Brucella canis Infectivity Rates In Stray and Pet Dog Populations

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Brucella canis, the causative agent of infectious abortion in dogs, was first isolated in 1967.[1, 2] The initial reports concerning this new *Brucella* species centered around explosive abortion epidemics where beagles were being raised. Meyer documents several examples, including *Br. canis*, where the *Brucella* organism with apparent suddenness acquires new or additional features and established itself in a host not previously a part of the reservoir system of the genus.[3]

The first five cases of human infection involved laboratory personnel engaged in epidemiologic studies concerned with these disease outbreaks in dogs. In 1969, based upon these early findings it was suggested that canine brucellosis was confined to beagles and that *Br. canis* posed no serious problem for the health of the general public.[4] Since that time, eight additional human cases have been reported, five of which were associated with infections in pet dogs.[5] In addition, it has been demonstrated that dogs other than beagles can be infected with *Br. canis*.[6]

Most infected dogs are free of clinical signs to the extent that they do not even develop a pyrexia following parental inoculation of large numbers (10^{10}) of *Br. canis* organisms. Canine brucellosis is suspected whenever healthy bitches abort approximately two weeks before term or if they fail to whelp after an apparently successful mating. Abortions occur without premonitary signs followed by a vaginal discharge emanating from the uterus that lasts for one to six weeks. This discharge contains *Br. canis* organisms estimated to be up to 10^8/ml. in number. Some males exhibit epididymitis, scrotal hyperemia and dermatitis, but these features are not consistent.[7]

Dogs exposed to *Br. canis* have been found to be bacteremic as early as seven days after exposure. With infections which have ranged from 10 to 24 months the period of bacteremia was uninterrupted; i.e., once dogs become culturally positive they remain so until the bacteremia ceases.[8]

In work correlating cultural and serologic data it was determined that dogs with agglutination titers of less than 1:100 may have been tested in the early stages of the disease when they are bacteremic or that they may have been tested in the final stages of the disease when bacteremia disappears. Dogs with titers of 1:200 or higher had more than an 80 per cent prevalence of bacteremia.[8] From these observations, the following guidelines were developed: (1) dogs with agglutination titers of less than 1:100 are considered negative; (2) dogs with titers of 1:100 are considered positive; (3) dogs with titers of 1:200 or greater are considered to be actively infected.[9] The criterion involving an interpretation of active infection is reasonable in that a bacteremia is consistently demonstrable at an agglutination titer of 1 : 320 or higher.[4]

It is generally agreed that the evidence presently available suggests a low incidence of clinical and subclinical human brucellosis due to *Br. canis*.[10] However, Munford, *et al.* emphasize that routine *Brucella* agglutination tests using *Br. abortus* antigen have all been negative for patients with a *Br. canis* infection.[11] The inference is that infection with *Br. canis* may be more widespread than is presently suspected. The difficulty of diagnosis in human beings is the vagueness of the clinical manifestations. The prominent symptoms are fever, chills, malaise, and weight loss.[11] In this respect, infection with *Br. canis* is typical of brucellae infections. It is only

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in areas like Malta where infections with *Br. melitensis* are very common that any acute febrile illness immediately alerts a physician to the possibility of acute brucellosis.[12]

Canine brucellosis involves the oral cavity, vagina, and conjunctiva as portals of entry. The portals of exit are vaginal discharges (including aborted fetal tissue), milk, urine (males), and semen.[13] Accepting it as probable that the dog serves as a mechanical and/or a biologic vector for *Br. canis*, an infected dog might transmit the disease to human beings sharing the same environment.[10] In this context, Fredrickson and Barton's report that ten of 228 stray and pet dogs had antibody titers indicative of an active infection assumes greater dimension.[5] Active infections, defined as bacteremias, have been reported to persist for periods of 20 to 33 months.[14] In another serologic survey of dogs, in Memphis, 235 strays and 67 pets had positivity rates of 9.4 and 0 per cent respectively.[15]

These data take on more meaning when it is recognized that the estimated number of dogs in the United States is 34 million and that this population is expected to double within the next decade.[16, 17] No reliable population data on stray dogs are available, but conservative evidence estimates that they account for 20 per cent of the dog population of the United States, or 6,800,000 dogs.

The purpose of the present serologic survey of stray and pet dogs in the Atlanta-Athens, Georgia area was to ascertain the prevalence of antibodies to *Br. canis* in both populations. These infectivity rates describe by inference the potential risk to human beings posed by each of these dog populations.

