Pulmonoscopy of Snakes

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KEYWORDS

• Pulmonoscopy • Endoscopy • Respiratory tract • Air sac • Pathology • Imaging • Snakes • Reptiles

KEY POINTS

- Pulmonoscopy is a practical ancillary diagnostic tool for the investigation of respiratory disease in snakes.
- Two different approaches exist for pulmonoscopy in snakes: tracheal and transcutaneous.
- Tracheal and transcutaneous methods are safe, and specific contraindications for pulmonoscopy in snakes are not known except for any anesthesia contraindication.
- Pulmonoscopy in snakes requires general anesthesia. Analgesia should be evaluated case by case, but it is strongly recommended with the transcutaneous approach, as soft tissue incision is required.

INTRODUCTION

Pneumonia and various forms of lower respiratory tract disease (LRTD) are common in snakes.[1] The ability of snakes to withstand long periods (weeks or even months) of limited respiratory activity means that respiratory diseases are often well advanced before any clinical signs are seen. Bacterial disease is the most common cause of LRTD in captive snakes, but parasites (lungworms, pentastomids) and viruses have also been identified. Endoscopic examination of the lung is a practical ancillary diagnostic tool for the investigation of respiratory diseases in snakes.[2–4] The body size and length of snakes and anatomic differences between ophidian species necessitate the application of different approaches, which can affect the complexity and effectiveness of examinations.[5] Two different approaches exist for pulmonoscopy in snakes, the tracheal and the transcutaneous approach, and both have been described in detail.[3,6–8]

Topography of the Serpentine Respiratory System

The dorsal tracheal membrane (dorsal ligament), which connects the tips of the tracheal rings, is small (1/4) in the proximal part of the snake respiratory tract

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(head and neck) where the main part of trachea (3/4) is the ventral canal made by tracheal cartilaginous rings. Compared with similar-sized mammals, the lung volume of snakes is large, but they only have about 10% to 20% of the lung surface area.[5,9,10] The lung(s) of most snakes occupy a major portion of the body cavity. The lungs vary in relative width and relative length from 8% to 94% snout-to-vent length (SVL).[11] Some species of elapid and viperid snakes have a tracheal lung, which is a proliferation of the dorsal ligament emanating from the dorsal aspect of the trachea, which often functions as the main respiratory organ when lung is compressed.[11] Most snakes (eg, viperids, elapids, and colubrids) have only one functional respiratory lung (right), with the left being vestigial or absent.[5,11] The lung is divided into a functional lung and a relatively avascular saccular lung (air sac), which is a direct continuation of the functional lung and can stretch as far as the second third of the coelom. In some aquatic snakes, the air sac can extend caudally to the cloaca. In some snakes (eg, boids), 2 lungs are present and can be comparable in size, although the left is typically smaller. The length of the tracheal lung ranges from 3% to 44% SVL, the length of the right lung from 8% to 82% SVL, and the length of the right bronchus from 0.5% to 54% SVL.[11]

Snake's Lung Anatomy

All snakes have a right lung (boas and pythons also have a left) located dorsal to the liver and lateral to the stomach on the right side of the visceral cavity. The snake lung is divided into the proximal part (functioning vascular lung) and the distal avascular part—the air sac. Snakes in the families *Anomalepididae, Typhlopidae*, and *Acrochordidae* have multichambered lungs. In other snakes, lungs are single chambered. The snake lung is unicameral.

The trachea may enter the right lung in several ways. The most common condition of tracheal entry is terminal. The trachea enters the most cranial portion of the lung (and the cranial lobe is absent) and the trachea becomes a bronchus on entrance into the lung. Normally, the moderate bronchus terminates around the level of the transition from the vascularized lung to avascular air sac, but the long bronchus may continue into the air sac (in snakes of the family *Bitis*).[11] The subterminal entry means that the trachea enters the mesial side of the right lung ventrally and caudally of its anterior tip. The small cranial lobe projects freely laterally of the trachea (**Fig. 1**).[11]

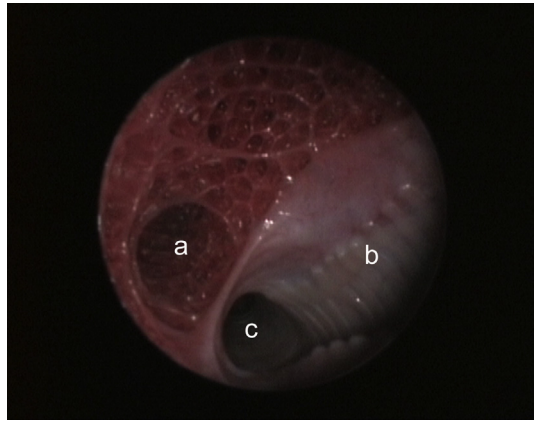

Fig. 1. Pulmonoscopy in a *Boa constrictor*. Endoscopic retrograde view of the cranial lung lobe (a), bronchus (b), and the distal part of the trachea (c).