ENDOSCOPY AT REST IN THE DIAGNOSIS OF UPPER AND LOWER RESPIRATORY TRACT

ANNE COUROUCÉ-MALBLANC

Endoscopy allows visualization of the upper respiratory tract (ventral and medium meatus, pharynx, guttural pouches, larynx), but also the beginning of the lower respiratory tract (trachea, carina, bronchi). It is an exam which is a valuable aid to the practitioner in the diagnosis of respiratory infections. Nevertheless, it always comes after the realization of a complete clinical examination.

The material
The endoscopic equipment can be grouped into two categories: optical fibers or videoendoscopes whose length and diameter vary. To view the upper airway as well as the trachea up to the carina, it is interesting to have an endoscope with a length of at least 1.40 m. The diameter of the endoscopes of this size is usually quite small and allows examination of the guttural pouches.

Practical realization
It is better not to sedate the horse first in order to assess the function of the pharynx and larynx (paresis, paralysis). In addition, the ideal is to achieve endoscopy with minimal restraint in order to not modify the movements of the pharynx and larynx. This can be done in a box or in a stock. If necessary restraint will be made with a twitch.

The endoscope is inserted in one of the nostrils and in the ventral meatus and/or middle meatus. Once in the pharynx, its function is evaluated: instillation of water to test the swallowing reflex, touching the wall of the pharynx to evaluate a possible paresis or paralysis. Similarly, there is the epiglottis (appearance, size, sub-epiglottic cysts), the soft palate and the larynx (arytenoid cartilages, vocal cords, ventriculis, ary-epiglottic folds). The function of the larynx is evaluated by various tests (slap test, obstruction of the nostrils, instillation of water) for assessing symmetry, synchronicity and also abduction and adduction of the arytenoid movements.

The endoscope is then directed to see the entry of guttural pouches that can be examined. For this it is necessary to pass the endoscope into the right nostril into the right guttural pouch and the left nostril into the left guttural pouch. The passage of the endoscope into the guttural pouch can be done by biopsy forceps introduced into the operator channel of the endoscope or a curved channel curved at its end inserted into the same nostril as the endoscope. The endoscope is then passed into the trachea to visualize the walls and the light of the trachea until the bifurcation of the bronchi (carina). When taking the the endoscope away, the ethmoid may be visualized.

ENDOSCOPY AT REST IN THE DIAGNOSIS OF UPPER RESPIRATORY DISEASES

1. The nasal cavities
During a thorough examination of the nasal cavity, the endoscope can be passed through the ventral meatus and the middle meatus, right and left. Both maxillary sinuses, and the frontal sinus (via the caudal maxillary sinus), communicate with the nasal cavities up to the middle meatus [10, 26]. Nasal discharge from a sinus can then be visible on endoscopy [24, 26].
2. **Progressive hematoma of the ethmoid**
Part of the ethmoid is visible on endoscopy. One of the conditions of the ethmoid may be a progressive ethmoid hematoma (PEH), mass of idiopathic origin and which may evolve in the nasal cavity and/or sinuses and cause a difficulty to breath, a respiratory noise and/or epistaxis [32]. Progressive hematoma of the ethmoid is visible on endoscopy when the abnormal part of the ethmoid bone develops in the nasal cavity.

3. **The pharynx**
The pharyngeal lymphoid hyperplasia or pharyngitis is common in young horses in training. This condition causing inflammation more or less of the pharyngeal region, is responsible for the development of chronic cough and is highlighted by endoscopy. Size, appearance and distribution of follicles help to give scores (Table 1). [2]

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>No follicles</td>
</tr>
<tr>
<td>Grade 1</td>
<td>Few follicles, small and not active</td>
</tr>
<tr>
<td>Grade 2</td>
<td>Follicles more numerous and more widely distributed: dorsal, lateral walls of the pharynx</td>
</tr>
<tr>
<td>Grade 3</td>
<td>Numerous and large follicules, pink to red. Follicules may also be present on the soft palate.</td>
</tr>
<tr>
<td>Grade 4</td>
<td>Very numerous follicules, large, oedematous distruted on all the pharnx: dorsal and lateral walls, doft palate and also epiglottis.</td>
</tr>
</tbody>
</table>

4. **Disorders of guttural pouch**
Each guttural pouch shows two compartments divided into two parts by the stylohyoïde bone. The lateral compartment contains the external carotid and maxillary arteries. The medial compartment contains the internal carotid artery and the cranial nerves IX, X, XI and XII. Affections of guttural pouches can be: empyema, mycosis or tumor.

