

Respiratory Disease in Snakes

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I. Incidence

- a. Lower respiratory tract disease is common in snakes
- b. Especially in larger species, such as boas and pythons

II. Anatomy & clinical applications

- a. Snake lungs are typically sac-like
- b. Lack a diaphragm
- c. Expulsion of respiratory secretions and exudates is functionally difficult

III. Predisposing factors

- a. Husbandry-related problems are the main cause of respiratory disease in captive snakes
 - i. Inappropriate temperatures (usually not warm enough)
 - ii. Humidity that is too high or too low
 - iii. Poor ventilation, especially with exposure to ammonia gases from urates/uric acid
- b. Infections or disorders of the oral cavity
 - i. Subsequent inhalation of mucus and infectious agents into the trachea and lungs
- c. Snakes used for breeding may be more susceptible to respiratory disease due to the temperature cycling used to initiate breeding activity and the stress of breeding itself.
- d. Other stressors that lead to immunosuppression

IV. Differential diagnoses

- a. Infectious agents
 - i. Bacteria
 - 1. Bacterial respiratory infections are not typically contagious from one snake to another. In most cases, the causative bacteria are opportunistic organisms
 - 2. Gram-negative bacteria
 - a. *Pseudomonas* spp. (and others in this same family), *Klebsiella* spp., *Proteus* spp., *Escherichia coli*, *Aeromonas hydrophila*, *Morganella morganii*, *Citrobacter freundii*, and *Pasteurella*.
 - b. Most common primary pathogens in respiratory disease in snakes
 - c. These organisms are part of normal flora but can become opportunistic with immunocompromise
 - d. *Salmonella*

- i. Often a commensal organism
 - ii. Often asymptomatic carriers.
 - iii. Many serotypes of *Salmonella* and *Arizona* have been cultured from the respiratory tract of snakes
 - iv. Often isolated with other potential pathogens
 - v. Treatment is controversial
 - vi. Zoonotic potential with some serotypes
- 3. Anaerobic bacteria are also commonly isolated
 - a. *Clostridium*, *Bacteroides*, *Fusobacterium*, *Propionibacterium*, and *Peptostreptococcus*
 - b. Usually present in conjunction with Gram-neg organisms
- 4. Gram-positive bacteria
 - a. *Streptococcus* spp., *Staphylococcus* spp., and *Corynebacterium*
 - b. Often part of the normal flora, but under the right conditions may become opportunistic
 - c. May occasionally be a primary pathogen, but more commonly, they are present in conjunction with Gram-neg organisms
- 5. Some special forms of bacterial respiratory disease may be more likely to be contagious
 - a. Several species of *Chlamydia* have been identified in association with lower respiratory tract of boas and pythons
 - b. Mycobacteria are occasionally found to be primary pathogens in lower respiratory disease in snakes
 - c. Mycoplasma identified as the causative agent in a case of proliferative tracheitis and chronic lower respiratory disease in a Burmese python.
- ii. Viruses
 - 1. Paramyxoviruses (ferlaviruses)
 - a. Causes disease restricted to the lower respiratory tract
 - b. Has been associated with respiratory outbreaks in collections of venomous snakes (elapids and rattlesnakes)
 - c. Occasionally identified as the causative agent causing respiratory disease in boids and colubrids (usually when kept in a mixed collection with venomous snakes).
 - 2. Serpentovirus (nidovirus)
 - a. Causes a proliferative pneumonia but disease is not limited to the lower respiratory tract
 - i. Severe tracheitis
 - ii. Pharyngitis
 - iii. Esophagitis
 - iv. Physical exam findings: increased fluid and inflammation in the oral cavity and pharyngeal region
 - b. Important cause of respiratory disease in pythons
 - i. Ball pythons

- ii. *Morelia* python genus, including green tree pythons, carpet pythons, and Australian pygmy pythons
Antaresia
 - c. May rarely cause respiratory disease in colubrids and boas less commonly
- iii. Parasites
 - 1. Trematodes: indigo snakes, fish or amphibian-eating snakes
 - 2. Nematodes: *Rhabdias*, *Strongyloides*, *Entolema*, filariids
 - 3. Pentastomes: boids, indigo snakes (wild caught as need intermediate host)
 - 4. Protozoa: *Entamoeba invadens*, *Monocercomonas*
- iv. Fungi (rare)
- b. Neoplasia (rare)
 - i. Chondromas reported in the trachea of ball pythons
- c. Normal shedding cycle in snakes
 - i. When opaque, just before initiation of shedding, cephalic edema occurs
 - ii. Wheezing and stridor may be noted but will resolve after shedding
- d. [Abnormal shed](#)
 - i. Obstruction of nares/nostrils with retained shed may result in increased sounds, fluid, and open mouth breathing.
- e. Defense “hissing” may be interpreted by the owner as respiratory disease
- f. Aspiration of...
 - i. Food material
 - ii. Substrate
 - iii. Vitamin/mineral powders

V. History and clinical signs

- a. The owner may note a change in the snake’s normal breathing pattern or increased noise with respiration, such as wheezing, gurgling, and/or popping sounds.
- b. Clinical signs associated with lower respiratory tract disease are often related to increased mucus and other secretions in the lungs, trachea, glottis, oral cavity, and nares
 - i. Pyogranulomatous response to bacterial invasion + snake’s inability to expectorate material > further obstruction of respiratory tract
 - ii. Nasal discharge and blockage of nares are often associated with open-mouth breathing
 - iii. Owners may also note a change in the snake's posture where the head is held in an elevated position with the neck stretched out to assist air movement

