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Survey on antibody against bovine herpesvirus 1 (BoHV-1) in cattle in Korea

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Abstract

This study was performed in Korea to get serological information for bovine herpesvirus 1 (BoHV-1), most commonly found in cattle. Antibodies against BoHV-1 were examined by targeting infectious bovine rhinotracheitis (IBR) in unvaccinated and vaccinated cattle, using viral neutralization (VN) test. In 2013, among 261 sera collected from IBR-unvaccinated herds, 7 sera (2.7%) were found seropositive and their VN titers were ranging from 1:4 to 1:32. Among 315 sera collected from IBR-vaccinated herds in large capacity farms, 303 sera (96.2%) were found to be seropositive for BoHV-1 and their VN titers were in the range of 1:4 to 1:2048. It was found that the IBR-vaccinated herds had higher levels of VN titer than IBR-unvaccinated herds. The results indicated that it may be due to heavy vaccination in vaccinated herds and no or a little infection in unvaccinated herds. At the end of the study it was concluded that although the seropositivity in IBR-unvaccinated herds was low, the monitoring of IBR should be continuously practiced to control and prevent the disease because of exportation of living cattle causing its nationwide outbreaks.

Key words : Bovine herpesvirus 1 (BoHV-1), Korea, Virus neutralization (VN) test, Infectious bovine rhinotracheitis (IBR)

INTRODUCTION

The bovine herpesvirus 1 (BoHV-1), which causes infectious bovine rhinotracheitis (IBR), infectious pustular vulvovaginitis (IPV) and infectious balanoposthitis (IBP), has been distributed worldwide; however it has been eradicated from some European countries. BHV-1 is a member of the family *Herpesviridae*, subfamily *alphaherpesvirinae* that has caused significant economic losses to the cattle industry (Turin et al, 1999). BoHV-1 generally infects cattle greater than 6 months of age once maternal immunity has waned (Woodbine et al, 2009). Clinical signs include nasal discharge, salivation, conjunctivitis, fever, inappetence, milk drop, abortion and depression. Many infections run a subclinical course. The virus is shed in secretions from the eyes, nose and reproductive organs. After initial infection, cattle become carriers of the virus which becomes latent in the trigeminal or sacral ganglia and tonsil (Winkler et al, 2000). Reactivation of the virus may occur when cattle are stressed (Ackermann et al, 1990) and virus can then be transmitted to susceptible cattle. The World Organization for Animal Health (Office International des Epizooties; OIE) lists IBR/IPV as a List B notifiable disease. In Korea, IBR is one of the legal communicable diseases of domestic animals.

Virus neutralization (VN) tests and various ELISAs are usually applied for detecting antibodies against BoHV-1 in serum (Kramps et al, 1993). Several types of ELISA are available commercially; however a stand-

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ard procedure for ELISA has not been established. There is no information on antibody against BoHV-1 using VN test in cattle in Korea. The present work is targeted at looking into the current situation of BoHV-1 infection in Korea as a constituent of an ongoing research project on causes of viral respiratory diseases of cattle in the country.

MATERIALS AND METHODS

Serum samples

A total of 261 blood samples were collected from IBR-unvaccinated herds in 8 provinces in 2013. For IBR-vaccinated herds, a total of 125 and 190 samples respectively were taken from large capacity farms in Livestock Improvement Main Center, National Agricultural Cooperative Federation located in Gyeonggi and Chungnam provinces.

Cell and virus

Madin-Darby bovine kidney (MDBK) cells and BoHV-1 PQ7 strain isolated in Korea were used for the virus neutralization (VN) tests. Cells and virus were cultivated with Dulbeco's Modified Eagle's Medium (DMEM) (Gibco, USA) supplemented with 5% fetal bovine serum (FBS) (Gibco, USA).

Detection of viral antibodies

VN test was used to detect the specific antibodies against BoHV-1 in serum. Sera were titrated in two duplicate wells across a microtiter plate from an initial 1:4 dilution. Then 50 μL samples of serial 2-fold serum dilutions were mixed with an equal volume of virus, having 200 $TCID_{50}$/100 μL in 96-well microplates and were incubated at 37°C for 60 min. Cell suspensions were added to each well and incubated at 37°C until cytopathic effects (CPEs) appeared in the virus control cells. The neutral antibody titer was expressed as the reciprocal of the serum dilution that inhibited CPEs. Serum that showed a dilution of 1:4 or greater was classified as seropositive.

