ORIGINAL ARTICLE

Posterior Cordectomy. Our Experience

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KEYWORDS
Bilateral vocal fold paralysis;
Laser surgery;
Respiratory distress

Abstract
Objective: Several surgical procedures have been proposed for the treatment of respiratory distress secondary to bilateral cord palsy. We performed a retrospective study of our experience in posterior cordectomy with a laser CO2, analysing the improvement of dyspnoea and voice quality after surgery.

Methods: This was a retrospective study of 13 cases (9 female, 4 male). The age range was 25–79 years. Iatrogenic post-thyroideectomy (4 cases) was the most common aetiology of bilateral laryngeal palsy in our study.

We assessed the subjective improvement of respiratory function and voice quality after laser surgery using the Spanish adaptation of the Voice Handicap Index (VHI).

Results: Dyspnoea improved in all patients. Two cases had a worsening of dyspnoea in the immediate postoperative period and one case was successfully solved with a new surgical intervention.

After surgery, most of patients suffered from mild or middle dysphonia.

Conclusions: The posterior cordektomy is an easy, safe, and effective treatment for dyspnoea secondary to bilateral laryngeal palsy, maintaining acceptable voice quality.

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PALABRAS CLAVE
Parálisis cuerda vocal bilateral;
Cirugía laser;
Insuficiencia respiratoria

Cordectomía posterior. Nuestra experiencia

Resumen

Introducción y objetivos: La parálisis bilateral en aducción de las cuerdas vocales ocasiona una disnea de intensidad variable, que puede ser tratada con diferentes procedimientos quirúrgicos. Se realizaría una revisión retrospectiva de nuestros casos tratados mediante cordectomía posterior con laser CO2, analizando tanto el resultado respiratorio (mejoría de la disnea) como el resultado vocal.

Métodos: Se realiza un estudio retrospectivo de 13 casos (9 mujeres y 4 varones) con edades comprendidas entre 25 y 79 años. En nuestra serie la causa más frecuente de la parálisis laringea bilateral es la tiroidectomía (4 casos).

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Se valora la mejoría de su disnea según la opinión subjetiva de los pacientes y la disfonía generada, utilizando la versión española del Voice Handicap Index (VHI).

Resultados: Todos los pacientes mejoraron significativamente de su disnea. Dos pacientes tuvieron que ser ingresados por disnea la primera semana del postoperatorio y uno de ellos fue reintervenido. Tras la intervención la mayoría de los pacientes sufrieron una disfonía leve o moderada.

Conclusiones: La cordectomía posterior es un tratamiento fácil y seguro, que proporciona buenos resultados respiratorios con una disfonía leve o moderada en la mayoría de los casos.

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Introduction

Laryngeal paralysis in adduction is an uncommon condition that can cause dyspnoea of varying intensity and that can be treated with different surgical procedures.

Posterior cordectomy is a surgical intervention, first described by Dennis and Kashima in 1989,1 which is indicated in dyspnoea by bilateral vocal fold paralysis in adduction.

Recurrent bilateral paralysis represents 25% of all cases of recurrent paralysis2,3 and its most common cause is iatrogenic (especially after thyroidectomy2,4). It is difficult to distinguish from cricoarytenoid joint ankylosis, although it is important to do so because their surgical managements are different.

Clinically, it is characterised by dyspnoea of varying intensity, with little or no dysphonia and without dysphagia.

In addition to tracheotomy, the surgical treatment of this problem includes several options. Resection techniques (cordectomy and arytenoidectomy) are the most commonly used, but there are also other alternatives such as arytenoidopexy or nerve reinnervation.

Breathing voice is sacrificed in all surgical procedures except reinnervation.

Posterior cordectomy is a simple operation to perform, almost without complications. Some modifications to improve the outcome have been described. We believe that, at present, it is the technique of choice because it provides the best balance between respiratory and phonatory results, without causing aspiration.

