Respiratory Diseases of Poultry

- **Acknowledgements:**
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Note: chickens = chooks

- Disclaimer
  - Disease strains and vaccination protocols may differ significantly between Australia and USA

Anatomic Features

- Turbinates – 3
- Paranasal sinuses – infraorbital sinus covered laterally by skin flap – not bone – sinusitis may be mistaken for subcutaneous abscess
- Palatine cleft – where nasal passages open into oral cavity
- Many species differences
- Trachea – tracheal rings can overlap
  - Syrinx at bifurcation – tympanic membrane
  - In emus, slit at base of trachea opens into subcutaneous pouch
- Subcutaneous air pouches in some e.g. pelican
- Lungs
- Air sacs - 8
- Pneumatic bones

Conjunctivitis/Rhinitis

- Clinical signs
  - Exudate
  - Photophobia
  - Closure of eye
- Causes
  - Traumatic
  - Toxic – ammonia
  - Infectious

Conjunctivitis/Rhinitis

- Infectious Causes
  - Infectious Bronchitis – respiratory form
    - Renal form most common in Australia currently
  - Infectious Laryngotracheitis (ILT)
  - "Wet" pox
  - Chlamydiosis – a zoonotic disease
  - Aspergillosis
  - Cryptosporidiosis – is this pathogenic?

Sinusitis

- Can lead to exophthalmia
- Differentiate from subcutaneous abscesses
- Specific diseases
  - Mycoplasmosis
  - Fowl coryza (*Avibacterium* sp)
  - Fowl cholera (Pasteurellosis)
  - TRT, SHS, Ornithobacterium – not in Australia
  - Vitamin A deficiency

Tracheitis

- Viruses
  - ILT – also with vaccine strain
  - Pigeon herpes virus disease
  - Newcastle Disease
  - Pox viruses
- Parasites
  - *Cryptosporidia* sp
  - Flukes, leeches, gapeworm (*Syngamus sp*), mites (*Strenostoma trachealotum)*

Diseases of the Lung

- Infectious
  - Septicemic diseases
    - Colibacillosis
    - Pasteurellosis
    - Salmonellosis
  - Mycoplasmosis
  - ILT
- Tumors – eg Marek's disease

Airsacculitis

- Often no clinical signs
- Chlamydiosis
- Mycoplasmosis
- Mycosis

Respiratory Diseases of Poultry

- Viral
  - Avian Influenza (Fowl Plague, HPAI) – orthomyxovirus – see separate AAHL presentation
  - Newcastle Disease – rubulavirus, subfamily paramyxoviriniae, family paramyxoviridae
  - Infectious Laryngotracheitis – herpes virus
  - Infectious Bronchitis Virus – coronavirus
  - Avian Pneumovirus - paramyxovirus – not in Australia

Respiratory Diseases of Poultry

- Bacterial
  - Fowl Cholera - *Pasteurella multocida*
  - Mycoplasmosis
  - Chlamydiosis
  - Infectious Coryza – *Avibacterium* sp
  - Turkey Coryza - *Bordetella avium* - not in Australia
- Fungal
  - Aspergillosis

Newcastle Disease (ND)

- Highly contagious disease of chickens, turkeys, & various other bird species
- Causative agent is a rubulavirus, subfamily paramyxoviriniae, family paramyxoviridae
- Clinical signs – dependent on strain – respiratory, neurologic, viscerotropic
- 1971 – an outbreak in California resulted in the slaughter of 12 million birds ($56 million)
- In NSW, outbreaks of neurotropic strain

Newcastle Disease (ND)

- Traditionally, 3 pathotypes of ND virus
  - Lentogenic – mildly pathogenic
  - Mesogenic – moderately pathogenic
  - Velogenic – highly pathogenic

Newcastle Disease (ND)

- Transmission
  - inhalation or ingestion of contaminated particles
  - fomites (contaminated shoes, equipment, etc.)
- Most species of birds (domestic & wild) susceptible
  - chickens - most susceptible poultry species
  - ducks & geese - least susceptible poultry species

Newcastle Disease (ND)

- carrier state in psittacine and wild birds
- live mesogenic or lentogenic virus vaccines may induce clinical disease and mortality
  - referred to as "hard reaction"
  - chickens may shed vaccine virus
- major source of velogenic ND in U.S. is imported &/or smuggled cage birds and fighting cocks

Newcastle Disease (ND)

- Clinical signs
  - vary markedly with pathogenic type of virus
  - lentogenic - most common form used in vaccines
    - young birds
      - mild respiratory disease
      - subclinical enteric infections
    - adults
      - usually subclinical

Newcastle Disease (ND)

- Clinical signs, cont.
  - Mesogenic
    - young
      - marked depression & prostration
      - marked respiratory disease (gasping, coughing, nasal discharge)
      - +/- CNS signs (abnormal head/neck positions)
      - paralysis with trampling by pen-mates
    - adults
      - sudden onset of mild depression & anorexia
      - mild respiratory disease
      - abrupt and almost complete cessation of laying

Newcastle Disease (ND)

- Velogenic (similar to HPAI)
  - viscerotropic velogenic ND (VVND) - gut hemorrhages
  - neurotropic velogenic ND (NVND) - nervous signs
  - young and adults
    - Rapid onset with high mortality
    - Respiratory disease (gasping, coughing)
    - Nervous signs (paralysis, torticollis, opisthotonus)
    - Edema of face (periocular) and neck (paratracheal)
  - ***mortality may reach 100% in susceptible birds***

Newcastle Disease (ND)

- Viscerotropic velogenic (VVND) in psittacines
  - respiratory disease
    - wheezing / sneezing
    - depression
    - head shaking
  - neurologic disease
    - leg paralysis
    - wing droop
  - ***infected (yet clinically normal) birds may shed virus actively***

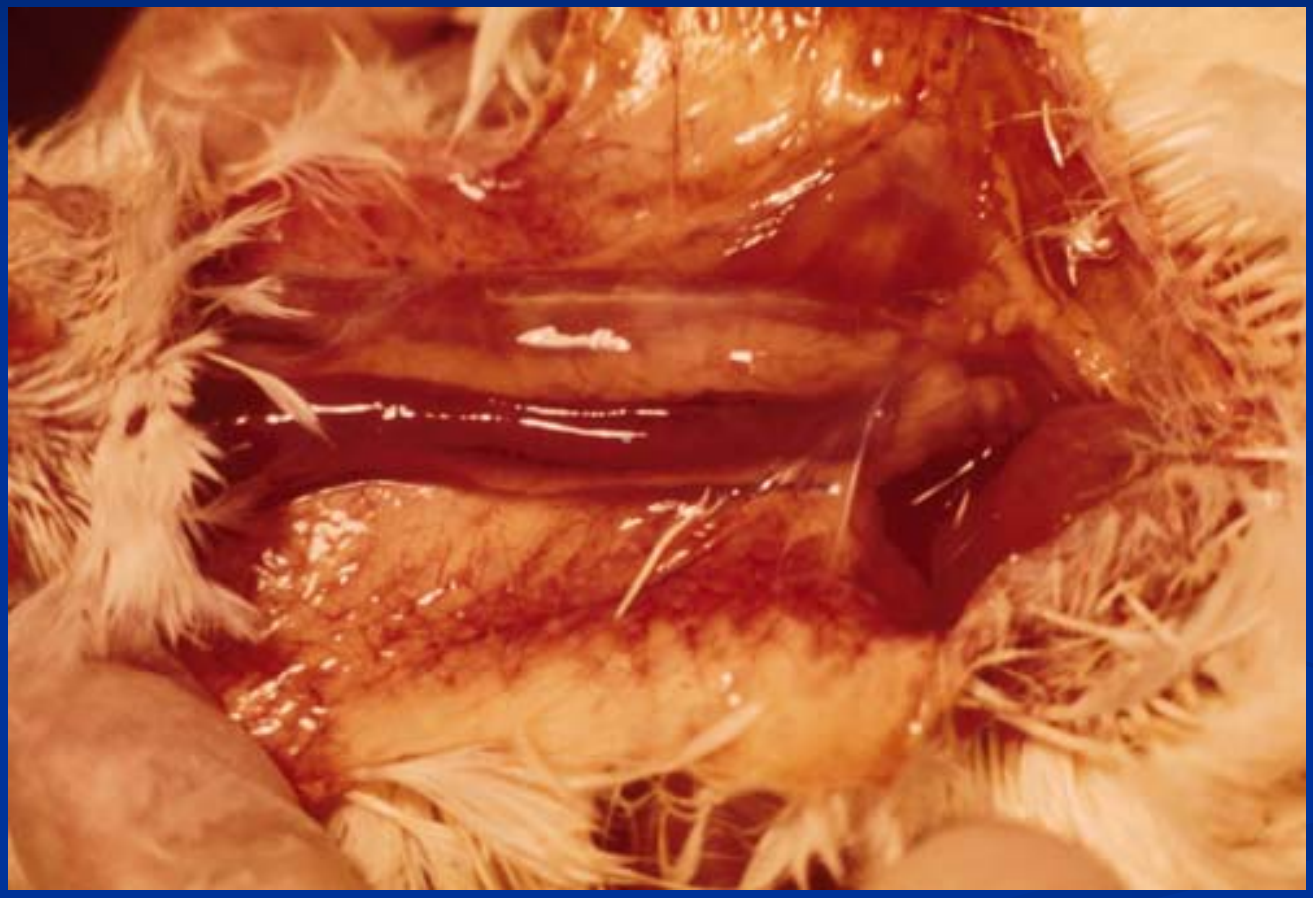
Newcastle Disease (ND)

