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Case report

Endoscopic CO2 laser laryngofissure in pediatric laryngotracheal reconstruction

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ABSTRACT

Anterior laryngofissure is often needed to provide excellent visualization of the posterior cricoid lamina during pediatric laryngotracheal reconstruction. Focus has shifted from survival and decannulation outcomes to postoperative voice outcomes as surgical techniques continue to improve. Surgeons must perform the laryngofissure extremely precisely to avoid damage to the true vocal folds and ensure proper reapproximation of the anterior commissure. Endoscopic CO2 laser laryngofissure represents a novel technique to divide the anterior commissure and facilitate its accurate reapproximation.

1. Introduction

Laryngotracheal reconstruction (LTR) represents one of several different surgical options for the management of subglottic stenosis in children. As the surgical techniques and perioperative care continue to improve, focus has shifted from survival and decannulation outcomes to postoperative voice outcomes. Most children who undergo LTR will survive and successfully achieve decannulation of their tracheostomy tubes. However, most children suffer from considerable dysphonia after surgery.

While performing a traditional LTR, an anterior laryngofissure is often necessary to provide an excellent view of the entire larynx and facilitate full access to the posterior cricoid lamina. Laryngofissure is believed to be the first laryngeal conservation surgical technique from which anterior commissure techniques, frontolateral laryngectomy, hemilaryngectomy, and supraglottic laryngectomy developed [1]. Application of this technique in pediatric airway surgery has proven vital in addressing both the anterior and posterior cricoid. Anterior laryngofissure must be performed extremely precisely to avoid direct vocal fold damage, and misapproximation of the anterior commissure may lead to asymmetric vocal fold height, inadequate vocal fold approximation, and subsequent dysphonia due to wave irregularities [2]. Kearns et al. performed fiberoptic laryngoscopy on patients after LTR and found anterior commissure blunting, false-cord phonation, arytenoid prolapse, and decreased movement of the arytenoids [3]. Smith et al. evaluated 8 pediatric LTR patients with voice disturbance and found that 2 had glottal incompetence due to inadequate adduction, 2 arytenoid fixation, 3 anterior commissure blunting or widening, 2 vertical asymmetry of the vocal folds, and 3 vocal fold scarring [4].

Division of the anterior commissure during full laryngofissure classically can be performed either by a strictly external approach or by a two surgeon endoscopic assisted approach. Both of these techniques are completed in the middle of the procedure. Endoscopic carbon dioxide (CO2) laser laryngofissure offers a different approach, which is typically conducted at the start of the LTR.

The use of endoscopic CO2 laser continues to expand in pediatric airway surgery. A few of the common applications include supraglottoplasty for laryngomalacia, excision of lesions in juvenile onset recurrent respiratory papillomatosis (JORRP), cordotomy for bilateral true vocal fold immobility, and endoscopic posterior cricoid split. Our aim was to utilize the CO2 laser endoscopically to perform an internal anterior laryngofissure exactly through the anterior commissure to both prevent damage to the true vocal folds and to facilitate precise reapproximation of the anterior commissure.

2. Methods

Patients undergo routine direct laryngoscopy and bronchoscopy with straight blade laryngoscope and a 4 mm 0-degree

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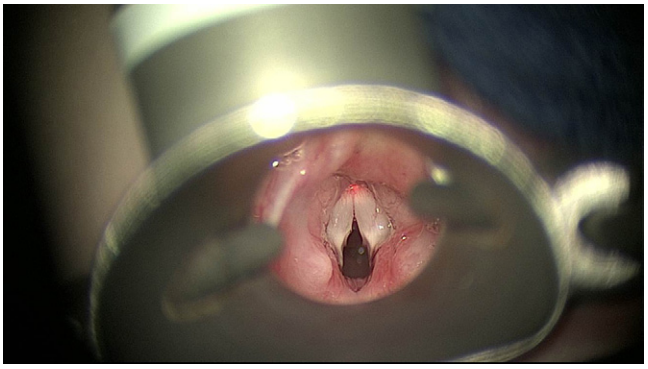

Fig. 1. Intraoperative photo showing adequate exposure during suspension laryngoscopy.

telescope at the start of the procedure to reassess the airway. Once the subglottic stenosis and other airway anatomy are confirmed, a Lindholm laryngoscope is inserted and placed on suspension (Fig. 1). A laryngeal spreader may also help maximize the view of the anterior commissure if needed. The CO2 laser with micromanipulator is then used on a continuous wave setting of 4 watts and pulse width 0.3 mm to divide the anterior commissure (Fig. 2). Gentle pressure on the anterior neck aids exposure and control of the larynx while using the laser. The incision continues at least partially through the thyroid lamina (Fig. 3). The laryngeal framework is then approached through a traditional anterior midline neck incision. Once the airway is skeletonized from thyroid notch to the proximal tracheal, the anterior cricoid is split with a 6900 Beaver blade. The anterior laryngofissure begins with a 6900 Beaver blade from inferior to superior in the midline of the thyroid cartilage while spreading a hemostat within the airway lumen, ensuring to leave the posterior perichondrium intact initially (Fig. 4). The inner perichondrium will already be divided along the anterior commissure. The thyroid cartilage then springs open directly through the anterior commissure after releasing the remaining inner perichondrium. Once the posterior cricoid split (if needed) and/or grafting is complete, the surgeon may now use the small char on either side of the divided anterior commissure to place sutures and accurately reapproximate the glottis (Fig. 5).

