Evaluation of the Upper Respiratory Tract at Rest and During Exercise

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History, physical examination, laryngeal ultrasound, and upper airway endoscopy are all important aspects of evaluating the upper respiratory tract. Additional diagnostics such as a dynamic examination of the upper airway may be required to elucidate the problem(s) causing an abnormal respiratory noise and/or exercise intolerance. Evaluation of the upper airway during exercise allows the clinician to determine if the horse has a dynamic upper airway abnormality and then make the most accurate treatment recommendation. Author’s address: Rood & Riddle Equine Hospital, PO Box 12070, Lexington, KY 40580-2070; e-mail: bwoodie@roodandriddle.com. © 2011 AAEP.

1. Introduction

A complete and thorough history is a very important part of the upper airway evaluation. It is best to obtain this information from the individual(s) that know the horse best. Most often this is the trainer or rider and may not be the owner of the horse. Specific questions regarding respiratory noise, exercise intolerance, coughing, nasal discharge, previous surgery, and current or previous treatments should be asked. Information regarding whether the noise is made during inspiration or expiration is very helpful but oftentimes it is not accurate because the owner/trainer/rider has not listened for that specifically. Try to determine if the abnormal noise occurs every time the horse works or if it is intermittent. In addition, ask questions to determine at what point during exercise the horse makes the noise. Another very important piece of information, especially in horses that show “collected” or with poll flexion, is: Does the head position of the horse have an effect on the respiratory noise? It can be helpful to have the individual describe and characterize any abnormal respiratory noise(s) that the horse makes. It is also important to determine if the horse is exercise intolerant and/or exhibiting poor performance.

Begin the physical examination with auscultation of both sides of the thoracic cavity. The heart rate, rhythm, and the presence of a cardiac murmur are assessed. A rebreathing examination is important to evaluate the lungs. Remember that disease(s) of the lower airways and lungs do not cause upper respiratory noise. Visual assessment of the head and nares should be performed to evaluate for asymmetry. I evaluate both nostrils for the presence of airflow and determine if it is equal. Evaluation of head and both eyes for the presence of any cranial nerve deficits should be performed. Each jugular vein should be evaluated for patency. Palpation of common surgical sites should be performed to check for scars. Palpation of a laryngoplasty scar can be difficult but clipping of the hair just ventral to the linguofacial vein can help you determine if a scar is present. Palpation of the trachea should be performed to assess if the horse has had previous...
trauma, malformed tracheal rings, or a tracheotomy. Palpation of the larynx to assess for symmetry should also be performed. This skill is not easy, and it requires practice for one to become proficient. Abnormalities such as a prominent muscular process as seen in cases of laryngeal hemiplegia or the lack of a cricothyroid articulation as seen in cases of laryngeal dysplasia are important physical examination findings.

Endoscopy of the upper airway is then performed. The resting endoscopic examination is very important to determine if there are any structural or anatomic abnormalities present. Dynamic abnormalities or problems that only occur at exercise will not be detected during the resting examination. The clinician may “get a sense” of what is happening at exercise, but an evaluation of the airway at exercise is the only way to determine if a dynamic problem exists. The horse should be restrained but not sedated. Sedation can affect the function of the larynx, thus making assessment difficult.1 Common methods of restraint include twitch, lip chain, neck skin roll, and ear twitching. I believe that both nasal passages, both guttural pouches, and the trachea should be evaluated in each horse presented for a respiratory examination. To begin, the endoscope is passed up the right nasal passage to the level of the nasopharynx. The nasopharynx should be evaluated for structural and functional abnormalities. The width of the nasopharynx at the level of the guttural pouch openings should be assessed. Horses that have collapse of the lateral pharyngeal walls during exercise often are very narrow at this location. The height of the nasopharynx is a subjective assessment, and the clinician should be cautious about predicting the occurrence of a dynamic problem (lateral pharyngeal collapse) from a resting examination. Nasopharyngeal cicatrix formation can be seen as scarring ranging from a focal area to involvement of the entire circumference of the pharynx. This abnormality is seen in horses from hot climates such as Texas, Louisiana, Mississippi, Oklahoma, and Florida. It is thought that an allergen in the environment causes nasopharyngeal inflammation that damages the mucosa and submucosa of the nasopharynx. Scar tissue formation and a reduction in airway diameter is the result.

