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Initial Outcomes of Endoscopic CO₂ Laser Posterior Cordectomy and Partial Arytenoidectomy Among Patients with Bilateral Vocal Cord Paralysis: A Case Series

ABSTRACT

Objective: To describe the initial outcomes of endoscopic CO₂ laser posterior cordectomy and partial arytenoidectomy among patients with bilateral vocal cord paralysis in our institution.

Methods:

Design: Case Series
Setting: Tertiary National University Hospital
Participants: 17 Patients

Results: Seventeen (17) patients who underwent transoral posterior cordectomy and partial arytenoidectomy using carbon dioxide laser were included in the study consisting of 14 females and 3 males. Iatrogenic injury was the most common cause of bilateral vocal cord paralysis in this subset of patients. Five patients who tolerated decannulation and another six who had no preoperative tracheostomy all reported subjective improvement in breathing. All of them were also observed to have resolution of stridor and increased respiratory comfort compared to their preoperative condition. The most common postoperative complication was granuloma formation at the medial arytenoidectomy site occurring only in 4 patients. None of the patients complained of aspiration episodes or dysphagia during the postoperative period.

Conclusion: Our initial experience with transoral endoscopic posterior cordectomy and partial arytenoidectomy using carbon dioxide laser has good postoperative outcomes among patients with bilateral vocal cord paralysis.

Keywords: *vocal cord paralysis; arytenoid; vocal cords; laser; carbon dioxide; tracheostomy; voice quality*

Vocal cord paralysis is a condition where in patients may present with hoarseness and life-threatening dyspnea. The most common cause of which is iatrogenic injury comprising 26 to 59% of cases.¹ Tracheostomy is the standard of care that remains to be a highly effective management of bilateral vocal cord paralysis.^{3,4}

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The introduction of endoscopic laser surgery offered a less invasive alternative for patients suffering from bilateral vocal cord paralysis, with less trauma, shorter hospital stay, and shorter time to successful decannulation. Dennis and Kashima recommended posterior cordectomy using endoscopic carbon dioxide laser. The voice quality was better postoperatively since the anterior three quarters of the fold are retained in their position.⁶ Based on a search of HERDIN Plus, the ASEAN Citation Index (ACI), Global Index Medicus - Western Pacific Region Index Medicus (WHO GIM-WPRIM), Directory of Open Access Journals (DOAJ), MEDLINE (PubMed and PubMed Central) and Google Scholar using the following search terms “vocal cord paralysis”, “incidence”, “laser”, “arytenoidectomy”, “cordectomy”, “Philippines”, “Filipinos”, we found no local studies regarding the incidence of vocal cord paralysis and only limited reports regarding its management and outcomes.⁵

This case series aims to describe the initial outcomes of using endoscopic carbon dioxide laser posterior cordectomy and partial arytenoidectomy among patients with bilateral vocal cord paralysis in our institution.

METHODS

With exemption from full ethical review by the University of the Philippines Manila - Research Ethics Board, this case series performed a chart review of records of all patients who underwent endoscopic carbon dioxide (CO₂) laser posterior cordectomy with partial arytenoidectomy for bilateral vocal cord paralysis in our institution from 2014 to 2017. Excluded were incomplete records (without demographic data, clinical history, physical examination findings, operative technique, postoperative course and follow up) and patients whose vocal cord paralysis resulted from laryngeal masses.

Bilateral vocal cord paralysis among these patients was confirmed preoperatively by indirect laryngoscopy using a rigid 90 degree scope or nasopharyngolaryngoscopy with a flexible scope. All surgical procedures were conducted uniformly by the same team. General anesthesia was commenced prior to conversion to a Mallinckrodt laser compatible tube (Shiley, Covidien, Ireland) for patients with prior tracheostomy. Direct laryngoscopy was performed using a Kleinsasser laryngoscope suspended using a laryngoscope support rod and chest holder (Karl Storz GmbH & Co., Tuttlingen Germany). Using a OPMI Vario S88 operating microscope (SOMA International, Bloomfield, CT, USA) with a working range of 200-415 mm, adequate visualization of the laryngeal complex was ensured. Sterile moist cottonoid strips were placed in the subglottic area to protect the trachea. Posterior cordectomy with partial arytenoidectomy was performed on only one side using continuous mode of CO₂ laser (C-Las Articulated Arm,