4a. **Empyema**
Empyema of the guttural pouches can reach horses of all ages however with a predisposition for young horses. Infections of the upper respiratory tract, in particular due to *Streptococcus equi*, as a retropharyngeal lymph node abscess in the guttural pouch are the most frequent of guttural pouch empyema causes leading to the accumulation of pus in one or both guttural pouch forming chondroid in chronic cases [11].
Retropharyngeal node may also be enlarged and abscessed in a guttural pouch. This is reflected by the presence of mucopurulent discharge in the pharynx and at the nostrils.

b. Mycosis
A fungal infection may be present in one or both guttural pouches. The offending organisms are *Aspergillus spp*, especially *Aspergillus fumigatus*, *Aspergillus nidulans* and *Candida spp*. There are no age, sex or race predisposition. The lesion is usually unilateral but may be bilateral. At endoscopy, the lesion may appear brown, yellow, green, black or white and is composed of necrotic tissue, cell debris, hyphae and a variety of bacteria. The fungus can cause bleeding (reaching the internal or external carotid) and/or cranial nerves can lead to a malfunction of the pharynx, laryngeal hemiplegia and/or dysphagia and/or cough [10, 11]. Consecutive dysphagia to the existence of a fungus guttural pouches may result in the presence of food in the pharynx. In rare cases in horses with a fungus, it is possible to find a connection between the two guttural pouches and also between the guttural pouches and pharynx.

c. Tympanism
The bloat is due to the accumulation of air or fluid in the guttural pouches. This is a rare condition that typically reaches foals until the age of one year. Females seem to be more affected, but this is a condition encountered in both sexes. The foals have swelling of the parotid region and often when they are nursing including respiratory noise. When tympanism is bilateral severe dyspnea may occur. Endoscopy can highlight a collapsed roof of the pharynx resulting in a reduction of air flow [11].

d. Tumor
Tumors of the guttural pouches are rare. This particularly melanoma as is often the case with gray horses. This can also be squamous cell carcinomas, sarcomas, round cell, fibroids, hemangiomas and hemangiosarcomas [11].

5. Cleft palate
The cleft is a rare congenital disorder that affects 0.01 to 0.02 % of foals [16]. In these foals, milk is rejected by the nose at birth. The diagnosis can be done by opening the mouth and/or endoscopy. Cases of varying severity can be diagnosed.

6. Disorders of the larynx
During endoscopy at rest, it is possible to diagnose a number of conditions. Endoscopy at rest identifies malfunctions upper respiratory tract. However, these abnormalities are not always related to the existence of a clinical problem or even the existence of a condition in the year. In contrast, a normal endoscopy at rest does not mean, either, that there is no affection when exercising and this, in particular, in the case of a horse with loss of performance or respiratory noise during exercise [13, 20, 27, 33].

a. Laryngeal hemiplegia
The laryngeal hemiplegia is a condition that can be detected at endoscopy without sedation rest of the horse [22]. Various methods of assessing score laryngeal hemiplegia have been proposed [29]. However, in 2003, a consensus has been built around a grading system and is
summarized in Table II [8]. It has recently been shown that this grading system is correlated with histopathological changes of the laryngeal muscles affected horses [3].

