Avian influenza: the Canadian experience

J. Pasick, Y. Berhane & K. Hooper-McGrevy

Canadian Food Inspection Agency, National Centre for Foreign Animal Disease, 1015 Arlington Street, Winnipeg, Manitoba, Canada, R3E 3M4

Summary
Reports of sporadic avian influenza outbreaks involving domestic poultry date back to the 1960s. With the exception of A/turkey/Ontario/7732/1966 (H5N9), which was isolated from a turkey breeding establishment, all viruses characterised prior to 2004 fit the criteria of low pathogenic avian influenza (LPAI). Only in retrospect was A/turkey/Ontario/7732/1966 shown to meet the criteria of a highly pathogenic avian influenza (HPAI).

In 2004, Canada reported its first case of HPAI to the World Organisation for Animal Health (OIE). The outbreak, which began in a broiler breeder farm in the Fraser Valley of British Columbia, involved an H7N3 LPAI virus which underwent a sudden virulence shift to HPAI. More than 17 million birds were culled and CAN$380 million in gross economic costs incurred before the outbreak was eventually brought under control. In its aftermath a number of changes were implemented to mitigate the impact of any future HPAI outbreaks. These changes involved various aspects of avian influenza detection and control, including self-quarantine, biosecurity, surveillance, and laboratory testing.

In 2005, a national surveillance programme for influenza A viruses in wild birds was initiated. Results of this survey provided evidence for wild birds as the likely source of an H5N2 LPAI outbreak that occurred in domestic ducks in the Fraser Valley in the autumn of 2005. Wild birds were once again implicated in an H7N3 HPAI outbreak involving a broiler breeder operation in Saskatchewan in 2007. Fortunately, both of these outbreaks were limited in extent, a consequence of some of the changes implemented in response to the 2004 British Columbia outbreak.

Keywords

The Canadian poultry industry

Poultry represents approximately 7% of Canadian farm cash receipts, with 75% of production concentrated in three provinces: British Columbia, Ontario and Quebec. In 2006 there were 2,792 chicken producers, 1,053 egg producers and 557 turkey producers (1). Supporting these producers are 120 registered hatcheries, 120 feed manufacturers, 276 registered egg grading stations, 18 registered breaking stations, and 82 federally registered abattoirs. Chickens and turkeys are supply-managed (i.e. production levels are managed to meet demand so that producers get a fair price for their produce) through four marketing agencies:

– the Chicken Farmers of Canada
– the Canadian Turkey Marketing Agency
– the Canadian Hatching Egg Producers
– the Canadian Egg Marketing Agency

Ducks represent a minor component of the Canadian poultry industry, with approximately 71% of production
concentrated in Quebec and Ontario. These 2,700 duck farms are not supply-managed and are small, averaging only 400 birds each. However, there are three large integrated duck producers located in Quebec, Ontario and British Columbia. They raise their own breeding stock, and have their own registered hatcheries, rearing barns and abattoirs.

Avian influenza in Canada prior to the outbreak in British Columbia in 2004

Although Canada had not reported a case of highly pathogenic avian influenza (HPAI) to the World Organisation for Animal Health (OIE) prior to 2004, a number of important H5 subtype viruses were isolated from turkeys in the 1960s by Dr Gerhard Lang at the University of Guelph. During this period it was common for turkeys to be raised in outdoor ranges, a practice that probably increased their risk of exposure to avian influenza viruses of wild bird origin. The viruses isolated included: H5N1 and H5N2 low pathogenic avian influenza (LPAI) viruses and an H5N9 HPAI (A/turkey/Ontario/7732/1966) in 1966, an H5N9 LPAI virus in 1967 and an H5N2 LPAI virus in 1968. It was only in retrospect that A/turkey/Ontario/7732/1966 (H5N9), which was isolated from a turkey breeding establishment, was recognised as fulfilling the OIE criteria of an HPAI virus. Ontario turkeys continued to be a source of avian influenza isolates during the 1980s, including viruses of H5, H6, H7 and H9 subtypes.

