

Voice and quality of life results in patients with unilateral vocal fold abduction paralysis treated with medialization thyroplasty

Resultados de voz y calidad de vida en pacientes con parálisis cordal unilateral en abducción tratados con tiroplastía de medialización

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Abstract

Objective: To evaluate functional and quality of life results in patients with unilateral vocal fold paralysis (UVFAP) of different etiology, who underwent medialization thyroplasty, using Netterville's technique. **Method:** In patients eligible for medialization thyroplasty, maximum phonatory time was measured, quality of life (VRQoL) and functionality (VHI-30) questionnaires were applied before surgery and posteriorly at 3 and 6 months after surgery. Means comparison tests were used to analyze the results. **Results:** Medialization thyroplasty was carried out in 27 patients presenting with UVFAP from 2013 to 2019. All had a statistically significant and clinically significant improvement. This was measure with maximum phonatory time (medium of 4.07 to 11.07 seconds), VHI-30 (medium of 81 to 29 points), and VRQoL (medium of 33 to 15 points). No mayor complications were documented. **Conclusions:** Medialization thyroplasty is a safe procedure that significantly improves functionality and quality of life in patients with UVFAP.

Keywords: Vocal fold paralysis. Medialization thyroplasty. Maximum phonatory time. VHI. VRQoL.

Resumen

Objetivo: Evaluar los resultados funcionales y el impacto en la calidad de vida de pacientes con parálisis cordal unilateral en abducción (PCUA) de etiología variable, posoperados de tiroplastía de medialización con técnica de Netterville en el Instituto Nacional de Rehabilitación. **Método:** En los pacientes candidatos a tiroplastía de medialización se documentaron el tiempo máximo fonatorio y cuestionarios de funcionalidad (VHI-30) y calidad de vida (VRQoL) prequirúrgicos y 3 a 6 meses posquirúrgicos. Se utilizaron pruebas de comparación de medias para analizar los resultados. **Resultados:** Se realizó tiroplastía de medialización en 27 pacientes con PCUA de 2013 a 2019. Todos tuvieron mejoría estadística y clínicamente significativa por el tiempo máximo fonatorio (media de 4.07 a 11.07 segundos), el VHI-30 (media de 81 a 29 puntos) y la VRQoL (media de 33 a 15 puntos). No se documentó ninguna complicación mayor. **Conclusiones:** La tiroplastía de medialización es un tratamiento seguro que mejora de manera significativa la calidad de vida y la funcionalidad de los pacientes con PCUA.

Palabras clave: Parálisis cordal. Tiroplastía de medialización. VHI. Tiempo máximo fonatorio. VRQoL.

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Introduction

Unilateral vocal fold paralysis (UVFP) in abduction represents a clinical problem due to the disability it causes for its impact on the voice, swallowing and airway protection¹. This causes dysphonia, aspiration, dyspnea and dysphagia¹⁻⁴, significantly affecting quality of life and functionality of patients⁵.

UVFP is caused by an injury to the vagus nerve or its branch, the recurrent laryngeal nerve, and due to its longer course, the injury occurs more often on the left side^{2,4}. The most common cause is post-surgical, due to procedures along its path, which is why thyroid surgery is reported at first place⁶, followed by anterior cervical approaches⁷, esophagectomy, cardiac surgery and mediastinoscopy¹. Other causes include direct trauma to the vagus nerve, prolonged intubation, neoplasms (thyroid, lung, aortic aneurysms, laryngeal chondrosarcomas), patent ductus arteriosus, radiation to the neck, and systemic causes (varicella, herpes, Lyme disease, syphilis, sarcoidosis, lupus, amyloidosis, silicosis and neurological conditions)^{1,8}.

UVFP treatment depends on the possibility of spontaneous recovery, which can take from 6 to 12 months, mainly in cases of idiopathic paresis. Treatment options include observation with or without voice therapy, laryngeal injection (laryngoplasty) with temporary materials, and laryngeal skeleton surgery. The choice of treatment depends on the patient (voice professionals, comorbidity that increases surgical risk), symptom severity, etiology, and paralysis evolution time^{4,9}.

Patients receiving early treatment (< 6 months) with laryngeal injection have been described to have better prognosis in terms of glottic competence and long-term voice quality; however, it does not reduce the need for surgery^{10,11}. In those patients with postoperative etiology, the probability of requiring surgical treatment for paralysis is higher⁹.

