

Place of Partial Arytenoidectomy in the Management of Bilateral Vocal Cord Immobilitis

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Abstract

Surgical management of laryngeal paralysis varies depending on whether the vocal cords are in abduction, adduction or paramedian position. Various surgical techniques have been described including partial arytenoidectomy which is reported to give good surgical results that are stable over time. The objective of the study was to analyze the surgical therapeutic elements of bilateral paralysis, especially to assess partial arytenoidectomy, one of the most performed techniques. This was a descriptive retrospective study of cases of bilateral immobility admitted between January 1st 2008 and March 31st 2018 and treated surgically. Socio-demographic and therapeutic data were collected. The survey involved 46 patients, with an equal number of male and female (23) with 50% of male patients and 23 patients were female, or a sex ratio of 1. The average age of the patients was 56 ± 17 years ranging between 14 and 89 years. Posterior partial arytenoidectomy was the most widely performed surgical technique (26 patients or 56.5%), followed by cordopexia or lateral-fixing of a vocal cord (19.6%) and posterior cordectomy (17.4%). Patients who received a partial arytenoidectomy and cordopexia had their vocal cords either in adduction or in the paramedian position. Those who received a posterior cordectomy had their vocal cords in adduction. 18 patients (39.13%) were taken to the operating theatre in less than 6 hours, 28 (60.9%) had no post-operative complications, and 9 patients received a surgical enlargement resumption. In post-operative follow-up, 11 patients suffered pulmonary aspiration corrected after speech therapy; 26 patients (56.5%) did not. Partial arytenoidectomy remains the most performed surgical procedure in the management of closed bilateral laryngeal paralysis at the Mont-Godinne University Hospital. It allows a reliable and durable breathing function over time with less impact on the voice.

Keywords

Vocal Cords, Bilateral Laryngeal Paralysis, Surgery, Partial Arytenoidectomy

1. Introduction

Laryngeal paralysis is the manifestation of a lesion that usually sits on the vagus or recurrent nerve between the jugular foramen and penetration point of the nerve into the larynx. It causes immobility of the vocal cords and poses different problems depending on whether the vocal cords are immobilized in abduction, adduction or paramedian position. Its surgical management varies depending on the case. Bilateral paralysis, whether complete or not, confronts the practitioner with a respiratory problem [1]. Endoscopic surgery has significantly simplified the management of laryngeal paralysis. Complete or partial arytenoidectomy, cordectomy and cordopexia, usually have positive functional prognostic. Functional consequences are simple in the majority of cases [2]. Cabanes [3] reports over time stable and effective postoperative results with laser arytenoidectomy which only requires a single operating act. In addition, major complications are rare. In our case series the procedure consisted of an endoscopic enlargement of the posterior glottic airway with good functional results. This study aims to report the experience of the CHU de Mont-Godinne in the surgical management of bilateral immobility of the vocal cords.

2. Study Methods

This descriptive retrospective study took place from 01 January 2008 to 31 March 2018 in the ENT department of the Mont-Godinne University Hospital Center in the municipality of Yvoir in Belgium. The study included records of patients who had received surgical management for bilateral vocal cord immobility. Incomplete records as well as records of patients who received exclusive medical treatment were excluded. The parameters studied were socio-demographic (age, sex), intervention modalities (types of intervention, operating time, post-operative follow-up). Preoperative delay has been defined as the time interval between the date of the first consultation and the date of surgery. Data were collected from each patient's medical records. The graphs and variables were analyzed using Excel and Stata version 13.

