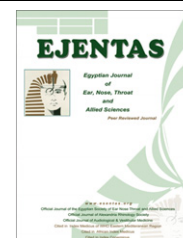




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ORIGINAL ARTICLE

## Screw nail medialization of arytenoid in unilateral adductor vocal cord paralysis: A new office procedure

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### KEYWORDS

Unilateral vocal cord paralysis;  
Arytenoids adduction;  
Maximal phonation time;  
Dysphonia

**Abstract** *Objectives:* The aim of this study is to describe and evaluate new technique for treatment of unilateral vocal cord paralysis giving the same results of the standard procedure but minimizing the surgical trauma.

*Patients and methods:* A prospective study was carried out between November 2009 and November 2011 in the Otorhinolaryngology Department, Zagazig University Hospitals, Egypt. It included 12 patients with unilateral idiopathic vocal cord paralysis who were managed by this new technique. Preoperative and postoperative video-laryngoscopy was done, maximal phonation time was calculated and ratings grade of dysphonia was compared.

*Results:* Postoperative video-laryngoscopy relieved complete glottic gap closure in 83.3% of cases and partial glottic gap in the remaining 16.7% of cases. The mean preoperative maximal phonation time was 9.42 s and the postoperative value was 21.5 s with a mean difference of 11.6 s. The rating of the grade of dysphonia showed great improvement in the patient's voice quality from severe dysphonia preoperatively to normal or near-normal voice postoperatively. All patients were satisfied with the results of the procedure except one patient (8.3%).

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*Conclusion:* The screw nail medialization technique gives a good reliable and easy procedure under local anesthesia for managing unilateral vocal cord paralysis and avoids the disadvantages of infection laryngoplasty and medialization thyroplasty using implants.

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## 1. Introduction

Unilateral vocal cord paralysis is not an uncommon finding in ENT practice. It is not a diagnosis by itself. The exact incidence of unilateral vocal cord paralysis has been difficult to evaluate. Many cases are undiagnosed due to spontaneous recovery, compensation by the opposite cord or inadequate postoperative evaluation<sup>1</sup>

It has been found that etiology of unilateral vocal cord paralysis shows changing trend varying with time and place. In 1930, aortic aneurysm (sphylic) and thyroidectomy were the most common causes of unilateral vocal cord paralysis. Many of those conditions, like sphylic aneurysm and tuberculous mediastinal nodes became rare or disappeared<sup>2</sup>

The relative incidence of non-laryngeal malignancy increased and it became the most frequent cause of unilateral vocal cord paralysis in 90s. With technological advances in anesthesia and surgery, the relative number of other surgical procedures like anterior cervical spine surgery, carotid endarterectomy, skull-base procedure with the potential risk for recurrent laryngeal nerve paralysis went up and thus brought down the relative incidence of thyroidectomy induced unilateral vocal cord paralysis. However, the incidence of unilateral vocal cord paralysis of unknown cause (idiopathic) has not reduced despite advances in imaging.<sup>3</sup>

Patients with unilateral vocal cord paralysis have hoarse, breathy voice while airway compromise and/or aspiration are usually not a problem.<sup>4</sup>

Flexible endoscopy is the most useful tool to evaluate vocal cord motion. It allows prolonged study of laryngeal motion and allows for video or still documentation. Videostroboscopy allows for even greater study of the vocal cords throughout their vibratory cycle. Another diagnostic aid to be considered is laryngeal electromyography which is a method for evaluation of laryngeal muscle innervations and it is gradually gaining acceptance by otolaryngologists.<sup>5</sup>

Voice therapy can play a role as a sole treatment or as part of combined treatment with surgical medialization of the paralyzed vocal fold. It is the primary treatment in patients who have a favorable (median) position of their vocal fold paralysis or those who are unwilling or unable to undergo surgery because of psychological or medication limitation. Voice therapy used in combination with surgery is usually used postoperatively.<sup>6</sup>

Surgical options for treatment of unilateral vocal cord paralysis include vocal cord medialization by injection laryngoplasty or by thyroplasty. Injection laryngoplasty involves direct injection of biocompatible material into a paralyzed true vocal cord guided by endoscopic visualization. This provides bulk to the affected vocal cord, thereby improving its opposition to the unaffected contralateral vocal cord.<sup>7</sup>

Injection laryngoplasty is the oldest method of treatment of unilateral vocal cord paralysis. Paraffin was used as injection material as early as 1911. A number of other substances have

been used to augment vocal cord. However, foreign body reactions to substances as Polytetrafluoroethylene and migration from injection sites have limited its use. Substances currently acceptable for injection laryngoplasty are collagen and fat.<sup>8</sup>

