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Endoscopic Examination of the Obstructive Upper Respiratory Diseases

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Abstract

Obstructive upper respiratory tract diseases are an important cause of poor performance in racehorses. Diagnosis of these diseases can be made easily by endoscopic examination. The aim of this study is to emphasize the frequently encountered obstructive respiratory tract diseases in the endoscopic examination of the upper respiratory tract in thoroughbred Arabian and British racehorses and the importance of endoscopic examination in the diagnosis of these diseases. The study material consisted of 72 horses (37 Arabian, 35 British horses) between the ages of 2-7 who had no respiratory complaints at rest, but had low racing and training performance. No pathology was detected in 32 (44.44%) of 72 horses who underwent clinical and endoscopic examination. it was detected that 19 (47.5%) palatal instability, 10 (25%) dorsal displacement of the soft palate (DDSP), 8 (20%) pharyngeal lymphoid hyperplasia, 2 (5%) laryngeal hemiplegia, 1 (2.5%) subepiglottic cyst of the remaining horses. As a result, it should be considered that there may be obstructive respiratory tract problems in horses that have a very good general health status at rest and show low racing and training performance. In addition, clinical examination in these horses should be supported by an upper respiratory tract endoscopic examination.

Keywords: DDSP, horse, palatal instability, subepiglottic cyst, upper airway.

INTRODUCTION

The upper respiratory tract is the part of the respiratory system that starts from the nostrils and covers the pharynx and larynx. The main obstructive upper respiratory tract diseases that cause performance loss in horses are related to the nose, pharynx and larynx (Davidson and Martin, 2003; Sheta and Ashour, 2017). The pharynx is a musculo-membranous structure that connects the nasal cavity, oral cavity, larynx, and esophagus (Tessier, 2006; Kumaş, 2009). The soft palate is a musculo-membranous structure extending from the caudal of the hard palate to the larynx (Kumaş, 2009). In horses, there is no functional communication between the oro and nasopharynx, as the soft palate comes into contact caudally with the epiglottis. Therefore, they make obligatory nasal breathing (Tessier, 2006). In addition, the ostium intrapharyngium is the only place where the oro-pharynx and nasopharynx open to each other (Kumaş, 2009). The soft palate is the structure that separates the oro-pharynx and nasopharynx (Kumaş, 2009; Allen, 2015). The ventral surface of the soft palate is covered by the oral mucosa, and the dorsal surface by the respiratory system mucosa.

The skeletal structure of the larynx region consists of the hyoid apparatus and five cartilages. These cartilages are the thyroid, cricoid, epiglottis, and a pair of arytenoid cartilages (Janicek and Ketzner, 2008). The rostral, ventral, and lateral walls of the larynx are formed by the thyroid cartilage. The caudal part of the larynx opens into the trachea. The epiglottis is a triangular, elastic cartilage. The apex of the epiglottis rests on the soft palate in its normal position. Its lateral edges are irregular. The submucosal vascular network can be easily seen on its dorsal surface. The mucous membrane covering the epiglottis extends upwards and fuses with both arytenoids to form the aryepiglottic folds, and ventrally, it extends towards the tongue to form the glossoepiglottal submucosa. One of the most important structures seen in the larynx is the double corniculate cartilages of the arytenoid (Kumaş, 2009).

In horses, especially in race horses, upper respiratory tract disorders prevent the inhaled air from reaching the lungs (Tan et al., 1999; Tan et al., 2005; Mitchell, 2017). In many studies, upper respiratory tract obstructive disorders include pharyngeal lymphoid hyperplasia, pharyngeal cyst, dorsal displacement of the soft palate (DDSP), palatal instability (Tan et al., 1999; Tessier, 2006; Mitchell, 2017), laryngeal hemiplegia, epiglottic entrapment, epiglottic hypoplasia, epiglottic retroversion, axial deviation of the aryepiglottic folds, collapse of the vocal cords, and rostral displacement of the palato-pharyngeal fold (Tan et al. 1999; Kumaş, 2009). In addition, endoscopic examination is required for the diagnosis of these diseases (Tan et al., 1999; Mitchell, 2017).

In this study conducted on thoroughbred Arabian and British racehorses, it was aimed to provide information about the endoscopic examination and incidence of obstructive respiratory diseases that also cause poor performance in horses.