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
<th>Sub-grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>All arytenoid cartilage movements are synchronous and symmetrical and full arytenoid cartilage abduction can be achieved and maintained</td>
<td>1. Transient asynchrony, flutter or delayed movements are seen</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. There is asymmetry of the rima glottidis much of the time due to reduced mobility of the affected arytenoid and vocal fold but there are occasions, typically after swallowing or nasal occlusion when full symmetrical abduction is achieved and maintained</td>
</tr>
<tr>
<td>II</td>
<td>Arytenoid cartilage movements are asynchronous and/or larynx asymmetric at times but full arytenoid cartilage abduction can be achieved and maintained</td>
<td>1. There is asymmetry of the rima glottidis much of the time due to reduced mobility of the arytenoid and vocal fold but there are occasions, typically after swallowing or nasal occlusion when full asymmetrical abduction is achieved and maintained</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Obvious arytenoid abductor deficit and arytenoid asymmetry. Full abduction is never achieved</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Marked but not total arytenoid abductor deficit and asymmetry with little arytenoid movement. Full abduction is never achieved</td>
</tr>
<tr>
<td>III</td>
<td>Arytenoid cartilage movements are asynchronous and/or asymmetric. Full arytenoid cartilage abduction cannot be achieved and maintained</td>
<td>1. There is asymmetry of the rima glottidis much of the time due to reduced mobility of the arytenoid and vocal fold but there are occasions, typically after swallowing or nasal occlusion when full asymmetrical abduction is achieved and maintained</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Obvious arytenoid abductor deficit and arytenoid asymmetry. Full abduction is never achieved</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Marked but not total arytenoid abductor deficit and asymmetry with little arytenoid movement. Full abduction is never achieved</td>
</tr>
<tr>
<td>IV</td>
<td>Complete immobility of the arytenoid cartilage and vocal fold</td>
<td></td>
</tr>
</tbody>
</table>

1. Description generally refers to the left arytenoid cartilage in reference to the right. However this grading system can apply to the right side (ie. right Grade III-1)

The laryngeal hemiplegia is a recognized cause of poor performance and the different grades can be diagnosed at rest. However, the clinical significance of these grades is controversial because the consequences of these abnormalities during exercise are highly variable. According to a study in which endoscopy at rest and on the treadmill during exercise were performed, 26 horses showed asynchronous movements and incomplete abduction of the arytenoid cartilages during endoscopy rest but only six of them had incomplete abduction and aggravated during the year. For the other 20 horses, two arytenoid cartilages were kept in complete abduction throughout the year [13].

c. Epiglottis entrapement
The epiglottis entrapment because of the ary-epiglottic folds. The entrapment may be permanent or intermittent at rest and/or during exercise. The incidence of this disease in horses was evaluated between 0.74% and 2.1% [12]. In a population of horses undergoing evaluation treadmill against on the grounds of poor performance or abnormal respiratory noise at exercise, the incidence of this condition has been estimated between 2.1 and 9.5% of cases [17, 25].
d. Sub epiglottic cyst
The pharyngeal cysts occur most often in sub-epiglottic area. They are more often described in males than in females and in young horses (between 2 and 4 years old). The horses are presented for respiratory noise, cough, exercise intolerance, nasal discharge and possibly dysphagia. The diagnosis is made by endoscopy in the examination of the nasopharynx. Sometimes the cyst goes to the oropharynx during swallowing.

e . Collapse of one or ary- epiglottic folds
One or two ary-epiglottic fold(s) can vibrate and partially or completely cause an obstruction of air flow during exercise. Although this condition may, in rare cases, be detected during endoscopy at rest, it does not presume what can happen during exercise. Under this condition, endoscopy exercise allows a more reliable diagnostic endoscopy at rest.

f . Rostral displacement of the soft palate and pharyngeal collapse
Factors affecting the nerves and muscles controlling the nasopharynx may result in a rostral collapse of the soft palate. Horses with this condition show an abnormal respiratory noise during exercise and/or exercise intolerance.

