

# **Dorsal Displacement of the Soft Palate**

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## **Introduction**

Horses are a unique species in that they are obligate nasal breathers. The soft palate plays a crucial role for a horse by separating the nasopharynx from the oropharynx during breathing and eating, but if an abnormality occurs within the soft palate it can lead to major respiratory impairment for an athletic horse.<sup>5</sup> In athletic and working horses, achieving a definitive diagnosis for upper respiratory tract issues is important, in order to reduce unnecessary cost, unsuitable surgeries, and get the horse back to top performance as soon as possible.<sup>1</sup>

## **Pathophysiology**

Typically observed in racehorses, dorsal displacement of the soft palate has become one of the most common upper respiratory tract illnesses effecting young horses.<sup>1</sup> It may present with a “snoring” like noise while working or no noise heard at all. Typically, an immediate decrease in performance is observed in horses when displacement occurs.<sup>3</sup> Horses have an interesting connection between the soft palate and larynx. Excluding deglutition, lying just ventral to the rostral body of the epiglottis is the caudal border of the soft palate. This renders horse’s obligate nasal breathers. Unfortunately, during exercise, the soft palate can become displaced dorsal to the epiglottis leading to decreased gas exchange and ventilation because of an obstructed airway. The etiology still remains a mystery, but several ideas link it to either behavioral, physical, or pathological abnormalities.<sup>5</sup>

Dorsal displacement of the soft palate is typically seen in racehorses between the ages of 2 to 4-years-old. Typically, saddlebreds and upper level dressage horses are commonly affected due to their head and neck being flexed during work. Western pleasure and show hunter horses are not typically affected. Dorsal displacement of the soft palate can lead to hypoxia, increased expiratory impedance, hypercarbia, and decreased minute ventilation.<sup>3</sup> This syndrome occurs

during exhalation and the gurgling like noise that is produced is from the vibrations of the caudal border of the soft palate.<sup>1</sup> Horses may also exhibit open-mouth breathing.<sup>2</sup>

Since the etiology is still unclear, this condition appears to be multifactorial. Some ideas believe it is based on the proximity and stability of the epiglottis and larynx to the soft palate, while other ideas point to a dysfunction of the nerves and muscles that control the soft palate. Studies performed have concluded that the thyrohyoideus muscle opposes the larynx and basihyoid bone during contraction. So, when dysfunction of these nasopharyngeal muscles occur it is possible for displacement of the soft palate. Important nerves that control nasopharyngeal function run through the guttural pouch and to the pharyngeal plexus. These nerves all connect with the dorsal wall of the nasopharynx. It is suggested that possible inflammation or infection of this area could lead to neuromuscular dysfunction of soft palate muscles. Two muscles, the palatinus and palatopharyngeus, receive motor function from the pharyngeal branch of the vagus nerve. These two muscles control the position of the caudal portion of the soft palate. In test performed, when the pharyngeal branch of the vagus nerve was desensitized bilaterally it caused dorsal displacement of the soft palate and dysphagia in horses. In addition, biopsies taken of the palatinus muscle in horses diagnosed with dorsal displacement of the soft palate showed chronic denervation, mild atrophy, and moth-eaten fibers.<sup>3</sup> Horses diagnosed with equine protozoal myelitis have even developed dorsal displacement of the soft palate.<sup>2</sup> Thus proving that nerve damage to these areas can lead to dorsal displacement of the soft palate.<sup>3</sup>

### **Diagnostic Approach/Considerations**

When a horse presents for respiratory issues, it is important that a complete history is obtained. This allows clinicians to ask precise questions that obtain specifically to the patient. Questions may be directed towards: exercise intolerance, coughing, respiratory noises,

dysphagia, and past surgeries or treatment. Once these questions have been asked a differential list can be started. Differential diagnosis for possible causes of the abnormal airway noises and respiratory associated exercise impairment include: laryngeal hemiplegia, dorsal displacement of the soft palate, epiglottic entrapment, and exercise induced pulmonary hemorrhage (EIPH). These are just a few of the many possible airway obstructions that can occur.<sup>4</sup>