The ethmoid turbinates and nasomaxillary sinus opening should be examined. Abnormalities that could cause respiratory noise include an ethmoid hematoma that is causing an obstruction in the nasal passage or a mass protruding from the nasomaxillary opening obstructing the airway. The right guttural pouch should be evaluated. Abnormalities that could be encountered include guttural pouch empyema, chondroids, enlarged retropharyngeal lymph nodes, stylohyoid bone abnormalities, lymphoid hyperplasia, and guttural pouch mycosis. These abnormalities do not directly cause abnormal respiratory noise, but they may lead to a problem such as dorsal displacement of the soft palate.

The epiglottis should be evaluated for any structural abnormalities. The most common abnormality would be epiglottic entrapment. Some clinicians take note of the length and consistency of the epiglottis as well. The ventral surface of the epiglottis should be evaluated for ulceration. The horse is sedated and the epiglottic cartilage is elevated using a grasping instrument passed up the contralateral nasal passage. The position of the soft palate with respect to the epiglottis should be assessed. Some horses will displace their soft palate during the resting examination and replace it after one to two swallows. Nasal occlusion is often used to assess soft palate function, but the clinician must remember that this test is not a replacement for a dynamic examination.

The degree of pharyngeal lymphoid hyperplasia should be characterized, if present. There is a grading system from I to IV.2 Grade I shows a small number of inactive (white in color) lymphoid follicles spread across the dorsal aspect of the pharynx. Grade II shows active as well as active lymphoid follicles (edematous and pink in color) spread across the dorsal aspect of nasopharynx to the level of the guttural pouch openings. Grade III shows larger active follicles that may extend to the level of the soft palate. Grade IV shows coalescing active lymphoid follicles. Severe lymphoid hyperplasia does not directly cause abnormal respiratory noise, but the severe inflammation may lead to problems such as pharyngeal collapse or dorsal displacement of the soft palate, which would cause the abnormal respiratory noise.

Each arytenoid cartilage should be evaluated for structure, symmetry, and movement. The shape and thickness of each arytenoid cartilage should be assessed. A granuloma can form on the axial surface of the corniculate cartilage, whereas the remaining portion of the arytenoid cartilage or its movement is not affected. The movement of the arytenoid cartilages should be evaluated during normal resting respiration, after swallowing, and during nasal occlusion. The goal is to determine if the structure of the arytenoid cartilages is normal and if the degree of abduction is normal. There is a grading scheme that is used to categorize arytenoid symmetry and movement.3

Grade I: There is synchronous and symmetrical movement.

Grade II:1: There is transient synchronous or asymmetrical movement, but maximal abduction is easily achieved.

Grade II:2: There is asynchronous or asymmetrical movement most of the time, and maximal abduction is achieved but with difficulty.

Grade III:1: There is asynchronous or asymmetrical movement and cannot maintain full abduction.
Grade III.2: There is limited arytenoid movement and cannot fully abduct.

Grade III.3: There is marked but not total abductor deficit.

Grade IV: There is lack of any arytenoid movement (completely paralyzed).

The right nasal passage should be examined as the endoscope is withdrawn. The nasal turbinates should be inspected for swelling, masses, or foreign material. The endoscope is then passed through the left nasal passage and the left ethmoid, nasomaxillary opening, and left guttural pouch are inspected. The trachea should be evaluated for signs of infection, hemorrhage, tracheal ring defects, granuloma formation, and for signs of prior trauma or surgery. In the typical 450-kg horse, the trachea can be examined nearly to the level of the tracheal bifurcation, using a 1-meter endoscope. The left nasal passage is then examined as the endoscope is withdrawn. Laryngeal ultrasound provides a non-invasive technique to gain information regarding the laryngeal cartilages and musculature.

There are numerous upper airway abnormalities that can be diagnosed by using standing endoscopy alone. However, a dynamic examination may be required to get the “full picture” of the horse’s airway. There are many reasons to perform an endoscopic examination of the upper airway while the horse is exercising/working on a high-speed treadmill. The following are a basic list of reasons:

1) The horse makes an abnormal respiratory noise and has a normal resting endoscopic examination; (2) assessment at exercise of a horse with an endoscopic abnormality at rest; (3) for the evaluation of poor performance (with or without abnormal respiratory noise); and (4) as a screening test/pre-purchase examination.

