Evaluation of Various Laryngeal Pathologies: Videolaryngoscopy Versus Videolaryngostroboscopy

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Abstract Voice disorders are common in various laryngeal pathologies. The aim of this study is to evaluate the diagnostic value of videolaryngostroboscopy (VLSS) over videolaryngoscopy (VLS) in laryngeal pathologies. This was a prospective observational study. Detailed examination was carried out for 80 cases which presented with different laryngeal pathologies. Cases were evaluated on the basis of VLS and VLSS in the same sitting and diagnosed separately. Sensitivity, specificity, positive predictive value and negative predictive value were calculated to find out the relationship between diagnoses made by VLS and VLSS. The diagnostic value of VLSS is significant; it has 98.15% Sensitivity and 50% specificity over VLS in finding true vocal cord abnormalities. Around one third of the cases, i.e. 26 cases (32.50%) were misdiagnosed on VLS. Also, VLSS gave additional diagnosis in 6 cases (7.50%) which were missed on VLS. However, the diagnoses revealed by VLS and VLSS were same in 48 cases (60%). The diagnostic value of VLSS correlated with the type of laryngeal pathology. Through the present study, it has been deduced that VLSS is the superior modality for diagnosing laryngeal pathologies. It offers better visualisation of the finer aspects of the vocal cords. It has various advantages over VLS in terms of sensitivity and specificity.

Keywords Videolaryngoscopy · Videolaryngostroboscopy · Laryngeal pathologies

Introduction

Most laryngeal disorders cause hoarseness of voice. The patients selected for this study were cases of laryngeal pathologies presenting with hoarseness of voice.

Hoarseness is defined as—“A perceived rough, harsh or breathy quality to the voice” [1]. Reduced voice-related QOL is defined as a self-perceived decrement in physical, emotional, social or economic status as a result of voice-related dysfunction [2].

Hoarseness is more prevalent in certain groups, such as teachers and voice professionals. It can affect all age groups and both the genders. In addition to the impact on health, it has an effect on quality of life (QOL) [2].

Hoarseness is often caused by benign or self-limiting conditions, but may also be the presenting symptom of a more serious or progressive condition, which requires prompt diagnosis and management. Hoarseness affects people differently. Some may have altered voice quality while others may experience problems with communication and diminished voice-related QOL.

There are various techniques to evaluate laryngeal pathologies.

Indirect laryngoscopy (IDL) is the basic method for laryngeal evaluation in OPD while Videolaryngoscopy (VLS) is used to examine the larynx at the office with more clarity and data preservation facility. The telescopic image is larger, brighter and clearer. VLS also helps in comparing preoperative & postoperative status of larynx. It allows preferential visualization of specific regions of larynx without compromising patient comfort in OPD [3]. VLS has been recommended for routine screening of laryngeal pathologies.

Videolaryngostroboscopy (VLSS) is another important modality for evaluation of various cases of laryngeal

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pathologies. VLSS allows the examiner to observe vocal fold vibration during sound production. This special viewing allows the evaluation of vocal cord (VC) vibratory parameters such as amplitude, mucosal wave, periodicity, phase symmetry, glottic closure etc. As important as any of these aspects, VLSS substantially improves the sensitivity of subtle laryngeal diagnosis [4].

As the effective treatment of laryngeal pathologies is based on the correct diagnosis, this study was conducted to evaluate various laryngeal pathologies by VLS and VLSS and compare efficacy of both techniques.

Materials and Methods

This was a prospective observational study conducted during August 2013–July 2015 in Department of Otorhinolaryngology of a tertiary care hospital.

This study includes 80 patients with various laryngeal pathologies. All cases were presented with change in voice. Acute inflammatory pathologies were excluded. All cases were subjected to a detailed history taking, general examination, followed by a complete ENT examination to reach a diagnosis. All these cases were subjected to VLS and VLSS examination under all aseptic precautions. VLS and VLSS were both performed in same hospital visit, by the same ENT surgeon thus reducing human error to the least. Data was saved digitally in both the procedures.