Provincial veterinary diagnostic laboratories provide frontline testing of avian diagnostic material, isolating the majority of avian influenza viruses from domestic poultry before forwarding them to the National Reference Laboratory for Avian Influenza for subtyping and pathotyping (15). During the past decade, most of the avian influenza viruses of poultry origin were isolated from turkeys (12/24), followed by chickens (6/24), domestic ducks (5/24) and quail (1/24). Most of the isolates forwarded to the National Reference Laboratory during this period originated from the provinces of British Columbia and Ontario (Fig. 1) and exhibited a seasonal incidence, with peaks occurring in late autumn and early spring (Fig. 2). Turkey isolates included H3N2, H6N1, H6N2, H6N8 and H7N1 LPAI viruses. Two of these isolates are noteworthy. The H7N1 LPAI virus, which was isolated from a turkey breeding establishment in the autumn of 2000, had an HA cleavage site PENPKTR/GLF and an intravenous pathogenicity index (IVPI) of 0. The affected birds showed signs of decreased egg production, respiratory disease and a slight increase in daily mortality.

No regulatory measures were taken at that time. The H3N2 isolates that emerged almost simultaneously in the provinces of British Columbia, Manitoba and Ontario in 2005, were associated with a pronounced drop in egg production in breeder turkeys (10). Genotypically, these viruses were found to be triple human/classical swine/avian reassortants with epidemiological links to swine and showing similarity to the novel reassortant H3N2 turkey viruses that had been isolated in the United States of America in 2003 (7, 10). Domestic duck LPAI isolates have included H2N5, H3N2, H4N6, H5N2 and H11N9 subtypes. Chicken isolates, though less common, have had a more significant impact on the Canadian poultry industry. These isolates have included H1N1, H6N8, H7N3, and H10N7 LPAI subtypes and two H7N3 HPAI subtype viruses.

British Columbia H7N3 highly pathogenic avian influenza outbreak, 2004

The Fraser Valley of British Columbia was the location of Canada's first reported HPAI outbreak (3, 13). The Valley, which is situated in the southwest corner of mainland British Columbia, is a densely populated poultry-producing area accounting for 85% to 90% of the province's poultry production. It contains more than 17 million birds within an area of 8,750 km². This includes 62 broiler breeder, 300 broiler, 50 turkey, and 96 egg producers, as well as a large speciality poultry sector that includes free-range chickens, squab, pheasant, tinamou, game birds, ducks and geese (3).

Although an active surveillance programme for avian influenza did not exist at that time, the provincial veterinary diagnostic laboratory located in Abbotsford (about 75 km southwest of Vancouver) would routinely carry out diagnostic workup on more than 300 cases of respiratory disease in poultry annually (2). In the ten years leading up to the HPAI outbreak, five avian influenza viruses were isolated from domestic poultry: two H6N2 isolates from turkeys in 1995 and 1996, one H6N1 isolate from turkeys in 1997, one H1N1 isolate from chickens in 1998 and one H4N6 isolate from ducks in 1999 (15).

In early February 2004, a two-age broiler breeder farm in Abbotsford noted a sudden decrease in feed consumption and a small increase in mortality (0.5% in a 72 h period) in the barn that contained 9,000 52-week-old birds. The adjacent barn containing 8,000 24-week-old birds was clinically unaffected. Four days after first recognition of the problem, the farm owner sought veterinary assistance and dead birds were submitted to the veterinary diagnostic

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laboratory in Abbotsford. Over the next few days, mortality in the 52-week-old flock subsided, although egg production had decreased by 20%. Ten days after the problem was initially recognised in the 52-week-old flock, a sudden increase in mortality (25% in 48 h) was observed in the 24-week-old birds. The mortality spike in the young birds coincided with the isolation of an influenza A virus from specimens taken from the older flock. The Canadian Food Inspection Agency (CFIA) was notified, allantoic fluid containing virus isolated from the older flock and fresh tissues harvested from dead birds from the younger flock were forwarded to the National Centre for Foreign Animal Disease, and the farm was placed under immediate quarantine.

