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# Etiological Factors and Management of Vocal Fold Paralysis: Single Institution Study

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**Abstract:** Vocal fold paralysis is a sign of underlying diseases. However, etiologies of this problem are varied and changing from center to center and need more clarification. The aim of the study is to determine the etiological factors and management options of vocal fold paralysis among patients attended to the voice clinic center at King Abdul-Aziz Medical City. The medical records of 106 patients diagnosed with vocal fold paralysis were studied retrospectively. The following variables were recorded; age, gender, occupation, smoking, surgical history, radiation history, cause and type of vocal fold paralysis, associated risks, and management. Out of the 106 cases, 58 were males and 48 females with a ratio of 1.2:1. The age of the patients ranged from 6-92 years. Surgical trauma (iatrogenic) was the leading cause of vocal fold paralysis (45.3%) followed by idiopathic (17.9%), external neck trauma (13.2), Non-laryngeal malignancy (6.6%), post upper respiratory tract infection and viral infection (5.7%), TB and TB lymphadenitis (3.8%), intubation (2.8%), neurogenic (1.8%) and thyroid mass (1.8%). Total thyroidectomy was the most common surgical etiology of vocal fold paralysis (38.8%). The most common etiology of vocal fold paralysis is surgery and most cases were total thyroidectomy. Otolaryngologists should be familiar with the etiology, incidence, evaluation, and management options of vocal fold paralysis to optimize patient care and avoid further complication. We recommend that all patients undergoing total thyroidectomy and surgeries related to the course of recurrent laryngeal nerves should have detailed voice assessment pre-and postoperatively.

**Keywords:** Vocal Fold Paralysis, Vocal Fold Paresis, Thyroidectomy

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## 1. Introduction

Vocal fold paralysis is caused by abnormality in the laryngeal muscles due to partial or complete interruption of nerves which innervate that muscles. Those nerves are recurrent laryngeal nerve and superior laryngeal nerve. This disorder is caused by disruption, compression or inflammation of the nerves along its anatomic course. It can be caused by; post-surgical complication such as head, neck, thorax and cervical spine procedures. Other causes include neck or chest trauma, base of skull tumor, neck tumor, viral infections and as a complication of endotracheal intubation. Studies prove that unilateral vocal fold paralysis is predominantly idiopathic. However, there are many studies proves that surgical trauma is the most common cause of vocal fold paralysis. Vocal fold

paralysis usually present with voice changes, airway problems, swallowing problem, and aspiration. [1-12]

The aim of the study is to determine the etiological factors and management options of vocal fold paralysis among patients attended to the voice clinic center at King Abdul-Aziz Medical City.

## 2. Materials and Methods

The study designated to be a retrospective cross-sectional study targeted all patients with vocal fold paralysis attended the voice clinic center at King Abdul-Aziz Medical City (KAMC) Riyadh, Saudi Arabia between January 2007 to December 2017. King Abdul-Aziz medical city is considered as a teaching and referral hospital in Riyadh which provide health services for National Guard employee and their

dependents. After approval of institutional review board (RC16/115/R), all records belong to patients with voice disorder attended to the voice clinic center at King Abdul-Aziz Medical City during the study period were 999 records. Out of these records, 108 records belonged to vocal fold paralysis and 891 records belonged to other voice disorder. Among vocal fold paralysis and paresis records, there were 2 excluded records due to missed files and data. Finally, total number of 106 vocal fold records were studied retrospectively. All patients were subjected to history taking and examined by video-stroboscope using KAYPENTAX Rhino-laryngeal Stroboscope model (PLS 9100B). The following variables were being included in this study; age, gender, occupation, smoking, surgical history, radiation history, cause and type of vocal fold paralysis, associated risks, and management. The data was regained from Best care documentation system, patient's files and database of KAYPENTAX Rhino-laryngeal Stroboscope. The data transferred to excel sheet with all required variables.

Data was inputted from excel sheet and analyzed using SPSS 20 software for windows, for categorical variables calculated the proportion (%) and for continues variables calculated means  $\pm$  standard deviation.