Medialization thyroplasty was first described by Isshiki et al. in 1975.<sup>9</sup> The technique was modified by Montgomery in 1997 who surgically inserted silastic prosthesis through a window in the thyroid lamina at the level of the vocal cord to medialize it, thereby improving glottic competency and facilitating phonation and airway protection<sup>10</sup>

Manipulation and placement of the arytenoid cartilage are the other ways to address glottic insufficiency. The arytenoid adduction procedure described by Isshiki et al.<sup>11</sup> has found widespread acceptance for correcting large glottic chinks, posterior glottic incompetence and malposition of arytenoids.<sup>12</sup>

The previously described methods for management of unilateral vocal fold paralysis were proven to be successful and safe. However, these methods need skin, perichondrial and cartilage incisions, muscle retraction and trauma.

The aim of this study is to describe and evaluate a new technique to minimize the surgical trauma with the same results of the standard procedures.

## 2. Material and methods

This is a prospective study which was conducted between November 2009 and November 2011 in the Department of Otorhinolaryngology, Head and Neck Surgery, Zagazig University Hospitals, Egypt. This study included 12 patients with idiopathic unilateral vocal cord paralysis.

All patients were diagnosed as having idiopathic unilateral vocal cord paralysis for more than one year to allow a chance for compensation or spontaneous recovery before any surgical interference.

### 2.1. Video laryngoscopy

Diagnosis of unilateral vocal cord paralysis was based on video laryngoscopic examination which was done preoperatively in all patients included in this study for the assessment of vocal cord mobility and glottic gap. This procedure was digitally recorded for the purpose of comparison with postoperative results of video-laryngoscopy to evaluate the results of this new procedure.

### 2.2. Maximal Phonation Time (MPT)

Maximal Phonation time (MPT) is an objective measure which is extremely useful in assessing surgical therapies. MPT was measured using Vocal Assessment Software from Tiger DRS, Inc. with a unidirectional microphone connected to a computer system. The patient was asked to sustain the vowel/a/

as long as possible at a comfortable pitch and loudness, with the mouth at a distance about 10 cm from the microphone following deep inspiration.<sup>13,14</sup> This was done both preoperatively and postoperatively.

### 2.3. Rating of the grades of dysphonia

Preoperative and postoperative ratings of the grades of dysphonia were compiled by an experienced phoniatician using the modified GRBAS scale.<sup>15</sup> Voice recordings of the patient reading a standard passage were reviewed. The following four-point scale (Table 1) was employed.<sup>15</sup>

### 2.4. Surgical technique

Before starting the operation, the patient was informed about the steps of local anesthesia and surgical procedure and he was instructed that he would be asked about his self satisfaction by the quality of his voice during the operation.

The patient was lying in supine position with the head tilted to the other side and supported by a head ring.

This procedure was performed as an office procedure under local anesthesia with an anesthesiologist attending the operation and pulse oximetry was used for monitoring of the patient.

Before administration of local anesthesia, the field was sterilized, thyroid cartilage was palpated, and then regional local anesthesia was infiltrated all around the thyroid cartilage at the operated side using adrenaline dissolved in saline in a concentration of 1:200,000. This solution was added to xylocaine 2% in a ratio of 5:1 and injected into the field of operation. A transverse incision was done over the mid part of thyroid lamina at the level of vocal cords extending from the posterior margin of the lamina to a point midway between the posterior edge of thyroid lamina and its anterior edge. Then, the incision was deepened through superficial and deep fascia including the platysma muscle. Strap muscles were then retracted reaching thyroid lamina but no incisions were done in the thyroid cartilage (Fig. 1a).

Two titanium screw nails were introduced through the posterior third of thyroid lamina at the level of vocal cords to medialize the arytenoid cartilage ensuring adequate glottic gap closure. The two screw nail sizes were 11 and 13 mm length and 1.5 mm width (Fig. 1).

The shorter screw nail was introduced first posteriorly into the body of arytenoids cartilage but it was not fully introduced, the medialization of arytenoid was visualized by the introduction of flexible fiber optic nasopharyngolaryngoscope asking the patient about his self satisfaction with the quality of voice, then the screw nail could be introduced more until the patient and the examiner became satisfied. Then the longer screw nail was introduced about 5 mm anterior to the shorter one to medialize the vocal process and to secure the arytenoid at the new position.

**Table 1** The rating scale of the grade of dysphonia.

Rating of the grade of dysphonia	Definition
0	Normal voice
1	Mild dysphonia
2	Moderate dysphonia
3	Severe dysphonia

At the end of the procedure, the muscle, subcutaneous tissue and skin were closed and the wound was dressed, postoperative antibiotic and steroids were prescribed to guard against infection and postoperative airway obstruction. The patient was observed for at least 6 h, then the patients were discharged from hospital and were followed up after one week, then the patient was followed up every two weeks for two months then every month for six months. In every setting of follow up, rating of the grades of dysphonia, video-laryngoscopy and MPT was done to ensure the position of vocal cord and arytenoid cartilage and to assess improvement.

