

EVALUATE THE EFFECTIVENESS OF ENDOSCOPIC SURGERY IN THE TREATMENT OF LARYNGEAL PARALYSIS

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ABSTRACT

Objectives: vocal fold paralysis is a rare but life-threatening condition mostly caused by iatrogenic damage to the recurrent laryngeal nerve. Endoscopic enlargement techniques have been the standard treatment for decades. Study Design: Prospective observational study. **Methods:** 68 patients, of whom 63 were eligible according to the study protocol. Subjects were assessed with phoniatric and respiratory evaluation preoperatively and at 1 and 6 months postoperatively. Results: Important respiratory improved significantly 6 months postoperatively, confirming that a glottal enlargement effectively reduced the obstruction. Objective parameters dealing with voice quality worsened significantly. **Conclusion:** Endoscopic glottal enlargement is an effective method for relieving symptoms of dyspnea due to BVFP. Postoperatively, voice quality objectively worsened.

KEYWORDS: Vocal fold paralysis, endoscopic surgery, voice outcomes, respiratory outcomes.

INTRODUCTION

Endoscopic enlargement in patients with vocal fold paralysis has been the standard therapy for the last few decades. There is a considerable range of surgical techniques. Due to the relative paucity of cases and the variety of surgical techniques, prospective studies with voice and respiration evaluation are rare. Currently there is no clear evidence for the functional superiority of any specific type of laryngeal surgery because of the lack of systematic comparison studies with generally accepted measures. A narrow glottis, often accompanied by a stridor, prolongs the inspiratory phase and interferes with phonation. An improvement of the respiratory status is the main indication for a surgical intervention. But even a successful glottal enlargement does not restore laryngeal function and results in a static and irreversible state. Glottal enlargement establishes a wider glottal gap in the region of the arytenoid cartilage and the posterior vocal fold (VF), but leads to reduced closure during phonation, scarring, and therefore to the expansion of the nonvibrating portion of the VF. Untreated BVFP can lead to a loss of voice, reduced professional prospects, and a lower social status. Living with permanent dyspnea, however, limits physical activity both in professional and everyday life and is a detrimental factor for overall health and well-being.^[3,4] Studies have reported contradictory results after glottal enlargement surgery and have not given detailed descriptions of the patients'

symptoms and complaints.^[5-8] The aim of this prospective study was to investigate the efficacy of endoscopic surgery for VFP in terms of respiration, voice production.

MATERIALS AND METHODS

We performed a prospective, observational study from October 2019 until June 2021. 63 of 68 of these subjects completed the study; 2 dropped out; and 3 were withdrawn. Patients aged between 36 and 71 years with the diagnosis of (BVFP 29 UVFP 34) assessed by patient's history and laryngoscopy and an indication for enlargement surgery were included. According to the study, we performed surgical procedures using the CO2 laser, microlaryngoscopy, Microdibrider, in 29 patients with bilateral vocal cord paralysis. The appropriate method was selected according to the experience of the surgeon and the specific needs of the patient. All surgery was performed under general anaesthesia via microlaryngoscopy. Medical history of the study population, study selection criteria, and type of surgery were reported in detail (see Table 1).

Laryngoscopies performed at the preoperative and 6-months postoperative visits were descriptively by us. The parameters rated were glottal gap, and maximum abduction and adduction. The glottal gap was visually estimated (in mm) while breathing. Increased values

indicated an improved situation. The length of the untreated entire membranous VF was rated 4(4/4). Six months postoperative, the remaining portion of the membranous VF was classified on a scale between 4 (4/4) and 1 (1/4). In order to rate the remaining mobility, maximal abduction and adduction were determined. Maximal abduction ranged from 0 to 3 (0=median position, 1=paramedian position, 2=intermedian position, and 3=lateral position). Maximal adduction was also

rated from 0 to 3 (0=none, 1=unclear adduction, 2=clear adduction, and 3=contact).

