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Infectious Laryngotracheitis (ILT)

Disease Overview

Plan of Talk

- Introduction
- Etiology
- Epidemiology
- Clinical signs
- Diagnosis
- Prevention and control

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Definition

- Infectious laryngotracheitis is a viral respiratory infection of chickens that may result in severe economic losses as a result of mortality and/or decreased egg production.

Geographical Distribution

- Although ILT is distributed world-wide, the disease may be present only in certain localities within a country or geographic region.
- The greatest incidence of disease is generally seen in areas of highly intensive poultry production.

Historical Overview

1. ILT was first confirmed in 1925 in canada
2. Followed by the united states in 1926
3. Australia & Great Britain in 1935
4. Europe in 1940 (cover, 1996).

› By 1962, ILT was described in at least 40 countries in the FAO-WHO-OIE Animal Health Yearbook (Pulsford, 1963).

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Etiology

- The disease is caused by *Gallid herpesvirus I*, commonly known as infectious laryngotracheitis virus (ILTV).

Etiology - Strain Differentiation

- Based on virus neutralization (VN), immunofluorescence (IF) and cross-protection studies, ILTV strains are considered to be antigenically homogeneous.
- **However, strains have been differentiated on the basis of:**
  1. Virulence for chickens or chicks.
  2. Plaque size.
  3. Morphology in cell cultures.
  4. Pock size on the chorioallantoic membranes (CAMS) of chicken embryos.

Etiology
Resistance to Chemical and Physical Agents

- In an in vitro environment, ILTV infectivity can be readily inactivated by:
  - Low heat (e.g. 60°C for 15 minutes or less)
  - Freeze-thawing in a medium which is free of organic materials or protein.
- Chemical disinfectants, such as coal tar derivatives, formalin, hypochlorite and iodophors, effectively inactivate ILTV on contact.
- ILTV in the laboratory is also susceptible to lipolytic solvents, such as ether or chloroform, and to extremes of pH.

Cont. ...

- In tracheal exudates and tissues, ILTV infectivity can persist for weeks or months in enclosed poultry production environments at relatively low temperatures (e.g. 10°C-20°C).
- However, the presence of 50% glycerol broth or sterile skim milk will greatly increase the time of survival possible for ILTV infectivity on swabs.
- However, putrefaction processes in the carcasses of dead chickens will shorten ILTV survival.

Etiology
In vitro cultivation

› Infectious laryngotracheitis virus can be grown in fertile chicken eggs and several avian primary cell cultures.

Etiology
In vitro cultivation - CE Inoculation

› Inoculation of the dropped CAM of eggs after incubation for 10-12 days results in pock formation and embryo death between two and twelve days post inoculation.

Etiology
In vitro cultivation - TC Inoculation

- The virus can be propagated in avian cell cultures derived from Chick embryo (liver, lung, kidney and tissues) where the typical cytopathic effect is syncytium formation.
- Chick embryo liver has been found to be the most sensitive system for primary isolation of virus from clinical material.
- Chick embryo fibroblasts, Vero cells and cells of quail origin have been shown to be relatively insensitive for ILTV growth from field material.

Etiology - Virus Kinetics

- The target organs for ILTV infection and disease are the respiratory tract, the epithelium of the trachea and larynx.
- Other mucous membranes such as the conjunctiva, as well as respiratory sinuses, air sacs and lung tissue, may also become infected periodically.

Etiology - Virus Kinetics
Acute Phase of Infection

- **During the first week of infection**
  - Active virus replication occurs only during this week.
  - Low levels of ILTV infectivity can be detected sporadically up to ten days post infection.
- **7-10 days after infection**
  - Chickens usually recover from primary ILT disease within 7-10 days of showing clinical signs.
  - These are matching with active ILTV replication in the trachea.
- **10 days – 4 weeks after infection**
  - Shedding of infectious ILTV may have ceased
  - Latent phase of infection is established through ILTV invasion of nervous tissues.

Etiology - Latent infection

- **Onset of latent ('hidden') phase of ILTV infection**
  - Invasion of the trigeminal ganglion (TRG) by ILTV has been found to occur from 3-6 days of acute phase of ILT infections by field and vaccine strains.
  - The latent infection starts from the immediate post-acute phase of infection
  - 7-10 after tracheal exposure.

Cont. …

- **Route on latent infection**
  - The exact route of infection of the TRG is not known, but thought to be the neural migration as this ganglion provides the main sensory innervation to the tissues of the upper respiratory tract, the mouth and the eyes.
  - *Williams et al.* has confirmed, by PCR, that the tracheal ganglion is the main site of ILTV latency.
- **Detecting latent infection**
  - Latent ILTV infections are not readily demonstrable during the first few months after infection, probably reflecting initially high levels of host immune control and surveillance.
  - Subsequently, sporadic reactivation of latent ILTV infection with shedding of low levels of infectious virus into the trachea will recur throughout life.

