CURRENT STATUS OF CANINE BRUCELLOSIS IN INDIA

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ABSTRACT

Canine brucellosis is a bacterial disease caused by *Brucella canis* which is the most common cause of reproductive failure in dogs. Incidence of the disease is higher in stray dogs than in pets. Though brucellosis was reported to have existed in India since 1879, the methodical study was taken up as late as 1943, in animals and man in Madras presidency. However, contagious abortion in livestock associated with brucellosis was first investigated in India by the Imperial Veterinary Research Institute, Mukteshwar in 1918. Since then the disease has been reported almost everywhere in India. Data on the prevalence of canine brucellosis in India is scarce or rather unreported, and the public health significance is not much known. Routine sero-surveillance of canines should also be done so that proper control measures can be taken.

Key words: Canine brucellosis, re-emerging anthropozoonosis, infertility, bacterial culture, prevalence.

INTRODUCTION

Brucellosis is considered a re-emerging anthropozoonotic disease having multifaceted epidemiology and socioeconomic implications around the globe. *B. canis* infection is the most common cause of reproductive failure in dogs. Incidence is higher in stray dogs than in pets (Johnston, *et al.,* 2001). Canine brucellosis is a bacterial disease caused by *Brucella canis* with public health significance. Although, dogs can be infected by four species of *Brucella* i.e, *Brucella canis*, *Brucella abortus*, *Brucella melitensis* and *Brucella suis* (WHO, 2006).

B. canis is a gram-negative coccobacillus which is differentiated from the other species of the genus B*rucella* (except *Brucella ovis*) by the difference that it forms rugose colonies (Carmichael and Bruner, 1968; Berthelot and Garin Bastuji, 1993). It grows in common culture media including triptose agar and does not require CO_2 for culture. It affects all breeds of dogs and can seldom affect human beings. Brucellosis in dogs occurs worldwide. It is endemic to the America, Asia (India) and Africa (figure) (Wanke, 2004). Since the discovery of *B. canis* as a cause of abortion, outbreaks in breeding and research kennels have been sporadically reported worldwide (Jones and Emerson, 1984).

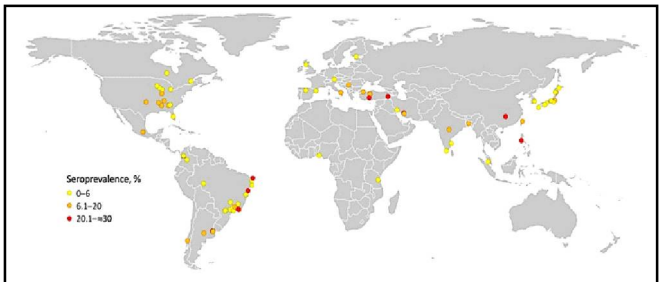

Fig-1: Locaion of published brucella canis serologic surveys of dogs (online technical appendix. https://wwwnc.cdc.gov/EID/Article/24/8/17-1171-techapp1.pdf). Each dot represents 1 pblished study; colours represent seroprevalence determined in each Cartography: cecilia Smith.

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The organism (*Brucella canis)* was first observed by Carmichael in 1966 in U.S.A. in a beagle colony and had been reported by many workers from different countries (Tanbulluoglu and Diker, 1983 and Delgado and Centorbi, 1990). In India, *Brucella canis* infection was reported for the first time by Thanappa Pillai *et al.* (1991). Since Leland Carmichael's rst isolation of *Brucella canis* in 1966 (Carmichael, 1966), canine brucellosis has been recognized as the cause of great economic loss in kennels. Even today, it is difcult to establish a true diagnosis of this disease and to convince breeders that their animal's normal reproductive life has ended.

DISEASE OVERVIEW

B. canis infection in dogs occurs predominantly through ingestion, inhalation, or contact with aborted fetuses or placenta, vaginal secretions, or semen. The organism exhibits tropism for reproductive tissue. Thus, infected dogs intermittently shed low concentrations of bacteria in seminal fluids and non-estrus vaginal secretions. Post-abortion vaginal fluids contain a high level of bacteria and are a source of infection for other dogs and humans. Even after castration, dogs may still serve as a source of infection because the bacteria can persist in the prostate and lymphoid tissues. In addition to in reproductive secretions, the organism is shed in the saliva, milk, nasal secretions, and urine. Studies suggest that the concentration of *B. canis* in urine is higher in male than female dogs due to urine contamination with seminal fluid.

