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Contralateral laryngeal reinnervation in the patient with the right-sided vocal cord paralysis – case-report

Kontralateralna reinerwacja krtani u pacjenta z prawostronnym porażeniem fałdu głosowego – opis przypadku

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ABSTRACT:

Introduction: Paralysis of the nerves supplying the larynx leading to the vocal fold paralysis may have iatrogenic, proliferative, idiopathic or post-traumatic etiology. The most common etiology is iatrogenic, including a complication of the removal of paraganglioma tumors. One of the therapeutic options for vocal cord paralysis in the course of nerve damage is reinnervation of the larynx. One of the most frequently used reinnervation techniques is the anastomosis of the recurrent laryngeal nerve with the cervical ansa, usually ipsilateral or, less often, contralateral.

Case presentation: The description concerns a 41-year-old patient with right-sided laryngeal paralysis after removal of a paraganglioma of the parapharyngeal space, the area of the jugular foramen and the skull base who underwent laryngeal reinnervation using a contralateral cervical ansa.

Conclusion: Laryngeal reinnervation procedure involving anastomosis of the recurrent laryngeal nerve with the contralateral cervical ansa allows recovery of the vocal fold function in a situation when the ipsilateral cervical ansa is damaged. This reinnervation involves taking a much longer section of the cervical ansa than in cases of ipsilateral reconstruction. Moreover this method requires creating a tunnel under the prelaryngeal muscles and passing the cervical ansa over the trachea or larynx.

KEYWORDS: anca cervicalis, paraganglioma, recurrent laryngeal nerve, reinnervation, vocal cord paralysis

STRESZCZENIE:

Wstęp: Porażenie nerwów zaopatrujących krtań, które prowadzi do porażenia fałdów głosowych może mieć etiologię jatrogenną, rozrostową, idiopatyczną oraz pourazową. Najczęstsza jest etiologia jatrogenna spowodowana między innymi usunięciem guzów o charakterze przyzwojaków. Jedną z opcji terapeutycznych porażenia fałdów głosowych w przebiegu uszkodzenia nerwów jest reinerwacja krtani. Jedną z najczęściej wykorzystywanych technik reinerwacji jest zespolenie nerwu krtaniowego wstecznego z pętlą szyjną, zazwyczaj tożstronną (ipsilateralną) lub rzadziej przeciwstronną (kontralateralną).

Opis przypadku: Opis dotyczy 41-letniego pacjenta z prawostronnym porażeniem krtani po operacji usunięcia przyzwojaka przestrzeni przygardłowej, okolicy otworu szyjnego i podstawy czaszki, u którego przeprowadzono zabieg reinerwacji krtani z wykorzystaniem przeciwstronnej pętli szyjnej.

Wnioski: Zabieg reinerwacji krtani, polegający na zespoleniu nerwu krtaniowego wstecznego z przeciwstronną pętlą szyjną, umożliwia odzyskanie funkcji fałdu głosowego w sytuacji, gdy tożstronna do porażenia krtani pętla szyjna jest uszkodzona. Reinerwacja ta polega na pobraniu znacznie dłuższego odcinka pętli szyjnej niż w przypadkach rekonstrukcji tożstronnych, wytworzenia tunelu pod mięśniami przedktraniowymi oraz przeprowadzeniu pętli szyjnej nad tchawicą lub krtanią.

SŁOWA KLUCZOWE: nerw krtaniowy wsteczny, pętla szyjna, porażenie fałdu głosowego, przyzwojak, reinerwacja

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ABBREVIATIONS

EMG – electromyography
MPT – maximal phonation time
MRI – magnetic resonance imaging
RIJV – right internal jugular vein
VLS – videolaryngostroboscopy

INTRODUCTION

Damage to the nerves supplying the larynx can be of iatrogenic, neoplastic, idiopathic, as well as post-traumatic etiology [1, 2]. Among the most common causes of laryngeal paralysis are surgical procedures during which the vagus nerve and its branches, including the recurrent laryngeal nerves, are damaged [3, 4]. Such surgeries include those of the thyroid gland, where a complication in the form of bilateral vocal fold paralysis caused by iatrogenic injury to the retrograde laryngeal nerves is diagnosed in 1 to 4.6% of patients [5]. Surgeries to remove head and neck paragangliomas can also result in laryngeal paralysis depending on the tumor location [6, 7]. Another common cause of damage to the nerves supplying the larynx consists in cancers directly infiltrating the vagus nerve or the recurrent laryngeal nerve, such as thyroid, lung, or esophageal cancers as well as mediastinal metastases [8–10].