### 3. Result

We studied a total of 106 cases that fulfilled our inclusion criteria. Out of these, 58 were males and 48 were females with a ratio of 1.2:1. The age of the patients ranged from 6-92 years with average age of (49.77  $\pm$  20.71 years). For age groups, 41-60 years was the most common age group incidence of vocal fold paralysis (36%, n = 39) followed by over 60 years (31%, n = 33), 19-40 years (22.6%, n = 24), and 0-18 years (9.4%, n = 10). Regarding job classification, (29.2%, n = 31) were house wife's, (28.3%, n = 30) were retired, (16%, n = 17) were students, (8.5%, n = 9) were martial, (4.7%, n = 5) were teacher, and only (1.9%, n = 2) were nurses, the remained patients with different occupation were (11.3%, n = 12) [Table1].

For type of vocal fold paralysis, left vocal fold is most vulnerable to paralysis (52.8%, n = 56) than right vocal fold paralysis (28.3%, n = 30), while bilateral vocal fold paralysis was (15%, n = 16), left and right vocal fold paresis were 4 cases (1.8%, n = 2 for each side) [Table 2].

Regarding etiologies of vocal fold paralysis, Surgical trauma (iatrogenic) was a leading cause of vocal fold paralysis (45.3%, n = 48) followed by idiopathic (17.9%, n = 19), external neck trauma (13.2%, n = 14), Non-laryngeal malignancy (6.6%, n = 7), post upper respiratory tract infection (URTI) and viral infection (5.7%, n = 6), Tuberculosis (TB) and TB lymphadenitis (3.8%, n = 4), intubation (2.8%, n = 3), neurogenic (1.8%, n = 2) and thyroid mass (1.8%, n = 2) [Table 3].

Total thyroidectomy was the most common surgical etiology of vocal fold paralysis (42.8%, n = 21) followed by cardiac surgery (28.5%, n = 14), cervical spine fixation (10.2%, n = 5), hemi thyroidectomy (6.1%, n = 3),

parathyroidectomy (6.1%, n = 3), lymph node dissection (2%, n = 1), aortic aneurism repair (2%, n = 1) and posterior craniotomy (2%, n = 1) [Table 4].

For Non-laryngeal malignancy etiologies of vocal fold paralysis, lung cancer was the most common (28.6%, n = 2) followed by esophageal cancer (14.3% n = 1), adenocarcinoma of unknown origin (14.3% n = 1), Jugulotympanic paraganglioma (14.3% n = 1), lymphoma (14.3% n = 1) and malignant otitis externa (14.3% n = 1) [Table5].

For associated factors of vocal fold paralysis, Gastroesophageal reflux disease (GERD) was the most common associated factor (40.6%, n = 43) followed by diabetes mellitus (27.4%, n = 29), hypertension (26.4%, n = 28), history of radiation exposure (17%, n = 18), smoking (16%, n = 17), bronchial asthma (13.2%, n = 14), and other associated diseases such as Parkinson, ischemic heart disease, stroke, gastric lymphoma, esophageal diverticulum, chronic obstructive pulmonary disease (COPD), systemic lupus erythematosus, contact granuloma and facial nerve palsy were (26%, n = 28), patients had more than one factor at the same time [Table 6].

Management of vocal fold paralysis include different modalities, most of the cases were managed conservatively (78.3%, n = 83), while 10 cases (9.4%) underwent surgery only and 13 cases (12.3%) have both surgery and conservative therapy. Conservative management include: voice hygiene advice (58.6%, n = 62), voice therapy (23.6%, n = 25), neuro-vitamins (13.2%, n = 14). Among these conservative options, 50 patients (60.2%) had only one conservative option, 32 patients (38.5%) had 2 conservative options and only 1 patient (1.1%) had 3 conservative options. Surgical management include: medialization injection with calcium hydroxylapatite (12.3%, n = 13), thyroplasty for unilateral vocal fold paralysis (3.8%, n = 4) and cordotomy for bilateral vocal fold paralysis (5.7%, n = 6) [Table7].

**Table 1.** Demographic data of vocal fold paralysis at KAMC 2007-2017.

Demographic data	n (%)	
Age of patient mean=49.77 $\pm$ 20.71 years	0-18	10 (9.4%)
	19-40	24 (22.6%)
	41-60	39 (36%)
	> 60	33 (31%)
Gender	Male	58 (54.7%)
	Female	48 (45.3%)
Occupation	Student	17 (16.0%)
	Teacher	5 (4.7%)
	House wife	31 (29.2%)
	Martial	9 (8.5%)
	Retired	30 (28.3%)
	Nurse	2 (1.9%)
	Other	12 (11.3%)