- Lesions:
  - Lentogenic – mild conjunctivitis, air sacculitis
  - Mesogenic – moderate/marked conjunctivitis and air sacculitis
  - Viscerotropic velogenic
    - *No pathognomonic lesions*
    - hemorrhages in mucosa of proventriculus and ventriculus, GALT, cecal tonsils, & cloaca
    - edema
      - periocular & paratracheal

Newcastle Disease (ND)

periocular edema

Newcastle Disease (ND)

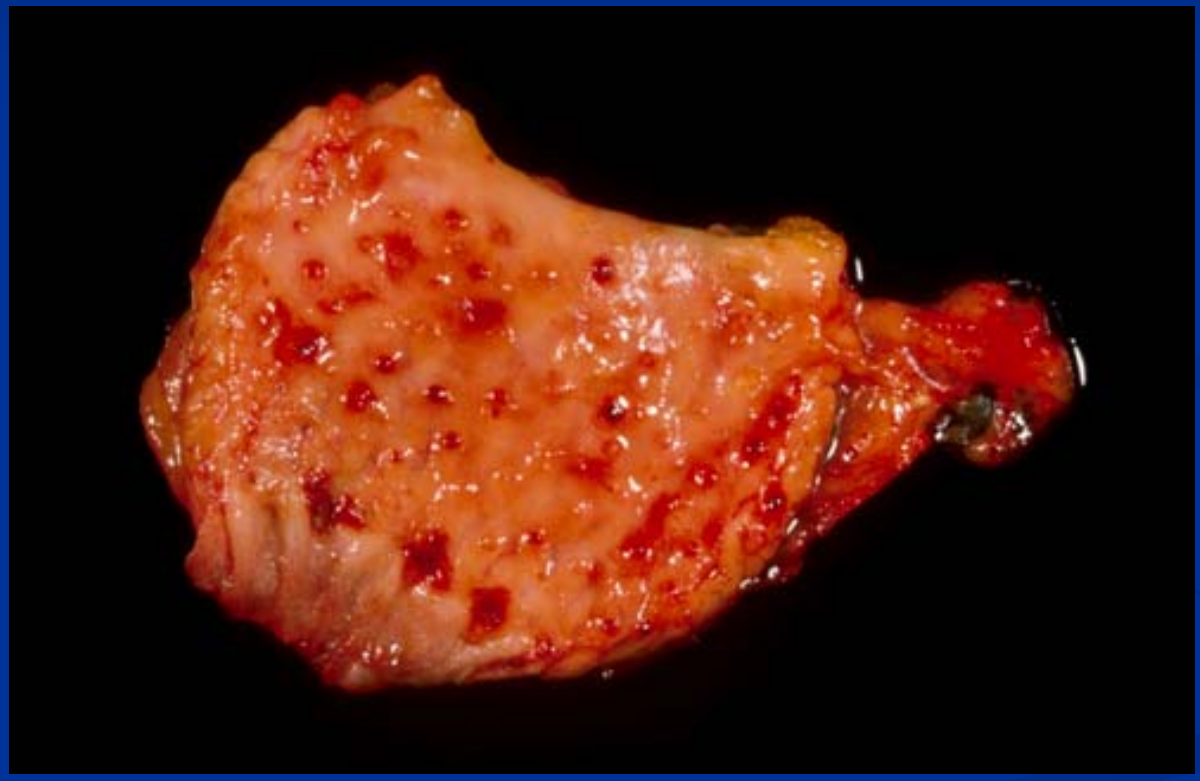


paratracheal edema

Newcastle Disease (ND)

proventricular hemorrhage

Newcastle Disease (ND)



proventricular hemorrhage

Newcastle Disease (ND)

hemorrhagic cecal tonsils & GALT

Newcastle Disease (ND)

hemorrhage, necrosis & pseudomembrane formation in cloaca

Newcastle Disease (ND)

- Diagnosis:
  - Serology
  - Fluorescent antibody
  - Virus isolation
  - PCR
- Differentials include Avian Influenza

Newcastle Disease (ND)

- Velogenic strains
  - Zoonotic potential – conjunctivitis in man
- Exotic Newcastle disease in California - 2002
  - backyard game fowl flocks
  - >4 million birds culled, $160 million to control

Infectious Laryngotracheitis (ILT, LT)

- Classically - acute respiratory disease of chickens, pheasants, & peafowl - severe dyspnea (mouth breathing and "snicking"), gasping, and expectoration of bloody exudate
- Causative agent is herpesvirus, also vaccine strain
- Occurrence:
  - worldwide
  - chickens primary natural hosts
  - most outbreaks in mature/near mature chickens
  - viral replication limited to respiratory tissues

Infectious Laryngotracheitis (ILT)

- Transmission
  - primary via upper respiratory tract & ocular tissues
  - ingestion via exposure of nasal epithelium
  - fomites (mechanical transmission)
  - recovered & vaccinated chickens can shed virus for extended periods of time

Infectious Laryngotracheitis (ILT)

- Morbidity / mortality:
  - clinical signs 6 - 12 days after exposure
  - clinical disease in flock - 2-6 weeks
  - in epizootics
    - morbidity = 90-100%
    - mortality = 5-70% (average of 10-20%)

Infectious Laryngotracheitis (ILT)