Symptoms of damage to the nerves supplying the larynx include unilateral or bilateral paralysis of the vocal folds, which can result in dysphonia, impaired swallowing with the risk of penetration and aspiration, and shortness of breath resulting from significant narrowing of the airway at the glottal level, which in extreme cases can lead to life-threatening acute respiratory failure and stridor [2, 10, 11].

One of the therapeutic options for vocal fold paralysis is laryngeal reinnervation, which is an effective method for restoration of neural connections to the laryngeal muscles, thereby preventing muscle atrophy, improving muscle tone and increasing vocal fold mass [12–14]. Reinnervation procedures are warranted in cases of the absence of spontaneous clinical improvement or lack of improvement in laryngeal electromyography (EMG) results as observed three to six months after the loss of function [15]. One of the most common reinnervation techniques, as originally presented by Crumley, consists in the establishment of anastomosis between the retrobulbar laryngeal nerve and the cervical ansa [16]. The ipsilateral cervical ansa is mainly used for reinnervation purposes; in patients who had lost the function of their ipsilateral ansa due to primary causes (i.e., tumor infiltration, damage during surgery) or who had experienced excessive scarring or adhesions within the area, contralateral cervical loop can be used for reinnervation [1].

AIM

Presented herein is a case of a 41-year-old male patient with right-sided laryngeal paralysis following surgery to remove a paraganglioma of the parapharyngeal space, the jugular foramen region and the base of the skull, who was subjected to laryngeal reinnervation using a contralateral cervical loop.

CASE REPORT

A 41-year-old male patient was admitted to the Department of Otorhinolaryngology, Head and Neck Surgery at the Medical University of Warsaw for surgical treatment and laryngeal reinnervation in March 2023.

Reporting on his history, the patient complained of head and neck pain as well as dizziness lasting since early 2022. In April 2022, a magnetic resonance imaging (MRI) scan revealed a tumor within the parapharyngeal space, jugular foramen region and skull base (Fig. 1.–2.). Radiation therapy (26 doses, PIB-COI) was implemented. Several months after the completion of radiotherapy, the patient developed new complaints in the form of paroxysmal head and neck pain, dizziness and fainting preceded by short-term visual disturbances of the scotoma type. Due to the aforementioned symptoms, the patient was admitted to the Department of Otorhinolaryngology, Head and Neck Surgery at the Medical University of Warsaw in December 2022. Upon admission, Doppler ultrasound of carotid vessels revealed a tumor presenting with increased vascularization, measuring 3 × 4 cm, located on the right side at the base of the skull, adjacent to the carotid vessels. The right internal jugular vein (RIJV) within the proximal segment was most likely compressed by the tumor. The patient was qualified for surgical resection of the tumor. In December 2022, surgery was performed to remove the tumor from the parapharyngeal space, jugular foramen region and skull base on the right side. Histopathological examination revealed a paraganglioma-like lesion. Immediately after the surgery, the patient developed anomalies in the innervation of the lower cranial nerve group presenting in the form of phonation and swallowing disorders. During hospitalization, phoniatric-speech therapy consultations were carried out several times combined with endoscopic evaluation of swallowing disorders. The phoniatric-speech therapy examination revealed the tongue being deviated to the right along with an asymmetry of the soft palate (drooping on the right side). Nasofiberoscopy as performed after removal of the nasogastric probe revealed the retention of saliva and food within the lower pharynx and larynx. The glottic fissure was sufficiently wide and the left vocal fold was properly mobile, while the right vocal fold was immobile and medially aligned. Incomplete glottal stop was observed. During the examination, the patient was given fluid of ST1 (slightly thick) consistency and food of ST4 (mashed) consistency. Retention of material was observed for both consistencies tested (particularly within the pyriform recesses) with a tendency to penetrate into the interarytenoid region. During the examination, the maneuver of rotating the head to the right along with simultaneous adduction toward the chest as well as the supersupraglottic swallowing maneuver were used (both being partially successful). The patient was discharged home with recommendations for further care including phoniatric and speech therapy rehabilitation in the outpatient setting.