**Table 2.** Types of vocal fold paralysis at KAMC 2007-2017.

Types	n (%)
Bilateral vocal folds paralysis	16 (15%)
Left vocal fold paralysis	56 (52.8%)
Right vocal fold paralysis	30 (28.3%)
Left vocal fold paresis	2 (1.8%)
Right vocal fold paresis	2 (1.8%)
Total	106

**Table 3.** Etiologies of vocal fold paralysis at KAMC 2007-2017.

Causes	n (%)
Surgical trauma	49 (46.2%)
Non-laryngeal malignancy	7 (6.6%)
External neck trauma	14 (13.2%)
Idiopathic	19 (17.9%)
Neurogenic	2 (1.8%)
Intubation	3 (2.8%)
Post URTI and viral infection	6 (5.7%)
Thyroid mass	2 (1.9%)
TB and TB lymphadenitis	4 (3.8%)
Total	106

**Table 4.** Surgical causes of vocal fold paralysis at KAMC 2007-2017.

Type of surgery	n (%)
Total thyroidectomy	21 (42.8%)
Hemi thyroidectomy	3 (6.1%)
Parathyroidectomy	3 (6.1%)
Cardiac surgery	14 (28.5%)
Cervical spine fixation	5 (10.2%)
Lymph node excision	1 (2.0%)
Aortic aneurism repair	1 (2.0%)
Posterior craniotomy	1 (2.0%)
Total	49

**Table 5.** Non-laryngeal malignancy causes of vocal fold paralysis at KAMC 2007-2017.

Non-laryngeal malignancy cause	n (%)
Lung cancer	2 (28.6%)
Malignant otitis externa	1 (14.3%)
Esophageal cancer	1 (14.3%)
Adenocarcinoma of unknown origin	1 (14.3%)
Jugulotympanic paraganglioma	1 (14.3%)
Lymphoma	1 (14.3%)
Total	7

**Table 6.** Associated factors of vocal fold paralysis at KAMC 2007-2017.

Associated factors	n (%)
Smoking	17 (16%) (14 males, 3 females)
GERD	43 (40.6%)
Diabetes mellitus	29 (27.4%)
Hypertension	28 (26.4%)
Bronchial asthma	14 (13.2%)
Radiation	18 (17%)
others	28 (26%)

**Table 7.** Management of vocal fold paralysis at KAMC 2007-2017.

Management	n (%)
Conservative only	83 (78.3%)
Surgery only	10 (9.4%)
Conservative and surgery	13 (12.3%)
Total	106
Conservative management types:	
1. Voice hygiene	62 (58.6%)
2. Voice therapy	25 (23.6%)
3. Neuro-vitamins	14 (13.2%)
Surgery management types:	
1. Medialization injection	13 (12.3%)
2. Thyroplasty	4 (3.8%)
3. Cordotomy	6 (5.7%)

## 4. Discussion

Vocal fold paralysis is a common problem in otolaryngology practice.

For age and occupation of the patients in this study, we had patients with age ranging from 6 years to 92 years with average age ( $49.77 \pm 20.71$  years). Vocal fold paralysis incidence found to be increased with age, rising and peaked in the fifth and sixth decade, this finding is in accordance with literature; Yumoto et al., who found that the incidence of vocal fold paralysis in the fourth decade is rapidly raised and peaked in the sixth decade. Moreover, Gandhi S et al. reported that unilateral vocal fold paralysis peaked in the fourth and fifth decade. [13, 14] Vocal fold paralysis found to be not related to the occupation of the patients; this finding was emphasized by Srivastava S et al. [15]

Regarding male to female ratio (1.2: 1), this finding is consistent with finding of Gandhi S et al. in which male to female ratio was 1.82: 1. Myssiorek D. has similar findings. On the contrary, Rosenthal et al. reported that female to male ratio was (1.43:1) for those who diagnosed with vocal fold paralysis. [1, 13, 16] The reason of male to female ratio discrepancy in literature is still not clear, we think that it is related to the type of centers and scope of the patients.

Left-sided vocal fold paralysis was diagnosed in more than half (52.8%) of the patients, while right vocal fold paralysis was diagnosed in (28.3%) of the patients. This finding is in agreement with literature. In the study done at Gartnavel General Hospital-Scotland to identify the etiology of unilateral vocal fold paralysis between 1997 to 2001; 77 patients were assessed, 83% of them had vocal fold paralysis in the left side and 17% had right vocal fold paralysis. Furthermore, similar findings were observed in other studies. [13-18] This support the fact that the left recurrent laryngeal nerve is more vulnerable to be injured due to its longer anatomical course through the chest.