The clinical signs of *B. canis* infection is not pathognomonic. In male dogs, B. canis causes epididymitis, prostatitis, and orchitis; chronic testicular

and epididymal inflammation can lead to unilateral or bilateral testicular atrophy and infertility.

The typical manifestation in females is mid- to late term abortion (during days 45–59 of gestation), followed by an odorless, brown-to-yellow vaginal discharge for 1–6 weeks. Another manifestation is embryonic death with resorption, which appears as conception failure after an apparently successful mating (Carmichael and Kenney, 1968).

Another manifestation of infection with B. canis is discospondylitis, which can occur in healthy dogs or in those with a history of reproductive failure that was treated with antimicrobial drugs. Infected dogs have a history of lameness, spinal pain, neurologic dysfunction, muscle weakness, or any combination of these signs, caused by vertebral osteomyelitis and intervertebral disc infection. Incidence of discospondylitis is higher in male than female dogs, perhaps because of a reservoir of bacteria in the prostate that results in intermittent bacteremia even in castrated males (Huroy *et al*., 1978). B. canis can also produce anterior uveitis (Saegusa *et al*., 1977) and, occasionally, isolated cases of polygranulomatous dermatitis, meningoencephalomyelitis (Purvis, 1981) and endocarditis (Ying *et al*., 1999)

Diagnosis of canine brucellosis is difficult because of unstable serum antibody titers that vary from individual to individual as well as between different methods used for their detection (Kim *et al*., 2007). Serology is still the most commonly used method to diagnose *Brucella*, but must be used in combination with more specific methods like the Tube Agglutination Test (TAT) and repeated blood culturing is necessary to confirm diagnoses (Keid *et al*., 2009). For *B. canis*, the standard method for diagnosis is bacterial culture.

Antimicrobial treatment alone after signs of reproductive failure is usually unsuccessful because of the ability of the bacteria to sequester intracellularly for long periods and cause episodic bacteremia (Carmichael and Shin, 1996). The recommended course of treatment is multimodal and includes surgical sterilization and antimicrobial drugs like streptomycin, penicillin and tetracyclines. Though, no treatment is 100% efficacious.

The absence of apparent clinical signs, diagnostic dilemma, non-availability of vaccine and no efficient antibiotic therapy makes canine brucellosis a high health risk to pet owners and animal handlers.

INDIAN SCENARIO

Brucellosis is prevalent in developing countries (like India) where humans and animals live in close proximity. Though brucellosis was reported to have existed in India since 1879, the methodical study was taken up as late as 1943, in animals and man in Madras presidency. However, contagious abortion in livestock associated with brucellosis was first investigated in India by the Imperial Veterinary Research Institute, Mukteshwar in 1918. Since then the disease has been reported almost everywhere in India.

Data on the prevalence of canine brucellosis in India is scarce or rather unreported, and the public health significance is not much known. According to census 2007, canine population of India is 19.9 million. Socio-economic deprivation, as well as the changes in the urban and peri-urban environment due to the development of slums and informal communities, has resulted in increased dog populations and thus a dramatic increase of canine roamers in these communities.

In most countries where brucellosis has been reported, no dogs can enter into a breeding program until they have tested negative for brucellosis. However, in India even though the disease has been reported, much importance is not given to it.

Indian Council of Agricultural Research (ICAR) recorded the national seroprevalence of brucellosis in cattle from 2012–2013 as roughly 13.5% which is at a stable, endemic equilibrium. As compared to cattle, there is limited information on brucellosis in canine populations of India as can be interpreted by the (Fig-1) above. In India, brucellosis in livestock is responsible for an estimated loss of US $3.4 billion per year (Singh *et al*., 2015).

The reports of canine brucellosis in India are very less documented. The disease remains undervalued in India. The current and past scenario indicated that serological survey of 460 dogs showed 2% infection Tamil Nadu (Srinivasan *et al*., 1992). *While,* In India, Srinivasan, 1991 reported a seroprevalence of 1.9% in Madras city and Aulakh *et al*., 1997 who observed 9.8% prevalence in dogs

In one study of Sharma *et al*., 2011, done in India, initial screening of serum samples should be carried out by I-ELISA followed by confirmation with AGID. immunochemical characterization of antigens of *Brucella canis* (*B. canis*) was carried out for its use in seroprevalence study of canine brucellosis.

A maximum of 16.12% seroprevalence of canine brucellosis was observed by I-ELISA while 2 ME-TAT, AGID and dotELISA detected a seroprevalence of 2.27%, 1.5% and 3.03%, respectively, in the present study. This discrepancy was attributed to the higher analytical sensitivity of I-ELISA.