For perceptive voice analysis, the RBH was used to evaluate the severity of roughness (R), breathiness (B), and hoarseness (H). Voice quality was analyzed according to the RBH scale (0=no deviance, 1=mild deviance, 2=moderate deviance, and 3=severe deviance). Mean values of a group of five raters were taken.

Table 1: Patient's and Surgical Characteristics (N43).

| Parameter | Absolute Number | Relative Number (%) |
|-------------------|-----------------|---------------------|
| Gender | | |
| Female | 44 | 70 |
| Male | 19 | 30 |
| Etiology | | |
| Iatrogenic | 34 | 54 |
| Trauma | 11 | 18 |
| Idiopathic | 13 | 20 |
| Other | 5 | 8 |
| Type of surgery | | |
| microlaryngoscopy | 7 | 25 |
| Microdibrider | 12 | 42 |
| LASER co2 | 10 | 33 |

RESULTS

Laryngoscopy. The glottal gap during respiration increased significantly from a median preoperative width of 2.5 mm to 4.6 mm, 6 months postoperatively. The remaining portion of the VF on the operated side was significantly reduced ($P<0.001$) from the whole length of 4/4 (100%) to 2.5/4 (62.5%). In other words, on average 2/3 of the VF was preserved. The results of observed, albeit restricted, maximal abduction and adduction of the VF undergoing surgery were descriptively compared 6

months postoperatively versus the preoperative situation. The analysis of the maximal abduction showed a significant shift from the median position preoperatively to the intermediate position 6 months postoperatively.

There was a moderate shift in the number of cases, whereas maximal adduction was barely detected preoperatively in the number of cases for whom at 6 months there was a complete lack of adduction (see Table 2).

Table 2: Laryngostroboscopic Findings Preoperatively and Postoperatively.

| Parameter | Preoperatively (mean values \pm SD) | 6-Month FU (mean values \pm SD) |
|--|---------------------------------------|-----------------------------------|
| Glottal gap (in mm) | 2.5 \pm 1.0 | 4.6 \pm 1.5 ($P<0.001$) |
| Remaining portion of the vocal fold (treated side) | 4 \pm 0.0 | 2.5 \pm 1.0 ($P<0.001$) |
| Maximal abduction (0–3) (treated side) | 0.6 \pm 0.6 | 1.4 \pm 0.8 ($P<0.001$) |
| Maximal adduction (0–3) (treated side) | 0.7 \pm 0.8 | 0.7 \pm 1.0 ($P=0.87$) |
| P values indicating differences between preoperative status and 6-month follow-up. | | |

Rating of vocal quality in terms of the RBH scale revealed a significant increase of breathiness and hoarseness from the preoperative status compared to the situation 1 and 6 months postoperatively and no changes of roughness over time. All subjects were asked at the preoperative- and the 6-month postoperative visit whether they consider more important improving their respiratory quality or having their voice quality preserved.

According to the results, the importance of improving the respiration quality was perceived to be much more important than voice preservation by a significant portion of the patients both preoperatively and 6 months postoperatively (see Table 3).

Table 3: Voice Parameters Preoperatively and Postoperatively.

| Parameter | Preoperative (mean values±SD) | 1-Month FU (mean values±SD) | 6-Month FU (mean values±SD) |
|-----------|----------------------------------|--------------------------------|--------------------------------|
| R | 1.13 (1–2) | 1.50 (0.75–2) (P=0.63)* | 1.50 (1–2) (P=0.56)† |
| B | 1 (1–2) | 2 (1.75–3) (P<0.001) | 2 (1–2) (P=0.005) |
| H | 1.63 (1–2) | 2 (1.8–3) (P=0.002) | 2 (2–2.25) (P=0.008) |

RBH=roughness, breathiness, hoarseness.