Two viruses were subsequently characterised: an H7N3 virus with PENPKTR/GLF HA0 cleavage site and an IVPI of 0 that was isolated from the 52-week-old birds and an H7N3 virus with PENPKQAYRKRMTR/GLF HA0 cleavage site and an IVPI of 2.96 from the 24-week-old birds. The most likely origin of the 7-amino-acid insert found in the HPAI virus was conjectured to be nucleotide 737 to 757 of the viral M1 gene and was probably introduced by non-homologous recombination (3, 8, 13). This was the second reported natural case of a virulence shift involving an H7N3 virus that was attributable to non-homologous recombination; the first involved a 30-nucleotide insert derived from the viral NP gene in a Chilean H7N3 HPAI virus (19).

Birds on the affected farm were destroyed on 19 and 20 February and a surveillance zone 5 km in radius was established around the index premises on 23 February. Serum and cloacal and oropharyngeal swab specimens were collected from commercial farms and backyard flocks at a level capable of detecting infected birds at a prevalence of 5% with 95% confidence. Between 23 February and 4 March birds from farms within that zone tested negative for influenza virus antibodies, nucleic acid and live virus. On 4 March a second broiler breeder farm located just 3 km west of the index farm experienced an increase in mortality which peaked on 9 March. On 11 March this farm was confirmed to be positive for an H7N3 virus with PENPKQAYRKRMTR/GLF HA0 cleavage site and an IVPI of 2.96 and the birds were destroyed on 12 March.

This second outbreak prompted the Minister of Agriculture and Agri-Food to establish a control area which
encompassed the entire Fraser Valley. Despite the implementation of movement controls, regular active surveillance, dead bird surveillance and pre-slaughter testing, two backyard and three commercial farms became infected in the two weeks following the identification of the second infected farm. As additional infected farms were identified, the decision was made to depopulate the entire control area, which was estimated to contain approximately 17 million birds. A significant portion of the laboratory testing that followed was carried out at the provincial veterinary diagnostic laboratory and was directed towards qualifying birds for slaughter. Swab specimens were collected and tested by a real-time reverse transcription polymerase chain reaction (RT-PCR) assay that targeted the influenza A matrix gene (17). Test results that were negative and completed within 48 h of specimen collection enabled the majority of the birds to be slaughtered for human consumption.

Over the course of the outbreak 42 out of 410 commercial flocks and 11 out of 553 backyard flocks were classified as infected based on the results of PCR or PCR + virus isolation (14). Subsequent epidemiologic analysis demonstrated that commercial flocks were 5.6 times more likely to be infected than backyard flocks. A large serosurveillance effort which involved the testing of approximately 17,000 samples was also conducted in the area surrounding the control zone. This confirmed that the outbreak had been brought to a halt and affirmed that freedom from HPAI had been re-established. In addition to the affected poultry, enhanced surveillance for conjunctivitis and influenza-like illness in exposed or potentially exposed people identified two individuals from which H7N3 was isolated (16, 20). Virus was isolated from a nasal specimen of one man and a conjunctival specimen from the other. Associated clinical signs were coryza with conjunctivitis in one individual and conjunctivitis with headache in the second. Despite the positive virus isolation results, no evidence of seroconversion was found (16, 20). This lack of systemic antibody response was hypothesised to be due to the mild nature of the infections which were restricted to the conjunctiva.