Once a differential list has been made, the next step is a thorough physical exam. The exam can provide clues to present issues as well as reveal past medical procedures. The exam should be conducted over the entire horse first and then narrow it down to the respiratory system. A visual observation of the horse's head should be done to look for any facial deformities along with any asymmetry of the head or neck. Laryngeal function can be evaluated by palpation, it just takes time and skill in order to become proficient.<sup>4</sup>

A physical exam provides valuable information, but that information will only go so far. This allows for the use of more advanced diagnostics. One diagnostic tool is a videoendoscopic device used to perform an endoscopic exam of the horses' upper respiratory tract at rest. A twitch should be used to restrain the horse, not sedated, in order to insure normal function of the airway is maintained. A thorough exam of the pharynx, larynx, and nasal passage needs to be performed to notice any abnormalities. It may also be beneficial to pass the endoscope down into the trachea to look for any feed material indicating aspiration. Endoscopic inspection directly following exercise can also be performed, but can be inconclusive or inaccurate. Videoendoscopic exam on a treadmill can also be performed to assess the upper airway system. For this procedure to be successful, the exercising conditions must replicate a horse's normal working activity. The horse must also become familiarized with the treadmill and healthy enough before the test can be performed. Recent research has shown that reproducing dorsal

displacement of the soft palate on a high-speed treadmill is very doubtful, unlike in natural field exercise.<sup>4</sup>

The gold-standard for diagnosis is observing the upper respiratory tract during exercise. This is accomplished best by using an overground (telemetric) endoscope during field exercise.<sup>1</sup> It is well tolerated by horses and allows for the exam to be performed in the natural training environment for the horse. In addition, the horse does not have to travel or have training sessions to prepare for the test.<sup>4</sup>

Ultrasonography has always been a diagnostic tool to evaluate the respiratory tract; however, lately it has shown promising value in studying the equine upper airway system. Unlike endoscopy, which can only look at the luminal characteristics, ultrasound can evaluate structural tissues surrounding the pharynx and larynx. Due to location ultrasound does have some limitations including the hyoid bones and mandible, but used in conjunction with endoscopy it can be very useful. In addition, radiographs, computed tomography (CT), and magnetic resonance imaging (MRI) all allow a different examination of important structures in the equine head when compared to endoscopy.<sup>4</sup>

Lastly, sound analysis has also become a technique used to assess the respiratory system. Using a cavison-mounted microscope, it reduces extraneous sounds and records respiratory sounds also heard by humans. These sounds are recorded and then analyzed by time, frequency, and intensity. This technique that performs the evaluation is called a spectrogram analysis. A computer and specialized software must be available in order to assess results. However, testing has shown a diagnosis can be made when viewing a spectrogram and listening to respiratory noises from a horse with dorsal displacement of the soft palate simultaneously.<sup>4</sup>

## **Treatment and Management**

Multiple medical and surgical options are available for dorsal displacement of the soft palate. Once a diagnosis has been made, it is important for the veterinarian to discuss all options with the owner and recommend the best plan for the horse.<sup>1</sup> The best results are when the procedure is performed under general anesthesia in dorsal recumbency with the horse's head extended. However, some procedures can be accomplished with the horse sedated and standing with local anesthesia.<sup>6</sup>

Knowledge of normal anatomy is important in order to understand abnormalities. Various muscles run along the ventral aspect of a horse's neck and are significant contributors to the larynx. Extending the complete length of the neck, the sternomandibularis muscle forms the ventral border of the jugular furrow. Dorsal to the sternomandibularis, the paired sternothyrohyoideus muscles can be found at the mid-cervical region. These muscles extend along the ventral aspect of the trachea. The basihyoid bone and lingual process of the hyoid bone serve as insertion points for the larger sternohyoideus muscle. The caudal border and abaxial surface of the thyroid cartilage provide insertion for the smaller sternothyroideus muscle. Originating from the subscapular fascia and close to the shoulder joint, the paired omohyoideus muscles unite with the sternohyoideus in the proximal third of the neck.<sup>6</sup>

Typically, if medical treatment is wanted over surgical this will involve a steroid. Corticosteroids are given to hopefully reduce inflammation within the pharynx or larynx. Primary palate dysfunction or secondary dysfunction from neurapraxia are believed to be caused by the inflammation. Currently, not enough research or evidence is available to conclude if this treatment is beneficial. More studies need to be performed to support this treatment.<sup>1</sup>

