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Biosecurity concerns for breeding dogs

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Abstract

There is little information in the veterinary literature specifically about biosecurity concerns for breeding dogs. This is a review of what is published about shedding and continuing viability of organisms in semen, venereal transmission of disease by direct contact of dogs at the time of breeding, and biosecurity for shipment of canine semen.

Keywords: Canine; Semen; Rabies; Brucellosis; Infectious disease

1. Introduction

Organisms can be shed into semen as a component of prostatic or testicular fluid or by hematogenous spread from systemic infection. Not all organisms that may infect the testes may pass into semen (for example, fungal organisms including *Aspergillus* sp. and *Blastomyces dermatitidis* [1,2]) and not all organisms shed into semen remain viable in semen. Many disease conditions for which dogs are required to be vaccinated or tested are not associated with demonstrated passage of organisms into semen. Diseases of greatest concern are rabies, brucellosis, leptospirosis, borreliosis, overgrowth of other bacterial species, canine herpesvirus, toxoplasmosis, and leishmaniasis.

2. Rabies

Rabies virus is not shed into semen in dogs nor is there great likelihood that infected dogs would be used for breeding as most die within days of exposure. The author is unaware of reports of rabies infection through venereal transmission in dogs or of experiments demonstrating viability of rabies virus in chilled or extended semen. Most countries require proof of vaccination with a killed vaccine for dogs shipped for breeding or from whom semen is collected for shipment [3].

3. Brucellosis

*Brucella canis* is shed into semen of naturally and experimentally infected dogs. Identification of DNA from *Brucella canis* has been reported in dogs that were not bacteremic and so tested negative for the disease using common serologic tests [4-6]. In one study of experimentally infected dogs, *Brucella canis* was cultured from semen samples held up to 48 h at

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37°C [6]. Venereal transmission and ingestion are the two most common routes of transmission of this organism between dogs. The author is unaware of studies documenting ability of *Brucella canis* to remain viable in extended chilled or frozen semen. Most countries require that any dog shipped for breeding or from whom semen is collected for shipment have tested negative for canine brucellosis within a specific window before shipment [3]. Few countries require a specific type of brucellosis test. Serologic tests that require development of bacteremia and antibody formation may take anywhere from 8 to 12 weeks post-infection to become positive. Polymerase chain reaction (PCR) testing and blood culture become positive earlier post-exposure [7,8].

4. Leptospirosis

*Leptospira interrogans* has been identified in semen of experimentally infected dogs and leptospires do colonize reproductive tissue in naturally infected dogs [6,9]. Venereal transmission is reported and organisms have been cultured from semen samples held up to 48 hours at 37°C [6,9]. The author is unaware of studies documenting viability of leptospires in extended chilled or frozen semen. Testing required for dogs intended for shipment or from whom semen is collected for shipment varies with vaccination status and country [3]. Many laboratories test for leptospirosis using the microscopic agglutination test. Paired serology is more valuable than any single sample [10]. PCR testing, if available, is as accurate as culture and will be positive earlier than serologic testing post-exposure [11].

5. Borreliosis

*Borrelia burgdorferi*, the causative agent of Lyme disease, may be shed into semen in naturally infected dogs. Viability of the spirochete was demonstrated after experimental infection in semen extended and chilled for 48 hours and in frozen-thawed semen, with 97% and 85% motility retained, respectively [12]. The organism ordinarily is transmitted by an insect vector, the deer tick. Testing of dogs intended for shipment or from whom semen is to be collected is complicated by vaccination and false positive results on readily available serologic tests [13].