In March 2023, the patient was admitted to the Department of Otorhinolaryngology, Head and Neck Surgery at Warsaw Medical University for surgical treatment consisting in a laryngeal reinnervation procedure. The procedure consisted of several stages (Fig. 3.–5.).

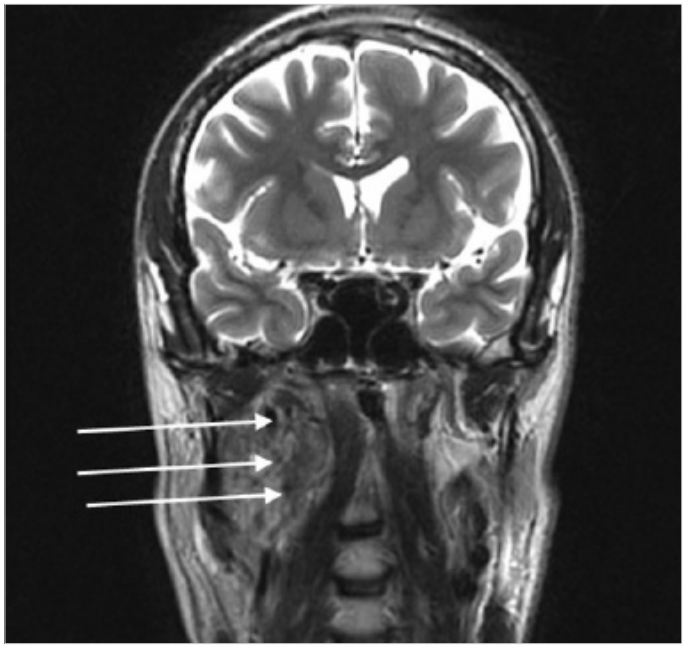

Fig. 1. MRI scan of a tumor of the neck and skull base on the right side in frontal projection, presenting with radiological features of increased vascularization.

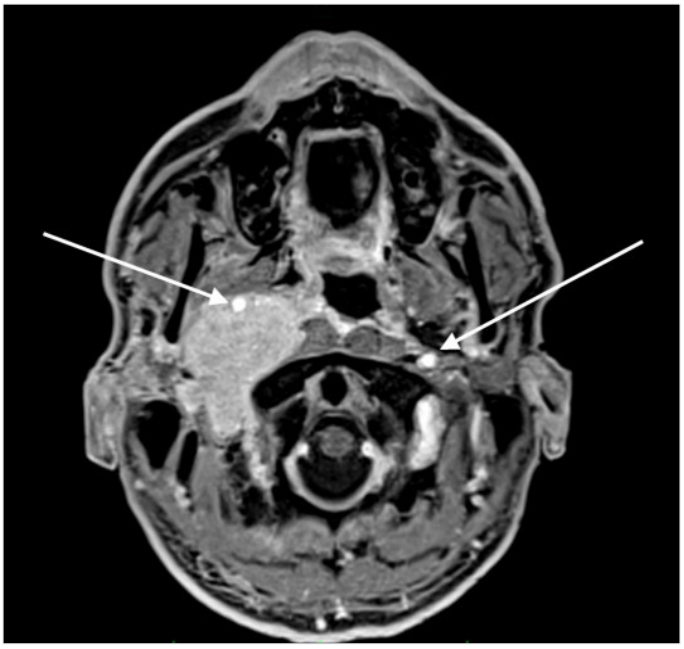

Fig. 2. Contrast-enhanced MRI scan of a tumor of the neck and skull base on the right side in axial projection; the internal carotid artery is being displaced forward by the tumor.