**Aftermath of the British Columbia outbreak**

The outbreak lasted more than 91 days, with associated gross economic costs exceeding CAN$380 million (2). A significant portion of these costs stemmed from the industry being ‘down’ for a total of 51 days during which barns were empty, and supporting enterprises such as hatcheries, feed companies, and processors lay idle. As a consequence, the British Columbia Hatching Egg Producers Association, the British Columbia Turkey Growers Association, the British Columbia Broiler Growers Association, the British Columbia Egg Producers Association and the newly formed British Columbia Specialty Bird Producers Association created the British Columbia Poultry Association. The two primary goals of this new Association were to expedite the poultry industry’s economic recovery and to better prepare for future disease outbreaks. To facilitate these efforts, grants totalling CAN$3.25 million were provided for the development of surveillance programmes, enhanced on-farm biosecurity and emergency disease response planning. A Biosecurity Committee formed by the British Columbia Poultry Association developed a set of biosecurity standards for the commercial poultry industry in the form of a Biosecurity Manual. This would form the basis of a mandatory on-farm biosecurity programme which was targeted to be operational for January 2007. Producer self-quarantine, an important aspect of the biosecurity programme, directs the producer to initiate a diagnostic workup, impose strict movement controls, and enhance sanitation upon first suspicion of an infectious disease event, thus transferring a portion of avian influenza control responsibilities to the industry (2).

Although foreign animal diseases such as HPAI are a federal responsibility, the British Columbia outbreak clearly demonstrated that for a country the size of Canada total reliance on a central laboratory to carry out diagnostic testing is not practical. The success of having the provincial veterinary diagnostic laboratory participate in the testing efforts led to the establishment of the National Avian
Influenza Laboratory Network (AI-LN). Ten network laboratories located in each province now carry out serologic and real-time PCR assays for avian influenza. The AI-LN responsibilities are shared among the Canadian Food Inspection Agency (CFIA), the National Reference Laboratory and the network laboratories. The CFIA responsibilities include: maintaining the National Reference Laboratory, maintaining national and international disease control programmes for notifiable avian influenza (NAI), reporting on avian influenza diagnostics and surveillance, management of disease control for NAI, regulation and registration for avian influenza diagnostic tests, and establishing laboratory standards for biocontainment in network laboratories. The responsibilities of the National Reference Laboratory include: training, provision of standard operating procedures, overseeing quality assurance and analyst proficiency and confirmatory testing. Network laboratories test for NAI, participate in quality assurance activities and report results (14).

Although the origin of the H7N3 LPAI virus that evolved into an HPAI virus was never determined, wild birds were suspected to be one possible source. However, due to the scarcity of genetic information on influenza A viruses circulating in Canadian wild birds, this remained a point of speculation. In late 2004, a decision was made by federal and provincial agencies representing public health, agriculture, and wildlife that a survey of influenza A viruses in wild birds be carried out in several locations across Canada. The Canadian Cooperative Wildlife Health Centre agreed to plan and coordinate the survey while provincial and federal laboratories would carry out virus testing and characterisation. This surveillance programme had five original objectives:

– to create an inventory of influenza A viruses that occur in wild birds in different areas across Canada

– to characterise these viruses to a sufficient degree that it may be possible to determine whether they may be the source, in whole or in part, of any future outbreaks in domestic animals or humans

– to monitor for the presence of particular influenza A viruses or their genetic components in the Canadian wild bird population

– to establish an archive of influenza A virus strains that would permit rapid retrospective analysis in response to disease outbreaks

– to build and maintain an integrated, multi-agency field, laboratory, regulatory and communications capacity within Canada to carry out influenza A virus sampling, identification and molecular characterisation (4).

In August 2005, the national surveillance programme for influenza A viruses in wild birds was initiated. In its first year, 4,268 cloacal swab specimens were collected from healthy young-of-year ducks from a total of 56 sites within six geographic regions. Swab specimens were screened by matrix real-time RT-PCR assay (17) with any positive samples undergoing further testing by H5- and H7-specific real-time PCR assays and virus isolation. Of the 4,268 samples that were analysed, 37% were positive for influenza A viral nucleic acid and 5% were positive for North American lineage, LPAI H5 subtype viruses (11). Two H5N1 viruses were among the H5 subtype viruses isolated in 2005; both were from juvenile mallard ducks, one from the province of Manitoba, the other the province of Ontario, and both had an IVPI of 0 (18). In 2006, the survey continued with the addition of dead bird testing, which was aimed at monitoring for the possible incursion of Eurasian HPAI H5N1. As in 2005, a significant percentage of young healthy ducks tested positive for influenza A viral nucleic acid, with virus isolates obtained from the majority of the PCR positive swab specimens. In survey year 2007, influenza A viruses of the H7 subtype were detected for the first time. The absence of H7 viruses in survey years 2005 and 2006 could indicate a cyclic periodicity for this subtype, a phenomenon that has been observed for other haemagglutinin (HA) subtypes (9). In the first three years of the survey Canadian wild birds were shown to harbour influenza A viruses of all HA subtypes with the exception of H14 and H15 and all neuraminidase (NA) subtypes (N1 to N9). The most common HA subtypes found during this period were H3, H4 and H5, while the most common NA subtypes were N2, N6 and N8. H4N6, H3N8 and H3N2 were the three most common HA/NA combinations.

