LARYNGOTRACHEITIS (LT)

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Laryngotracheitis

- Synonyms: infectious laryngotracheitis (ILT), avian diphtheria
- History:
  - First described 1925
    - Perhaps observed earlier
    - Isolated (1930)
    - Named by AVMA (1931)
    - Caused by filterable virus (Beaudette 1937)
  - First major effective avian virus vaccine

Laryngotracheitis – Incidence and Distribution

- Worldwide distribution
  - Intensive rearing
- Control
  - Layers and breeders
    - Typically well vaccinated/controlled
  - Broilers
    - Short life cycle; often not vaccinated unless regional problems
  - Niche/Fanciers
    - May be endemic in some flocks

Laryngotracheitis – Hosts

- Primarily in chickens
  - Usually older birds
  - Respiratory tract: viremia unlikely
- Pheasants & pheasant crosses (sporadic)
- Peafowl (rare isolate)
- Turkeys (experimental)
- Other birds resistant (ducks, pigeons, doves, sparrows, crows, starlings, guinea fowl)
  - May still carry virus mechanically

Laryngotracheitis – Economic Significance

- Not determined
- Estimated millions of $$$ in US
  - Mortality
  - Decreased production
    - Meat, eggs, breeder potential, increased down time
    - Uniformity, feed conversion
    - Processing issues
  - Vaccination (vaccines, labor)
  - Waste disposal & storage
  - Labor (service responsibilities, transport, cleaning and disinfection, etc.)

Laryngotracheitis – Etiology

- Alphaherpesvirus
  - Morphology/composition
    - Similar to other Alphaherpes viruses
    - Double stranded DNA (155kb)
    - Enveloped
      - Glycoprotein spikes (humoral and cell mediated immunity)
    - Shape: Icosahedral
    - Size: 195-250 nm
  - Similar to MDV

Laryngotracheitis – Strain classification

- Importance: differentiation of wild-type field strains vs. modified live vaccine strain
- Antigenically homogenous
- Differ in pathogenicity

Laryngotracheitis – Physical/Chemical Susceptibility

- Susceptible to heat
  - 100F (48 hours)
  - 155F (15min ?)
- Susceptible to many chemicals
  - Chloroform, ether, iodophors, cresols, lye
  - Hydrogen peroxide mist/fumigant (5%)

Laryngotracheitis – Pathogenesis

- Portal of entry
  - Upper respiratory/ocular
  - Ingestion → nasal epithelium
- Horizontal transmission
  - Aerosolization of virus
  - Birds, feed, water
  - Contaminated litter
  - Fomites (equipment, boots, clothes, tires)
  - Moves slowly through flock
- No vertical or egg transmission known

Laryngotracheitis – Pathogenesis

- Virus present in trachea for 6-10 days PI
  - Inflammation and necrosis (tracheal cores)
    - Necrotic cells, blood, inflammatory debris
  - High virus shed during infection
  - Leads to …
    - Death (asphyxiation)
    - Latent carriers
- Latent carriers
  - Trigeminal ganglion + tracheal epithelium
  - Persistent infection & intermittent shedding

Laryngotracheitis – Pathogenesis

- Spread to trigeminal ganglion 4-7 days PI
  - Found to be latent for up to 15 months
  - Stress may cause virus to recrudesce
    - Movement, reproduction, etc.
- Carriers in flock for 16 months
  - Tracheal swabs ~ 2%
  - Organ cultures ~ 50%

Laryngotracheitis – Pathogenesis

- Carrier chickens
  - Vaccinated flocks
  - Niche/independent flocks potentially
- Vaccinated breeder/layer/broiler flocks
  - Often incriminated as source of broiler outbreaks
  - High density breeder/production areas
- Spread can be controlled by biosecurity

Laryngotracheitis – Clinical Signs

- Acute respiratory disease
  - Conjunctivitis – almond eye (often first signs)
  - Nasal discharge
  - Moist rales, coughing, gasping
  - Dyspnea
  - Expectoration of blood (only in severe infections)
- Decreased production
  - Egg production 5-15%: no problems with shell quality
- Unthrifty birds
- Recovery in ~7-28 days (usually 10-14 days)
- Duration ~2-6 weeks in flock