MATERIALS AND METHODS

The study material consisted of 72 thoroughbred Arabian and British horses of different ages and sexes. The horses included in the study had complaints such as poor racing performance and racing training (gallop), excessive sweating after racing and exercise, nosebleeds, abnormal sounding, coughing, prolonged time for breathing to return to normal, and quitting training or racing towards the end of the race or gallop, but there were no symptoms at rest.

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Clinical examination of each horse (inspection, auscultation, percussion of the chest and abdominal region, orthopedic examination and laboratory tests) in the study was performed at rest. Upper respiratory tract endoscopic examination was performed either after the gallop or after the race, and an Olympus CLK-4 endoscopy device was used. Since this device does not have the ability to take and save photos, no photos of the cases were taken. Sedatives or any pre-anesthetics were not administered to the horses for both clinical examination and endoscopic examination. In the endoscopic examination, it was applied nose twitch to the upper lip for restraint of the horse. The nasopharynx was reached by directing it through the ventral meatus of the nose with the endoscopy catheter. After that, upper respiratory tract obstructive disorders (pharyngeal lymphoid hyperplasia, pharyngeal cyst, laryngeal hemiplegia, palatal instability, dorsal displacement of the soft palate, epiglottic entrapment, epiglottic hypoplasia, subepiglottic cyst, epiglottic retroversion of the epiglottic vocal folds, axial dehiscence of vocal folds, axillary palate rostral displacement of the pharyngeal fold) was examined.

Rush and Mair's (2004) scales (Table 1 and Table 2) were used for grading pharyngeal lymphoid hyperplasia and laryngeal hemiplegia. The grading of pharyngeal lymphoid hyperplasia was graded according to the extent of the prominence of mucosal lymph nodes, and laryngeal hemiplegia was graded according to the inward collapse and movement of the cricoid cartilages during inspiration and expression.

Table 1. Pharyngeal lymphoid hyperplasia rating scale*

Form	Endoscopic view
I	Lymph nodes identified in the upper wall of the pharynx are few, white in color and slightly prominent.
II	Lymph nodes spreading towards the lateral walls of the pharynx are more numerous than the I. form and some of them are hyperemic.
III	The number and volume of hyperemic lymph nodes increased. The region is edematous. Enlarged lymph nodes spread a little more towards the lateral walls of the pharynx.
IV	The number of hyperemic and enlarged lymph nodes increased further and covered the entire pharynx. Since the area is edematous, it gives the appearance of tissue growth.

* The pharyngeal lymphoid hyperplasia rating scale as described by Rush and Mair's (2004)

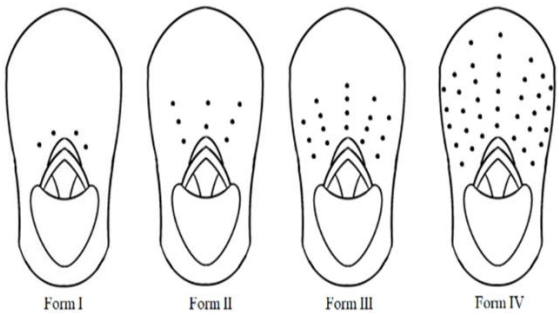

Figure 1. The forms of pharyngeal lymphoid hyperplasia were schematized.

Table 2. Grading of laryngeal hemiplegia*

Grade	Endoscopic view
I	The opening and closing movements of the arytenoid cartilages are normal and their movements are simultaneous. It is difficult to diagnose.
II	The movements of the arytenoid cartilages are not synchronous and the affected side is not fully opened. It is recognized by experience.
III	The arytenoid cartilage on the side of hemiplegia moves significantly slower than healthy cartilage during respiration and cannot fully open. There is an asynchronous movement between the cartilages. It is easy to diagnose.
IV	It is observed that the arytenoid cartilage on the side of hemiplegia is immobile. The affected cartilage protrudes towards the midline of the rima of the glottis.

* Grades of laryngeal hemiplegia described by Rush and Mair's (2004).

RESULTS

Of the horses (72) included in the study, 37 (51.38%) were Arabian and 35 (48.61%) British horses. The age distribution of the horses was in the range of 2-7 years.

