CO₂ Laser Microsurgery for Type 1 Posterior Glottic Stenosis Misdiagnosed as Bronchial Asthma: A Case Report

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This paper reports a case of type 1 posterior glottic stenosis in a 60-year-old woman that was misdiagnosed as bronchial asthma. The patient was intubated at another hospital after ingesting herbicide and extubated seven days later. Although her voice changed, she had not received treatment at that time. She visited a local internal medicine clinic when her condition deteriorated to the point of dyspnea, but several months of treatment for bronchial asthma failed to improve her symptoms. Upon admission to the author's hospital, a laryngoscopic examination revealed a type 1 posterior glottic stenosis, which was removed surgically using a CO₂ laser.

Key words

Type I posterior glottic stenosis; Bogdasarian's classification; CO₂ laser; Bronchial asthma

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INTRODUCTION

Posterior glottic stenosis is defined as an internal rotation of the true vocal cord with either a total or partial fixation.¹ This condition can be categorized into four types using Bogdasarian's classification, namely type 1, interarytenoid adhesion; type 2, interarytenoid adhesion and posterior glottic scarring; type 3, posterior glottic scarring with unilateral cricoarytenoid joint fixation; and type 4, posterior glottic scarring with bilateral cricoarytenoid joint fixation.²

Most cases of posterior glottic stenosis are caused by tracheal intubation, which induces prolonged inflammation of the damaged mucosa. In such cases, stenosis occurs due to scar tissue formation on the posterior glottis.³ However, events such as laryngopharyngeal reflux, neck trauma, and toxic gas or corrosive substance inhalation may also cause posterior glottic stenosis. Recent studies also determined that this condition may be caused by recurrent respiratory papillomatosis or congenital laryngeal

malformation.^{4,5}

Although posterior glottic stenosis is a very well-known disease, it may be overlooked depending on the manifesting symptoms, which range from voice changes and slight dyspnea to severe respiratory distress and may depend on the extent of stenosis or the speed of disease progression.³ Some reports have described cases wherein posterior glottic stenosis was misdiagnosed as a bronchial foreign body⁶ or vocal cord dysfunction.⁷ In this report, we described our experience with a case of posterior glottic stenosis that arose after intubation consequent to herbicide injection, which was initially mistaken for bronchial asthma. In addition to the case details, we presented a review of the current literature.

CASE REPORT

A 60-year-old woman presented at our clinic with the complaints of voice changes and dyspnea, which deteriorated recently. Her medical history included a suicide

Fig. 1. Results of pulmonary function testing at another hospital. Although the FEV1/FVC was 70%, the FVC of < 80% indicated a restrictive pattern. FVC, forced vital capacity; FEV1, forced expiratory flow in 1 s; FEF 25%–75%, forced expiratory flow during 25%–75% of the FVC.

attempt 8 months earlier via the intentional ingestion of herbicide (glufosinate). At that time, she was transported to an emergency department for intubation and remained in that state for 7 days until extubation was deemed safe. Although she experienced voice changes after extubation, she did not seek treatment until she later presented to a local primary internal medicine clinic with dyspnea on exertion.

History-taking, physical examinations, and pulmonary function testing (PFT) were performed at primary clinic. PFT result revealed a restrictive pattern with a forced vital capacity (FVC) of 74%, forced expiratory volume in 1 s (FEV1) of 61%, FEV1/FVC of 81%, and forced expiratory flow at 25%–75% of the FVC (FEF 25%–75%) of 42% (relative to the expected values) (Fig. 1). A bronchial provocation test yielded negative results, despite a 1-month period of inhaled corticosteroid treatment under a diagnosis

of bronchial asthma. Because her symptoms did not improve with inhaled corticosteroids, inhaled long-acting beta-2 agonists were added to the treatment regimen for an additional 7 months.

When her voice changes worsened and her condition continued to deteriorate to the point of experiencing dyspnea at rest, the patient presented to our otolaryngology outpatient clinic. Laryngoscopy findings at her first visit to our clinic revealed a type 1 posterior glottic stenosis according to Bogdasarian's classification (Fig. 2). Computed tomography of the larynx was performed to further evaluate the extent and calcification of the stenosis but revealed no specific findings (Fig. 3).

We removed the posterior glottic stenosis using a suspension laryngoscope and CO₂ laser (Ultrapulse Encore; Lumenis Ltd., Santa Clara, CA, USA). Stenosis was present in the interarytenoid space at the subglottic level and

Fig. 2. Laryngoscopic analysis performed during the first visit of the patient to our clinic. Stenosis is observed in the interarytenoid space at the true vocal cords (white arrow).

Fig. 3. Performance of computed tomography to determine the extent of the stenosis and calcification. No specific lesion was observed other than the stenosis observed via the laryngoscope.