H5N2 low pathogenic avian influenza in a British Columbia commercial duck and goose operation, 2005

In November 2005 domestic ducks from a commercial duck and goose farm in the Fraser Valley were submitted to the veterinary diagnostic laboratory for necropsy. Although serositis was found to be the predominant lesion, cloacal swab specimens were collected and tested for the
presence of influenza A virus nucleic acids as part of routine passive surveillance. When initial testing produced positive results, additional specimens were collected and tested by H5- and H7-specific real-time RT-PCR, with the former giving positive results. Confirmatory testing conducted on the original and additional specimens collected from animals on the suspected farms verified the presence of an influenza A virus of H5N2 subtype. Sequencing of HA and NA gene segments showed 97% identity to A/Tk/California/D0208651-C/2002 (H5N2) and a derived HA, cleavage site of PQRETR/GLF, typical for LPAI. The LPAI was confirmed with an IVPI of 0 for two of the H5N2 viruses that were isolated from two farms operated by the same owner. Birds on the affected farms were destroyed and surveillance testing of the surrounding area demonstrated no additional affected farms (12).

Of relevance to this outbreak was the high prevalence of H5N2 viruses found in juvenile wild ducks on Nicola and Minnie Lakes, located approximately 120 km to the northwest of the infected premises, during August 2005. Of the 640 cloacal swab specimens that were tested, 351 (55%) gave positive results for influenza A virus nucleic acid and 161 (25%) of the total were also positive for H5 HA nucleic acid. Twenty-four H5 viruses were eventually isolated from these swab specimens, the majority of which were H5N2. At the time when the affected duck and goose farm was identified, there was an abundance of waterfowl passing through the Fraser Valley on their southward migration. This prompted the authors to investigate the possibility of whether wild birds may have been the source of the NAI virus that affected the duck and goose farm. Comparison of HA, NA, M and NS gene sequences from one of the H5N2 viruses isolated from wild birds with those of the virus isolated from the domestic duck flock demonstrated a high degree of identity (≥96%) (12), supporting the hypothesis that wild birds were the source of the LPAI outbreak.

Saskatchewan

H7N3 highly pathogenic avian influenza, 2007

In September 2007, a broiler hatching egg operation in the Regina Beach area of Saskatchewan experienced increased mortality in a barn housing 390 24-week-old roosters (5). The premises were situated in a low density poultry-producing area with six small non-commercial flocks located within a 3 km radius and one commercial operation within a 10 km radius. This consisted of ten confinement barns housing a total of 53,000 birds of multiple ages that included 16,000 55-week-old birds housed in two barns; 16,000 10-week-old pullets housed in three barns; and a total of 4,200 1-, 10-, 17- and 24-week-old roosters housed in three barns. The six barns housing the pullets and roosters were all in one location and separated from the four barns housing the 55- and 32-week-old breeders by approximately 400 m. Farm workers and equipment were shared among all barns.

Mortality in the flock of 390 spikers (24-week-old roosters) was 140 (36%) on 22 September and 240 (62%) by 23 September. Ten days prior to this, 200 roosters from the affected barn were moved in with the 55-week-old broiler breeder flock. This group of roosters never returned to their original barn and showed no signs of illness. On 18 and 19 September, a second group of 200 roosters from the affected barn were moved in with the 32-week-old broiler breeder flock. This group of roosters also never returned to their original barn, however, morbidity involving the 32-week-old layers was eventually noted on 28 September.

