

Brucella Abortus in Dog Population: An Underestimated Zoonotic Disease

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ABSTRACT

Brucellosis is an infection that affects different animal species and human. This disease is particularly contagious and cross- species transmission of *Brucella* spp. can occur. Dogs infection is usually caused for *B. canis*. However, *B. abortus* infection, associated with infected cattle, has been reported experimentally and under field conditions and transmission from dog to human is possible. This communication highlights the occurrence of *B. abortus* infection in dogs, revealing for the first time, the analysis of a farm dog population in Argentina that being infected with *B. abortus* and emphasize the importance of the zoonotic transmission of the diseases in a rural area. In the study reported here, 195 dog sera were analyzed, and 61 of them (31%) were found positive for *B. abortus* by Buffered *Brucella* antigen test; 54 dogs (27,7%) were then confirmed seropositive for Slow Agglutination test and 2-mercaptoethanol test, with antibody titer $\geq 1:100$. Examination of case histories showed that all the *B. abortus* seropositive dogs lived in a proximity with brucellosis seropositive livestock and may have access to aborted fetuses and placentae from infected cattle, or they were house dogs that had close contact with farm dogs. Elimination of infected cattle only may not necessarily eradicate the brucellosis but avoided the contact of dogs from infected cows should prevent the transmission.

Introduction

Brucellosis is an infection that affects different animal species and human. Bacteria of the genus *Brucella* includes 12 recognized species [1], *Brucella abortus*, *B. melitensis* and *B. ovis* are the typical species found in cattle and small ruminants. *B. suis* mainly caused porcine brucellosis and other species of interest include *B. canis* and *B. ovis*, infecting dogs and sheep respectively [2]. This disease is particularly contagious and cross- species transmission of *Brucella* spp. take place [2]. All biovars of *B. abortus* and *B. melitensis* and biovars 1, 3, and 4 of *B. suis* are common zoonotic pathogens [3,4], causing undulant fever and influenza-like symptoms in humans, but *B. canis* is less recognized as the cause of a zoonosis disease [5]. Brucellosis in dogs has been reported worldwide and is endemic to the Americas; Asia and Africa, serologic surveys of dogs from numerous countries established a wide range of seropositivity, from 1- 28% [6]. Brucellosis infection in dogs can be caused not only for *B. canis*, but also dog's infection by *B. abortus*, *B. melitensis*, and *B. suis* has been reported experimentally and under natural conditions [7-9]. Clinical signology of Brucellosis infection are not pathognomonic, since dogs may be subclinically affected or may

exhibit reproductive disorders in bitches and causes epididymitis, prostatitis, and orchitis in male dogs [10].

B. canis can cause both acute and chronic infections in human like other *Brucella* species [11]. However, epidemiological data concerning *B. canis* human infection is lacking, because are hardly considered in differential diagnoses and identification of the bacteria infection via serology is tough [12]. Human cases of *B. canis* are rare and mainly resulted from contact aborting bitches or veterinary practitioners [13]. It has been previously reported *B. abortus* natural infection in dogs associated with infected cattle, and horizontal transmission of the disease is possible from dog to dog, cattle to dog, dog to cattle, and dog to human [14,15]. However, brucellosis caused by *B. abortus* typically manifests in humans as non-specific clinical signs, including malaise, fatigue, arthritis and fever, with the development of a chronic disease [16]. Human to human transmission can occur via placenta or breastfeeding [17]. This infection is most commonly transmitted through direct contact with tissues from infected animals (aborted fetal tissue) or unpasteurized dairy products [16].

Usually the clinically infection were reported from people who work in close contact with cows, that include veterinarians and farmers [13]. Although the global prevalence of brucellosis in humans is unknown, mainly due to underdiagnosis and under notification, it is estimated that worldwide affects 500,000 people a year, especially in countries in the Mediterranean area, Arabia, India, Mexico, America Central and South America [18]. In Argentina, official data reported that the estimated prevalence of brucellosis in cattle, caused by *B. abortus*, is 10–15% among herds and 4–5% among individual animals [19]. There is not epidemiological data regarding human infection with *B. abortus* through dogs. This communication highlight information regarding occurrence of *B. abortus* infection in dogs, emphasizing *B. abortus* as an underestimated pathogen in canine. Revealing for the first time, the analysis of a farm dog population in Argentina that being highly infected with *B. abortus* and emphasize the importance of the zoonotic transmission of the diseases in a rural area. From 2015 to 2018, a total of 195 serum samples from dogs that live in a farm environment in a rural area of Buenos Aires province of Argentina were collected and tested for *B. abortus* and *B. canis* infections.