As far as the etiologies are concerned, surgical trauma (iatrogenic) found to be the main cause of vocal fold paralysis in almost half of the patients (45.3%). This finding is consistent with literature; Takano S et al. reported that the incidence of post-surgical (iatrogenic) vocal fold paralysis was (58.5%) and non-surgical etiology was (41.5%). Other studies revealed that the incidence of iatrogenic vocal fold paralysis ranged from 11% to 66%. [18-28]

Among surgical trauma causes of vocal fold paralysis, total thyroidectomy was the most common reported procedure (38.8%). Takano S et al proved same finding with total number of 106 cases (22.7%) out of 466 cases. Previous studies reported that the rate of vocal fold paralysis post thyroid surgery ranged from 7-50.9%. [18-20, 23, 28]

In addition to total thyroidectomy, we reported that cardiac surgery, cervical spine fixation, hemithyroidectomy, parathyroidectomy, lymph node dissection, aortic aneurysm repair and posterior craniotomy as surgical etiologies for vocal fold paralysis. These causes were found in previous studies with different range of incidence. [3, 29-34]

Idiopathic cause of vocal fold paralysis was found in 19

cases (17.9%). This finding is in conjugation with literature; Al-Khtoum N et al. found that the incidence of idiopathic vocal fold paralysis was 18.9%. [18] On the contrary, Gandhi S et al. reported that the predominant etiological factor of vocal fold paralysis found to be idiopathic (49.1%). [13]

Other etiologies for vocal fold paralysis reported in our study include external neck trauma, non-laryngeal malignancy, post URTI, TB and TB lymphadenitis, endotracheal intubation, thyroid mass and neurogenic origin. Many previous studies found same etiologies in addition to other etiology such as sarcoidosis with different range of incidence. [13, 18, 35-37]

Non-laryngeal malignancy has been reported in seven cases (6.6%) of this study, 2 cases (28.6%) were due to lung cancer and the remained 5 cases were esophageal cancer, adenocarcinoma of unknown origin, jugulotympanic paraganglioma, lymphoma and malignant otitis externa. Similar finding was reported by Al-Khtoum N et al study, they found that 7.5% of non-laryngeal malignancy were responsible for unilateral vocal fold paralysis. Furthermore, many previous studies found the most common non-laryngeal malignancy causing vocal fold paralysis was lung cancer. [1, 14, 18, 19]

Gastroesophageal reflux disease found to be predominantly associated factor for vocal fold paralysis with total number of 43 cases (40.6%) followed by diabetes mellitus and hypertension with 29 cases (27.4%) and 28 cases (26.4%) respectively.

Radiation exposure found in 18 cases of this study. However, all cases with vocal fold paralysis and exposed to radiation had concomitant other cause of vocal fold paralysis and documented as the main cause of the vocal fold paralysis, 17 of the cases had total thyroidectomy followed by vocal fold paralysis and 1 case with jugulotympanic paraganglioma developed vocal fold paralysis before radiation exposure.

The discrepancy in the literature regarding the etiology of vocal fold paralysis may be due to the scope of diseases treated in each center.

Management options of vocal fold paralysis in our study were conservative, surgically or both. Conservative management was the major treatment option for our patients with total number of 83 cases (78.3%) and included one or more of the following: voice hygiene, voice therapy, and neuro-vitamins. Surgical options were done for 10 cases (9.4%) either by medialization injection with calcium hydroxylapatite voice gel, thyroplasty (for unilateral vocal fold paralysis) or cordotomy (for bilateral vocal fold paralysis). Moreover, there were 13 cases (12.3%) had both conservative and surgical treatment. Jiang Y et al. classified treatments methods as medication (glucocorticoids, neurotrophic medicines, and vasodilators); acupuncture and moxibustion, ultrashort wave therapy, voice therapy, medialization injection and re-innervation methods. [38] Different modalities of management can be explained by different facilities and experts in each center. [39]

## 5. Conclusion

The most common etiology of vocal fold paralysis is surgery and majority of the cases were total thyroidectomy. Otolaryngologists should be familiar with the etiology, incidence, evaluation, and management options of vocal fold paralysis to optimize patient care and avoid further complication. We recommend that all patients undergoing total thyroidectomy should have routine laryngoscopy pre- and postoperatively. In tertiary hospital, it is highly needed to have expert phono-surgeon or laryngologist who can optimize management of such cases.

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