Currently, medialization thyroplasty is considered the standard method for UVFP definitive treatment^{1,8}. The surgical procedure was described by Isshiki in 1974 as type I thyroplasty for vocal cord medialization. The technique consists of creating a window on the anteroinferior border of the thyroid cartilage, allowing access to the paraglottic space with measurement and placement of a silicone prosthesis. The procedure is carried out with the patient awake, with local anesthesia, and simultaneous endoscopic control in order to determine the maximum medialization point required for proper phonation¹². This technique is safe

and efficacious, and achieves a fine and graduated adjustment of vocal cord position to restore laryngeal function (protection, phonation and respiration) with a very low rate of complications (4-8%), which include edema, surgical site infection and extrusion^{13,14}.

The Voice Handicap Index (VHI) is a questionnaire designed in 1997 by Jackobson that quantifies the subjective impact (perceived by the patient) of a voice-related disorder, and that in 2007 was validated in Spanish (Cronbach's alpha: 0.93)¹⁵.

The Voice-Related Quality of Life (VRQoL) questionnaire was designed in 1999 by Hogikyan and Sethuraman with the purpose to measure the impact on quality of life in patients with voice disorders (Cronbach's alpha: 0.91)¹⁶.

Maximum phonation time (MPT) is a clinical exam for assessing dysphonia described by Kent in 1987¹⁷. To measure it, the patient is asked to take a deep breath and then hold a vowel; it is performed thrice and average time is taken, with a result > 8 seconds being considered normal. The outcome depends on glottic competence and on the volume of air available in the lungs for phonation¹⁷.

The purpose of this study is to report voice outcomes using MPT³, disability measured with the VHI-30 scale¹⁵ and voice-related quality of life measured with the VRQoL questionnaire¹ in patients with unilateral vocal fold paralysis on abduction treated with medialization thyroplasty.

Method

Observational, retrospective, longitudinal study, approved by the institutional ethics committee.

A review of medical records of patients diagnosed with UVFP who underwent medialization thyroplasty in the 2013 to 2019 period was carried out. Twenty-seven patients were included, of whom we report functional and quality of life outcomes. Patients diagnosed with vocal cord paresis, bilateral vocal cord paralysis, those who were not candidates for surgical treatment due to significant comorbidity, and those who refused surgical treatment were excluded.

Surgical technique

All interventions were carried out by the same surgeon (MSDF) with the standardized technique described by Netterville et al.¹³ in 1993. A 30-density Silastic prosthesis was used. The procedure was carried out under sedation and with local anesthesia.

In order to ensure the prosthesis proper position and avoid band or ventricle medialization, the prosthesis position was corroborated under endoscopic control with nasopharyngolaryngoscopy. The size of the prosthesis and the degree of medialization were determined by the change in MPT and voice quality obtained during the procedure.

In these patients, MPT was measured and the following Spanish language-validated questionnaires were applied:

- VHI-30, which considers three dimensions: vocal function, related physical capacity and emotional effect caused by dysphonia. It consists of 30 items organized in three subscales (functional, physical, and emotional) with 10 items each. Each item has a score from 0 to 4 to measure perceived severity, which yields a maximum score of 120 points; the higher the score, the greater the patient disability. There is a modification with 10 items (VHI-10) that has also been validated for measuring disability¹⁵.
- VRQoL, which consists of 10 items that measure physical functionality and socio-emotional aspects. Each item is rated from 1 to 5 by the patient and the highest score is 50 points; the higher the score, the higher the quality of life impairment^{16,18}.

Indirect laryngoscopy was carried out with a 70° endoscope prior to surgery and subsequently at 1, 3 and 6 months after surgery.

Statistical analysis

For statistical analysis of results, descriptive statistics and Student's t-test were used on the Excel (Microsoft Corporation) and SPSS (IBM) programs.

Results

Twenty-seven patients diagnosed with UVFP, with a mean age of 45 years (range: 13-68 years), out of whom 17 were women (62%), and 10 men (38%), were included in the study. Left vocal cord was found to be compromised in 18 patients (66%) and the right in 9 (33%). The most common etiology was postsurgical in 17 (62%), followed by cervical tumors in 4 (14%), neurological causes in 2 (7%) and idiopathic in 4 patients (14%). Evolution time to treatment was on average 55 months (range: 9-216 months), depending on the moment at which patients were referred to our department. These characteristics are summarized in table 1.