Methods

We conducted a retrospective study of 13 patients who underwent posterior cordectomy due to bilateral vocal fold paralysis in adduction, between June 1998 and January 2008. Of these, 9 were female and 4 were male. Their ages ranged between 25 and 79 years. Classifying by aetiology we found: 4 after thyroidectomy, 1 following traumatic brain injury, 1 due to multinodular goitre, 2 following combined treatment with radiotherapy and chemotherapy due to laryngeal squamous cell carcinoma, 2 from neurological disease (both with multisystem atrophy), and 3 of unknown aetiology (Table 1).

Clinically, all patients presented dyspnoea on moderate exertion with nocturnal stridor. Two patients had previously undergone surgical procedures for this problem (1 of them on 2 occasions – cordectomy and arytenoidectomy with cordopexy – and the other, arytenoidopexy).

We used electrocautery in all cases except for 1, in which CO2 laser was used, due to technical problems. No patient underwent tracheotomy at the time of the intervention.

We performed prior tracheotomy in only 1 case. This patient was scheduled for total thyroidectomy surgery (due to large multinodular goitre with intrathoracic extension) and removal of a pituitary adenoma. The tracheotomy was removed after 1 month, without any problems.

Results

All cases presented significant improvement in dyspnoea 1 year after the intervention. Two patients suffered a worsening of their dyspnoea in the first 2 weeks after surgery, requiring hospital admission. One of them received drug treatment with good response and the other underwent cordectomy.

To assess the degree of dysphonia generated, we used the Spanish version of the Voice Handicap Index (VHI) 1 year after the intervention. We excluded the patients who presented dysphonia before surgery, that is, patients with cancer (2), neurological cases (2), patients who had undergone surgery on 2 previous occasions, and patients who underwent cordectomy. Of the 7 remaining cases, 2 suffered a mild dysphonia (VHI under 30), 4 a moderate dysphonia (VHI between 30 and 60) and 1 a severe dysphonia (VHI between 60 and 90). All patients were satisfied with the vocal outcome, except for the one who underwent cordectomy (Table 1).

The 2 cancer patients and the 2 neurological patients died due to their underlying diseases, without requiring tracheostomy in any case.

Discussion

Bilateral paralysis of both vocal folds accounts for 25% of cases of recurrent paralysis2,3. The most common cause of bilateral recurrent paralysis is the iatrogenic, especially thyroidectomy4,5.

It may appear as sudden dyspnoea (usually in the immediate postoperative period, perhaps requiring urgent tracheostomy) or, even more frequently, as dyspnoea upon small and moderate efforts. It does not usually cause dysphonia (and when it does appear, it is mild) or deglutitive problems.

Whenever possible, it is advisable to wait at least 6 months before performing surgery, because there may be a spontaneous recovery of the paralysis.5
Table 1  Scheme of Cases Studied and Vocal Result With VHI.

<table>
<thead>
<tr>
<th>Case</th>
<th>Age</th>
<th>Aetiology</th>
<th>Prior Surgery</th>
<th>CO₂ Laser</th>
<th>Prior Tracheotomy</th>
<th>Postoperative Dyspnoea</th>
<th>Reintervention</th>
<th>VHI</th>
</tr>
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<tbody>
<tr>
<td>Case 1</td>
<td>79</td>
<td>Thyroidectomy</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>78</td>
</tr>
<tr>
<td>Case 2</td>
<td>47</td>
<td>Thyroidectomy</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td>51</td>
</tr>
<tr>
<td>Case 3</td>
<td>61</td>
<td>Thyroidectomy</td>
<td></td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td>33</td>
</tr>
<tr>
<td>Case 4</td>
<td>77</td>
<td>Thyroidectomy</td>
<td></td>
<td>+ +</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Case 5</td>
<td>56</td>
<td>Thyroid goitre</td>
<td></td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>Case 6</td>
<td>23</td>
<td>BT</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>75</td>
</tr>
<tr>
<td>Case 7</td>
<td>82</td>
<td>Neurological</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Case 8</td>
<td>54</td>
<td>Neurological</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Case 9</td>
<td>55</td>
<td>Oncological</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Case 10</td>
<td>72</td>
<td>Oncological</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Case 11</td>
<td>75</td>
<td>Unknown</td>
<td></td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td>10</td>
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<tr>
<td>Case 12</td>
<td>50</td>
<td>Unknown</td>
<td></td>
<td>+</td>
<td></td>
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<td>76</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>33</td>
</tr>
</tbody>
</table>

BT: brain trauma; VHI: Voice Handicap Index.

