

Research Article**A Prospective Clinical Study to Determine the Laterality, Position and Side of Vocal Cord Involvement in Patients of Vocal Cord Paralysis Attending a Tertiary Health Care Services in SKIMS Medical College, Bemina, Kashmir****Mushtaq Sangoo¹, Sajad Hamid^{2*}, Asif Wani³, Masood H. Kirmani⁴, Shahnawaz Hamid⁵, Qazi Najeeb⁶**¹Department of Otorhinolaryngology, SKIMS Medical College, Bemina, Kashmir, India²Lecturer, Department of Anatomy, SKIMS Medical College, Bemina, Kashmir, India³Assistant Professor, Department of Otorhinolaryngology, SKIMS Medical College, Bemina, Kashmir, India⁴Professor & HOD, Department of Otorhinolaryngology, SKIMS Medical College, Bemina, Kashmir, India⁵Post-graduate Student, SKIMS Medical College, Bemina, Kashmir, India⁶Post-MD Demonstrator, Biochemistry, SKIMS Medical College, Bemina, Kashmir, India***Corresponding author**

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Abstract: The aim of this clinical study is to identify the position of vocal cord and side of vocal cord involvement in patients having vocal cord paralysis. The Study was conducted in otolaryngology clinic of a referral & a teaching tertiary care SKIMS Medical college, Bemina, India. The present study included 46 cases having vocal cord paralysis who presented in out-patient department for a period of one year with effect from Nov. 2012 to October 2013. The study included a detailed history & complete physical examination with relevant investigations. A thorough ENT examination was conducted in all the patients especially indirect laryngoscopy to look especially for vocal cord movement, position of vocal cords, side of paralysis & direct laryngoscopy in cases where indirect laryngoscopy examination was not possible. Routine and Special investigations like Barium study of esophagus, CT-Scan, MRI, Esophagoscopy, Bronchoscopy were done as & when required. In our study, out of 46 patients, the most common position of vocal cord was paramedian & the least common position was median. Left vocal cord was most commonly involved 28(60.8%). Right vocal cord involvement was found in 17 (37%) patients. Left vocal cord involvement was seen in majority of patients, with the right vocal cord involvement predominantly seen in patients undergoing thyroidectomy and paramedian position was the most common position of vocal cords in vocal cord paralysis.**Keywords:** Hoarseness, Vocal cords, Recurrent laryngeal nerve.

INTRODUCTION

Phonation is beyond doubt one of the highest functions of the human larynx. It is evolved not only for the verbal communicative faculty of speech & language but also for certain non-verbally communicated messages. The vocal cord is a multilayered vibrator. Vocal cords are defined as two fold-like structures which extend from the midline of the angle of the thyroid cartilage to the vocal process of the arytenoids cartilages. Changes in the length & tension of the vocal folds control the pitch of the voice & are produced normally only when the vocal folds are in contact for phonation. The function of the vocal cords is to produce sound varying only in pitch & intensity. This is then modified by resonating chambers above & below the larynx & is ultimately converted into phonemes by the articulating action of pharynx, tongue, palate, teeth & lips. The crude adduction is affected by cricothyroid & the lateral crico-arytenoid muscles & the fine tension of the vocal cords is

produced by the tonic contraction of the vocalis muscle. The inter-arytenoid muscles by pulling the arytenoids cartilages together complete adduction by closing the posterior glottis chink. Vocal cords are lengthened by the crico-thyroid muscle [1].

True vocal cord paralysis signifies loss of active movements of the true vocal cords, secondary to the disruption of the motor innervations of the larynx. Disruption of the innervations may occur along the length of the recurrent laryngeal nerves & the vagi & may include damage to the motor nuclei of the vagus. It should be differentiated from fixation of the vocal cord secondary to the direct infiltration of the vocal cord, larynx or laryngeal muscles. It should be distinguished from fixation at the cricoarytenoid joint, encountered with rheumatoid arthritis or following traumatic intubation [2].

Vocal cord paralysis must be regarded as a sign of

underlying disease, not simply a diagnosis unto itself. Diagnosis of underlying etiology involves localization of the lesion of vagus nerve or its branches any where from the cerebral cortex to the neuromuscular junction or at the crico-arytenoid joint. Several studies point to the extra-laryngeal malignancy as the leading etiology of vocal cord immobility where as other surgical causes may be replacing thyroidectomy as the leading cause of surgical trauma [3].

