Fowl Plague:

Vigilance always necessary

Avian Influenza, sometimes called Fowl Plague, is one of the most feared poultry diseases because of its potential to cause high mortality and serious production losses in infected flocks.

by John Bashiruddin, Paul Selleck & Harvey Westbury

Although considered an exotic disease to Australia, there have been two outbreaks in the past 20 years. The outbreaks, which were successfully contained by government disease control programs, underlined both the seriousness of the disease and the huge amount of work which is involved in eradicating an exotic disease.

Avian Influenza is caused by a virus which affects mainly poultry and some wild birds. However, it shares some characteristics with human flu viruses, particularly the difficulty of producing an effective vaccine. This inability to produce a vaccine means eradication is the only effective control measure against avian flu.

Eradication the only control

The first recorded outbreak of Avian Influenza in Australia occurred in 1976 on three farms in the suburb of Keysborough, Melbourne. One was a 17,000 broiler farm with an attached processing plant, another was a 25,000 layer farm and the last, located opposite these, was a 16,000 duck farm. Signs of infection were observed in the layer farm and to a lesser extent on the broiler farm. The affected chickens were generally depressed, their combs and wattles were swollen and eventually appeared dark red to bluish.

The Victorian Department of Agriculture undertook sampling and testing of affected birds to establish the cause of the disease symptoms. Swabs from the throat and vent as well as blood were collected and some of this material was injected into nine-day-old incubated eggs. The inoculated embryos died within 38 hours, indicating the presence of an avian flu virus. This was confirmed by viral tests undertaken at the Central Veterinary Laboratory, Weybridge, London.

Following consultations between the Victorian chief veterinary officer and similar officers from other states and the Commonwealth Government, it was decided to eradicate the affected birds immediately to prevent the spread of the virus.

More than 17,000 broilers, 22,000 layers, 5,500 eggs, 100 tonnes of poultry feed and 40 tonnes of produce were destroyed and buried. All litter and equipment incapable of disinfection in sheds and years of accumulated poultry manure were also removed.

A further 16,500 ducks were destroyed on an adjoining farm. The total cost of the 1976 outbreak excluding salaries was estimated at more than $250,000.

The second outbreak of Avian Influenza occurred on a mixed broiler and layer farm in Lockwood, near Bendigo in 1985. Symptoms of the disease were first noticed in mid-May, and within four days the mortality rate in one of the four affected sheds had risen to 75%.

CSIRO experimental scientist, Paul Selleck, conducting elisa testing, which can detect the avian influenza virus within four hours.

Laboratory tests by the Victorian Department of Agriculture and Rural Affairs indicated the birds had been in contact with several bacterial pathogens, and showed signs of being in contact with both the Newcastle Disease and Avian Influenza viruses. Further testing by Central Veterinary Laboratory, London, confirmed it to be the same viral subtype which caused the 1976 Keysborough outbreak.

A state of emergency was declared under the Animal Diseases Emergency Plan and an immediate interstate ban was imposed on all Victorian poultry. More than 200,000 birds on the affected farm were destroyed and all contaminated material was buried. Affected sheds were cleaned and disinfected.

Extensive laboratory testing of all poultry products originating from the area and all poultry deaths in Victoria monitored the spread of the disease. All up, more than 20,000 blood samples were processed by the Department of Agriculture and the CSIRO Australian Animal Health Laboratory (AAHL), Geelong. AAHL also prepared essential testing reagents for distribution to interstate laboratories in case the disease spread interstate.

Tests conducted at AAHL also showed that this virus could produce 100% mortality in chickens within seven days, but lesser symptoms in turkeys and none at all in ducks. Monitoring of surrounding properties indicated a further eight poultry farms had been in contact with the affected enterprise. All birds on these high-risk properties were destroyed, along with pet birds and backyard fowl.

By mid-July, cleaning operations were completed and the ban on interstate movement was lifted. However, the affected farm remained in quarantine for a further six months.

The total cost of the 1985 operation including compensation and control was
more than $2 million.

Continuing research
Since then, the AAHL has continued work on better techniques for the detection, diagnosis and control of avian influenza. Funded jointly by the Chicken Meat and Egg Industry Research and Development Councils, the laboratory has been developing tests which improve the speed and sensitivity of detection of the disease.

The presence of virus in birds is judged in two ways: either searching for the virus in tissue or swab samples taken from affected birds; or searching antibodies in blood samples taken from suspect birds. (Antibodies are produced by the bird’s immune system in response to a viral infection, and therefore can be used to indicate the presence of the avian flu virus).

Current techniques are based on cultivating the virus, usually in incubated chicken eggs. However, some modern techniques can detect the virus directly in the tissues of the birds themselves.

This means that the tests can be done quicker and a diagnosis obtained earlier. AAHL has been working on direct detection tests using a laboratory system called elisa and by microscopic techniques. The elisa system, which can detect the virus within four hours, relies upon a series of steps using complex purified reagents. Although it is extremely sensitive, it can be disrupted by non-specific factors.

A second system for direct detection of the flu virus is taking smears from the surface of organs in the bird and then staining them with special reagents. This technique, called fluorescent antibody, only works because the stain virus glows when treated in this way, is very sensitive and quick and can be used in most laboratories in Australia.

Another method of diagnosing avian flu is by detecting antibodies to the virus in blood. The elisa technique is one of the more accurate methods of such, and can also be mechanised, automated and computerised for reading and storing the results. It is thus suitable for handling large numbers of samples.

Genetic analysis
Part of the delay in providing a complete diagnosis of avian flu stems from the difficulty in judging the potential severity of disease caused by the different types of avian flu viruses.

It has been known for some years that the H protein on the surface of these viruses plays a major role in their capacity to cause disease. It is a peculiar protein which allows the virus to invade certain tissues of the bird and so causes disease. The H protein of disease-causing flu viruses can be chemically ‘cut’ very easily, which allows the virus to swiftly invade many tissues in the bird.

By contrast, the H protein of non-disease causing avian flu viruses cannot be cut easily and so the virus invades fewer tissues. This ability to cut the H protein is determined by the structure of protein, which consists of chains of amino acids. Therefore, the sequence of amino acids at the cutting site is an important determining factor in the ability of the virus to cause disease.

In turn, this sequence is dictated by genetic material in the virus particle. Therefore, analysis of the gene responsible for the H protein cutting site will reveal the likely disease-causing potential of the avian flu virus.

AAHL has been working on methods of genetic analysis to produce a test which predicts this factor. A major advantage of these tests, besides negating the need to send material abroad for testing, is that they are extremely sensitive. Very little sample material is needed for testing and it may be possible to detect the presence of virus at the very early stages of infection. Pathogenicity testing in this way also provides a result within days, whereas conventional methods may take weeks.

However, genetic analysis is expensive.
and will probably remain confined to a national reference library such as the AAHL.

While such tests offer quick diagnosis, successful eradication and control is dependent upon the early notification of a strange disease, and this responsibility lies with every producer. Suspected outbreaks must be reported immediately to allow swift detection, diagnosis and monitoring for successful and economical control.

The symptoms of avian influenza are wide ranging and depend on the breed of chicken, age, sex, presence of other infections, stress and so on. The early signs of disease include decreased activity, feed consumption and egg production. Hens appear broody and ruffled, and may suffer from sneezing and diarrhoea. All of these may occur in combination, and can get worse very suddenly and lead to the more specific signs such as severe respiratory illness, a complete stop in egg production and feeding, severe diarrhoea and lack of co-ordination.

Very sick birds appear nearly unconscious with their heads almost touching the litter. When the strain is particularly virulent, deaths occur suddenly and can range from 20-100%.

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