replicates in the nuclei of host cells that are dividing (Kahn and Line, 2010). Transmission primarily happens via the feco-oral pathway. Moreover, infected dogs excrete a high quantity of viruses in their stools. Although it has a larger affinity for the digestive, respiratory, and central neurological systems, it has major adverse consequences and clinical symptoms nonetheless (Joshi *et al.,* 2022b). The virus is exceedingly immunosuppressive and heightens the host's susceptibility to secondary infections, the leading cause of mortality (Joshi *et al*., 2022a; Joshi *et al*., 2022b). Desai *et al.* (2020a.) utilized the LFA test to detect canine parvovirus. Table 1 presents epidemiological reports of canine sickness from India.

Canine Leptospirosis

Due to its increasing prevalence in both emerging and wealthy nations, leptospirosis is one of the world's most concerning diseases (Desai *et al*., 2020c). It is caused by pathogenic spirochetes, which are mobile and impact a wide variety of hosts worldwide. It is once again a significant zoonotic disease. Leptospira interrogans serovars are ubiquitously prevalent in subclinically infected wild and domestic animal reservoir hosts (Desai *et al.*, 2020c). Leptospirosis can be diagnosed by dark field microscopy (DFM), microscopic agglutination test (MAT), ELISA, and polymerase chain reaction (PCR) (Desai *et al*., 2020c). Although DFM is the most cost-effective and time-efficient method for demonstrating organisms under a

microscope, it is less sensitive to detection (Desai *et al*., 2020c). MAT is the gold standard test for the detection of various serovars in samples through the detection of organisms or antibodies. Leptospirosis prevention in domestic animals is mostly dependent on vaccination. As immunity is serovar-specific, the prevalent leptospiral serovar should be included in the vaccination for the location. Treatment of instances with a high probability of treatment evasion, which could lead to the development of antibiotic resistance, is extraordinarily difficult (Bhinsara *et al*., 2018). Antimicrobial resistance and antimicrobial residues are of primary concern for both domesticated and companion animals (Muglikar *et al*., 2019; Tumlam *et al*., 2022). (Patel *et al*., 2019; Patel *et al*., 2020). Intimate interaction between dogs and humans may facilitate the spread of resistant microorganisms in the opposite direction. By employing protective equipment and avoiding swimming in contaminated water sources, the risk of occupational damage to humans can be decreased. Due to the fact that vaccination is the most efficient means of disease prevention, testing a rodent control-culling program and vaccinating pets can both contribute to a drop in the animal population as well as vaccine delivery agents and adjuvants are also most important (Makwana *et al.*, 2018; Karunakaran *et al*., 2023). Leptospirosis is endemic in the south Gujarat coastline region (Desai *et al*., 2020c). People and domesticated animals such as cattle, buffalo, sheep, goats, and dogs are impacted. Table 1 presents epidemiological reports of canine sickness from India.

Other Illnesses

In addition to kennel cough, herpes virus infection, canine ehrlichiosis, and other prevalent protozoal and parasite infections, canine demodicosis, canine pyoderma, dermatophytosis, canine scabies, and tick infestation are prominent diseases that affect dogs (Anikar *et al*., 2021, Parmar *et al*., 2021). The information on the reported disorders is presented in Table 1. These disorders are often treatable and can be diagnosed by a variety of means. Hepatozoonosis, one of the most serious diseases that can affect dogs, is transmitted by ticks and is caused by the hepatozoon parasite. Due to the increased sensitivity of antibody-based serology assays such as the direct fluorescent antibody test (Patel *et al*., 2018), ELISA based detection kits (Mavadiya *et al*., 2021), and nucleic acid– based polymerase chain reaction (PCR) assays, clinical investigation of bovine, equine, canine herpesvirus, and other canine pathogenic pathogens has increased (Vala *et al.,* 2020). Canine coronavirus disease (CCoV) is a highly contagious intestinal illness that primarily affects puppies (Desai *et al.,* 2020a). Group A rotaviruses are among the infectious agents that can cause gastrointestinal illness in people and animals (Tumlam *et al*., 2019; Makwana *et al.,* 2020a; Makwana *et al*., 2020b). Sequencing analysis of the genes encoding the two outer capsid proteins, VP7 and VP4, the inner capsid protein, VP6, and the nonstructural protein NSP4 is useful for both the collection of epidemiological data and the identification of the origin of distinct rotavirus strains (Makwana *et al.,* 2020a; Makwana *et al.,* 2020b). The danger of disease transmission increases when animals are transported from one location to another, when animals are housed together in one location as part of an organized farm, or when animals are transferred from one location to another (Sakhare *et al.,* 2019; Sharma *et al*., 2019). As a result, it contributes not only to the spread of disease within canine populations, but also among populations of other animals. Furthermore, it contributes to the transfer of bacterial and viral illnesses between species. TVT is currently classified as a round cell neoplasm, placing it in the same classification as mast cell tumors, basal cell carcinomas, histiocytomas, and lymphomas. On the other hand, other cases of malignancies, such as adenoma of the perianal gland, have been reported (Chaudhari *et al*., 2017). TVT is both naturally infectious and sexually transmissible in dogs, and it is seen most frequently in strays and breeding dogs. Hence, several types of canine cancers, such as TVT and canine memory happy tumors, are prevalent in Gujarat and the southern section of the state. Other emerging diseases like monkeypox, sudan ebola virus are threat to animal population and poses the risk for zoonotic transmission (Rana *et al*., 2022; Patel *et al*., 2023a; Patel *et al*., 2023b)

Policies

Disease control policies need to be implement by authorities. Stray and pet dogs, cat should vaccinate against rabies and other deadly diseases. Government should make regulation by making policy of vaccination for pet animal. Government should enforce the guidelines pertaining to pet and it should follow by pet parents. Government should make a law, which regularized mandatory vaccination of pet and their insurance to protect pet and their owner from any diseases outbreak. The mandatory vaccine law would be the best to control diseases and any outbreak. State and government of India can enforce the law for the better regulation of diseases outbreaks, pet health and public health.
The policies:

1) State wide compulsory vaccination of pet or stray dog and cat.
2) State law or central law which regularize and mandate the compulsory vaccination of pet and if fail to do so then owner should be punished.
3) Government should offer free vaccination to stray animal by collaborating with any animal saving group or involving the local organisation.
4) Online pet registration for its vaccination record and digital health card for prevention and controlling of diseases.

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