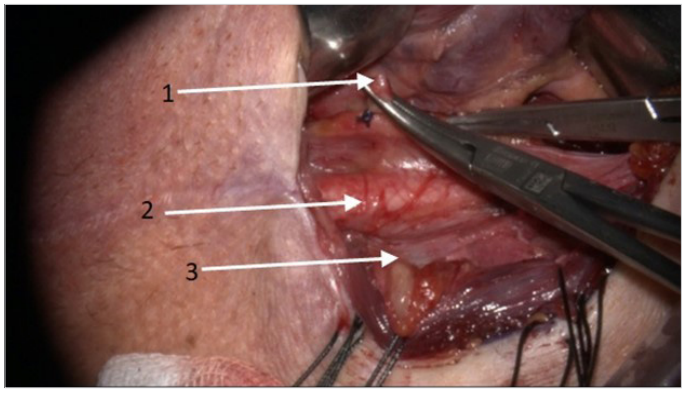

Fig. 3. Intraoperative image. Dissection of the lateral margin of the thyroid gland in search of the recurrent laryngeal nerve following the transection of the middle thyroid artery (1 – stump of the middle thyroid artery; 2 – common carotid artery; 3 – internal jugular vein).

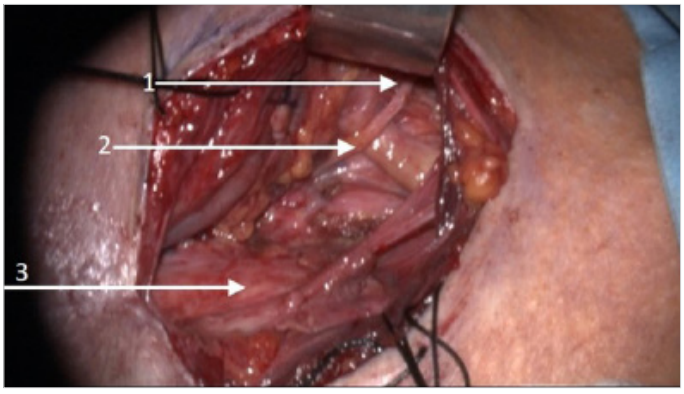

Fig. 4. Intraoperative image. Dissection of the recurrent laryngeal nerve on the right side. (1 – recurrent laryngeal nerve – proximal part; 2 – retrograde laryngeal nerve – distal part; 3 – common carotid artery).

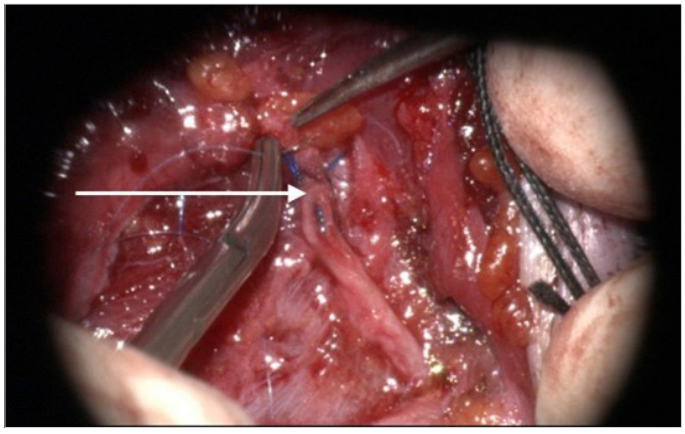

Fig. 5. Intraoperative image. Suturing of the recurrent laryngeal nerve with the cervical ansa pulled over the prelaryngeal muscles – 10-0 non-absorbable sutures. Epineurium of the anastomosed nerves stabilized with 3-0 absorbable sutures.

Stage 1: A longitudinal cut was made in the neck on the right side, along the scar formed following the previous surgery.

Stage 2: The subcutaneous tissue was dissected, and the thyroid cartilage and the recurrent laryngeal nerve were exposed. Due to the doubts regarding the function of the nerves of the right cervical ansa, a decision was made to perform an incision on the left side.

