

Lateral fixation for bilateral vocal cord paralysis and its social aspects

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Abstract

Introduction: Different techniques are used to reduce laryngeal obstruction in bilateral vocal cord paralysis.

Methods: This article describes one of the simplest and less traumatic techniques that can be used in cases of bilateral vocal cord paralysis. This technique has been previously published, but it is the first time to be used in Malta. No preoperative tracheostomy is needed. This procedure is carried out under general anesthesia where two needles are inserted through the thyroid cartilage. Non-resorbable monofilament sutures are introduced through the needles and the needles are then withdrawn. The fiber thus forms a permanent loop around the vocal cord.

Conclusion: Using this new method the patients' breathing as well as voice quality improves significantly. Apart from being very effective, this technique is also minimally invasive and at the same time doesn't preclude more extensive surgical procedures from being performed.

Keywords

Lateral fixation, bilateral vocal cord paralysis, laryngoplasty

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Introduction

Bilateral vocal cord paralysis (BVCP) is a rare but dangerous condition which always results in shortness of breath and poor quality of voice. The commonest causes are: viral infections, neck trauma, idiopathic and surgical complications. Surgical complications leading to BVFP can be seen after thyroid surgery, parathyroid surgery, oesophageal surgery, tracheal surgery and brainstem surgery.

Up to now, all the patients who suffered this complication were managed by an urgent tracheostomy (which remains the gold standard). A wide range of techniques are nowadays used to enable the patient both to speak and to breathe without the need of permanent tracheostomy.⁸ One of these is the latero-fixation secundum Ejinell,^{1,2} which combines an endo-laryngeal together with an external approach. The management of singers, as well as other professional, who rely significantly on the quality of their voice poses a significant challenge on the existing techniques.

Materials and methods

Methodology

Prior to the operation, temporary against permanent management should be contemplated, especially if the patient has still got some chances of recovery of vocal cord movement. For example post-viral vocal cord paralysis tends to slowly recover spontaneously. One tends to hold back surgical intervention even longer with teacher and other voice professionals who are usually treated conservatively for longer periods of time. Following repeat and careful examinations of the vocal cords, the optimal compromise between good breathing and useful speech must be found.

The choice of which vocal cord to operate upon depends on various factors. Usually one of vocal folds is more excavated than the other. The more prominent, voluminous and tense vocal fold should be chosen, as this makes the procedure more effective. However, the voice weakens in direct correlation with the degree of vocal cord lateralisation.

The glottis consists of two parts, the pars intercartilaginea posteriorly, which is found in between the arytenoids cartilages, and pars intermembranacea anteriorly. Widening of the glottis closer to posterior commissure, pars intercartilaginea, gives better results in breathing and does not affect voice as much as the widening anteriorly in pars intermembranacea.

Case report

A fifty five year old female teacher was followed up for ten years by the endocrinologist for an autoimmune thyroid disorder. Over a few months, the patient started complaining of progressive shortness of breath and on clinical examination she was found to have a goitre. Her voice was clear, resonant and voluminous. However, after an hour into a lecture she always experienced shortness of breath. A CT scan showed a large multicystic retro-sternal goitre and thus, it was decided to proceed for a total thyroidectomy.

Immediately after extubation, the patient had severe breathing difficulties with inspiratory stridor. Laryngoscopy showed BVCP, which was initially thought to be due to be secondary to transient neuropraxia of the recurrent laryngeal nerves. An urgent tracheostomy was performed to improve her breathing. This was followed by course of steroids and prolonged period of speech therapy. The conventional tracheostomy tube was changed to a fenestrated one, with a speaking valve, in order to improve her speech and to start the rehabilitation of the vocal muscles. After one year of intensive speech therapy, the patient did not make any improvement thus the BVCP was deemed to be permanent.

The patient worked as a teacher, thus having a permanent tracheostomy was a major hindrance to her daily function. Despite this significant voice disturbance, she continued in her vocation. Her whispering sounded weak and due to insufficient glottic space she could not inhale deeply enough to produce loud speech. Approximately two years after the operation laterofixation secundam Ejnell was offered to the patient.

Method

The laterofixation secundam Ejnell is performed by a combined approach from two surgeons. The first part, involves approaching the thyroid cartilage from an external horizontal skin crease incision on lateral side of the thyroid cartilage. The lateral side of the thyroid cartilage is exposed by retracting the external laryngeal muscles posteriorly. The perichondrium is gently removed in the explored area.

Two lines must be identified in order to position the two needles correctly. The first being the oblique line, on the lateral surface of thyroid cartilage, where the sternothyroid and thyrohyoid muscles originate. The second line going through the middle of the height of thyroid cartilage is considered as the plane of glottis. The meeting point of the two lines represents the point of needle insertion. Two pink venesection (20G) needles are introduced from the outside of the larynx, through the lateral aspect of thyroid cartilage, just behind the oblique line and in the middle of thyroid cartilage height (Figure 1).

The second surgeon guides a rigid laryngoscope into the glottic space; an operating microscope and micro-laryngoscopic instrumentation are used to guide the tips of the needles within the larynx. The first needle is introduced by a twisting movement below and the second above the level of glottis. An iron stylette is used to clean the opening of both

needles from the remnants of cartilage (Figure 2).