DISCUSSION

Bilateral vocal fold paralysis is a rare condition resulting from damage to and lesions in the recurrent laryngeal nerve. The most common causes are complications after thyroid surgery as well as idiopathic cases. In fewer cases, the underlying reason is cervical vascular or spinal surgery.^[16] Usually BVFP has only minor negative effects on phonation due to the incomplete VF contact required.^[16,17] However, this pathology often results in severe breathing impairment, condemning untreated subjects to a largely sedentary lifestyle. Endoscopic resection techniques are minimally invasive and improve breathing, they lead to a deterioration in voice quality because they physically enlarge the airway.² For the majority of the patients, respiratory quality was considered more important than voice quality. They considered acceptable a certain degree of impairment in their voice for the benefit of improved respiration quality. Indeed, we observed a worsening of the objective voice parameters the perceptual parameters hoarseness (H) and roughness (R). Breathiness (B) did not change because it is evoked by the irregularity of the VF vibration, and hence turbulent noise, which was equally impaired preoperatively and 6 months postoperatively. We explain this discrepancy by the fact that the overall increase of well-being due to relief of dyspnea compensated for the loss of voice quality. We are fully aware that our study reflects short- and midterm results, and that long-term results cannot be predicted from this.¹⁸ Judgment of the laryngoscopic findings showed different results: The resection in the region of the VF led to a wider glottal gap, reduced closure during phonation, scarring, and the extension of the nonvibrating portion at the expense of the vibrating part. The obtained measurements suggest an apparent degree of accuracy, but this should be considered with caution, even if the tendency of an increased glottal width after surgery is supported by this rough estimation. Six months postoperatively, we observed increased glottal gap the treated VF moved significantly to a more abducted position from the preoperative- to the 6-month postoperative situation. This fact allows the prediction of better respiratory results for those patients who do not have not completely immobile VFs. The result suggests that the extent of functional loss due to the expected damage of the phonatory system caused by surgery could not be easily predicted by the findings before treatment; that is, good voices before surgery will not necessarily be

good voices after surgery. In general, laryngoscopic findings did not correlate strongly with voice and respiratory outcomes. The most predictive parameters seem to be the glottal gap for respiration and the remaining adduction of the untouched VF for the voice.

CONCLUSION

This is a good prospective study investigating respiratory and phoniatric outcomes in patients with BVFP. Endoscopic glottal enlargement is an effective method for relieving symptoms of dyspnea due to BVFP, objectively assessed voice parameters indicate an impaired function.

However, these are not necessarily perceived as such by the patients; relief of dyspnea appears to compensate for the decreased voice quality.

BIBLIOGRAPHY

1. Kashima HK. Bilateral vocal fold motion impairment: pathophysiology and management by transverse cordotomy. *Ann Otol Rhinol Laryngol*, 1991; 100: 717–721.
2. Sapundzhiev N, Lichtenberger G, Eckel HE, et al. Surgery of adult bilateral vocal fold paralysis in adduction: history and trends. *Eur Arch Otorhinolaryngol*, 2008; 265: 1501–1514.
3. Thurston NL, Fiedorowicz JG. Improvement of paradoxical vocal cord dysfunction with integrated psychiatric care. *Psychosomatics*, 2009; 50: 282–284.
4. Cohen SM, Bellucci E. Healthcare utilization among patients with vocal cord dysfunction. *Nurs Forum*, 2011; 46: 177–185.
5. Yilmaz T, Suslu N, Atay G, Ozer S, Gunaydin RO, Bajin MD. Comparison of voice and swallowing parameters after endoscopic total and partial arytenoidectomy for bilateral abductor vocal fold paralysis: a randomized trial. *JAMA Otolaryngol Head Neck Surg.*, 2013; 139: 712–718.
6. Testa D, Guerra G, Landolfo PG, et al. Current therapeutic perspectives in the functional rehabilitation of vocal fold paralysis after thyroidectomy: CO₂ laser arytenoidectomy. *Int J Surg.*, 2014; 12(suppl 1): S48–S51.
7. Mohamed NN, Sorour SS, El-Anwar MW, Quriba