Posterior partial arytenoidectomy

This procedure is performed under or without tracheal intubation, using a Venturi Jet Ventilation [4]. The larynx may be exposed by a posterior commissure laryngoscope (Ossoff type) [5] [6]. A conventional Bouchayer type laryngoscope is used, positioned to expose the arytenoid cartilage, the posterior commissure, the interarytenoid cleft and at least half of the other arytenoid cartilage. To do this, the rubber endotracheal tube, 5 or 5.5 mm, is loaded with the laryngoscope and pushed forward. This exposes the operating field and allows a

proper vision of the arytenoid. The operating microscope, coupled with the CO₂ laser, is equipped with a focal length of 400 mm, focused to obtain a microspot of 0.8 mm. The CO₂ laser is used in continuous firing or superpulse with a 0.8 mm microspot. The horned and arytenoid cartilages are gradually decreased from top to bottom in total endoscopic arytenoidectomy. Two laser adjustment modes are used alternately: 0.1 s intermittent mode, with an approximate power of 2 W/cm² for vaporization of the mucoperichondrium; continuous mode with a power of more than 3 W/cm² for the vaporization of the cartilage itself. Because of the risk of definitive false routes in the event of total arytenoidectomy, Remacle recommends the preservation of the pharyngeal side of the arytenoid cartilage [7]. Excision begins with the section of the vocal cord at the raze of the vocal process and continues outside and backward on the ventricular floor until it reaches the lateral surface of the arytenoid cartilage (Figure 1). The section passes through the laryngeal side of the arytenoid cartilage, which preserves a pharyngeal slope of 2 to 3 mm. The posterior commissure is spared, usually protected by the tracheal intubation tube. The body section of the arytenoid cartilage leaves a posterior wall of 2 mm and spares the muscular process. The gesture lasts between 25 and 30 minutes.

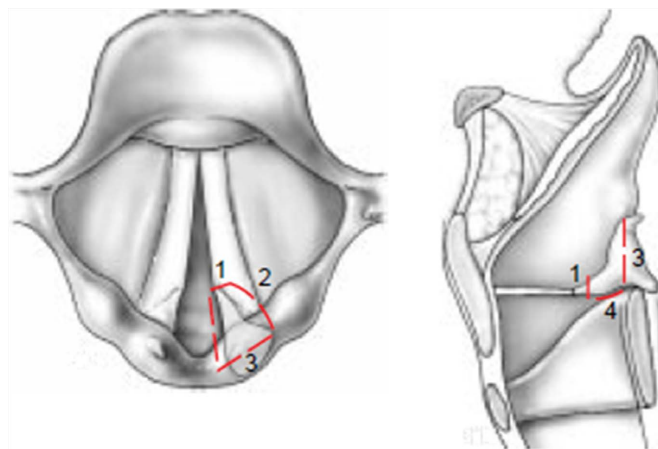
No antibiotic corticosteroid treatment is necessary postoperatively. Fibrinous tissue covers the surgical site from the second postoperative day and disappears during the third week, when healing is achieved.

3. Results

3.1. Socio-Demographic Characteristics

This study included patients surgically treated in the ENT department for bilateral immobility of the vocal cords from January 1, 2008 to March 31, 2018 (10 years 3 months).

46 patients were included, with exactly half of each sex for a sex ratio of 1. The mean age of patients was 56 ± 17 years ranging between 14 and 89 years.



1. vocal cord; 2. ventricular band; 3. arytenoid; 4. cricoid cartilage.

Figure 1. Subtotal arytenoidectomy (According to Remacle). Resection limits. [1]

3.2. Methods of Intervention

- **Surgical technique**

Partial arytenoidectomy, cordopexy, and posterior cordectomy were performed in 43 patients (93.5% of cases). **Figure 2** shows the distribution of patients by type of intervention.

Table 1 shows the relationship between the positioning of the immobile vocal cords and the type of intervention.

- **The operating time**

18 patients (39.13%) were taken to the emergency operating room in less than six hours. The others were operated in less than 30 days, with a 1 month to 12 months delay, or after 12 months in 8 cases (17.39%), 12 cases (26.09%) and 8 cases (17.39%) respectively.

