

Evaluating the Lungs

Corinne R. Sweeney, DVM, Dipl. ACVIM

The purpose of this article is to provide easily retrieved material for the equine practitioner on several basic techniques to evaluate the horse's lung. How to, what to use, and advantages and disadvantages of each technique are included. Author's address: University of Pennsylvania, School of Veterinary Medicine, New Bolton Center, 382 West Street Road, Kennett Square, PA 19348. © 1999 AAEP.

1. Thoracic Auscultation

A. Materials

- Quiet environment
- Good stethoscope
- Rebreathing bag (garbage bag)

B. Auscultatory Findings in the Normal Horse

- Soft air flow
- Usually louder on the right than the left
- Usually louder over the carina
- Inspiration is always louder than expiration
- Expiration is usually very quiet or inaudible

C. Examples of Abnormal Findings: Pneumonia

- The earliest auscultatory changes heard include increased harshness and intensity of expiratory sounds.
 - When expiratory sounds are as loud as inspiratory sounds, significant airway disease is present.
 - In cases of more advanced pneumonia, auscultation usually demonstrates end inspiratory crackles, signifying transient atelectasis, and/or increased secretions.
 - Expiratory wheezes may be present if airways are inflamed or narrowed by thick secretions.

D. Examples of Findings: Pleuropneumonia

- Normally the smooth, well-lubricated pleura move silently. When the pleural surfaces are roughened by fibrin, the sliding motion is interrupted and sound is generated. A pleural friction rub is usually characterized by loud, coarse sounds resembling creaking or rubbing of new leather.
 - Friction rubs may be detected in the peracute stages; however, these sounds often disappear as pleural effusion accumulates.
 - As pleural effusion accumulates, soft air flow changes and is replaced by loud sound resembling air passing through the trachea.
 - Voluminous pleural effusion may attenuate lung sounds over the entire thorax.

2. Thoracic Percussion

A. General

- A method of examination based on interpretation of the sounds and the sense of resistance encountered upon striking the thoracic wall in a systematic fashion.
 - Along with auscultation, the most cost-effective diagnostic method for pulmonary evaluation.

NOTES

B. Method

- Successful percussion requires an automatic technique so that the entire attention is concentrated on listening to the sound and feeling the resistance.

- For horses the indirect method is used. Best performed by use of a plexor (rubber reflex hammer) and pleximeter (ordinary teaspoon).

- Pleximeter pressed firmly into the intercostal space. With series of 2 uniform staccato blows delivered to the pleximeter. The pleximeter is then moved to a different location, the blows are repeated, and the resulting sounds are compared. Delivering the blows rapidly and moving the pleximeter briskly to a new location often aid the detection of different resonance.

C. Problems?

- Thorax is large; thus, it takes time to evaluate by percussion.

- Tend to percuss over a rib till one learns the technique.

- Percussion over caudodorsal lung field difficult to interpret because of abdominal viscera (one tends to ignore findings in this area).

- Percussion over the cranial lung field difficult due to triceps brachii musculature.

D. Findings

- Cranial ventral dullness: pleural effusion, consolidation of lung, or pericardial effusion

- Focal areas of dullness: lung consolidation, necrosis, or abscessation

- Expanded borders: chronic obstructive disease

E. Thoracic Percussion Borders in the Horse

- Cranial—shoulder musculature

- Dorsal—back musculature

- Caudoventral

Level with tuber coxae at 17th IC space

Level with tuber ischii at 15th IC space

IC space

Field then extends cranioventrally in a curving line to the point of the shoulder

3. Percutaneous Transtracheal Aspirate

A. Definition

Technique useful for obtaining sample for cytology and microbiological culture.

B. Materials

- 16-gauge, 24-inch Intracath (through the needle IV catheter by Desert Pharmaceutical ~\$8.00)

- Three 50-cc syringes filled with ~20 cc sterile saline

- Sterile sponges and surgical gloves

- Tubes for samples

- Materials for surgical scrub

- Disposable razor/clippers

- 3 cc local anesthesia (lidocaine)

C. Location

- The small area (2 ½ × 2 ½ inches) over the mid third of the cervical trachea is clipped or shaved and aseptically scrubbed.

D. Restraint and Anesthesia

- Many horses require no sedation. If used, a modest dose so horse's head is not hanging down too much. A 2-cc bleb of lidocaine is injected into the skin at the site. If an Intracath is used, local anesthesia is not *absolutely* necessary. With some horses only a twitch is needed.

E. Technique

- The needle is pushed through the skin and in between the tracheal rings. The catheter is pushed through the needle down the trachea, approximately 12 inches. The syringe is attached and saline injected (approximately 20 cc) slowly. You then begin aspirating. If no fluid comes, move the catheter out slowly; keep aspirating. After obtaining your sample, remove catheter *before* you remove needle from the trachea.

- If an inadequate sample is obtained, the flushing and aspiration can be repeated. The site should then be left alone.

F. Sample

- Fluid obtained will be used for both cytological and bacteriological examinations. Therefore, know in advance how the laboratory you use wants you to handle the sample. Likely, part of the sample should be placed in a tube with an anticoagulant for cytology examination, while the other part of the sample is placed in a sterile container for microbiological examination.