- AS, Mahdy MA. Comparison between laser- and diathermy-assisted posterior cordotomy for bilateral vocal cord abductor paralysis. *JAMA Otolaryngol Head Neck Surg.*, 2013; 139: 923–930.
8. Bernstein JM, Jones SM, Jones PH. Unilateral transverse cordotomy for bilateral abductor vocal fold immobility. *J Laryngol Otol*, 2012; 126: 913–917.
 9. Nawka T, Sittel C, Gugatschka M, et al. Efficacy of permanent transoral surgery of bilateral vocal fold paralysis (BVFP) in adduction: a prospective multicenter trial. *Laryngoscope*, 2015; 125: 1401–1408. doi: 10.1002/lary.25137. Epub 2015.
 10. Ulmer W. *Lungenfunktions-Manual: Nach den Richtlinien der Deutschen Gesellschaft für Pneumologie*. Stuttgart, Germany: Georg Thieme Verlag, 2004.
 11. Dejonckere PH, Bradley P, Clemente P, et al. A basic protocol for functional assessment of voice pathology, especially for investigating the efficacy of (phonosurgical) treatments and evaluating new assessment techniques. Guideline elaborated by the Committee on Phoniatics of the European Laryngological Society (ELS). *Eur Arch Otorhinolaryngol*, 2001; 258: 77–82.
 12. Nawka T, Rosanowski F, Gross M. How to render an expert opinion on dysphonia. *Laryngorhinootologie.*, 2014; 93: 591–598.
 13. Friedrich G, Dejonckere PH. The voice evaluation protocol of the European Laryngological Society (ELS)—first results of a multicenter study. *Laryngorhinootologie*, 2005; 84: 744–752.
 14. Crary MA, Mann GD, Groher ME. Initial psychometric assessment of a functional oral intake scale for dysphagia in stroke patients. *Arch Phys Med Rehabil*, 2005; 86: 1516–1520.
 15. Rosenbek JC, Robbins JA, Roecker EB, Coyle JL, Wood JL. A penetration/expiration scale. *Dysphagia*, 1996; 11: 93–98.
 16. Sittel C, Wassermann K, Mathen F, Eckel HE. Unilateral and bilateral recurrence of inferior laryngeal nerve paralysis. *Pneumologie*, 2001; 55: 568–578.
 17. Grosheva M, Wittekindt C, Pototschnig C, Lindenthaler W, Guntinas-Lichius O. Evaluation of peripheral vocal cord paralysis by electromyography. *Laryngoscope*, 2008; 118: 987–990.
 18. Misiolek M, Ziora D, Namyslowski G, et al. Long-term results in patients after combined laser total arytenoidectomy with posterior cordectomy for bilateral vocal cord paralysis. *Eur Arch Otorhinolaryngol*, 2007; 264: 895–900.
 19. Gorphe P, Hartl D, Primov-Fever A, Hans S, Crevier-Buchman L, Brasnu D. Endoscopic laser medial arytenoidectomy for treatment of bilateral vocal fold paralysis. *Eur Arch Otorhinolaryngol*, 2013; 270: 1701–1705.
 20. Yilmaz T. Endoscopic total arytenoidectomy for bilateral abductor vocal fold paralysis: a new flap technique and personal experience with 50 cases. *Laryngoscope*, 2012; 122: 2219–2226.
 21. Eckel HE, Thumfart M, Wassermann K, Vossing M, Thumfart WF. Cordectomy versus arytenoidectomy in the management of bilateral vocal cord paralysis. *Ann Otol Rhinol Laryngol*, 1994; 103: 852–857.
 22. Dursun G, Gokcan MK. Aerodynamic, acoustic and functional results of posterior transverse laser cordotomy for bilateral abductor vocal fold paralysis. *J Laryngol Otol.*, 2006; 120: 282–288.
 23. Li Y, Pearce EC, Mainthia R, et al. Comparison of ventilation and voice outcomes between unilateral laryngeal pacing and unilateral cordotomy for the treatment of bilateral vocal fold paralysis. *ORL J Otorhinolaryngol Relat Spec*, 2013; 75: 68–73.