- **Post-operative follow-up**

Postoperative complications were reported in 18 cases (39.1%) of the study population. We registered postoperative bleeding (2 cases; 4.35%), recurrence of

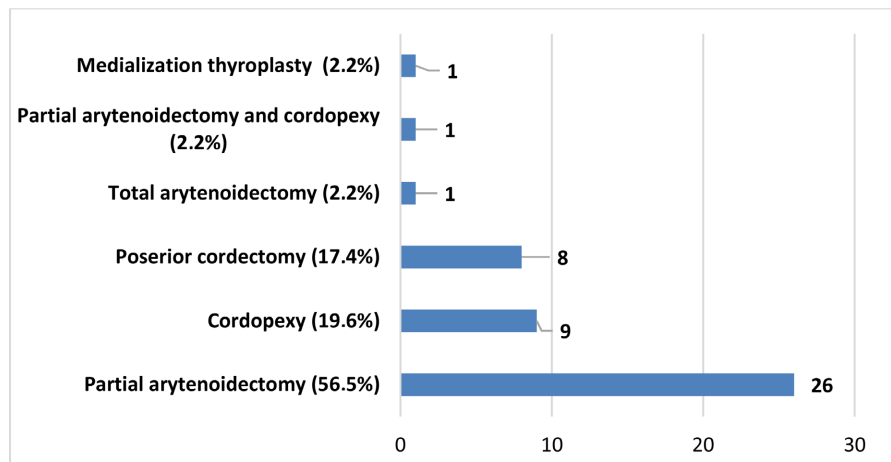


Figure 2. Distribution of patients according to the type of intervention.

Table 1. Relationship between vocal cord positioning and the type of intervention received.

	Vocal cord positioning			Total (%)
	Adduction	Paramedian	Abduction	
Partial arytenoidectomy	10	16	0	26 (56.5)
Cordopexy	4	5	0	9 (19.6)
Posterior cordectomy	8	0	0	8 (17.4)
Total arytenoidectomy	1	0	0	1 (2.2)
Partial arytenoidectomy and Cordopexy	0	1	0	1 (2.2)
Medialization thyroplasty	0	0	1	1 (2.2)
Total	23 (48.94)	22 (48.94)	1 (2.13)	46 (100.00)

glottic stenosis (2 cases; 4.35%). Both cases of bleeding from the surgical site benefited from haemostasis by adrenaline infused gauze under general anaesthesia with favourable outcomes. Revision enlargement surgery has been performed in cases of recurrence of glottic stenosis. 11 patients presented false routes that regressed after 10 readaptative sessions on average (between 6 and 20 sessions).

4. Discussion

4.1. Socio-Demographic Parameters

Male patients accounted for exactly half of our study population. Min Y.J. *et al.* [8] reported 59.4% of male subjects in their series. A female predominance was reported by some authors such as Omari M. in 2017 with 91.89% [9] and Sounni A. with 90% of women against 10% of men [10]. This could be explained by the predominance of thyroid pathologies in females [11]. The average age of the study population was 56 ± 17 years ranging from 14 to 89 years. Remacle *et al.* in 2005 in a study of a population of 69 patients, had noted a mean age of 56 years with extremes of 11 and 82 years. Amoussa-Houunkpatin K. [12] reported 57 as the average age in his series with extremes of 8 and 86. These rates are almost similar to those of Sounni A. [10] which is 51.5 ± 12.45 with extremes of 20 and 77 years and those of Omari M. [9] which is 52.46 years.

4.2. Modality of Interventions

Bilateral laryngeal paralysis in the closed and paramedian position is more common. Treatments therefore most often use procedures that aim to widen the respiratory tract [13], at the cost of a decrease in phonatory abilities. The most used surgical techniques in this series are subtotal arytenoidectomy (56.5%), followed by cordopexy or laterofixation of a vocal cord (19.6%) and posterior cordectomy (17.4%). Total arytenoidectomy is effective in terms of breathing but promotes pulmonary aspiration, and the remaining arytenoid mucosa can collapse into the larynx [14] [7]. That is why we recommend respecting a posterior wall of 1 to 2 mm of the arytenoid cartilage. This cartilaginous shell prevents collapse of the arytenoid mucosa during inspiratory efforts. The risk of pulmonary aspiration is also reduced by respecting the pharyngeal side of the arytenoid. Partial endoscopic arytenoidectomy gives good respiratory results that are stable over time. For Cabanes *et al.* [3], laser arytenoidectomy requires only one operating time.