Stage 3: A longitudinal cut was made on the neck on the left side, analogous to the one previously made on the right side. The subcutaneous tissue was dissected, and the cervical ansa was exposed.

Step 4: The recurrent laryngeal nerve was dissected and cut above the clavicle and then anastomosed to the longest contralateral nerve branch coming off the cervical ansa using four epineural sutures. The tunnel through which the cervical ansa was passed was established above the cricothyroid muscle. The anastomosis site was secured with Surgicel.

No complications were observed in the perioperative and postoperative course. In the months following surgery, the patient reported on subjective improvement in voice and swallowing

quality. After 4 months, a videolaryngostroboscopy (VLS) exam revealed restoration of right vocal fold mobility and a reduction in glottic fissure insufficiency. Glottal stop remained incomplete. The patient continues to receive phoniatric-speech therapy as well as otorhinolaryngological care.

DISCUSSION

The treatment of vocal fold paralysis as a complication of various surgical procedures is a challenge for treatment teams consisting of otorhinolaryngologists, phoniatrists, and speech therapists. Due to the possibility of spontaneous nerve regeneration, one of the initial stages of treatment consists in watchful waiting and/or conservative treatment with vocal rehabilitation. Regeneration of phonatory and swallowing functions is a long-term process, hence the different recommendations regarding the length of the watchful waiting period (from 6 to even 12 months) [2, 17].

However, the above management should not delay the implementation of subsequent treatment techniques, particularly if significant voice quality impairment and significant speaking effort are present. Some authors suggest that adopting a wait-and-see attitude for a period of 12 months may unnecessarily delay the implementation of appropriate causal treatment and contribute to a decrease in patients' quality of life [18, 19].

Despite numerous surgical techniques being described, no consensus has been established regarding the most functional and effective method of reinnervation. The efficacy and complication rates of individual reinnervation techniques depend, among other factors, on the causes of paralysis – unsatisfactory results achieved using a particular technique in a particular pathology may be much better in the treatment of other pathologies. Significant difficulties remain with regard to the individualization of treatment on a case-by-case basis [20].

Laryngeal reinnervation techniques include end-to-end anastomosis of the recurrent laryngeal nerve as well as anastomosis of the recurrent laryngeal nerve to the cervical ansa. Sublingual nerve has also been proposed for use in laryngeal reinnervation, albeit this procedure carries a high risk of sublingual nerve palsy [21, 22]. The first direct laryngeal nerve anastomosis had been described by Horsley as early as in 1910 [23]. In 1986 and in 1991, Crumpley and Izdebski reported on a group of patients in whom recurrent laryngeal nerve had been anastomosed to cervical ansa nerves with very good results. They further noted that the use of cervical ansa loop as a donor may prevent the occurrence of laryngeal synkinesis which can develop when the recurrent laryngeal nerve is anastomosed using the end-to-end method [16, 24]. The cervical ansa appears to be an extremely good donor for several reasons, including its relatively easy intraoperative accessibility, its location in the vicinity of the larynx, its diameter, and its nerve activity at rest [24, 25]. On the other hand, the usefulness of cervical ansa may be hindered in the case of inferior accessibility, for example due to neck trauma, tumor infiltration or previous surgery in the neck, i.e. excision of a paraganglioma of the vagus nerve. In such cases, contralateral cervical ansa can be used, transferred and anastomosed to the recurrent laryngeal nerve [1, 26, 27]. On the basis of 56 cases, Wang et al. presented an improvement in voice quality outcomes following reinnervation with the use of the contralateral cervical loop [26]. An improvement in vocal fold tone on the reinnervation side was also observed by the authors upon laryngovideostroboscopic evaluation along with full glottal stop in 87.5% of patients. Normalization of acoustic parameters and prolongation of the mean maximal phonation time (MPT) from 6.41 seconds to 15.97 seconds was achieved in the patients. In addition, laryngeal electromyography exams revealed significant postoperative improvement in voluntary recruitment of motor units upon phonation [26].

