

Assessment and Management of Bilateral Vocal Cord Paralysis in Three Cases: Case Series

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Abstract

Objectives: Glottic stenosis leads to respiratory restrictions. Factors like daytime dyspnea and nighttime respiratory restrictions, including obstructive sleep apnea (OSA), should be considered before deciding on a suitable mode for therapy. We aimed to demonstrate clinical pathways to analyze and compare approaches for the management of chronic bilateral vocal fold palsy (BVFP). A decision tree is presented for surgical therapy, continuous positive airway pressure (CPAP) therapy, or no therapy.

Subjects and Methods: The case reports of 3 patients (1 woman and 2 men) aged between 78 and 88 years who presented with dyspnea due to BVFP are described in this case series. Clinical examinations included laryngoscopy using a rigid or flexible transnasal laryngoscope with video documentation of the laryngeal morphology and respiratory motility of the vocal folds, full-night polysomnography (PSG), and spirometry. Treatment procedures comprised CPAP or surgical therapy involving unilateral posterior cordotomy with or without arytenoidectomy.

Conclusion: We propose a diagnostic pathway using laryngoscopy, spirometry, and polysomnography results to aid in the decision-making process for treatment of BVFP in older patients.

Keywords: Bilateral Vocal Fold Palsy; Obstructive Sleep Apnea; Cordotomy; Arytenoidectomy; CPAP

Abbreviations

BVFP: Bilateral Vocal Fold Palsy; OSA: Obstructive Sleep Apnea; PSG: Polysomnography; FIV1: Forced Inspiratory Volume in 1s; AHI: Apnea-Hypopnea Index; FEV1: Forced Expiratory Volume in 1s; CPAP: Continuous Positive Airway Pressure; nCPAP: Nasal Continuous Positive Airway Pressure

Introduction

Bilateral vocal fold palsy (BVFP) is a rare cause of dyspnea. Although the most common etiologies are surgical complications, thyroidectomy, congenital, endotracheal intubation, neurological diseases, rheumatological diseases, neoplasm, autoimmune diseases, and surgery or cancer of cardiothoracic origin, occasionally the cause cannot be identified [1,2]. BVFP may lead to respiratory restrictions, dysphonia, and dysphagia [3]. Apart from hampering physical activity and reducing the quality of life, respiratory restrictions may induce cognitive impairment and depression due to obstructive sleep apnea (OSA) and hypopnea in older adults [4]. However, no stringent management approaches exist for the treatment of BVFP.

In order to decide upon adequate therapeutic strategies to treat upper airway obstruction due to BVFP and to prevent physical, cognitive, and emotional sequelae, a thorough examination of the narrowed glottis and a study of the associated respiratory restrictions should be performed. We propose a diagnostic pathway for older patients with chronic BVFP by studying and presenting 3 cases in which the patients suffered from issues related to respiratory competence during the day and the night.

Case Presentation

Case 1: A 78-year-old woman presented with dyspnea, sleep apnea, and excessive daytime sleepiness. Her relatives mentioned that she made noises while sleeping, along with voiced inspiration. The patient had no dysphagia. She had undergone a complete thyroidectomy 41 years ago. Otolaryngological examination showed BVFP both in a paramedian position, respectively (Figure 1a). The spirometry and polysomnography (PSG) data were considered when deciding upon the treatment plan. On account of the very narrow glottis, low forced inspiratory volume in 1s (FIV1 [1.19L]) and high apnea-hypopnea index (AHI [12.2]) with low nadir of oxygen saturation (75.9%) (Table 1), endoscopic unilateral posterior cordotomy surgery was performed (Figure 1b).



Figure 1a



Figure 1b

Figure 1: (a) Laryngoscopic view of vocal folds (b) Laryngoscopic view of vocal folds after unilateral posterior cordotomy of the left vocal fold at maximal opening of the glottis.

There were no intraoperative or postoperative complications. Increased respiratory competence allowed the patient to engage in more physical activity. In addition, the noisy respiration and daytime sleepiness vanished quickly after surgery.

The values of postoperative spirometric parameters and respiratory flow curve were as follows: forced expiratory volume in 1s (FEV1) of 1.42L and FIV1 of 1.54L. The postoperative AHI was 15.5/h with a nadir of oxygen saturation of 78.2%. Continuous positive airway pressure (CPAP) therapy was recommended for this patient.

Case 2: An 88-year-old man presented with dyspnea due to idiopathic BVFP. He had no dysphagia. Laryngoscopy showed BVFP with slight adduction movement on both sides that caused complete glottic closure (Figure 2). Based on the patient's symptoms and results of endoscopy, spirometry, and PSG, CPAP therapy was recommended.



Figure 2: Laryngoscopic view of maximal glottic opening.

A follow-up PSG 3 years later confirmed the diagnosis of severe OSA with an AHI of 34.2/h and minimal oxygen saturation of 61.5%. CPAP therapy was continued.

Case 3: An 88-year-old man presented with dyspnea and hoarseness. He complained of difficulty in swallowing hard food. The patient had undergone thyroidectomy and radiotherapy 40 years ago. Laryngoscopic examination revealed significant glottal stenosis from BVFP (Figure 3) with both vocal folds in the paramedian and intermediate position. Spirometry and PSG showed only slight deviations from normal parameters (Table 1). No further therapy, except examination of the esophagus, and regular laryngoscopy, spirometry, and polysomnography were recommended in this patient's case.