RESULTS

Seropositivity rate and distribution of VN titer of BoHV-1 in IBR-unvaccinated herds

We found the presence of antibody against BoHV-1 in unvaccinated serum samples; however the seropositivity rate was very low. Seven out of the 261 serum samples examined, were positive for the BoHV-1 (Table 1); which correspondes to a seroprevalence of 2.7% (7/261). Furthermore, antibody titers to BoHV-1 in the sero-

Table 1. Seropositivity rate of bovine herpesvirus 1 (BoHV-1) in cattle in infectious bovine rhinotracheitis (IBR)-unvaccinated herds

Province	No. of Tested (heads)	No. of Positive (heads)	Positive rate (%)
Busan	9	0	0
Daegu	12	0	0
Gwangju	9	0	0
Gyeonggi	64	4	6.3
Chungbuk	43	0	0
Chungnam	29	1	3.4
Gyeongbuk	50	2	4
Gyeongnam	45	0	0
Total	261	7	2.7

Table 2. Distribution of viral neutralization (VN) titers to BoHV-1 in cattle

Herds group			VN titer										
			< 4	4	8	16	32	64	128	256	512	1024	2048
Vacc*	Number (heads)	303	12	3	13	23	30	72	82	55	17	7	1
	Rate (%)	96.2	3.8	1.0	2.5	7.3	9.5	22.9	26.0	17.5	5.4	2.2	0.3
Unvacc†	Number (heads)	7	0	3	2	1	1	0	0	0	0	0	0
	Rate (%)	2.7	0	1.1	0.6	0.4	0.4	0	0	0	0	0	0

*, Vaccinated; †, Unvaccinated.

Table 3. Seropositivity rate of bovine herpesvirus 1 (BoHV-1) in cattle in infectious bovine rhinotracheitis (IBR)-vaccinated herds

Province	No. of Tested (heads)	No. of Positive (heads)	Positive rate (%)
Gyeonggi	125	113	90.4
Chungnam	190	190	100
Total	315	303	96.2

positive serum samples were not very high (Table 2).

Seropositivity rate and distribution of VN titer of BoHV-1 in IBR-vaccinated herds

Among 315 IBR-vaccinated herds collected from Gyeonggi and Chungnam provinces, 303 (96.2%) were seropositive (Table 3). The ranging of VN titers in vaccinated herds were from 1:4 to 1:2048. Of the 315 herds, 209 (66.3%) were the ranging from 1:64 to 1:256 (Table 2).

DISCUSSION

IBR is caused by BoHV-1, alternatively known as IBR virus. Initial IBR infections are usually non-fatal. However, they can become deadly with added complications such as stress, secondary bacterial infections which include pneumonia, bovine virus diarrhea (BVD), parainfluenza-3 or other infections (Roshtkhari et al, 2012). A closely related strain of BoHV-1 is called IPV. IPV causes cold-sore-like lesions in the birth canal and on male genitals. IBR and IPV differ largely by their method of transmission and the fact that IPV is usually a localized infection. Both of these bovine herpesviruses produce persistent latent infections that are carried for years and can be reactivated in healthy cows by stress or steroid injections (Wang et al, 2001). Such carrier cattle can initiate outbreaks in susceptible herds that are unvaccinated and are free of infection.

The seroprevalence of BoHV-1 was 2.6% (25/948) in Korean native goats (Han et al, 2003), whereas no serogical evidence of IBR was found in farmed deer (0/78) and wild water deer (0/7) (Jo et al, 2009). According to the national animal disease database of Korea, the reported IBR cases in cattle for last four years are 8 in 2010, 24 in 2011, 8 in 2012 and 4 in 2013 (Korean Animal Health Integrated System, Korea). No information can be found on antibody against BoHV-1 in cattle in Korea.

In our study, we found that the seropositivity to BoHV-1 in IBR-unvaccinated herds was low (2.7%) because of the rarity of BoHV-1 infection in the cattle population. On the other hand, we found that the majority of vaccinated herds within large scale farms were seropositive (96.2%).

In China, the levels of BoHV-1 antibodies detected in cattle were higher (35.8%) in the field conditions (Yan et al, 2008). The herd-level BoHV-1 seroprevalence of 74.9% was seen in Ireland, where 81.8 percent of farmers used BoHV-1 vaccine (Cowley et al, 2011). The results of the studies on the prevalence of BoHV-1, in Australia, were reported to vary from 30% (Smith et al, 1995), to a range of 15-96% (Australia Government, 2005).