Cont. ...

- **Importance of latent infection**
  - A landmark study which helped to explain how apparently spontaneous outbreaks of ILT can occur in field situations showed that rates of shedding of ILTV into the trachea could be significantly increased by the stresses of either the onset of lay or mixing with unfamiliar birds.
  - In this case, the latently infected chicken can act as an unsuspected reservoir host and enable ILTV to infect further susceptible chickens.
- **Latent infection, the key for ILTV survival**
  - It should be understood that establishment of latency by ILTV, in common with other herpes viruses, is the biological survival mechanism which enables ILTV to evade host immune surveillance and to persist, even in small flocks of chickens, over generations.

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Epidemiology

- The primary host species for ILTV is the **chicken**.
- **The sources of ILTV are as follows:**
  1. Clinically affected fowls.
  2. Fowls which are latent 'carriers' of infection.
  3. Fomites and poultry farm personnel contaminated with ILTV.

Cont. …

- Natural transmission occurring by:
  1. Horizontal transmission
     - Direct contact with upper respiratory and discharge.
  2. Vertical transmission
     - No evidence for vertical ILTV transmission to the egg or for shedding ILTV on shells of eggs laid by infected hens.

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Clinical Signs - Sub Acute Form

- It can also be a sub acute disease with:
  1. Nasal and ocular discharge
  2. Tracheitis
  3. Conjunctivitis
  4. Mild rales

Clinical signs - Acute Form

1. Gasping, coughing, rattling, and extension of the neck during inspiration are seen 5–12 days after natural exposure.
2. Reduced productivity is a varying factor in laying flocks.
3. Affected birds are anorectic and inactive.
4. The mouth and beak may be blood stained from the tracheal exudate.

Cont. ...

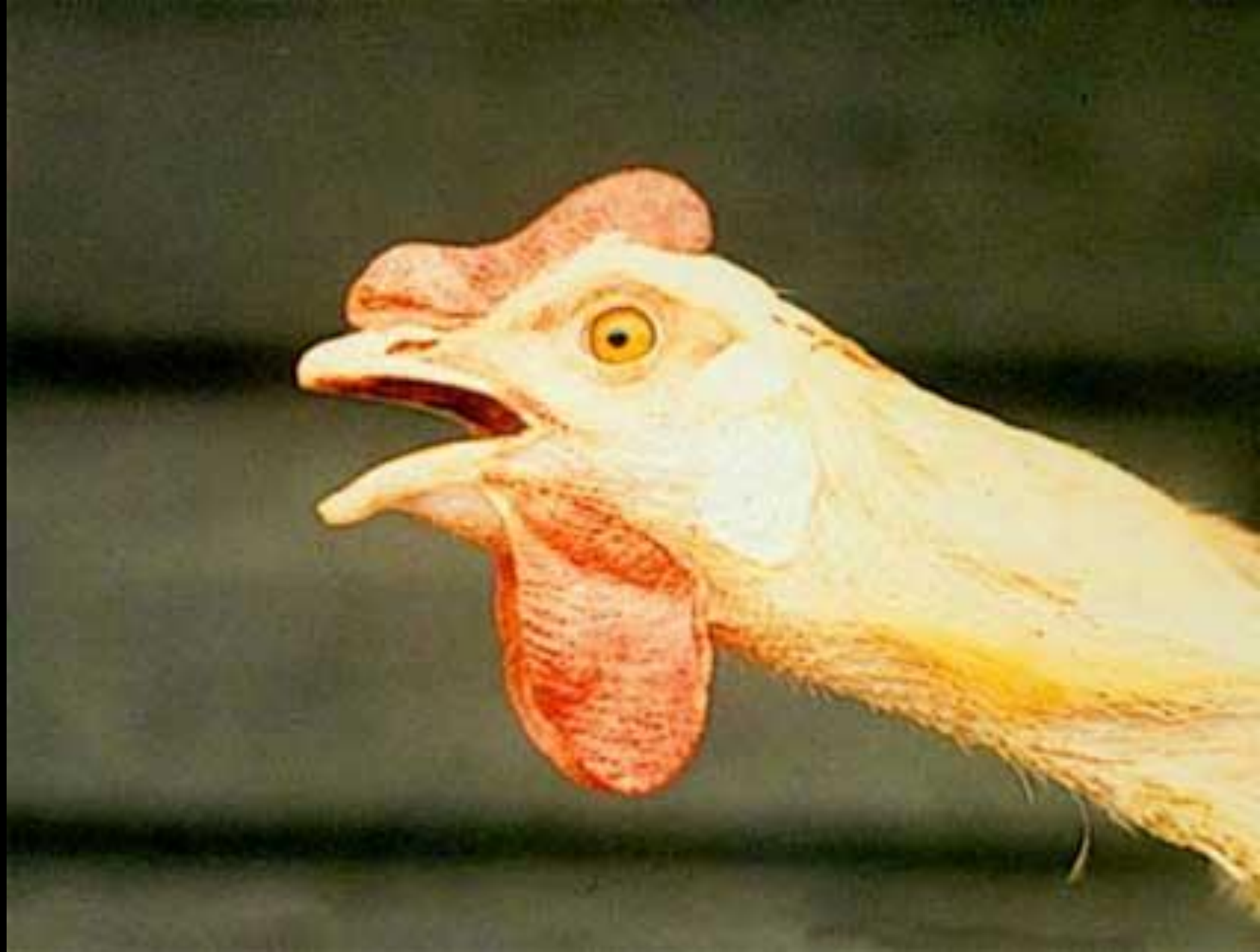
5. Mortality varies but may reach 50% in adults and is usually due to occlusion of the trachea by hemorrhage or exudate.
6. Signs usually subside after 2 weeks, although some birds may show signs for longer periods.
7. Strains of low virulence produce little or no mortality with mild respiratory signs and a slight decrease in egg production.