No abnormal findings were found in the clinical examination performed during the resting period of all horses included in the study. However, no pathological findings were found in 32 (44.44%) of 72 horses who underwent endoscopic examination after racing or galloping, while endoscopic examination of the remaining 40 [53.33% (21 Arabian horses, 19 English horses)]; 19 (47.5%) palatal instability, 10 (25%) dorsal displacement of the soft palate (DDSP), 8 (20%) pharyngeal lymphoid hyperplasia, 2 (5%) laryngeal hemiplegia, 1 (2.5%) subepiglottic cyst detected. None of the diagnosed cases could be photographed because the endoscopy device used was old and did not have the ability to take photographs. For this reason, some cases were schematized with figures. DDSP constituted 25% of the cases (6 Arabian horses, 4 English horses) with pathology in the endoscopic examination. In the anamnesis of 6 of these cases, there was deficient performance and hitting the wall (stopping the race and training abruptly towards the end of the race and gallop), while the other 4 horses had a history of abnormal sound in racing and training. In the endoscopic examination, it was observed that the soft palate protrudes above the epiglottis and closes the laryngeal entrance (It is schematized in Figure 2). During the endoscopic examination, it was found that the horse showed a swallowing reflex, but the soft palate did not return to its normal position immediately. Cases in which the soft palate did not return to its normal position despite swallowing reflexes twice or more were defined as DDSP.

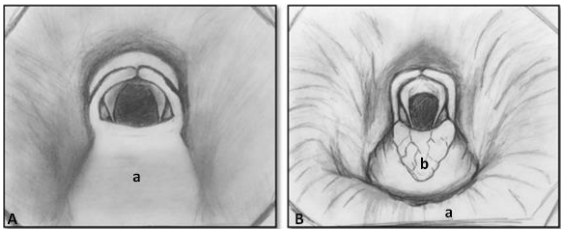

Figure 2. A. The dorsal dysplasia of the soft palate is schematized. It is shown that the soft palate (a) covers the epiglottis (b). B. The normal appearance of the pharynx on endoscopic examination in a healthy horse is schematized. a. Soft palate, b. Epiglottis

Pharyngeal lymphoid hyperplasia was detected in 8 cases (20%). All of these cases had complaints of poor performance. Pharyngeal lymphoid hyperplasia was performed according to 4 forms as stated by Rush and Mair (2004). Endoscopic examination revealed that lymph nodes in the pharynx became prominent in 3 cases, some of them were hyperemic and (form II), and the number of lymph nodes that became more prominent and hyperemic in the other 5 cases increased more and spread more towards the lateral walls of the pharynx (form III) (It is schematized in Figure 1).

Palatal instability constituted 19 (47.5%) of the cases with pathology in the endoscopic examination. Endoscopy revealed that the caudal part of the soft palate was flattened and undulated under the epiglottis in the dorso-ventral direction, the curved apex of the epiglottis was flattened on the soft palate, and the soft palate undulated and the epiglottis fluctuated in these horses, which had complaints of vocalization and loss of performance during training.

Laryngeal hemiplegia was seen in 2 (5%) of the cases. In these cases, there were complaints of unsatisfactory performance and whistling noise in racing and training. Endoscopic examination revealed that the left side was affected in both cases. One of these two cases had 2nd degree and the other 3rd degree laryngeal hemiplegia. In the endoscopic examination of the case with grade 2, it was determined whether the arytenoid cartilages were opened symmetrically and the left side was not fully opened. In the third-degree case, it was observed that the arytenoid cartilage on the left moved very slowly compared to the right side, did not fully open, and obstructed respiration more than in the second-degree case.

In one case (2.5%), a subepiglottic cyst was detected by endoscopic examination. In the anamnesis of this case, there was a decrease in training and racing performance and cough. In the endoscopic examination, a fluctuating cystic structure was observed under the epiglottis.