Many other authors have presented encouraging results that confirm the possibility of voice quality being normalized and the mobility of the previously paralyzed vocal folds being restored following laryngeal reinnervation surgery [1, 26, 28–30]. In his 2011 study, Paniello compared voice quality scores and voice quality-dependent improvement in the quality of life following laryngeal reinnervation and medialization laryngoplasty. Significantly better outcomes were demonstrated following laryngeal reinnervation surgery in patients below the age of 52 [28].

CONCLUSIONS

Laryngeal reinnervation procedure involving anastomosis of the recurrent laryngeal nerve with the contralateral cervical ansa facilitates the recovery of the vocal fold function in situations when the ipsilateral cervical ansa is damaged. Reinnervation requires that a much longer segment of the cervical ansa is collected than in cases of ipsilateral reconstruction. Moreover, the method requires a tunnel being established under the prelaryngeal muscles to passing the cervical ansa over the trachea or larynx. Despite the more difficult technical conditions, contralateral laryngeal reinnervation using a cervical ansa is a promising method leading to functional vocal and swallowing rehabilitation.

REFERENCES

1. Lorenz R.R., Esclamado R.M., Teker A.M., Strome M., Scharpf J. et al.: Ansa cervicalis-to-recurrent laryngeal nerve anastomosis for unilateral vocal fold paralysis: experience of a single institution. Ann Otol Rhinol Laryngol., 2008; 117: 40–45.
2. Stager S.V.: Vocal fold paresis: etiology, clinical diagnosis and clinical management. Curr Opin Otolaryngol Head Neck Surg., 2014; 22(6): 444–449.
3. Yumoto E., Minoda R., Hyodo M., Yamagata T.: Causes of recurrent laryngeal nerve paralysis. Auris Nasus Larynx., 2002; 29: 41–45.
4. Rosenthal L.H., Benninger M.S., Deeb R.H.: Vocal cord immobility: a longitudinal analysis of etiology over 20 years. Laryngoscope., 2007; 117: 1864–1870.
5. Misiołek M., Dzielicki J., Namysłowski G., Kołodziej A., Orecka B.: Małoinwazyjna technika operacyjna gruczołu tarczowego a niedowład nerwów krtaniowych wstecznych. Otorynolaryngol., 2004; 3(4): 151–154.
6. Netterville J.L., Jackson C.G., Miller F.R., Wanamaker J.R., Glasscock M.E.: Vagal Paraganglioma: A Review of 46 Patients Treated During a 20-Year Period. Arch Otolaryngol Head Neck Surg., 1998; 124(10): 1133–1140. doi: 10.1001/archotol.124.10.1133.

