International Journal of Pediatric Otorhinolaryngology 97 (2017) 13–17

Contents lists available at ScienceDirect

International Journal of Pediatric Otorhinolaryngology

journal homepage: http://www.ijporlonline.com/

Endoscopic management of bilateral vocal fold paralysis in newborns and infants

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ARTICLE INFO

Article history:
Received 23 February 2017
Received in revised form
13 March 2017
Accepted 16 March 2017
Available online 18 March 2017

Keywords:
Bilateral vocal cord paralysis
Cricoid split
Stridor
Vocal cord immobility
Airway

ABSTRACT

Introduction: Bilateral vocal cord paralysis in adducted position (BVCPAd) is a severe cause of airway obstruction and usually debuts with stridor and airway distress necessitating immediate intervention. Tracheostomy has long been the gold standard for treating this condition, but has significant associated morbidity and mortality in pediatric patients. New conservative procedures have emerged to treat this condition thus avoiding tracheostomy, like endoscopic anterior and posterior cricoid split (EAPCS). The objective of this paper was to review our experience with EAPCS in newborns and infants.
Methods: Prospective study involving patients undergoing endoscopic EAPCS for symptomatic BVCPAd. The primary outcomes were tracheostomy avoidance and resolution of airway symptoms.
Results: Three patients underwent EAPCS between January 2016 and December 2016. All patients stayed at least 7 days in the Intensive Care Unit (ICU) intubated. All patients presented complete resolution of their symptoms due to airway obstruction, without the need for tracheostomy.
Conclusion: EAPCS is a novel and effective alternative to treat BVCPAd in patients under 1 year old. Our study is an initial experience; more cases are required to identify the real impact and benefits of this technique and to determine the proper selection of patients.

1. Introduction

Stridor in the neonatal period may be a manifestation of multiple congenital anomalies of the respiratory tract. Due to the size and the shape of the airway of the newborn, stridor represents a warning sign that could be secondary to a potentially dangerous anomaly. Independent of its etiology, the approach is to ensure a stable and secure airway, and then develop a diagnostic approach [1].

Unilateral or bilateral vocal cord paralysis (VCP) is a known cause of stridor in the neonate [2], corresponding to the second most common cause of congenital anomaly of the larynx after laryngomalacia, being more frequent than congenital subglottic stenosis [3]. Reports in the literature refer to both unilateral and bilateral vocal cord paralysis [4–9], the latter being a rare condition, with an estimated incidence of 0.75 cases per 1 million births per year [10].

The term VCP is one of the most common causes of vocal cord immobility, which covers a wide range of clinical conditions and includes causes such as ankylosed cricoarytenoid joints and posterior glottis stenosis. The most important considerations in the diagnostic approach of pediatric patients with VCP is to determine if a VCP is congenital or acquired and if it involves one or both vocal folds. More than 50% of pediatric patients present a spontaneous recovery of their VCP in the first 12 months of life [4,5,7].

Bilateral true vocal fold immobility (BTVFI) in adducted position represents a subgroup that has the additional challenge of upper airway obstruction during inspiration. It has been described as idiopathic or secondary to neurological disorders such as the Arnold-Chiari malformation, hydrocephalus, myelomeningocele, cerebral palsy, hypoxia and hemorrhage [10].

The primary goal in the management of VCP during infancy is establishing an adequate airway while maintaining an acceptable voice and safe swallowing function. Tracheostomy has long been the gold standard to achieve this goal. This procedure allows to preserve an adequate respiratory function and laryngeal architecture, but has significant morbidity and even mortality in the pediatric group [11]. Since there is potential for spontaneous recovery

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http://dx.doi.org/10.1016/j.ijporl.2017.03.021
0165-5876/

of vocal cord mobility, in the last 20 years, the management of this condition has evolved to a more conservative approach, developing different management strategies and surgical alternatives seeking to increase the glottis area thus avoiding a tracheostomy. Unfortunately, these procedures may result in irreversible sequela at the level of the larynx and an increased risk of postoperative aspiration and/or dysphonia [4–9,12,13].

We present 3 cases of bilateral vocal cord paralysis with onset in the neonatal period with significant compromise of respiratory function, in whom, to avoid a tracheostomy and its associated morbidity, we perform a novel surgical technique that aims to achieve relief of airway obstruction without compromising swallowing function and voice. This technique which was recently described by Rutter [14] consists of an endoscopic anterior and posterior cricoid split (EAPCS) associated with balloon dilation and endotracheal tube (ETT) stenting postoperatively. The aim of this paper is to report our initial experience with this surgical technique, and to develop a discussion of its most important aspects and findings.

2. Material and method

Prospective study in which patients younger than 1-year-old with bilateral vocal cord paralysis in adducted position with compromised respiratory function at the Hospital Guillermo Grant Benavente of Concepcion, Chile during the year 2016 were enrolled to be treated by EAPCS. Parental consent was obtained prior to the procedure. The demographic data included in this study were gender, age of onset, age at time of surgery, symptoms, etiology and comorbidities. The surgical information gathered was the diameter of preoperative and postoperative subglottis, intubation time after surgery, the need for additional endoscopic procedures and the possible requirement of reintubation or tracheostomy. The measurement of the internal diameter of the airway was performed according to the Cotton-Myer's classification [15].