A non-resorbable monofilament suture (3/0) is introduced through each needle. The non-resorbable material makes the laterofixation more permanent. However, if the voice weakens after the surgery and moreover the patient is not in satisfied with the results, a simple trans-laryngeal cut of the non-resorbable material results in an immediate return to the pre operative state.

The ends of the sutures are pulled from the larynx to the outside through the mouth. They are then tied to each other. Finally both sutures are pulled backwards, inside the larynx. The knot is pulled out through the thyroid cartilage with the bottom needle. Then a simple loop remains around the posterior third

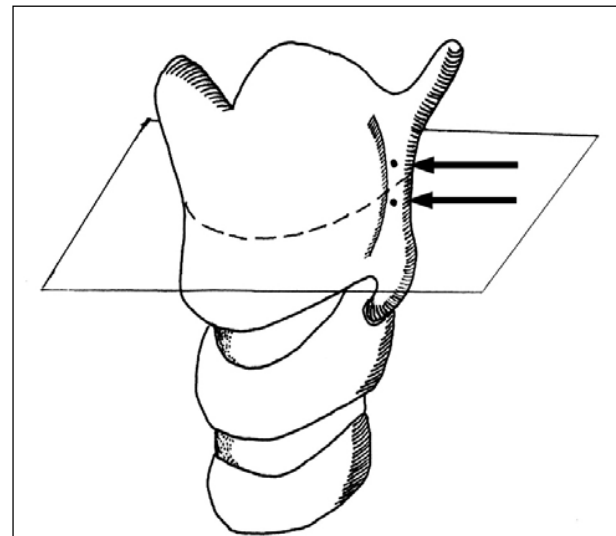


Figure 1: External anatomy of the larynx: Two points for needle introduction (arrow) are 5mm up and down from plane cutting horizontally the larynx in the middle and are placed just behind the oblique line, the origination of sternothyroid and thyrohyoid muscles

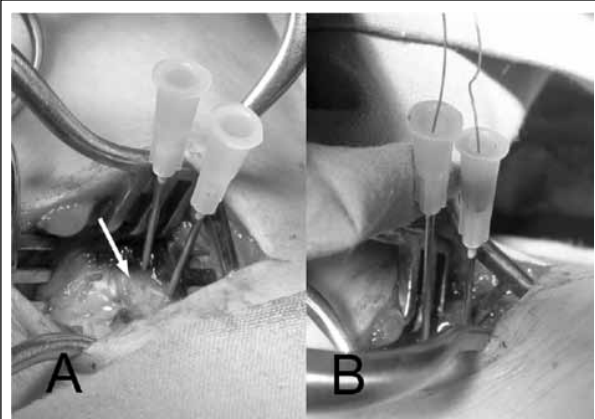


Figure 2: Detail of exposed lateral side of thyroid cartilage: (A) two needles are introduced through the lateral face of thyroid cartilage, just behind the oblique line of the thyroid cartilage (arrow). (B) Two non-resorbable fibers are introduced through the needles

of vocal fold. Pulling the suture and fixing it on the outside of the thyroid cartilage brings the vocal fold laterally. A silicon sheet should be inserted under the knot, on the surface of thyroid cartilage, to prevent the suture from cutting through the cartilage (Figure 3).

It is also recommended to use prophylactic antibiotics for five days as the cartilage tends to infect more easily than other tissue. A bolus of corticosteroid (hydrocortisone 200 mg) can be administered to reduce postoperative oedema.

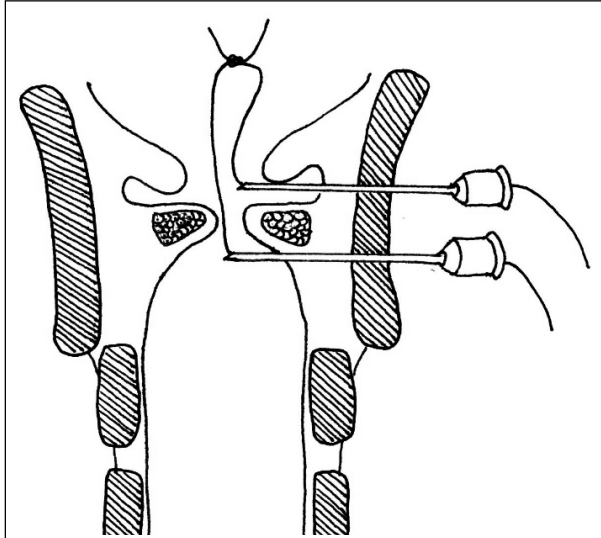


Figure 3: Coronal cross section of the larynx in the level of vocal fold - pars intercartilaginea: Two needles are introduced through the lamina of thyroid cartilage above and beneath the vocal fold. Two fibers are connected together, forming loop and then the nod pulled out of the larynx. Thus the vocal cord is pulled laterally