The VN test can not differentiate serologically between infected and vaccinated animals. But, to diagnose an acute infection, serum samples from the acute and convalescent stages of infection in the same animals are examined in one test. A seroconversion from negative to positive, or a four-fold or higher increase in antibody titer is considered to indicate the presence of an infection (OIE, 2012). Generally, VN antibody titers induced by vaccination were lower than those induced by infection. However our results indicated the presence of higher levels of the VN antibody titer in vaccinated cattle, with 1:512 for 17 heads, 1:1024 for 7 heads and 1:2048 for 1 head. The present study unclearly indicated the widespread prevalence of BoHV-1 infection in Korea. Absence of clinically recognized symptoms of BoHV-1 infections with noticeable outbreaks of respiratory signs and abortion may lead to underestimation of the importance of the disease in the Korea. This situation may, however, change and the disease can pose a considerable threat due to the increase in the trend of exotic breed cattle to satisfy the rising demand for milk and other dairy products. Hence, further countrywide serological studies of BoHV-1 infections in cattle are called for to provide information required for formulat-

ing well-designed control programs and performing research project.

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REFERENCES

Ackermann M, Muller HK, Bruckner L, Kihm L. 1990. Eradication of infectious bovine rhinotracheitis in Switzerland: review and prospects. Vet Microbiol 23: 365-370.

Australia Government/Department of health and ageing/office of the gene technology regulator. 2005. The biology of bovine herpesvirus 1 (BoHV-1): 7.

Cowley DJB, Clegg TA, Doherty ML, More SJ. 2011. Aspects of bovine herpesvirus-1 infection in dairy and beef herds in the republic of Ireland. Acta Veterinaria Scandinavica 53: 40.

Han DU, Kwon YK, Moon JS, Yoon SR, Wee SH, Jang H, Tark DS, Lee TW, Kang MI. 2003. Serologic epidemiological studies on bovine viral diarrhea (BVD), bovine herpesvirus type-1 (BHV-1) and parainfluenza virus type-3 (PI-3) in Korean native goats. Kor J Vet Publ Hlth 27: 159-165.

Jo YS, Chu KS, Lee JW, Camer GA, Chekarova I, Seol MS, Park HJ, Kim BS, Lim CW. 2009. Prevalence of antibodies against bovine viral infectious diseases in farmed deer and wild water deer in Jeonbuk province. Korean J Vet Serv 32: 111-117.

Kramps JA, Quak S, Weerdmeester K, Van Oirschot JT. 1993. Comparative study on sixteen enzyme linked immunosorbent assays for the detection of antibodies to bovine herpesvirus 1 in cattle. Vet Microbiol 35: 11-21.

OIE. 2012. Infectious bovine rhinotracheitis / infectious pustular vulvovaginitis (Chapter 2.3.5.). In: Manual of Standards Diagnostic Tests and Vaccines for terrestrial animals. 7th ed.

Roshtkhari F, Mohammadi G, Mayameei A. 2012. Serological evaluation of relationship between viral pathogens (BHV-1, BVDV, BRSV, PI-3V, and Adeno3) and dairy calf pneumonia by indirect ELISA. Trop Anim Health Prod 44: 1105-1110.

Smith GA, Young PL, Reed KC. 1995. Emergence of a new bovine herpesvirus 1 strain in Australian feedlots. Arch Virol 140: 599-603.

Turin L, Russo S, Poli G. 1999. BHV-1: new molecular approaches to control a common and widespread infection. Molecular Medicine 5: 261-284.

Wang P, Hurley DJ, Braun LJ, Chase CCL. 2001. Detection of bovine herpesvirus-1 in peripheral blood mononuclear cells eight months postinfection. J Vet Diagn Invest 13: 424-427.

Winkler MT, Doster A, Jones C. 2000. Persistence and reactivation of bovine herpesvirus type 1 in the tonsils of latently infected calves. J Virol 74: 5337-5346.

Woodbine KA, Medley GF, Moore SJ. 2009. A four year longitudinal sero-epidemiological study of bovine herpesvirus type-1(BHV-1) in adult cattle in 107 unvaccinated herds in south west England. BMC Vet Res 5: 1-12.

Yan BF, Chao YJ, Chen Z, Tian KG, Wang CB, Lin XM, Chen HC, Guo AZ. 2008. Serological survey of bovine herpesvirus type 1 infection in China. Vet Microbiol 127: 136-141.