Materials and Methods

Five milliliters of whole blood were collected from 200 apparently healthy, mature dogs from the Atlanta-Athens, Georgia area. Of these, 100 were newly captured stray dogs while the remaining 100 were pets. The blood was allowed to clot, and after centrufugation the serum was pipetted into screw-topped vials and stored at 4° C until used.

The serums were screened using the Canine Brucellosis Diagnostic Test®, which is a rapid plate agglutination test.[18] If this test was positive, antibody titer was determined using the standard tube agglutination test that employs a *Br. canis* antigen prepared by Carmichael's method.[9] Dogs with antibody titers of 1:100 or greater were considered positive. Dogs with antibody titers of 1:200 or greater were considered to be actively infected.[5, 9]

Utilizing the criterion of the 1:100 titer to determine if a serum sample was positive or not for *Br. canis* antibodies, the positive and negative data for both populations was arrayed into discrete categories (2 x 2 table). The chi-square test for two independent samples was used to determine the significance of the difference in the infection rates.[19] In the same manner, using the 1:200 criterion, the significance of the difference in the active infection rates were computed.

[R]Pitman-Moore, Inc., Washington Crossing, NJ.

Results

Of the 200 serums tested, 10 were positive for *Br. canis* antibodies (titers $\geq$ 1:100). Of these, nine were from stray dogs and one was from a pet. The positivity rates, 9 per cent for the stray dog population and 1 percent for the pet dog population were significantly different ($0.01 < P > 0.025$). Eight (8 per cent) of the strays and one (1 per cent) of the pet dogs had titers of 1:500. This meets the criterion considered to be indicative of an active infection. These rates were also significantly different ($0.025 < P > 0.05$).

Discussion

The results of this comparative serosurvey are similar to those obtained in Memphis.[15]

The significant difference ($0.01 < P > 0.025$) of the infection rates of the stray dog population (9 per cent) as compared to the pet dog population (1 per cent) probably reflects the greater opportunity of stray dogs for exposure to infected dogs.[5] Since dogs have active infections for periods between 20–33 months, the significant difference ($0.025 < P > 0.05$) in the active infection rates of the stray dog population (8 per cent) and the pet dog population (1 per cent) probably is a function of the infection rate. Titers of $\geq$ 1:200 are only used as a general indication of an active infection. A definitive diagnosis can only be made by bacterial isolation.

Recognition of brucellosis caused by *Br. canis* in human beings is difficult because not only does human brucellosis exhibit signs and symptoms simulating other conditions, but, as pointed out earlier, the routine agglutination test which utilizes *Br. abortus* as an antigen will not detect *Br. canis* antibodies.[11]

The increasing evidence that *Br. canis* infections are endemic in the dog population gives rise to the suspicion that the zoonotic potential may be greater than suspected. The transmission cycle of *Br. canis* infections in dogs indicated that infection can take place on all of the mucous membranes.[13] It seems likely that human beings may contract the disease in a similar manner.

Br. canis in the pet dog is a manageable problem. The infection rate in these dogs is low and detection of *Br. canis* antibodies is easily accomplished with the rapid slide agglutination test. If the pet dog population increases significantly during the next decade, routine use of the rapid slide agglutination test could conceivably lower the present low infectivity rates.

The stray dog is another matter. All indications are that the size of the stray dog population is a function of the size of the pet dog population. If irresponsible owners continue to allow indiscriminate growth of the pet dog population, pets, which for one reason or another become "surplus", will be added to the stray dog population.[17] Therefore, unless present trends are reversed the stray dog population will increase concomitantly with the pet dog population. In this event, even if the *Br. canis* infectivity rate in the stray dog population continues at its present level, infected dogs will in-

creasingly contaminate the environment with aborted fetal tissue, vaginal discharges, and urine (males).

Summary

A serological survey of 200 healthy, mature dogs was made to determine *Brucella canis* infectivity rates. The 9 per cent rate reported in the stray dogs was significantly higher ($0.05 < P > 0.025$) than the 1 per cent rate found in pet dogs. These rates coupled with a predictably growing stray dog population have patent zoonotic implications.

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Use of the Hospital Emergency Room In Relation to Use of Private Physicians

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Background

The health and social circumstances surrounding the use of a hospital emergency room in a suburban, semi-rural area by families with and without their own primary care physicians, were studied in 1973 in an effort to define needed changes in hospital policy and procedures. The study was prompted by earlier reports of increased inappropriate emergency room use especially by individuals or families who had their own physicians.

Methods

Two groups of emergency room patients—one who reported having a primary care physician, and another who in-

Findings

In contrast to reports of urban emergency room utilization,[1–3] both groups of families in this hospital were derived from similar economic and ethnic backgrounds. The group without their own physicians, however, were more recent

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