Fig. 4. Laryngoscopic images obtained during follow-up. Left, 4 months postoperatively; right, 7 months postoperatively. The patient did not exhibit signs of recurrence (e.g., voice changes or dyspnea) during the 7-month follow-up period and remains under observation at the outpatient clinic.

was not connected with the posterior glottis. No further stenotic lesion was detected. After removing the stenotic lesion, bleeding was controlled using Bosmin gauze. Crico-arytenoid joint movement was observed, and all bilateral joint movement was normal. The patient was discharged 2 days postoperatively, at which time both her dyspnea and voice quality improved. At 7 months postoperatively, no signs of recurrence had been detected during outpatient follow-up visits (Fig. 4).

DISCUSSION

The posterior and anterior glottis differ both anatomically and histologically. Like the subglottis, the posterior glottis comprises respiratory epithelium, which is prone to injury from minor trauma,⁴ whereas the anterior glottis comprises squamous epithelium. During intubation, an endotracheal tube can easily be pushed posteriorly beyond the tongue base to form an angle with the posterior of the trachea, which places direct pressure on the posterior glottis and its mucosa and results in posterior glottic stenosis.⁸ Accordingly, the most common cause of this condition is trauma from endotracheal intubation, with a reported incidence of approximately 14% among patients intubated for more than 10 days.⁹ A multicenter study by Hillel et al. (2016) identified diabetes mellitus, ischemia, and the endotracheal tube size (particularly inner diameter > 7.5 mm) as risk factors for posterior glottic stenosis in men.¹⁰ Before the introduction of prolonged endotracheal tube intubation, most cases of laryngeal stenosis were attributed to infectious diseases such as syphilis, laryngeal diphtheria, tuberculosis, and typhoid fever.¹ In our case, posterior glottic stenosis was attributed to a chemical burn of the larynx and subsequent prolonged intubation. However, as stenosis occurs more often in patients intubated for more than 10 days, we suspect that the chemical burn played a more significant causal role.

Posterior glottic stenosis can be diagnosed via laryngoscopic examination, although a preoperative computed tomography scan should also be performed to determine the presence of interarytenoid calcification and confirm that the stenosis is not connected to the cricoid cartilage. Particularly, the latter tissue must be avoided during laser lysis to ensure that the operation results in a safe outcome.¹¹ In some cases, a thin septum (3–4 mm) between the arytenoid cartilage and stenosis may be removed under laryngoscopy or via simple resection, although the latter confers a risk of recurrence. Moreover, a CO₂ laser may be used to remove a stenotic lesion of short duration, although this procedure often results in reoccurrence in

children. In the pediatric population, cartilage transplantation via an open technique yields better outcomes. An open technique is also preferred in cases involving lesions with more extensive lengths or progression of the stenosis to the subglottic level. However, the results of treatment tend to be less successful in such cases. Research since the first report of laryngoscopic surgery by Ossoff in 1983 demonstrated that the results achieved with this technique are not inferior to those achieved with open techniques, even in cases of type 1 posterior glottic stenosis.^{12–14} Consequently, laryngoscopic operations increased in popularity over time.

According to Mayer and Wolf, type I posterior glottic stenosis exhibits a good prognosis, is associated with high rates of tracheal extraction, and vocal cord movement recovery and a high percentage of patients who recover normal vocal cord deviation.¹ Another report of an animal study suggests that the administration of mitomycin-C suppresses fibroblast proliferation and prevents collagen accumulation at the injury site, thus reducing visible scar and granulation tissue formation and preventing posterior glottic stenosis.¹⁵

As noted above, vocal cord dysfunction results from various etiologies, and the presenting symptoms often lead to a misdiagnosis of asthma. However, cases that do not improve in response to steroid or bronchodilator treatments often progress to a requirement for endotracheal intubation or tracheotomy.

Meanwhile, asthma is a chronic bronchial inflammatory disease characterized by reversible airway obstruction and airway hypersensitivity, which manifests primarily as coughing, wheezing, and dyspnea. In children, particularly, cases involving bronchial foreign bodies, acute epiglottitis, and laryngomalacia are often misdiagnosed as asthma, and one report describes such a misdiagnosis in a child with Down syndrome with a bronchial foreign body.⁶ Therefore, an accurate diagnosis is very important to ensure the provision of correct treatment and avoidance of unnecessary treatment.

CO₂ laser is a useful tool that can be applied to many areas of surgery. There may be side effects such as burns,¹⁶ but it is a relatively safe tool with less side effects. There are various reported cases treating with CO₂ laser in the field of otorhinolaryngology, such as benign vocal fold mucosal disorder, Wharton's duct stones, pyriform sinus cysts, and supraglottic carcinoma.^{17–20} There are not many reported cases of using CO₂ laser to treat posterior glottic stenosis, but this patient achieved good prognosis without recurrence after treatment with CO₂ laser. Therefore, CO₂ laser may serve as a treatment of choice in the

management of posterior glottic stenosis.

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