Standardizing Laryngeal Cleft Evaluations: Feasibility of the Inter-Arytenoid Region Assessment Protocol

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Introduction:
The Benjamin-Inglis classification system is widely used to diagnose laryngeal clefts1-2. However, this classification system does not clearly identify an anatomic superior limit for type 1 laryngeal clefts, or describe the range of normative inter-arytenoid anatomy. This leads to possible disagreement when classifying minor laryngeal clefts. It may be difficult to define whether a patient has a type 1 laryngeal cleft, a deep inter-arytenoid notch, or simply normal anatomy. This poses challenges when attempting to accurately construct a database of normative anatomy or monitor outcomes of pediatric dysphagia patients, without a more comprehensive descriptive classification system. The challenges of diagnosing type 1 laryngeal cleft anatomically have led to the use of various techniques including the modified barium swallow test or video swallow study, functional endoscopic evaluation of swallowing, and response to conservative therapy to aid in diagnosis3 in addition to operative evaluations. With different operative assessment techniques employed by different surgeons at different academic institutes, variance exists in the resulting anatomic classifications. Current anatomical evaluation of laryngeal clefts involve telescopic evaluation with or without suspension laryngoscopy or vocal cord spreaders, and palpation of the inter-arytenoid area using laryngoscopes, right angle probes, alligator forceps, endotracheal tubes, or other equipment2. Our proposed inter-arytenoid assessment (IARA) protocol provides a descriptive classification of the inter-arytenoid region by utilizing a standardized technique. This study establishes feasibility of the proposed IARA protocol in an academic practice.

Methods:
The protocol was developed with the goal of providing standardized, efficient, and comprehensive evaluations of the inter-arytenoid region in patients. The protocol was created using a modified Delphi approach, with input from otolaryngologists at Seattle Children’s Hospital. The proposed steps of the IARA protocol are:

Step 1: Insert and suspend laryngoscope. A Parsons laryngoscope is best suited for this protocol (Figure 2A).

Step 2: Insert intant true vocal cord spreaders. Contact the false vocal cords. The vast majority of pediatric patients only require extension of spreaders to first click, be careful not to over distend the larynx (Figure 2B).

Step 3: Palpate inter-arytenoid area. Perform palpation using either nerve hook or right angle laryngeal measuring stick. Palpate and observe bulk of inter-arytenoid muscle anterior-posterior and cranio-caudal extent. Palpate surface of cricoid to observe for notching. Check for submucosal laryngeal clefts (Figure 2C).

Step 4: Objective assessment of inter-arytenoid region depth. Use a right angle laryngeal measuring stick to swing anteriorly from a resting place just above the inter-arytenoid mucosa to determine anatomical reference to the level of false vocal folds, true vocal folds or cricoid (Figure 2D). Additionally if available, measure the cranio-caudal distance from mucosa to cricoid in millimeters using a right angle laryngeal measuring stick and straight measuring stick attached to the telescope (Figure 2E, F, and Figure 1 for assembly).

IRB exemption was approved. This IARA protocol was presented to the otolaryngology surgeons at Seattle Children’s Hospital. For pediatric patients undergoing comprehensive airway evaluation, participating surgeons incorporated the additional steps of the IARA protocol into their standard procedures. Review of each video was performed, and analyzed to determine if steps 1-4 were performed successfully in each case. Additionally, when at least steps 1-3 were performed, start to finish completion times were measured.

Results:
Four surgeons participated in the IARA protocol implementation. A total of 29 endoscopic videos were collected. Five videos were removed because of errors in filming, leaving 24 videos for analysis and data collection. Twenty-four videos were reviewed and completion rates were determined (Figure 3). Completion rates for each step ranged from 96-100%. Step 4 was further analyzed to show 98% completion of the anatomic reference (or swinging hook) technique, and 37.5% completion of the cranio-caudal measurement technique. Mean time to completion was 71 seconds when using the anatomic reference technique and 145 seconds with the cranio-caudal measurement technique.

Conclusions:
Overall, the high success rates and low time to mean completion were signs that the IARA protocol is feasible in an academic institution that wishes to standardize and improve endoscopic evaluations of the inter-arytenoid region.

After establishing feasibility, the next steps of our research program will look at the reliability of this assessment, by determining inter-rater and intra-rater reliability. If the IARA protocol is determined to be reliable, we will use it to begin establishing a normative database for laryngeal anatomy in pediatric dysphagia patients.