

Bilateral dynamic laryngeal collapse associated with collection in "high poll flexion" in a gaited Icelandic horse

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Summary

A 6-year old female Icelandic Horse was evaluated because of marked respiratory noise and distress at the tölting gait. Resting endoscopy and high speed treadmill videoendoscopy at trot and gallop did not reveal any significant abnormalities, but it was not possible to urge the horse into the tölting gait on the treadmill by using long reins. It was however possible to ride the horse on the treadmill and when tölting, an abnormal respiratory noise was immediately noticed. Videoendoscopy revealed marked bilateral vocal fold and arytenoid cartilage collapse (bilateral dynamic laryngeal collapse) that disappeared when the horse was allowed to lower its head carriage and trot or gallop. The condition was consistently and easily reproduced when the horse was urged back into the tölting gait. The horse was intended for gaited competitions, bilateral ventriculocordectomy was therefore attempted in hopes of restoring some degree of performance. The mare was able to compete thereafter, but a mild degree of respiratory noise was still audible when ridden at the tölting gait. Bilateral dynamic laryngeal collapse associated with poll flexion has previously only been described in harness racehorses. In this case the syndrome was only apparent while the horse was tölting and seemed related to periods of collection in "high poll flexion". This case underscores the importance of accurately reproducing the conditions that provoke the clinical disorders in order to arrive at a correct diagnosis.

Keywords: Icelandic Horse, dynamic laryngeal collapse, poll flexion, tölting gait, high speed treadmill videoendoscopy

Bilateraler dynamischer Kehlkopfkollaps in Zusammenhang mit der Kopf-Halshaltung im Tölt bei einem Islandpferd