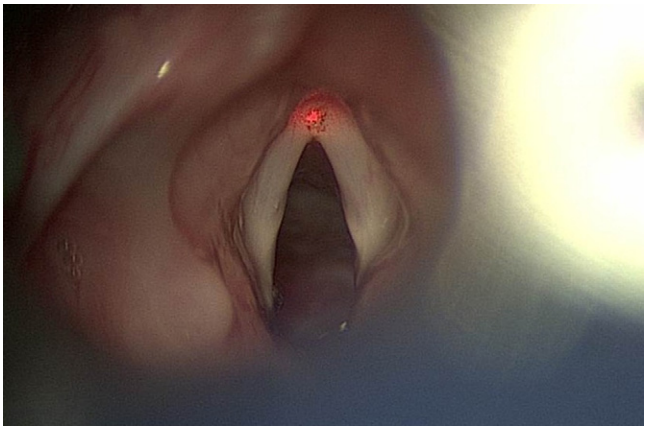

Fig. 2. Intraoperative photo depicting start of incision through anterior commissure.

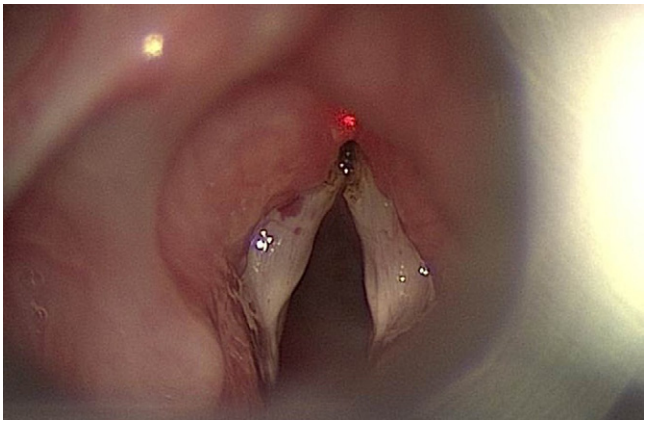

Fig. 3. The incision is continued through the anterior commissure and into the thyroid lamina.

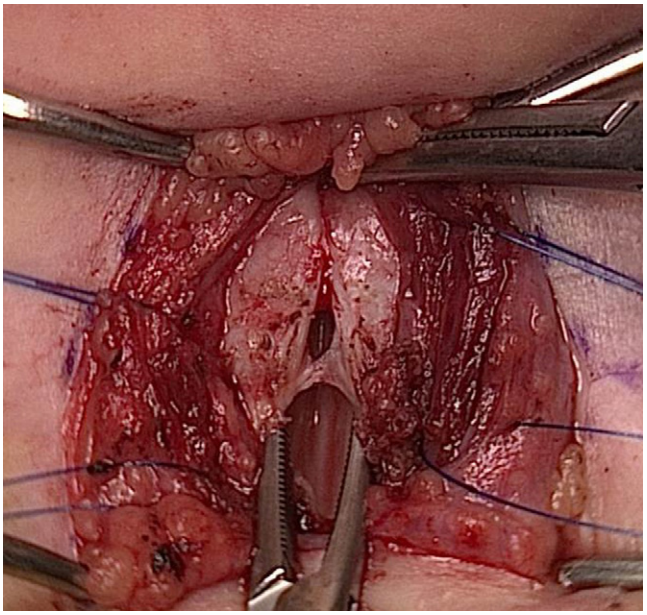

Fig. 4. External laryngofissure preserving the inner perichondrium initially. Note the perichondrium has already been divided by the CO2 laser in the region of the anterior commissure.

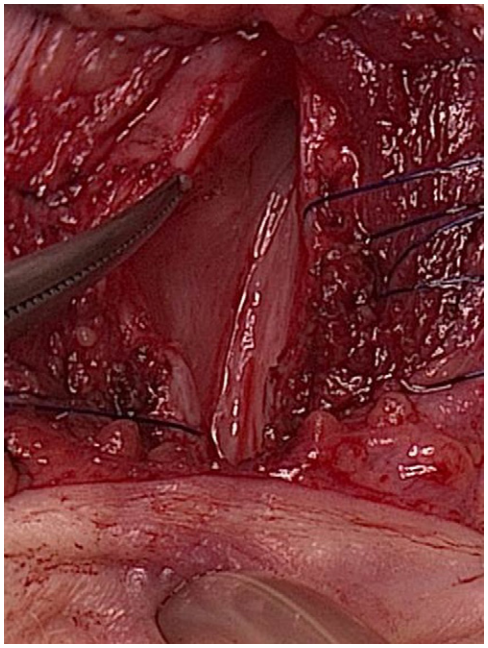

Fig. 5. A hemostat points to a small area of char on the right portion of the divided anterior commissure created by the CO2 laser.