A CFIA diagnostic team was dispatched to the premises on 23 September, at which time diagnostic specimens were submitted to Prairie Diagnostic Services in Saskatoon, Saskatchewan (part of the Avian Influenza Laboratory Network), and the National Centre for Foreign Animal Diseases in Winnipeg. The premises were placed under immediate quarantine and further movements of poultry, poultry products, or things exposed to poultry or poultry products were prohibited pending laboratory results.

An H7N3 subtype virus bearing the HA, cleavage site PENPKTKPRPR/GLF, and an IVPI of 3.0 was isolated. The origin of the six-amino-acid insert TKPRPR was not definitively determined; however, several proteins of eukaryotic origin were identified as potential donors, with a hypothetical protein of Gallus gallus (GenBank accession XM_424122) being one notable possibility. Of concern was the fact that the H7 real-time RT-PCR assay that was supposed to have enabled rapid identification of H7 subtype viruses produced negative results. Sequencing of the HA gene revealed that the H7 real-time RT-PCR forward primer, reverse primer and probe binding sites contained a total of eight nucleotide substitutions: two in the forward primer, one in the reverse primer and five in the probe. This experience alerted the authors to the importance of closely coordinating influenza surveillance in waterfowl with the monitoring of HA subtype-specific real-time RT-PCR assay performance.

Phylogenetic analysis of all eight gene segments revealed close kinship with a number of recent North American H7N3 viruses isolated from wild waterfowl. The high degree of identity shared by A/chicken/Saskatchewan/HR-00011/2007 (H7N3) with other H7N3 viruses isolated
from North American wild aquatic birds in 2006 and 2007 was strong circumstantial evidence that the outbreak resulted from the direct introduction of virus from wild aquatic birds. To further substantiate this hypothesis, the area surrounding the infected premises is a habitat for wild waterfowl. It is particularly interesting to note that Last Mountain Lake, an 80-km-long lake whose northern end is a bird sanctuary and important waterfowl staging area, is only 5.5 km from the premises. Furthermore, the province of Saskatchewan is situated between two major migratory bird flyways, the Central and the Mississippi. It is possible that virus excreted by wild birds could have been inadvertently introduced on an employee’s footwear or clothing. Alternatively, although the facility used municipal water, surface water from a dugout located approximately 380 m from the breeder barns was also used during high demand periods. This water was routinely filtered and ozonated, but there was a history of failure of the ozonater prior to the outbreak.

National surveillance programmes for notifiable avian influenza

Canada currently monitors for NAI through:

- wild bird surveillance
- passive surveillance when clinical signs suggestive of NAI are reported
- targeted surveillance when NAI is detected.

The Canadian Notifiable Avian Influenza Surveillance System (CanNAISS), which was implemented in June 2008 (6), will enhance these surveillance activities to meet new international requirements. CanNAISS is being developed by the CFIA in collaboration with provincial and territorial governments and poultry industry representatives. It is an enhanced surveillance system to detect NAI in commercial poultry flocks in Canada (i.e. chickens, turkeys, ducks and geese). When fully implemented, CanNAISS will include a number of components, including on-farm, pre-slaughter surveillance and active surveillance at exporting poultry genetics companies. This programme is one of a number of domestic and international initiatives that have been implemented by governments, industries and Canadian farmers, to prevent, detect and eliminate the presence of H5 and H7 subtypes of NAI in the domestic poultry flocks. CanNAISS has been designed to meet the current NAI guidelines from the OIE and new trade requirements from the European Union (EU) that take effect in January 2009. CanNAISS will enhance Canada’s ongoing surveillance programme and provide information about NAI viruses in Canada’s domestic poultry flocks that will be required for Canadian poultry producers and processors to continue doing business internationally.