Dynamische Obstruktionen der oberen Atemwege sind bei Pferden ein wohlbekanntes leistungshemmendes Problem, sowohl bei Reit- als auch bei Rennpferden. Meist erscheinen die Pferde während der Endoskopie im Ruhezustand normal, auch wenn atmungstimulierende Mittel oder eine manuelle Schließung der Nasenlöcher angewandt werden. Die Videoendoskopie auf dem Laufband hat zahlreiche dynamische Diagnosen ermöglicht, die sonst nicht diagnostiziert worden wären. Einige Diagnosen lassen sich nur feststellen, wenn die Pferde in der Versammlung den Hals aufrichten. Der bilaterale dynamische Kehlkopfkollaps, definiert als bilateraler Stimmbandkollaps mit einem gleichzeitig mehr oder weniger ausgeprägten Kollaps der Aryknorpel, ist ein erst vor kurzem beschriebenes dynamisches Leiden der oberen Atemwege. Norwegische Kaltbluttraber scheinen prädisponiert zu sein und das Leiden hängt scheinbar mit der Kopfhaltung zusammen. Bei der videoendoskopischen Untersuchung auf dem Laufband erscheinen diese Pferde bei freier Kopfhaltung normal, aber eine Kopf-Halshaltung in Versammlung ruft sofort einen Kehlkopfkollaps hervor. Dieser Fallbericht beschreibt den ersten diagnostizierten Fall eines dynamischen Kehlkopfkollapses eines Islandpferdes, der nur im Tölt auftrat. Eine 6-jährige Isländerstute wurde wegen eines deutlich inspiratorischen Atemgeräusches, das nur im Tölt hörbar war, an der Norwegischen Tierärztlichen Hochschule untersucht. Die klinische Allgemeinuntersuchung war ohne besondere Befunde. Die endoskopische Untersuchung in Ruhe und auf dem Laufband in Trab und Galopp ergab keine abweichenden Befunde im Kehlkopfbereich. Das Pferd wollte auf dem Laufband allerdings nicht tölten, auch nicht mit Hilfe von langen Zügeln. Unter dem Reiter auf dem Reitplatz war das Atemgeräusch im Tölt sofort deutlich hörbar, gleichzeitig zeigte die Stute Stress-Symptome und versuchte den Kopf nach vorne und unten zu ziehen. Eine direkt anschließende Endoskopie ergab allerdings immer noch keine abnormalen Befunde. Das Pferd ließ sich aber auf dem Laufband reiten und dabei im Tölt mit Videoendoskop untersuchen. Ein bilateraler Kollaps der Stimmbänder und der Aryknorpel wurde direkt nachdem die Stute anfang zu tölten beobachtet. Im Trab oder Galopp waren die anatomischen Verhältnisse wieder normal. Das Atemgeräusch war zeitgleich mit dem Kehlkopfkollaps deutlich hörbar. Da die Stute in Gangartturnieren starten sollte, wurde eine Ventrikulokordektomie durchgeführt. Das Pferd ließ sich danach im Tölt reiten und nahm in den folgenden Jahren an mehreren Turnieren teil, ein geringgradiges Atemgeräusch war aber immer noch hörbar. In den letzten Jahren haben mehrere Studien gezeigt, dass die Kopfhaltung für die Entstehung dynamischer Stenosen der oberen Atemwege von Bedeutung sein kann. In diesem Fall trat der Befund nur im Tölt auf. Es ist nicht wahrscheinlich, dass die Gangart selbst das Leiden hervorruft, sondern eher die zum Tölen notwendige Kopfhaltung, welche der eines Trabers ähnelt. Die Pathogenese des bilateralen dynamischen Kehlkopfkollapses ist noch nicht bekannt. Anfänglich hatte man angenommen, dass bei betroffenen Pferden, der negative inspiratorische Druck zum Kollaps von Stimmbändern führen würde und in der Folge zum Kollaps der Aryknorpel und eventuell weiterer Strukturen im Larynxbereich. Ventrikulokordektomie war deshalb bei den ersten Fällen die Therapie der Wahl. Eine retrospektive Studie von 26 mit dynamischem Kehlkopfkollaps diagnostizierten Trabrennpferden ergab jedoch keine signifikanten Unterschiede bezüglich der Rennleistungen zwischen 16 ventrikulokordektomierten und 10 nicht-operierten Pferden. Sechs von den operierten Pferden wurden anschließend auf dem Laufband endoskopiert und alle zeigten unverändert einen Kehlkopfkollaps. Das diagnostische Aufarbeiten dieses Leidens ist eine Herausforderung. Dieser Fallbericht illustriert deutlich, dass es zwingend notwendig ist, die Situation zu reproduzieren, in der das Problem auftritt, um eine korrekte Diagnose stellen zu können.

Schlüsselwörter: Islandpferd, dynamisch, Kehlkopfkollaps, Versammlung, Kopfhaltung, Tölt, Laufband, Videoendoskopie

Introduction

Dynamic obstruction of the upper respiratory tract is a well-documented cause of respiratory distress and poor-perfor-

mance in horses. High-speed treadmill videoendoscopy has enabled the diagnosis of numerous forms of upper respiratory tract disorders which are obvious only during exercise (Franklin 2009). In some cases, enforced poll flexion during

examination is necessary to induce the upper respiratory tract obstruction (Strand et al. 2004, Franklin et al. 2006). Left sided arytenoid cartilage collapse, vocal fold collapse and axial deviation of the aryepiglottic folds are the most common disorders affecting the larynx (Tan et al. 2005, Franklin et al. 2006, Lane et al. 2006). These disorders are most often present regardless of head and neck position. Bilateral vocal fold and arytenoid cartilage collapse associated with poll flexion is a newly described disorder most frequently diagnosed in Norwegian Coldblooded Trotters (Strand et al. 2004, Fjordbakk et al. 2008). This disorder is often associated with other abnormalities of the upper respiratory tract, such as axial deviation of the aryepiglottic folds and dorsomedial deviation of the epiglottic margins, and has therefore recently been denoted bilateral dynamic laryngeal collapse (Fjordbakk et al. 2008). Norwegian Coldblooded Trotters are powerful harness racehorses that can be difficult to restrain. Although they race with different types of head-checks enforcing "high" head and neck position, poll flexion occurs when they are restrained onto the bit. Correct diagnosis is only made videoendoscopically when the horse is driven into the bit by using full racing gear and long reins on the high-speed treadmill (Strand et al. 2004, Fjordbakk et al. 2008). This report describes the first case of bilateral dynamic laryngeal collapse diagnosed in an Icelandic Horse evident only during the tölting gait.