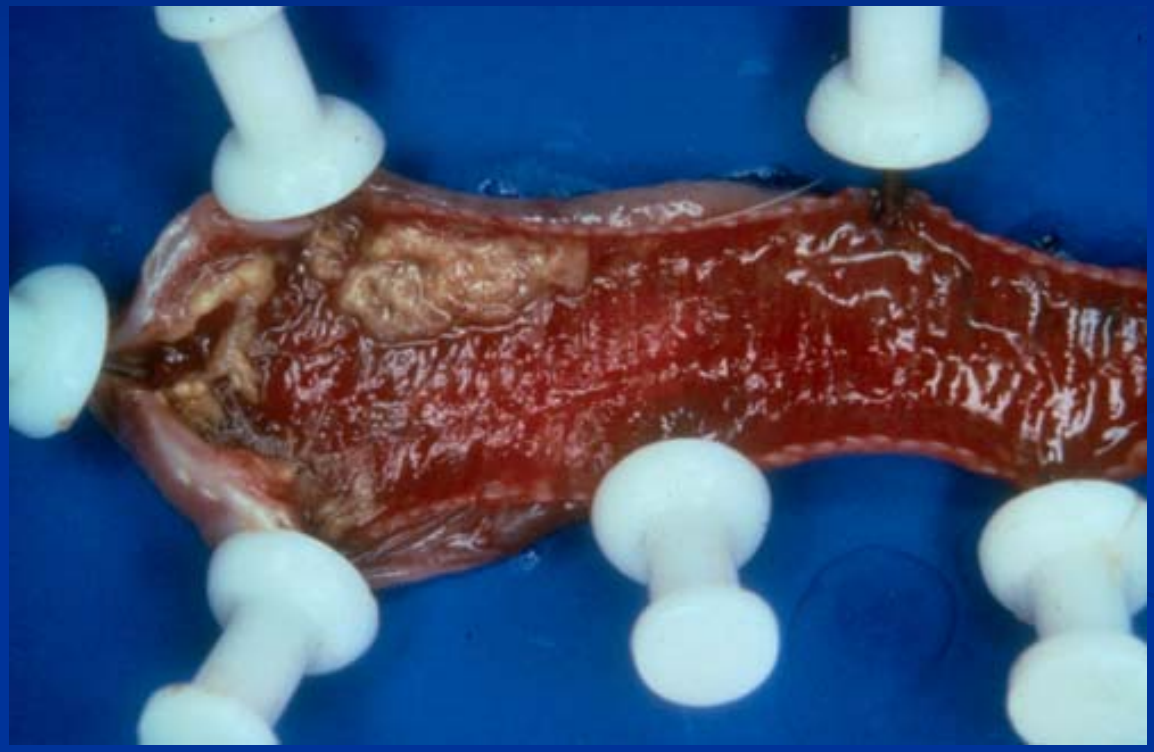
- Clinical signs:
  - Variable (depends on pathogenicity of strain)
  - Highly pathogenic
    - acute dyspnea, gasping
    - head shaking
    - expectoration of blood-stained mucus
  - Low pathogenic
    - None to conjunctivitis, lacrimation, nasal discharge, decreased egg production

Infectious Laryngotracheitis (ILT)

Infectious Laryngotracheitis (ILT)

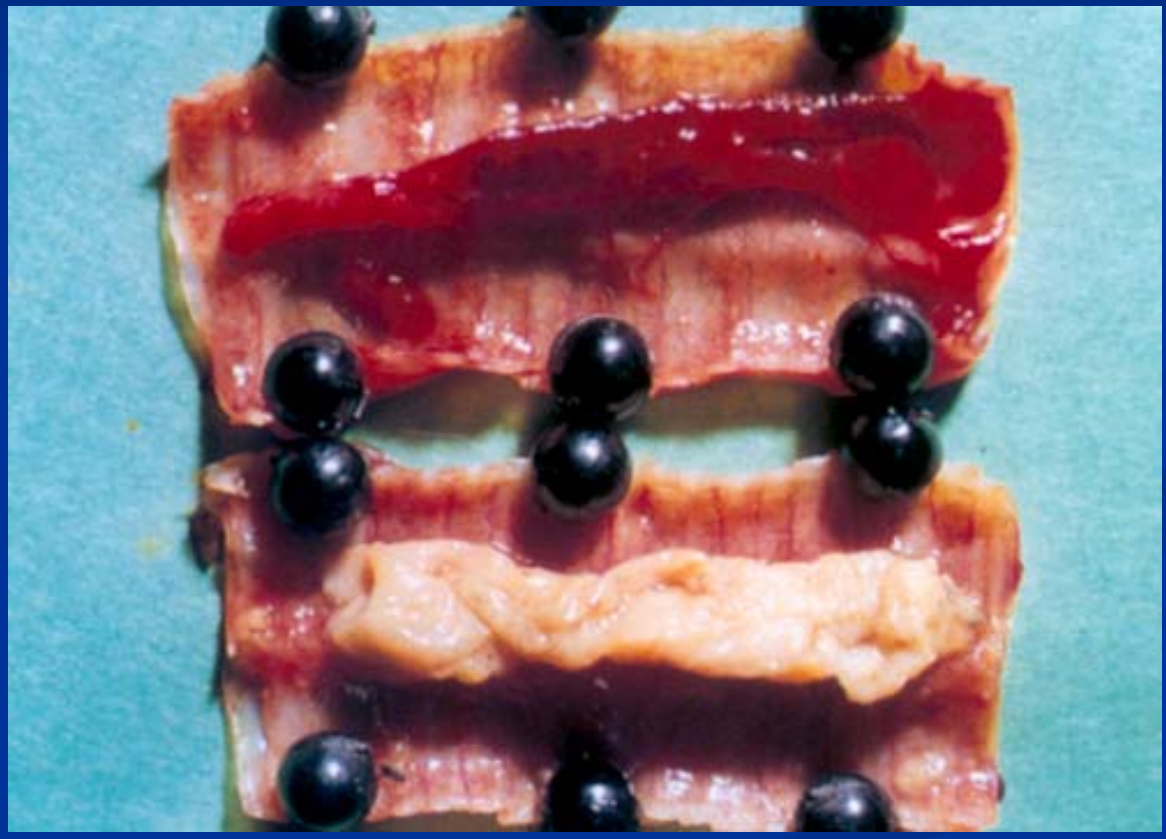
- Lesions:
  - Highly pathogenic
    - hemorrhage & necrosis of laryngeal and tracheal mucosa
    - **diphtheritic pseudomembrane in trachea** ("tracheal plugs")
  - Low pathogenic
    - None to conjunctivitis, infra-orbital sinusitis

Infectious Laryngotracheitis (ILT)



diphtheritic pseudomembrane in larynx & trachea, with tracheal hemorrhage and necrosis