Cont. ...

- After recovery, birds remain carriers for life and become a source of infection for susceptible birds, upon stress.
- The latent virus can be reactivated under stressful conditions.
- Infection also may be spread mechanically.
- Several epidemics have been traced to the transport of birds in contaminated crates, and the practice of litter spread in pastures is believed to be related to epidemics of the disease.

Open-mouth breathing
or gasping

Wet irritated eyes



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Diagnosis - PM lesions

- **The acute disease is characterized by:**
  1. Presence of blood, mucus, yellow caseous exudates, or a hollow caseous cast in the trachea.
  2. Microscopically, a desquamative, necrotizing tracheitis is characteristic of acute disease.

- **In the sub acute form:**
  1. Punctiform hemorrhagic areas in the trachea and larynx.
  2. Mild conjunctivitis with lacrimation may be detected.


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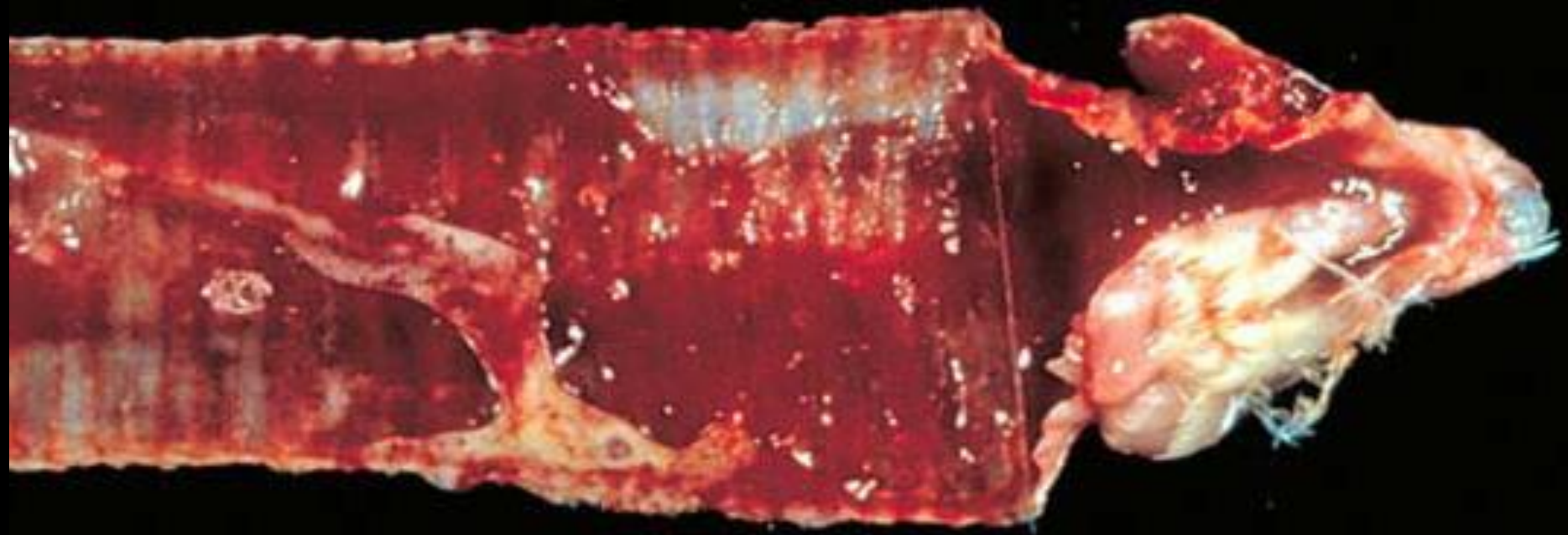

Trachea filled with
blood and mucus

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Prevention and Control

- **Broiler** production,
  - Strict biosecurity and the short growth cycle can obviate the need for prophylactic vaccination.
- **Layer** and **breeder flocks**.
  - Biosecurity and vaccination using modified-live vaccines.