Case report

A 6-year old female Icelandic horse intended for use in gaited competitions was referred to the Norwegian School of Veterinary Science, Equine Section. The mare had a history of dyspnea and marked upper respiratory tract noise during ridden exercise at the tölting gait. The abnormal respiratory noise had been present since the mare had been schooled to the tölting gait approximately 1 year previously. The mare reportedly performed well and tirelessly at other gaits, but made abnormal respiratory sounds soon after urged into this gait. Several minutes thereafter the mare became so tired that the exercise had to cease. There was no previous history of upper respiratory tract infection, coughing, or any other abnormalities or illnesses. No abnormalities were noted during resting endoscopy performed by the referring veterinarian.

Upon initial examination at the Norwegian School of Veterinary Science, the horse appeared bright, alert and responsive. Resting videoendoscopy (Pentax EG-2930K, Tokyo, Japan) of the upper respiratory tract was performed in the unsedated horse using a twitch for restraint. No abnormalities were noted on endoscopy. This evaluation included repeated manual nasal occlusions for 30-60 seconds, as well as administration of a respiratory stimulant (0,20 mg/kg bodyweight lobuline IV) to induce approximately 60 seconds of hyperpnoea. The administration of lobuline caused the soft palate to displace dorsally over the epiglottis 3 times, but it replaced quickly each time the horse swallowed. A lateral radiograph of the pharyngeal/laryngeal region did not reveal any abnormal findings.

Since no abnormalities were found at rest, dynamic videoendoscopy utilizing high-speed treadmill (Säto, Uppsala,

Sweden) was performed. The mare was acclimated to run on the treadmill the day prior to the evaluation. After a warm-up period the following day, the treadmill was stopped and the videoendoscope passed through the right nostril, positioned to obtain a clear view of the larynx, and then secured to the horse's noseband with velcro straps and tape. The horse was trotted and galloped at speeds up to 11 m/sec for 4 minutes without evidence of endoscopic abnormalities or production of unusual respiratory noise. An attempt to drive the horse into the tölting gait on the treadmill by using bit and long reins failed and the examination was aborted. The horse was ridden again on an outdoor track and an abnormal inspiratory snoring noise became noticeable immediately after the horse began to tölt. The horse seemed to be in distress when this abnormal noise was produced as she tried to force her head down. When she was allowed to lower her head and trot, the signs of distress as well as the abnormal noise disappeared. Videoendoscopy was performed several seconds after ceasing exercise at the tölting gait but no upper respiratory abnormalities were noted.

Due to the highly disciplined nature of the mare it was agreed that the owner would ride the horse on the treadmill at the tölt gait while videoendoscopy was performed. The horse tölted confidently on the treadmill when ridden (Fig 1) and the respi-



Fig. 1 Videoendoscopy while the horse is ridden on the treadmill at the tölting gait. This head and neck position was associated with bilateral dynamic laryngeal collapse.

Videoskopie im Tölt auf dem Laufband. Kopf- und Genickhaltung war mit bilaterem dynamischen Kehlkopfkollaps verbunden.

ratory noise was quickly induced. At the same time as the abnormal respiratory noise became apparent, bilateral vocal fold and arytenoid cartilage collapse were registered (Fig 2). When the horse was allowed to trot with a lower head carriage, the sound and the airway collapse disappeared (Fig 3), but were easily and consistently reproduced when the horse was urged back into the tölting gait. The bilaterally symmetric vocal fold and arytenoid cartilage collapse was evaluated as "marked" according to a previously published grading scale (Fjordbakk et al. 2008). No other dynamic abnormalities were noted during this examination.