### 3. Statistical analysis

Data were analyzed using SPSS (Statistical Package for Social Sciences) version 17. Comparison between pre-operative and 6 months post-operative rating of dysphonia was done by Chi-square test. Comparison between the pre-operative and 6 months post-operative maximal phonation time was done by Wilcoxon matched pairs test which is a non-parametric test.

### 4. Results

The patients included in this study and satisfying the criteria of the study were 12. They were 9 males (75%) and 3 females (25%) and the age of the patients ranged from 21 to 67 years with a mean age of 44 years.

Regarding the side of vocal cord paralysis, 8 patients (66.7%) had left cordal paralysis and 4 patients (33.3%) had right cordal paralysis. Vocal cord paralysis was idiopathic in all patients included in this study and this was confirmed after clinical examination, laboratory investigations and radiology which revealed no definite cause of paralysis.

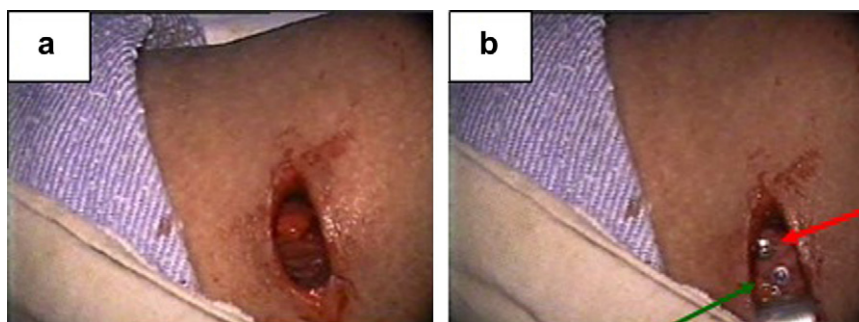
Video-laryngoscopy was done for all cases both preoperatively and postoperatively. Comparison of the results of preoperative and postoperative video-laryngoscopy revealed complete glottic gap closure in 10 cases (83.3%) (Fig. 2) and partial glottic gap closure in 2 cases (16.7%).

Six months postoperative MPT was found to be increased in all patients with highly significant differences from the pre-operative MPT. The mean preoperative MPT was 9.42 s, the mean postoperative MPT was 21.5 s and the mean difference was 11.6 s (Table 2).

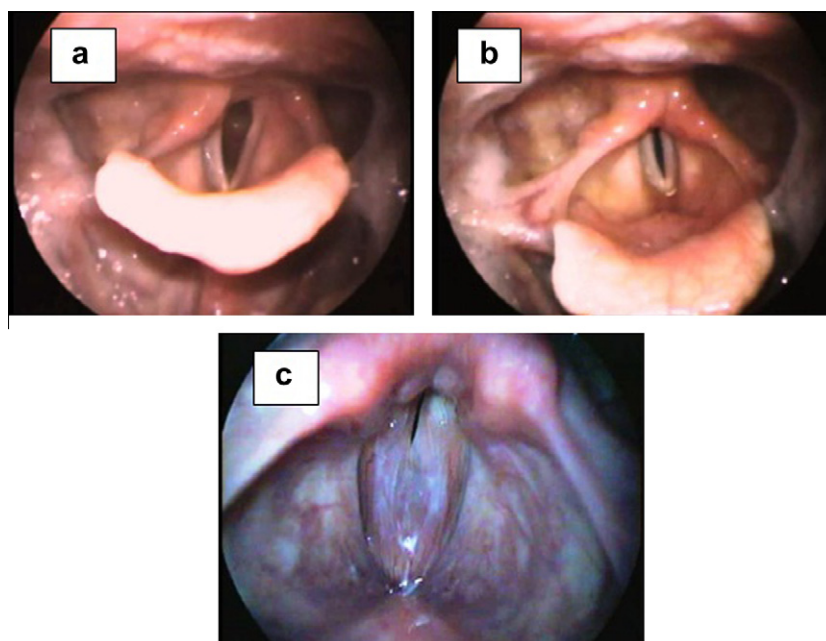
Preoperative and postoperative ratings of the grade of dysphonia were compiled by an experienced phoniatician and the results showed highly significant differences between pre-operative and post-operative assessments. Preoperative assessment showed that 4 patients (33.3%) had grade II (moderate) dysphonia while 8 of them (66.6%) had grade III (severe) dysphonia. Postoperative assessment showed good improvement in the grade of dysphonia as; 3 patients (25%) had no dysphonia at all, 7 patients (58.3%) had grade I (mild) dysphonia, 1 (8.3%) had grade II (moderate) dysphonia and 1 (8.3%) had grade III (severe) dysphonia (Table 3).