Combined laterofixation or cordopexy [1] is a technique that provides glottic opening by a pexy thread that lateralizes the posterior part of the vocal cord [15]. The procedure is performed under general anesthesia. It combines a laterocervical approach and a laryngoscopic exposure in suspension. The operating time is about 30 minutes. A contralateral gesture can be carried out and an ipsilateral recovery is possible.

The posterior transverse cordectomy of Kashima [16] is called by other authors cordotomy since the vocal cord is not completely removed. It consists of

an excision of the C-shaped membranous vocal cord of 5 mm by 5 mm located in front of the vocal process without stripping it. Gaillard et Haguenaer [17], Dennis and Kashima [16] suggested a uni- or bilateral posterior cordectomy. Kashima [18] refines the gesture by performing only a transverse cordotomy but associated with an internally based triangle resection along the vocal processes. Voice quality would be better preserved. many authors favor this intervention. It should often be performed bilaterally to ensure stability of results. There is no significant difference in respiratory results (flow/volume curves) and phonatory after 6 months follow up but arytenoidectomy can allow an enlargement if the cordectomy has been insufficient. On the other hand, the subclinical pulmonary aspirations are observed in the “arytenoidectomy” group of patients. According to Rémacle [19] subtotal arytenoidectomy has two advantages: The first one is related to the arytenoidectomy itself:

- It allows reliable and durable breathing over time;
- less impact on the voice unlike cordectomy;
- and minimizes impact on swallowing unlike total arytenoidectomy.

The second is related to the laser:

- allows a precise incision with less laryngeal edema;
- good hemostasis of small vessels;
- a faster and shorter hospitalization.

Bilateral paralysis in abduction are rare and entail vital risks to the importance of pulmonary aspirations. To improve laryngeal occlusion, uni- or bilateral medialization procedures are suggested in literature. Thyroplasty consists of the placement of an inert implant through a window made in the ipsilateral thyroid cartilaginous wing by cervicotomy [20]. The advantage of this method lies in the possibility to perform it under local or loco-regional anesthesia with a real-time evaluation of the phonatory result by the surgeon and the patient. There is a prominent place for thyroplasties that can be supplemented secondarily by a fat injection in case of insufficient results. An associated medialization arytenoido-pexy may also be performed [21]. Performing transiently maintained tracheostomy is recommended because of the risk of dyspnea, especially in case of arytenoid manipulation or in the presence of neuromuscular disorders [21].

4.3. Operative Time

An emergency tracheostomy is performed when the cords are in adduction, followed by surgery to enlarge the glottic tract. Smith [22], reported sudden dyspnea with respiratory distress in 50% of patients in his tracheostomy series. This tracheostomy can be avoided with a posterior cordectomy or arytenoidectomy in acute laryngeal dyspnea [23] [24]. A rescue intubation can also be performed for example during an intervention that has injured the both recurrent nerves. In our series 18 patients or 39.13% were taken to the emergency operating room among the 46 patients who were treated surgically, and 17.39% in less than a month.

4.4. Post-Operative Complications

In patients who received partial arytenoidectomy, 16 patients or 61.5% had no complications, 2 patients experienced postoperative bleeding and 5 experienced revision enlargement surgery. In subtotal arytenoidectomy [1], the occurrence of posterior synechiae is possible. The results reported by Lichtenberger on cordopexy show 78% (46 patients out of 59) positive results at the first intervention (removal of the tracheostomy cannula, satisfactory breathing). Some patients required contralateral surgery (ten patients) [25]. A series of 11 patients evaluated after at least 5 years has been reported [26]: two had to be reoperated for persistent dyspnoea and one for vocal problems. This technique has the advantage of being not very traumatic. It is renewable in case of over- or under-correction. In our series, 2 of the 9 patients who received cordopexy were referred to for enlargement surgery. Four patients showed excellent results. According to Drancy [27], the satisfactory pathway after a cordectomy was often obtained at the expense of surgical revision in more than 90% of cases for posterior partial cordotomy. These results seem to alter over time but most often without the need for long-term surgical revision. The dysphonia was often transient. We reported no complications in 5 out of 8 patients who had a posterior cordectomy.

