History
A female Beagle in a kennel aborted at 7 weeks of gestation. She had been leased 5 months previously from a kennel (kennel of origin) located in a neighboring state in the southeastern United States. The kennel of origin contained hunting dogs that participated in field trials. Fourteen days before the female Beagle was leased, serologic testing for *Brucella canis* was performed, which yielded negative results. Prior to the abortion, the bitch had access to other dogs in her current kennel each day in an exercise area.

Microbial culture of samples obtained from the aborted fetuses (ie, liver, spleen, lungs, thymus, and kidneys) revealed a predominant growth of *B. canis*. Serologic testing for brucellosis was conducted on the bitch at the time of abortion. That testing yielded positive results for both the RSAT and 2-mercaptoethanol–RSAT. In addition, microbial culture of a sample obtained from the vagina of the bitch at the time of abortion yielded a predominant growth of *B. canis*.

Question
What is the most practical course of action for the bitch and the other dogs in the kennel? Please turn the page.
Answer

The infected bitch should be euthanized. The other dogs in the kennel should be quarantined, and all dogs that had contact with the bitch, contaminated tissues, or fluids (including urine, vaginal discharges, and aborted materials) should be serologically tested by use of the RSAT.

Results

After the abortion, additional inquiries into the medical history of the infected bitch revealed that she was leased from a kennel located in an area in which \textit{B canis} was prevalent. The infected bitch was euthanized, and dogs in the kennel at which the bitch aborted were quarantined. The kennel was cleaned with quaternary ammonium compounds. All dogs that had been in direct contact with the infected bitch or that shared a common exercise area, including the male to which she had been mated, were tested by use of the RSAT once a month for 3 consecutive months. All of these dogs had negative results. In addition, all other dogs on the premises were tested once by use of the RSAT, and all had negative results.

Discussion

Following confirmation of brucellosis in a kennel, several steps need to be implemented to eradicate the disease. These include euthanizing infected dogs, quarantining other dogs in the kennel, testing all other dogs in the kennel (especially those that had direct contact with infected dogs), and implementing procedures to prevent future outbreaks.

\textit{Brucella canis} is a gram-negative intracellular organism. Therefore, it is difficult to eliminate by administration of antimicrobials.\textsuperscript{1, 2} Also, the bacteria can be shed in large numbers in milk, as well as in postabortion discharges for up to 6 weeks after abortion, which provides a continual source of infective material for other dogs.\textsuperscript{2, 3} Because the bacteria are rarely eliminated from an infected dog, euthanasia of infected animals is recommended in a kennel situation.\textsuperscript{2, 3, 6}

In addition, \textit{B canis} is a zoonotic disease. Thus, it is recommended that these dogs not be sold or placed in homes as pets.\textsuperscript{6} It is imperative that the kennel be quarantined during an outbreak of brucellosis.\textsuperscript{3} No dogs should enter or leave the premises until the disease is eradicated. This will prevent new dogs from entering the kennel and becoming infected and will also prevent dogs from leaving the kennel and possibly transmitting the bacteria directly or indirectly through contamination of their new environment. In addition, to prevent additional exposure, dogs should not be moved within the kennel. The kennel can be cleaned with quaternary ammonium compounds or iodophors, and personnel should take care to ensure removal of all organic material.\textsuperscript{1, 3, 6}

Brucellosis is a reportable disease in some states.\textsuperscript{7} Specific regulations can be obtained by contacting the Department of Agriculture in each state.

Because brucellosis is a zoonotic disease, it is important that personnel working in the kennel use precautions to avoid direct contact with potentially infected materials (such as urine, lochia, semen, or aborted tissues).\textsuperscript{1, 3, 5} In addition, pregnant women, children, and immunocompromised people should not be exposed to these dogs.

All dogs in the kennel should be serologically tested for \textit{B canis}.\textsuperscript{5, 6} Dogs that have positive results for brucellosis should be euthanized. Serologic testing should continue monthly until all dogs have negative results for a minimum of 3 consecutive months. Because newly infected dogs and, hence, new positive results can occur during the screening process, monthly testing may need to continue for 7 or 8 months until all dogs have negative test results for 3 consecutive months.