One surgical procedure is called a staphylectomy. This surgery basically trims the caudal free margin of the soft palate. It is believed to be beneficial by possibly increasing the strength and stability of the soft palate due to scarring and by reducing the amount of soft palate tissue therefore reducing possible airway obstruction. The procedure is performed with the horse under general anesthesia and in dorsal recumbency. It is performed through a laryngotomy incision along the ventral aspect of the neck. The incision may be closed or left open to heal by second intention. This surgery has about a 60% prognosis for improvement.<sup>3</sup>

Sternothyroid myectomy is another possible procedure. It can be performed either standing or in dorsal recumbency. An incision is made along the ventral aspect of the neck. The sternohyoid muscle is exposed and elevated for transection distally. Then the smaller sternothyroid muscles are found and removed. The incision is then closed. Possible seromas or abscesses can form. This procedure also has a 60% prognosis for improvement.<sup>3</sup>

Combined staphylectomy and sternothyroideus tenectomy are done to prevent caudal movement of the larynx and scarring of the caudal soft palate. This procedure is performed under general anesthesia. An incision is made along the ventral aspect of the neck centered over the cricothyroid membrane. The sternothyroid is transected just caudal to where the thyroid cartilage inserts. A portion of the muscle and tendon are removed bilaterally. The staphylectomy is then performed as described above. This procedure has a 60% prognosis for resolution of dorsal displacement of the soft palate.<sup>3</sup>

Epiglottic augmentation is designed to strengthen the epiglottic cartilage in order to keep the soft palate ventral to the epiglottis. Performed under general anesthesia. A laryngotomy incision is made to expose the epiglottis and then it is inverted into the lumen of the larynx. Then three to seven milliliters of Teflon paste are injected submucosally. It has a 60% prognosis for

resolution of dorsal displacement of the soft palate. Unfortunately, this procedure is not performed often due to the lack of evidence to support it.<sup>3</sup>

Laryngeal tie-forward procedure is performed on the basis that the position of the larynx is just dorsal to the basihyoid bone during exercise. The horse is under general anesthesia and in dorsal recumbency. An approximately 15 centimeter incision is made along the ventral aspect of the neck and extends from the rostral portion of the basihyoid bone to the caudal portion of the cricoid cartilage. The sternohyoideus muscles are dissected to expose the ventral aspect of the larynx. Exposure of the basihyoid bone is done using a retractor and a larger retractor is used to expose the lateral portion of the thyroid cartilage. The basihyoid bone is then exposed using a curette. A drill bit is used to make a hole in the basihyoid bone just rostral to its caudal border. Sutures (USP polyblend, Fiberwire) are passed through the hole made in the basihyoid bone. That suture is then placed through the left wing of the thyroid cartilage near where the sternothyroideus muscle inserts. Another suture is placed within a centimeter to increase the strength of the fixation and reduce stress on the one suture. The same procedure is done on the right side. Before tying the sutures, the horse's neck is lifted to a 90 degree angle to help assist tying. The placement of the first suture is done so the rostral aspect of the thyroid cartilage is dorsal to the basihyoid bone. The second suture is placed to help with tension. The sternohyoideus muscles are re-apposed incorporating the fascia over the ventral larynx. The subcutaneous tissues and skin are then closed. It is important the horse be fed at shoulder height to reduce stress on the sutures. This procedure has an 86% prognosis for resolution of dorsal displacement of the soft palate.<sup>3</sup>

**Conclusion:**

In conclusion, there are multiple respiratory conditions that impair athletic performance in race and speed event horses. Dorsal displacement of the soft palate may be difficult to diagnose. It may present with abnormal airway noises or no noises at all. With the exact etiology unknown, diagnosis sometimes is made by past history if diagnostics are inconclusive. These are only a few of the procedures that can be performed for resolution of dorsal displacement of the soft palate. It is important to consult with a veterinarian who can perform a thorough physical exam and workup for a horse with respiratory issues for the best possible performance outcomes.

## References

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