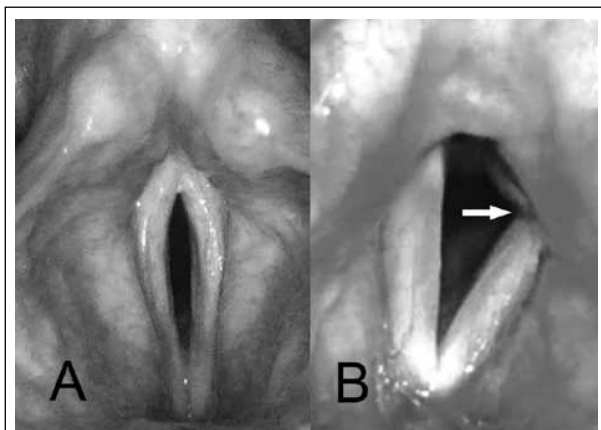


Figure 4: Laryngoscopic findings: (A) Before the operation: vocal cord in paramedial position, caused by bilateral vocal fold paralysis, space barely enough to breath. (B) After the laterofixation secundam Ejnell. Picture taken when patient speaks. Left vocal cord is pulled laterally in its posterior third by introduced fiber loop

Results

Immediately after the operation, the patient noticed a major improvement in her breathing. Within a few hours postoperatively, her inspiratory stridor had completely disappeared and her speech became more voluminous. Intensive speech therapy played a very important role in her rehabilitation. Unfortunately, the hoarseness persisted.

Six months after the operation, her breathing had improved up to an extent that allowed moderate physical activities. The patient restarted to work as a teacher despite of her speaking difficulties (Figure 4).

Discussion

More than 100 years after the first surgical interventions at restoring the airway in BVFP, tracheostomy still plays an important role in the management of this. However, different techniques were developed later. Nowadays those techniques are divided into three main groups:⁸

- Techniques using resections or trans-sections of anatomical structures within the larynx.
- Techniques which reshape the glottis by means of shifts of existing anatomical structures.
- Restoration or substitution of the missing innervations of the laryngeal musculature.

Techniques using resections or trans-sections of anatomical structures within the larynx

Initially BVCP was treated by open surgery to the larynx from the outside, then in 1948, Thornell described an intralaryngeal approach for arytenoidectomy, which is based on partial or complete removal of arytenoids cartilage.⁹ Posterior cordotomy is based on a vocal fold vertical incision close the posterior commissure (intercartilaginous portion of the vocal cord). Slitting of vocal cord can be made on one side or bilaterally. Cold techniques are more common, but the endolaryngeal laser incision is preferable.

Having good microlaryngeal instruments allows both methods to be performed more easily, however the anatomical changes are irreversible and the quality of voice is usually not satisfactory, due to scarification of the vocal folds. More radical treatments have also been described for example chordectomy, which is designed to remove the whole vocal cord.⁵ Nowadays this procedure is used almost exclusively for treatment of vocal fold tumors.

For all the above procedures (arytenoidectomy, chordotomy and chordectomy) both the translaryngeal and external approaches can be used. Unfortunately, posterior chordotomy and arytenoidectomy for glottic dilatation are very susceptible to granuloma and scar formation, which will inevitably lead to re-stenosis of the airway. Chordectomy results in considerable speech deterioration.

Techniques which reshape the glottis by means of shifts of existing anatomical structures

In 1982, Ejnell described laterofixation of the vocal fold by one or two loops which are introduced from outside to inside of the larynx through two needles above and underneath the vocal fold.¹ Ejnell uses the method as an emergency surgery after thyroid surgery instead of tracheostomy.² The main advantage of this method is that it is completely reversible and minimally invasive for the laryngeal mucosa. It avoids scarification and gives good results of the post-operative voice. The method has been modified several times, for example Ezzat et al used adjustable laterofixation, which enables a better voice modulation.³

In 1983, Lichtenberg described endo-extralaryngeal needle carrier which enables a translaryngeal needle to be introduced within the larynx.⁷ The same author reports excellent voice results in patients with BVFP.⁶ Lichtenberg's needle carrier was further improved and is still widely used.⁴

Restoration or substitution of the missing innervations of the laryngeal musculature

Reinnervation techniques which create a new nerve supply are also known and their results are quite good. However these techniques are not widely used because of technical complexity.^{11,12} New techniques of tissue reimplantation provide a more innovative approach to BVCP treatment, with improvement in the functional outcome.¹⁰

Experimental techniques

Experiments are being performed in artificial laryngeal pacing.¹³ The vocal cords remain tougher and the muscles do not atrophy. Other techniques involve injections of botulinum toxin in to the cricothyroid muscle with the intention to minimise its medialisation effect.

Conclusion

Procedures for BVCP have two main aims, which are to enable patients to breathe comfortably and to speak satisfactorily. Currently an urgent tracheostomy in cases of acute BVCP, required to relieve the respiratory distress in the acute setting, is the golden standard treatment.

We suggest that laterofixation secundam Ejnell should be kept in mind as an effect yet relatively simple treatment option, in the non acute management of patients suffering from BVCP since it avoids permanent damage to the vocal cords, together with being an easily and fully reversible procedure if better treatment options become available.

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