FIELD ASSESSMENT OF POOR PERFORMANCE

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Athletic horses with poor performances are often a challenge for owners, trainers and veterinarians. Of horses presented with a clear history of reduced performance a high percentage will have few or no abnormal findings on examination. Other cases may show abnormalities either on clinical examination or on one of the diagnostic tests used, but it may be difficult to prove that these abnormalities are contributing to the poor performance. All these facts, together with a horse presented free of overt clinical disease may make it often extremely difficult to arrive to a definitive diagnosis for the cause of poor performance. The investigations undertaken will depend on the type of equipment and facilities available. In the field, the basic evaluation of any athletic horse with poor performance is to obtain a precise history, to perform a detailed clinical examination using appropriate diagnostic aids and also field clinical exercise testing, ECG measurement during exercise and also endoscopy during exercise. Also, respiratory samples may be taken after exercise (tracheal wash and broncho-alveolar-lavage).

I - MEASUREMENTS

Exercise fitness depends on adequate functioning and coordination of key body systems such as the cardiovascular, respiratory, haematological and muscular systems which largely have been investigated independently (Persson, 1983). Optimal function of the metabolic pathways that supply power to generate muscle force during exercise is dependent on the complex interaction between all of these major body systems.

Blood samples for haematology and biochemistry measurements. These variables may be measured at rest or after exercise.

The response to exercise is an important indication of metabolic capacity. On the track, the range of measurements includes heart rate (HR) and speed during exercise, and blood or plasma lactate concentration, haematocrit and muscular enzymes (Lindner and Wittke, 1993).

One of the key issues in track exercise testing is the measurement of speed. The easiest way to measure velocity is to use a GPS (Polar, RS800 for example).

Heart rate response to exercise is an important indication of metabolic capacity. It may be easily measured and registered by means of two electrodes placed on the horse and connected to a heart rate monitor. The HR response to graded exercise is linear between 120 and 210 beats.min⁻¹. Many factors may influence the regression line of HR on work speed such as exogenous factors (geometry and length of the track and environmental conditions for example), training state (Foreman et al., 1990) and disease (Erickson et al., 1987).

Blood lactate concentration may be measured by taking blood samples at the end of the exercise period, from the jugular vein into tubes containing fluoride-oxalate. The aerobic-anaerobic transition or onset of blood lactate accumulation (OBLA) has been defined empirically as 4 mmol.l⁻¹ blood lactate concentration.

ECG recording during exercise may be of great importance as some arrhythmia appear only during exercise (Jose-Cunilleras et al., 2006).

Endoscopy during exercise in order to visualize function of upper respiratory airways.

Respiratory samples: tracheal wash and/or broncho-alveolar lavage for intermediate and lower respiratory airways evaluation.

Muscular system may also be investigated by exercise testing with CK and ASAT measurements and also by muscular biopsies realization.

II – HAEIMATOLOGY AND BIOCHEMISTRY

Haematology and biochemistry measurement is the first exam performed when evaluating a horse. It is always done after a complete clinical exam and may be done punctually or during a follow-up in order to define a reference for the horse and follow-up of the evolution during training and competitions.

III – TESTING PROCEDURE, CALCULATION AND INTERPRETATION OF INDICES OF EXERCISE CAPACITY

Numerous various testing procedures have been described for horses involved in different disciplines such as three-day eventing, endurance, show jumping or racing. Whatever the horse’s discipline, field exercise test protocols should always be rigidly defined in order to calculate meaningful fitness measurements and to limit variability.
Following standardised procedures is of great importance as the data derived from each test can be compared to subsequent tests for the same horse or with measurements from other horses of similar age and training status.

**Velocity and blood lactate concentration**

For comparison of blood lactate values between horses or in the same horse during training, the velocity at a blood lactate concentration of 4 mmol.l\(^{-1}\) (V\(_4\)) generally has been used. V\(_4\) is considered as a reference value for horses as it is a good predictor of their aerobic capacity (Persson, 1983). A high value for V\(_4\) is an indication of superior exercise capacity and is related to racing performance.

