

# Effect of combined staphylectomy and laryngotomy on upper airway mechanics in clinically normal horses

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**Objective**—To investigate the effect of combined staphylectomy and laryngotomy on upper airway mechanics in clinically normal horses running on a treadmill.

**Animals**—6 Standardbreds.

**Procedure**—Upper airway mechanics were measured with horses trotting or pacing on a treadmill at 5, 8, and 10 m/s before and 6 weeks after combined staphylectomy and laryngotomy. Pharyngeal and tracheal inspiratory and expiratory pressure were measured by use of transnasal tracheal and pharyngeal side hole catheters connected to differential pressure transducers. A pneumotachograph mounted on the rostral end of an airtight face mask was used to measure airflow.

**Results**—Upper airway and translaryngeal inspiratory impedances were higher, respiratory rate was decreased, and inspiratory time was longer ( $P < 0.05$ ) at all speeds after staphylectomy and laryngotomy.

**Conclusion**—Combined staphylectomy and laryngotomy significantly affects upper airway mechanics in clinically normal horses.

**Clinical Relevance**—Because combined staphylectomy and laryngotomy exerts a potentially adverse effect on upper airway mechanics in clinically normal horses, the procedure should only be performed when it is clearly indicated. (*Am J Vet Res* 1997;58:1018–1021)

**D**orsal displacement of the soft palate (DDSP) is a dynamic condition of the equine pharynx that occurs intermittently during high-speed exercise and is associated with a characteristic expiratory gurgle and performance limitation. Despite considerable investigation and to the authors' knowledge, the etiopathogenesis of DDSP has not yet been fully elucidated.<sup>1-10</sup> The condition has been attributed to various anatomic and functional causes, which result in laryngopalatal dislocation and disruption of the normally airtight seal of the ostium intrapharyngium. On the basis of these proposed causes, various treatments have been described, including anti-inflammatory medications, tongue tying, alterations in harness, sternothyrohyoideus myectomy, and combined staphylectomy/laryngotomy.<sup>4</sup> Surgical treatments are often performed without accurate diagnosis of the condition perhaps attributable, in part, to the difficulty in confirming a diagnosis of this intermittent condition in horses at rest, on a treadmill, or during athletic performance.

In horses, efficient respiration requires the ostium intrapharyngium to be sealed; because we speculated

that staphylectomy likely increases the size of the ostium intrapharyngium, it was our hypothesis that staphylectomy/laryngotomy would alter the upper airway mechanics in clinically normal horses during high-speed treadmill exercise. The purpose of the study reported here was to record the upper airway mechanics before and 6 weeks after combined staphylectomy/laryngotomy to determine the effect of this surgical procedure in clinically normal horses.

## Materials and Methods

**Horses**—Six Standardbreds, 2 castrated males and 4 females, from 6 to 9 years old and weighing between 445 and 551 kg, were studied. All horses received paddock exercise for 2 weeks before the study and had ad libitum access to mixed hay and water. Horses were housed in box stalls during the study. Physical examination of the horses and endoscopic examination of the larynx and pharynx were within normal limits at rest.

Horses were accustomed to the treadmill and instrumentation prior to experimentation. All horses wore a safety harness, which was attached to a support frame over the treadmill when they were running.

**Instrumentation**—Horses were instrumented to measure inspiratory and expiratory tracheal and pharyngeal pressures while running on the treadmill, as described.<sup>11</sup> Transnasal pharyngeal and transnasal tracheal catheters were passed through the left naris and secured to the muzzle with adhesive tape. Two 176-cm side-hole Teflon catheters<sup>a</sup> (ID, 2.38 mm; OD, 3.97 mm) were used; the tip of the pharyngeal catheter was positioned at the level of the opening of the left diverticulum of the auditory tube (guttural pouch), and the tip of the tracheal catheter was positioned at the junction of the proximal and middle thirds of the cervical portion of the trachea. Each catheter was made with 4 side holes, beginning a distance of 8 catheter diameters from the sealed tip. Catheters were phase matched at 5, 10, and 15 Hz.<sup>12</sup> Tracheal and pharyngeal pressures were measured by use of differential pressure transducers,<sup>b</sup> referenced to atmospheric pressure, and recorded on a physiograph.<sup>c</sup> Before each trial, the transducers were calibrated at pressures from 0 to 30 cm of H<sub>2</sub>O, using a water manometer.

A 15-cm pneumotachograph<sup>d</sup> was mounted on an airtight face mask, which was positioned on the horse's head over the catheters, with the catheters exiting the caudal aspect of the mask. The face mask was constructed from injection-molded plastic and was form fitted to the horse's head by use of insulation foam. The foam lining extended rostrad to the level of the commissure of the mouth, thereby leaving the most rostral aspect of the face mask open for unimpeded nostril dilation. A halter was incorporated around the face mask to support the mask and to secure it on the horse's head. The pneumotachograph was calibrated prior to each horse running on the treadmill by forcing a known airflow through the face mask system; flow was measured, using a rotameter<sup>e</sup> capable of measuring airflow up to 90 L/s.<sup>11</sup>

Respiratory variables, including respiratory rate, tracheal and pharyngeal pressure, translaryngeal pressure, airflow, and inspiratory and expiratory times, were determined by use of a computerized data acquisition system,<sup>f</sup> the pro-

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