Recurrent laryngeal nerve supplies all the intrinsic musculature of the larynx except Cricothyroid muscle this is supplied by the external laryngeal nerve. Injury to recurrent laryngeal nerve results in vocal cord paresis / paralysis. Because of its longer course left recurrent laryngeal nerve is paralyzed more often than the right, the ratio is 4:1 & bilateral paralysis occurs in about 6% of cases. Men are affected 8 times more than females. Vocal cord paralysis may be unilateral or bilateral, abductor or adductor. The cord is often described as being either in midline or in the lateral or cadaveric position. Semon's theory proposes that abductor fibers are more susceptible to pressure than adductor fibers.

In unilateral abductor vocal cord paralysis, paralyzed vocal cord lies in the paramedian position. In unilateral adductor palsy, the vocal fold lies in the lateral position & gives rise to husky voice. Bilateral abductor paralysis is usually the result of damage to both recurrent laryngeal nerves at thyroidectomy, vocal fold lies in paramedian position & voice is good but degree of stridor is variable. In bilateral abductor paralysis, both fold lie in paramedian position [4].

As in the pediatric population, the most common cause of vocal cord paralysis is a central nervous system abnormality such as meningocele or an Arnold- chiari malformation. Most commonly, therefore, children present with the vocal cords in the midline or adducted position. Pediatric patients usually have a good voice or cry & a poor airway [5].

Although bilateral vocal cord paralysis has been known to undergo spontaneous recovery, it is generally accepted that Airway intervention such as tracheostomy is required in over 50% of the affected patients [6].

Laryngeal Paralysis is best classified according to the result of the particular denervation. For example, unilateral paralysis of recurrent laryngeal nerve should be identified according to the resultant position of the paralyzed vocal fold (e.g; a unilateral or bilateral recurrent laryngeal nerve paralysis in the position of abduction, adduction or paramedian). When the unilaterally paralyzed vocal cord assumes the position of adduction, the voice is invariably normal. However, patients may notice some alteration in their singing voice. In patients with recurrent laryngeal nerve paralysis & the vocal cord in the paramedian position, the symptoms are variable. Some patients can

compensate quite well & only slight alterations in their voices. However they do have difficulty in not moving to the complete adduction position for days, weeks, months & changing pitch & are usually unable to sing. The compensation is accomplished by the unparalyzed cord adducting beyond the midline, the cricothyroid muscle can still lengthen & tense the paralyzed cord & some posterior medial position is achieved by the action of the bilaterally innervated interarytenoid muscle. Recurrent laryngeal nerve paralysis that results in the cord assuming the position of abduction is much more serious clinically. The patient has whispered voice or may be aphonic. There is poor cough reflex. The patient is unable to laugh. Paralysis of both recurrent laryngeal nerves resulting in vocal cords assuming the position of adduction can present a life threatening situation. However, section of both recurrent laryngeal nerves may leave the patient with an adequate voice chink, & the cords may not migrate to the complete adduction for days, weeks, months & sometimes years after the original injury. The patient with paralyzed vocal cords in the adducted position most often has a good strong voice but a poor airway. Some patients can compensate for bilaterally recurrent laryngeal nerve paralysis with cords in the paramedian position. Patients with this type of paralysis have varying degrees of hoarseness caused by air escape. Aspiration may be present as well as loss of the cough reflex & the ability to laugh. Paralysis of the bilateral recurrent laryngeal nerves that result in the cords assuming the position of abduction is a very serious medical problem. The patient has no voice, aspirates freely & is without a cough reflex or the ability to laugh [7].

Paralysis of the recurrent laryngeal nerve & superior laryngeal nerve may occur in association with paralysis of the other cranial nerves as a result of lesions at the base of skull or in the neck & may manifest in the form of [8].

- Avellis Syndrome
- Schimdt's Syndrome
- Vernet's Syndrome
- Hughling's – Jackson Syndrome
- Collet – Sicard Syndrome (Villaret's Syndrome)
- Klinkert Syndrome
- Ortner's Syndrome

METHODOLOGY

The present study included all the cases having vocal cord paralysis who presented in out-patient department of Otorhinolaryngology and Head & Neck Surgery, SKIMS, Bemina for a period of one year with effect from November 2012 to October 2013. The study included a detailed history & complete physical examination with relevant investigations. Special emphasis was given to the symptoms of hoarseness, cough, hemoptysis, dysphagia, difficulty in breathing & fatigue of voice