**Velocity and heart rate**

A useful reference point for comparison of cardiovascular capacity in Standardbred or Thoroughbred horses, is the V\(_{200}\) which represents the velocity at a HR of 200 beats.min\(^{-1}\) (Persson, 1983). For saddle horses the velocity for a HR of 170 bpm (V\(_{170}\)) seems to be more interesting as it seems more difficult for these horses to reach a 200 beats.min\(^{-1}\) HR (Auvinet et al., 1991).

V\(_4\), V\(_{170}\) or V\(_{200}\) may be interpreted according to fitness level of the horse but also to subclinical diseases such as respiratory or locomotor diseases. Some examples will be taken.

**IV – ENDOSCOPY DURING EXERCISE**

1. **Rest vs exercise endoscopic findings in horses**

Upper airway disorders may cause airway obstruction and induce a respiratory noise and/or a decrease in performance level. Several studies have documented that these disorders cannot be diagnosed accurately during a resting endoscopic examination (Parente and Martin, 1995; Ferrucci et al., 2004; Tan et al., 2005; Lane et al., 2006b). Although endoscopy at rest may allow identifying an upper respiratory airway disorder in some cases, the presence of abnormalities at rest does not necessarily indicate a clinical problem. On the other hand, no abnormality at rest does not rule out a dynamic upper airway obstruction, which may only be present during strenuous exercise (Ferrucci et al., 2004).

Dorsal displacement of soft palate (DDSP) is the most common cause of dynamic nasopharyngeal collapse identified during treadmill exercise of racehorses (Martin et al., 2000; Lane et al., 2006a). The true prevalence of the condition is difficult to determine in the field because it occurs typically during strenuous exercise and, therefore, a definitive diagnosis can be made only during exercise. Also, according to Lane et al. (2006b), for 15% of the horses showing a DDSP there was no history of noise during exercise. It has been suggested in previous reports that some abnormalities observed at rest may point to a diagnosis of DDSP during exercise. It includes:

- Prolonged spontaneous dorsal displacement or displacement or billowing in response to nasal occlusion or swallowing
- Ulceration of the caudal border of the soft palate
- The presence of a hypoplastic or flaccid epiglottis

However, in the majority of cases, resting endoscopy is believed to provide limited information. For Lane et al. (2006b), resting endoscopic observations revealed that 70 horses had palatal or epiglottic abnormalities during quiet breathing. Of these, 60 (86%) developed palatal instability (PI) or DDSP during exercise. There was a significant association between resting and treadmill endoscopic observations. However, although the specificity was high, the sensitivity was low (15%).

Recurrent laryngeal neuropathy (RLN) has been recognized as a cause of poor performance for centuries. True hemiplegia show no active abductory or adductory mobility can be determined easily at rest. However, controversy still exists regarding the clinical significance of asymmetric or asynchronous movements of the arytenoids cartilages as observed during a resting examination. According to Ferrucci et al. (2004), even though 26 horses had asynchronous, even pronounced, arytenoids movements at rest, the incomplete abduction worsened dramatically during exercise on only 6 cases. In the other 20 horses, both arytenoids cartilages were maintained in a completely abducted position during the whole treadmill session. According to Lane et al. (2006a), there was a significant association between laryngeal function score and dynamic laryngeal collapse during exercise (Lane, 2004):
- 29/433 (7%) of horses with “normal” laryngeal function (grade 1 or 2 LFS) at rest developed some form of dynamic laryngeal collapse during exercise
- 43/111 (39%) with grade 3 LFS at rest exhibited arytenoid cartilage collapse (ACC) and/or vocal cord (VCC) during exercise. 61% were able fully to abduct the larynx.
- 6/30 (19%) with grade 4 LFS were also able fully to abduct the larynx.
- 4/4 (100%) with grade 5 LFS sustained dynamic ACC during exercise.

Complex dynamic collapse
According to Lane et al. (2006a), complex dynamic collapse was diagnosed in 32% with URT obstruction and LFS grade and crico-arytenoideus dorsalis (CAD) atrophy. Horses with dynamic laryngeal collapse were significantly more likely to experience complex dynamic collapse than horses with other forms or URT obstruction. However, it was not possible to determine which horses with palatal malfunction would exhibit complex dynamic collapse (Lane et al., 2006b).