Laryngotracheitis – Clinical Signs

- Incubation 6-12 days post infection (PI)
  - 2-4 days experimentally
- Severe
  - 90-100% morbidity
  - 5-70% mortality (usually 10-20%)
- Mild ('silent LT')
  - As low as 5% morbidity and 0.1% mortality
- Males slightly more susceptible

Infectious Laryngotracheitis – Gross Necropsy

- Conjunctivitis and sinusitis
  - Inflammation, hemorrhage, edema
  - In mild cases, may be only sign (inflammation)
- Laryngotracheitis
  - Mucus, hemorrhage
  - Diphtheritic changes (necrosis, blood, casts/plugs)
- Lungs and airsacs
  - Inflammation (uncommon)

Laryngotracheitis – Diagnosis

- Clinical signs only in severe cases are highly presumptive
  - Expectoration of blood
- Collect
  - **Trachea**
  - **Eyelid**
  - Lung

Laryngotracheitis – Diagnosis

- Histopathology
- Virus isolation
- Detection of LT antigens
- Detection of LT viral DNA
- Electron microscopy
- Serology

Laryngotracheitis – Histopathology

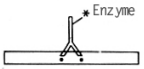
- H&E staining
- Very high specificity
  - Pathognomonic lesions (intranuclear inclusions)
- Low sensitivity (~57%)
  - Window of opportunity ~ 3-5 days PI

Laryngotracheitis – Histopathology

- **Type A intranuclear inclusions**
  - 3 day PI (only found for ~ 1-5 days)
- **Syncytia** (multi-nucleated giant cells)
- Epithelial edema, enlargement, and decilliation
- Inflammatory cells → mucosa
- Loss of goblet cells
- Separation of epithelial layers
  - Sloughing into lumen
  - Exposure of vessels/hemorrhage

Laryngotracheitis – Diagnosis

- Detection of LT antigens (immunohistochemistry)
  - Frozen or formalin fixed tissue
    - Paraffin embedded
  - Fluorescent antibody, immunoperoxidase (IP), ELISA
    - IP higher sensitivity (~ day 1-9 PI)



Laryngotracheitis – Differential Diagnosis

- Pox (diptheretic or wet)
- Other respiratory diseases
  - NDV, AI, IBV, fowl adenovirus, Aspergillus, etc.
- Vaccine induced vs. field strain

Laryngotracheitis – Prevention and Control (Management)

- **BIOSECURITY**
  - Bird to bird
    - Contact of naïve birds with latently infected or recently vaccinated
  - Feed/water
  - Contaminated litter
  - Fomites
    - Anything that has contacted infected/vaccinated birds
    - Boots, hands, clothes, equipment, vehicles
    - People, rodents, wild birds, and dogs may mechanically carry LT

Laryngotracheitis – Prevention and Control (Management)

- **BIOSECURITY**
  - Niche/fancier flocks
    - Know and take precautions
  - Between flocks
    - Pile litter & heat (100F @ 2 day minimum)
      - Lack of piling may make reaching 100F difficult
    - C&D
    - Follow quarantine (all personnel)

Laryngotracheitis – Prevention and Control (Management)

- Reporting and quarantine
  - Reportable in NC
  - Rapid reporting = decreased spread
    - Minimization of vaccines
  - Moved to processing in NC ASAP under quarantine
    - Hold in house?
- Rapid diagnosis
- Consider vaccination program installation

Laryngotracheitis – Immunity

- Active immunity
  - Local immunity is the way to protect
    - IgA in trachea ~ 7 days PI (peak 10-28 days)
  - VN antibodies start 5-7 days PI (peak 21 days)
    - Titers do not always correlate with protection
  - Cell Mediated Immunity (unknown)
- Maternal immunity
  - Does not prevent infection
  - Does not interfere with vaccination

LT Prevention – Modified Live Vaccination (MLV)

- Chicken embryo origin (CEO)
  - Passage in embryos
  - More potent vaccines
    - More severe reactions
    - Higher risk of reversion to virulence
- Tissue culture origin (TCO)
  - Passage in tissue culture
    - Virus less adapted to birds
  - Less potent vaccine
    - Less reactions
    - Much lower risk of reversion to virulence
  - More dose specific