Initially, dogs should be screened by use of the RSAT.\textsuperscript{5} The RSAT is a sensitive test that is easy to perform. However, it may take 3 or 4 weeks after infection before antibodies reach detectable concentrations, and false-negative results have been reported for up to 8 to 12 weeks after infection.\textsuperscript{7} Thus, dogs should be tested once a month and have 3 consecutive months with negative results on the RSAT before they can be considered free of infection.

When a dog has a positive result on the RSAT, further testing can be performed with the 2-mercaptoethanol–RSAT, which is a more specific test. A subsequent negative result on the 2-mercaptoethanol–RSAT should be interpreted to indicate that the dog is not infected with brucellosis. However, a subsequent positive result on the 2-mercaptoethanol–RSAT requires additional confirmatory testing. To obtain a definitive diagnosis, the AGID test should be performed on cytoplasmic protein antigens or, alternatively, bacterial culture of a blood sample should be conducted. These tests are not used for initial screening of dogs in a kennel because the AGID cannot detect antibodies until 12 weeks after infection with \textit{B canis}, and bacterial culture of blood samples generally does not yield positive results until 5 weeks after infection. Bacterial culture can be difficult to perform because multiple samples may be required. In addition, \textit{B canis} grows slowly and can be overgrown by contaminants; thus, false-negative results are common.\textsuperscript{5, 7, 8}

When an owner elects not to euthanize an infected dog or dogs, precautions in addition to those already mentioned should be implemented. Because the organism localizes in reproductive organs, the infected dogs should be neutered.\textsuperscript{1, 6, 7} In addition, infected dogs should be administered an antimicrobial regimen (consisting of enrofloxacin\textsuperscript{8} or a combination of tetracycline and gentamicin) for 4 weeks. In 1 study,\textsuperscript{8} treatment with enrofloxacin prevented clinical signs of brucellosis and recurrent abortions. However, the dogs were treated for extended periods (30 days followed with treatment throughout estrus and diestrus), and antibody concentrations persisted in some of those treated dogs. Dogs should be tested by bacterial culture of a blood sample or use of the AGID test at the end of the treatment schedule and 1, 3, and 6 months after treatment. The antimicrobial regimen should be repeated when \textit{B canis} is detected.
Owners should be advised that relapse following treatment is common. Also, owners should be warned that these precautions will not eradicate the disease from the kennel, but will limit disease transmission. The treated dogs are still a possible source of infection for other dogs at the kennel.

Furthermore, the potential zoonotic implications must be emphasized. Although transmission to humans is rare and the symptoms seen in humans infected with *B. canis* are mild, compared with the symptoms resulting from infection with other *Brucella* species, owners should not come in contact with bodily secretions from infected dogs. In addition, as mentioned previously, pregnant women, children, and immunocompromised people should not be exposed to infected dogs.

Finally, a plan needs to be implemented to prevent future outbreaks of brucellosis. All new acquisitions, both males and females, > 6 weeks old should be tested at least 2 times by use of the RSAT (interval of 4 to 6 weeks between tests) and have negative results on both tests before being allowed to enter the kennel. When a dog is < 6 weeks old, it should have negative results on bacterial cultures of 3 blood samples performed at least 24 hours apart. Also, any dogs that are not part of the kennel (such as dogs used for breeding) or dogs that temporarily leave the kennel (such as for shows or breeding) should be seronegative by use of the RSAT before readmission. In a closed kennel, all dogs should be routinely screened 2 to 4 times/y. In an open kennel, monthly testing may be necessary.

### Outcome

Analysis of results of serologic testing revealed that the disease did not spread through the other dogs in the kennel. Procedures were implemented in which all new dogs were quarantined and tested monthly for 3 consecutive months before entry into the kennel. All new dogs were tested in this manner, regardless of results of tests conducted by other sources.

### References