& all the symptoms were recorded. It also included relevant past history such as history of tuberculosis, previous surgery, malignancy & other systemic diseases. Special attention was given to the personal habits like smoking, alcohol & vocal habits. General physical examination & systemic examination was carried out to rule out any associated disease. A thorough ENT examination was conducted in all the patients with special attention to

1. Detailed examination of oral cavity
2. Detailed examination of oropharynx
3. Examination of Larynx
 - External examination for mobility, crepitus, expansion of laryngeal framework
 - Internal examination

a) Indirect laryngoscopy to look especially for vocal cord movement,

position of vocal cords, side of paralysis

b) Direct laryngoscopy in cases where indirect laryngoscopy examination was not possible or where detailed examination of larynx was needed.

Examinations of nose & paranasal sinuses were done for any pathology. Examination of neck for any lymphadenopathy or any cervical mass was carried out detailed examination of Ears was performed. Routine investigations like hemogram, urine examination, KFT, LFT, X-ray chest P/A View, X-ray soft tissue neck (lateral view), X-ray nasopharynx (lateral view). Special investigations like Barium study of esophagus, CT-Scan, MRI, Esophagoscopy, Bronchoscopy were done as & when required. Other special tests like Sputum examination for tuberculosis, FNAC of the thyroid gland & other neck swellings were performed in selected patients.

RESULTS

Table 1: Position of Vocal Cords In Our Study

Sl. No.	Aetiology	Paramedian	Median	Cadaveric	Total
1	Neoplasms	16	1	2	19
2	Surgical	9	0	0	9
3	Idiopathic	8	0	1	9
4	Inflammatory	8	0	0	8
5	Infectious	1	0	0	1
Total		42(91.30%)	1(2.17%)	3(6.52%)	46(100%)

Table 2: Side of Vocal Cord Involvement in Our Study

Sl. No.	Aetiology	Vocal Cord (Right side)	Vocal Cord (Left side)	Vocal Cord (Bilateral)	Total
1	Neoplasm	3	15	1	19
2	Surgical	7	2	0	9
3	Idiopathic	5	4	0	9
4	Inflammatory	2	6	0	8
5	Infectious	0	1	0	1
Total		17(37%)	28(60.8%)	1(2.17%)	46(100%)

Table 3: Number of Cases with Unilateral & Bilateral Vocal Cord Paralysis in Our Study

Sl. No.	Unilateral/Bilateral	Number of Cases	Percentage of Cases
1	Unilateral	45	97.82%
2	Bilateral	1	2.17%

DISCUSSION

Vocal cord paralysis must be regarded as a sign of underlying disease, not simply a diagnosis unto itself. Our study was a prospective study conducted over a period of 1 year in which 46 patients with vocal cord paralysis were evaluated to find out the laterality & position of vocal cord in paralysis. In our study, only patients with neurological causes of vocal cord paralysis were taken as inclusion criteria & the patients with fixity of vocal cord due to tumour infiltration or crico-arytenoids joint fixation were excluded from the study. A complete history was taken in every patient of vocal cord paralysis attending otolaryngologic OPD in

our department. A thorough physical examination was performed. The patients were then investigated thoroughly. CT- Scan head- neck & chest, bronchoscopy, barium study of esophagus & esophagoscopy were the most common special investigations done in our study. Even after thorough workup, no cause was found in many cases which were thus labeled as idiopathic. There has been a changing etiology of vocal cord paralysis perhaps due to the availability of better investigations which are now available, that is why the incidence of idiopathic causes of vocal cord palsy is decreasing.

As far as the etiology of vocal cord paralysis is concerned, neoplasms were the most common cause responsible for vocal cord paralysis in our study (Table 1). Overall, neoplasms were responsible for vocal cord paralysis in 19(33.33%) patients, out of 46 patients who were diagnosed of having vocal cord paralysis

In our study, no extra-thyroid surgery was found to be the etiological factor. Vocal cord paralysis as a consequence of thyroid surgery can be prevented by doing the surgery meticulously by identifying the recurrent laryngeal nerve during thyroidectomy. Thus by meticulous surgery, many cases of the post-thyroidectomy vocal cord paralysis can be prevented. So far as the side of the vocal cord involvement is concerned, left vocal cord was most commonly involved in our study (Table 2). Left side was involved in 28 patients (60.86%) & right side affection was seen in 17 patients (37%). Bilateral vocal cord involvement was seen in only 1 patient (2.17%) who was suffering from esophageal carcinoma. These results were consistent with other studies (Table 3). The more involvement of the left vocal cord was justified by longer course of left recurrent laryngeal nerve which was thus more vulnerable. In case of vocal cord paralysis secondary to thyroid surgery, right vocal cord involvement was seen in majority of patients which may be attributed to more superficial course of right recurrent laryngeal nerve.