Table 1. Epidemiological characteristics

	Range (mean)
Age, years	13-68 (45)
Evolution time, (months)	9-216 (55)
	n (%)
Gender	
Females	17 (62)
Males	10 (38)
Paralyzed vocal cord	
Left	18 (66)
Right	9 (33)
Etiology	
Postsurgical	17 (62)
Tumors	4 (14)
Neurological	2 (7)
Idiopathic	4 (14)

As it can be observed in table 2, MPT had an improvement of 7 seconds, with a mean postsurgical result of 11 seconds (Fig. 1). An MPT $\geq$ 8-second is considered normal and, therefore, a surgical success. Two patients (7.4%) had an MPT < 8; however, they showed an improvement of 3 to 6 seconds and 1 to 4 seconds, both patients with pulmonary ventilation alterations due to cerebral vascular disease (CVD) sequelae.

As for functionality measured by VHI-30, a mean decrease of 52 points on total score was reported (Fig. 2). If we consider each subscale, we found a highly homogeneous improvement: functionality, 17 points; physical, 16 points; and emotional, 18 points (Fig. 3). An overall decrease of 18 points or 8 points on each subscale is considered clinically significant. Only 3 patients (11.1%) had an improvement of less than 18 points, one of them due to CVD sequelae, and the other two, for having a low score since the preoperative period.

On quality of life measured by VRQoL, an average change of 17 points was obtained (Fig. 4). An 8-point change is considered to be clinically significant. With the three measured parameters, it is possible to speak of surgical success. Three patients (11.1%) were unsuccessful in this parameter, one of them due to CVD sequelae, another due to low preoperative score and another patient with a 7-point change, which contrasts with VHI, on which she had an improvement of 48 points.

Of the 27 patients, two required reoperation. The first patient underwent reoperation 2 months after initial

Table 2. Results before and after surgery

Metrics (mean $\pm$ SD)	Pre-surgical	Postsurgical	Average difference	Statistical test and significance
Total VHI-30	81 $\pm$ 32.78	29 $\pm$ 16.41	52	Student's t-test (p = 0.000)
Functional VHI	28.19 $\pm$ 11.34	11.88 $\pm$ 6.7	17.61	Student's t-test (p = 0.000)
Physical VHI	28.38 $\pm$ 10.87	10.76 $\pm$ 6.7	16.30	Student's t-test (p = 0.000)
Emotional VHI	24.42 $\pm$ 12.24	6.34 $\pm$ 4.9	18.07	Student's t-test (p = 0.000)
VRQoL	33.34 $\pm$ 10.12	15.53 $\pm$ 5.36	17.81	Student's t-test (p = 0.000)
MPT	4.07 $\pm$ 1.5	11.30 $\pm$ 4.9	7.23	Wilcoxon (p = 0.00)

MPT: maximum phonation time; SD: standard deviation; VHI: Voice Handicap Index; VRQoL: Voice-Related Quality of Life.

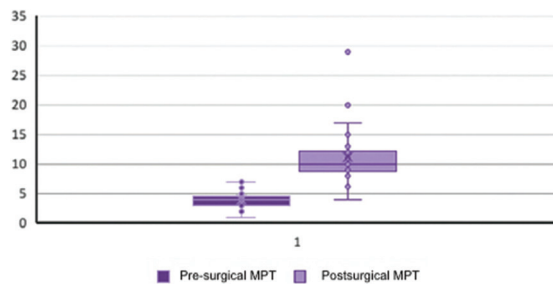


Figure 1. Maximum phonation time (MPT) before and after surgery.

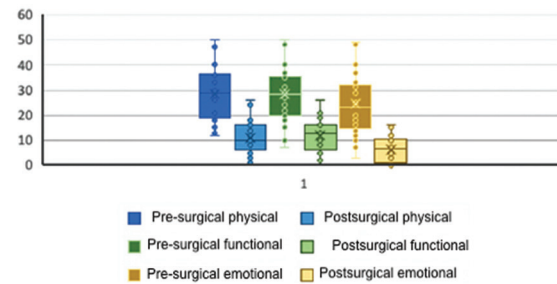


Figure 3. Voice Handicap Index subscales results before and after surgery.

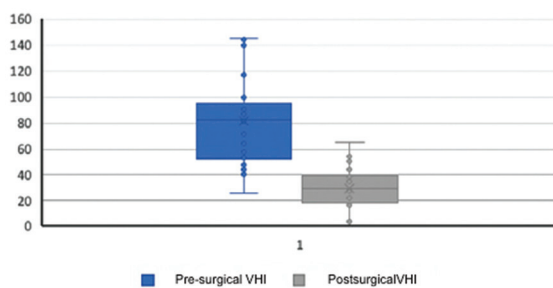


Figure 2. Voice Handicap Index (VHI-30) results before and after surgery.