LT Prevention – MLV (Risks)

- Can create carrier birds
  - Recommended only in endemic areas
  - In NC, must have permission from state officials
- May spread to unvaccinated flocks
  - Poor biosecurity
- Can revert to virulence
  - As little as 10 passages (CEO)
    - Same virulence as highly virulent field strains
    - Vaccine outbreaks (1-4 weeks post-vaccination)
    - Especially with poor vaccination uniformity

LT Prevention – MLV (Doses/Use)

- 10^2 dose minimum eyedrop
- ~ 10^5 dose drinking water
  - Lower doses may have less uniformity of vaccination
- Follow manufacturer instructions
  - Storage
  - Resuspension
  - Dilution – dose

LT Prevention – MLV (Doses/Use)

- Contact representative from vaccine company
- Sometimes dose is cut
  - Cost, availability, minimize reactions
  - **NOT RECOMMENDED**
    - Potential problems with uniform protection
    - May enhance rolling reaction
    - May not protect from challenge

LT Prevention – MLV (Application Routes)

- Eyedrop
  - Most effective route (highest protection rate)
  - Safety
    - Decreased chance rolling reaction
    - Less chance reversion to virulence
- Mass application (water/spray)
  - Not nearly as effective
  - High risk of rolling reactions/technique failure

LT Prevention – MLV Spray Vaccination

- **USE AS PER LABEL**
- Early uniformity issues (~15-20% protection)
  - Not enough volume water
  - Too fast pass through house
  - Corners
  - Fans not turned off
- Too small droplet – deep penetration of vaccine
- Too high dose – severe reactions

LT Prevention – MLV Drinking Water Vaccination

- **USE AS PER LABEL**
- Low protection rate (~20-75%)
  - Depending on dose
  - Depending on technique
  - Requiring oral-nasal passage
- Requires removal of all meds, sanitizers, etc from line
  - ~3 days

LT Prevention – MLV Drinking Water Vaccination

- Empty, raise, and clean waterers
- Withhold water 2-4 hours (based on temp)
- Mix and use vaccine per label (short time)
  - Run lines until vaccine present/blue stabilizer
- Make sure birds are drinking
  - Walk house
  - Blue tongue

LT Prevention – MLV (Vaccine Program)

- Broiler vaccination 2-4 wks of age
  - Frequently given in drinking water
  - May be as early as 10-12 days in hot spot
  - Partial protection 3-4 days; full 6-8 days
    - Based on good uniformity of vaccination
  - Immunity to 8-15 wks post vaccination
- Breeders: (re)vaccinate at 10-12 wks of age
  - Eyedrop
- Layer vaccination ~ 7 & 15 weeks of age
- Vaccinate at end of week?
- **Wait wk before/after for NDV/IBV vaccination???**

LT Prevention – Other Vaccines

- Inactivated vaccines
  - High cost and labor
- Recombinant vaccines
  - Virus vectored products (pox/HVT)
    - ILT glycoprotein expressed during replication
    - Wing web administration
    - May greatly facilitate future eradication
      - Absence of carrier state
  - Marker genes
  - Deletion of virulence factors

Laryngotracheitis

- Treatment
  - None
    - Eradication
  - Can vaccinate in face of infection
    - Unaffected birds
      - Protection before exposure
    - Eyedrop administration recommended

Laryngotracheitis – Eradication

- High host specificity of virus
  - Most likely reservoir is broiler breeder/layer flocks
  - Reservoir niche/fancier flocks possible
  - Fragile/enveloped virus
- Does not survive well outside of host
- Antigenically homogenous
  - Good cross protection among strains

Laryngotracheitis – Eradication

- Report immediately and quarantine
  - Lock down farm
  - Service person out of commission
    - Service farms last
- Early slaughter
  - Recommended 2 weeks post-recovery
  - Regulated route
  - Timing
    - Last shift of the week

Laryngotracheitis – Eradication

- Good biosecurity
  - C&D
  - **Extended down time!!!**
    - 4-6 weeks recommended
- Inform all company personnel
  - **Not just what to do but why (risk)**
    - Compliance issues otherwise
- Vaccinate related/adjacent flocks
  - Good biosecurity!!!
  - Appropriate technique and dose!!!