H5N8 Highly Pathogenic Avian Influenza in the Republic of Korea: Epidemiology During the First Wave, from January Through July 2014

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Abstract

Objectives: This study describes the outbreaks of H5N8 highly pathogenic avian influenza (HPAI) in Korea during the first wave, from January 16, 2014 through July 25, 2014. Its purpose is to provide a better understanding of the epidemiology of H5N8 HPAI.

Methods: Information on the outbreak farms and HPAI positive wild birds was provided by the Animal and Plant Quarantine Agency. The epidemiological investigation sheets for the outbreak farms were examined.

Results: During the 7-month outbreak period (January–July 2014), H5N8 HPAI was confirmed in 212 poultry farms, 38 specimens from wild birds (stools, birds found dead or captured). Ducks were the most frequently infected poultry species (159 outbreak farms, 75.0%), and poultry in 67 (31.6%) outbreak farms was asymptomatic.

Conclusion: As in the previous four H5N1 epidemics of HPAI that occurred in Korea, this epidemic of H5N8 proved to be associated with migratory birds. Poultry farms in Korea can hardly be free from the risk of HPAI introduced via migratory birds. The best way to overcome this geographical factor is to reinforce biosecurity to prevent exposure of farms, related people, and poultry to the pathogen.

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1. Introduction

On January 16, 2014, an outbreak of highly pathogenic avian influenza (HPAI) had occurred on a breeder duck farm located in Gochang, Jeollabuk-do, in the southwest of the Republic of Korea. On the next day, another case was reported by a meat duck farm in Buan, Jeollabuk-do. These two farms were located within a 10-km distance. Outbreaks were subsequently confirmed almost every day until early April, 2014, and continued at a lower rate until July 25, 2014 (total number of days, 191) in a total of 212 poultry farms. This epidemic resulted in the slaughter of 13,061 birds in 548 farms, with the total including both infected birds and preemptive slaughter [1].

The first outbreak was immediately reported to the World Organisation for Animal Health after its confirmation on January 17, 2014 [2]. Previously, research papers on H5N8 avian influenza virus infection in poultry and wild birds had been published from Ireland [3], South Africa [4], United States [5], and China [6,7]. However, this report on the outbreak in Korea was the first official notification of H5N8 HPAI since the Irish epidemic in 1983 [8]. In April 2014, Japan notified the World Organisation for Animal Health about an outbreak of H5N8 HPAI in a broiler chicken farm in Kumamoto Prefecture. The outbreak ended by one event [9].

Little is known about the epidemiological characteristics of HPAI of virus type H5N8 owing to the absence of a previous epidemic. This study describes the outbreaks of HPAI that occurred in Korea from January 2014 to July 2014; its purpose is to provide better understanding of the epidemiology of H5N8 HPAI.

2. Materials and methods

Information on the outbreak farms and HPAI positive wild birds was extracted from the “Status of HPAI: reception of specimen and laboratory confirmation,” updated every day by the emergency response center of the Animal and Plant Quarantine Agency. The epidemiological investigation sheets for the 212 outbreak farms were written. The first draft of the investigation sheet was written by the on-site investigation team based on clinical examination and face-to-face interviews. SatScan version 9.3.1 (download from www.satscan.org) was used to identify clusters according to space and time.

3. Results

3.1. Affected population

During the 7-month outbreak period (January—July 2014), H5N8 HPAI was confirmed in 212 poultry farms, 38 specimens from wild birds (stools, birds found dead or captured), and nine other specimens taken at the affected farms (stool samples, feathers, egg trays, samples from dogs). The majority of infected poultry species were ducks (159 outbreak farms, 75.0%). Infection was also confirmed in chickens (44 outbreaks, 20.8%) and other kinds of poultry (nine outbreaks, 4.2%), including mallards, Muscovy ducks, ostriches, and geese.

The H5 antibody was detected in 25 poultry farms. Both the H5N8 antigen and the H5 antibody were detected in 14 farms, whereas only the H5 antibody was detected in 11 farms. In the case of wild birds, antibodies were detected in 24 individuals and the antigen was also detected in 19 of the 24 birds. By contrast, the H5 antibody was detected in dogs from 15 outbreak farms.

3.2. Evolution of epidemic

The peak in the number of outbreaks was observed in Week 5 of the epidemic. Outbreaks were continuously confirmed for 19 consecutive weeks from the beginning of the epidemic. In late May, 2014 the outbreak pattern became sporadic. During the first 15 days from the start of this HPAI epidemic (January 16—30, 2014), one or more outbreaks were detected per day. During the month of February, 2014, at least one outbreak per day was reported for 26 days. In 2014, outbreaks were reported on 22 days in March, 11 days in April, 4 days in May, and another 4 days in June. The highest number of outbreaks for 1 day was recorded on February 19, 2014 with 22 new detections. The outbreak status began to lull in March, 2014. Although detection of HPAI in wild birds was the highest in January, 2014 (18 cases), 13 cases were detected in February, 2014. HPAI in wild birds continued to be detected into early May, 2014, with five confirmed cases in March, 2014, one in April, 2014 and another in May, 2014 (Figure 1).