2. Treadmill vs field exercise endoscopic findings in horses
Treadmill endoscopy has been the only means of performing upper airway endoscopy in the past couple of decades. The cost of such equipment has limited its use to a restricted number of specialized centers. Considering treadmill examinations are performed by highly trained teams, on acclimatized and sound horses, they represent a remarkably safe procedure. There have been anecdotal reports of accidents but they are far less common than those encountered in ridden horses. The advantages of treadmill examinations are that the exercise conditions are perfectly controlled and repeatable. They also provide the possibility to include additional investigations and record physiological parameters which are useful in establishing a differential diagnosis of poor performance.

Very recently, overground endoscopes have been developed to examine the horse in field conditions and overcome the lack of availability of treadmills, as well as their perceived riskiness. These endoscopes are either carried by the rider or the horse and videoendoscopy is recorded throughout exercise. Some units are also equipped with telemetry, allowing direct visualization of the upper airways during the procedure. The advantages of overground endoscopy are that it allows examining ridden horses and to account for rider interaction. Overground endoscopy is usually well tolerated, even in racehorses. Because the endoscope cannot be repositioned during high speed exercise, careful placement is important prior to the onset of exercise.

We have recently undertaken a comparative study of both treadmill and overground upper airway endoscopy in 9 Standardbreds trotters and in 9 Warmbloods performing in disciplines such as showjumping, eventing, dressage or leisure riding (van Erck-Westergen et al., 2009). The horses were examined on different days in both conditions. The duration and intensity of exercise was standardized, as well as head position. The endoscopic examinations of the upper airways were similar in 12/18 cases. Two trotters showed palatal instability and DDSP only on the treadmill and would not sustain strenuous exercise at the track. Generally, upper airway obstruction occurred earlier during the treadmill exam in comparison to the track test. In sport horses, riding often caused a reduction in nasopharyngeal diameter, even at a walk and promoted further dynamic collapse of the pharyngeal walls at higher speeds. Three horses developed more obvious or different clinical signs when ridden in comparison to treadmill examination. These results show that similar observations can be obtained from treadmill and overground upper airway endoscopy but that there are some differences according to the type of discipline. In a very near future, overground endoscopy will most certainly contribute to more widespread and improved diagnosis of upper airway dynamic obstructions.

V – RESPIRATORY SAMPLING AFTER EXERCISE
Tracheal wash and/or bronchoalveolar lavage may be performed 1H after exercise for cytology, bacteriology and/or virology.
Cytologic analysis may be helpful, for example, to evaluate if horses show inflammatory airway disease (IAD) or Exercise Induced Pulmonary Hemorrhage (EIPH).

CONCLUSION
A detailed clinical examination and blood samples for haematology and biochemistry should always be the first step of a poor performer evaluation. However, the results of this exams are often normal in these horses. Although V4 and V200 are calculated during submaximal intensity exercise, they are related to racing performance and are of great interest in assessing the fitness level of a particular horse. These measurements may help both trainers and veterinarians to manage training programs in order to define precisely the exercise intensity, to evaluate
performance ability in order to make a selection among a population of horses and, finally, to detect underlying diseases.

Also, exercise endoscopy is of great importance for establishing a precise diagnosis of upper respiratory airway obstruction. This examination should be performed during strenuous exercise in order to obtain an accurate diagnosis and thus, take an adequate therapeutic decision. It is also essential to perform a complete upper respiratory tract examination (including guttural pouch endoscopy) and a lower respiratory tract evaluation (clinical examination and respiratory samples such a tracheal wash and/or broncho-alveolar lavage) in order to diagnose and treat all the diseases which may be involved in the horse’s poor performance. Incomplete investigations and inaccurate diagnosis and treatment lead to significant time and economical losses for both owner and trainer.

Respiratory samples after exercise are also very useful to evaluate the lower respiratory airway status.

REFERENCES