VLS was performed using a Karl Storz 70° endoscope attached to an external light source and colour video camera of Maxer 1000. VLSS was performed using a stroboscopic light source, a microphone of Riester, a C mount video camera of Maxer 1500, a Maxer basic high-light portable stroboscope 70° and a video recorder. Data was stored on computer in both the procedures.

Findings of each laryngeal sub site were recorded separately. The patients were evaluated on the basis of VLS, VLSS and diagnoses were reached separately. Diagnosis made on VLSS considered as the final diagnosis.

Statistical analysis was done by using SPSS software (Version 20.0). Descriptive statistics regarding age, sex, voice abuse, smoking and gastroesophageal reflux disease (GERD) of the study population were performed. Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) were calculated to find the diagnostic value of VLS and VLSS.

Results

The diagnostic value of VLSS was evaluated by comparing diagnosis made by VLS and VLSS. The study included 80 cases of hoarseness. Among 80 cases, 45 (56.30%) were

Table 1 Showing age wise distribution of laryngeal pathologies (n = 80)

Age group in years	Number of patient	Percentage (%)
14–20	7	8.8
21–30	12	15
31–40	16	20
41–50	13	16.3
51–60	19	23.8
>60	13	16.3
Total	80	100

Table 2 Various laryngeal pathologies included in this study (n = 80)

Diagnosis on VLSS	No. of cases
VC Palsy	15
VC Paresis	9
VC Polyp	8
VC Cyst	5
VC Nodule	10
VC Keratosis	2
VC Leucoplakia	3
Malignancy	7
Sulcus Vocalis	5
Dysphonia plica Ventricularis	8
Chronic Laryngitis	7
Subglottic Stenosis	1
Puberphonia	4
Laryngeal papillomatosis	1
Post intubation phonatory gap	2
Total	87*

* 7 patients had more than one diagnosis on VLSS

males and 35 (43.80%) were females. Gender wise near equal distribution observed with male female ratio of 1.28:1. Age range of this study population was between 14 years to 80 years. Age wise distributions of cases are given in Table 1.

Also in this study 50 cases (62.50%) of laryngeal pathologies were chronic in onset while 30 cases (37.50%) of laryngeal pathologies were acute in onset.

Majority of cases in this study were of VC palsy, VC paresis, VC nodule, VC Polyp and VC malignancy. Few premalignant conditions like VC leucoplakia, VC keratosis and laryngeal papillomatosis were also diagnosed (shown in Table 2). Seven cases in this study had more than one diagnosis.

This study shows that in 48 patients (60%), diagnoses revealed by VLS and VLSS were same. Pathologies like Sulcus Vocalis, Puberphonia, Premalignant conditions like keratosis and leucoplakia were detected only on VLSS

Fig. 1 Showing B/L sulcus vocalis-detected on VLSS which is not seen on VLS

Table 3 Showing comparison of diagnoses on VLS and VLSS (n = 80)

Diagnosis	VLS	VLSS
Sulcus Vocalis	0	5
Leucoplakia	0	3
Keratoses	0	2
Puberphonia	0	4
VC Polyp	3	8
VC Cyst	2	5
Normal	11	0
VC Palsy	16	15
VC Paresis	8	9
VC Nodule	13	10
Malignancy	9	7
Dysphonia plica Ventricularis	5	8
Chronic Laryngitis	9	7
Subglottic Stenosis	1	1
Laryngeal papillomatosis	1	1
Post intubation phonatory gap	2	2
Total	80	87*

The bold values indicate the VLS missed more than half of vocal polyps

* 7 patients had more than one diagnosis on VLSS

(Fig. 1).VLSS also plays important role in detecting VC polyp and VC Cyst (shown in Table 3).

VLSS gave a definitive diagnosis in 26 cases (32.50%) which were misdiagnosed on VLS. In 11 cases (13.75%), VLS was normal while VLSS revealed some pathology. Also VLSS gave added diagnosis in 6 patients (7.50%) which were missed on VLS (shown in Table 4).