A.R.C Laser, Germany) at 4-6 watts per charge. A tracheostomy tube was reinserted postoperatively for patients with prior tracheostomies. Postoperative medications included intravenous Dexamethasone 4 mg given every 8 hours for 3 doses, Amoxicillin + Clavulanic acid 500 mg every 8 hours for 7 days and oral proton pump inhibitors at 40 mg once a day for 2 weeks. Patients with tracheostomy tubes were instructed to begin corking one day postoperatively until they were able to tolerate occlusion for more than 24 hours without dyspneic episodes and desaturation. Patients who were successfully decannulated during the same admission were discharged after 24 hours of observation. Follow up was scheduled after two weeks post-op and then one month after for all patients.

Hospital records of patients meeting the inclusion criteria were reviewed and the following data were obtained: age, preoperative diagnosis, etiology of bilateral vocal cord paralysis, duration of bilateral vocal cord paralysis prior to surgery, date of posterior cordectomy and partial arytenoidectomy procedure, date of decannulation (for those who tolerated corking), date of follow-up, postoperative complications, and need for revision surgery.

The data obtained were tabulated using MS Excel for Mac version 16.62 (Microsoft Corp. Redmond, WA, USA). Discrete and continuous variables such as age and duration of bilateral vocal cord paralysis were summarized using means and ranges.

RESULTS

A total of 17 patients underwent endoscopic carbon dioxide (CO₂) laser posterior cordectomy with partial arytenoidectomy for bilateral vocal cord paralysis in our institution from 2014 to 2017. There were 14 females and 3 males with ages ranging from 29 to 71 years old and a mean age of 54.6 years. The presenting symptoms of these patients and reasons for consulting included dyspnea, stridor, hoarseness, and desire for decannulation. The duration of their symptoms ranged from 2 days to 72 months. The most common cause of bilateral vocal cord paralysis was surgical injury to the recurrent laryngeal nerve during thyroid surgery (8; 47%). Other etiologies of vocal cord paralysis were thyroid malignancy (5; 29%), central/neurologic disease (1; 6%), neck trauma (1; 6%), squamous papilloma (1; 6%), and idiopathic (1; 6%). Bilateral vocal cord paralysis was confirmed preoperatively by indirect laryngoscopy using a rigid 90 degree scope or nasopharyngolaryngoscopy with a flexible scope. Eleven out of 17 patients had tracheostomies prior to the procedure while six patients had no prior tracheostomy.

The follow up period ranged from 3 weeks to 24 months. Of the 11 with tracheostomies preoperatively, five tolerated decannulation within an average of 14 days postoperatively. Four patients (*Patients # 09, 11, 15, 16*) were lost to follow up and their tolerance for decannulation

could not be determined. The remaining two patients with prior tracheostomies (*Patient #13 and #14*) could not be decannulated due to underlying co-morbidities. The first patient (*Patient #14*) who could not tolerate decannulation had bilateral vocal cord paralysis secondary to non-accidental strangulation injury. This patient was unable to tolerate corking of the tracheostomy tube especially when supine or during episodes of exertion, and was advised further diagnostic examinations to evaluate a possible central cause and imaging to assess the state of the laryngeal framework. Another patient (*Patient #13*) who could not tolerate decannulation had recurrent Papillary thyroid carcinoma. Diagnostic suspension laryngoscopy revealed a submucosal bulge in the supraglottic area from an anterior neck mass causing an eighty to 90% airway obstruction. The patient no longer desired further surgery and had an excellent response to radioiodine therapy.

The most common postoperative complication was granuloma formation at the medial arytenoidectomy site occurring only in 4 patients. Granuloma formation was managed conservatively with proton pump inhibitors for 4 weeks with resolution. No recurrence of granuloma was observed thereafter. Only one patient developed postoperative edema at the arytenoidectomy site.