VI. Physical exam findings

- a. Decreased muscle mass and poor body condition
- b. Nares
 - i. Fluid or purulent material may be present within the nares or choanal region
 - ii. The nares may be blocked with discharge
 - iii. Patency can be checked by placing a drop of saline over the nares to see if it is inhaled into the nostril.
- c. Oral cavity

- i. May be pale or hyperemic
 - ii. There is often an increase in mucus and saliva with a “foamy” or “ropey” appearance
 - iii. In more advanced cases, mucopurulent discharge may be present in the choanal area, glottis, or trachea
- d. Respiration
 - i. Increased respiratory rate
 - ii. Respiratory distress (wheezing and stridor)
 - 1. It is important to discern if noise/stridor originates from the trachea and/or glottis or the nares, or both.
 - 2. Listen for these sounds with the mouth both closed and open (with the mouth open, the nares and upper respiratory system are no longer involved).
- e. Bloated appearance
 - i. Snakes may retain air in the lungs or air sacs due to an increase in fluid and mucopurulent material.

VII. Diagnostics

- a. Culture and sensitivity/PCR sampling
 - i. Sampling the trachea or the rim of the glottis has been shown to be diagnostic
 - ii. Swabs of the oral cavity or choanal area are not likely to be diagnostic for lower respiratory tract disease (except in the case of PCR testing for serpentovirus)
 - iii. When possible, submit anaerobic bacterial culture as mixed infections with aerobic and anaerobic bacteria are common
- b. Tracheal or lung wash
 - i. Indications
 - 1. Poor initial response to therapy
 - 2. Suspicion of concurrent parasitic disease (i.e. wild-caught reptiles).
 - ii. Pass sterile red rubber catheter through the glottis into the trachea and advanced to the lower trachea and/or lungs.
 - iii. Introduce sterile saline (approximately 1% of the reptile’s body weight) into the respiratory system.
 - iv. It may be helpful to gently roll the patient to increase fluid contact with respiratory surfaces before aspirating fluid
 - v. Submit fluid recovered for...
 - 1. Aerobic and anaerobic culture
 - 2. Cytology
 - 3. Parasitic examination
- c. [Imaging](#)
 - i. Radiographs
 - 1. Generally not as useful for diagnosing respiratory disease in snakes
 - 2. Exceptions
 - a. Advanced cases with large amounts of mucopurulent accumulation
 - b. Respiratory disease associated with pentastomes (worm-like crustaceans/arthropods can sometimes be seen on radiographs)

- ii. Computed tomography is also Can effective way to evaluate the respiratory tract in snakes
- d. Pneumonostomy
 - i. Endoscopic evaluation
 - 1. Direct visualization of the lung, air sac, and trachea
 - 2. Collect samples from specific lung lesions for histopathology, culture, and PCR testing
 - ii. Techniques
 - 1. Transtracheal with a bronchoscope OR
 - 2. Transcutaneous with a rigid endoscope
 - iii. Indications
 - 1. Refractory cases
 - 2. Management of large groups
 - 3. Collections in which there are concerns about contagious etiologic agents.

VIII. Case management

- a. Oxygen therapy may be necessary initially to stabilize critical patients
- b. Examine and clear nares, nostrils, choana, and glottis
 - i. Clear of any obstruction as soon as safely possible
 - ii. Gently remove mucus and/or purulent material with cotton-tipped swabs
 - iii. In extreme cases, suction of material from the glottis may be necessary
 - iv. Saline or antimicrobial ophthalmic drops can help to loosen material in the nostrils
- c. [Supportive care](#)
 - i. Warm the reptile
 - 1. Target the upper end of the preferred optimal temperature zone (POTZ) for the species
 - 2. For most reptiles, between 26–32°C (80–90°F) is a good starting point
 - ii. [Fluid therapy](#) may be indicated based on presenting hydration deficits and the condition of the reptile
 - 1. 15–25 ml/kg/day is usually a good starting point
 - 2. Adjust fluid rate as needed
- d. Antimicrobial therapy
 - i. Can be initiated once the reptile is hydrated
 - ii. Combination therapy is typically recommended, pairing a gram negative targeting antibiotic (amikacin or enrofloxacin) with an anaerobic, gram positive and gram negative targeting antibiotic for reasons described earlier. Appropriate initial choices of combination therapy might include (pending culture and sensitivity results):
 - 1. Amikacin 2.5 mg/kg IM q72h and Ceftazidime 20–40 mg/kg, IM q72h OR Piperacillin 100–200 mg/kg IM q24–72h
 - 2. Enrofloxacin 5–10 mg/kg, IM, q24–72h and Ceftazidime 20–40 mg/kg, IM q72h OR Piperacillin 100–200 mg/kg IM or SQ q24–72h
 - iii. Continue parenteral antibiotics for a minimum of 4 weeks in mild cases and 6–10 weeks in severe cases

- iv. Follow-up evaluations are critical
 - 1. Ensure progress and complete resolution of lesions
 - 2. Adjust length of treatment prn
- v. Nebulization
 - 1. This author has not found nebulization to be a useful adjunct therapy for treating lower respiratory tract disease in snakes
 - 2. Often exacerbates fluid and mucus accumulation in the airways (likely due to the length of the trachea)
- vi. Chlamydia
 - 1. The ability to successfully treat and clear Chlamydia in reptiles is unknown
 - 2. Some regimens for attempting to treat Chlamydia in snakes include:
 - a. Azithromycin 10 mg/kg PO q48h x 6-8 weeks
 - b. Oxytetracycline 5–10 mg/kg IM, q24–48h x 6-8 weeks

References

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