A study was conducted by Sharma (2014) on canines exhibiting symptoms of abortion, orchitis, anorexia, persistent temperature, itching etc. in **Punjab** state in which 112 serum samples of dogs were analyzed

and serologically positive samples were 9.8%. Out of which 32.6% positive samples were among those which showed clinical symptoms.

Maansi and Upadhyay (2015) on 26 dog samples recorded a prevalence of 7.69% in male dogs through RBPT and ELISA and none of the female dogs was positive by serological test.

Out of the 26 (18 male and 8 female dog) serum samples examined; prevalence was estimated to be 7.69%.

- Another study was conducted by Preena *et al*., 2016 in the **Tamil Nadu** state of India to determine the prevalence and possibility of cross- species transmission of brucellosis among small ruminants, swine and canine populations. Anti-Brucella antibodies were detected by RBPT, i-ELISA and dot-ELISA in 300 dogs and an overall seroprevalence of 7.33% for canine brucellosis was recorded.
- In a study by Shafeena *et al*, 2016, carried out in **Tamil Nadu**, India, sera samples (n=150) were collected from dogs with clinical signs of brucellosis like abortion, conception failure, scrotal oedema and discospondylitis. Canine brucellosis antibodies were detected using Immunocomb canine Brucella antibody test kit and Bru alert monoclonal based blocking ELISA.

  From the clinically suspected dogs tested, 13.13 % turned seropositive. Of these, 12 % was positive for *Brucella canis* (rough) antibodies implying that this population got aborted due to the *Brucella canis* (rough) antigen. Upon the data analysis, it was found that the prevalence was highest in 5-6 years age group and 33.33% dogs got aborted at a gestational length of 46-55 days. Statistical analysis revealed that there was a significant difference ($p<0.05$) in the prevalence of brucellosis among age groups and gestation length at which abortion happened. Statistical analysis also revealed that there was no significant difference ($p>0.05$) in the prevalence of brucellosis among various breeds and sex of the dogs.
- Lingam *et al*. (2020) conducted a study to know the sero occurrence of brucellosis in dogs from **Telangana** state using a total of 400 (171 North and 229 South Telangana) blood samples from dogs and sera samples subjected to four serological tests namely RBPT, LFA, STAT and ELISA. Dogs of sexually active (11 months and above) were more predisposed to Canine Brucellosis.

  The prevalence in dogs in less than 1 year was zero, in 1-5 years and above 5 years age group it was ~3%. Out of 130 male dogs from Telangana state 2 (1.54%), 2 (1.54%), 1 (0.77%) and 2(1.54%) and out of 270 females 9 (3.33%), 10 (3.70%), 8 (2.96%) and 11 (4.07%) were positive by RBPT, LFA, STAT and ELISA respectively.
- Department of Biotechnology (DBT), Ministry of Science and Technology, Government of India, has launched a “network project on brucellosis”. The mission of the network is to develop simple, rapid and convenient diagnostic kits like lateral flow assay (LFA) rapid detection kits and indirect ELISA (iELISA) kits and validate them at the National Reference Laboratories. These kits are currently being used in the field to understand the prevalence of brucellosis in a large spectrum.

  In its study, a total of 14,343 (223 dog) samples were collected randomly from various parts of the country, including domestic animals, wild animals and humans involved in animal practices. Out of the 223 samples of dogs, 4 tested positive (prevalence of 1.8%) when tested using LFA and iELISA (Manasa *et al*., 2019).

  The World Health Organization and the World Organization for Animal Health do not have policies relating to brucellosis caused by *B. canis.* Routine sero-surveillance of canines should also be done so that proper control measures can be taken especially in breeding and pregnant dogs, thereby preventing the spread of infection in kennels, veterinary institutions and associated zoonotic implications from aborted animals and other sources.

CONCLUSION:

Brucellosis in dogs remains endemic to many parts of the world and without stronger intervention measures will probably remain an under-recognized threat to human health and animal welfare. Brucellosis is a significant zoonoses in India that causes veterinary and public health problems.

Studies suggest strongly that canine brucellosis persists in India with detectable sero prevalence and due to the increasing canine population, it is more difficult to control it. Despite having the knowledge about the disease and its easy mode of transmission, the disease has aced negligence in India as far as its control is concerned. India needs to have an effective plan to control canine brucellosis. Future work is required to improve diagnostic assays for canine population and to generate policies to prevent the spread of disease. Implementation of mandatory testing before interstate or international movement of dogs would be a good step. Also, the dog owners should make sure that they get the serum samples checked every semester in order to know the disease status of their dog.

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