Cont. ...

Important note

- Since ILTV infections or vaccination will result in latently infected carrier birds, it is extremely important to avoid mixing vaccinated or recovered birds with susceptible chickens.
- Special precautions should be taken to obtain a complete history when mixing breeding stock.

Controlling ILT Outbreak

1. Rapid diagnosis
2. Institute a vaccination program and prevent further virus spread.
   - Vaccination in the event of an outbreak will:
     1. Limit virus spread.
     2. Shorten duration of the disease.
3. Strict biosecurity procedures to prevent spread of ILTV
4. Adequate cleaning and disinfecting
   - The virus is readily inactivated outside the host chicken by disinfectants and low levels of heat, thus spread of disease between successive flocks housed in the same building can be prevented.

Immune Responses

- A variety of responses are generated by the immune system following infection by ILTV;
  1. **Humoral virus neutralizing antibodies:**
     1. Become detectable in the serum within 5-7 days of tracheal exposure.
     2. Peak around 21 days.
     3. Wane over the next several months to low levels at which they can persist for a year or more.

Cont. …

› Numerous laboratory and field studies have independently confirmed that immune protection to ILTV challenge is neither indicated by the presence of serum or maternally-derived antibody.

Cont. …

2. **Mucosal virus neutralizing antibodies:**
   - 7 days post infection, mucosal antibodies and low levels of virus-neutralizing and enzyme-linked immunosorbent assay (ELISA) **antibody** activity become detectable in tracheal secretions and washings.
   - Plateau at 10-28 days.

Cont. …

3. **Cell-mediated immunity**
   - It is known to be the protective immune response in ILT infection and for vaccination.
   - Studies by Fahey and York, using vaccinated bursectomised chickens, have demonstrated that even tracheal mucosal antibody is not essential in preventing the replication of virus in vaccinated chickens. Rather, the effector mechanism of protection from ILT is likely to be the local cell-mediated immune response in the trachea.

ILT Vaccination

- Vaccination is done with either;
  1. Live attenuated vaccines.
  2. Viral vector recombinant vaccines.

ILT Vaccination - Live Vaccines

- Originated from virulent isolates that were attenuated by consecutive passages in embryos or tissue culture.
- These are applied via eye drop or through mass vaccination by water or spray.

ILT Vaccination - Viral Vector Recombinant Vaccines

- Viral vector recombinant vaccines in fowl pox and herpes virus of turkeys have been designed to express ILTV immunogenic proteins and are administered to individual birds by in ovo, SC, or wing-web vaccination.

ILT Vaccination

- At present, only modified-live vaccine viruses are available for prophylactic vaccination.

- Modified live virus vaccines are prepared by propagation of vaccine strains in either:
  1. Cell culture (tissue culture-origin)
     - Low post vaccine reaction, suitable for priming dose.
  2. Embryonated eggs (chick embryo-origin)
     - High post vaccine reaction, suitable for booster dose.

ILT Vaccination

- ILT vaccines are generally administered to chickens by either:
  1. Eye drop.
  2. Orally (through drinking water).
  3. Spray.
- However, problems have been associated with routes of inoculation:
  1. Drinking water (titer).
  2. Spray (reaction).

ILT Vaccination - Primary Vaccination

- Primary vaccination with current modified-live ILT vaccine strains will confer:
  - Partial protection against challenge by 3-4 days post exposure.
  - Complete protection after one week.

- **High levels of protection** occur between **15-20 weeks** post vaccination, with variable degrees of protection within a flock over the following year.

ILT Vaccination - Revaccination

- Revaccination with live vaccines may or may not assist in maintaining protection levels, as the infectivity of any vaccine virus may be neutralized and replication prevented at the portal of entry into the host chicken.

ILT Vaccination - Virus Shedding

- Whilst the chickens on a particular site may have been vaccinated adequately, it is important to remember that reactivation and excretion of ILTV will be occurring continually in a small proportion of these chickens.

Cont. …

- On multiple age production sites, stressful events, such as entering into lay, or shifting and mixing of flocks will occur regularly, causing an even higher proportion of hens in a flock to shed virus into the environment.
- After exposure of a flock to live ILT vaccine, or after an ILT outbreak, active ILTV shedding cannot be assumed to have ceased until approximately two weeks after vaccination or the onset of the last clinical cases in a naturally infected flock.

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