The first surgical intervention for this problem was a cordoventriclectomy performed by Chevalier Jackson in 1922. In 1941, King proposed an arytenoidopexy with suture to the omohyoid muscle and Kelly performed an external arytenoidectomy that same year. Thornell carried out the first endoscopic arytenoidectomy (1948), which Ossoff later repeated with CO₂ laser in 1983. In 1989, Dennis and Kashima published posterior cordectomy, an even more restricted procedure on the glottis. With the development of endolaryngeal microsurgery and lasers, external approaches have been practically abandoned (except in children, in whom endoscopic approaches can still be performed); some authors have obtained better results with external approaches.

The most commonly used techniques are resections, including cordectomy (endoscopic or external), which often causes severe dysphonia. Arytenoidectomy (external or endoscopic) has aspiration as a major complication (although some technical variants have been described that avoid it) or cricoid necrosis (especially in irradiated patients). Lastly, posterior cordectomy achieves sufficient air passage with moderate vocal sacrifice.

Possible non-resection surgical procedures include arytenoidopexy, which can be external or endoscopic (Lichtenberger has designed instrumentation that facilitates it). Its main advantage is that arytenoidopexy is potentially reversible, while its main disadvantage is that its results seem to worsen over time.

Laryngeal reinnervation was first described by Tucker in 1976, with excellent results (he used a myoneural pedicle from the hypoglossal loop to the posterior cricoarytenoid muscle). The intervention is technically difficult and has shown worse results in other series.

Other procedures such as a laryngeal pacemaker or botulinum toxin may become important alternatives in the future.

Posterior cordectomy consists in a transverse incision of the vocal fold in front of its insertion into the vocal process, which must completely sever the elastic cone reaching the cricoid perichondrium (Figs. 1 and 2). Some authors employ variants of posterior cordectomy, such as procedures on both

Figure 1  Posterior cordectomy. Immediate postoperative period (the day after the intervention).

Figure 2  Posterior cordectomy. Final outcome (at 3 months postoperatively).
vocal folds\textsuperscript{12,19,20} or extending the resection to the ventricular band or the vocal fold or vocal process.\textsuperscript{21-23} Although it was originally described with CO\textsubscript{2} laser, it can also be performed with KTP laser\textsuperscript{23-25} or with electrocautery, as in 1 case within our series.

Some authors employ a prior tracheotomy,\textsuperscript{7,13} although we generally do not consider it necessary and have only used it in 1 case.

This intervention is simple to perform, but its main drawback is the appearance of dyspnoea in the immediate postoperative period (15\% of our cases). This dyspnoea is caused by granulomas, oedema, or crusts attached to the surgical site during scarring.\textsuperscript{12,25} Nevertheless, it is transient and can be treated medically (with anti-inflammatory drugs, antibiotics, mucolytics, humidifiers, etc.).

It is important to distinguish whether the bilateral immobility of the vocal folds is caused by recurrent paralysis or cricoarytenoid ankylosis, although few series make this distinction.\textsuperscript{5,19,26} Cricoarytenoid ankylosis is mainly due to endotracheal intubation,\textsuperscript{5,26} followed by autoimmune diseases (Wegener, rheumatoid arthritis\textsuperscript{27}). Cricoarytenoid ankylosis can be resolved through other surgical procedures such as sectioning scar tissue or adhesions that fix the arytenoids, intra-articular injection of corticosteroids or others.\textsuperscript{6} Laryngeal electromyography can be of great help in differentiating both conditions, as well as in establishing a prognosis in recurrent paralysis.\textsuperscript{5,15,6}

With respect to respiratory outcomes, almost all studies report satisfactory results, between 95\%\textsuperscript{24} and 100\% of cases (as in our series), although with reoperation rates ranging from 50\%\textsuperscript{21,24,23} to 33\% as in the first communication by Dennis and Kashima\textsuperscript{1} or 7\% as in our series. The parameters used to measure these results differ from 1 study to the next. Some, including ours, use the subjective improvement of dyspnoea or the degree of patient satisfaction,\textsuperscript{24} while others use the percentage of decannulations\textsuperscript{8,21} or pulmonary function tests (flow volume curves,\textsuperscript{1} body plethysmography\textsuperscript{19,22,23}).