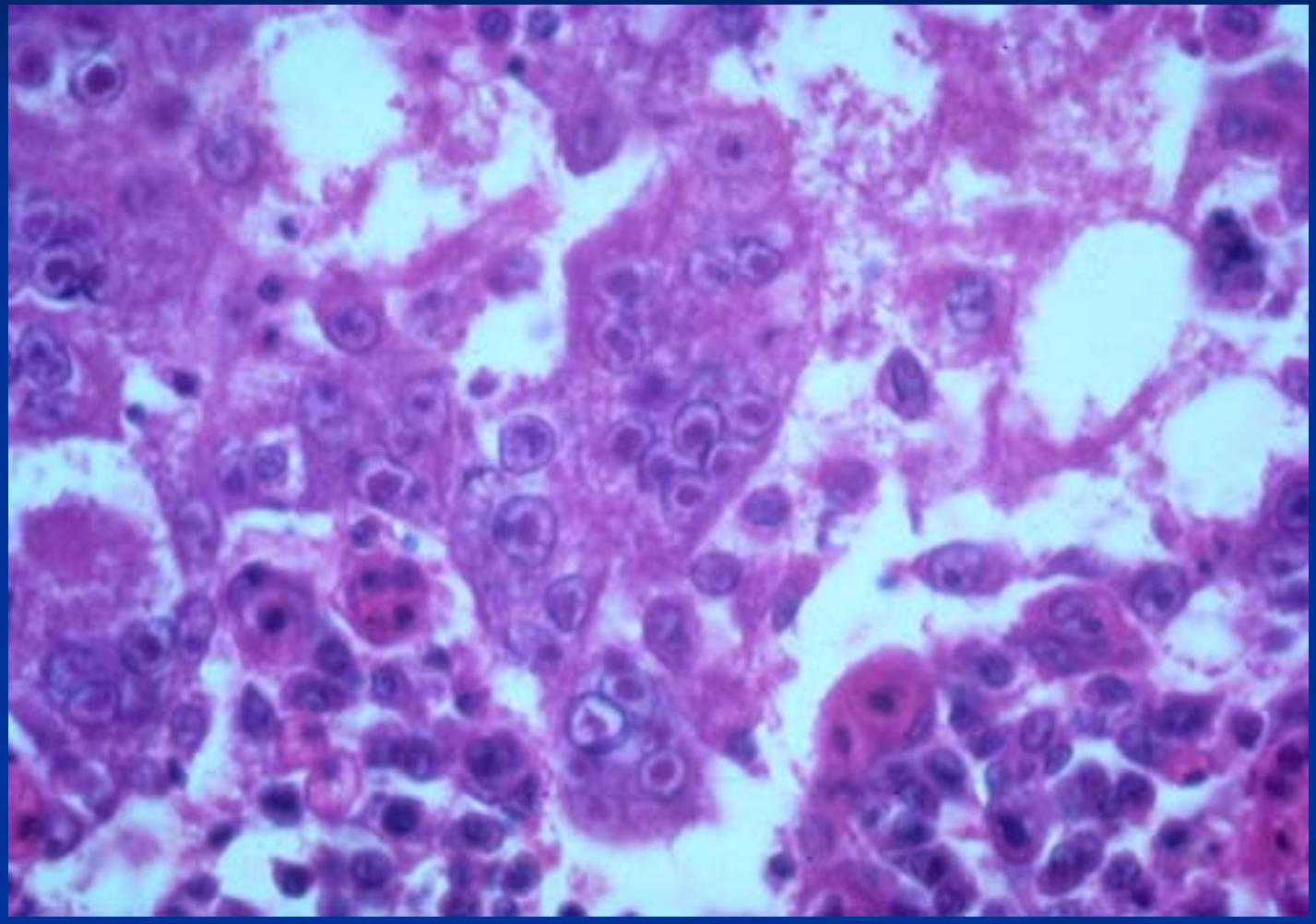
Infectious Laryngotracheitis (ILT)



Infectious Laryngotracheitis (ILT)

- Diagnosis
  - Histopathology – **necrotizing laryngotracheitis with syncytial cells & eosinophilic intranuclear inclusion bodies**
    - **Turbinates a good site for inclusion bodies**
  - Serology
  - FA
  - PCR
  - Virus isolation
- *In USA, ILT is reportable in many states*

Infectious Laryngotracheitis (ILT)



Infectious Bronchitis (IB, IBV)

- Acute, highly contagious respiratory disease of chickens
  - classically see infectious bronchitis in 6 wk old chicks
- Respiratory disease, **renal disease**, & decreased egg production
- Causative agent is coronavirus
- In Australia, renal form most common – uncommon disease due to vaccination

Infectious Bronchitis

- Pathogenicity
  - considerable variation among strains
  - replication in respiratory, intestinal, renal & reproductive tissues
- In Australia (J. Comp. Pathol. 2002)
  - 1960s to 1970s – mainly highly nephropathogenic, mortality 5-90%
  - 1980s to early 1990s – mainly respiratory – no kidney lesions and no mortality.
  - Mixed pathogenicity strains – tracheitis, mild nephritis, no mortality
  - Now nephrogenic strains

Infectious Bronchitis

- Transmission
  - primary route via aerosol (inhalation of viral particles from infected, coughing chickens)
    - airborne virus may spread over a distance of 1 km
  - recovered birds may be carriers and shed virus for months
- Secondary *E. coli* infection may be present

Infectious Bronchitis

- Clinical signs
  - chicks
    - gasping, coughing, sneezing, oculonasal discharge
    - mortality usually low unless complicated by other agents
    - nephrotropic strains may cause high mortality

Infectious Bronchitis

- Clinical signs, cont.
  - broilers/layers
    - coughing, sneezing, rales (rarely see oculonasal discharge)
    - marked decrease in egg production - eggs may be misshapen or soft-shelled
    - increased mortality (associated with urolithiasis from nephrotropic strains)

Infectious Bronchitis

Infectious Bronchitis

Misshapen eggs from IBV infected hens

Infectious Bronchitis

- Lesions
  - serous or catarrhal exudate in trachea, especially bifurcation
  - air sacculitis
  - pale & swollen **kidneys** with ureters distended with uric acid crystals (+/- urolithiasis)
  - fluid yolk material in abdominal cavity

Infectious Bronchitis

Infectious Bronchitis

- Histopathology
  - Trachea – mucosal edema, cilial loss, mild tracheitis and lymphoid hyperplasia (a common response to antigen stimulation)
  - Kidney – interstitial nephritis, vacuolation and desquamation of tubular epithelium , multifocal necrosis
- Diagnosis
  - virus isolation (trachea, cecal tonsils)
  - serology
  - PCR

Viral Respiratory Diseases

- Avian Pneumovirus – not in Australia
  - Paramyxovirus in genus Pneumovirus
  - Primarily a disease of turkeys
  - Also called
    - turkey rhinotracheitis - TRT
    - swollen head syndrome - SHS
    - avian rhinotracheitis -ART
  - Europe, Africa, Asia, USA (1996)
  - More severe disease often associated with secondary infection, especially swollen head

Bacterial Respiratory Diseases

- Fowl Cholera (FC)
  - infectious disease of domesticated and wild birds (particularly waterfowl)
  - causative agent is *Pasteurella multocida*
  - acute septicemia with high morbidity and mortality or respiratory disease
  - pathogenicity
    - virulence variable and complex
    - pathogenicity enhanced by lipopolysaccharide capsule/endotoxin

Fowl Cholera

- Incidence / distribution
  - occurs in most countries
  - more prevalent in late summer, fall, & winter
    - seasonal occurrence because birds are more susceptible as they reach maturity
    - bacterium is easily inactivated by sunlight, drying, or heat
  - recent outbreak near Camden (EMAI) in turkeys

Fowl Cholera

- Hosts
  - turkeys more susceptible than chickens
  - mature chickens (laying flocks) > juveniles
  - week old poults resistant to effects of LPS
  - domestic ducks & geese highly susceptible
  - may affect other avian species (raptors & birds in collections)

Fowl Cholera

- Transmission
  - usual route - mucous membranes of pharynx & URT
  - major source - chronically-infected birds
    - including free-flying, wild birds
  - fomites (contaminated shoes, cages, etc.)