6. Mixed bacterial species

Significant growth of aerobic bacteria from semen is defined as growth of greater than $10^5$ CFU/ml. Organisms most commonly cultured from semen from populations of normal dogs and dogs with history of reproductive tract disease were beta-hemolytic *Streptococcus* sp., *Pasteurella multocida*, beta-hemolytic *E. coli*, non-hemolytic *E. coli*, beta-*Streptococcus* sp., *Achromobacter xylosidans*, *Actinomyces pyogenes*, *Bacillus* sp., coagulase-positive *Staphylococcus* sp., *Hemophilus hemoglobinophilus*, *Klebsiella pneumoniae*, *Proteus mirabilis*, *Pseudomonas aeruginosa*, and *Staphylococcus intermedius* [14-16]. In one study, 28.4% of samples from dogs presented for breeding soundness examination (n = 39), infertility (n = 25), or reproductive tract disease (n = 30) yielded significant growth of aerobic bacteria [14]. In a longitudinal study of 15 fertile male dogs, 31.2% of samples yielded significant growth of aerobic bacteria [16]. Transfer of bacteria to bitches at the time of copulation was reported in the latter study [16]. Growth of bacterial organisms may be controlled in chilled and frozen semen by addition of antibiotic to the extender; the author is unaware of studies documenting decreased growth of bacteria after extension of canine semen. Any growth of anaerobic bacteria from
semen is considered significant. In one study, there was significant growth of anaerobic bacteria from 13.7% of samples submitted from 95 dogs, with the most common organisms identified being *Bacteroides* sp., *Peptostreptococcus* sp., *Propionibacterium acne*, *Clostridium perfringens*, *Fusobacterium necrophorum*, *Propionobacterium avidum*, and *Streptococcus morbillorum* [14].

7. Mycoplasmosis

*Mycoplasma* sp. are part of the normal flora of the distal urethra in dogs. Quantitative culture is difficult so many laboratories report only positive or negative results. In one study, positive growth of *Mycoplasma* sp. was reported from 57.9% of samples submitted from 95 dogs [14]. In another study, 72% of semen samples were positive for *Mycoplasma* sp., with higher isolation rate from dogs with a history of infertility or reproductive tract disease [17].

8. Herpesvirus

Canine herpesvirus causes inapparent infection in adult male dogs and bitches. The most common clinical manifestations in male dogs are mild vesicular lesions on the penis and other mucosal surfaces. Venereal transmission may occur but is not considered to be a significant mode of transmission [18]. Serologic testing is complicated by lack of antigenicity of the virus and subsequent weak antibody response, and by widespread exposure of dogs to canine herpesvirus world-wide. Male dogs have higher titers with increasing age and increasing number of times bred [19]. That same study identified higher titers in both bitches and dogs bred to individuals from outside the kennel; this suggested to these authors that both oronasal and venereal transmission occurred [19]. The author is unaware of studies documenting viability of canine herpesvirus in extended chilled or frozen semen.

9. Toxoplasmosis

*Toxoplasma gondii* is an uncommon protozoal infection in dogs, usually manifested clinically as neurologic disease. Infective life stages of *Toxoplasma gondii* have been identified in the testes, epididymes, and semen of infected dogs, and seronegative bitches bred to those males seroconverted [20].

10. Leishmaniasis

*Leishmania chagasi* is shed into semen intermittently in naturally infected dogs [21]. Passage of the organism usually requires an insect vector, the sand fly, but transmission through semen has been demonstrated in dogs even in the absence of the insect vector [22]. Leishmaniasis can be identified by enzyme-linked immunosorbent assay (ELISA) or PCR testing [23].

11. Transmissible venereal tumor

A final concern in dogs bred naturally is transmissible venereal tumor (TVT). TVT is transmitted between young, sexually intact dogs at the time of mating and so is most common in free-ranging dog populations. The tumor is friable and easily exfoliated and so could also
potentially be shed into semen, although it is overt and is, therefore, unlikely to be overlooked by someone collecting semen for storage or shipment.

12. Conclusions

For shipment of semen internationally, the reader is cautioned always to contact the relevant government agency in the country to which semen is to be sent, as regulations change frequently. The website of the Federation Cynologique Internationale (www.fci.be) is a good source for information. Besides the testing requirements listed above, other kinds of regulations that may be enforced include types of paperwork required (import permits, health certificates, certificates of testing and vaccination); type of liquid nitrogen or shipping container used; source of materials in semen extender (for example, egg yolk from countries with avian flu); and vaccination, residency, microchipping, and DNA identification requirements for donor dogs [3].

Research in human medicine and large animal veterinary medicine has identified concerns about passage of infectious disease in semen including inappropriate use of antibiotics; inefficiency of testing methods; and potential for inadvertent contamination during semen collection or processing [24]. Much research remains to be done in canine reproduction to determine if these are genuine concerns in this species and to find methods to offset problems that are identified.

References