The most common position of vocal cords in our study was paramedian which was present in 42 patients (91.30%), with paramedian & median positions in 3 (6.52%) & 1(2.17%) patients, respectively (Table 1).

Parnell and Brandenbeg [9] studied 100 consecutive cases of vocal cord paralysis & also classified them according to their etiologies. Minuck [10] observed unilateral vocal cord paralysis, may follow intubation with an endotracheal tube without the presence of any local lesion. Holinger *et al.* [11] studied 144 cases of congenital bilateral vocal cord paralysis. David and Philip [12] in their study found that one out of 3 cases (33%) of vocal cord paralysis was due to cancer, 29% cases due to surgical trauma, 4% inflammatory causes, 24% idiopathic. Delorme [13] stated that long course of recurrent laryngeal nerve makes it vulnerable to damage & infiltration by various tumours. Recurrent nerve paralysis caused by a tumour indicates advanced disease. Terris *et al.* [14] also studied cause of unilateral vocal cord motion impairment. Thermann *et al.* [15] carried out 3492 thyroidectomy operations & studied post-operative vocal cord paralysis. Ramadan *et al.* [16] retrospectively reviewed 98 cases of unilateral vocal cord paralysis & found that left vocal cord was involved in 70% cases. Ellen *et al.* [17] studied vocal cord paralysis in pediatric population & observed that central nervous system abnormality to be the most common cause. Srirompotong *et al.* [18] conducted study on 90 patients with unilateral vocal cord paralysis & found

that left vocal cord was involved in 73% cases. Loughran *et al.* [19] also conducted a prospective study on 77 patients of vocal cord paralysis & observed left vocal cord paralysis in 83% cases. Hans *et al.* [5] in their study conducted on 218 adult patients with immobility of both vocal cords requiring surgery for airway obstruction were reviewed & RLN paralysis was identified in 186 patients. Jorgensen *et al.* [20] conducted studies on 94 patients of vocal cord paralysis & observed various etiologies of unilateral & bilateral vocal cord paralysis. Wu Q *et al.* [21] in their retrospective study of 51 aged patients of unilateral vocal cord paralysis & concluded that the extra-laryngeal malignant tumours were the main cause of vocal cord paralysis & should be greatly suspected in aged with unilateral vocal cord paralysis. Franz J. Wippold [22] observed that in unilateral vocal cord palsy, 90% due to peripheral nerve lesion & only 10% originate in the CNS. Hartl *et al.* [23] in their study stated that the unilateral vocal fold paralysis was a peripheral neurogenic disorder caused by any pathological occurrence affecting the motor neuron in the nucleus ambiguus, the vagus nerve or the recurrent (inferior) laryngeal nerve. Stacey *et al.* [24] conducted their study on 66 adults & 35 pediatric cases & concluded that most common childhood cause of unilateral vocal fold motion immobility was idiopathic whereas, adults were more often noted to suffer from iatrogenic causes. Neoplastic processes were the third leading cause in adult Category but the least cause in pediatric survey.

G. Worley [25] concluded from their study that the etiology of bilateral vocal cord immobility including birth trauma, iatrogenic causes, neurological causes, idiopathic & miscellaneous causes. Kazuhira *et al.* [26] in their study found a case of bilateral vocal cord palsy temporarily observed after using laryngeal mask airway & was due to RLN damage caused by prolonged compression of the pyriform fossa. Wareing and Obholzer [27] concluded from their study that the cause of unilateral RLN palsies can be iatrogenic, neoplastic, ortner syndrome, idiopathic. The causes of unilateral complete vagal paralysis were iatrogenic, neurologic, brainstem infarction, a malignant growth & inflammatory. The cause of bilateral complete vagal nerve paralysis included brainstem infarction, multiple sclerosis & motor neuron disease.

CONCLUSION

The following conclusions were drawn

- Left vocal cord involvement was seen in majority of patients with the right vocal cord involvement predominantly seen in patient's undertgoing thyroidectomy.
- Unilateral vocal cord paralysis was much more common than the bilateral vocal cord paralysis.
- Paramedian position was the most common position of vocal cords in vocal cord paralysis.

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