Fowl Cholera

- Clinical signs:
  - Acute disease (may only be present 1-2 hours)
    - mostly abrupt increase in mortality ("sudden deaths")
    - fever, anorexia, ruffled feathers, oral mucous discharge, tachypnea, cyanosis
  - Chronic disease - esp with low virulence types
    - wattles, sinuses, joints, foot pads - swollen with purulent exudate
    - URT—croup, tracheal rales, dyspnea
    - torticollis if middle ear & skull affected (osteomyelitis)

Fowl Cholera

wattles distended
with exudate

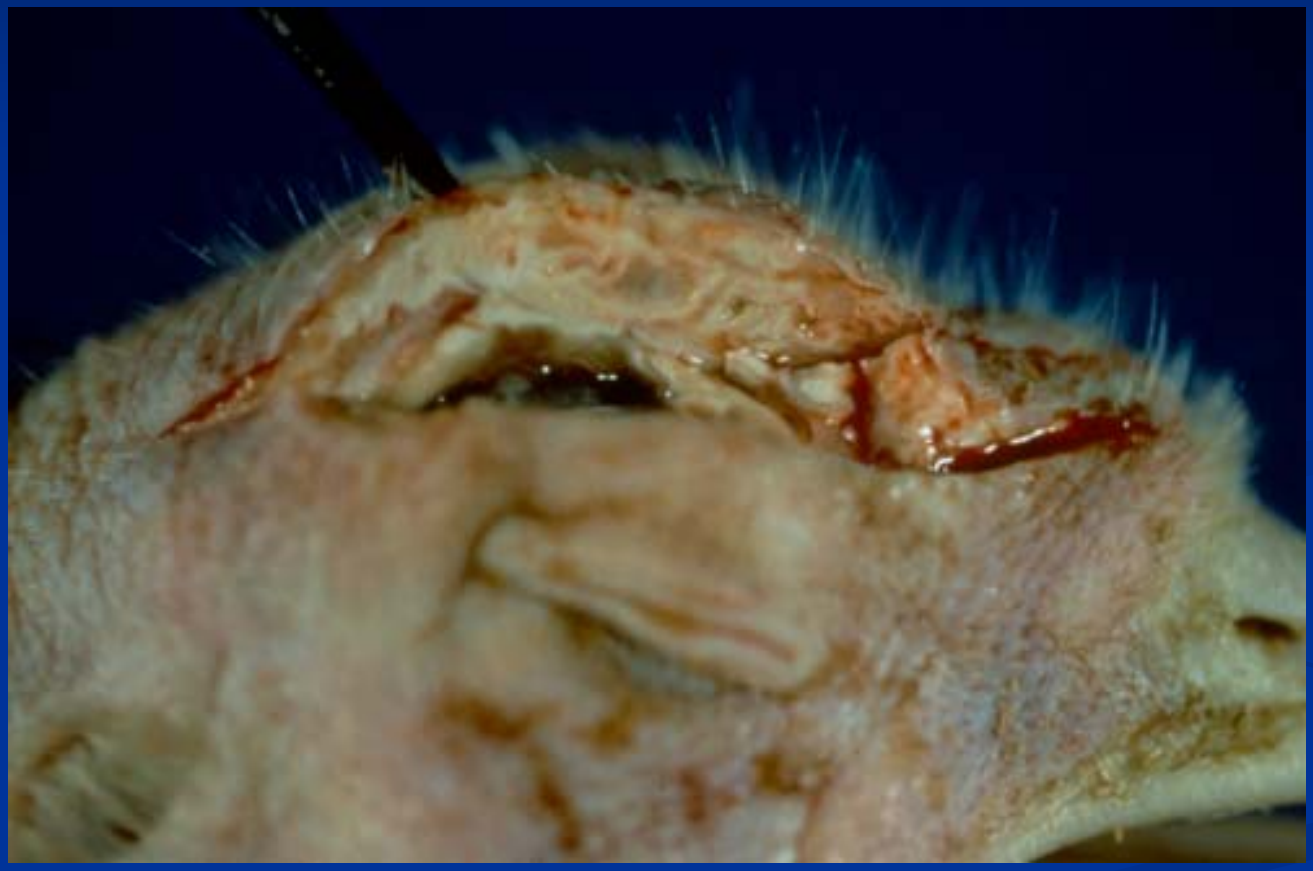
Fowl Cholera

torticollis

Fowl Cholera

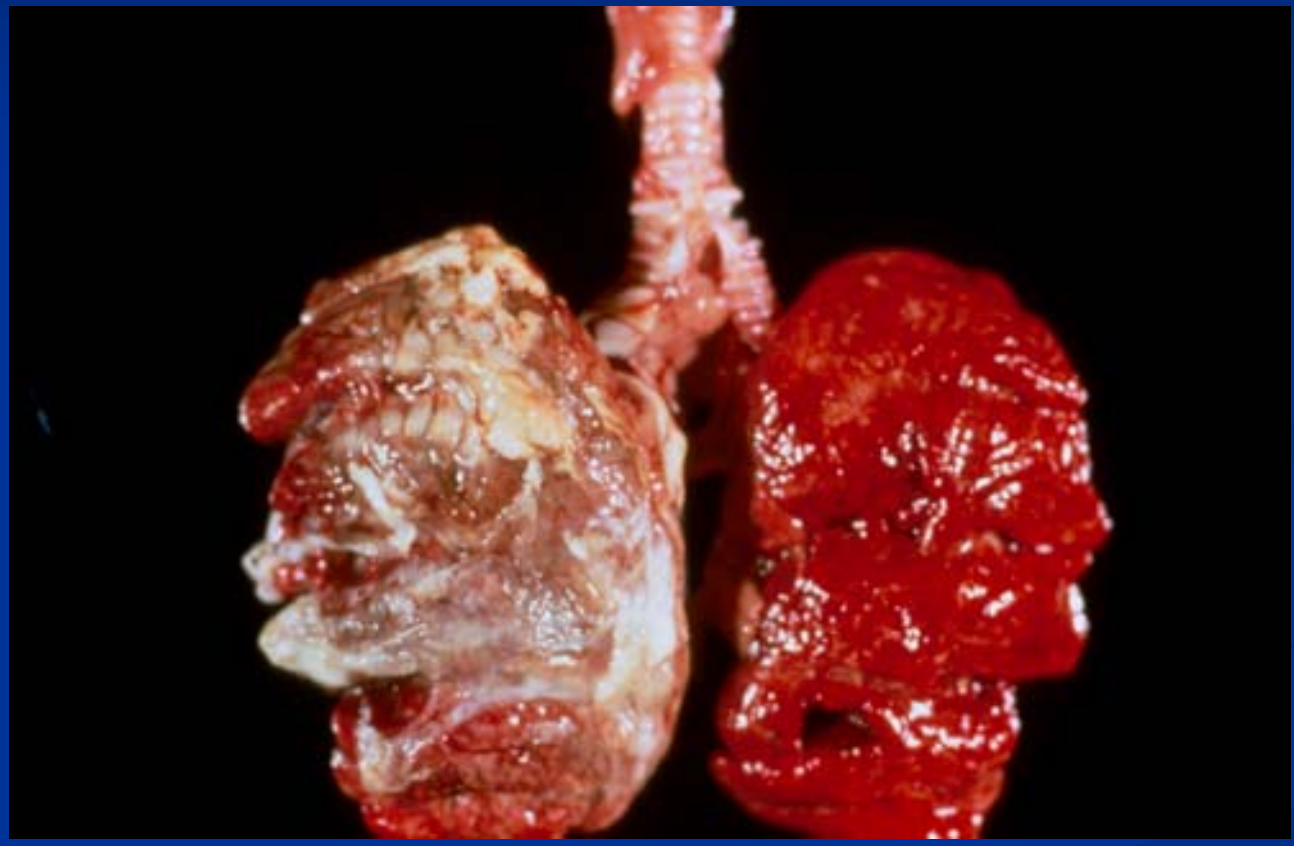
- Gross lesions:
  - acute disease
    - epicardial hemorrhages
    - **hepatomegaly** (+/- miliary necrotic foci)
    - fibrinous pleuropneumonia (especially in turkeys)
      - *often unilateral*
    - may see only a fibrinous serositis/peritonitis
  - chronic disease
    - osteomyelitis
    - purulent dermatitis, air sacculitis, polyarthritis