When true VC findings were compared on VLSS and VLS, it showed that VLSS has 98.15% Sensitivity and 50% Specificity over VLS in finding true vocal cord abnormalities. Also, it shows that VLSS has a 92.86% NPV over VLS. This is an excellent indicator of the ability of VLSS to identify true positive cases and efficiently filter out all true negative cases which were shown positive on VLS thus leaving almost no margin for error.

Table 4 Showing changed and additional diagnoses of laryngeal pathologies on VLSS

VLS diagnosis	Change in diagnosis/additional diagnosis on VLSS	No. of cases
Normal	Sulcus Vocalis	3
Normal	Chronic laryngitis	2
Normal	VC Cyst	1
Normal	Puberphonia	4
Normal	Dysphonia plica Ventricularis	1
VC Nodule	VC Nodule + VC Polyp	2
VC Nodule	VC Nodule + VC Cyst	1
Dysphonia plica Ventricularis	Dysphonia plica Ventricularis + Sulcus vocalis	1
Laryngeal papillomatosis	Laryngeal papillomatosis + Sulcus vocalis	1
VC Palsy	VC Palsy + Leucoplakia	1
Chronic laryngitis	Dysphonia plica Ventricularis	3
Chronic laryngitis	VC Polyp	1
Chronic laryngitis	Leucoplakia	1
VC Nodule	VC Polyp	1
VC Nodule	VC Cyst	1
VC Nodule	VC Cyst + Keratoses	1
VC Cyst	VC Polyp	1
VC Cyst	Malignancy	1
Malignancy	VC Cyst	1
Malignancy	Leucoplakia	1
Malignancy	Keratoses	1
Dysphonia plica Ventricularis	Chronic laryngitis	1
VC Palsy	VC Paresis	1
Total		32

It shows that VLSS has 100% Sensitivity and 97.37% Specificity over VLS in diagnosing AE fold abnormalities. VLSS also has 100% Sensitivity and 91.67% Specificity over VLS in diagnosing arytenoids abnormalities.

It has been noted that statistically VLSS has 92.31% Sensitivity and 76.12% Specificity over VLS in finding

Table 5 Showing statistical significance of VLSS over VLS in detecting abnormalities of laryngeal sub sites

VLSS over VLS	Sensitivity	Specificity	PPV	NPV
AE fold Findings	100.00	97.37	66.67	100.00
Arytenoid findings	100.00	91.67	57.14	100.00
False vocal cord findings	92.31	76.12	42.86	98.08
True vocal cord findings	98.15	50.00	80.30	92.86
Hypopharynx findings	81.82	92.75	64.29	96.97

Fig. 2 Showing right VC keratosis detected only on VLSS in addition to left VC cyst

false VC abnormalities. VLSS has a higher NPV (98.08%) over VLS. This proves VLSS to be a more accurate diagnostic tool over VLS.

Similarly when hypopharynx findings compared on VLS and VLSS, Statistically it showed that VLSS has 81.82% Sensitivity and 92.75% Specificity over VLS in finding hypopharyngeal abnormalities. The PPV of VLSS is 64.29% and NPV is 96.97%.

The advantages of using VLSS over VLS as a diagnostic modality is substantiated by these statistics. This proves that VLSS is superior diagnostic tool than VLS (Table 5).

GERD was found to be associated in 16 cases (20.00%), smoking was associated in 30 cases (37.50%) while in 22 cases (27.50%) voice abuse was noted.

Discussion

Hoarseness is a symptom, not a disease. It is one of the commonest symptoms and is invariably earliest manifestation of a large variety of conditions affecting voice apparatus. Though benign lesions are numerically more common cause than malignant diseases, opportunity for cure has been lost by delay under a benign diagnosis [2]. This study consists of 80 cases of various laryngeal pathologies. All the cases were presented with change in voice. All cases of laryngeal pathologies were evaluated by history, VLS and VLSS in same hospital visit by same ENT surgeon. This was done to reduce human error in laryngeal evaluation. During the course of the assessment, both benign as well as malignant

laryngeal pathologies have been evaluated thus including most prevalent conditions.

