Cambridge VETERINARY GROUP

AVIAN INFLUENZA ("BIRD FLU")

KEY POINTS

- Avian Influenza ("Bird Flu") is not a new disease: it has been recognised since the late 1800s, with regular epidemics in various parts of the world ever since.
- Influenza viruses are prolific and prone to mutation, but almost all mutations "fail" and die out.

In humans:

- Mutation of Avian Influenza virus to a strain adapted to survival in humans alone, if it happens, is likely to start where larger numbers of humans and birds live very close together (e.g. the Far East).
- If a human-adapted strain of Avian Influenza virus develops, infected humans not birds will be the risk to fellow humans.
- Historically, human influenza pandemics have occurred every few decades: another one is "overdue" and hence the concern about the current Avian Influenza H5N1 strain.

In captive birds:

- Commercial birds in the UK are **not** vaccinated against Avian Influenza. If an outbreak occurs here, other than in quarantine, then this is most likely as massive sudden death in a commercial flock (with media coverage).
- **At present, there is no need to keep pet birds inside or to feed them under cover unless near bird migration routes or resting sites.**

BACKGROUND

Microbes

The most widely known of these microscopic organ-isms are bacteria and viruses.

Bacteria

Each individual bacterium divides to form two new identical bacteria, and they in turn do the same. In ideal conditions - temperature, humidity and something to feed on ("food" supply) - a bacterium can divide every 20 minutes. It can go through as many generations in a day as the human race in 2,000 years. In theory a single bacterium could in one day multiply to many billions of bacteria, but in reality the usual limiting factor is "food" supply. For this reason large, but not these immense, numbers can be reached.

Bacteria often affect several different species of "*host*" (i.e. are not *species specific*). For example, *Salmonella* may affect poultry, calves and people, causing food poisoning.
Bacteria can be killed with antibiotics unless, as with MRSA in humans, they become resistant.

Viruses

Viruses replicate by a single virus (a *virion*) "hi-jacking" a living cell and making it manufacture millions of identical virions which ultimately destroy the cell. These then escape to invade other cells. If bacteria seem prolific, then viruses leave them standing!

Viruses are classified into various groups (such as parvoviruses, influenza viruses, etc.). Within each group of viruses each strain of virus is usually *species specific*, i.e. only affects a single *host species*. There are a few exceptions, such as rabies virus which can affect most mammals.

Antibiotics are totally ineffective against viruses.

Mutation

Mutation means a change in the genetic "make-up" of an organism. All living things mutate; the history of their evolution is the history of successful mutat-ions. Any mutation which gives survival advantage will result in that strain multiplying and dominating less successful mutations. It's important to realise that **almost all mutations give no survival advantage** and so "fail" and die out.

If all species mutate at a similar frequency, then those organisms which multiply the fastest will have most mutations over any given period of time. Viruses are top of the class on this reckoning.

Mutation of a virus from one host species to another is most likely where existing and potential host species live in large numbers in close proximity. Thus, mutation from birds or pigs to humans has historically occurred in the Far East. This is much the most likely scenario if Avian Influenza virus mutates to a human adapted strain.

Pathogenicity

Microbes which cause disease are called *pathog-enic*. Some are worse than others. They vary in two ways:

- Different strains of the same microbe affecting the same host species may differ in their effects. For example, Avian Influenza virus has both high and low pathogenic strains, causing very serious and less serious disease.
- The way they act in different host species. For example, the *Leptospira* bacterium can live in the common brown rat without making it ill but the same rat may transmit the bacterium to dogs or humans. Dogs then suffer from leptospirosis and humans from Weil's disease. The microbe uses the rat as a *reservoir* or *carrier*.

Immunity

Because antibiotics are powerless against viruses, there are only two ways to fight them: prevention and cure. Both ways involve developing immunity to a particular virus. That immunity depends on *antibodies*. A healthy individual may acquire antibodies which ward off an attack or, if the virus has already taken hold, the individual may develop immunity.

Immunity may be acquired either naturally or "artificially" through vaccination. A good example of an individual acquiring immunity naturally can be seen in the course taken by the common cold. We suffer for several days until our bodies create enough antibody to defeat the virus.

Vaccination is how we try "artificially" to protect individuals and is the only way to protect against viral disease apart from isolation/quarantine. Effective vaccines are much easier to develop for a little-changing virus (e.g. rabies) but much more difficult for fast mutating ones (e.g. influenza). When dealing with fast-changing viruses we may have to take an educated guess and try to anticipate which strains are likely to strike next. This is what happens each winter when a vaccine is sought to protect older people from 'flu. Developing a vaccine and proving it works safely can take a long time.

Population immunity is the key to infectious disease prevention or control when large numbers of individ-uals are involved. The more individuals in a community that lack sufficient immunity, the greater the risk they run of coming into contact with infection and the greater the risk of the disease spreading. Generally, if less than 80 per cent of the population has sufficient immunity, there is great likelihood of the disease taking hold. This proportion varies between different diseases.

Two sorts of individuals act as *carriers*:

- those which show no signs of the disease because they have sufficient immunity not to develop it, yet continue to pass on the microbe.
- those carrying a microbe which does little harm to their species but is much more harmful to others. For example, migratory birds may survive the avian flu microbe they carry but transmit it to domestic poultry.

Epidemiology

This is the study of how diseases spread. It takes into account a wide range of factors, such as pathogenicity, population immunity, carriers, population movement and inter-mingling, and climate. Because so many factors can be involved, epidemiological studies are often very complex, difficult and can be long-term (e.g. smoking and lung cancer).

An *epidemic* is an outbreak of disease in a population of individuals (e.g. BSE in cattle). A *pandemic* is an epidemic which is much more widespread, perhaps continent-wide or world-wide.

Epidemics and pandemics occur when the population immunity is too low. Two ways this can happen are:

- failure to be properly vaccinated due to complac-ency or anxiety over vaccine side-effects;
- when a virus mutates in such a way that it can jump from its original host species to another species which lacks any immunity. This is what happened in previous human influenza pandemics and also happened when parvovirus first affected in dogs in the early 1980s.