Fowl Cholera



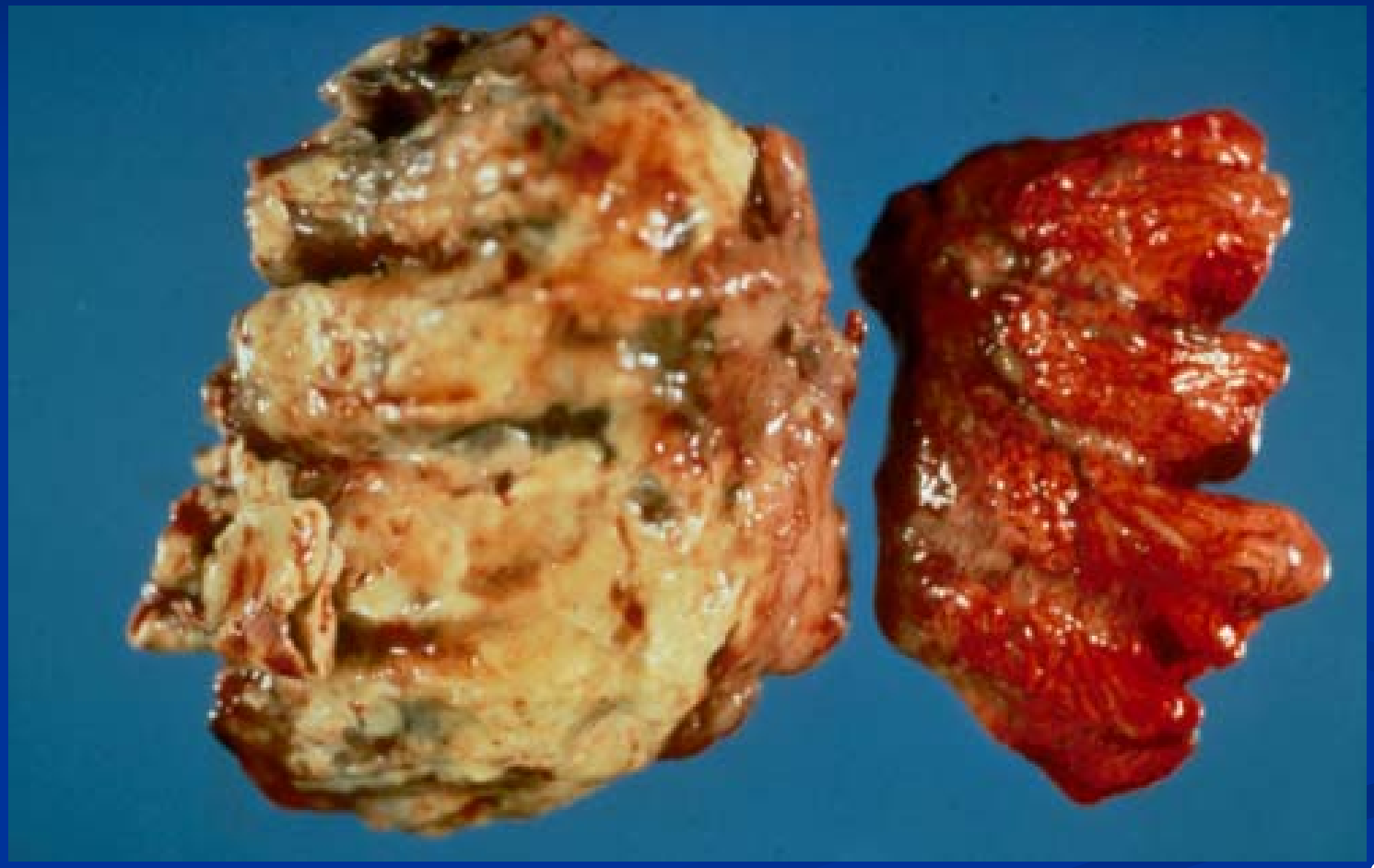
purulent exudate in subcutaneous tissues of head, comb, & wattles