G. Complications

- *Frustrating, but not detrimental to the patient* Inadequate sample due to contamination by the pharynx or lack of an aspirate: can occur if a horse coughs the tubing retrograde so that aspirated sample contains pharyngeal elements (squamous cell epithelium and numerous bacteria) or if end of tubing in trachea is not positioned properly

- *Not common and of minor concern to the patient* Subcutaneous emphysema: unlikely to occur with 16-g needle

- *Not common, but should be taken seriously if it occurs* Subcutaneous infection at the site of the puncture due to leakage of infectious exudate from the trachea or external contamination. This usually presents as a local swelling or cellulitis within 24–36 hours following the procedure. Symptomatic treatment: hot packs or cold hosing, antibiotics. Topical DMSO may be beneficial.

- Breaking off of tubing in the trachea: because of its sharp end, the needle could cut the tubing

BACK TO BASICS

leaving it within the lumen of the trachea. Fortunately, horses usually cough the tubing out and the vialon tubing does *not* cut easily.

4. Bronchoalveolar Lavage

A. Definition

- Aliquots of saline are infused into a bronchus and mixed with epithelial lining fluid; when the saline is recovered by aspiration, epithelial lining fluid is recovered along with the saline.

B. Material

- Use a commercially available BAL tube (Equine Bronchoalveolar Lavage Catheter, Bivona Inc., 5700 W 23rd Ave., Gary, IN 46406; 1-800-348-6064; Item # VBAL30).

- Its size is similar to a stomach tube so it can be carried with you and used easily in a field practice.

- The main disadvantage of the BAL tube vs. a long endoscope is the inability to know the exact site of the lung that is being lavaged which may or may not be important and depends on the type of patient.

C. Sedation

- Bronchoalveolar lavage (BAL) can be done in the standing sedated horse.

- The use of xylazine (0.5–1.0 mg/kg) alone or with butorphanol (0.01–0.02 mg/kg) is recommended.

D. Technique

- The BAL tube is passed into the trachea, down past the carina and is wedged into a subsegmental bronchus.

- When the BAL tube is passed into the proximal trachea, the horse may cough mildly.

- When the BAL tube or endoscope passes the carina the horse may cough significantly.

- The coughing usually subsides once the BAL tube or endoscope is wedged and the lavage fluid is infused.

- If violent coughing persists, the procedure should be stopped.

- Many people like to infuse lidocaine solution as they pass the tube past the carina and wedge it into the distal airways. It is the author's impression that in horses with a particularly strong cough reflex, the lidocaine solution minimally depresses the coughing.

- The lavage fluid can be infused in a number of ways.

- A frequently used technique is to infuse 100 ml aliquots of the fluid and aspirate and repeat three times for a total of 300 ml.

- An alternative method is filling the tube with 20 ml and following with a 60-ml lavage (see AAEP Proceeding 1998).

- No aftercare is necessary, nor are antibiotics indicated.

5. Transtracheal Aspirate vs. Bronchoalveolar Lavage

A. Bronchoalveolar Lavage

- Samples a very small segment of the lung and provides the best evaluation of that area.

- Questionable value for culturing
- Can be misleading if lung condition is not diffuse
- Better morphology of cells
- Interpretation of cytology analysis frequently easier

B. Transtracheal Aspirate

- Collection relatively easy, no sedation
- Excellent for bacterial culture
- Contains secretions from all of lung, more suitable for detecting focal pulmonary disease
- Whether the material is being shed from a relatively small area of the lung or if it reflects diffuse pulmonary disease cannot be determined cytologically
- Complications at puncture site
- If identification of the bacteria involved in the lower respiratory disease is your objective, tracheal aspirate remains as specimen of choice.

Picture the horse's airway as a river system. All the small streams of water (tertiary bronchi) empty into the bigger branches (main stem bronchi) and then into the big river (trachea). It has been found that people who live on the big river (trachea) are getting sick because of a toxic chemical in the water. There are many chemical plants all along these little waterways, up and down the right and the left branch of the river and on all the little small streams that flow into the river. It is our job to find out what chemical is responsible for the illness and we can collect only *one* water sample, and we don't know which chemical plant is the offender. There is only

Table 1. BAL Findings in Horses with Different Conditions.

	Cell Counts/ μ l	Neutrophils	Macrophages	Lymphocytes	Other
Normal horse	160–500	<10%	35–50%	35–50%	
Horse with COPD	2–3 \times \uparrow	50–70%	\downarrow	\downarrow	
Inflammatory airway disease		15%	\uparrow	\uparrow	\pm mast cells or eosinophils
Interstitial pneumonia silicosis	\uparrow	\uparrow	\uparrow		Intracellular crystals
Immunostimulant reaction	2 \times \uparrow			\uparrow	
Pneumonia	\uparrow	\uparrow	\downarrow	\downarrow	

one reasonable place to collect our sample: the big river (trachea). If we collect from the main stem bronchi or tertiary bronchi, we may “miss” the chemical. And so, it is in the horse’s lung.

C. When to Choose a Tracheal Aspirate and When to Choose a BAL

- Try to determine if horse has an infectious or noninfectious disease.
- Try to determine if the horse has a diffuse (e.g., COPD) or focal (e.g., pneumonia) disorder.
- In an investigation of unknown equine pulmonary disorders: a combination of percutaneous tracheal

aspirate culture and cytology and BAL cytology gives additional information over either technique alone.

6. Endoscopic Tracheal Aspirate

- Pass endoscope into trachea and pass tubing through the endoscopic channel.
- Infuse and aspirate as above.
- There are several commercially available swabs, brushes, and telescoping tubes to be used through the endoscope to obtain a tracheal aspirate for culture and cytology. Designed to provide sterile sample with minimal to no upper respiratory tract contamination.
- All endoscopic samples are much more prone to contamination because of going through the nares.