4.5. Post-Operative Follow-Up

Postoperative pulmonary aspiration in partial arytenoidectomy was absent in 17 patients and seen in 5 patients but controlled after speech therapy. Fluid aspiration is common during the first postoperative days and is rapidly compensated in subtotal arytenoidectomy [1]. Excellent results were reported by Khalifa [28], using bilateral posterior cordectomy at the same endoscopic time. In Hariga [29] series, posterior laser cordectomy was performed in four patients with laryngeal diplegia in closed position, the result was considered satisfactory by the patients both on phonatory and respiratory levels. For Hammami B. [30], posterior cordectomy was performed in the first stage in 4 cases. It was bilateral in two stages in 2 cases and unilateral in 2 cases. An initial arytenoidectomy was performed for the other two patients. Only one patient retained respiratory discomfort without true dyspnea with a closed speaking cannula and decanulation was refused. A satisfactory voice was obtained for all patients. Transient false routes were noted in 2 cases.

To date, he has not reported any significant vocal or respiratory differences between arytenoidectomy and posterior cordectomy [31]. Cordectomy is easier to perform, faster and more effective in the short term. It must often be bilateral and recurrences are not rare because of fibrosis at the level of the section area. Arytenoidectomy is longer and more difficult but more stable in its results.

5. Conclusion

Bilateral vocal cord immobility is a life-threatening condition. Appropriate surgical treatment depends on the positioning of the vocal cords, which may be in

adduction, paramedian position, or in abduction. Partial arytenoidectomy remains the most performed surgical procedure in the management of bilateral laryngeal paralysis in closed position at Mont-Godinne UHC. It allows reliable and durable breathing over time with less impact on the voice.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- [1] Makeieff, M., Garrel, R. and Guerrier, B. (2001) Chirurgie des paralysies laryngées. *EMC-Techniques Chirurgicales-Tête et Cou*, **1**, 1-15.
- [2] Remacle, M. and Lawson, G. (2006) Paralysies laryngées. *EMC-Oto-Rhino-Laryngologie*, **21**, 1-18.
- [3] Cabanes, J., de Corbière, S., Naudou, P. and Salf, E. (1995) Aryténoïdectomie par voie endoscopique au laser CO₂ dans les paralysies récurrentielles bilatérales à propos de 45 ans. *Annales d'oto-laryngologie et de chirurgie cervico faciale*, **112**, 58-62.
- [4] Sosis, M. (1989) Anesthesia for Laser Surgery. *Journal of Voice*, **2**, 163-174. [https://doi.org/10.1016/S0892-1997\(89\)80143-2](https://doi.org/10.1016/S0892-1997(89)80143-2)
- [5] Ossoff, R.H., Duncavage, J., Krespi, Y., Shapshay, S. and Sisson, G. (1990) Endoscopic Laser Arytenoidectomy Revisited. *Annals of Otolaryngology, Rhinology & Laryngology*, **99**, 764-771. <https://doi.org/10.1177/000348949009901002>
- [6] Ossoff, R.H., Sisson, G.A., Moselle, H.I., Duncavage, J.A., Andrews, P.E. and Mcmillan, W.G. (1984) Endoscopic Laser Arytenoidectomy for the Treatment of Bilateral Vocal Cord Paralysis. *Laryngoscope*, **94**, 1293-1297. <https://doi.org/10.1288/00005537-198410000-00006>
- [7] Remacle, M., Lawson, G., Mayné, A. and Jamart, J. (1996) Subtotal Carbon Dioxide Laser Arytenoidectomy by Endoscopic Approach for Treatment of Bilateral Cord Immobility in Adduction. *Annals of Otolaryngology, Rhinology & Laryngology*, **105**, 438-445. <https://doi.org/10.1177/000348949610500604>
- [8] Min, J.-Y., Hong, S.-D., Kim, K. and Son, Y.-I. (2008) Long-term Results of Artecoll Injection Laryngoplasty for Patients with Unilateral Vocal Fold Motion Impairment: Safety and Clinical Efficacy. *Archives of Otorhinolaryngology-Head & Neck Surgery*, **134**, 490-496. <https://doi.org/10.1001/archotol.134.5.490>
- [9] Omari, M. (2017) Les paralysies laryngées. Faculté de Médecine et de Pharmacie, Fès, 188 p.
- [10] Sounni, A. (2015) Place de l'aryténoïdectomie subtotale au laser CO₂ dans le traitement des paralysies laryngées bilatérales. Faculté de Médecine et de Pharmacie, Fès, 184 p.
- [11] Vignikin-Yéhouéssi, B., Flatin, M., Vodouhè, S., Hounkpè, Y. and Medji, A. (2008) Place de la thyroïdectomie en pratique ORL au CNHU de Cotonou. *Revue CAMES-Série A*, **6**, 37-41.
- [12] Amoussa-Hounkpatin, K. (2010) Place de la chirurgie dans la prise en charge des immobilités des cordes vocales. Faculté des Sciences de la Santé, Cotonou, 60 p.
- [13] Lacau, J., Chevalier, D., Arnoux-Sondt, B., Beutter, P., Debry, C., Fugain, C., *et al* (2002) Paralysies récurrentielles de l'adulte. SFORL-Recommandations pour la pratique Clinique, France, 44 p.