Five patients who tolerated decannulation and another six who had no preoperative tracheostomy all reported subjective improvement in breathing. All of them were also observed to have resolution of stridor and increased respiratory comfort compared to their preoperative condition. None of the patients complained of aspiration episodes or dysphagia during the postoperative period. It was notable that among patients with no prior tracheostomy, none experienced any postoperative complications and all had an unremarkable postoperative course.

DISCUSSION

Our preliminary series showed satisfactory outcomes among 11 of 17 patients who underwent endoscopic CO₂ laser posterior cordectomy with partial arytenoidectomy for BVCP. Decannulation was achieved for five of six patients who had prior tracheostomy, while all six patients who had no prior tracheostomy reported subjective improvement in respiratory and vocal function.

Bilateral vocal cord paralysis (BVCP) is most commonly caused by iatrogenic injury to the recurrent laryngeal nerve. Performing transoral posterior cordectomy and partial arytenoidectomy among patients with BVCP has improved the respiratory comfort and allowed decannulation in five of the patients in this case series. Only four out of the 17 patients developed postoperative granuloma formation which was conservatively managed. According to Motta *et al.*,⁷ removal of the posterior third of the true and false vocal cord with arytenoidectomy

provided adequate glottic opening while ensuring preservation of voice quality. It also preserved glottal sphincter function decreasing the risk of developing aspiration postoperatively.⁷ In our present series, the vocal cord defect created by the CO₂ laser remained wide postoperatively probably due to contraction of both ends. Performing this procedure also had several advantages such as the simplicity of the concept, reliable and predictable outcomes, low risk for complications, and option for revision surgery postoperatively.

Management of patients with bilateral vocal cord paralysis is complex especially among those with blunt neck trauma or underlying structural or functional disorders of the laryngeal framework as seen in the case of the non-accidental strangulation injury included in our series. According to Kunii *et al.*,⁹ post-hanging vocal cord paralysis may be brought about by laryngohyoid fractures but also by edema of the surrounding laryngeal framework. Although rare, vocal cord paralysis from blunt neck trauma may be due to neuropraxia.¹⁰ Imaging such as computed tomography and magnetic resonance scans may help characterize and evaluate the state of the cartilaginous and soft tissue of the laryngeal complex.¹⁰

Stringent selection is important in order to achieve excellent postoperative outcomes in patients undergoing this procedure. Not all patients presenting with bilateral vocal cord paralysis can be good candidates to undergo the said procedure as exemplified by the two patients in our series who were not decannulated postoperatively due to underlying conditions. Patient 13 whose BVCP was from iatrogenic injury secondary to thyroid surgery was elderly. Older age (>66 years old) was identified by Jackowska *et al.* to be a factor that can make decannulation less likely after performing this procedure. Aside from older age, presence of comorbidities such as diabetes and GERD, undergoing more than one surgery for thyroid disease, presence of subglottic stenosis due to a "high tracheostomy" are some of the factors that make patients less likely to tolerate decannulation or achieve respiratory comfort. Hence, presence of the aforementioned conditions may serve as a guide for surgeons when choosing the procedure for patients with BVCP.

Our small series has several limitations. Objective measurements of preoperative and postoperative respiratory, voice, and swallowing functions were not performed. Tolerance of decannulation postoperatively was the proxy measure of improved respiratory function. Because preoperative vocal quality was not measured, subjective reporting by patients was the basis for determining improved vocal outcome. Future studies can determine postoperative vocal quality using the Voice Handicap Index-30, maximum phonation time (MPT), and videostroboscopy values such as jitter and shimmer percentages. Swallowing and presence of postoperative aspiration



can also be evaluated using fiberoptic endoscopic evaluation of swallowing (FEES). Respiratory function can be tested using flow volume spirometry. It is also necessary to emphasize the importance of diagnostic imaging especially for patients with complicated etiologies of BVCP. These aforementioned objective tests may be performed in future prospective studies involving a larger sample of patients.

