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Horses as a Potential Reservoir of Lyme Borreliosis in Jeju-do, Korea

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Lyme borreliosis (LB) is the most common tick-borne infectious disease in North America, and it was designated as a national notifiable infectious disease in Korea in December 2010. While no cases in Jeju-do were recorded from 2012 to 2016, a recent survey reported that the seroprevalence of *Borrelia burgdorferi* using enzyme-linked immunosorbent assays in horses in Jeju-do was 19.0% (95% confidence interval, 12.0 to 28.3%). This fact suggests that horses may be a potential reservoir of LB in Jeju-do and that individuals in close contact with horses may be a high-risk group. Thus, a serological study in this high-risk group is urgently needed.

Key words: *Borrelia burgdorferi*, *Ixodes*, Lyme borreliosis, Lyme disease, Tick

Lyme borreliosis (LB) is the most common tick-borne infectious disease in the US [1], and was designated as a group 4 national notifiable infectious disease in Korea in December 2010. Cases of LB have been reported not only in North America, but also in Europe and Asia [2].

The disease is caused by *Borrelia burgdorferi* sensu lato, which is subdivided into 3 species: *B. burgdorferi, B. afzelii,* and *B. garinii* [3]. Each species is thought to be associated with different clinical manifestations, with the North American species *B. burgdorferi* causing arthritis, and the European and Asian species *B. afzelii* and *B. garinii* causing dermatitis and neuritis, respectively [3].

These bacteria were first identified in South Korea (hereafter Korea) in 1993 from *Ixodes persulcatus* [4], while the first case was also reported in the same year [5]. Moon et al. [6] con-

cluded that the Taebaek region of Gangwon Province was at the highest risk of outbreak in Korea, after studying the epidemiological features and clinical manifestations of 16 domestic cases of LB over the period from 2005 to 2012.

The known major reservoirs of LB in North America are white-footed mice and white-tailed deer [1]. Considering the widespread consumption of deer blood and antlers in Korea, a serological survey was conducted of 516 deer farmers in 2009, and only 2.5% of them had LB antibodies [7]. Although LB cases continue to be reported in Korea, the main reservoirs of the disease have yet to be confirmed.

In 2016, Lee et al. [8] conducted a study of *B. burgdorferi* seroprevalence between 2009 and 2013 in domestic horse sera. Among a total of 727 horses studied, 5.5% showed antibody prevalence, with meaningful variation across regions ($p<$ 0.001). The estimated prevalence rates were 2.5% (95% confidence interval [CI], 1.0 to 5.6%), 2.4% (95% CI, 0.8 to 5.7%), 5.2% (95% CI, 2.9 to 8.7%), and 19.0% (95% CI, 12.0 to 28.3%) in the northern, central, southern, and Jeju regions of Korea, respectively. Jeju had a statistically significantly higher rate than the other regions. Nonetheless, all tests of antigen prevalence were negative.

Meanwhile, a Jeju resident was diagnosed with LB in mid-

March 2018. A 32-year-old woman experienced numbness in her left arm in mid-February, and it was found that she had engaged in horseback riding every week from April to December 2017 [9].

The results of the horse sera screening and the emergence of the recent case jointly provide a basis for the following inferences. First, horses farmed in Jeju may be a potential reservoir of LB. Second, workers in the horse industry, such as horse keepers, trainers, and jockeys, should be regarded as a high-risk group. Third, Jeju is likely to see more LB cases in the future due to climate change [8].

Based on these inferences, the following future actions must be considered. First, seroprevalence testing should be carried out on horses raised in Jeju-do to detect *B. burgdorferi* antigens. Then, positive cases should be treated appropriately to prevent wild *Ixodes* from being infected [10]. Second, antigen and antibody prevalence screening should be conducted on all workers in the domestic horse industry, including keepers, trainers, and jockeys, to identify acute LB patients and confirm whether horses are a reservoir. Third, an active surveillance system should be implemented for horse industry workers. As of 2017, no cases of LB in Jeju had been reported, other than 1 foreign-imported case in 2011, the year after the disease was designated as a national notifiable infectious disease. It is possible that there have been many missed diagnoses, likely caused by lack of a reasonable suspicion. An early diagnosis system to allow medical staff in the region to share relevant information is needed so that appropriate antibiotic treatment can be prescribed in time, especially for high-risk groups. Last but not least, another crucial step would be to obtain genetic information from unidentified pathogens to distinguish home-grown cases from imported cases.

CONFLICT OF INTEREST

The author has no conflicts of interest associated with the material presented in this paper.

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