Postoperative wound infection occurred in one patient in the form of pain and tenderness but without pus collection. Infection was relieved after one week of antibiotic therapy.

Regarding patient satisfaction, all patients were satisfied with the quality of voice except one patient (8.3%) who was unsatisfied.



**Figure 1** (a) neck incision, (b) two screws application.



**Figure 2** (A) Preoperative view of right VC paralysis during inspiration. (B) Preoperative view of right VC paralysis during phonation. (C) Postoperative view with glottic gap closure.

**Table 2** Preoperative and postoperative Maximal Phonation Time (MPT).

No.	Preoperative MPT in seconds	Postoperative MPT in seconds	
1	12	28	<i>P</i> = 0.00 significance: highly significant difference
2	9	21	
3	7	18	
4	13	32	
5	10	22	
6	8	20	
7	6	15	
8	14	30	
9	11	18	
10	8	20	
11	10	20	
12	5	14	
Mean	9.42	21.5	

**Table 3** Comparison between preoperative and postoperative rating of the grade of dysphonia.

Grade of dysphonia	Pre-operative	Post-operative
0	–	3
1	–	7
2	4	1
3	8	1

Chi-square ( $\chi^2$ ) = 17.2.

Probability (*P*) = 0.001.

Significance = highly significant difference.

## 5. Discussion

Unilateral vocal fold paralysis, a major cause of dysphonia, can be detected by laryngoscopic inspection. Unilateral vocal

cord paralysis is secondary to many causes including trauma, malignancy and surgery.<sup>16-18</sup>

Although unilateral vocal cord paralysis can be idiopathic, it may also be presenting feature of many serious underlying disease processes. The exact cause should be investigated in all patients because the etiology determines its prognosis and management.<sup>17</sup>

If the etiology of the paralysis is thought to be idiopathic or there is any thought that the paralysis may recover, definitive therapy should be deferred for at least six months to one year. Approximately 60% of idiopathic cases recover or compensate to near-normal voices within one year.<sup>5</sup>

Vocal fold medialization adducts the glottic folds, thus improving phonation and reducing complications such as aspiration pneumonia. Surgical techniques to medialize the vocal cord (thyroplasty) include implantation of silastic or direct injection of Teflon, fat or gelfoam. Teflon has been widely used for vocal cord medialization since 1960s; however, its use has declined because of the rate of complications related to improper injection, over infection and the formation of granulomas.<sup>18</sup>

In this study, comparison of the results of preoperative video-laryngoscopy with the postoperative results showed complete glottic closure in 83.3% of cases and partial glottic closure in 16.7% of cases. This means that patients who undergo this new technique for medialization of arytenoid are more likely to have glottic closure after surgery than before the surgery with comparable results to previous studies.<sup>8,13</sup>

The improvement in the patient's voice quality supports the success rate of this new technique.

The good improvement in the mean of the MPT after 6 months of surgery from 9.42 to 21.5 with highly significant differences from the preoperative assessment revealed that this screw nail medialization technique not only improves the quality of voice, but also helps in better respiratory support during phonation. This is a logical finding as the size of gap decreased noticeably after surgery. So the amount of glottis air escape decreased also.

The results of this study are comparable to a great extent with the results of Mohanty et al.<sup>13</sup> who used Gore-Tex for medialization thyroplasty patients with unilateral vocal cord paralysis. The results of this study are also comparable to the results of Amin and Koufman<sup>15</sup> who performed endoscopic arytenoid reposition for cases of unilateral arytenoid fixation.

Complications in this new technique were minimal in the form of postoperative infection in one patient.

Most of the studied patients were satisfied with the results as they noticed voice quality improvement but only one patient (8.3% of cases) was unsatisfied in whom glottic closure was incomplete.

The new technique of this study seems to be better than injection laryngoplasty as it gives comparable and accepted results and at the same time it avoids the disadvantage of injection laryngoplasty as improper injection, over infection, airway obstruction and foreign body reaction with granuloma formation.

The results of this new technique are comparable with the results of medialization thyroplasty using an implant to medialize the arytenoid, but it carries the advantages of being sim-

ple technique performed as an office procedure under local anesthesia, without large skin incisions, no significant cartilage, perichondrium or muscle trauma as in open medialization techniques. Further long term assessments are needed for this new technique.

## 6. Conclusion

The screw nail medialization technique gives a good reliable and easy procedure under local anesthesia for managing unilateral vocal cord paralysis and avoids the disadvantages of injection laryngoplasty and medialization thyroplasty using implants.

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