7. Leonetti J.P., Brackmann D.E.: Glomus vagale tumor: the significance of early vocal cord paralysis. Otolaryngol Head Neck Surg., 1989; 100(6): 533–537. doi: 10.1177/019459988910000601.
8. Spataro E.A., Grindler D.J., Paniello R.C.: Etiology and Time to Presentation of Unilateral Vocal Fold Paralysis. Otolaryngol Head Neck Surg., 2014; 151(2): 286–293.
9. Evans J.M., Schucany W.G.: Hoarseness and cough in a 67-year-old women. Proc (Bayl Univ Med Cent)., 2004; 17: 469–472.
10. Chen H.C., Jen Y.M., Wang C.H., Lee J.C., Lin Y.S.: Etiology of vocal cord paralysis. ORL J Otorhinolaryngol Relat Spec., 2007; 69: 167–171.
11. Czesak M., Osuch-Wojcikiewicz E., Niemczyk K.: Selective reinnervation of the larynx as a treatment method for bilateral vocal fold paralysis. Pol Otorhino Rev., 2021; 10(3): 8–12.
12. Rzepakowska A., Jachimowska J., Niemczyk K.: Laryngeal reinnervation in unilateral vocal fold paralysis – case report and literature review. Pol Otorhino Rev., 2017; 6(2): 33–37.
13. Lee W.T., Milstein C., Hicks D., Akst L.M., Esclamado R.M.: Results of ansa to recurrent laryngeal nerve reinnervation. Otolaryngol Head Neck Surg., 2007; 136: 450–454.
14. Zheng H., Li Z., Zhou S., Cuan Y., Wen W.: Update: laryngeal reinnervation for unilateral vocal cord paralysis with the ansa cervicalis. Laryngoscope., 1996; 106: 1522–1527.
15. Puxeddu R., Marrosu V., Filauro M., Mariani C., Parrinello G. et al.: Bilateral selective laryngeal reinnervation in patients with bilateral vocal cord palsy. Acta Otorhinolaryngol Ital., 2023; 43(3): 189–196. doi: 10.14639/0392-100X-N2395.
16. Crumley R.L.: Update: ansa cervicalis to recurrent laryngeal nerve anastomosis for unilateral laryngeal paralysis. Laryngoscope., 1991; 101: 384–387; discussion 388.
17. Mau T., Pan H.M., Childs L.F.: The natural history of recoverable vocal fold paralysis: Implications for kinetics of reinnervation. Laryngoscope., 2017; 127: 2585–2590.
18. Spector B.C., Netterville J.L., Billante C., Clary J., Reinisch L. et al.: Quality-of-life assessment in patients with unilateral vocal cord paralysis. Otolaryngol Head Neck Surg., 2001; 125: 176–182.
19. Hogikyan N.D., Wodchis W.P., Terrell J.E., Bradford C.R., Esclamado R.M.: Voice-related quality of life (V-RQOL) following type I thyroplasty for unilateral vocal fold paralysis. J Voice., 2000; 14: 378–386.
20. Gibbins N.: The Evolution of Laryngeal Reinnervation, the Current State of Science and Thoughts for Future Treatments. J Voice., 2014; 28(6): 793–798.
21. Paniello R.C.: Laryngeal reinnervation with the hypoglossal nerve. II: clinical evaluation and early patient experience. Laryngoscope., 2000; 110: 739–748.
22. Manni J.J.: Laryngeal reinnervation with the hypoglossal nerve. Laryngoscope., 2001; 111: 1113–1114.
23. Horsley J.S.: Suture of the recurrent laryngeal nerve: with report of a case. Ann Surg., 1910; 51: 524–528.
24. Crumley R.L., Izdebski K.: Voice quality following laryngeal reinnervation by ansa hypoglossi transfer. Laryngoscope., 1986; 96: 611–616.
25. Chhetri D.K., Berke G.S.: Ansa cervicalis nerve: review of the topographic anatomy and morphology. Laryngoscope., 1997; 107: 1366–1372.
26. Wang W., Chen S., Chen D., Xia S., Qiu X. et al.: Contralateral ansa cervicalis-to--recurrent laryngeal nerve anastomosis for unilateral vocal fold paralysis: a long--term outcome analysis of 56 cases. Laryngoscope., 2011; 121(5): 1027–1034. doi: 10.1002/lary.21725.
27. Miyauchi A., Yokozawa T., Kobayashi K., Hirai K., Matsuzuka F. et al.: Opposite ansa cervicalis to recurrent laryngeal nerve anastomosis to restore phonation in patients with advanced thyroid cancer. Eur J Surg., 2001; 167: 540–541.
28. Paniello R.C., Edgar D.J., Kallogeri D., Picciro J.: Medialization vs Reinnervation for Unitaleral Vocal Fold Paralysis. A Multicenter Randomized Clinical Trial. Laryngoscope., 2011; 121(10): 2172–2179.
29. Dzodic R., Markowic I., Santrac N., Buta M., Djurisic I. et al.: Reccurent Laryngeal Nerve Liberation and Reconstructions: A Single Institution Experience. World J Surg., 2016; 40(3): 644–651.
30. Seung-Ho C.: Optimal Injection Timing for Vocal Fold Paralysis, In: Vocal Fold Injection, red. L. Byung-Joo, K. Tack-Kyun, C.A. Rosen, Springer, Singapore 2021, 69–72.

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Competing interests: The authors declare that they have no competing interests.

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