DISCUSSION AND CONCLUSION

Unsatisfactory performance in race horses is the inability of the horse to complete the exercise or the race and not show the expected success, although the horse's physical structure is suitable. In race horses, a good performance during the race and training is possible if the whole body is in a certain harmony. Damage to any part of the body can cause a decrease in racing and training performance. In a horse with clinically significant symptoms and disease, the cause of poor performance can be easily determined. However, in a healthy horse, it is very difficult to detect deficient performance or a potential problem in the clinical examination performed at rest. There are many reasons that cause deficient performance in racehorses (Kumaş, 2009). Obstructive upper respiratory tract diseases are a major cause of unsatisfactory performance in athletic horses (Tan et al., 2005; Kumaş, 2009; Kaiseler at al., 2012; Kumaş and Maden, 2013; Melkowa et al., 2016; Sheta and Ashour, 2017). In addition, abnormal breath sounds during exercise are often associated with upper respiratory tract disorders (Kumaş and Maden, 2013). Obstructions formed in the upper respiratory tract are characterized by anamnesis information such as abnormal breathing sounds, poor performance, cough, and quitting the race in race horses during training or racing. Endoscopic examination is important in the diagnosis and diagnosis of obstructive airway problems (Tan et al., 2005; Sheta and Ashour, 2017; Mitchell, 2017). Endoscopy allows visualization of inaccessible areas of the pharynx, larynx and trachea (Tan et al., 2005; Koblinger et al., 2011; Kaiseler et al., 2012; Sheta and Ashour, 2017). The aim of this study is to report the frequency of obstructive respiratory tract diseases in thoroughbred Arabian and British racehorses and to report the findings of the endoscopic examination in the diagnosis of these diseases that cause unsatisfactory performance.

Davidson (2003) reported that 40% to 42% of racehorses with performance decline have respiratory tract problems and stated that DDSP, defined as respiratory tract dysfunction, is the most common respiratory disorder and affects 29% to 35% of racehorses. DDSP is a condition that results in a shift of the caudal border of the soft palate over the epiglottis during exercise and closure of the rima glottis during expiration (Tessier, 2006; Conceiçao et al., 2020). The soft palate should normally remain in the subepiglottic position at all times, except when swallowing. Although the etiology is not fully understood (Holcombe et al., 1999; Tessier, 2006; Joo et al., 2020), it has been suggested that factors such as intermittent DDSP, soft palate ulceration, and small or loose epiglottis on endoscopic examination at rest may be indicative of DDSP during exercise (Allen, 2015). Horses with DDSP during rest endoscopy are more likely to have DDSP during exercise, but the majority of horses with DDSP during exercise can appear normal on rest endoscopic examination (Holcombe et al., 1999; Allen, 2015). DDSP may not be diagnosed during resting endoscopic examination, many studies have reported that endoscopy should be performed during exercise for definitive diagnosis (Kumaş, 2009; Allen, 2015; Melkowa et al., 2016). In cases where the soft palate covered the epiglottis and covered the rima glottis, failure of the soft palate to return to its normal position despite swallowing 2-3 times was defined as DDSP. It was determined that it was seen in 25% (n=10) among the cases with pathology in endoscopic examination. Considering the horse's effort during the race and training, it is thought that this rate may be higher.

Pharyngeal lymphoid hyperplasia (PLH) is one of the most common diseases of the upper respiratory tract in young racehorses (Tessier, 2006; Kaiseler et al., 2012). Its etiology is not known exactly (Tessier, 2006). The prevalence decreases as horses get older (Kaiseler et al., 2012). The most common clinical manifestations are inspiratory dyspnea and exercise intolerance. On endoscopic examination, varying degrees of hyperplasia may be seen (Sheta and Ashour, 2017), ranging from a few scattered white follicles to hyperemic, edematous follicles to polyps containing all visible pharyngeal mucosa. In this study, grading was made according to the forms of lymphoid hyperplasia stated by Rush and Mair (2004). In three cases, lymph nodes in the pharynx became prominent and a few lymph nodes became hyperemic (form II). In 5 cases, it was observed that the number of lymph nodes that became prominent and hyperemic increased and spread more towards the lateral walls of the pharynx (form III). It has been reported that pharyngeal lymphoid hyperplasia will predispose to obstructive upper respiratory tract diseases such as nasopharyngeal collapse, dorsal displacement of the soft palate (Tan et al. 1999; Kaiseler et al., 2012). In a study by Tan et al. (1999), it was reported that they detected pharyngeal lymphoid hyperplasia at a rate of 65.49% and they encountered it more in male horses than in females. In our study, pharyngeal lymphoid hyperplasia was seen at a rate of 20%. However, it was determined that there was no difference between the sexes

and it was more common in young horses aged 2-4 years. In addition, all patients with lymphoid hyperplasia had complaints of unsatisfactory performance.