Conclusions

Canada has a modern, supply-managed poultry industry with production in all ten provinces but with the bulk concentrated in three. Low pathogenic avian influenza has caused sporadic problems, manifesting itself primarily in the form of respiratory disease and decreased egg production, and is seen predominantly during late autumn and early spring. The occurrence of HPAI H7N3 in the Fraser Valley of British Columbia was Canada’s first reported outbreak to the OIE. It precipitated a number of changes from producer to federal government levels, dealing with issues ranging from self-quarantine to laboratory testing. The association of viruses that were responsible for subsequent LPAI H5N2 and HPAI H7N3 outbreaks with those found circulating in wild birds stresses the importance of the latter as a continued source of infection and of biosecurity as a means of preventing exposure. Implementation of the AI-LN and CanNAISS should help to reduce the impacts of any future outbreaks of NAI.

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La vaccination contre l’influenza aviaire : l’expérience du Canada

J. Pasick, Y. Berhane & K. Hooper-McGrevy

Résumé

En 2004, le Canada a déclaré un premier cas d’IAHP à l’Organisation mondiale de la santé animale (OIE). Le foyer est apparu dans un élevage de poulets de chair situé dans la vallée du Fraser en Colombie britannique ; le virus responsable était un virus de l’IAFP de sous-type H7N3, devenu hautement pathogène après avoir subi une mutation soudaine vers la virulence. Plus de 17 millions d’oiseaux ont été sacrifiés, avec des pertes économiques brutes estimées à 380 millions de dollars canadiens, avant que le foyer ait pu être finalement maîtrisé. À la suite de ce foyer, plusieurs mesures ont été introduites afin d’atténuer les conséquences des futurs foyers d’IAHP. Ces mesures concernent la détection et la prophylaxie de l’influenza aviaire, y compris la quarantaine volontaire, la biosécurité, la surveillance et les tests de laboratoire.


Mots-clés

La experiencia canadiense con la influenza aviar

J. Pasick, Y. Berhane & K. Hooper-McGrevy

Resumen
Los primeros informes de brotes esporádicos de influenza aviar en aves de corral domésticas se remontan al decenio de 1960. Con la excepción de la cepa A/turkey/Ontario/7732/1966 (H5N9), que fue aislada en una explotación de cría de pavos reproductores, todos los virus caracterizados antes de 2004 concuerdan con los criterios definitorios de la influenza aviar levemente patógena (IALP). Sólo retrospectivamente se demostró que la cepa A/turkey/Ontario/7732/
1966 correspondía a las características de la influenza aviar altamente patógena (IAAP).
En 2004, Canadá notificó su primer caso de IAAP a la Organización Mundial de Sanidad Animal (OIE). El brote, que surgió en una granja de pollos asaderos de Fraser Valley (Columbia Británica), se debía a un virus de la cepa H7N3 de la IALP que sufrió un súbito cambio de virulencia y pasó a causar IAAP. Para llegar a contener el brote hubo que sacrificar 17 millones de aves e incurrir en un gasto bruto de 380 millones de dólares canadienses. A raíz de aquel episodio se introdujeron una serie de cambios destinados a mitigar en el futuro las consecuencias de eventuales brotes de IAAP, cambios que afectaron a diversos aspectos de la detección y el control de la influenza aviar, en especial la autocuarentena, la seguridad biológica, la vigilancia y las pruebas de laboratorio.
En 2005 se puso en marcha un programa nacional de vigilancia del virus de la influenza aviar en aves salvajes. El estudio arrojó datos demostrativos de que las aves salvajes eran probablemente la fuente de un brote de IALP causado por la cepa H5N2 que afectó a patos domésticos de Fraser Valley (Columbia Británica) en otoño de 2005. En 2007, las aves salvajes intervinieron de nuevo en un brote de IAAP por la cepa H7N3 que afectó a una granja de cría de pollos asaderos de Saskatchewan. Por fortuna, gracias a algunos de los cambios instituidos tras el brote de 2004 en la Columbia Británica, ambos episodios fueron de alcance limitado.

**Palabras clave**
Aves salvajes – Cambio de virulencia – Influenza aviar – Influenza aviar altamente patógena (IAAP) – Influenza aviar levemente patógena (IALP) – Influenza aviar de notificación obligatoria – Subtipo H5 – Subtipo H7.

**References**