Fowl Cholera

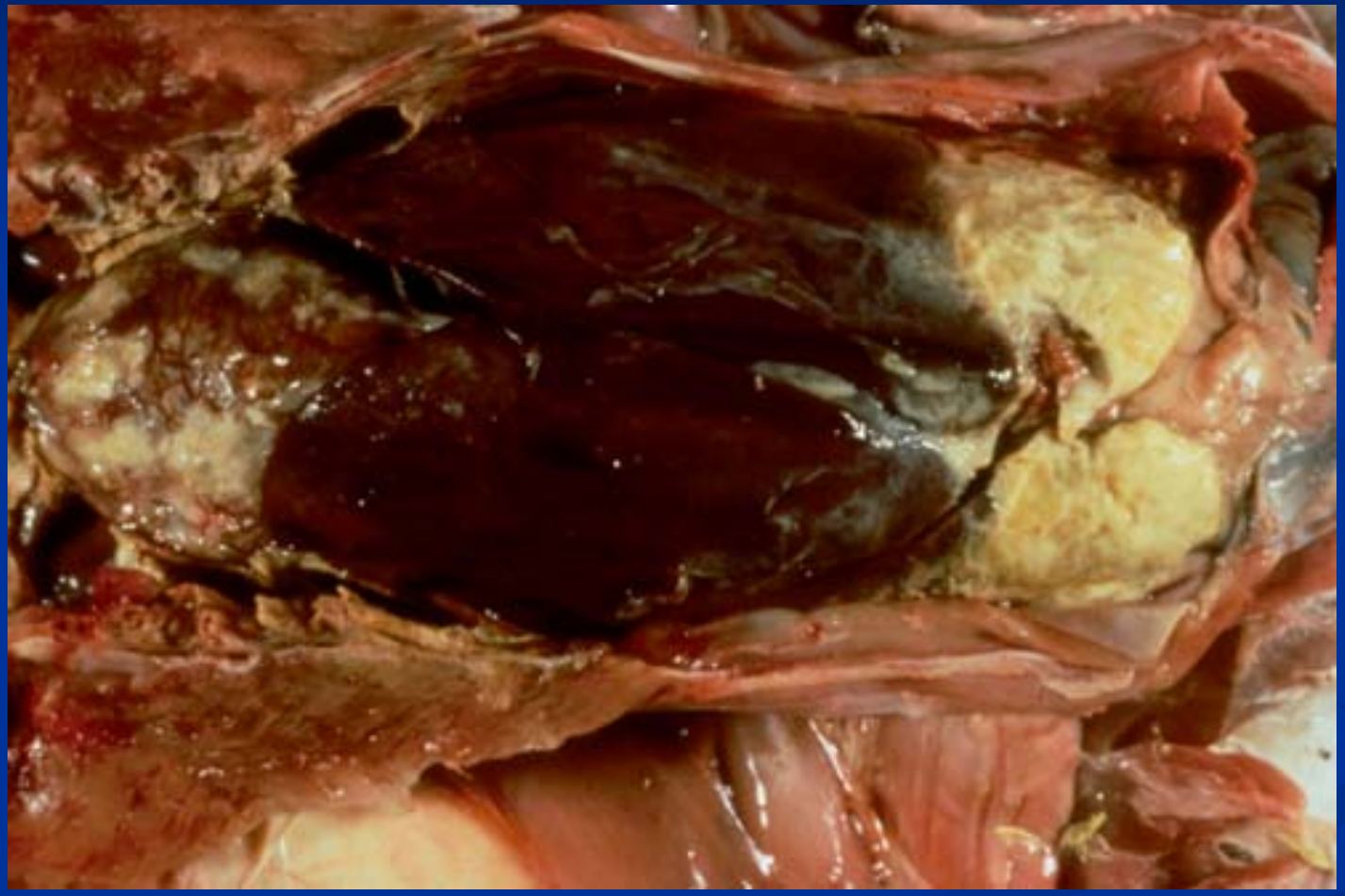


unilateral
fibrinous
pleuropneumonia

Fowl Cholera



Fowl Cholera

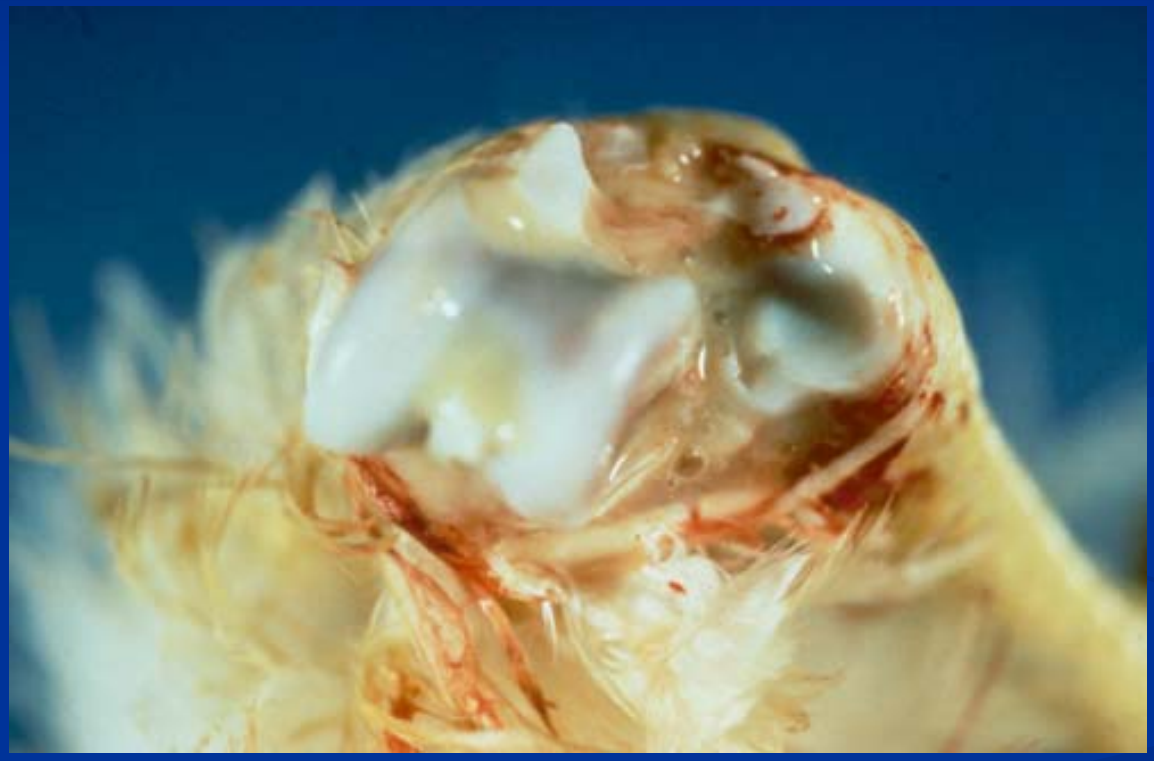


pericarditis
hepatomegaly
air sacculitis

Fowl Cholera

hepatomegaly with multifocal necrosis

Fowl Cholera



purulent
polyarthritis

Fowl Cholera

purulent
tenosynovitis

Fowl Cholera

- Diagnosis
  - Smear – stain with Giemsa
  - Culture
    - *always suspect in epizootic losses in waterfowl (domesticated or wild)*
  - Differentials for acute disease– viruses discussed above, including AI
    - waterfowl, turkeys - *Riemerella anatipestifer*
    - multiple species - *Ornithobacterium rhinotracheale* (not in Australia)
    - both G -ve rods

Mycoplasma gallisepticum (MG)

- MG primarily in turkeys > chickens
  - Turkeys - "infectious sinusitis"
  - Chickens - "chronic respiratory disease"
- Note - *M. meleagridis* only in turkeys
- Economic losses - air sacculitis leads to carcass loss
- Pathogenicity:
  - isolates vary widely in pathogenicity
  - turkeys more susceptible than chickens
  - lateral and vertical transmission

Mycoplasma gallisepticum (MG)

- Clinical signs:
  - Turkeys – infectious sinusitis
    - swelling of paranasal (infraorbital) sinuses – "bubble eye"
    - nasal discharge and foaming of eye secretions
    - tracheal rales, coughing, labored breathing
    - decreased egg production

Mycoplasma gallisepticum (MG)

Mycoplasma gallisepticum (MG)

- Clinical signs:
  - Chickens - chronic respiratory disease
    - tracheal rales, coughing, nasal discharge
    - weight loss
    - decreased egg production
    - *subclinical infections occur, with no clinical disease until birds are stressed*

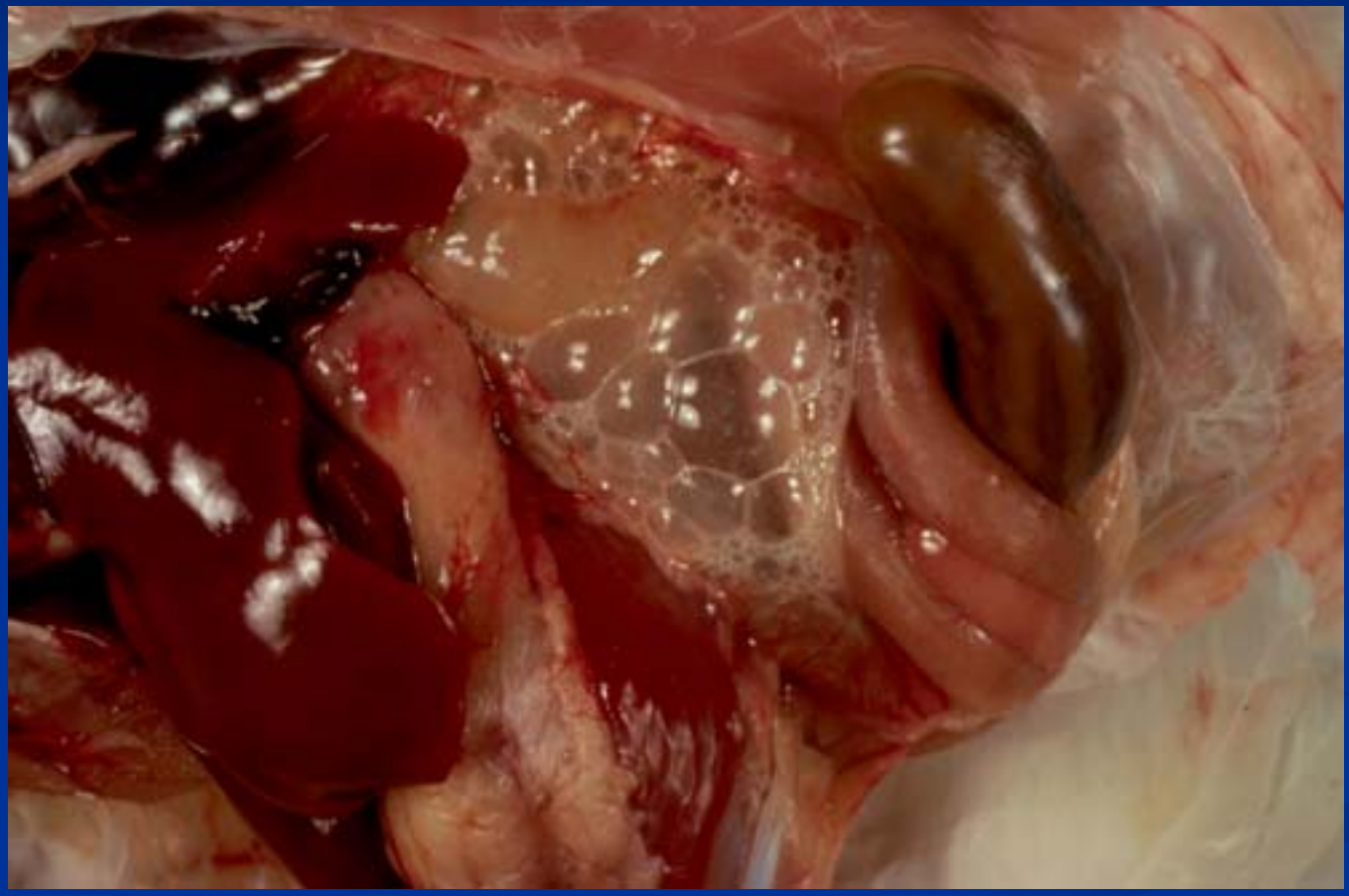
Mycoplasma gallisepticum (MG)