g . Dorsal displacement of the soft palate
Dorsal displacement of the soft palate (DDSP) is the most common dynamic collapse of the nasopharyngeal region identified during treadmill exercise in racehorses [19, 23]. A dorsal displacement of the soft palate may be seen during endoscopy at rest. However, it may not be in relation with what happens during exercise. Studies indicate that certain abnormalities at rest may suggest the existence of a dorsal displacement of the soft palate during exercise. This includes:
- A spontaneous and prolonged displacement of the soft palate in response to nasal occlusion or swallowing;
- Ulceration of the caudal edge of the soft palate;
- The presence of a hypoplastic and flaccid epiglottis

However, in most cases, endoscopy at rest provides limited information. For Lane et al. (2006b), observations during resting endoscopy revealed that 70 horses had abnormalities of the soft palate or epiglottis at rest. Of these horses, 60 (86%) had instability or dorsal displacement of the soft palate during the year. The actual prevalence of this disease in the field is not well known because it often occurs during intense exercise. According to Lane et al. (2006b), 15% of horses with DDVP have no abnormal respiratory noise during exercise.

h . Complex and dynamic collapse
Endoscopy at rest can highlight certain conditions but can not always predict what happens during exercise. According to Lane et al. (2006a ), a complex dynamic collapse is diagnosed in 32% of cases with obstruction of the upper airways. However, endoscopy at rest can never determine which horses will show a problem during exercise [20].

7 . Per endoscopy and post- treatment
Endoscopy provides the introduction of treatment:
• Medical treatment based on the instillation of antifungal medication in the guttural pouch in case of mycosis, injection of the ethmoid hematoma using 4 % formaldehyde via a catheter passing through the working channel of the endoscope, ...
ENDOSCOPY AT REST IN THE DIAGNOSIS OF LOWER RESPIRATORY AIRWAY DISEASE

In the diagnosis of lower respiratory diseases, endoscopy will help to visualize the trachea (walls and light), to note the presence of inflammation, abnormal secretions (mucus, blood) and possibly a foreign body.

1. The trachea

a. Mucus
In the trachea, the presence of mucopurulent secretions can be evaluated and graded (0 to 5). This score can be established taking into account several parameters: accumulation, location, the apparent viscosity and color [15]. The mucus is the witness of inflammation and/or infection that may be characterized by other tests (tracheal wash and/or bronchoalveolar lavage). This accumulation of mucus may reflect, for example, the existence of an inflammatory disease of the lower respiratory tract (IAD) or obstructive disease of the lower respiratory tract (RAO) or a bacterial infection.

b. Blood
The presence of blood in the trachea after exercise reflects the existence of an induced pulmonary hemorrhage year (EIPH), a condition that occurs in almost every exercise in racehorses (trotters and gallopers) but also frequently in other horses subjected to intense exercise. The presence of blood in the lower respiratory tract can cause a cough and may also lead to a an IAD [1]. In contrast, some authors suggest that pulmonary hemorrhage during exercise is secondary to the existence of an inflammatory disease of the lower respiratory tract [7].
The endoscope allows to grade the presence of blood in the trachea by means of a score from 1 to 4 by [28]. This is done during endoscopy performed after exercise (from 30 min to 2 hours after exercise) [3].

2. Carina

The trachea is examined until the bifurcation of the bronchi (carina). A thickening of the septum of the carina score was assigned by Koch et al. (2007). It has been shown that these measures are repeatable but are insufficient alone to differentiate animals with MIVRP or MOVRP compared to healthy animals [18].

CONCLUSION
Endoscopy is very important for the evaluation of the respiratory tract and may be decided because of specific signs during the clinical examination (nasal discharge, persistent cough, respiratory noise during exercise, ...) or as part of up examination (purchase visit for example). This exam will show some abnormalities and accurate diagnosis in some cases. To go further, it may be necessary to perform an endoscopy during exercise on a treadmill or on the track to assess the function of the larynx and accurate diagnosis in order to establish the most adapted treatment of [6, 14, 30, 34]. In other cases, it will be necessary to have to do...
other tests such as blood work (hematology and biochemistry), radiography (head and thorax) or sampling of respiratory fluids.

Bibliography:
