**AVIAN RESPIRATORY ANATOMY, PHYSIOLOGY AND DISEASE**

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1. Normal anatomy/physiology; vocabulary terms
2. Upper respiratory tract
   1. Cere
   2. Nares
   3. Operculum
   4. Birds have an incomplete hard palate with a median fissure
      1. Choanae (internal nares)
      2. Choanal slit
      3. Choanal papillae
      4. Infundibular cleft
   5. Birds have one paranasal sinus: infraorbital sinus (IOS)
   6. The IOS has diverticula
   7. The upper airway is relatively unprotected
      1. Glottis
      2. No epiglottis
3. Trachea
   1. Complete, overlapping rings
   2. Long and flexible
   3. Large diameter
   4. Syrinx: the site of vocal production
      1. Distal trachea
      2. Modified cartilages and muscles
   5. Bifurcates in primary bronchus, secondary bronchi and then parabronchi within lung
4. Lower respiratory tract
   1. The avian lungs are located dorsally, fixed in place
   2. The air capillary off atria of parabronchi; analogous to the alveolus
   3. The air sacs serve as bellows
5. Respiration
   1. Low respiratory rate and minimally visible is normal
   2. Two breath cycle: Inspiration > Expiration > Inspiration > Expiration
   3. Unidirectional air flow
   4. Cross current blood flow
   5. Gas exchange in parabronchi, atria and air capillary
      1. Best in air capillary
      2. Blood-gas barrier thinner
      3. Smaller diameter of air capillary
      4. Greater density of air capillary to alveoli
6. Clinical signs of respiratory disease; Five areas for diseases
   1. Upper respiratory disease (infection, allergy, foreign body, tumor)
      1. Open-mouthed breathing without dyspnea
      2. Nasal discharge
      3. Abnormal beak with chronic disease (groove, etc)
      4. Abnormal shape of naris
      5. Nasal plug
      6. Facial swelling
   2. Large airway disease (granuloma, foreign body, thyroid)
      1. History of voice change
      2. Exaggerated respiratory click
      3. Open-mouthed breathing
      4. Increased expiratory effort
      5. Wet, sterterous sounds
   3. Small airway disease (inhaled toxins, smoke, asthma)
      1. Open-mouthed breathing
      2. Wide-based stance, wings abducted
      3. Expiratory squeak
   4. Pulmonary parenchymal disease (lungs and air sacs)
      1. Nebulous signs; quiet, poor appetite, decreased activity
      2. Increased respiratory rate and effort
      3. Mild to moderate tail-bob
      4. Not usually open-mouthed breathing
   5. Coelomic disease (ascites, egg, mass)
      1. Loss of air sac volume
      2. Tachypnea
      3. Short, shallow respirations
7. Emergent treatment of respiratory disease
   1. Move to warm oxygen cage immediately; allow time to rest before treatment if possible
   2. During movement to oxygen cage; brief physical examination
      1. Palpate abdomen for mass, fluid
      2. Palpate keel for body condition
      3. Palpate crop for presence of food/liquid
      4. Assess hydration
   3. Treatment of upper respiratory disease
      1. Remove any nasal plugs
      2. Cytology of plug and discharge
      3. Nasal flush
      4. Topical and systemic treatments may be warranted
   4. Treatment of large airway disease
      1. Terbutaline 0.1mg/kg IM may help
      2. Air sac cannula may be needed
         1. Anesthetize bird if possible
         2. Place on right side, caudal to ribs, cranial to thigh, just below vertebrae
         3. Use tracheal tube or red rubber tube
         4. Suture into place with purse-string and finger knot
   5. Treatment of small airway disease
      1. Terbutaline 0.1mg/kg IM
      2. Diphenhydramine 1-2mg/kg IM
      3. Nebulize and ventilate with terbutaline for inhaled toxin
   6. Treatment of coelomic disease
      1. Remove fluid if present (cytology/culture)
      2. Keep quiet and avoid stress
      3. Remove egg if present
8. Diseases of the respiratory tract
   1. Nares, nasal cavity
      1. Foreign body
         1. Clear to mucopurulent discharge
         2. Remove with flushing
         3. Endoscopy or biopsy
      2. Rhinoliths or nasal granuloma
         1. Malnutrition, air quality, low humidity play roles
         2. Wheezing, sneezing, discharge
         3. Debride and remove material
         4. Submit for cytology/culture
         5. Topical and systemic treatment
      3. Rhinitis
         1. Infection, allergy, irritation
         2. Discharge reflects cause
         3. Environmental factors can play role: dust, low humidity, smoke, aromatic oils
         4. Bacteria include: *Klebsiella, Pseudomonas, E. coli, Enterobacter*, *Mycoplasma* (small birds), *Chlamydophila*.
         5. Aspergillosis in some species
         6. Culture, flush, systemic and topical treatment
      4. Infraorbital sinus
         1. Infection, hypovitaminosis A
         2. Caseous exudate difficult to remove
         3. Surgical debridement may be needed
   2. Trachea
      1. Tracheitis
         1. Bacteria; gram negative, *Staphylococcus, Streptococcus*
         2. Fungal; aspergillosis most common
         3. Viral; uncommon in pet birds
         4. Granulomas form at bifurcation
         5. Radiographs and endoscopy helpful for diagnosis and removal
      2. Foreign body
         1. Aspiration of small material
         2. Usually obstruct at level of bifurcation
         3. Visible radiographically or via endoscopy
         4. Removal with endoscopy or tracheotomy
      3. Other disease
         1. Bite wound and infection; cat, dog, bird
         2. Trauma during flight (wild birds)
         3. Thyroid mass
   3. Lungs and air sacs
      1. Neoplasia
         1. Uncommon
         2. Primary: adenoma, carcinoma, bronchial carcinoma
      2. Asthma
         1. Common in macaws
         2. History of environmental contaminants
         3. Quick response to terbutaline and diphenhydramine
      3. Infectious disease
         1. Bacteria typically gram negative
         2. Chlamydiophila will have other signs with air sacculitis
         3. Viral diseases less common in pet birds (pox, paramyxovirus)
         4. Parasitic infections in outdoor birds (*Sarcocystis, Syngamus, Sternosoma*)
      4. Aspiration pneumonia
         1. Caudal lungs and air sacs (radiographs)
         2. Food and fluid can cause
         3. History of hand-feeding, vomiting, etc
      5. Toxins
         1. Very sensitive due to physiology
         2. Smoke, CO, CO2, aromatic chemicals, teflon
         3. Acute onset pulmonary edema, hemorrhage
         4. Chronic pneumoconiosis can occur
   4. Coelomic disease
      1. Fluid accumulation
         1. Transudate: liver disease, hypoproteinemia, inflammation, neoplasia
         2. Exudate: egg-yolk peritonitis, infection, neoplasia
         3. Remove fluid for respiratory comfort and cytology
         4. Ultrasound helpful diagnostically
            1. Fluid in different compartments depending on cause