3.3. Geographical distribution of outbreaks

The 212 outbreak farms were detected in 41 counties (or cities) of 17 provinces. Most of them (205 farms, 96.7%) were located in the western part of Korea. Outbreak poultry farms and infection of wild birds were reciprocally located within easy distance. Four spatio-temporal clusters of outbreaks were detected, three of which were statistically significant (p < 0.05). The most significant cluster was found in Eumseong, where the highest number of outbreak farms (40, 18.9%) was detected. When the cluster was focused on the 19 sites (38 cases) of H5N8 type HPAI in wild birds, the most significant cluster was found to be around Donglim Reservoir, followed by Eumseong, and then Naju and Yeongam, Jeollanam-do (Figure 2).

The first outbreak breeder duck farm was located in Gochang, and the subsequent 35 outbreaks during the initial phase in January, 2014 and February, 2014 were reported in the three adjacent counties in Jeollabuk-do:
Figure 1. Temporal distribution of H5N8 highly pathogenic avian influenza (HPAI) outbreaks in poultry and wild birds from January 2014 to July 2014: the peak in number of outbreaks was observed in Week 5 of the epidemic. Outbreaks were continuously confirmed during 19 consecutive weeks from the beginning of the epidemic. In late May, 2014, the outbreak pattern became sporadic.
Gochang, Buan, and Jeongeup (Figure 3). All these farms reared ducks (breeder or meat type), except for one, which was a breeder of broiler chickens. They were geographically distributed around Donglim Reservoir within a 10-km radius, and the straight distance from the west coast was <5 km (Figure 3). Farmers of these premises testified that flights of large flocks of Baikal teal (*Anas formosa*) came close to their farms, even passing above the farms, approximately 2–3 weeks prior to the outbreak. Some of them mentioned the sound of dripping birds’ feces on the roof.

4. Discussion

Based on the following three facts, the Korean H5N8 HPAI epidemic seemed to be introduced from abroad. First, H5N8 avian influenza virus had never previously been detected in Korea in the active surveillance of poultry and wild birds. More than 2.1 million specimens were collected and tested at the laboratory from 2011 to 2013, after eradicating the last epidemic of H5N1 HPAI in 2011 [10]. Second, phylogenetic analysis indicated that the H5N8 HPAI virus isolated in the 2014 epidemic in Korea likely originated from the novel H5N8 virus in China [11]. Third, the movement of migratory birds between eastern China and western Korea was revealed in studies on tracking migration routes [12]. Genetic sequences of identical isolates that were found in outbreaks of wild birds and poultry farms also support the key role of migratory birds [13].

In 2014 in Korea, outbreaks of HPAI continued even in the summer season, a period of atmospheric conditions that are unfavorable for the survival of viruses. Meanwhile, the four countries with the highest number of HPAI (H5 or H7) worldwide since 2004 are Vietnam, Thailand, Egypt, and Bangladesh [8], all of which are located in the subtropical zone. In Thailand, cases of
H5N1 have been detected throughout the year, and the highest susceptibility was shown from late summer to late autumn [14]. By contrast, the first outbreaks of H5N1 in chicken farms in Hong Kong were reported from March 1997 to May 1997, and the first outbreak after 1997 occurred in May 2001 [15]. In the Korean epidemic of 2008, the index case of HPAI (H5N1) was confirmed in April, and it spread throughout Korea through sales of chicks at traditional markets in May [16]. Similarly in 2014, with the progression of the H5N8 HPAI epidemic, the outbreaks spread to small holders and to nonmajor species of poultry. For those reasons, poulterers at traditional markets, and middlemen and their moorings, were also involved and led to spontaneous outbreaks even during the summer.

As in the previous four epidemics of HPAI that occurred in Korea [15,17], this epidemic of H5N8 proved to be associated with migratory birds. As 77% of duck farms of Korea are located in the western part of the country [18], poultry farms can hardly be free from the risk of HPAI introduced via migratory birds flying from the north and south of Eastern Asia. The best way to overcome this geographical factor is to reinforce biosecurity to prevent exposure of farms, related people, and poultry to the pathogen. The importance of public relations and education about biosecurity and hygiene to block HPAI cannot be emphasized enough.

Conflicts of interest

The authors declare no conflicts of interest.

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