	Case 1	Case 2	Case 3
Etiology	Thyroidectomy	Idiopathic	Radiotherapy
BMI (kg/m ²)	35.1	26.4	19.6
FEV1	1.07	1.99	1.28
VC	1.86	2.79	3.53
FEV1/FVC%	86%	74	-*
PEF	1.88	5.94	1.58
MEF 25-75	1.14	1.27	0.83
FIV1	1.19	2.35	2.47
AHI	12.2	28.4	3.2
Nadir oxygen saturation	75.9%	75.3%	91%
Average oxygen saturation %	89.9%	-*	96.3%

Table 1: Data of the 3 patients suffering from bilateral vocal fold palsy.

-* Not measured.

BMI: Body Mass Index; FEV1: Forced Expiratory Volume in One Second; VC: Vital Capacity; FEV1/FVC: Ratio of Forced Expiratory Volume and Forced Vital Capacity also called Tiffeneau-Pinelli Index; PEF: Peak Expiratory Flow; MEF: Maximal Expiratory Flow; FIV1: Forced Inspiratory Volume in One Second; AHI: Apnea-Hypopnea Index.



Figure 3: Laryngoscopic view during respiration with maximal glottic opening. Retention of saliva in the posterior portion of the larynx indicates a swallowing disorder.

Discussion

Dyspnea is the main symptom of BVFP with glottic stenosis. Most patients experience respiratory limitations during the day, and some patients also experience sleep disorders or daytime sleepiness. Until now, the decision on the treatment procedure was based primarily

on laryngoscopy and spirometry, which are the most important parameters to assess respiratory competence. However, there are few reported cases in the literature that demonstrate an association between vocal fold paralysis and OSA [3,5-8]. These reports and the cases described in our study support the utilization of endoscopy, spirometry and, polysomnography results in deciding treatment options for patients suffering from chronic BVFP.

Estimating the FIV1 values can aid in detecting laryngeal obstructions [9]. The cut-off value is 2.0L and values lower than 1.5L indicate a life-threatening obstruction. Utilizing this parameter is useful when making clinical decisions, especially in older individuals who do not perform excessive physical activities or cannot describe respiratory competence. When FIV1 values are lower than 1.5L, surgical widening of the glottis is indicated.

Surgical treatment of BVFP includes cordotomy, cordectomy, and arytenoidectomy to widen the glottis and preserve the voice [10-14]. Re-establishing laryngeal neural function is not a standardized procedure. The results of reinnervation surgery were satisfactory in some patients [15], and implantation of a laryngeal pacer that stimulates the posterior cricoarytenoid muscles to abduct the vocal folds during inspiration was also effective [16].

Tracheostomy may be performed as an alternative to endolaryngeal surgery when the glottic width inhibits sufficient respiration. Unlike in cases of endolaryngeal widening procedures of the glottis [17], tracheostomy does not normally lead to deterioration of voice; however, it significantly alters the airway.

Treatment of obstructive sleep disorder often involves the use of a nasal continuous positive airway pressure (nCPAP) device. However, surgery may be performed in cases of laryngeal obstruction [18]. Surgical glottic widening had a satisfactory effect on PSG parameters for BVFP patients [18] when nCPAP therapy was insufficient. Effective sleep apnea management associated with BVFP using vocal fold laterofixation [7], bilateral cordotomy [5], and arytenoidectomy using a CO₂ laser [19] or a microdebrider [20] has been described in previous studies.

Considering the absence of firm protocols to treat BVFP, we propose a decision tree for therapy indications based on the results of laryngoscopy, spirometry, and PSG, while considering the symptoms and needs of the patients.

The outcomes of the case reports presented in this study suggest that surgical widening of the larynx should be planned in BVCP patients suffering from dyspnea if FIV1 and AHI are abnormal. If the FIV1 value is in the normal range, but a full-night polysomnography test reveals an increased AHI, then CPAP therapy without surgical intervention may be planned. BVCP patients with normal values of FIV1 and AHI would not need CPAP or surgical therapy (Figure 4).

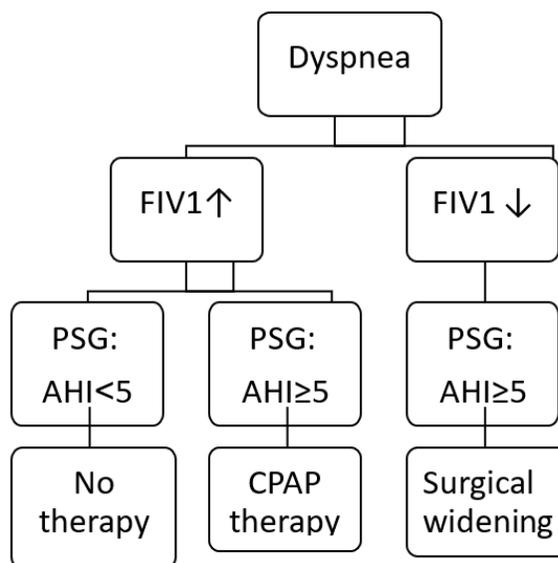


Figure 4: Decision tree regarding therapy indications based on the results of laryngoscopy, spirometry, and PSG. FIV1: Forced Inspiratory Volume in One Second; AHI: Apnea-Hypopnea Index, PSG: Polysomnography; CPAP: Continuous Positive Airway Pressure.

Conclusion

We propose a diagnostic pathway using laryngoscopy, spirometry, and polysomnography results to aid in the decision-making process for treatment of BVFP in older patients.

Declaration of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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