Bilateral ventriculocordectomy was performed through a laryngotomy incision (Turner und McIlwraith 1989) with the horse in dorsal recumbency under general anesthesia in an attempt to relieve the respiratory compromise affecting the

horse. Resting videoendoscopy performed 37 days postoperatively revealed that the surgery sites had healed optimally without complication. The horse had not demonstrated any signs of feed aspiration or coughing, and returned to training for gaited competitions thereafter. Post-operative evaluation of the horse under actual competition revealed reduced noise production and improved stamina. It was now able to complete its approximately 4 minute competitive program in tölt without undue distress, but to the critical ear was still not considered to be restored to normal. After several moderately successful seasons in competition the horse was retired

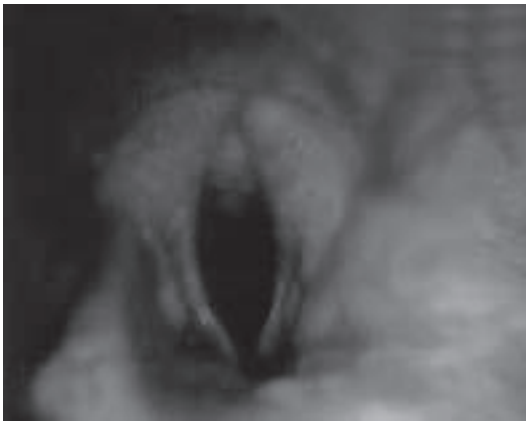


Fig. 2 Bilateral arytenoid cartilage and vocal fold collapse observed while the horse was töltting.
Bilateraler Kollaps der Stimmbänder und Aryknorpel im Tölt endoskopiert.



Fig. 3 Normal anatomical appearance while the horse was trotting/galloping
Normale anatomische Verhältnisse während Trab/Galopp.

Discussion

Bilateral dynamic laryngeal collapse has previously only been reported in harness racehorses, and Norwegian Cold-blooded Trotters seem predisposed to this disorder relative to Standardbreds (Strand et al. 2004, Fjordbakk et al. 2008). The diagnosis can only be established while the affected individual is driven into the bit during high-speed treadmill videoendoscopy wearing a bridle and head check rein. If exercised with only a halter and free head carriage, no abnormalities are noted. This disorder appears to be a separate entity from recurrent laryngeal neuropathy (Strand et al. 2004, Fjordbakk et al. 2008). Resting videoendoscopy revealed

no upper respiratory tract abnormalities in this case, as is typical for this syndrome. Nasal occlusion has been used as a simple method to simulate upper airway negative pressure achieved during high speed exercise (Holcombe et al. 1996), but as previously reported, this has not been useful as a diagnostic tool in cases of dynamic laryngeal collapse associated with poll flexion (Strand et al. 2004). Administration of the alkaloid lobeline IV produces hyperpnoea of 30-60 seconds duration, which may facilitate examination of dynamic upper respiratory airway function in some cases (Marlin et al. 2000, Brink 2005). This test made the horse displace its soft palate dorsally over the epiglottis 3 times, but it repositioned the soft palate quickly when it swallowed. Arytenoid and vocal fold function was assessed as being within normal limits.

High-speed treadmill videoendoscopy has been proven to be essential in diagnosing dynamic upper respiratory tract collapse and recent studies have also showed the importance of poll flexion to induce various forms of dynamic collapse (Strand et al. 2004, Franklin et al. 2006, Fjordbakk et al. 2008, Franklin 2009). Petsche et al. (1995) have scientifically demonstrated that poll flexion causes upper respiratory tract obstruction in seemingly normal Standardbred horses.