VLS is the basic procedure for examination of larynx. But certain vocal fold vibratory parameters such as amplitude, mucosal wave, periodicity, phase symmetry, glottic closure, etc. are still difficult to visualize on VLS. For this purpose stroboscopes have been introduced in laryngeal evaluation.

Since VLSS has the ability to assess the above mentioned factors, it has been established as a superior diagnostic tool as compared to VLS.

VLSS is the investigatory tool of choice for assessing the finer characteristics of the VC movements. This has a great contribution in judging the severity and progression of the disease. This alters the line of management of the disease leading to a better outcome.

In the present study, 62.5% of cases were chronic in onset and 37.5% were acute in onset. These findings were similar to a study held by Banjara et al. [5] who recorded 56.25% of chronic onset pathologies and 43.75% of acute onset pathologies. However, most of the other studies had chronic pathologies as a majority.

Some pathologies like keratosis, leucoplakia, sulcus vocalis and puberphonia were not detected at all by VLS (Fig. 2). All these diagnoses were made on further examination by VLSS. Only 3 cases of vocal polyp were diagnosed by VLS while additional 5 were detected on further evaluation through VLSS (Fig. 3). These findings were similar to a study conducted by Printza et al. [6] where diagnostic value of VLSS differed considerably for the above mentioned cases.

Fig. 3 Showing right vocal polyp detected on VLSS which is misdiagnosed as right vocal nodule on VLS

In the present study, out of the total number of cases, the diagnoses of 32.50% cases changed on evaluation by VLSS. Also, additional diagnosis was made for 7.50% cases that were incompletely diagnosed on VLS.

The results of the present study were similar to the one carried out by Satallof et al. [7] in which VLSS altered 18% of the diagnoses made by VLS. VLSS also gave additional information in 29% of cases.

A study by Ahmad [4] revealed that VLSS altered the diagnosis in 19% of cases. Casiano et al. [8] conducted a study which showed that VLSS altered the diagnosis in 14% of all cases. The findings of these studies supports VLSS as superior diagnostic modality as compared to VLS.

A study conducted by Printza et al. [6] showed that VLSS altered the diagnosis in 4.7% of the cases and contributed to the initial diagnosis in 32.20%.

Thus the literature review proves that VLSS as a diagnostic modality is superior to VLS as it helps in identification of pathologies of the finer characteristics of the VC. These are missed by VLS.

The study group of Printza et al. [6] showed 39.30% GERD cases and the study group of Banjara et al. [5] showed 0.9% GERD cases. This study showed 20% cases of laryngeal pathologies were associated with GERD.

In the present study, 37.50% of all laryngeal pathologies were associated with smoking. Also, it was found that 100% of the cases of malignancy and 75% of the cases of dysphonia plica ventricularis were associated with smoking. This statistic is comparable to those recorded by Printza et al. (25.33%) [6] and Sellapampatti et al. (56%) [9]. However, Jensen et al. [10] held a study on subjects with hoarseness of voice in which the total percentage of smokers was found to be 97%.

It has been noted that 27.50% of pathologies were associated with voice abuse. Out of the total cases of vocal nodules, 70% were associated with voice abuse. This finding was similar to findings recorded by Sellapampattiet al [9], in which 31.4% of cases were associated with voice abuse.

Taking into consideration all the previous studies and the present study, it can be inferred that VLSS is an accurate,

efficient and superior diagnostic modality for the detection of various benign and malignant laryngeal pathologies.

This study shows that VLS as a diagnostic modality for detecting few pathologies of AE fold, arytenoids and hypopharynx. However, for accurate diagnosis of all conditions of the false VC and true VC, VLSS is indispensable. It should necessarily be used in combination with VLS to arrive at a final diagnosis for conditions relating to the above mentioned anatomical areas.

Compliance with Ethical Standards

Conflict of interest All authors declares that they have no conflict of interest.

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