Meanwhile, our initial experience suggests that transoral endoscopic posterior cordectomy and partial arytenoidectomy using carbon dioxide laser has good postoperative outcomes with minimal complications. Further studies which include objective measurements of respiratory effort and voice quality are needed to demonstrate the safety and efficacy of this procedure among patients with bilateral vocal cord paralysis.

REFERENCES

1. Toutouchi SJS, Eydi M, Golzari SE, Ghaffari MR, Parvizi N. Vocal cord paralysis and its etiologies: A prospective study. *J Cardiovasc Thorac Res.* 2014;6(1):47-50. DOI: 10.5681/jcvtr.2014.009; PubMed PMID: 24753832; PubMed Central PMCID: PMC3992732.
2. Ahmad S, Muzamil A, Lateef, M. A study of incidence and etiopathology of vocal cord paralysis. *Indian J Otolaryngol Head Neck Surg.* 2002 Oct; 54(4): 294–296. DOI: 10.1007/BF02993746; PubMed PMID: 23119914; PubMed Central PMCID: PMC3450463.
3. Jackowska J, Sjogren EV, Bartochowska A, Czerniejewska-Wolska H, Piersiala K, Wierzbicka M. Outcomes of CO2 laser-assisted posterior cordectomy in bilateral vocal cord paralysis in 132 cases. *Lasers Med Sci.* 2018 Jul;33(5):1115-1121. DOI:10.1007/s10103-018-2478-9; PubMed PMID: 29557514; PubMed Central PMCID: PMC6004269.
4. Dennis DP, Kashima H. Carbon dioxide laser posterior cordectomy for treatment of bilateral vocal cord paralysis. *Ann Otol Rhinol Laryngol.* 1989 Dec;98(12 Pt 1):930-4. DOI:10.1177/000348948909801203; PubMed PMID: 2589760.
5. Ng EY, Lim W, Martinez NV, Lopez MS. Microscopic endolaryngeal arytenoidectomy. *Philipp J Otolaryngol Head Neck Surg.* 1989;9:9–13. [cited 2022 September 5] Available from: <https://pjohns.pso-hns.org/index.php/pjohns/issue/view/91/39>.
6. Manolopoulos L, Stavroulaki P, Yiotakis J, Segas J, Adamopoulos G. CO2 and KTP-532 laser cordectomy for bilateral vocal fold paralysis. *J Laryngol Otol.* 1999 Jul;113(7):637-41 DOI:10.1017/S002221510014472x; PubMed PMID: 10605560.
7. Motta S, Moscillo L, Imperiali M, Motta G. CO2 laser treatment of bilateral vocal cord paralysis in adduction. *ORL J Otorhinolaryngol Relat Spec.* 2003 Nov-Dec;65(6):359-65. DOI:10.1159/000076055; PubMed PMID: 14981330.
8. Sapundzhiev N, Lichtenberger G, Eckel HE, Friedrich G, Zenev I, Toohill RJ, et al. Surgery of adult bilateral vocal fold paralysis in adduction: history and trends. *Eur Arch Otorhinolaryngol.* 2008 Dec; 265(12):1501-14. DOI: 10.1007/s00405-008-0665-1; PubMed PMID: 18418622.
9. Kunii M, Ishida K, Ojima M, Sogabe T, Shimono K, Tasuke T, et al. Bilateral vocal cord paralysis in a hanging survivor: a case report. *Acute Med Surg.* 2020 Jun;7(1):e519. DOI: 10.1002/ams2.519; PubMed PMID: 32528709; PubMed Central PMCID: PMC7280028.
10. Latoo M, Lateef M, Nawaz I, Ali I. Bilateral recurrent laryngeal nerve palsy following blunt neck trauma. *Indian J Otolaryngol Head Neck Surg.* 2007 Sep;59(3):298-9. DOI: 10.1007/s12070-007-0087-1; PubMed PMID: 23120459; PubMed Central PMCID: PMC3452116.