- [14] Plouin-Gaudon, I., Lawson, G., Jamart, J. and Remacle, M. (2005) Subtotal Carbon Dioxide Laser Arytenoidectomy for the Treatment of Bilateral Vocal Fold Immobility: Long-Term Results. *Annals of Otolaryngology, Rhinology & Laryngology*, **114**, 115-121. <https://doi.org/10.1177/000348940511400206>
- [15] Ejnell, H., Mansson, I., Bake, B., Hallén, O., Stenborg, R. and Lindström, J. (1984) A Simple Operation for Bilateral Vocal Cord Paralysis. *Laryngoscope*, **94**, 954-958. <https://doi.org/10.1288/00005537-198407000-00018>
- [16] Dennis, D.P. and Khashima, H.K. (1989) Carbon Dioxide Laser Posterior Cordectomy for Treatment of Bilateral Vocal Cord Paralysis. *Annals of Otolaryngology, Rhinology & Laryngology*, **98**, 930-940. <https://doi.org/10.1177/000348948909801203>
- [17] Gaillard, J., Haguenaer, J.P., Dubreuil, C., Pignal, C., Higuera, E. and Guetat, M. (1982) Use of the Laser in Acquired Laryngostenosis and Laryngeal Diplegia. *Journal Francais d'oto-rhino-laryngologie, Audiophonologie, Chirurgie Maxillo-Faciale*, **31**, 261-266.
- [18] Khashima, H.K. (1991) Bilateral Vocal Fold Motion Impairment: Pathophysiology and Management by Transverse Cordotomy. *Annals of Otolaryngology, Rhinology & Laryngology*, **100**, 717-721. <https://doi.org/10.1177/000348949110000905>
- [19] Maurizi, M., Paludetti, G., Galli, J., Cosenza, A., Di Girolamo, S. and Ottaviani, F. (1999) CO₂ Laser Subtotal Arytenoidectomy and Posterior True and False Cordotomy in the Treatment of Post-Thyroidectomy Bilateral Laryngeal Fixation in Adduction. *European Archives of Oto-Rhino-Laryngology*, **256**, 291-295. <https://doi.org/10.1007/s004050050248>
- [20] Montgomery, W.W., Blaugrund, S.M. and Varvares, M.A. (1993) Thyroplasty: A New Approach. *Annals of Otolaryngology, Rhinology & Laryngology*, **102**, 571-579. <https://doi.org/10.1177/000348949310200801>
- [21] Weinman, E.C. and Maragos, N.E. (2000) Airway Compromise in Thyroplasty Surgery. *Laryngoscope*, **110**, 1082-1085. <https://doi.org/10.1097/00005537-200007000-00003>
- [22] Murty, G.E. and Smith, M.C.F. (1989) Recurrent Laryngeal Nerve Palsy Following Heart-Lung Transplantation: Three Cases of Vocal Cord Augmentation in the Acute Phase. *The Journal of Laryngology & Otolaryngology*, **103**, 986-969. <https://doi.org/10.1017/S0022215100110643>
- [23] Baujat, B., Delbove, H., Wagner, I., Fugain, C., de Corbière, S. and Chabolle, F. (2001) Immobilité laryngée post-thyroidectomie. *Annales de Chirurgie*, **126**, 104-110. [https://doi.org/10.1016/S0003-3944\(00\)00488-0](https://doi.org/10.1016/S0003-3944(00)00488-0)
- [24] Berkowitz, R.G. (2007) Natural History of Tracheostomy-Dependent Idiopathic Congenital Bilateral Vocal Fold Paralysis. *Otolaryngology—Head and Neck Surgery*, **136**, 649-652. <https://doi.org/10.1016/j.otohns.2006.11.050>
- [25] Lichtenberger, G. and Toohill, R.J. (1997) Technique of Endo-Extralaryngeal Suture Lateralization for Bilateral Abductor Vocal Cord Paralysis. *Laryngoscope*, **107**, 1281-1283. <https://doi.org/10.1097/00005537-199709000-00023>
- [26] Geterud, A., Ejnell, H., Stenborg, R. and Bake, B. (1990) Long-Term Results with a Simple Surgical Treatment of Bilateral Vocal Cord Paralysis. *Laryngoscope*, **100**, 1005-1008. <https://doi.org/10.1288/00005537-199009000-00016>
- [27] Drancy, A., Laccourreye, E., Brasnu, D. and Laccourreye, H. (1992) Cordectomie partielle postérieure au laser CO₂ dans les paralysies récurrentielles bilatérales. *Annales d'OTO-Laryngologie et de Chirurgie Cervico Faciale*, **109**, 235-239.
- [28] Khalifa, M.C. (2005) Simultaneous Bilateral Posterior Cordectomy in Bilateral Voc-