Smooth *Brucella* spp. (*B. abortus*, *B. suis* or *B. melitensis*) express the immunodominant O side chain on the lipopolysaccharide of their surface. Therefore, this side chain forms the antigenic basis of diagnostic tests, such the Buffered Brucella Antigen Test (BBAT), Slow Agglutination Test (SAT) and 2-Mercaptoethanol test (2-ME), can detect smooth species. Tests for rough *Brucella* species as *B. canis* differ from test for smooth *Brucella* spp, since *B. canis* does not hold the O side chain on its surface, the Rapid Slide Agglutination Test (RSAT) is used for serologic analysis. Therefore, *B. canis* infected dogs are not possible to have positive results for *B. abortus* test and vice versa [20]. The dog serum samples were analyzed by using the BBAT as a screening test. Then, the positive samples were confirmed by SAT and 2-ME tests. Also, all the dog's serum was serological tested for *B. canis* infection by RSAT. In the study reported here, sera from 61 dogs (31%) were found positive by BBAT; 54 dogs (27,7%) were confirmed seropositive for SAT and 2-ME with antibody titer $\geq 1:100$; 7 (3,5%) dog's serum samples were demonstrated positive for *B. canis*, and only 1 dog resulted positive for both *B. abortus* and *B. canis*.

Examination of case histories showed that all the *B. abortus* seropositive dogs lived in a proximity with brucellosis seropositive livestock and may have access to aborted fetuses and placentae from infected cattle, or they were house dogs that had close contact with farm dogs. Vaginal discharges from *B. abortus* positive cattle have been reported to persist more than 40 days after abortion or parturition and turned into an infected source for dogs. Seroconversion in *B. abortus* infected dogs can occur between 5- and 20-days post-infection and excretion of *Brucella* spp. into the environment via urine or feces have been reported [21]. This via could explain the infection of the house dogs that never been

to the farm, which were apparently infected by ingesting brucella contaminated feces or urine from the farm dogs. By the Argentinian government law, the brucellosis seropositive cattle should be removed under surveillance program in order to avoid the spread of the disease. Since canine brucellosis is not part of the surveillance program, dogs could play the role of reservoir hosts for *B. abortus*.

So far there is no evidence that dogs play an active epidemiological role in the transmission of *B. abortus* to humans or cattle. However, this source of transmission should not be underestimated, since cross species transmission of *Brucella* spp. is possible. Sporadic transmission of *B. canis* from pet dogs to their owners has been reported [22]. In addition, other report describes *B. suis* detection in dogs and warning the public about the potential pig-to-human transmission [23]. Because *B. abortus* is more pathogenic to humans than *B. canis*, patients exposed to *B. abortus* farm dogs should be tested for the infection and monitored for clinical signs. *B. abortus* infected dogs have the potential to infect cattle and could be a threat of brucellosis transmission than had been assumed before. Although the risk of transmission appears to be mild, infection of human or cattle associated with *Brucella*-infected dogs would cause unfavorable political and economic consequences. Elimination of reactor cattle only may not necessarily eradicate the disease, but removal of contact dogs from infected herds should prevent such transmission. During Brucellosis eradication programs, serological testing of dogs for *B. abortus* may be a valuable indicator (sentinel) of the presence of brucellosis in cattle [21].

Brucellosis is a thoughtful, globally distributed zoonotic disease and ingestion of contaminated dairy products is the major risk for brucellosis in disease-endemic areas [16]. However, should not be underestimated the potential transmission of *B. abortus* to humans in contact with infected farm dogs. More than 60% of human pathogens are estimated to have an animal source, and the incidence of a disease is affected by environmental factors, therefore diverse approaches are valid in order to control the incidence of zoonotic diseases [24,25].

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