2.1. Surgical technique

The procedure was performed under general anesthesia, spontaneous ventilation and using suspension laryngoscopy. A Lindholm laryngoscope was placed in position and a vocal fold spreader was used to expose the cricoid. The cricoid plates were injected with 2% lidocaine with 1:100.000 epinephrine using a 25G butterfly needle through the laryngoscope to reduce mucosal bleeding. We incised the posterior cricoid plate first, to avoid blood coming from the anterior split to interfere with the posterior incision. The mucosal and cartilaginous incision was made in the midline using a straight laryngeal scissor (Fig. 1). The incision was palpated using a blunt microlaryngeal round knife to ensure that the posterior cricoid plate was completely divided. The interarytenoid muscle shouldn't be damaged to reduce the risk of a posterior glottis stenosis. Once the posterior split was done, the vocal cord spreader was repositioned if needed to expose the anterior cricoid plate. A slight external pressure on the anterior cervical region was required to achieve a more vertical position of the cartilage and thereby facilitate the subsequent split of the anterior cricoid plate using a laryngeal sickle knife (Fig. 2). Only the tactile feedback of the sickle knife was used to ascertain the split of the anterior plate. As described by Rutter [14] the anterior split is necessary to relieve the spring of the cricoid ring that will otherwise close the gap obtained by splitting the posterior cricoid. After the posterior and anterior split (Fig. 3), we proceeded to balloon dilate. The balloon diameter selected was 2 mm larger than the normal sized cricoid for the age of the patient, therefore we used a 7-mm balloon. Once the dilation was done the posterior cricopharyngeal mucosal raphe was seen at the posterior split site and the patient was nasotracheally intubated and kept sedated in the intensive care unit. The endotracheal tube used was at least one size (0.5 mm of internal diameter) larger than the age-appropriate tube. We used soft non cuffed ETT, either Siliconised or Ivory Portex® to try to minimize additional trauma to the larynx during the stenting period. All patients were placed on reflux treatment with proton pump inhibitors and no corticosteroids were used in the postoperative period except 24 h prior to extubation. A direct laryngoscopy was performed one day prior to the planned extubation during which an airway calibration was performed to assess the subglottic diameter by means of the presence of leakage around the ETT with a 25 cm H_2O pressure applied by the anesthetist. To evaluate the healing of the surgical site the ETT tube was removed during the procedure, the patient was reintubated with an ETT one size smaller and sedation was suspended. Because of the depth of sedation used to avoid damaging the larynx due to excessive patient movement, extubation was performed in all cases in the pediatric intensive care unit 24–48 h after the direct laryngoscopy.

3. Results

3.1. Case 1

A 2 months old male patient without comorbidities, but with family history of an older brother with congenital BTVFI, presented with biphasic stridor since birth with progressive supraclavicular and intercostal retraction evolving to severe respiratory distress at 2 months of age. Flexible scope exam revealed a bilateral vocal cord paralysis in adducted position. A magnetic resonance imaging of the brain (MRI) and echocardiography did not reveal any other pathological findings.

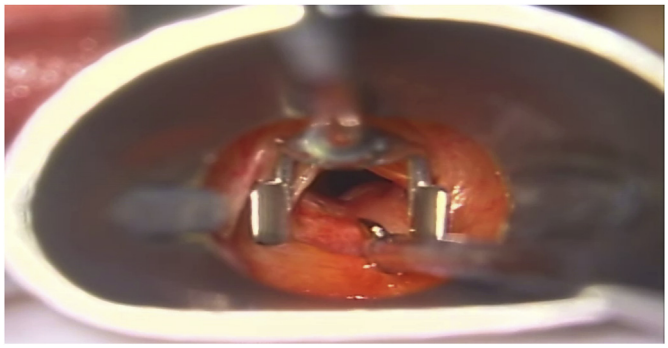

Fig. 1. Posterior cricoid plate being incised.

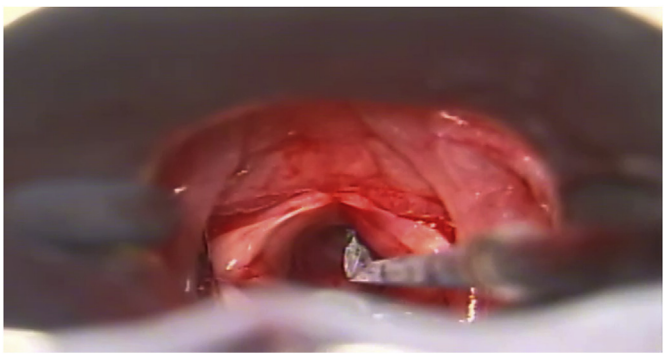

Fig. 2. Incision of the anterior cricoid plate.