al Fold Paralysis. *Otolaryngology—Head and Neck Surgery*, **132**, 249-250.

<https://doi.org/10.1016/j.otohns.2004.09.063>

- [29] Hariga, I., Ben Amor, M., Azaza, F., Hannachi, R., Ben Gamra, O., Zribi, S., *et al.* (2012) Les paralysies laryngées. *Annales Françaises d'OTO-Rhino-Laryngologie et de Pathologie Cervico-Faciale*, **129**, A152.

<https://doi.org/10.1016/j.aforl.2012.07.413>

- [30] Hammami, B., Kallel, S., Kolsi, N., Smaoui, L., Charfeddine, I. and Ghorbel, A. (2011) Traitement des diplégies laryngées en fermeture: Apport du laser. *Journal Tunisien d'ORL et de Chirurgie Cervico-Faciale*, **26**, 37-40.

- [31] Lawson, G., Remacle, M., Hamoir, M. and Jamart, J. (1996) Posterior Cordectomy and Subtotal Arytenoidectomy for the Treatment of Bilateral Vocal Fold Immobility: Functional Results. *Journal of Voice*, **10**, 314-319.

[https://doi.org/10.1016/S0892-1997\(96\)80013-0](https://doi.org/10.1016/S0892-1997(96)80013-0)