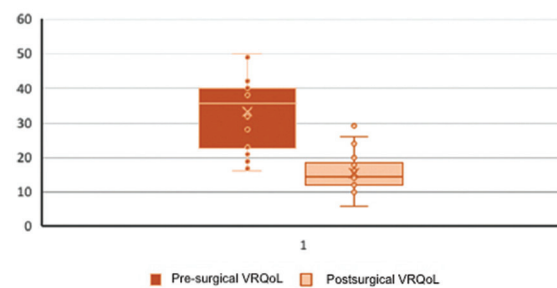


Figure 4. Voice-Related Quality of Life (VRQoL) questionnaire results before and after surgery.

surgery due to insufficient medialization, with the same technique being applied and the maximum point of medialization being corrected with good results. The second patient underwent reoperation because 2 years after the first surgery he presented with data consistent with aspiration again; proper position of the vocal cord

was confirmed and an arytenoid adduction was performed, which improved the symptoms. One patient presented with prosthesis extrusion, but did not require reoperation since even after extrusion he did not experience glottic insufficiency again. No major complications were reported.

Table 3. Voice Handicap Index (VHI) and maximum phonation time (MPT) results

Author	Year and country	Pre-surgery VHI	Post-surgery VHI	Pre-surgery MPT	Post-surgery MPT
Shen, et al. ²⁵	2013, USA (meta-analysis)	72.2	34	6.16	12.4
Benninger, et al. ²⁴	2015, USA	67	22	8.5	24.2
Aravena, et al. ²³	2017, Chile	33.2 (VHI-10)	17.4 (VHI-10)		
Marvin, Dávalos	2020, Mexico	81	29	4	11.3

Discussion

Uncompensated vocal fold paralysis significantly affects patient functionality and quality of life. This is because they experience an alteration in voice quality and swallowing, but especially airway protection deficiency. Chronic aspiration episodes are a risk factor for recurrent pneumonia¹⁹.

Unilateral vocal fold paralysis is a common complication in neck surgery, with a higher incidence after thyroid surgery. Currently, there is the possibility of thyroid surgery with vagus nerve neuromonitoring in order to reduce the risk for it to be injured; however, a statistically significant decrease in the incidence of recurrent laryngeal nerve lesions with the use of neuromonitoring has not been reported, despite a downward trend and better prognosis in these patients' rehabilitation. This is probably due to the fact that knowing the state of the nerve in the perioperative and immediate postoperative period allows early decisions to be made in order for the best therapeutic behavior to be determined^{20,21}.

In patients with UVFP in whom neural recovery is not expected, the treatment of choice is medialization thyroplasty, given that it is a safe procedure, with a low rate of complications and with good immediate and long-term results. We used MPT and VHI-30 to objectively and subjectively measure operated patients' disability, given that these are parameters with a high percentage of significance, accessible and easy to apply²². In addition, we used VRQoL to measure the impact on the quality of life of these patients before and after surgery. The results of our center are comparable with those reported in the literature (Table 3)²³⁻²⁵, probably because all surgeries were carried out by the same surgeon and with the same technique.

The benefits of Netterville's technique over medialization thyroplasty with preformed implants insertion include its low cost (up to 10 surgeries can be carried

out with a single silicone block) and medialization precision by carving the prosthesis according to the specific needs of each patient, which may also explain the low rate of reoperations.

As for the limitations of our study, we should mention that it is a retrospective series and, therefore, variables cannot be controlled, and that we had a small sample, despite being a referral center. It is difficult for intervention time to be standardized, since most our patients are referred from other institutions.

Conclusions

UVFP may not only precipitate complications such as chronic cough, weight loss or aspiration pneumonia, but it is also accompanied by a decrease in quality of life due to physical, emotional, and social disability.

Given that the most common cause of UVFP is postsurgical, the surgeon who manages the vagus nerve and its branches at any region of its path (base of the skull, neck and chest) should be aware of the short- and long-term implications of its injury, and of the treatment alternatives that exist and that significantly improve the quality of life and functionality (MPT) of these patients, among which medialization thyroplasty with Netterville's technique has been shown to offer rapid results in patients in whom neural recovery is not expected.

Conflicts of interest

The authors do not have any conflicts of interest.

Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments have been performed on humans or animals for this research.

Confidentiality of data. The authors declare that they have followed the protocols of their work center on the publication of patient data.

Right to privacy and informed consent. The authors declare that no patient data appear in this article.

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