- Morbidity/mortality:
  - morbidity approaches 100% in turkeys and chickens
  - mortality in turkeys highly variable
  - mortality in chickens usually < 5%
  - complications by secondary bacteria (*E. coli*) may increase mortality

Mycoplasma gallisepticum (MG)

- Lesions:
  - Chickens & Turkeys
    - Chronic sinusitis, tracheitis, & air sacculitis
    - Lymphocytic infiltrates in airsacs and trachea
  - Turkeys – also may see
    - Fibrinopurulent hepatitis and pericarditis

Mycoplasma gallisepticum (MG)



air sacculitis

Mycoplasma gallisepticum (MG)

secondary *E. coli* infection

Mycoplasma gallisepticum (MG)

- Diagnosis:
  - serology (most common)
  - isolation of MG
  - PCR

- *MG is a reportable disease in commercial birds in most states*

Infectious Coryza (IC)

- acute respiratory disease of chickens NOT turkeys
- caused by *Avibacterium* (*Haemophilus paragallinarum*) *sp*
- worldwide distribution
- difficult to culture - most isolates of *Avibacterium sp* require V-factor (NAD/NADH) for growth
- high morbidity, low mortality

Infectious Coryza

- Transmission
  - inhalation of aerosols or ingestion of contaminated feed &/or water
  - carrier birds are main reservoirs
  - infections are most frequent in the fall & winter
  - disease less severe in juvenile birds
  - is not vertically (egg) transmitted

Infectious Coryza

- Clinical signs
  - facial swelling (especially periocular)
  - conjunctivitis
  - decreased egg production**
  - +/- diarrhea
  - chronic infections complicated by *E. coli*
  - poor growth**
- Pathology
  - Catarrhal bronchopneumonia
  - Airsacculitis

Infectious Coryza

Infectious Coryza

Infectious Coryza

Diagnosis:

- bacterial isolation - sinus swabs best
- PCR
- Serology-less reliable

- Multiple serovars makes vaccination difficult

Turkey Coryza (= Bordetellosis)

- NOT in Australia
- Abrupt onset of sneezing ("snicking"), oculonasal discharge, submandibular swelling, and tracheal collapse in young **turkeys (2-6 wks)**
- Causative agent is *Bordetella avium* *(G –ve)*
- Opportunistic pathogen in chickens

Chlamydiosis (Psittacosis, Ornithosis)

- Causative agent is *Chlamydophila psittaci* (formerly *Chlamydia psittaci*), an obligate intracellular bacteria
- Serotypes of *C. psittaci* naturally infecting birds are distinct from those that normally infect humans
- But - zoonotic potential – many reports – owners, handlers, veterinarians
- Worldwide distribution
- Poultry – turkeys, ducks, chickens
- Pigeons, budgies, cockatiels, parrots, macaws, etc

Chlamydiosis

- Transmission
  - primarily via aerosol & ingestion of contaminated materials (feed and water)
  - wild birds & pigeons are carriers
  - infected migratory birds (ducks, gulls, egrets) may excrete *C. psittaci* in feces

Chlamydiosis

- Pathogenicity
  - Virulence varies by strain
  - Psittacine birds, wild birds, and pigeons may be chronically infected with primarily one serotype of *C. psittaci*
    - under stress, birds may become clinically ill and shed organisms
  - In contrast, most outbreaks in turkeys are acute and explosive, involving entire flocks

Chlamydiosis

- Pathogenicity, cont.
  - 2 general categories
    - highly virulent strains
      - mortality of 1-30%
      - most common in turkeys
    - low virulent strains
  - variable morbidity (5-80%)
  - in pigeons, ducks, and some psittacine birds – accompanied by *Salmonella* infections

Chlamydiosis

- Clinical signs:
  - turkeys
    - anorexia, fever, nasal discharge, respiratory distress
    - *yellow-green diarrhea*
    - markedly decreased egg production
  - pigeons
    - unilateral or bilateral conjunctivitis
    - +/- watery diarrhea

Chlamydiosis

- Lesions:
  - Turkeys (highly virulent form)
    - Conjunctivitis, keratitis
    - Rhinintis
    - Pneumonia and fibrinous air sacculitis
    - Polyserositis - fibrinous exudate on lungs and heart
    - Hepatomegaly with fibrinous exudate
    - Splenomegaly
    - Diarrhoea

Chlamydiosis

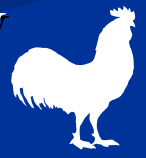
- Diagnosis:
  - ELISA (Antigen capture)
  - histopathology with special stains (Gimenez, Giemsa) or immunohistochemistry to see elementary bodies (can use conjunctiva)
  - serology
  - PCR
  - culture

Chlamydiosis

- Zoonosis:
  - "Compendium of Measures To Control Chlamydophila psittaci (formerly Chlamydia psittaci) Infection Among Humans (Psittacosis) and Pet Birds, 2002"
  - http://www.avma.org/pubhlth/psittacosis.asp

Fungal Respiratory Disease

- Aspergillosis:
  - mycotic disease of respiratory tract & air sacs
  - usual cause is *Aspergillus fumigatus* or *A. flavus*
  - also known as "brooder pneumonia"
  - fairly ubiquitous in nature (decaying matter, soil, feed grains) – source of infection
  - big problem in contaminated incubators, hatchers or brooders
  - was a big problem in emu and ostrich industry



Pulmonary Aspergillosis

- Occurrence:
  - 2 forms of aspergillosis in poultry
    - acute disease
      - high mobidity/mortality in young birds
      - mortality may approach 50-75% in poults
    - chronic disease
      - adults (especially breeder birds)
  - Also affects pet and wild birds

Pulmonary Aspergillosis

- Clinical signs
  - poults & chicks
    - dyspnea, gasping, cyanosis
    - +/- CNS signs, if spread to brain (torticollis)
    - ocular infections
      - conjunctivitis
      - uveitis/panophthalmitis

Pulmonary Aspergillosis

- Lesions - poults & chicks
  - Small, white nodules (1-2 mm) in lungs and/or air sacs
  - Mycelial growth with sporulation may appear as fuzzy plaques in air sacs
  - Granulomatous airsacullitis, pleuritis and pneumonia
- Diagnosis
  - Lesions are highly suggestive of infection
  - Cytology of nodules
  - Culture

Pulmonary Aspergillosis

- Parasites
  - Protozoa - cryptosporidiosis
  - Gapeworm (*Syngamus sp*)
  - Mites (*Strenostoma trachealotum*)
  - Flukes
  - Leeches
- Nutritional
  - Vitamin A Deficiency
    - Squamous cell metaplasia of upper respiratory tract, etc

Parasitic - Gapeworm

- *Syngamus trachea* – strongylid nematode
- Adults are red – in trachea
- Definitive host – several avian species
- Intermediate host – earthworm, snails, slugs, insects
- Larvae may migrate leading to hemorrhage and edema
- Pathology – catarrahal tracheitis with intralesional nematode