We used the Spanish version of the VHI to evaluate the vocal results.\textsuperscript{28,27} This is a questionnaire with 3 parts (functional, physical, and emotional), with 10 questions each, which are answered with a value of 0–4, that is, with a maximum score of 120. A VHI below 30 is considered as a mild dysphonia, between 30 and 60 as moderate dysphonia, between 60 and 90 as intense dysphonia, and between 90 and 120 as severe dysphonia. Other studies use patients’ subjective assessments\textsuperscript{19,20,24} or resort to other parameters (Yanagihara scale based on spectrogram,\textsuperscript{21} Göttingen scale,\textsuperscript{19} or Dejonckhere scale\textsuperscript{25}). We obtained good vocal results in most cases (85\% of mild or moderate dysphonia in our series) and all patients reported being satisfied with their voice.

Neither our series nor any of those reviewed reported deglutitive disorders after the intervention.

Some studies compared the outcome between posterior cordectomy and arytenoidectomy,\textsuperscript{26,30} without finding significant differences in either vocal or respiratory results. Nevertheless, they have found that arytenoidectomy often causes subclinical aspiration whereas posterior cordectomy does not.\textsuperscript{26} No differences in outcome were found when using either CO\textsubscript{2} or KTP laser.\textsuperscript{21,24,25}

**Conclusions**

Dyspnoea caused by bilateral paralysis of vocal folds in adduction is rare, but it represents a delicate problem. Posterior cordectomy is a rapid, simple intervention that has few complications. In most cases, this intervention provides a sufficient increase in glottic space (similar results to other techniques), with a mild or moderate dysphonia without aspiration. We believe that, at present, this is the technique of choice in this pathology.

**Conflict of Interests**

The authors have no conflicts of interest to declare.

**References**

14. Perouse R, Coulombeau B, Arias C, Casanova C. Arytenoidopexie selon la technique de Lichtenberger: intérêt dans
16. Tucker HM. Long term results of neme-muscle pedicllerein-
18. Cohen SR, Thompson JW. Use of botulinum toxin to lat-
eralize true vocal cords: a biomedical method to relieve
microsurgical bilateral posterior cordectomy for the treatment
20. Khalifa MC. Simultaneous bilateral posterior cordectomy in
22. Reker U, Rudert H. Modified posterior Dennis and Kashima
23. Manolopoulos L, Stavroulaki P, Yiotakis J, Segas J, Adamopoulos G. CO2 and KTP-532 laser cordectomy for bilateral
24. Ferri E, Garcia Purríos FJ. Tratamiento quirúrgico endoscópico
con láser diodo de la parálisis laringea en aducción. Acta Oto-
25. Segas J, Stavroulakis P, Manolopoulos L, Yiotakis J, Adamopoulos G. Management of bilateral vocal fold paralysis:
experience at the University of Athens. Otolaryngol Head Neck
26. Lawson G, Remacle M, Hamoir M, Jamart J. Posterior cordec-
tomy and subtotal arytenoidectomy for the treatment of
27. Landa M, Rodríguez L, Rivas A, Abrego M, Zulueta A, Ar-
29. Nuñez_Batalla F. Validación de la versión traducida al español
del Indice de Incapacidad Vocal (Voice Handicap Index). Acta
Otorrinolaringol Esp. 2007;58:385.
30. Eckel HE, Vossing M. Endolaryngeal surgical procedures in glottis
expansion in bilateral recurrent nerve paralysis. Laryngorhi-