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UPDATE ON LARYNGEAL TIE-FORWARD OPERATION

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The procedure was developed following experimental treadmill studies where bilateral resection of the TH resulted in exercise-induced DDSP that was corrected by moving the larynx rostrally and dorsally.¹ This surgical mobilization and fixation of the larynx (“Laryngeal tie-forward”) is based on experimental data suggesting the larynx’s optimal position during exercise is dorsal and rostral to the basihyoid bone.¹ A recent evaluation of the outcome of surgery relating to position of the larynx and hyoid bone after laryngeal tie-forward, established that laryngeal tie-forward procedure moved the basihyoid bone dorsally and caudally and moves the larynx dorsally and rostrally.³ This recent paper revealed that after surgery a more dorsal basihyoid bone and larynx position was more important. In this case-controlled study a positive outcome was defined at return to racing and earnings to pre-operative level of both operated horses and to the matched control. We feel that the dorsal position of the basihyoid is a result of its caudal movement and that really the dorsal position of the larynx may indeed be the most important part of this procedure. The mechanism by which a more dorsal position of the larynx might be helpful in providing stability to the nasopharynx is unknown. This presentation will draw on the literature, clinical population of 488 horses (41% TB, 58% SB, 1% sport horses).

Horses that have DDSP associated with a palatal or subepiglottic cyst/granuloma require targeted treatment for these problems and are not primary candidates for the laryngeal tie-forward procedure.

Surgical technique

The horse is placed under general anesthesia in dorsal recumbency, and endotracheal intubation is performed. A 15 cm ventral midline incision is made, extending from the rostral aspect of the basihyoid bone to 1 cm caudal to the cricoid cartilage. The paired sternohyoid muscles are bluntly separated on the midline, and dissection is bluntly extended to the ventral aspect of the larynx. If not already performed in a prior surgery, the sternothyroid (ST) muscle tendon of insertion on the thyroid cartilage lamina is undermined and isolated (but not yet transected) in preparation for transection.

One size 5 polybend suture (Fiberwire® Arthrex Inc., Naples, FL) is inserted at the ventral aspect of the right ST tendon of insertion and exited from the lamina of the thyroid cartilage and through the thyrohyoideus muscle 1 cm rostrally and slightly dorsally from its insertion point. The suture is then placed again through the right lamina of the thyroid cartilage slightly more dorsal (0.5 cm) and exits more dorsally than the previous bite forming a loop in the thyroid lamina. The procedure is repeated on the left side. The ST tendon of insertion is transected after the sutures are placed in the thyroid lamina. A suture or wire passer is used to pass the most dorsal suture on the right side and most ventral suture on the left side dorsal to the basihyoid to exit on the right side of the lingual process where they are tagged with separate hemostats. The most dorsal suture on the left side and most ventral suture on the right side are then similarly passed dorsal to the basihyoid to exit on the left side of the lingual process where they are tagged with separate hemostats. To remember the suture order the phrase “**D**ude **I**s **V**ery **C**ool” can be used; **D**orsal suture is placed **I**psilateral, **V**entral suture placed **C**ontrolateral.

Mobilization of larynx: The horse's nose is lifted so the head and neck are angled at approximately 90°. The sutures are tied separately using a slip knot. The sutures are tied so the rostral aspect of the thyroid cartilage is ~1 cm rostral to the caudal aspect of the basihyoid bone. The larynx moves approximately 4 cm rostrally and 2 cm dorsally using this procedure. Remember it appears at this time that the dorsal movement is more important. The head is replaced in its normal resting position and the incision closed in an acceptable manner.

Return to training was recommended at 2 weeks. In the first 2 weeks postoperatively the horses are fed and watered at shoulder height.

Results

More recently a case-control study (Level 3 evidence base; n=106) was able to demonstrate that the surgical procedure can restore performance/earning to that of matched control. Out of 416 horses, our short term complication rate was 14.2%. Specific short-term complications included 10.3% intra-operative bleeding, 2.2% intra-operative suture problems, and 1.7% incisional (1% infection, 0.7% swelling).

Management of complications of laryngeal tie-forward

Laryngeal tie-forward is a relatively safe procedure with low complication rates. However the following complications have been observed: 4.1% intra-operative bleeding, 1.4% excessive swelling, 0.4% intra-operative suture problems, 0.7% incisional infection. Most rare ($\leq .004\%$) complications seen after tie-forward of unknown association: AE entrapment, laryngeal hemiplegia, stylohyoid bone fracture. Recurrence rate of DDSP is ~6%. One author has reported vocal cord collapse after laryngeal tie-forward

Incisional infection: Early incisional infection can be treated with appropriate drainage followed by lavage with sterile saline and broad spectrum antibiotics. More chronic incisional infections may best be treated by waiting ~2 months after surgery for scarring to be advanced in order to prevent caudal retraction of the larynx with early suture removal. This waiting is practical if persistent draining tract is present. If an abscess is present, it must be addressed to prevent compression of the larynx. Removal of the suture can be done standing with the horse sedated appropriately and infiltration local anesthesia. The goal is to find the knot of the sutures near the basihyoid bone so the incision is centered on the caudal aspect of the basihyoid bone. After the knot is secured the suture is grasped with a hemostat and removed. The incision is left to heal by second intention.

Recurrence: Horses that initially responded to treatment may experience recurrence (approximately 6% of horses). Failures are usually acute (i.e. from one race to another). If the horse has an initial positive response and radiographic evaluation indicated some caudal/ventral displacement of the larynx, revision tie-forward is indicated. Of note one should be aware that endotracheal intubation is more difficult after laryngeal tie-forward presumably because of lateral restriction of the nasopharynx associated with the larynx being placed midline to the thyrohyoid bones. After the sutures have been identified and removed, the larynx has to be freed of the surrounding tissues, to allow remobilization.

Vocal cord collapse: This has been reported in one case following surgery (Dart, A.J. 2006). The cause of this complication is likely that the function of the cricothyroid muscles was interfered with bilaterally. Possible proposed explanations for this type of complication are that 1) the external branch of the cranial laryngeal nerve is damaged either at surgery or because of excessive/abnormal postoperative fibrosis, 2) the cricothyroid muscle is damaged during surgery (perhaps more likely if prior surgery in the area) or by scarring after surgery and 3) sutures are inadvertently placed around the cricoid cartilage instead of the thyroid cartilage thus interfering with the contraction of the cricothyroid muscle.

Other technical tips/concerns

- If the horse had prior laryngeal surgery (i.e. strap muscle resection) it may be more difficult to distinguish the thyroid from the cricoid cartilages. Placement of sutures around the cricoid instead of thyroid cartilage would interfere with crico-thyroid muscle function. In addition it is more likely to lead to inadvertent penetration of the larynx during suture placement.
- Do not place the sutures in the thyroid lamina too dorsally and rostrally as you may penetrate the ventricle that is most caudal in the dorsal location.
- VC performed at the same time as the laryngeal tie-forward should be done with great caution as the sutures will be separated from luminal contamination only by the crico-arytenoideus lateralis muscle.
- If bleeding is observed from the ventricle postoperatively you may want to consider continuing the antimicrobials a little longer as ventricle penetration has occurred.
- Swelling from one or more ventricles postoperatively is likely due to hematoma and is of no permanent consequence.
- Marked deviation of the larynx postoperatively is an indication of unilateral suture failure.
- Horse may have finicky appetite for 1-2 days after surgery

References

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4. [Dart, A.J. Vocal fold collapse after laryngeal tie-forward correction of dorsal displacement of the soft palate in a horse. *Vet Surg*. 2006; 35:584-585.](#)