Palatal instability is a condition in which the caudal part of the soft palate undulates in the dorso-ventral direction with flattening of the epiglottis against the dorsal surface of the soft palate (Lane et al., 2006; Allen and Franklin, 2013). It causes turbulent air flow in the nasopharynx during racing and training (Barakzai and Hawkes, 2010), causing a sound similar to snoring (Lane et al., 2006). Palatal instability and DDSP are fairly frequently diagnosed causes of upper airway obstruction (Barakzai and Hawkes, 2010). Some researchers (Lane et al., 2006; Barakzai and Hawkes, 2010) reported that there is a relationship between palatal instability and DDSP, that increased palatal instability predisposes to DDSP, and that palatal instability is the preliminary stage of DDSP. Pharyngeal collapse, palatal instability, as in DDSP, is a dynamic condition and cannot be detected in resting endoscopic examination. If possible, dynamic endoscopic examination is more suitable for an accurate examination and definitive diagnosis (Barakzai and Hawkes, 2010). The lack of dynamic endoscopic device in our unit is one of the missing points of this study. If dynamic endoscopic examination had been performed, the number of 32 cases without pathology could have been less. The number of palatal instability and DDSP cases diagnosed in our study could have been higher, and a diagnosis of pharyngeal collapse not seen in classical endoscopic examination could have been made. In this study, palatal instability was observed in 19 cases (47.5%) in the endoscopic examination performed immediately after the race and training, and it was found that the epiglottis was flattened on the dorsal surface of the soft palate and the soft palate was fluctuating in the dorso-ventral direction.

Subepiglottic cysts are one of the rare causes of noisy breathing and poor performance. In subepiglottic cysts, a noisy breathing is observed during inspiration and expiration during exercise (Janicek and Ketzner, 2008). Cysts are soft-walled, fluctuant masses (Kumaş, 2009) of varying sizes in the subepiglottic region. They can be congenital or shaped later. While congenital cysts originate from the thyroglossal duct, which is an embryonic remnant, the source of subsequently formed cysts is local traumas and infections (Janicek and Ketzner, 2008; Kumaş, 2009). In resting endoscopy, these cysts are located in the subepiglottic tissue dorsal to the soft palate (Janicek and Ketzner, 2008). In our study, a subepiglottic cyst was detected in only 1 case. This case was seen in a 3-year-old Arabian horse. No information was obtained regarding its etiology.

Laryngeal hemiplegia is a disorder (Kumaş, 2009) frequently seen in horses that mostly affects the left arytenoid cartilage. It can be formed unilaterally or bilaterally (Çolakoğlu et al., 2016). Laryngeal hemiplegia occurs as a result of atrophy of the musculus cricoarytenoideus dorsalis muscle, which abducts the arytenoid cartilage. The main reason is shown as the deterioration of the nerve conduction of this muscle (Witte et al., 2009). It has been reported that the incidence of laryngeal hemiplegia in horses varies between 2.6-11% (Brown et al., 2003). Laryngeal hemiplegia causes abnormal breathing sounds and exercise intolerance that occur with impaired respiratory tract functions (Çolakoğlu et al., 2016). Rush and Mair (2004) graded laryngeal hemiplegia in 4 degrees according to the asynchronous or asymmetric movement of the arytenoid cartilages and the degree of closure of the rimal glottis by the arytenoid cartilage according to its appearance in endoscopy. In a study by Tan et al., (1999), they reported that the incidence of laryngeal hemiplegia was 1.63%, and hemiplegia was formed on the left side in all cases. In this study, laryngeal hemiplegia was observed in 2 cases (5%) and both were shaped on the left side. Grading of laryngeal hemiplegia was performed as previously described by Rush and Mair (2004). Accordingly, it was observed that laryngeal hemiplegia of II degree was formed in one case and III degree in the other case. In the endoscopic examination of the case with grade II, it was determined that the arytenoid cartilages had an asymmetrical movement and the left side was not fully opened compared to the right side. In the case with grade III, it was observed that the arytenoid cartilage on the left moved rather slowly (asynchronously) compared to the right side, and did not fully open. In addition, it was observed that it prevented respiration more than the case with grade II.

In conclusion, it should be kept in mind that there may be an obstructive disorder in the upper respiratory tract in horses that appear to be in good general health, but do not perform as desired in races and training, and have noisy breathing in training and races. These horses should be evaluated in terms of upper respiratory tract problem. This evaluation must be supported by endoscopic examination.

Conflict of Interest

The authors declare that they have no competing interests.

Authorship contributions

Concept: E.Ç., Design: E.Ç., Data Collection or Processing: E.Ç., Analysis or Interpretation: E.Ç., Literature Search: E.Ç., Writing: E.Ç.

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