The treadmill examination should not be taken lightly. It can be very dangerous for the horse and the people performing the examination. Fortunately, problems do not occur very often, but there is a risk for injury. To get an accurate assessment of the horses’ airway function, the treadmill examination must mimic the type of work the horse does. It is very important for show horses to have the same head and neck carriage when they are working on the treadmill as they do when showing. Make sure the trainer/owner brings the necessary “gear” to “set” the horse’s head. Standardbreds should have their harness (including hobbles if necessary). Thoroughbred racehorses typically do not need any special tack. Before the examination, discuss with the trainer if the horse is currently in work, their level of fitness, and how much work they are doing. It is also important to find out under what circumstances the horse exhibits the abnormality. In other words, is it early in the workout, at the end of the workout, once a certain speed is reached, when the head is in a certain position, and so forth. Reviewing a race record can yield helpful information regarding the distances and race times that the horse is achieving. Once it is determined that the horse is fit enough and does not have a musculoskeletal reason that would preclude it from strenuous exercise, it is time to acclimate the horse to the treadmill.

The hind shoes are typically removed (leave the front shoes on) from Thoroughbred racehorses, but the shoes are left on the other breeds. The shoes are very important for proper gait in most of the show horses; therefore it is important to leave them on. Protective gear such as bell boots and sports medicine boots are helpful to prevent injuries. Standardbreds will often wear knee boots or other protective equipment. Before acclimating the horse to the treadmill, the horse will be fitted with an ECG monitor and a resting ECG will be done. A resting endoscopic examination should be performed in addition to a physical examination. The horse will be walked through the treadmill a few times to get him comfortable with the footing and side bars. The horse is then taught to walk on the treadmill. Once he is comfortable, the walking pace will be increased to a trot then gallop if that is an appropriate gait for the horse. The acclimation process gives the horse a chance to get comfortable with the treadmill as well as warm up for strenuous exercise. Fortunately, most horses acclimate quickly. However, there are certain horses that are difficult to acclimate, and more time is necessary. It is a big mistake to rush the process—injury to the horse, people, and/or damaged equipment will be the end result. There are horses that are not safe to treadmill, and the procedure should be abandoned. During the acclimation phase, watch for signs of lameness; if present, perform a thorough lameness examination before increasing the exercise intensity.

Once the horse is acclimated and comfortable working on the treadmill, the endoscope should be passed up the right nasal passage (or left, depending on how the treadmill is set up) and secured to the nose band on the halter. There are a variety of ways to secure the scope in position. The scope should not be so secure that it will be damaged if the horse decides to go backward. Positioning the end of the endoscope in the nasopharynx is very important. The tip of the endoscope should be rostral to the epiglottis but not so far rostral that you do not have good view of the larynx. Once the endoscope is positioned and secured, the treadmill examination should commence. Ensure that the ECG is recording and that the video recording device is capturing video. A recording device is critical to document the examination and allow you to replay the video in slow motion for critical evaluation. The treadmill speed is increased until the appropriate speed is reached. The clinician must watch the video endoscopy as well as have awareness of how the horse is doing on the treadmill. During the examination, listen for abnormal respiratory noise and correlate...
that noise with the video image. If there is abnormal respiratory noise and no visible abnormality, then the problem is either rostral to the end of the endoscope or caudal to the larynx. Repositioning of the endoscope will be necessary, and the examination must be repeated. The speed may need to be increased, decreased, or maintained. Once the examination is completed, then the endoscope should be removed and the horse is cooled out. During this time, the video endoscopic examination can be reviewed. It is crucial to have slow-motion review capabilities to fully assess the airway.

The ability to perform a dynamic video endoscopic examination of the upper airway while the horse is being ridden and/or worked (over ground endoscopy or telemetric endoscopy) is available. This diagnostic tool allows the veterinarian to examine the horse in its “own environment” and under the same conditions as it normally is worked. The interaction of the rider with the horse and the horse performing appropriate maneuvers for their discipline is accounted for. There are limitations with over-ground endoscopy. Not all of these endoscopic systems have a means to clean the lens during exercise, or the clinician does not have the ability to clean the lens at their discretion during the examination (without stopping the horse). Repositioning of the endoscope during the examination usually requires stopping the horse and manipulating the endoscope. However, there are systems that have the ability to change the position of the scope remotely. Typically the image quality of the over-ground endoscopic systems is poorer than that of a regular video endoscope. The technology used in this type of endoscopic equipment is advancing, and the units are becoming smaller in size, lighter in weight, and the image quality is improving.

There are multiple dynamic abnormalities that can occur in the upper airway. The list includes but is not limited to the following: intermittent dorsal displacement of the soft palate, axial deviation of one or both aryepiglottic folds, pharyngeal collapse, axial deviation of one or both vocal cords, collapse of one or both arytenoid cartilages, epiglottic retroversion, tracheal collapse, billowing of the rostral aspect of the soft palate, epiglottic entrapment, and combinations of these problems. Once the clinician has determined the type and number of upper airway problems that the horse has, then a treatment plan can be developed.

References