The pathogenesis of this condition is unknown. Initially it was hypothesized that increased negative inspiratory pressure occurring during poll flexion caused bilateral vocal fold collapse and then secondary collapse of the arytenoid cartilages, and occasionally other laryngeal structures in susceptible horses. This was in part based upon vocal fold collapse seemingly preceding collapse of arytenoid cartilages and other abnormalities in affected horses, and that many affected horses have a relatively small laryngeal lumen based upon videoendoscopic examination and laryngotomy surgery (Strand et al. 2004, Fjordbakk et al. 2008). Additionally, Holcombe et al. (2006) have recently demonstrated that primary vocal fold collapse can occur as a result of cricothyroid muscle dysfunction. Two recently published studies seem to disprove this original hypothesis. In one study, 16 horses received bilateral ventriculocordectomy surgery and management recommendations, and were compared to 10 other affected horses which received just management recommendations (Fjordbakk et al. 2008). These recommendations included using a longer check rein and avoiding excessive tension on the bit and reins. Comparison of the groups could not demonstrate any clear benefit of the surgical procedure with regard to racing times and earnings. Those horses receiving surgery that had follow-up high-speed treadmill videoendoscopy examination continued to have collapse of the arytenoid cartilages and other structures despite the absence of the vocal folds and laryngeal ventricles. This seemingly ruled out vocal fold collapse as the primary initiating event in this disorder. Eleven of the 26 horses were retired prematurely from racing due to continued poor performance attributed to persistent upper respiratory tract problems.

A second recent study compared tracheal pressure measurements in a group of 5 elite Norwegian Coldblooded Trotter racehorses to 6 affected individuals during alternating phases of free head carriage and poll flexion (Strand et al. 2009). Both groups of horses had similar mean baseline inspiratory pressures during the initial phase of free head carriage

(Elite - 30.66 cm H₂O; Affected - 31.28 cm H₂O) dispelling the hypothesis that affected horses could have greater baseline driving pressures due to "smaller" laryngeal lumen size. Both groups had significantly greater negative inspiratory pressures during poll flexion relative to free head carriage; however, the affected group had much greater negative inspiratory pressures (-58.4 cm H₂O) relative to the elite group (-39.4 cm H₂O). In summary, this study demonstrated that even elite racehorses develop a mild upper respiratory tract obstruction during periods of poll flexion, and that dynamic laryngeal collapse associated with poll flexion causes a severe upper respiratory tract obstruction based upon tracheal pressure measurements. Further studies are needed to identify the exact cause of this disorder.

The Icelandic horse has been bred as a pure breed for approximately 1000 years, and is growing in popularity across Europe and North America especially because of its comfortable and flashy tölting gait. The tölting gait is a lateral 4 beat gait performed collected in high poll flexion. It can be difficult to urge a horse to tölt without a rider, and an attempt to mimic the head carriage while tölting by using long reins on the high-speed treadmill failed. It is unlikely that the gait itself provoked the laryngeal collapse, but rather the head carriage necessary for maintaining the gait. This mare was in obvious respiratory distress while tölting and was not able to maintain this gait in competitions where horses may have to perform at speeds up to 30-40km/h. Bilateral ventriculocordectomy was therefore attempted to reduce the upper respiratory tract obstruction in hopes of restoring some degree of performance. In this particular case the surgery seemed to help the mare, but upper respiratory tract function was not fully restored to normal. The mare still seemed to experience a mild degree of airway obstruction and noise production when ridden at tölt. We hypothesize that this would be due to continued arytenoid collapse as this would not be addressed by ventriculocordectomy. Unilateral laryngoplasty could potentially have also been attempted but would only address the dynamic arytenoid collapse on that particular side.

This case underscores the importance of accurately reproducing the conditions that provoke the clinical disorder in order to arrive at a correct diagnosis. For this particular case the horse had to be ridden during high-speed treadmill videoescopy at a particular gait with a certain head and neck carriage. The recent development of over-ground endoscopes should enable the diagnosis to be established under field conditions during ridden exercise.

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